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Foreword

In 2001, the OECD conducted an *OECD Territorial Review of Bergamo*, acknowledging the strengths of its industrial structure and highlighting its competitiveness in international markets. The review also identified several weaknesses, among them a lack of formal education of the labour force and a poorly developed transport infrastructure. It concluded that the province needed to improve local governance and recommended the creation of a “regional alliance” among local actors. These weaknesses remain today areas of development for policy action.

In the years since the Territorial Review, Bergamo has maintained its industrial base but has experienced a slowdown in its productivity. This has led to a distinct decline in Bergamo’s competitive advantage relative to other OECD Territorial Level 3 (TL3, or small) regions of similar industrial structure. Some of the factors contributing to this lacklustre performance were identified in the 2001 review, such as a low level of skills in the workforce and the need to improve co-ordination among local economic actors. Other factors have come to the fore more recently, such as increasing international competition and an increasingly unfavourable national macroeconomic and regulatory framework.

The goal of the current review is to monitor progress since the last review and to reassess the main development challenges of Bergamo in the current context, with a special focus on how to transition to higher value-added and more technology-intensive activities. Actions to support this transition include: 1) elaborating a development plan for the province that is supported by all local actors; 2) improving the skills of the adult population through adequate education and training programmes; 3) stimulating the innovation system; 4) attracting foreign direct investment (FDI); and 5) boosting the competitiveness of small and medium-sized enterprises (SMEs).

The creation of a framework to build a development strategy for Bergamo remains a crucial ingredient for future policy design and implementation. Only a concerted effort, by local public and private stakeholders, can contribute to a holistic strategy that promotes complementarity across policies. The recent administrative reform of the provincial government makes the need to create a platform where local actors can meet and elaborate a common vision for Bergamo’s future even more pressing.

This review was undertaken under the auspices of the Regional Development Policy Committee (RDPC), created in 1999 as a unique forum for international exchange and debate. The RDPC has developed a number of activities, including a series of Territorial Reviews of regions. These studies follow a standard methodology and common conceptual framework, allowing countries to share their experiences and disseminate information on good practices.

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Acronyms and abbreviations

CIS	Community Innovation Survey
CPIA	Permanent local centres for adult education <i>Centri provinciali per l'istruzione degli adulti</i>
DSP	Domestic Stability Pact
EU	European Union
FDI	Foreign direct investment
FP7	Seventh Framework Programme for Research and Technological Development
FUA	Functional urban area
GDP	Gross domestic product
GVA	Gross value added
GVC	Global value chain
ICT	Information communication technology
NEET	Not in employment, education or training
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Co-operation Treaty
PIAAC	Programme for the International Assessment of Adult Competencies
PISA	Programme for International Student Assessment
R&D	Research and development
RDPC	Regional Development Policy Committee
RIS	Regional innovation scoreboard
S3	Smart Specialisation Strategies
SME	Small and medium-sized enterprise
TL2/TL3	Territorial Level 2 (large regions)/Territorial Level 3 (small regions)

Executive summary

Key facts

- ***Bergamo has historically been a high-performing region.*** Small and medium-sized enterprises (SMEs) in the region benefit from a system of industrial relations based on proximity and local interactions (industrial districts). Per capita gross domestic product (GDP) in Bergamo exceeds the average across OECD Territorial Level 3 (TL3, or small) regions, and its unemployment rate has traditionally been very low. Bergamo's level of labour productivity surpasses that of most of its European peers and other OECD regions with similar areas of specialisation.
- ***Bergamo's traditionally strong industrial economy remains a key asset for success.*** Manufacturing continues to account for more than a third of the province's economic activity (35.1% of gross value added [GVA] and 34% of employment in 2012). Manufacturing has experienced important structural changes linked to the province's growing reliance on exports, and technological upgrading.
- ***Since the early 2000s, however, Bergamo has been losing ground to other regions.*** GDP per capita and productivity growth are stagnating (especially if compared to similar TL3 OECD regions). The crisis has accentuated this poor economic performance, leading to a drop in both GDP per capita and productivity and a sharp rise in unemployment. In 2000, Bergamo's labour productivity was 33% above the OECD average; by 2011 the corresponding figure was only 14%.
- ***The poor macroeconomic performance of the Italian economy has undermined Bergamo's performance.*** The stagnation in economic growth and productivity is a national issue. Aggravated by the recent global economic crisis, economic stagnation has led to increasing unemployment and a drop in domestic demand. The institutional and regulatory settings are not business friendly. Overly complicated labour and fiscal laws alongside an inefficient justice system makes it particularly difficult to attract foreign capital. The recent reform of the intermediate levels of government has increased institutional uncertainty at the provincial level, creating a potential void of governance.
- ***The adult population's lack of skills represents a constraint for the move towards higher value-added production.*** Although there has been a gradual improvement in general skills amongst young people, the average skill level of the adult population remains low. The province scores above the OECD average in international student assessments (PISA), but on the assessment of general skills among the adult population (PIAAC), it is well below the OECD average. The industrial legacy contributed to a high share of high school drop-outs with job-specific skills – acquired in the workplace – but few transferable skills.

- ***Bergamo’s innovative activities surged through the 1980s and 1990s but have plateaued since 2000.*** Among Lombardy’s 12 provinces, Bergamo is the second-strongest performer in innovation, surpassed only by Milan. Measured in terms of patents, Bergamo experienced a steady increase in innovative activity in the 1980s and 1990s and across 1 708 OECD TL3 regions, Bergamo improved from a rank around 550 in the early 1990s to 350 in the late 1990s. Since the early 2000s, its rank has varied around 275, with no indication of any further upward momentum.

Key policy challenges and recommendations

- ***Transition to higher value-added and more technologically intensive activities.*** Restoring economic growth and competitiveness will depend on Bergamo’s ability to transition towards higher value-added and technologically intensive activities. A shift in this direction can generate the necessary dynamism to maintain and improve the current income level and standard of living. Achieving this goal requires action in several key areas that reinforce and complement each other.
- ***Develop an inclusive governance arrangement to co-ordinate the development and delivery of a common development strategy.*** This regional development strategy should include actions over the short, medium and long terms and facilitate interaction with institutions at the regional and national levels. A number of working groups in key areas such as internationalisation, innovation, skills and training, business development and accessibility should support the delivery of actions in the regional development strategy.
- ***Improve workforce skills through the creation of a “one-stop shop” and the promotion of synergies in training provision across firms.*** Internationalisation and industrial change require not only specific skills, but also skills that are focused on adapting to a changing environment. This is particularly important for young adults with a long work horizon ahead of them. Bergamo should aim at increasing voluntary uptake of training and should try and push for combining receipt of governmental funds with an incentive for skill improvement.
- ***Promote innovative networks among SMEs and ensure provincial innovation priorities are well understood at a regional, national and European scale.*** Co-operation among SMEs and research institutions is difficult to achieve, as incentives and information need to be aligned. Successful initiatives such as those initiated by the provinces’ employer associations should be learnt from and expanded. More effort is also required to work with the region of Lombardy to ensure that Bergamo’s priorities are understood at a regional, national and European scale.
- ***Increase the attractiveness of Bergamo as an investment destination by building stronger connections to international markets.*** As an economy close to the productivity frontier, Bergamo needs to push towards technological upgrading and replace some of the local links in favour of deeper international connections. Attracting foreign direct investment (FDI) and skilled labour is also crucial to push the technological frontier. This will require a clear strategy for attracting FDI, further promoting the internationalisation of local firms, and better connecting Bergamo with Milan and Orio al Serio International Airport.

Assessment and recommendations

Assessment

Bergamo has an advanced economy and a high standard of living...

- ***Bergamo has historically been a high-performing region.*** Per capita gross domestic product (GDP) in Bergamo exceeds the average across OECD Territorial Level 3 (TL3, or small) regions, and its unemployment rate has traditionally been very low – less than 4% between 2000 and 2010, although it has since risen to around 7%, but remains below the OECD average. The attraction of the province is further confirmed by population growth, which continued to grow strongly despite the crisis: during 1995-2007 and 2007-11 Bergamo's population grew at annual average rates of 1.0% and 1.2%, respectively, more than four times the Italian average and more than three times as fast as the average for OECD TL3 regions.
- ***Manufacturing remains essential for Bergamo's economy.*** A reduction in the contribution of the manufacturing sector and an increase in services to the economy is a common trend across OECD countries. Defying this trend, Bergamo's small and medium-sized enterprise-based manufacturing sector remains strong. Manufacturing continues to account for more than one-third of the province's economic activity: about 35% of gross value added (GVA) in real terms and 34% of employment, substantially above European and OECD averages. Five sub-sectors (metal products, machinery and equipment, rubber and plastics, textiles, and electrical equipment) together account for 51.8% of manufacturing employment.
- ***Bergamo's manufacturing sector remains significant because it has shifted to higher value activities.*** Employment has markedly shifted from traditionally strong sectors like textiles and clothing and repair and installation of machinery towards production of machinery and equipment, rubber and plastics, and chemicals. This change has contributed to an increase in technological intensity within the manufacturing sector, which has been shifting from medium- and low-tech manufacturing activities towards medium-high tech.
- ***The manufacturing sector has performed strongly.*** The vast majority of firms remain small and medium-sized enterprises, and Bergamo has one of the highest concentrations of small firms amongst OECD regions. These firms draw on shared networks and ties to grow and innovate. Bergamo's labour productivity surpasses that of most of its European peers and other OECD regions with similar industry profiles. Against the backdrop of weak domestic demand, Bergamo's export growth rate was 6% per year in the period 2000-07 and 3% for 2008-11. Exports in recent years have shifted from sales within Europe to world markets.

... but emerging challenges are eroding Bergamo's competitive advantages

Productivity has stagnated

- ***Productivity growth has flatlined since the early 2000s.*** Bergamo's economy has been losing ground to competitor regions since the turn of the century. Productivity growth during 2000-11 was below the average for OECD TL3 regions, and lower than peer regions with similar characteristics. It was also slightly lower than the national average, which was itself very poor in comparison to other OECD countries. In 2000, Bergamo's labour productivity was 33% above the OECD TL3 average; by 2011, it was only 14% above. This disappointing performance owes much to the slowdown in industrial productivity growth, which averaged just 0.7% per year in 2000-11, as opposed to an average of 2.1% in EU15 countries.
- ***Italy's recent stagnation has undermined Bergamo's performance.*** Italy has experienced sustained low productivity since the 1990s and low economic growth for more than a decade. The global economic and financial crisis made matters worse and Italy has yet to bounce back. Italian GDP in 2013 was very slightly below the level of 2000 in real terms, making for the second-lowest average growth recorded among OECD countries. The lack of funding from the national level brought by tight budgets during the crisis has also constrained economic activity in Bergamo. Institutions and the national regulatory framework represent an obstacle to attracting foreign direct investment (FDI) to the province. Furthermore, the province does not have any leverage on the regulatory rules and policies set at national level.
- ***The effects of the crisis have been particularly severe in Bergamo.*** Since 2007, productivity in Bergamo has declined at a faster rate than in Italy or other OECD TL3 regions. The rebound in productivity, evident in other OECD countries since, is not reflected in Bergamo. In terms of total output, the GDP contraction in Bergamo during the period 2007-11 (-2.4%) was eight times more severe than the average for OECD TL3 regions (0.3%), and even more severe than the national average (-1.7%). As a result, Bergamo's lead in income per capita declined relative to peer regions. In 2000 it stood 36% above the average of peer regions, but this gap has since closed. The level of GDP per capita in 2011 was equivalent to the level in 2006.

Skills do not match the contemporary needs of the economy

- ***The deterioration in labour market performance has been particularly pronounced.*** By 2012, the unemployment rate in Bergamo was triple that of 2004, an increase that was greater than that recorded for Italy as a whole. Fortunately, unemployment among 15-24 year olds, though very high (25%), remained below the Italian average of 35%. However, the surge in youth unemployment marks an important change in Bergamo, which was traditionally characterised by high activity rates, fuelled by the easy access of teenagers to the labour market. The change may well represent a higher demand for high-skilled workers in the province, as well as the weakening of overall labour market conditions.

- ***The industrial legacy contributed to a high share of high school drop-outs with job-specific skills – acquired in the workplace – but with few transferable skills.*** More than half of the province’s employees did not complete high school; many of them chose to learn their trades on-the-job once they finished compulsory schooling. The result is a large share of employees who are highly skilled in specific tasks but who lack the general skills required to adapt to modern production techniques and the implementation of innovative practices. This limits labour mobility and the overall efficiency of the labour market.
- ***Although there has been a gradual improvement in general skills among youth, the average skill level of the workforce in Bergamo remains below OECD standards.*** The province scores above the OECD average performance in international student assessments (PISA), and in the two waves of the PISA study Bergamo has improved considerably. However, the general skills amongst the adult population are well below the OECD average. In addition, the training participation rate of people in the workforce who did not finish high school is low in Bergamo compared to the OECD average. A continuation of these trends will make it more difficult for the region to increase productivity and promote inclusive growth.

The region is not making the most of its innovative potential

- ***Bergamo’s innovative activity surged through the 1980s and 1990s but has plateaued since 2000.*** Among Lombardy’s 12 provinces, Bergamo is the second-strongest performer in innovation, surpassed only by Milan. Measured in terms of patents, Bergamo experienced a steady increase in innovative activity in the 1980s and 1990s, and across 1 708 OECD TL3 regions, Bergamo improved its ranking from around 550 in the early 1990s, to 350 in the late 1990s. This performance plateaued in the 2000s, and its rank has since varied around 275, with no indication of any further upward momentum.
- ***The internationalisation of small firms will be critical to future innovation performance.*** Medium-sized and large firms have a high propensity to innovate. Among smaller enterprises, it is mainly the internationally active ones that are innovators. Small enterprises constitute the (vast) majority of businesses active in the province and only a minority of them export internationally.
- ***The region’s innovation infrastructure needs to be better utilised.*** Two science parks, Il POINT and Kilometro Rosso, support innovative companies and start-ups. The former is governed by local private and public institutions; the latter is a private initiative. The province’s academic infrastructure is another innovation strength that could be better mobilised. It is home to the University of Bergamo, a major hospital and the non-profit Mario Negri Institute, which conducts and publishes academic research and has strong relationships with higher education institutions in Milan.

Recent reforms have raised questions about the future role of the province

- ***Governance challenges in Bergamo must be seen in the broader Italian context.*** Italy has three subnational levels of government. The regional and the provincial administrations are involved in health, education, transport and local economic development. The local municipal level is responsible for the provision of local public services such as garbage collection, pre-school and primary education, and housing.

- ***The ongoing reform of Italy’s provinces generates uncertainty for Bergamo.*** A recent reform of the provincial level of administration, adopted in 2014, elevates the role of larger cities and removes the direct election of political representatives. Italy’s ten largest cities, including Milan, will become “metropolitan cities” and will replace the corresponding provinces. They will have greater powers than did the former provinces and the mayor of the main city will head the new government body. The remaining provinces, including Bergamo, will be governed by an assembly of all mayors and an executive council that consists of a local administrator elected by all local councils on a population-weighted basis. The exact functions allocated to the new provincial bodies will be determined by regional governments, creating institutional uncertainty about the future role of the provinces.
- ***The change in the province’s status may necessitate a greater role for business in regional economic governance.*** Along with administrative actors there are other institutions that operate at the provincial level, and represent important elements of Bergamo’s governance architecture. The Chamber of Commerce bridges the public and private sectors and traditionally brings together the business community to discuss, and devise solutions for, the economic development of the region. This includes activities such as the training of workers, promoting innovation, provision of business services, organisation of business events and tourism promotion.
- ***Bergamo suffers as a result of the weaknesses of public governance in Italy overall.*** In terms of the quality of government, Italy scores especially low in corruption and rule of law, two key elements for the creation of a sound environment for business activity. This, coupled with the inefficiency of the judicial system and the burden of labour- and product-market regulation, represents a crucial bottleneck for business development and attraction of foreign capital into the province.

These challenges require policy responses in the following domains:

Strengthening regional planning and governance

- ***Bergamo requires a clear plan to transition towards higher value-added and technology-intensive activities.*** Achieving this goal requires action in several key areas that reinforce and complement each other. The priorities identified for Bergamo include improving the skills of the workforce and enhancing innovation potential. For each area, this review identifies areas of action and policy levers. These levers for change should be applied in a co-ordinated fashion, according to a common vision, to achieve the greatest benefit. This will require the establishment of a governance structure at the local level, which is currently missing.
- ***Key stakeholders in Bergamo need to create a common vision for regional development.*** These stakeholders include the Mayor of Bergamo, the other mayors of the province, leaders in the private sector and from academic institutions, as well as the employers’ associations, unions, and the Chamber of Commerce.

- **Priorities should be clear with resources and accountabilities to ensure delivery.** These efforts at co-operation should be formalised and include participation from representatives of the public and private sectors, as well as civil society, to increase a sense of ownership. In addition, it should also be linked to resources and policy levers. The vision in the short run should result in a common policy framework with clearly articulated guidelines that: 1) identify key policy goals and the parameters for actions and evaluation; 2) are supported by political commitment.
- **A shared vision can enhance Bergamo's bargaining power vis-à-vis regional and national stakeholders.** A shared vision for Bergamo's development will not only benefit the province's stakeholders directly, it would also increase their bargaining power in relation to other provinces and the regional and national government, and improve their capacity to influence regional and national policies.

Improving workforce skills

- **Adult education and training is helping to offset the skills deficits faced by early school-leavers.** One important focus of education and training policies has been to address the high share of high school dropouts and offer alternative upper secondary education outside the university system. The Higher Technical Education and Training (Istruzione e Formazione Tecnica Superiore, IFTS) introduced in 1999, followed by formative poles (*poli formative*) and since 2008 higher technical institutes (istituti tecnici superiori, ITS) have been designed to provide training pathways for young people. All these institutions are aimed at providing skills that are directly relevant to Bergamo's local labour market and are designed in close co-ordination with the local entrepreneurs.
- **Nevertheless, the majority of learning occurs – mostly informally – within small firms.** Provision of adequate training opportunities and upgrading of skills is crucial to maintain and improve firms' competitiveness. However, financing training can be an obstacle for small firms. With about two-thirds of employees working in small firms, addressing these concerns is a key policy challenge. However, while firms tend to be small, they also tend to be integrated in strong local supply chains with larger firms. OECD experience suggests that mobilising these networks to identify common training needs can create a critical mass of demand for training and help workers in smaller firms develop new skills and capabilities.

Enhancing innovation potential

- **Potential participants in the innovation process need to be better connected.** Many local firms (especially SMEs) fail to generate demand for innovation stemming from research institutions and universities, as they are often simply unaware of the available options. On the other hand, research institutions and universities lack incentives to collaborate with small firms, either due to their prevailing interest in research rather than in diffusion of technology, or due to the higher transaction costs in dealing with small (and often micro) firms. Bergamo's innovation policy should aim to support R&D investment and closer linkages between firms, research institutions and universities.

- ***The activities of key institutions are not co-ordinated.*** Three institutions – the hospital (Ospedali Riuniti di Bergamo “Papa Giovanni XXXIII”), the university (Università degli Studi di Bergamo) and a private research centre (Laboratori Negri Bergamo) – account for nearly all academic publications in the province. Research and development of new products and processes is conducted mainly in the private sector and is supported by private and public institutions, as well as by the higher education system. Policies that support innovation exist at all administrative levels starting from the provincial level, for example through the initiatives of the Chamber of Commerce, up to the European level and the European Union’s Smart Specialisation Strategy. There is a need to better co-ordinate all these actors.
- ***Bergamo has made progress in promoting business incubators in recent years.*** In 2001, the Chamber of Commerce started a business incubator to support new enterprises. In 2014, the incubator’s facilities were moved to the science park Il POINT, where more space is available, allowing the inclusion of manufacturing firms in the incubator. The inclusion of manufacturing firms increased the possibility of cross fertilisation, already enhanced by the connection with a broad network of national and international science parks. Firms that participate in the incubator are selected on an annual basis and benefit from shared facilities and business support services.

Increasing the attractiveness of Bergamo as an investment destination

- ***The industrial sector can benefit from openness to international actors and attractiveness to FDI.*** Bergamo has been successful in promoting exports but it has not elaborated a regional strategy to attract FDI. Foreign investors could contribute to entrepreneurship in the province, which has been stagnating since the early 2000s and could also enlarge the scope of skills available within the regional economy. Most importantly, FDI would positively affect the investment propensity – and then the growth potential – of the region. International evidence suggests that the presence of a multinational located within an industrial district helps other firms along the supply chain both as a buyer of their products and by positively affecting the quality of the business services available in the area. This will require better co-ordination across local policies, including spatial planning, transport and service delivery.
- ***Accessibility is crucial for the attractiveness of the region.*** To remain a highly productive region and facilitate the transition of its productive framework toward a global network, Bergamo needs to capitalise on its national and international links. The recent construction of the new motorway connecting Brescia to Milan through the south part of the province of Bergamo and the addition of a fourth lane in the existing motorway connecting Bergamo city to Milan, represent an important step forward. Train services connecting the city of Bergamo with the Val Seriana has also helped reduce congestion and improve environmental conditions in the valley. Nonetheless, there remains room for improvement in public transportation, particularly the connection between the airport and the city of Bergamo, as well as between Bergamo and the metropolitan city of Milan.
- ***Tourism has increased in importance and can improve Bergamo’s attractiveness.*** Joint efforts of the province of Bergamo, the region of Lombardy, the local airport and employers’ associations to improve and promote Bergamo as

a tourist destination and the rapid growth of the Orio Al Serio Airport have helped increase the profile of the sector in Bergamo. The share of employees working in the core tourism industries increased from 4.4% to 6.1%. The whole tourism supply chain accounted for 9.4% of employment in 2011. This is a sizeable share, but about 1.4 percentage points less than in Lombardy as a whole and 2.6 percentage points less than across all of Italy. The improvement of cultural and physical amenities can enhance the attractiveness of Bergamo for foreign investors and high-skilled workers.

Recommendations

Strengthening regional planning and governance	
(1) Develop a common development strategy and an inclusive governance arrangement to deliver on it	Successfully making the transition to higher value activities will depend upon a shared development vision for the region and a governance arrangement to co-ordinate the delivery of it. This regional development strategy should include actions over the short, medium and long term; investments required to deliver them; and how outcomes will be evaluated. A formalised regional governance arrangement should be established to oversee its delivery and include the Mayor of Bergamo, the other mayors of the province, and leaders from the private sector and from academic institutions, as well as the associations of employers, organised labour, and the Chamber of Commerce.
(2) Create working groups within this regional governance arrangement to implement specific aspects of the regional development strategy	A number of working groups in key areas such as internationalisation, innovation, skills and training, business development and accessibility should support the delivery of actions in the regional development strategy. These working groups will improve co-ordination amongst key actors, support information sharing and mobilise key experts within each field.
Improving workforce skills	
(3) Develop alliances amongst firms to better deliver training services	Measures to help integrate the training efforts of smaller firms, particularly along local supply chains, will be critical to improving workforce skills. Larger firms should also be incentivised to organise training on behalf of smaller firms within their supply chain as they also benefit from these investments through improved goods and services. In other OECD countries, similar efforts are supported by public funding.
(4) Implement a one-stop shop for training services	Training in Bergamo is provided by a variety of private and public actors that are not co-ordinated, making it difficult for employers or individuals to pick the right programme. The “shop” could take the form of an interactive web-based platform that informs interested individuals about available training opportunities. This platform should also allow for feedback from participants on the quality and impact of training programmes.
(5) Re-skill vulnerable workers	An important target group for adult training are workers who have recently been laid off. Bergamo should aim at increasing voluntary uptake of training by this group of workers and should try and push for combining receipt of governmental funds with an incentive for skill improvement. In particular, workers that benefit from the <i>cassa integrazione guadagni</i> – a form of unemployment insurance in which the worker remains formally employed by the firm – should be considered as a target group for skill improvement. Improving the general skills among these workers can benefit both their current employers and the workers themselves as it can open up opportunities in other sectors.
(6) Better align skills training to future industry needs	Internationalisation and industrial change requires transferable skills that support higher value industrial activities and adaptability to a changing economic environment. For example, ICT skills are becoming increasingly important in manufacturing and services employment. Teaching these skills to people who are in the workforce will require new training models to be developed.
Enhancing innovation potential	
(7) Encourage innovative networks among small and medium-sized enterprises (SMEs)	Partnerships between local firms and research institutions should be encouraged to promote innovation. Such an initiative can benefit from the experience gained by the province’s employers’ associations in helping their members set up consortia for interdisciplinary research, especially when it comes to creating organisational structures and legal foundations for joint undertakings. This will also help the regional actors access national and European funding by increasing the quality and scale of project proposals.

(8) Better connect Bergamo's innovation strategy to the EU Smart Specialisation agenda	Smart Specialisation Strategies (S3s) at a regional level are used by the European Union to facilitate investment in innovation. Some of the province's strengths are reflected in Lombardy's S3, but a concerted effort at the provincial level to influence the strategy could improve visibility and focus. A local co-ordinator should be appointed who can work with business and research institutions to promote the province's innovation priorities at a regional, national and European level.
(9) Leverage successful private initiatives to promote a culture of innovation and entrepreneurship	Entrepreneurship will be important for the region's strategy to grow higher value activities. The province can consider building on the success of the annual science fair – a private initiative – to further expand its reach and support the creation of an innovation and entrepreneurship driven culture. Sponsoring a competition among school students, with winners being featured at the event, would be an option, but alternatives (e.g. a separate event in between fairs) could help retain interest and attention to the topic all-year round.
Increasing the attractiveness of Bergamo as an investment destination	
10) Prepare an investment attraction strategy	Foreign investors will bring new capital, ideas and skills to the regional economy. The province currently does not have a clear strategy to attract foreign direct investment. For example, an investment prospectus with data and information such as land availability and costs, skills profile, and regulatory process which are relevant to investment decisions would be useful. This task should be taken on by a working group.
(11) Increase access to business expertise for SMEs	Small and medium-sized businesses often lack the critical mass to innovate and access finance, in particular venture capital. The province is home to several highly competitive global businesses that invent, create and produce in specific market niches. Establishing a business angel network could help leverage this expertise to support the growth of young innovative firms.
(12) Better connect Bergamo with the airport and the metropolitan area of Milan	Bergamo needs to capitalise on its proximity to Milan and the Orio al Serio Airport. There remains room for improvement in public transportation between the airport and the city of Bergamo, as well as between Bergamo with the metropolitan city of Milan.
(13) Further promote internationalisation of SMEs	The integration of SMEs into international markets is a pressing issue that has already received considerable attention in Bergamo. A good example is the Temporary Export Manager Project, which involves deploying experienced managers in small enterprises to develop measures to internationalise the firm. This programme is run by the Chamber of Commerce through its development agency Bergamo Sviluppo. Consideration should be given by a working group to enhancing and extending initiatives such as these.
(14) Harness the financial strength of Milan	More could also be done to harness the financial strength of Milan, especially in the field of venture capital – for example, by creating an annual fair for investors, venture capitalists and businesses looking to expand their portfolio on the one side and start-ups and growing businesses in the need of financing on the other.
(15) Improve the diffusion of information to SMEs	Supporting the growth of SMEs will depend upon awareness about business support programmes. Diffusion of information in the province must be expanded, to ensure that a maximum number of SMEs can be reached. One key element would be to centralise information that is relevant for business at one clear point of access and working with business associations to ensure a broad range of SMEs are made aware of it.

Chapter 1

Challenges and opportunities for Bergamo

This chapter provides a description of the general socio-economic framework of the province of Bergamo, along with an assessment of the challenges and opportunities faced by the province. In particular, the first section provides an analysis of the macroeconomic and regulatory settings of the Italian economy, which represent the economic and institutional contexts within which the economy of Bergamo operates. Then, a detailed description of the territory and demographic structure of Bergamo is provided. Next, the analysis focuses on the economic trends and performance of the province of Bergamo, identifying the main challenges and opportunities for Bergamo. Finally, the last section discusses the possibility of a strategic approach to local governance that can facilitate the implementation of regional development policies.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Introduction

The province of Bergamo is located in northern Italy at the margin of the “industrial triangle” between Milan, Turin and Genoa, the cradle of industrialisation in Italy. Bergamo is also one of several areas in Italy where industrial districts first developed. This solid industrial legacy is the backbone of the province’s economy. Its economy is one of the most prosperous in Italy, contributing substantially to Italian exports in the manufacturing sector. It includes a productive mix of manufacturing, services and agricultural activities in the densely populated plain next to the province of Milan. Its complex network of industrial, political and social stakeholders in national and international markets was the subject of OECD analysis more than a decade ago (OECD, 2001).

The 2001 *Territorial Review of Bergamo* praised Bergamo’s industrial structure, analysing some of the key strengths of the territory. The review highlighted the importance of its manufacturing sector and the high level of gross domestic product (GDP) and employment by comparison with other Italian provinces and with Italy as a whole. Bergamo is one of the most prosperous provinces in Italy. The review, however, identified some challenges for the competitiveness of the economy, including a lack of formal education among the labour force and the poorly developed transport infrastructure. It concluded that the province needed to improve local governance and recommended the creation of a “regional alliance” among local actors, which remains a key area of development.

Some of the recommendations made in the 2001 review have been adopted. In particular, co-operation and communication among local stakeholders appears to have improved, and the transport infrastructure has benefited from the creation of a new motorway and light train connection between the city of Bergamo and its surroundings. The tourism sector has also been developed and has profited from the extensive development of Bergamo airport. Nonetheless, since the last review, three factors have reshaped the socio-economic environment:

1. the increased globalisation of the world economy
2. the 2008 global financial and economic crisis
3. the recent administrative territorial reform implemented by the Italian government.

The increased globalisation of the world economy has brought opportunities and challenges for economies like Bergamo’s, with a dominant export sector. To compete internationally and benefit from the opening of new markets, especially in Southeast Asia, Bergamo’s industries have introduced innovative products and production processes.

Italy was severely hit by the global financial and economic crisis and ensuing recession. The immediate effect of the crisis was the collapse, in 2008, of international trade flows, which had a dramatic impact on open economies (Araújo and Oliveira Martins, 2011), and Italy has not yet experienced a recovery. In this context, the province of Bergamo represents an interesting case, given its reliance on exports and the increased dependence of its manufacturing sector on foreign demand in international markets.

Both globalisation and the economic crisis present two interrelated, challenges for Bergamo:

4. Globalisation is a structural phenomenon that presents Bergamo with challenges and opportunities. Its traditional manufacturing base faces strong international competition. On the other hand, the integration of global markets opens new markets.
5. The global financial crisis has exacerbated some of the structural weaknesses of Bergamo's traditional industrial sectors, including construction and textiles (This chapter and Chapter 2). It will have to upgrade production processes to generate more value - added and remain competitive.

A third challenge is presented by the Italian government's recent administrative territorial reform. Under this measure, the elected provincial level of government was eliminated and replaced by an assembly of mayors and an executive board elected by local public administrators. This is likely to redefine the institutional framework within which the economic actors operate, changing the vertical relationship between levels of government and the interaction among local administrations and other non-institutional stakeholders (e.g. associations of entrepreneurs, Chamber of Commerce, etc.). The local administrative framework shapes the governance of any regional development process and the formulation of a common vision for development. This review will explore some of the reform's advantages and disadvantages and provide some insight on how to co-ordinate the activity of local stakeholders.

The analysis of the socio-economic framework of the province of Bergamo reveals some challenges that policy makers should address in order to boost competitiveness and restore economic growth. Amongst the main challenges are the following:

- The underperforming national economy has adversely affected Bergamo, given its strong domestic linkages. For more than a decade, Italy has suffered from sustained low productivity and economic growth. The global economic and financial crisis has made matters worse, and Italy has yet to reverse the negative trend. In 2013, Italian GDP, measured in real terms, had fallen below the level of GDP in 2000, and Italy's growth was the lowest among OECD countries.
- The traditional strengths of Bergamo's model have not been able to sustain strong growth since the turn of the century. Productivity growth in particular has flatlined since the early 2000s, and Bergamo's economy has lost ground in relation to other manufacturing regions.
- The adult workforce lacks general skills. Many adult workers have few transferable skills. Bergamo's traditional strength in manufacturing used to make school-to-work transitions relatively easy. As a result, young people often joined the labour market as soon as they had completed compulsory schooling, without finishing secondary education or obtaining a degree. They found work and acquired job-specific skills in the workplace.
- Innovation is below its potential. Lombardy is one of Italy's most innovative regions, but R&D expenditure has stagnated relative to the national and European average in recent years.

This review surveys the progress the region has made in the light of the recommendations of the 2001 *OECD Territorial Review of Bergamo*, and outlines the emerging challenges. This chapter begins by examining the lessons and recommendations of the 2001 review, and an overview of the macroeconomic and regulatory framework of Italy follows, evaluating Bergamo's performance in the context of the national economy. An analysis of recent territorial and demographic trends in Bergamo is followed by a

diagnosis of its economic performance, reviewing the main drivers and bottlenecks for productivity growth. The chapter concludes with an initial assessment of the main policy and governance challenges and opportunities Bergamo faces. Chapter 2 focuses on the industrial structure of the economy and Chapter 3 on skills and innovation.

Lessons from the 2001 *OECD Territorial Review of Bergamo*

The review conducted in 2001 demonstrated the strengths of Bergamo's economy and diversified manufacturing sector, but revealed some stagnation and inward-looking attitudes at the institutional level, with deficits in formal education, transport infrastructure and land-use planning. Its geographical proximity to metropolitan Milan is a double-edged sword, presenting both an opportunity, with access to international markets and specialised services, but also the risk of marginalisation. The review concluded that Bergamo must extend its traditional manufacturing role to escape becoming irrelevant. In particular, it noted four areas of concern (Table 1.1).

Table 1.1. **Recommendations of the OECD 2001 review**

Thematic areas		Recommendations and status			
Spatial planning and transport	Co-ordinate transport and land-use plan	Reinforce public transport	Use Bergamo airport as a base for development	Foster intermodal freight transport	Develop a common vision of sustainable provincial development
Education and innovation	Specialise by responding to the demand of the local economy (strengthening links with the economy) and develop new curricula	Create avenues for re-entry into formal education	Make formal education more accessible to workers and improve the status of vocational education	Attract women to non-traditional occupations	Co-ordinate training options
Tourism and sustainable growth	Set up a legal and institutional support framework	Support human resources	Design a tourism strategy around the city of Bergamo	Promote integrated thematic strategies	Establish a rural development office within the provincial government and enhance and preserve amenities
Territorial governance	Create a regional identity	Promote local partnership	Catalytic projects for intra-regional co-operation (e.g. environmentally sound logistics; industrial tourism and cultural industries; centre for applied federalism)	Develop a provincial "foreign policy" and create a "Bergamo regional alliance"	Strengthen the steering capacity of the provincial government

Source: OECD (2001), *OECD Territorial Reviews: Bergamo, Italy 2001*, <http://dx.doi.org/10.1787/9789264195028-en> (accessed 15 April 2016).

In terms of spatial planning and transport, the main development since 2001 is the extension of the Orio al Serio Airport, which has become the fourth ranked in Italy in terms of passenger traffic (according to data from 2013). This is an important factor for Bergamo's economy. In 2013, of the almost 9 million passengers, about half (47.3%) were travelling for tourism/leisure, 24.9% for business and the remaining 27.8% for other

reasons, including for their education, family and health. The airport is an important economic asset both directly, since it employs local residents, and indirectly, as a gateway for tourists and business travellers, allowing local businessmen easy access to European markets. The airport has also been a driver of the University of Bergamo's expansion, attracting students from other Italian regions and Eastern Europe.

Significant improvements have been made in road transport, although more could be made in public transport. Both the recent construction of the new Brebemi motorway connecting Brescia to Milan through southern Bergamo province and the addition of a fourth lane to the existing motorway (the A4) connecting the city of Bergamo to Milan will not only reduce congestion, but increase access between Bergamo and the rest of northern Italy. Rail transport from the airport to the city of Bergamo and between the city and the metropolitan area of Milan is, however, still underdeveloped. Some progress, however, has been made in the public transport network linking the city of Bergamo and neighbouring territories, mainly the valleys. A light rail system now connects Bergamo's train station with cities along the Val Seriana to the east. This has reduced congestion and improved environmental conditions in the city and the valley.

Box 1.1. A motorway link between Brescia and Milan

This new motorway, 62.1 kilometres long, has improved access between the cities of Brescia and Milan, by providing an alternative route to the previous motorway, which passes close to the city of Bergamo. The Brebemi is expected to attract some of the long-distance traffic to Milan, reducing congestion on the motorway linking Brescia to Bergamo and Milan.

The proposal for a motorway cutting through the plain south of the province of Bergamo originated in the early 1990s. Securing consensus, financial resources and planning permission for the project took several years, and construction began in July 2009. In July 2014, the new motorway opened to the public. Financing the project took about ten years.

An unusual feature of the project is its private funding. Of its EUR 1.6 billion budget, 75% is financed by bank loans and 25% by equity raised through private companies. National, regional and local government involvement is limited to the procedural and administrative level. The financing of the project was designated one of the best infrastructure projects in Europe, winning a Project Financing International award in 2013.

Source: Società di Progetto Brebemi SPA, www.brebemi.it (accessed 25 April 2016).

The previous review noted the need to improve the educational level and skills of the working population in Bergamo. This remains a potential obstacle to the sustainability of the region's economic development.

In tourism and sustainable development, the main improvement has been in developing tourism in the city of Bergamo. Public and private institutions have co-operated on various tourist amenities, drawing on the city's cultural assets, including museums, historical buildings and concert halls.

The recent changes in territorial governance are likely to influence the efforts to create a common identity and an environment in which firms can co-operate. Such efforts have been led by the Chamber of Commerce through its special agency Bergamo Sviluppo and by Imprese & Territorio, which represents several sectoral associations and Confindustria, an association of industrial entrepreneurs. The province of Bergamo never fully assumed a leading role, and it is not clear what the current administrative reform

will bring. The most active local actors appear to be the Chamber of Commerce and the region's economic associations (Confindustria, Confcommercio, Confesercenti, Confartigianato, Confagricoltura, etc.).

The previous review noted that local stakeholders should draft a shared vision of regional development. This recommendation, however, was not embodied in any institutional legacy, and no new or existing institution was in a position to take up this role. The review's recommendations were partially assumed by Bergamo Sviluppo, a special agency created by the Bergamo Chamber of Commerce, which includes associations representing most of Bergamo's economic sectors. Its aim is to promote development in a series of initiatives dedicated to innovation (e.g. through business incubators) and to help create a network of firms to promote internationalisation. This remarkable achievement, however, is limited to the economic actors in the province and does not involve political or academic participants.

Since the last review, new economic challenges and opportunities have emerged. This chapter provides a socio-economic assessment of the province, highlighting its strengths and challenges.

National economic and regulatory framework

This section provides an overview of the framework conditions for economic actors in the province of Bergamo. At the macroeconomic level, Italy was severely affected by the crisis of 2008, with stagnant levels of GDP per capita and labour productivity. The weakness of the Italian economy and weak domestic demand is a source of concern for Bergamo. As a consequence of the global economic crisis, the tightening of fiscal policy and internal fiscal rules has reduced the resources from the central government to the local economy. Furthermore, the recent reform of the provincial administration has introduced an element of uncertainty in local governance.

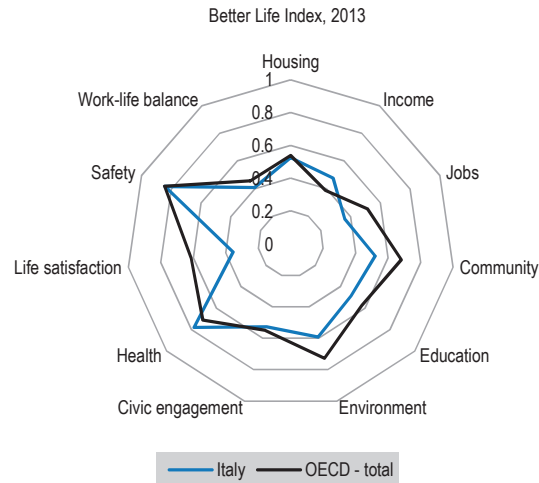
The macroeconomic context is critical for Bergamo's performance. The analysis starts by defining the national institutional and economic framework, to assess the environment in which Bergamo's economy operates. This section looks first at the recession that has stalled Italy's economy since the global financial crisis and the consequent fiscal consolidation, which has reduced the flow of resources from the central government to the regional economy and regional/local budgets under the internal stability pact. The focus shifts to an analysis of the territorial structure of the province and an assessment of demographic trends at the administrative and functional urban area (FUA) level. Bergamo's economic performance, the levels and trends in GDP and labour productivity, and the performance of the labour market are considered next.

Italy at a glance: Well-being indicators

The OECD produces an aggregate indicator of well-being for its member countries. The indicator is composed of indices that assess different aspects of life, including "hard" indicators showing income and employment levels and "soft" indicators, such as life satisfaction and civic engagement. Compared to other OECD member countries, Italy is doing well in terms of safety, health, and housing, but lagging in terms of life satisfaction, sense of community and environmental indicators, education, and the labour market.

Italy enjoys high levels in basic services, like health and safety, but falls behind in indicators crucial for economic competitiveness, such as education and jobs.

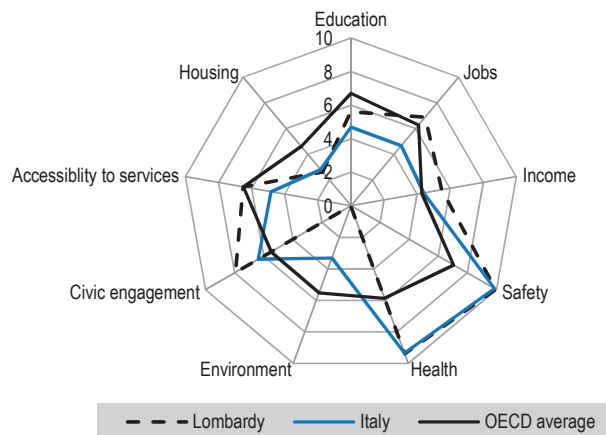
Figure 1.1. Indicators of well-being, comparing Italy with the OECD average



Source: OECD Better Life Index, www.oecd.org/statistics/datalab/bli.htm.

Italy is quite diverse, which masks some local differences. The OECD recently produced a set of indicators to measure well-being at the regional (subnational) level. Most of the indicators for Lombardy are above the Italian average. Lombardy has levels equal to Italy's in terms of health and safety and is doing far better than the country as a whole in terms of jobs, income, access to services and civic engagement. However, although it is doing better than Italy as a whole, Lombardy's performance in terms of education with respect to the OECD average remains poor. The environmental quality (essentially air quality) in Lombardy is below both the Italian and the OECD averages.

Figure 1.2. Lombardy outperforms Italy in most well-being indicators



Source: OECD Regional Well-Being indicators, www.oecdregionalwellbeing.org.

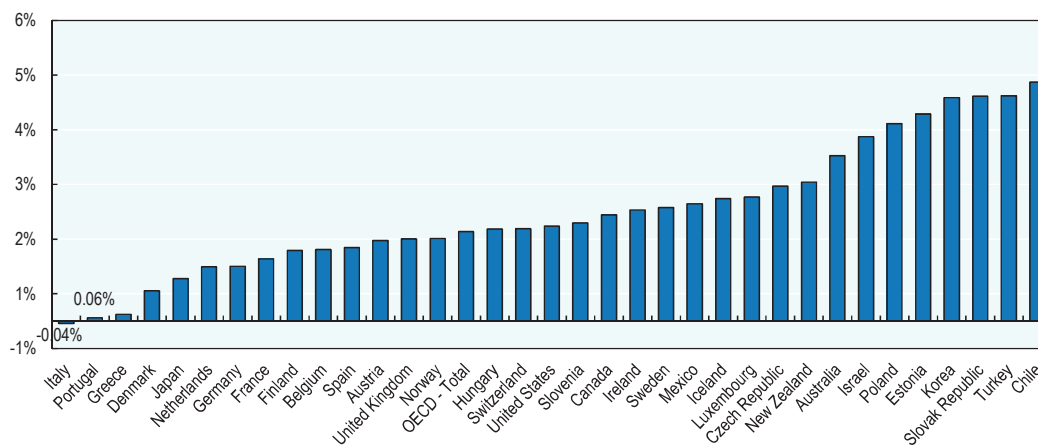
The analysis of the well-being indicators helps to frame the socio-economic context surrounding Bergamo. Though they are good overall, concerns remain about education and environmental quality, both of which are important determinants of future economic growth.

The OECD study of regional well-being makes it possible to define the TL2 regions that are similar to Lombardy in term of well-being indicators. On this basis, Lombardy most resembles Alsace (France), Gangwon (Korea), Carinthia (Austria) and Aragon (Spain). These regions have in common poor performance in terms of environmental protection and strong performance in terms of safety and health-related services.

Italy's macroeconomic performance has faced major challenges...

Italian economic performance is characterised by sustained low productivity growth and low economic growth. The global economic and financial crisis has only accentuated the stagnant performance of its economy in the past 15 years. The macroeconomic level presents two types of problems: a contingent challenge linked to the financial crisis; and a structural problem, related to the low productivity of the Italian economic system (OECD, 2013b).

Figure 1.3. Average annual GDP growth in OECD countries, 2000-13



Note: GDP is measured in constant 2005 US dollars; figures refer to the annualised growth rate between 2000 and 2013.

Source: OECD National Accounts database, http://www.oecd-ilibrary.org/fr/economics/data/oecd-national-accounts-statistics_na-data-en.

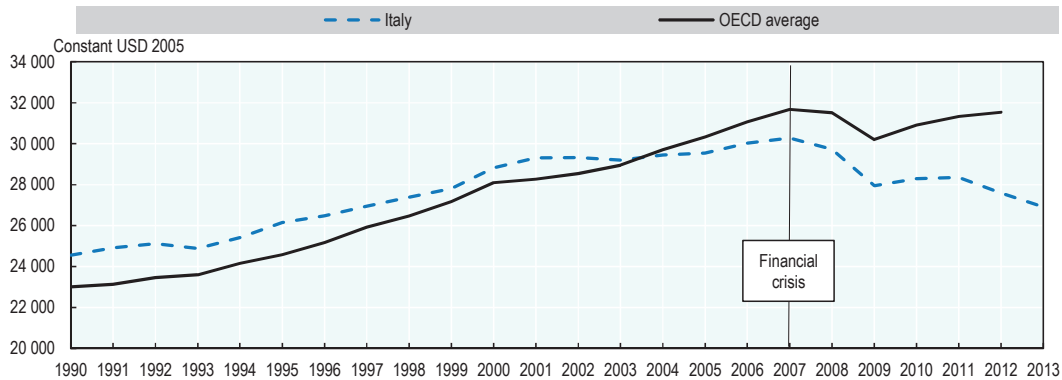
The global financial and economic crisis was a severe blow, and Italy's annualised growth of real GDP between 2000 and 2013 was the weakest among OECD countries. This is an indication of a problem of competitiveness that goes beyond the economic crisis. The analysis of the trend of GDP and GDP per capita shows weak performance even before the crisis, when compared with the OECD average (Figure 1.4).

Italy's competitiveness can best be assessed through an analysis of productivity trends. Productivity can be measured in terms of capital, labour and total factor productivity. These reflect different elements of the transformation of inputs into outputs. Labour productivity is of particular note in developed countries, given the high cost of labour in the productive process.

The evolution of labour productivity (measured as output per hour worked) for Italy in the period 1990-2013 reveals a major structural problem of Italy's economy. Well before the global crisis, Italy's growth of productivity was much flatter than the G7 average. Figure 1.5 shows that after 1995, the two trends began to diverge, with Italy constantly lagging in productivity levels below that of other advanced countries.

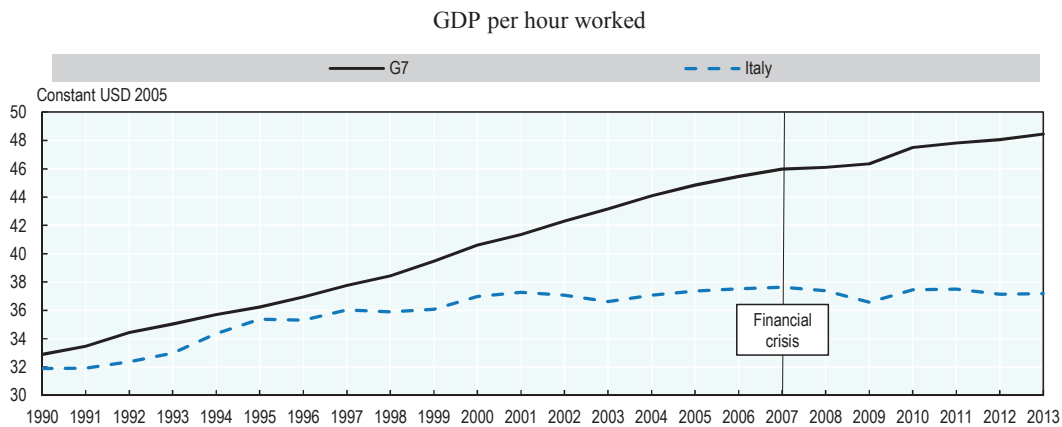
After 2000, the trend is almost completely flat, increasing this discrepancy. This suggests a structural problem not directly related to the global financial crisis.

Figure 1.4. Evolution of real GDP per capita



Source: OECD National Accounts database, http://www.oecd-ilibrary.org/fr/economics/data/oecd-national-accounts-statistics_na-data-en.

Figure 1.5. Evolution of labour productivity in Italy compared to the average for G7 countries



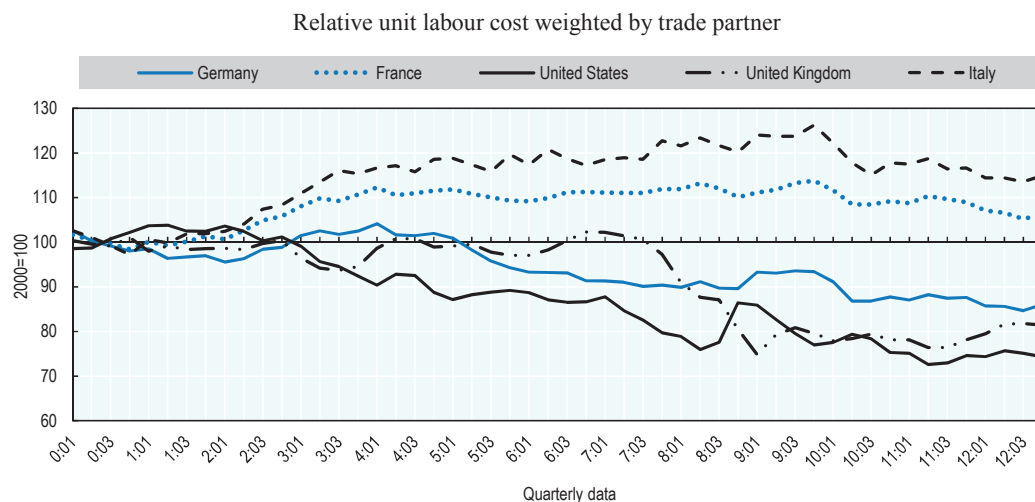
Source: OECD Productivity Statistics, http://www.oecd-ilibrary.org/employment/data/oecd-productivity-statistics_pdtvy-data-en

A further confirmation of Italy's structural problem in labour productivity can be obtained from an analysis of labour costs in relation to those of other advanced countries. Figure 1.6 shows the trend of the indicator of labour costs corrected for the weight of the trading partners. While Germany, the United Kingdom and the United States show a declining trend, France and Italy started an upward trend that was only recently reversed, as a consequence of the crisis (OECD, 2013b).

The state of public finances in Italy has tightly constrained expansion, and recent trends suggest a continuing phase of consolidation. Italy's fiscal policy has been constrained by the high levels of debt accumulated since the 1990s (Figure 1.7). International financial pressure has increased since the crisis, forcing the government to

tighten fiscal policy. The *OECD Economic Outlook* (OECD, 2014a) reported that the country's fiscal policy since 2009 had shrunk by over 4% of GDP, with further tightening planned in 2015 and 2016.

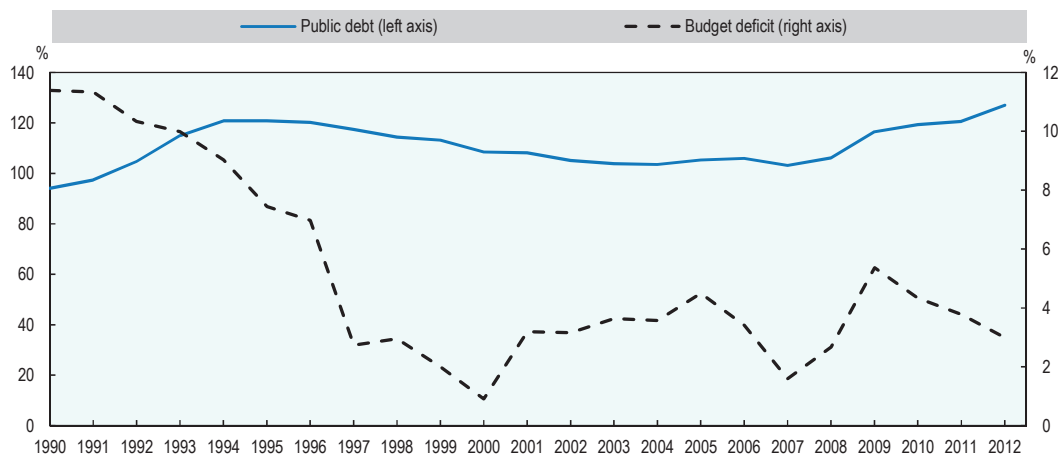
Figure 1.6. **Labour cost competitiveness, 2000-12**



Source: OECD (2013b), *OECD Economic Surveys: Italy 2013*, http://dx.doi.org/10.1787/eco_surveys-ita-2013-en.

Figure 1.7. **Evolution of Italy's public debt and budget deficit**

As a percentage of GDP



Source: OECD (2013b), *OECD Economic Surveys: Italy 2013*, http://dx.doi.org/10.1787/eco_surveys-ita-2013-en.

As a way to pursue fiscal consolidation more effectively, the Italian government has introduced an internal fiscal rule to better control the budget of subnational government tiers (Box 1.2).

The presence of fiscal rules that limit the activity of lower levels of government is not a novelty. The Domestic Stability Pact for Italian municipalities was introduced in 1995, and the phenomenon is not limited to Italy or other countries in Europe. Fiscal rules exist in many countries as part of the vertical relationship between levels of government

(Table 1.2). In Italy, however, the Domestic Stability Pact has been increasingly strengthened to achieve fiscal consolidation at the national level. It now represents a tight constraint on the operation of regional and municipal governments.

Box 1.2. The Italian Domestic Stability Pact

In 1999, the budget autonomy of Italian municipalities, and also of its regions and provinces, was reduced with the introduction of a Domestic Stability Pact (DSP), stipulated in Law 448/1998. Such fiscal rules were introduced by most countries in the euro zone as a consequence of the Stability and Growth Pact, to control and possibly limit the budget deficits of lower levels of government. These fiscal rules generally involve a limitation on running deficits and/or direct limits to spending.

In Italy, the DSP mainly defines a set of norms contained in the annual budget law. Because the DSP is prescribed in the budget law, it may be subject to substantial modification from one year to the next, creating a problem of credibility. Bartolini and Santolini (2009) identify three periods within which the DSP consists of homogeneous norms. In the first period, from 1999 to 2004, the objective of the DSP is to limit the deficit that arises as the difference between revenues and current expenditures – with the exception of the year 2002, in which an explicit limit to the growth of current expenditures was added. In the second period, 2005-06, the DSP consisted of a direct limit on the growth of expenditures. In the last period, from 2007 to 2011, the focus shifted back to the budget deficit.

A problem with the Italian DSP in the first two periods was the difficulty of imposing sanctions. Although different types of sanctions were prescribed at different times, their implementation was beset by legal problems. For instance, in 2002, it was prescribed that a violation of the DSP should lead (among other things) to a reduction in central government transfers for the following year, but a conflict with Italian constitutional law precluded the application of such sanctions. This problem affected the implementation of the DSP until recently (2007-11), when a more effective system of monitoring and sanctions was introduced.

Source: Bartolini, D. and R. Santolini (2009) “Fiscal Rules and the Opportunistic Behaviour of the Incumbent Politician: Evidence from Italian Municipalities”, *CESifo Working Paper Series*, No. 2605.

As a consequence of the poor performance of the Italian economy in GDP and productivity growth, internal demand dropped for a protracted period (Table 1.3). By 2013, domestic demand had contracted to the levels of the early 2000s.

Access to credit is a key driver of economic recovery. The evolution of economic activities demands initial financing, to produce additional resources in a second phase. Three major sources for companies to finance their investment include internal resources, capital markets and credit markets. Credit markets have been particularly constrained by the global crisis.

Access to credit in Italy is another constraint for the economy, and thus for firms in Bergamo. A recent survey conducted by the European Commission shows that the Italian credit market is particularly strict in terms of access to credit (Figure 1.8).

Table 1.2. **Subnational fiscal rules in OECD countries, 2011**

Sub-central government	Balanced budget rule	Expenditure limit	Taxation limit	Borrowing constraint
Australia state	X		X	X
Australia local			X	X
Austria state	X			
Austria local	X			
Belgium state	X		X	
Belgium local	X		X	X
Canada state	X			X
Canada local	X		X	X
Chile			X	X
Czech Republic	X		X	
Denmark	X	X	X	X
Estonia	X			X
Finland	X		X	
Germany state	X			X
Germany local	X			X
Ireland	X			X
Italy state		X	X	X
Italy local	X		X	X
Korea	X	X	X	X
Mexico state				X
Mexico local				X
New Zealand	X	X	X	X
Norway	X	X	X	X
Poland	X			X
Slovak Republic	X			X
Slovenia	X		X	X
Spain state	X	X		X
Spain local	X	X		X
Sweden	X			
Switzerland state	X		X	
Switzerland local	X	X	X	X
Turkey		X		X

Source: OECD (2013a), *Fiscal Federalism 2014: Making Decentralisation Work*, <http://dx.doi.org/10.1787/9789264204577-en>.

Table 1.3. **Domestic demand**

	Annual percentage change				
	2010 current prices (billion EUR)	2011	2012	2013	2014
Private consumption	980	0	-4.1	-2.7	0.2
Government consumption	328	-1.8	-1.5	-0.7	-0.2
Gross fixed capital formation	319	-1.7	-7.5	-5.4	-2.7
Housing	89	-6.5	-6.7	-5.4	-3.3
Final domestic demand	1 628	-0.7	-4.2	-2.8	-0.4

Source: OECD (2014b), *OECD Economic Outlook: Statistics and Projections* (database), <http://dx.doi.org/10.1787/eo-data-en> (accessed 6 May 2016).

Box 1.3. Fiscal rules

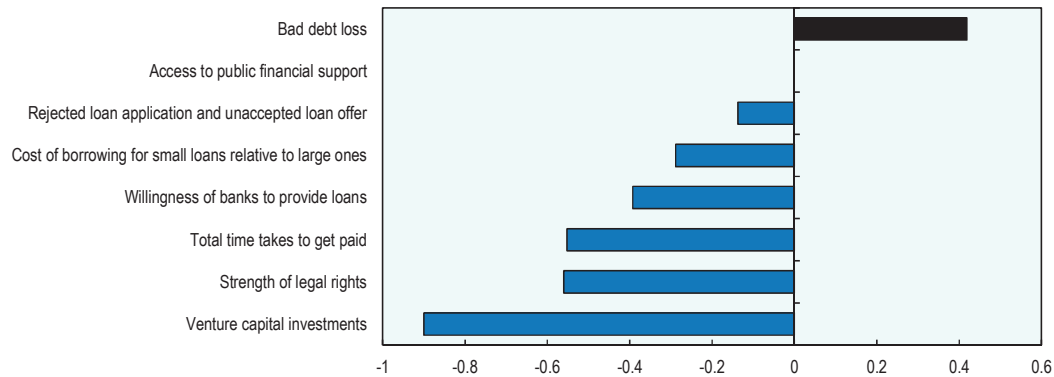
Many countries have adopted fiscal rules to manage public finances in a multi-level government structure. Such rules have gained importance as sub-central autonomy has increased. One factor that has aroused interest in such rules has been the drive towards decentralisation in both OECD and non-OECD countries since the 1990s. New spending assignments and responsibilities often preceded increased tax autonomy, which led to the emergence of large-scale transfer systems that were prone to spending excesses at the sub-central level. When they were allowed access to capital markets, sub-central governments without significant revenue-raising autonomy covered deficits through borrowing. Since they depended largely on transfers, lenders perceived them as borrowers whose debt was implicitly guaranteed by central government. The costs of profligate fiscal policy to the rest of the country arose through the moral hazard of potential bailouts from central government, raising overall borrowing costs and leading to higher, more volatile public spending and tax rates. The crisis has probably increased the perception of irresponsible sub-central fiscal behaviour as the cause of unsustainable public finances and the desirability of long-term sustainability.

Although a multitude of fiscal rules may be invoked, and each country has peculiar specificities, such rules can be grouped into four broad categories, each reflecting a different budget objective:

1. Budget-balancing rules: sub-central governments' budget-balancing requirements may vary across several dimensions. The first relates to aggregate targeted budgets. Rules may cover both the current budget and capital account, and in some cases, off-budget items. A common rule, especially at the local level, is the "golden rule", which requires a balanced budget for current spending but allows borrowing for capital spending (public investment). The second dimension relates to the relevant time horizon. Many budget-balancing rules, both at the state/regional and local level, require an annually balanced budget, which is likely to entail a pro-cyclical fiscal stance. The third dimension relates to who sets the rules. In most countries, budget-balancing rules are imposed by a higher tier of government, with the exception of some federal countries where state-level rules are self-imposed or negotiated.
2. Borrowing and debt rules: borrowing constraints, typically imposed by a higher tier of government, cover a range of restrictions on sub-central governments' recourse to debt financing. In the most restrictive cases, borrowing is not allowed at all, while in others it is restricted to such purposes as capital spending or to borrowing in domestic currency only. Rather than prohibiting borrowing altogether, a few countries cap sub-central debt in relation to GDP, own revenues or debt-servicing costs. Higher levels of government rarely provide an explicit guarantee for sub-central government debt. However, implicit rescue guarantees are widespread, and several countries have bailed out over-indebted sub-central governments, which has damaged the credibility of budget-balancing and borrowing constraints.
3. Tax limits: most central governments impose limits on sub-central tax rates and/or the tax base (a review of the various types of restrictions on tax autonomy can be found in Blöchliger and Rabesona [2009]). Tax limits usually come in the form of explicit minimum or maximum tax rates, although some countries apply sanctions in the form of lower transfer revenue, to restrain hikes in tax rates. Other countries embed sub-central taxes in tax-sharing systems, which leave sub-central governments no discretion over tax revenues. Nonetheless, most sub-central governments enjoy some degree of tax autonomy, typically over the rate or the base, though not always both. Local governments generally have less tax autonomy than state governments.
4. Spending limits: explicit spending limits are rare in OECD countries. They are linked to income, inflation or population growth, or to some other needs-based criterion or a combination thereof. Some take the form of ceilings on expenditure growth and can be set for annual or multi-annual periods. One of the possibly most restrictive rules is the requirement to hold referenda for expenditure above a given threshold or for certain types of spending (e.g. capital spending). Where there are spending limits, they are generally self-imposed.

Source: OECD (2013a), *Fiscal Federalism 2014: Making Decentralisation Work*, <http://dx.doi.org/10.1787/9789264204577-en> and <http://dx.doi.org/10.1787/5k97b111wb0t-en> (accessed 6 May 2016).

Figure 1.8. Access to credit indicators with respect to EU countries, 2013



Note: Figures refer to the ratio of the indicator for Italy relative to an average of the indicator for EU countries.

Source: European Commission (2014), “2014 SBA Fact Sheet: Italy”,

<http://ec.europa.eu/DocsRoom/documents/16121/attachments/20/translations/en/renditions/native> (accessed 6 May 2016).

An overview of the macroeconomic conditions paints a gloomy picture of the Italian economy. The country had long been losing its edge in relation to other OECD countries, and the global economic crisis has accentuated this trend. While Bergamo’s economy may perform better than the national economy, its stagnant real GDP per capita growth and poor performance in productivity are likely to have a negative impact. Given weak domestic demand, foreign exports are the only way out of the current crisis.

At the regional and provincial level, the situation is similar, with a continuous contraction of credit for all economic actors, households and firms alike. Data on firms from the Bank of Italy show a reduction of this negative trend in 2013 and the beginning of 2014. Although firms continue to report difficulties in access to credit, data for the period 2008-13 show that most of the demand for credit is spent on debt restructuring and capital replacement, with a reduction of credit for net investment and mergers and acquisitions (Bank of Italy, 2014).

As for the province of Bergamo, Table 1.4 shows that lending to firms is still falling, with a difference between 2012 and 2013 of less 5%. The table also shows that this reduction affects not only SMEs but large firms.

Table 1.4. Variations in lending in the province of Bergamo

Percentage change from 2012 to 2013

2013	Public administration	Financial intermediaries	Firms total	Medium-large	Small	Family businesses	Families	Total
March	-6.0	4.5	-4.4	-4.5	-3.9	-4.4	-0.1	4.3
June	-7.0	4.4	-4.8	-5.0	-3.7	-2.6	-0.6	4.1
September	-6.0	-2.2	-4.7	-5.0	-3.0	-2.4	-0.6	-2.3
December	-8.6	-5.3	-7.5	-8.0	-4.6	-3.0	-0.9	-5.3

Source: Bank of Italy (2014), “L’economia della Lombardia”.

Institutional and regulatory framework

In addition to the macroeconomic situation, the institutional and regulatory setting determines the framework in which economic agents operate and economic policies are implemented. This section considers Italy's administrative structure, with a focus on its multi-level governance structure, and the role of institutions and norms in the creation of a sound environment for business. In particular, the rule of law and the level of corruption are important determinants of a competitive and attractive business environment. Many studies have also drawn attention to the fundamental role of social capital for economic development. Indeed, high social capital can facilitate co-operation among economic actors and the implementation of public policy.

The section concludes with an analysis of the regulatory framework, which shapes the boundaries in which local actors in Bergamo operate.

Italy's administrative structure and the recent reform of the provincial administration...

The Italian public administration includes a central administration and three subnational levels of government. Italy has 20 regions, 110 provincial administrations embedded in them, and more than 8 000 municipal administrations.

The regional and provincial administrations are the intermediate levels of government involved in policy related to health, education, transport and local economic development. The municipal level is the closest to citizens and the most involved in providing local public services and goods, such as garbage collection, housing, and preschool and primary education.

A process of decentralisation of administrative and fiscal powers began in the early 2000s. This increased the role of the regional governments and municipalities in relation to the provincial administrations. The current government has planned a comprehensive set of reforms to radically change Italy's institutional setting. The main reform ends the bicameral Italian parliamentary system, turning the Senate into a chamber representing subnational levels of government (regions and municipalities). In April 2014, Law 56/2014 prescribed the transformation of the provincial level of government into an "institutional body of second level", without a political mandate, and the creation of so-called "metropolitan cities" in the ten largest urban areas.

The reform of the provincial level is of particular interest for the current review, as it directly affects local governance in the province of Bergamo. Italy's 110 provinces represent one of the oldest institutions in the country. They are also linked to institutions like school districts, chambers of commerce and juridical districts. The reform changes their status and functions:

- The reform revokes the status of an independent level of government from the provinces, abolishing the direct election of the governing bodies. Under the reform, the new provincial level is made up of an assembly including the mayors of all municipalities in the provincial jurisdiction, and an executive branch elected by local administrators on a population-weighted basis. In other words, the new provincial level embodies the municipal level of government and an instrument for co-ordinating their activity on issues of common relevance.
- The provinces will remain as administrative intermediate bodies in charge of co-ordinating public policy related to the maintenance of the road network and school buildings. It is not clear whether provinces will retain their responsibility

for active labour policies. Indeed, the mandate of the province will depend on the delegation of functions from the regional and the municipal level of government, and thus different provinces may have different functions.

Another important aspect of the reform is the creation of ten metropolitan cities (*città metropolitane*) in place of the former provinces of Turin, Milan, Venice, Genoa, Bologna, Florence, Naples, Bari, Reggio Calabria and Rome. In addition, the five Italian regions with special status can create their own metropolitan cities. Law 54/2014 accords special status to metropolitan cities in relation to the other provinces, allocating them exclusive functions that do not depend on the regional level.

Although the reform aims to streamline Italy's multi-level governance, its implementation introduces an element of institutional uncertainty, because the role of the new institution and the capacity of local administrators to participate in the new institutions remains unclear. Nevertheless, the new provincial body is a platform to facilitate co-ordination and co-operation among local governments.

The creation of the metropolitan city of Milan changes the balance of administrative powers at the regional level. All provinces in Lombardy had been under the administrative umbrella of the regional government, but the metropolitan city of Milan now occupies a different position in relation to the rest of the provinces.

Italy is not alone in undergoing significant administrative reform. In the past 15 years, several OECD countries have planned, and in some cases implemented, reforms. This process received new impetus in the global financial crisis, which forced countries to implement tight fiscal consolidation policies, including reorganising and rationalising their administrative structures to save financial resources.

Getting governance right is a key factor in economic performance...

Institutions and social norms play an important role in countries' economic performance (Acemoglu and Robinson, 2010). For instance, the implementation of the rule of law and an efficient judiciary system provide two crucial elements for the creation of a sound environment for business activities. Institutions and social norms provide the environment and ground rules for interaction between economic actors (whether firms, consumers or politicians, etc.). The World Bank provides a set of perception-based indicators useful in comparing countries on several dimensions of governance.

Figure 1.9 shows that Italy falls below the OECD average in all dimensions of quality of governance. Particularly worrying is the low score in terms of control of corruption and rule of law. These are important elements for creating a sound environment for business. This, coupled with the lengthy judicial process (see OECD, 2013b), represents a bottleneck for business development and attracting foreign capital to the country.

It is not possible to isolate indicators for Bergamo, as the World Bank database covers only the country level. Another set of indicators is available, however, from the Quality of Government project of the University of Göteborg (Box 1.4). The dataset consists of perception-based indicators obtained in a series of surveys conducted in 2009 of the EU population. Quality of government is expressed as a composition of several aspects of the relationship of the government with its citizens, including the perceived quality of services (such as education, health and justice), equitable access to these services, and the level of corruption in the provision of and access to these services. It thus provides a snapshot of the quality of services that directly affect the lives of citizens and the business environment for firms.

Table 1.5. Territorial administrative reforms in selected OECD countries

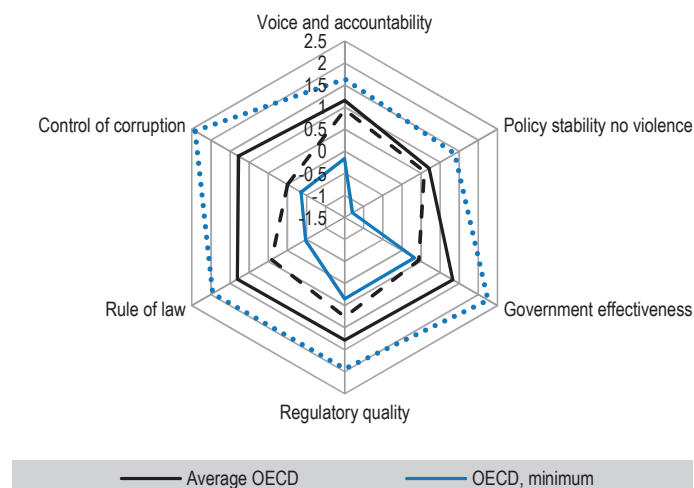
Country, year	Horizontal fragmentation	Vertical fragmentation	Note
Latvia, 2009	Reduction of the number of municipalities from 527 to 119.	Abolition of the intermediate level of government (26 districts), leaving only one level of subnational government (the municipal level).	The reform did not distinguish between urban and rural areas.
Germany, 2006-11	Trend of mergers between municipalities, whose numbers fell from 16 216 in 1990 to 11 327 in 2012 (a drop of 30%).		The trend of mergers affected some federal states more than others; for instance, in 2011, the number of municipalities in Saxony-Anhalt was reduced from 840 to 219 (where 44% of the population lives in rural areas).
Italy, 2014	No mergers of municipalities, but inter-municipal co-operation is encouraged for municipalities of fewer than 5 000 inhabitants.	The intermediate level of government (provinces) is transformed into an assembly of mayors. Ten metropolitan governance bodies (<i>città metropolitane</i>) are created to administer large cities.	Some provinces have been transformed into metropolitan bodies and others into assemblies of mayors. This may lead to asymmetrical functions and competences.
France, 2014		In December 2013, a law was passed creating a new governance structure for the 3 major metropolitan areas (Paris, Lyon and Aix-Marseille) as well as for 11 other urban areas of more than 400 000 inhabitants, on a voluntary basis.	The reform implicitly introduces an asymmetrical governance structure differentiating large urban centres and rural regions.
Greece, 2010-11	In January 2011, the number of municipalities decreased to one-third, from 1 033 to 325.	The 54 departments were replaced by 13 democratically elected regions, including 2 metropolitan regions (Attica and Thessaloniki).	The so-called Kallikratis reform, adopted as part of Law 3852/2010, which took effect on 1 January 2011, is both a territorial and institutional reform.
Denmark, 2007	As a result of territorial administrative reform, the number of municipalities dropped from 271 to 98, with an average population of 55 000 inhabitants.	Replacement of 13 counties by 5 newly created regions (at the NUTS 2 level).	The reform included a new distribution of tasks between levels of government, and a new financing and equalisation system. The merger of municipalities was achieved by limiting municipalities to a maximum of 20 000 inhabitants.

Source: Various sources compiled by OECD; Dexia (2008), *Sub-national Governments in the European Union*; Nam, C.-W. (2013), “Sub-national government system in the EU and its recent reforms”.

A comparison of the quality of government indicator for Lombardy with the rest of the Italian regions suggests that although Lombardy ranks above the Italian average, it falls below other northern Italian regions (Figure 1.10). Lombardy is in line with other northern regions in terms of quality of health care and law enforcement, but falls below other northern Italian regions in education quality and control of corruption.

At the European level, a distinct divide can be noted between northern and southern Italy. Quality of government in the north of Italy is comparable to that of France or Germany, but the south ranks at the bottom of EU countries. Bergamo’s quality of government thus rates highly in terms of the European average.

Figure 1.9. Quality of governance in Italy compared to that of OECD countries



Source: OECD (2013b), *OECD Economic Surveys: Italy 2013*, http://dx.doi.org/10.1787/eco_surveys-ita-2013-en.

Box 1.4. Quality of subnational government: Using citizens' perceptions as a basis for measurement

In an attempt to gather data on the subnational quality of government, Charron, Lapuente and Dijkstra (2012) conducted a regional representative survey across 27 EU countries, asking respondents about their perceived quality of their subnational government. The survey data were then used to construct a composite index of the quality of government for 172 European regions (see Quality of Government Institute [2010] for details). The indicator is based on public perceptions of four components of governance: 1) the rule of law; 2) corruption; 3) the quality of the bureaucracy; 4) democracy and the strength of electoral institutions. The data were collected in a single survey year (2009) from 34 000 respondents in 18 EU countries.

Two main limitations should be noted in the use of the indicator to study the link between quality of government and economic performance. The first is that it was collected for only one year (2009), and that no time series are yet available. The second is that the indicator is based entirely on public perceptions, which may be incomplete or inaccurate. There is reason to believe that public perceptions of institutional quality can change rapidly for the worse (e.g. in response to a corruption scandal or the exposure of poor performance in some part of the public sector), but tend to improve slowly, often lagging behind changes in actual public sector performance. This is especially true where public sector actors face rising public demands and expectations for services. Nevertheless, public satisfaction data do directly tap into the ultimate demand for quality administration – the needs of the governed – rather than relying on synthetic measures, which must be regarded as a strong point. Moreover, the evidence suggests that measures of public perception may deviate from reality, but only up to a point. Countries with a reputation for corruption, for example, generally do have serious problems with this problem.¹

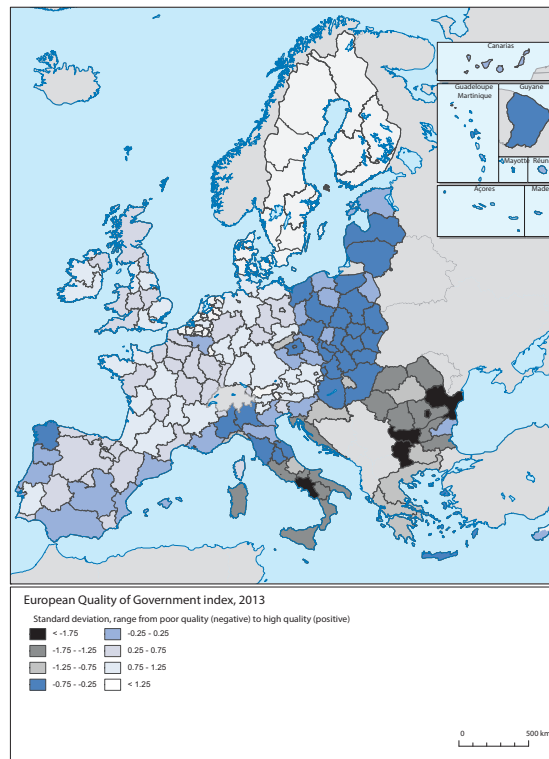
Note: 1. For a detailed look at this literature, see Mocan (2004) and Olken (2009).

Sources: Charron, N., V. Lapuente and L. Dijkstra (2012), "Regional governance matters: A study on regional variation in quality of government within the EU",

http://ec.europa.eu/regional_policy/sources/docgener/work/2012_02_governance.pdf; Quality of Government Institute (2010), "Measuring the quality of government and subnational variation", http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/2010_government_1.pdf; Mocan, N. (2004), "What determines corruption? International evidence from micro data", www.nber.org/papers/w10460.pdf; Olken, B. (2009), "Corruption perceptions versus corruption reality", <http://dx.doi.org/10.1016/j.jpubeco.2009.03.001>.

Figure 1.10. European Quality of Government Index, 2013

Standard deviation, range from poor quality (negative) to high quality (positive)



Note: EU=0.

Source: Based on Charron, N., L. Dijkstra and V. Lapuente (2015) “Mapping the Regional Divide in Europe: A Measure for Assessing Quality of Government in 206 European Regions”, *Social Indicators Research*, Vol. 122(2), pp. 315-346.

The analysis of quality of government based on the aggregate level for the region of Lombardy may be mainly driven by the metropolitan area of Milan and may not be representative of the province of Bergamo, but it is nevertheless an indication of the institutional context for the economy of the province of Bergamo.

The territory and the demographic structure of Bergamo

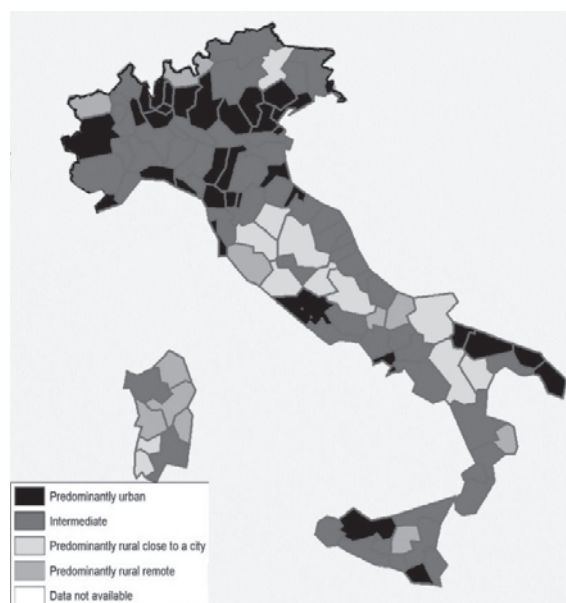
This section begins with a description of the territorial characteristics of the province of Bergamo, and goes on to consider its administrative features, focusing on functional urban areas (FUA) and the implications of agglomerations beyond administrative boundaries. Finally, demographic trends are considered and benchmarked with other OECD regions.

Territorial characteristics

Bergamo has a surface area of 2 722.86 square kilometres, of which 64% is mountainous, 12% foothills and 24% plains. These areas constitute three belts: the province's northern section is mainly mountainous, with two large valleys, Val Brembana and Val Seriana; the central section includes foothills, where the city of Bergamo is located; and the southern part of the province is a plain terrain, part of the *pianura padana*. These belts cut horizontally across the province, concentrating population and infrastructure mainly in the central and southern sections.

For statistical purposes, the OECD divides member country regions into two territorial levels: TL2, corresponding to the Italian regions, and a lower level, TL3, corresponding to the provinces. Under this statistical classification, the province of Bergamo can be analysed with other countries' TL3 regions. Bergamo is classified as a predominantly urban region, along with Lombardy's other northern provinces.

Figure 1.11. OECD TL3 regional typology for Italy



Source: OECD (2013d), *OECD Regions at a Glance 2013*, http://dx.doi.org/10.1787/reg_glance-2013-en.

Italy is one of the OECD member countries whose population mostly lives in predominantly urban or intermediate TL3 regions. This reflects the existence of a dense network of cities, especially in the north of Italy, as indicated by an analysis of the distribution of FUAs in Italy.

Box 1.5. OECD territorial classification

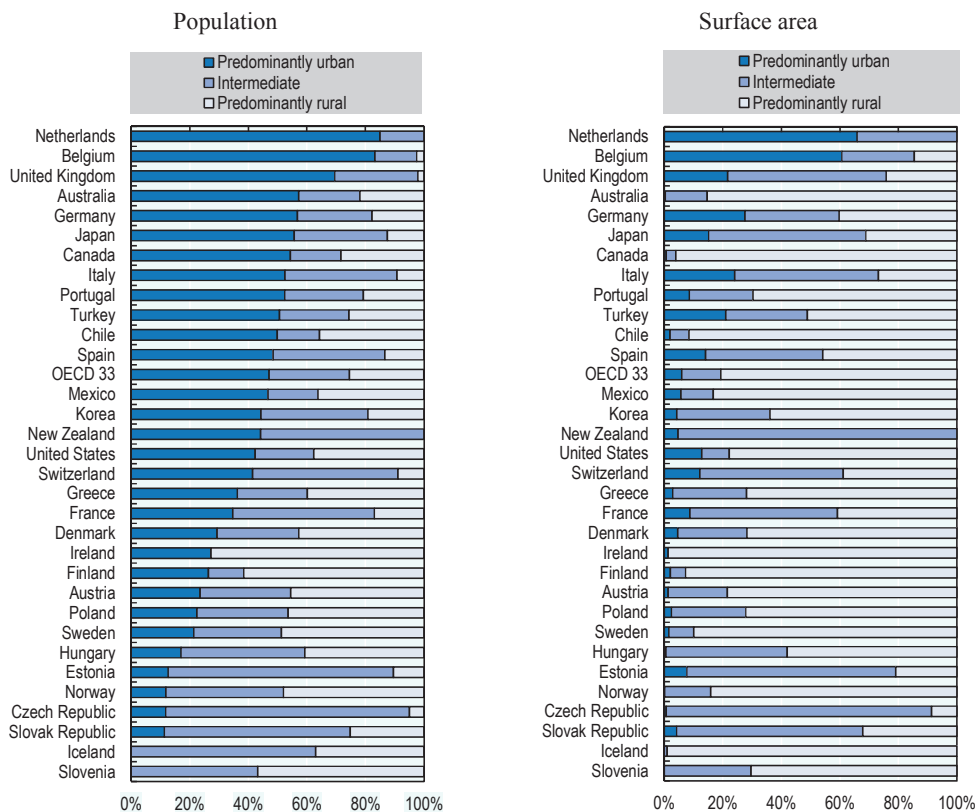
The OECD typology classifies TL3 regions as predominantly urban, predominantly rural and intermediate. This typology, based on the percentage of regional population living in rural or urban communities, allows for meaningful comparisons between regions of the same type and level. The OECD regional typology is based on three criteria. The first identifies rural communities according to population density. A community is defined as rural if its population density is below 150 inhabitants per square kilometre (500 inhabitants in Japan, to account for the fact that its national population exceeds 300 inhabitants per square kilometre). The second criterion classifies regions according to the percentage of population living in rural communities. Thus, a TL3 region is classified as:

- predominantly rural (rural) if more than 50% of its population lives in rural communities
- predominantly urban (urban) if less than 15% of the population lives in rural communities
- intermediate if the percentage of population living in rural communities is between 15% and 50%.

The third criterion is based on the size of the urban centres. Thus:

- a region that would be classified as rural on the basis of the general rule is classified as intermediate if it has an urban centre of more than 200 000 inhabitants (500 000 for Japan) representing no less than 25% of the regional population
- a region that would be classified as intermediate on the basis of the general rule is classified as predominantly urban if it has a urban centre of more than 500 000 inhabitants (1 million in Japan) representing no less than 25% of the regional population.

Figure 1.12. Distribution of population in TL3 regions, according to the OECD typology



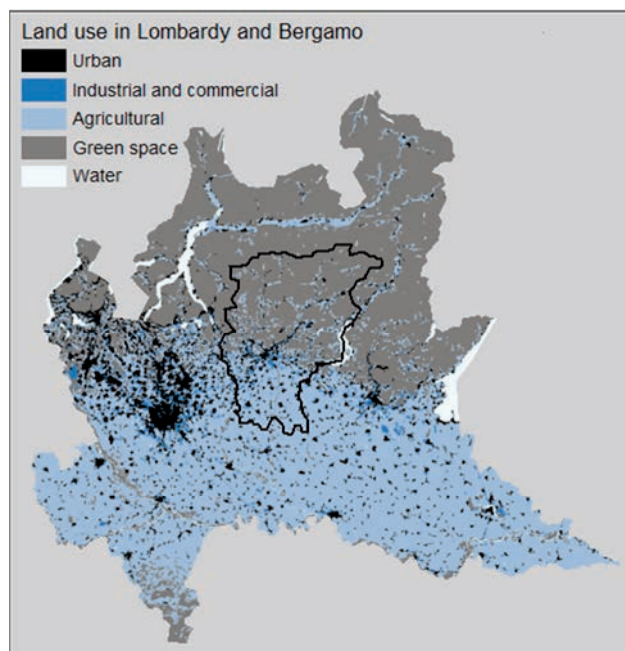
Source: OECD (2013c), *OECD Regions at a Glance 2013*, http://dx.doi.org/10.1787/reg_glance-2013-en.

Bergamo is classified in the category of predominantly urban regions, mainly because of the high density of population in the plains and the valleys. This review uses this classification to compare the performance of the province of Bergamo to TL3 regions of similar characteristics. Benchmarks are conducted for a number of groups of regions that permit a valid comparison with the performance of Bergamo. These include:

1. all OECD TL3 regions
2. predominantly urban regions
3. a subset of 19 TL3 regions with an economic structure similar to the province of Bergamo's (see Table 1.A1.1, left panel, in Annex 1.A1)
4. a subset of 10 TL3 regions of similar functional urban structure and proximity to a larger metropolitan area (see Table 1.A1.1, right panel, in Annex 1.A1)

Analysis of land use offers a good picture of the distribution of economic activities in the province of Bergamo. Figure 1.13 shows the clear latitudinal divide between the mountainous north of the province, where land is mainly left to forestry (the gray areas), and the south of the province, where land is shared between agricultural activities and industrial sites (blue areas).

Figure 1.13. Land use in the province of Bergamo



Source: Copernicus (2014) *CORINE Land Cover 2006*, <http://land.copernicus.eu/pan-european/corine-land-cover/clc-2006/view> (accessed 5 July 2016).

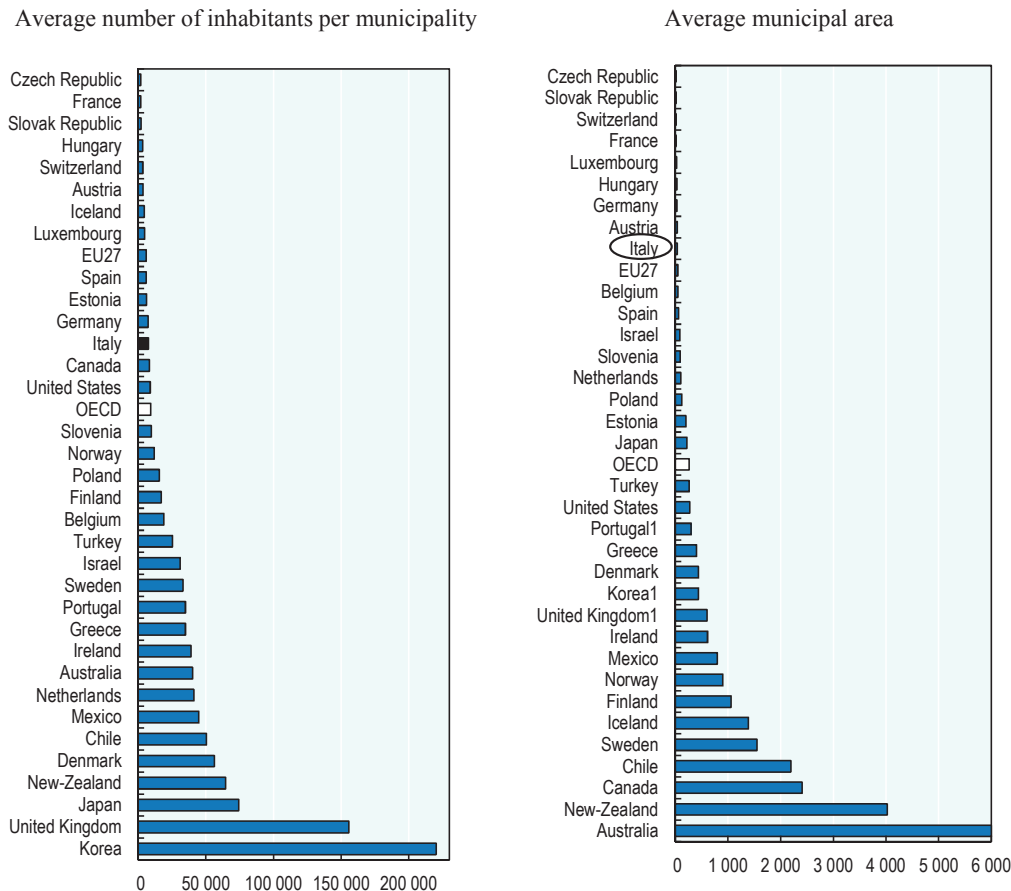
Administrative structure of the province of Bergamo

The territory of the province of Bergamo falls under the jurisdiction of the provincial government of Bergamo, which is under the jurisdiction of the regional government of Lombardy. These two intermediate levels of government play an important role in implementing policies for economic development. The other important actor at the local

level is the municipality, which has traditionally been the provider of local public services, including transport and some social services.

The province of Bergamo's administrative structure is similar to the Italian structure, including a large number of small municipalities. Among other OECD countries, Italy's municipal structure, like that of France, is among the most fragmented.

Figure 1.14. **Municipal administrative structure in Italy compared to that of OECD countries, 2012**



Note: 1. Submunicipal administrative level exists in Korea, Portugal and the United Kingdom.

Source: OECD (2013d), *Subnational governments in OECD countries: Key data* (brochure).

Table 1.6 shows that in terms of average number of inhabitants per municipality, Italy scores quite low, with about 7 300 compared to 41 000 in the Netherlands or 155 000 in the United Kingdom. In terms of surface area, Italian municipalities are small compared to municipalities in other countries. Compared to the average in OECD member countries, Italian municipalities are smaller both in population size and surface area.

The presence of an administratively fragmented territory is not necessarily a problem. The small size ensures a better match between the policies pursued by the municipal government and the needs of the population; it also makes politicians more accountable to the electorate. A small municipality, however, runs the risk of being inefficient in the provision of some local public goods, because it cannot exploit economies of scale and may lack financial and human resources. For example, a small municipality may find it

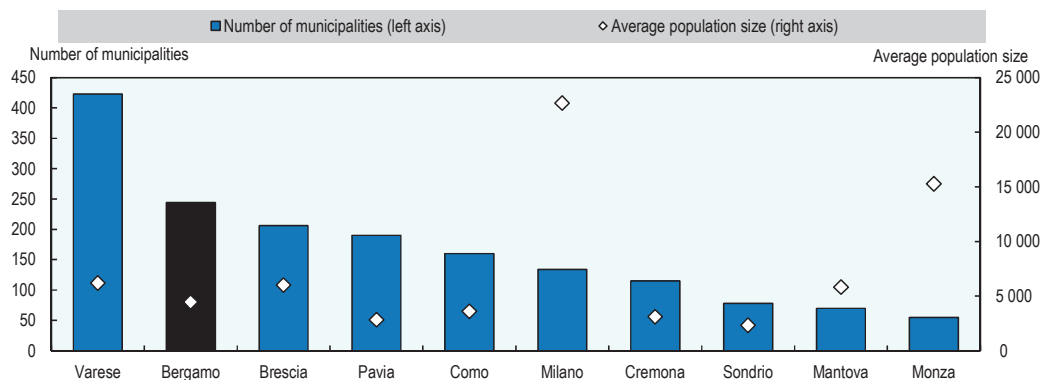
too expensive to provide school buses or care for the elderly. Furthermore, the small size of the jurisdiction may result in policy spillovers, i.e. a policy implemented by one local government may affect citizens of other jurisdictions. A typical example concerns transport policies, where commuters live in different municipalities, but tighter local security (e.g. more local police on patrol) may drive criminals to neighbouring jurisdictions.

Table 1.6. Population and municipal size, 2011

	Number of municipalities	Residents	Average size	Fragmentation
Bergamo province	244	1 086 277	4 452	22.46
Lombardy region	1 393	9 144 086	6 564	15.23
Italy	8 092	59 433 744	7 345	13.62
Bergamo FUA	23	292 204	12 705	7.87
Milan FUA	252	4 073 812	16 166	6.19

Source: OECD elaboration based on data from the Italian Census 2011.

Figure 1.15. Municipal structure in Lombardy's provinces



Source: OECD elaboration based on data from the Italian Census 2011.

The “optimal” size of the institutions, that is, the size that allows the best synthesis between proximity and an adequate scale, depends on a region’s territorial and economic characteristics. The impact of municipal fragmentation on regional economic performance may depend on the percentage of people living in rural areas. A recent OECD working paper (Bartolini, 2015), shows that municipal fragmentation harms economic growth in the most urbanised regions. The impact depends on the percentage of population living in rural areas: the higher the rural index, the lower the negative impact. In fact, for rural regions, the impact turns slightly positive. The reduction of fragmentation on the one hand makes it possible to internalise policy spillovers, reducing the cost of co-ordination, but it also reduces the proximity of residents to political power. This trade-off has different effects in urban and rural areas. In urban areas, policy spillovers are greater than in rural areas, and their reduction more than compensates for the loss of political proximity. Conversely, in rural areas, the population is scattered over a vast territory and policy spillovers are smaller, but the loss of political proximity may impede access to the political level for a large proportion of the population.

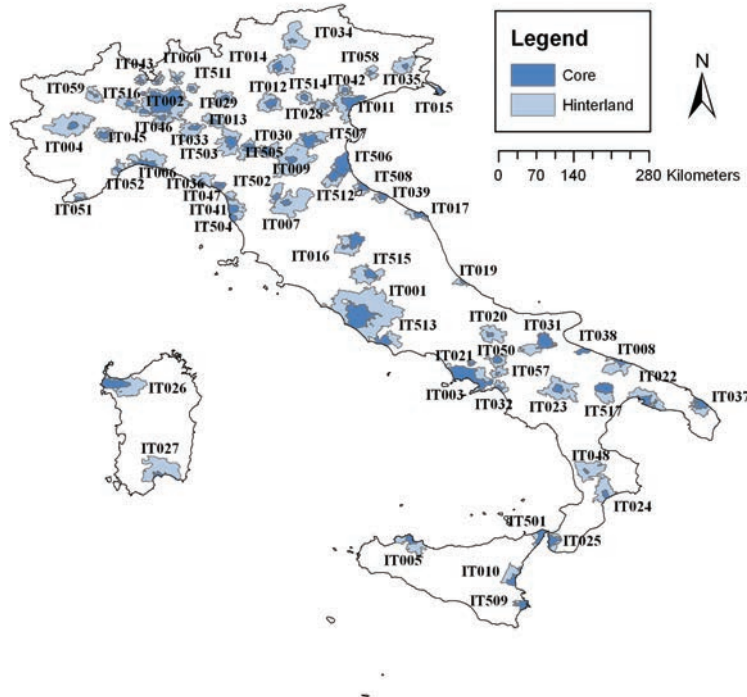
The province of Bergamo may benefit from the reduction of municipal fragmentation in the plain and in the foothills. Reducing fragmentation may be pursued by various policies, resulting in different degrees of integration: from amalgamation of municipalities (full integration) to light forms of co-operation.

Beyond administrative boundaries: Functional urban areas

The performance of the province in terms of population dynamics may be driven by the city of Bergamo. The role of any city is better appreciated if its definition extends beyond the administrative borders. Considering the whole set of relations originating in the agglomeration of Bergamo, the range of commuting workers provides a better unit of analysis for economic potential than the administrative boundaries of the city of Bergamo. The OECD and the European Commission have developed methodologies to define functional urban areas (FUAs) on the basis of a centre (the administrative city) and a hinterland defined by commuting patterns. The main goal of the methodology is to provide comparable sets for metropolitan areas across OECD countries.

The map of FUAs in Italy looks like a series of functional urban areas, with a special cluster in the north of Italy. Bergamo FUA, identified by the label IT511 (the legend for FUAs is provided in Annex 1.A1) lies in close proximity to the Milan FUA and is surrounded by other FUAs.

Figure 1.16. Functional urban areas in Italy



Source: OECD (2012b), *Redefining “Urban”: A New Way to Measure Metropolitan Areas*, <http://dx.doi.org/10.1787/9789264174108-en>.

The definition of the areas covered by the FUA is based on commuting data from 2001, given the lack of recent commuting data for Italy.

Demographic trends

The evolution of the population in the province reveals dynamic growth by comparison with the average in OECD TL3 regions, predominantly urban regions and the two groups of regions of similar productive structure and city (FUA) composition. The

rise in population growth can partly be driven by migration patterns to the provinces, which have experienced consistent growth, despite the effects of the crisis.

Table 1.7. **Population growth**

	1995-2007	2007-11	1995-2011
Bergamo	1.04%	1.22%	1.08%
OECD TL3	0.45%	0.60%	0.47%
Predominantly urban	0.72%	0.78%	0.73%
Industry reference	0.20%	0.23%	0.21%
FUA reference	0.33%	0.22%	0.31%

Note: “Industry reference” refers to a subset of OECD TL3 regions of an economic structure and size similar to Bergamo; “FUA reference” refers to a subset of OECD TL3 regions similar to Bergamo in terms of FUA size and proximity to a large metropolitan area.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed 5 July 2016).

Elderly dependency ratios, that is, the ratio of population over 65 to the working-age population, are significantly higher in Bergamo than in similar regions outside Italy. This trend is partly driven by national patterns; it will nevertheless present challenges in service delivery and sustaining competitiveness in the medium and long term, as the total workforce shrinks by comparison with Bergamo’s potential competitors’.

Table 1.8. **Elderly dependency ratio**

	2011
Bergamo	26.61%
OECD TL3	24.05%
Predominantly urban	22.78%
Industry reference	25.63%
FUA reference	27.82%

Note: “Industry reference” refers to a subset of OECD TL3 regions of an economic structure and size similar to Bergamo’s; “FUA reference” refers to a subset of OECD TL3 regions similar to Bergamo in terms of FUA size and proximity to a large metropolitan area.

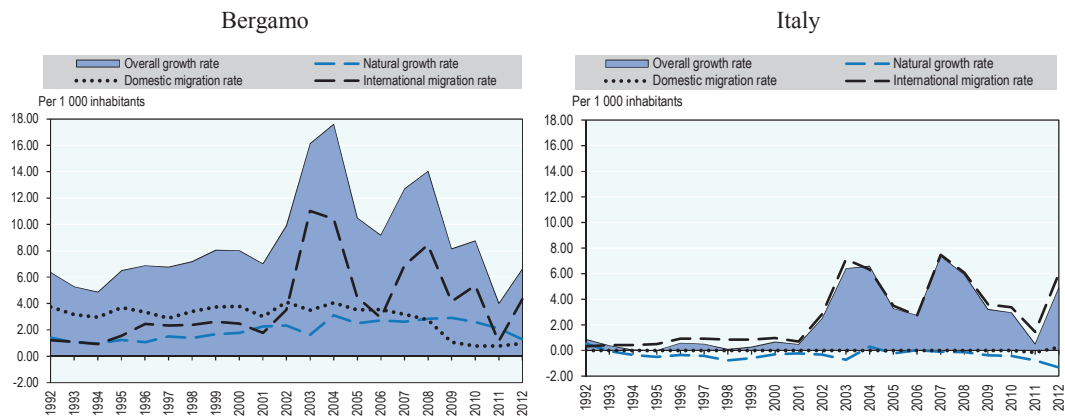
Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed date 5 July 2016).

The administrative structure of the province of Bergamo consists of many municipalities and a relatively high level of municipal fragmentation. This may present a problem for policy co-ordination, in particular for policies related to economic development and infrastructure likely to have spillovers in neighbouring municipalities. Furthermore, the large number of small municipalities makes it more difficult to exploit economies of scale in providing services to citizens.

The level of administrative fragmentation is in line with that of Italy as a whole, but much higher than that of other OECD TL3 regions.

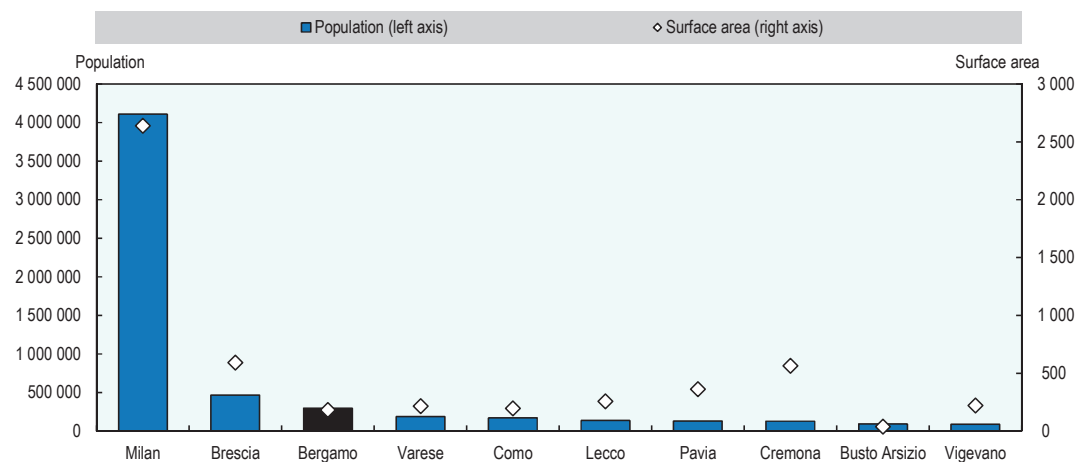
In comparing FUAs in the Lombardy region, Milan plays the dominant role, as shown in Figure 17. This suggests that linkages and spillover effects between Bergamo and Milan are an important factor for the Bergamo region, as is proximity to an international city. It also suggests that in terms of prioritising future connections of the region, Milan is the sole and dominant urban agglomeration.

Figure 1.17. Composition of demographic trends in Bergamo and Italy



Source: Chamber of Commerce of Bergamo.

Figure 1.18. Population and area of functional urban areas in Lombardy



Source: OECD (2016b), “Metropolitan areas”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/data-00531-en> (accessed 5 July 2016).

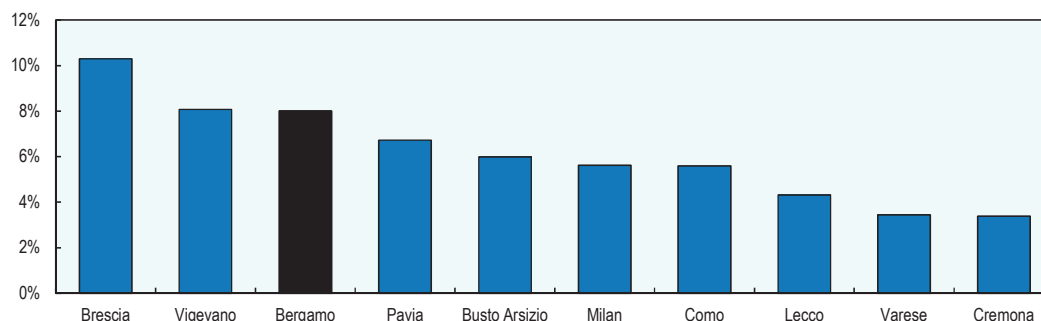
In terms of FUA population trends in the region, the most dynamic are Brescia and Vigevano, closely followed by Bergamo (Figure 1.19). Interestingly, the FUA of Milan does not appear to dominate in terms of population growth rate. The dynamic population growth of the TL3 region as a whole has been driven by the city and surroundings (i.e. the FUA) of Bergamo. Nonetheless, the 8% increase in population in the Bergamo FUA between 2001 and 2011 is lower than the growth of population in the province as a whole in the same period (about 12%), indicating that a significant part of the population increase occurred outside the FUA of Bergamo.

Summary of territorial and demographic trends

The province of Bergamo is classified as a predominantly urban region under the OECD typology. This is mainly due to the concentration of the population in the southern plain and the foothills in the centre. The province includes many small municipalities, which is typical of Italy as a whole. As a consequence, the only FUA in the province is

the city of Bergamo. In terms of population, the FUA of Bergamo has grown over the past ten years (Figure 1.19). This growth seems to be driven by an increase in the birth rate, and not by an increased concentration of the province's population in the FUA of Bergamo.

Figure 1.19. **Population dynamics in functional urban areas in Lombardy, 2001-11**



Source: Research based on data from OECD (2016b), “Metropolitan areas”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/data-00531-en> (accessed July 2016).

Economic trends and performance of the province of Bergamo

The analysis of economic indicators for Bergamo offers an overview of the performance of the province, highlighting strengths and challenges for the economy. Most of the analysis is conducted by benchmarking Bergamo with comparable OECD regions, as well as over time, to assess the medium- and long-term challenges.

The analysis reveals a stagnant productivity trend. Growth in labour productivity was flat before the crisis and then fell, presenting serious concern for the region's economic competitiveness over the medium and long term. In the same period, TL3 regions have been catching up with Bergamo, and its divergence from the best-performing OECD TL3 regions has increased.

The analysis focuses on four drivers of productivity: agglomeration effects, innovation, education and infrastructure. The main bottlenecks are at the level of skills of the workforce and the female participation rate. Although the quality of education has improved in the past decade, the assessment of adult skills, measured by scores on the OECD Survey on Adult Skills (PIAAC), reveals important gaps in relation to most OECD regions. The lack of adequate skills for the transition of Bergamo's economy towards global markets, and an increasing technological intensity in the product and production process, are among the main obstacles to sustained growth. This is confirmed by recent figures on youth unemployment, which show that school dropouts are finding it more difficult to recover from the crisis than the cohort with at least a secondary degree or longer working experience.

The low female participation rate represents an untapped source of growth that could be mobilised. Figures show that the rate for Bergamo, although higher than the Italian average, is below that of most OECD regions and Lombardy, and shows no sign of catching up.

Identification of comparison regions

The OECD is a forum in which member countries can discuss economic policies and gather experiences from other countries with similar problems. One of the main tools of

OECD analysis is the benchmarking of economic, social and demographic indicators among member countries. The same methodology is also used in conducting analysis at the territorial level, where the benchmarking is conducted among regions (subnational territories) of OECD member countries. The treatment of regional data implies a time lag in the availability of the dataset for the analysis.

One of the tools used to analyse the province of Bergamo is benchmarking it with other TL3 regions in OECD countries. Benchmarking indicators such as economic performance, demographic trends and labour market outcomes gives a general idea of the performance of Bergamo relative to regions in other OECD countries. In particular, a comparison of long-term trends can reveal structural challenges.

The analysis is conducted by benchmarking the main economic, social and demographic indicators for the province with the average of OECD TL3 regions, which provides a comparison with territories of a similar type, and with the regional (Lombardy) and national levels. This helps illustrate the context in which the economy of Bergamo operates. To provide more informative benchmarking than the average for all OECD TL3 regions, two methods are used to identify a subgroup of regions (see Annex 1.A1 for details on the selected regions). First, a multivariate distance measure is used to identify regions of similar size, industrial structure and income (TL3 ref); second, georeferenced information on urban systems is used to identify regions with an urban system similar to the province of Bergamo's, that is, a small FUA in close geographical proximity to a large FUA (FUA ref).

This first group (TL3 ref) identifies a set of regions that are current or potential competitors of Bergamo. The vast majority of the regions identified are in Europe (17 out of 19), of which 6 are from dynamic east European countries (such as the Czech and Slovak Republics) and the remaining 11 from Western Europe and Asia (Korea and Japan).

The second group (FUA ref) considers the urban system surrounding Bergamo. A key characteristic of the province is that it is a medium-sized urban agglomeration (the city of Bergamo), adjacent to Milan, one of the largest metropolitan areas in Italy. The resulting list of comparison regions consists of ten TL3 regions from eight OECD countries with an urban structure comparable to Bergamo's. This comparison group may capture the effect of the province's relationship with a big metropolitan area, which can represent an additional source of growth and competitiveness for the province.

Declining performance in GDP and GDP per capita

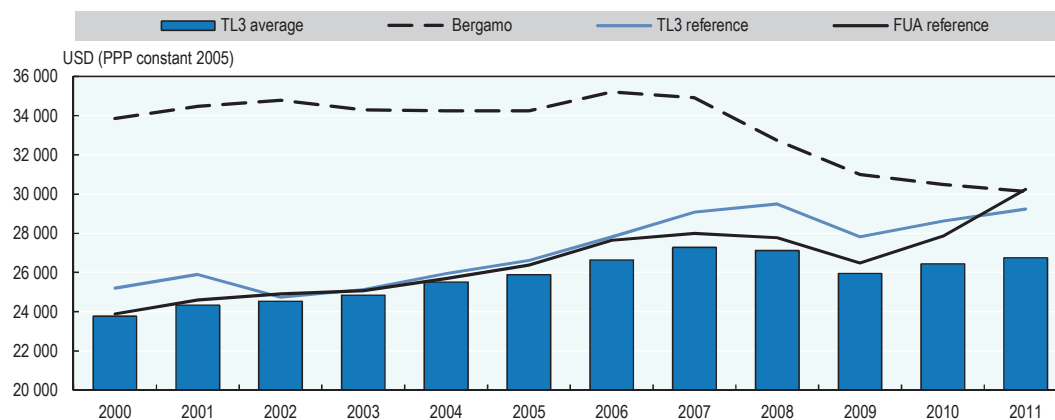
The value of production in Bergamo (gross domestic value) measured in real terms and per capita provides an indication of the current state of the economy. Bergamo is larger than the average OECD TL3 region, but slightly larger than the average among the sub-sample of TL3 regions of comparable economic structure (TL3 ref), and similar to the sub-sample of regions of comparable urban structure (FUA ref).

The growth rate of GDP and GDP per capita for 1995-2011 reveals Bergamo's underperformance by comparison with OECD TL3 regions, urban regions and similar types of regions (in industry and FUAs). The effects of the crisis have been harder on Bergamo both in absolute and relative terms (relative to the Italian average). This implies a structural decline in the province's competitiveness, exacerbated by the crisis.

The structural loss of competitiveness appears to have started in early 2000. The rate of GDP growth for the decade 2000-10 reveals an overall contraction of -0.77%, putting the

province in the bottom 5% of OECD TL3 regions ranked by GDP performance for the period (or 798th of 843 regions).

Figure 1.20. GDP per capita in Bergamo compared to that of other OECD TL3 regions



Note: TL3 reference considers a sample of TL3 regions of similar economic structure; FUA reference refers to TL3 regions of FUAs similar to Bergamo's.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Table 1.9. Bergamo's performance in GDP growth compared to that of other OECD TL3 regions

	In absolute terms				Deviations from the national average		
	1995-2007	2007-11	1995-2011		1995-2007	2007-11	1995-2011
Bergamo	2.34%	-2.39%	1.13%	Bergamo	0.03%	-0.73%	-0.16%
All OECD	2.60%	-0.31%	1.82%	All OECD	..	..	..
Predominantly urban	2.73%	-0.36%	1.89%	Predominantly urban	0.19%	0.04%	0.14%
TL3 reference	3.11%	0.66%	2.47%	TL3 reference	0.20%	0.22%	0.20%
FUA reference	2.57%	0.55%	2.05%	FUA reference	0.15%	0.66%	0.31%

Note: The table on the left refers to the growth rates computed by the value of GDP for all regions; the table on the right refers to the change in the value of GDP compared to the national average of each TL3 region. "TL3 reference" refers to a subset of OECD TL3 regions of an economic structure and size similar to that of Bergamo; "FUA reference" refers to a subset of OECD TL3 regions of Bergamo's FUA size and proximity to a large metropolitan area.

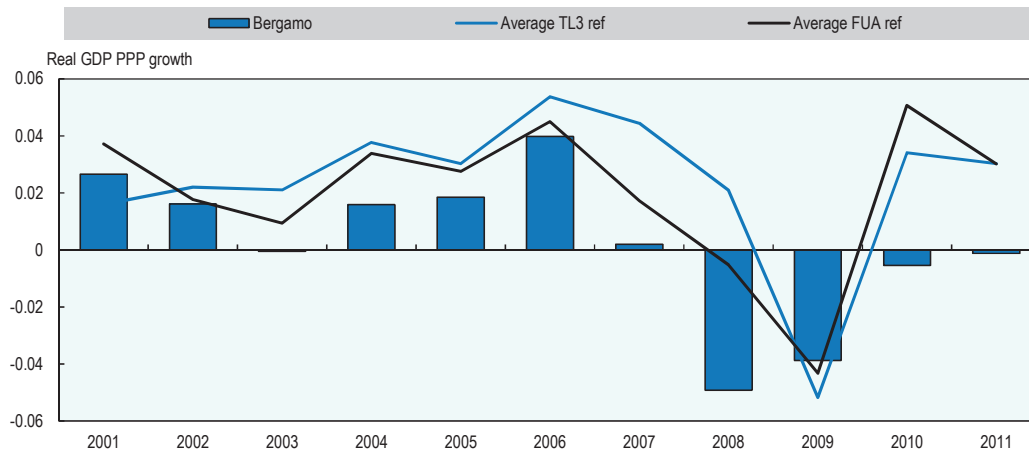
Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

A comparison of annual growth rates over this period (2000-11) reveals the gradual loss of competitiveness by comparison with similar TL3 regions (both in terms of economic structure and FUA typology). Particularly worrying is the lack of recovery after the crisis, with negative values for GDP growth in 2011, in the light of the positive recovery of comparable TL3 regions.

The analysis in terms of GDP per capita performance confirms Bergamo's poor performance in the medium term. Compared to similar types of regions in 2000, Bergamo exceeded by around 36% the level of GDP per capita in similar types of regions. This advantage has gradually decreased to the point where similar types of regions attained Bergamo's level of GDP per capita in 2011. Figure 1.21 reveals the adverse effects of the crisis for the province of Bergamo, and its failure to recover.

As noted at the beginning of this section, the loss of competitiveness in GDP per capita is in line with the loss of competitiveness in Italy, which is underperforming in relation to the average for OECD member countries. Nevertheless, Figure 1.22 demonstrates the lacklustre performance of the province relative to the Italian trend both over the medium term and during the effects of the crisis, particularly in 2009 and 2010. Indeed, the value of real GDP per capita in 2011 fell below the 2000 level.

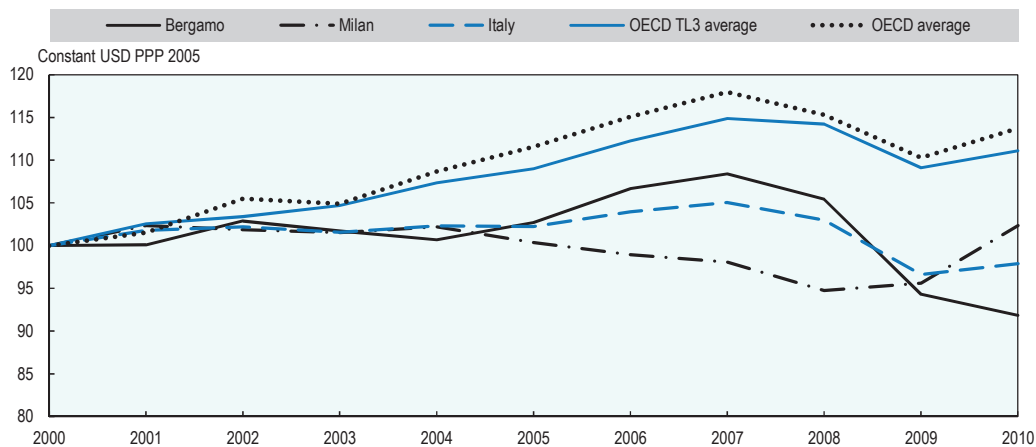
Figure 1.21. GDP growth rate in Bergamo compared with that of selected OECD TL3 regions



Note: TL3 reference considers a sample of TL3 regions of similar economic structure; FUA reference refers to TL3 regions of FUAs similar to Bergamo's.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Figure 1.22. Evolution of GDP per capita in Bergamo compared to that of OECD TL3 regions and OECD countries



Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

The analysis will also be based on a comparison of the performance of the territory of Bergamo with the performance of other Italian provinces and other OECD TL3 regions. Particular attention is paid to the vicinity of the city of Milan and the comparison with other territories with a similar urban system.

Productivity has been lacklustre in recent years...

Trends in GDP per capita can be divided into four main components: labour productivity, employment rate, participation rate and activity rate. This section focuses on the trends in labour productivity.

Table 1.10. Trends in per capita GDP

	Absolute variation				Deviations from the national average		
	1995-2007	2007-11	1995-2011		1995-2007	2007-11	1995-2011
Bergamo	1.31%	-3.61%	0.06%	Bergamo	-0.81%	-1.67%	-1.02%
All OECD	2.36%	-0.62%	1.57%	All OECD	..	..	..
Predominantly urban	2.40%	-0.83%	1.55%	Predominantly urban	0.13%	-0.09%	0.07%
TL3 reference	3.31%	0.39%	2.45%	TL3 reference	0.28%	0.22%	0.24%
FUA reference	2.40%	0.31%	1.83%	FUA reference	0.19%	0.63%	0.30%

Note: The table on the left refers to the growth rates computed for the value of GDP for all regions; the table on the right refers to the change in the value of GDP compared to the national average of each TL3 region. “TL3 reference” refers to a subset of OECD TL3 regions of an economic structure and size similar to that of Bergamo; “FUA reference” refers to a subset of OECD TL3 regions whose FUA size and proximity to a large metropolitan area are comparable to Bergamo’s.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Productivity is the main measure of a region’s competitiveness. It basically represents the efficiency of the production function in transforming inputs into outputs. In economics, two measures of productivity are usually considered: total factor productivity and labour productivity. Total factor productivity accounts for the interaction of all factors of production and represents the long-term evolution of technological progress. It is not possible to measure it directly; it is measured as a residual once the other factors of production are taken into consideration. This review, due to lack of data, focuses on labour productivity, measured as GDP per number of employed workers. Taking this measure for the province of Bergamo and comparing it with the average of TL3 regions in OECD countries, it emerges that the level of productivity in Bergamo is higher than the level for Italy as a whole and much higher than the average of other OECD TL3 regions.

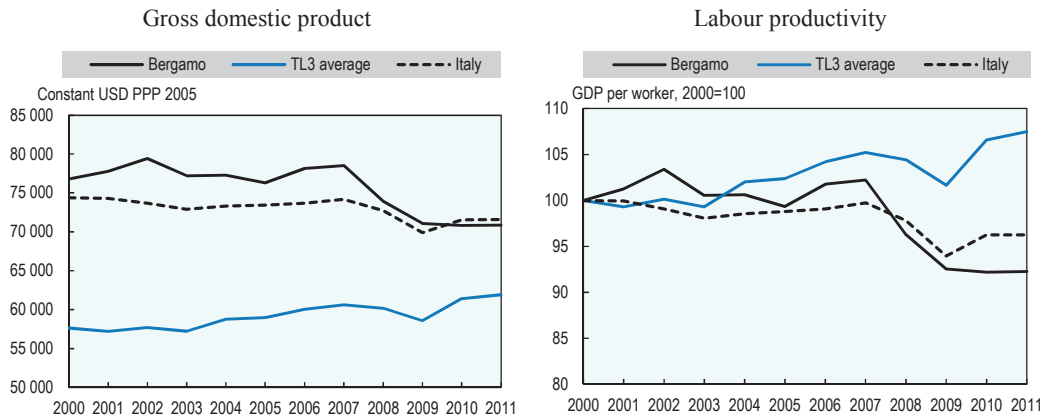
Although labour productivity is high in Bergamo, Figure 1.24 shows a worrying decline after the crisis that is steeper than the decline for Italy and the OECD TL3 average. This probably reflects the predominantly manufacturing structure of the economy in the province of Bergamo and the fact that the 2008 global financial crisis was followed by a sudden drop in international trade in the following year (Araújo and Oliveira Martins, 2011).

An analysis of the evolution of labour productivity in the decade from 2000-10 shows a decline in Italy and Bergamo as a consequence of the crisis, and relative stagnation (in relation to the OECD average) in the period 2003-05. This trend is not driven by the composition of our sample of TL3 regions. A selection of regions from our sample whose levels of productivity are similar to those of the province of Bergamo shows a period before the crisis (mainly 2003-07) where other regions have a positive dynamic of productivity (Figure 1.25). The region of Linz-Wels in Austria, whose level of productivity in 2000 exceeded Bergamo’s, has shown a positive trend, increasing the gap between the two regions. Other regions, such as Limburg in the Netherlands, closed the gap in productivity over the period 2000-07, and after falling in the aftermath of the global financial crisis, its subsequent recovery (2009-11) has shown better resilience than Bergamo.

Main drivers of productivity in Bergamo

An economy's performance depends on several factors that contribute to its competitiveness. A loss of competitiveness can be driven by human capital, institutional factors, infrastructure, labour market performance, innovation activity and agglomeration economies. The importance of some of these factors is highlighted in Box 1.6.

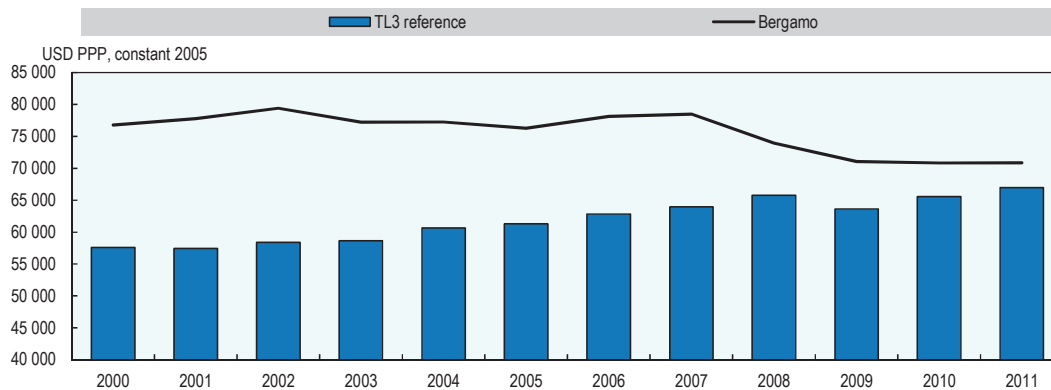
Figure 1.23. Labour productivity in Bergamo is higher than in Italy and the OECD TL3 average



Note: Data for all OECD TL3 regions are available only until 2009; for recent years, data are available only for selected countries.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Figure 1.24. Evolution of labour productivity relative to selected TL3 regions



Note: TL3 reference includes a subset of OECD TL3 regions of an economic structure and size comparable to that of Bergamo.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Box 1.6. Promoting growth in all regions

Why should governments invest in underdeveloped regions rather than focusing on a few main engines of growth? Do such regions have anything to offer the rest of the country? Highly underdeveloped regions can often impose high costs on national budgets. For example, regions with high and rising elderly and jobless dependency ratios may see their young and highly skilled workers leave in search of opportunities elsewhere. Such regions can develop a dependency culture – waiting for support from the national level – rather than developing their own resources. For these reasons, less-developed regions are often seen as a drag on national performance, rather than as potential assets. There has been a tendency to argue that such regions have no growth potential.

OECD work combining statistical analysis and 23 regional case studies across the OECD between 1995 and 2007 provides some insights. It indicates that this is a simplistic view that has left significant growth potential untapped. It offers evidence to help policy makers rethink the objectives and instruments of regional development and improve its impact on national economic and social well-being:

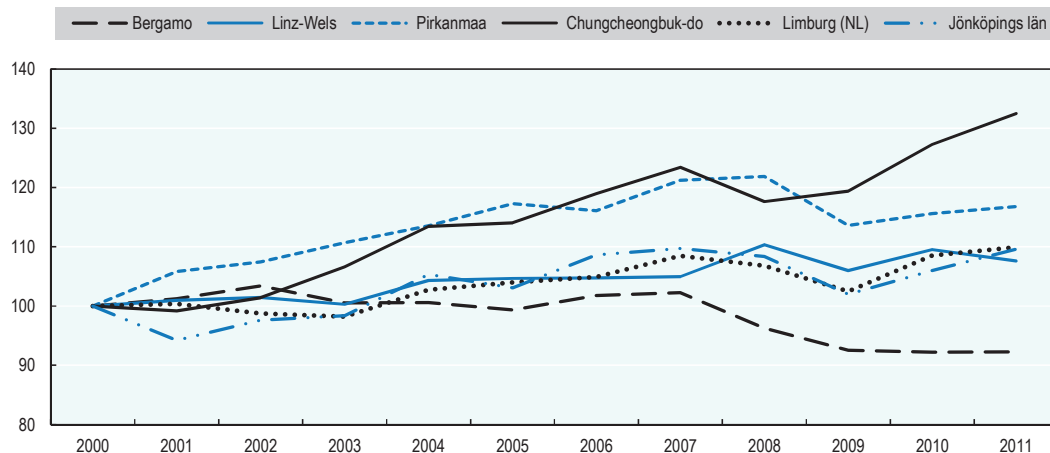
- Investing in less-developed regions makes good economic sense and should not be seen merely as social support. These regions have much to contribute to national growth as long as their assets are nurtured. Between 1995 and 2007, less-developed regions contributed to 43% of aggregate growth. Furthermore, predominantly rural regions have, on average, enjoyed faster growth than intermediate or predominantly urban regions. Growth potential exists in all types of regions.
- A pro-growth, rather than a subsidy-based, policy stance is the most beneficial and sustainable approach. In the long run it also helps build a fairer society. It can prevent dependency, rent-seeking behaviour and high remedial costs in the future.
- Policies that increase the skills of low-skilled workers are critical. Programmes and actions that reduce the proportion of low-skilled workers may be as important for growth as policies for expanding higher education.
- Policies targeting infrastructure are not usually the most effective tools for strengthening growth in underdeveloped regions; infrastructure does not appear to be the binding constraint for the great majority of regions. Yet given that the gains from improvements in infrastructure are higher (at the margin) in underdeveloped regions than in advanced ones, infrastructure packages can be important instruments if they are co-ordinated with other policies.
- Policy packages have more impact than individual policy measures, because they make it possible to capitalise on policy synergies and co-ordination across related domains.
- How policy makers frame the challenges they face does matter. The case studies suggest that a self-conscious shift towards a growth-oriented policy framework is often part of the recipe for success. As long as policy makers focus on exogenous sources of support for a region, growth is unlikely to take off, and actors are likely to focus on the appropriation of funds from external sources.
- Formal and informal institutions that bring together and integrate key actors into the development process are vital for enhancing policy continuity. The challenge is to create institutions that strengthen the region's "voice" in dealing with other regions and countries and for making links among the private, public and education sectors.

Source: OECD (2012), *Promoting Growth in all Regions*, <http://dx.doi.org/10.1787/9789264174634-en>.

Agglomeration effects in Bergamo are closely linked with Milan

Economic activities tend to concentrate geographically, due to the benefits associated with economies of agglomeration. Simply put, firms like to locate close to other firms and to densely populated areas, thanks to lower transport costs, proximity to markets and the wider availability of labour supply. People, in turn, prefer locating in densely populated areas, given the wider availability of job opportunities and the variety of goods and services. These mutually reinforcing forces yield important economic benefits to both consumers and firms, including benefits associated with economies of scale, better matching and functioning of labour markets, spillover effects and more intense technological advances. It is no surprise that productivity, and therefore wages, tend to be higher in densely populated areas. These benefits, however, must be weighed against the costs of densely populated areas, such as higher congestion costs, negative social effects of the possible oversupply of labour, higher land prices, rising inequality and environmental pressures. The net effect varies from urban area to urban area, resulting in different economic performance (OECD, 2013c; 2014d).

Figure 1.25. Productivity trends in TL3 regions with high levels of productivity

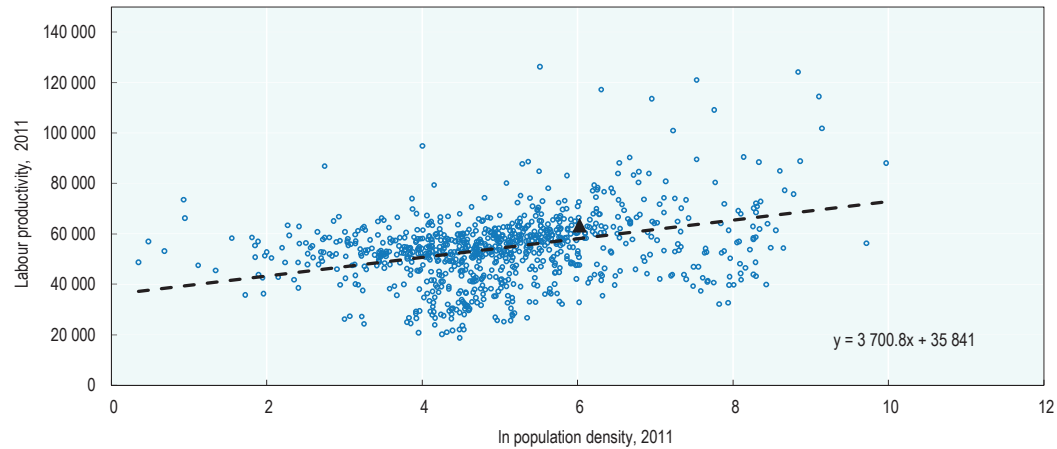


Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Despite the progress in transport and telecommunications, close proximity and population density are important predictors of economic performance. A simple analysis of population density and labour productivity in OECD TL3 regions shows a positive correlation between the two indicators (Figure 1.26).

In terms of population density, a recent OECD study (OECD, 2015) shows that larger urban areas tend to have higher levels of productivity than other areas, and that this premium can be attributed to agglomeration economies. The metropolitan area of Milan (as defined by the OECD) performed well in labour productivity in 2010, which can also benefit neighbouring areas.

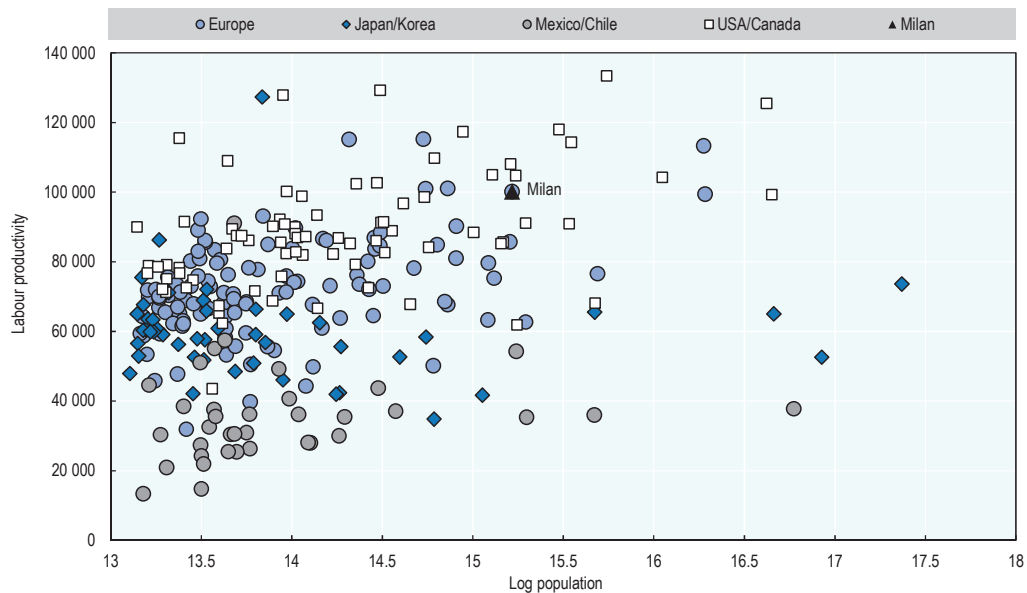
Figure 1.26. Population density has a positive impact on labour productivity



Note: The black triangle is the marker for the province of Bergamo.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

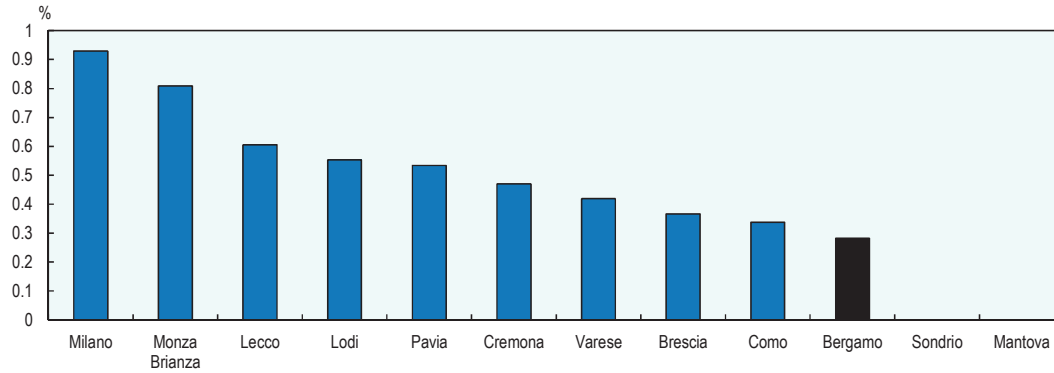
Figure 1.27. Labour productivity in metropolitan areas, 2010



Source: OECD research, using data from OECD (2016b), “Metropolitan areas”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/data-00531-en> (accessed July 2016).

The potential benefits of agglomeration can be captured by the percentage of population of the TL3 region (the province) living in the FUA. Figure 1.28 shows that among the provinces in Lombardy, population density in Bergamo’s FUA is the lowest among provinces that have at least one FUA.

Figure 1.28. Percentage of population living in cities, for each province in Lombardy, 2011

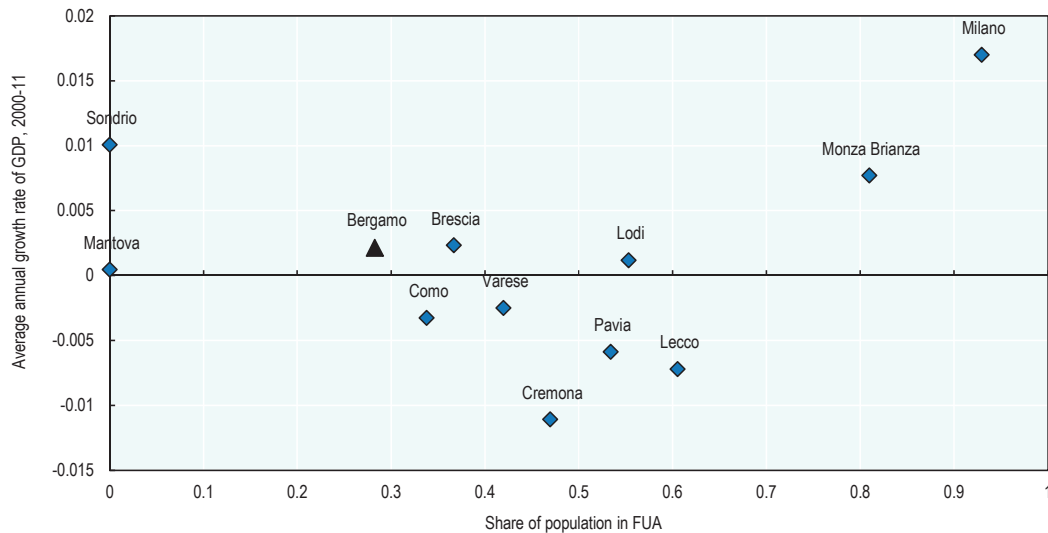


Source: OECD elaboration based on data from OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

As for the impact of the FUA on the performance of the province, the correlation between the percentage of population in the FUA and growth of real GDP in the period 2000-11 shows that this effect is not well captured by the agglomeration of people in the FUA.

The provinces of Lombardy do not show a positive correlation between the share of population in the FUAs and economic performance. Figure 1.29 shows that, apart from the FUA of Milan (which covers the province of Milan and the province of Monza and Brianza), performance appears to be negatively correlated to the size of the FUA. This may be the result of the dominance of Milan's FUA in the region's economy and the small size of the rest of the FUAs. It suggests that for Bergamo, the relevant dimension is not urban agglomeration but the agglomeration of firms in clusters and the connection with the FUA of Milan.

Figure 1.29. GDP growth and urbanisation in Lombardy's provinces, 2000-11



Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Large metropolitan areas are important drivers of national economic activity and typically have the highest per capita GDP within a country. However, the economic effects of large metropolitan areas are not confined to their borders. They also play an important part in economic activity in surrounding regions. Their size and economic strength makes them key markets for many firms in rural areas. Even firms that do not sell directly to metropolitan areas rely on them as hubs for long-distance trade and travel and providers of specialised business-to-business services. Ahrend and Schumann (2014) explored the relationship between distance and economic performance from 1995-2010. They found that proximity, in terms of travel time, to large metropolitan areas (more than 2 million inhabitants) is associated with a statistically significant higher growth of per capita GDP at the TL3 regional level.

In this sense, the metropolitan area of Milan can be expected to generate positive spillovers for the economy of Bergamo, since it has more than 4 million inhabitants. Figure 1.30 shows that the metropolitan area of Milan performs quite well in terms of labour productivity. This positive spillover, however, seems to depend on travel time more than aerial distance. Transport linking Bergamo to the metropolitan area of Milan is an important influence on spillovers.

Box 1.7. Proximity to cities and economic growth

Ahrend and Schumann (2014) study the relation between distance to metropolitan areas and economic growth. It turns out that the travel time required to reach a metropolitan area is a better predictor of economic growth than aerial distance. Travel time indicates the time required to travel by car from the centre of a region to the centre of the closest large metropolitan area, and is obtained from Google Maps. Unlike aerial distance, travel time also accounts for factors such as the state of transport infrastructure and geographical characteristics affecting traffic.

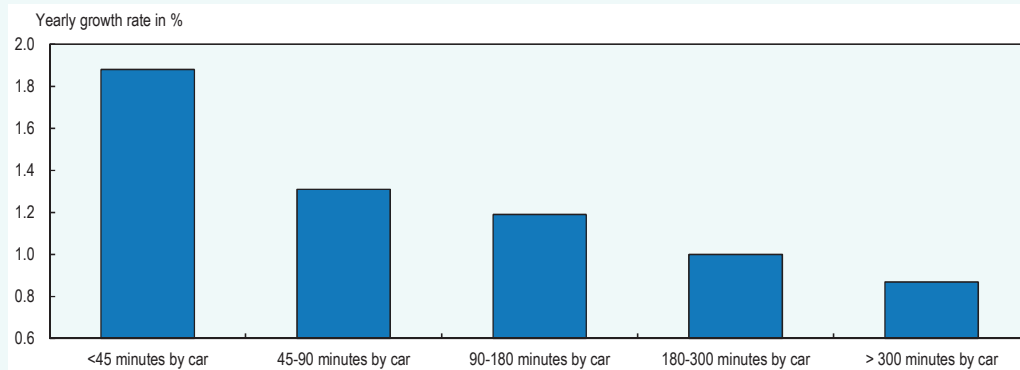
Between 1995 and 2010, longer travel time to metropolitan areas has been associated with a significantly lower growth of per capita GDP at the regional level. The effect is most pronounced in the case of very large metropolitan areas with more than 2 million inhabitants. However, it also affects smaller metropolitan areas.

The marginal effect of an additional minute in travel time is greatest at short distances to metropolitan areas. It becomes continuously weaker for longer travel times. Beyond 300 minutes, the correlation between travel time and per capita GDP growth disappears. In the Netherlands, the average travel time to the centre of a metropolitan area of more than 2 million inhabitants varies from 18 to 106 minutes. This is lower than the average for European OECD regions and indicates that most Dutch regions are close enough to metropolitan areas to benefit from borrowed agglomeration economies, i.e. to take advantage of the connection with the large metropolitan area.

Figure 1.30 shows the results of a regression of yearly growth rates on a set of dummy variables for the respective travel time brackets (including initial per capita GDP levels and a set of country fixed-effects as control variables). The data cover TL3 regions from 18 OECD countries over the 1995-2010 period. The graph shows average yearly growth rates for each group of regions, conditional on the control variables. It illustrates that regions within 45 minutes of a metropolitan area of more than 2 million inhabitants grew on average by 1.8% per year. The growth rate is almost half a percentage point higher than the growth rate of regions within 45-90 minutes of metropolitan areas of the same size.

Box 1.7. Proximity to cities and economic growth (continued)

Figure 1.30. Effect of growth rates on TL3 regions close to metropolitan areas



Source: Ahrend, R. and A. Schumann (2014), “Does regional economic growth depend on proximity to urban centres?”, <http://dx.doi.org/10.1787/5jz0t7fxh7wc-en>.

The province of Bergamo is well-connected with other territories in Italy and the European Union. To continue to be highly productive and make the transition toward a global network, it needs to capitalise on these national and international associations. Co-ordinating with the national government will also be important, since it can provide Bergamo with public goods on a larger scale.

The city of Bergamo is a relatively small urban centre, but its proximity to the metropolitan area of Milan is an important asset for regional development. As already noted, the province of Bergamo could benefit from agglomeration effects. Important functional linkages are already in place between the two areas. An OECD report assessing Milan (OECD, 2007) discusses industrial districts on the eastern border of the Milan FUA that include some located in the province of Bergamo.

The East Milan district is a relatively recent district built principally on foreign direct investment (FDI). The industrial district is specialised in the production of electric, electronic and medical equipment. Before the global financial and economic crisis, more than 400 firms operated in this area and were distributed across the provinces of Milan, Bergamo, Lecco and Lodi. The district includes three manufacturing specialities: office equipment and computers; electrical equipment; medical and surgical equipment, precision apparatus and optical instruments. The decision of IBM and ST Microelectronics to locate in the area attracted local investment and helped create SMEs specialised in related activities and in outsourcing services (OECD, 2007).

Bergamo and the metropolitan area of Milan have strong physical links. New road infrastructure, including the new Brebemi motorway, which opened in 2014, is expected to facilitate commuting and commercial freight. Bergamo’s airport has become a key hub in Italy and connects Milan with many cities in Europe, specialising in low-fare flights. In terms of public transport, there is scope for improving rail connectivity between Milan and Bergamo.

Milan provides Bergamo with international visibility and specialised services. For instance, the international exhibition held in Milan in 2015, EXPO Milano, represents a worldwide attraction and an opportunity to establish new productive networks and showcasing the area to a large number of potential investors.

Box 1.8. Understanding agglomeration economies

The mechanisms that create agglomeration benefits can be broadly split into three groups: sharing, matching and learning. The outline below follows Duranton and Puga's contribution to *The Handbook of Regional and Urban Economics* (2004) and builds on a long history of research, with early discussion of the concept of agglomeration benefits dating back to the 19th-century economist Alfred Marshall's *Principles of Economics*.

Sharing of facilities or inputs by a large number of firms is one way of creating critical mass. The provision of goods or facilities requires a critical mass of beneficiaries. For example, diverting a river to provide a constant stream of fresh water for an industrial site involves high fixed costs that are only worth paying if enough firms can benefit from the investment. A similar argument applies to the provision of specialised goods and services. Specialisation creates gains, but also requires a large enough demand to sustain the business model.

Larger labour markets result in better matches between employers and employees. A better match means that the person hired for a job is better suited for his or her position and hence more productive. Most people tend to look for jobs primarily within their city. In larger cities, they have more choice between different potential employers and are more likely to find a suitable one.

Another cause often considered relevant is the so-called technology spillover. Businesses tend to learn from businesses nearby about the latest production methods. Larger cities with more businesses offer more opportunities to learn about the most efficient production methods and to adapt accordingly.

Agglomeration benefits are also considered to be related to the higher "connectivity" of individuals in larger cities, and to higher levels of "knowledge-based capital", or intangible assets, in enterprises located in larger cities.

Lastly, a larger number of businesses increases the level of competition within a city. Fiercer competition ensures that unproductive businesses leave the market, increasing the average level of productivity in a city and raising its GDP.

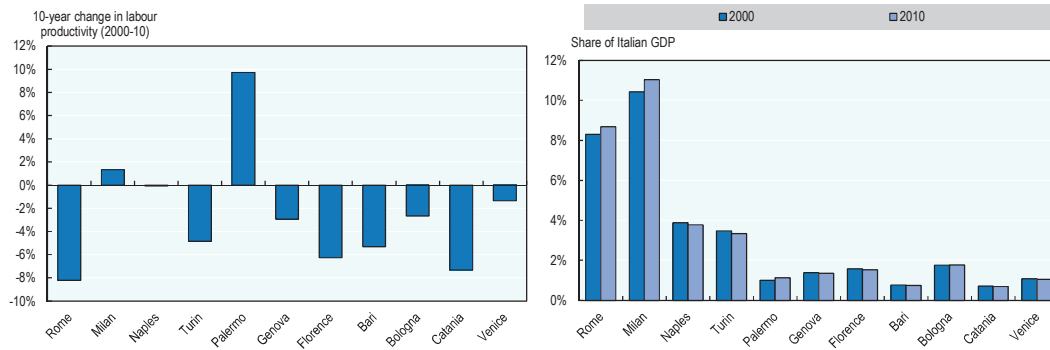
Sources: Duranton, G and D. Puga (2004), "The micro-foundations of urban agglomeration economies"; Marshall, A. (2008), *Principles of Economics: Unabridged Eighth Edition*.

Milan is Italy's economic hub (OECD, 2007) with strong connections with international markets. In the last decade, despite the 2008 global financial crisis, Milan outperformed most Italian cities. In terms of labour productivity, the functional urban area of Milan is among the few Italian regions that registered positive growth in the period 2000-10, while Rome, Turin and Genoa experienced a contraction in labour productivity (Figure 1.31). Milan is the largest metropolitan area in Italy in terms of GDP and slightly improved its position in the national economy in the decade from 2000-10.

By international standards, Milan is losing its edge with respect to some OECD metropolitan areas. An international comparison shows Milan lost ground in labour productivity over the period 2000-10, relative to the best-performing (and largest) metropolitan areas in the OECD, both in Europe and in the United States (Figure 1.32).

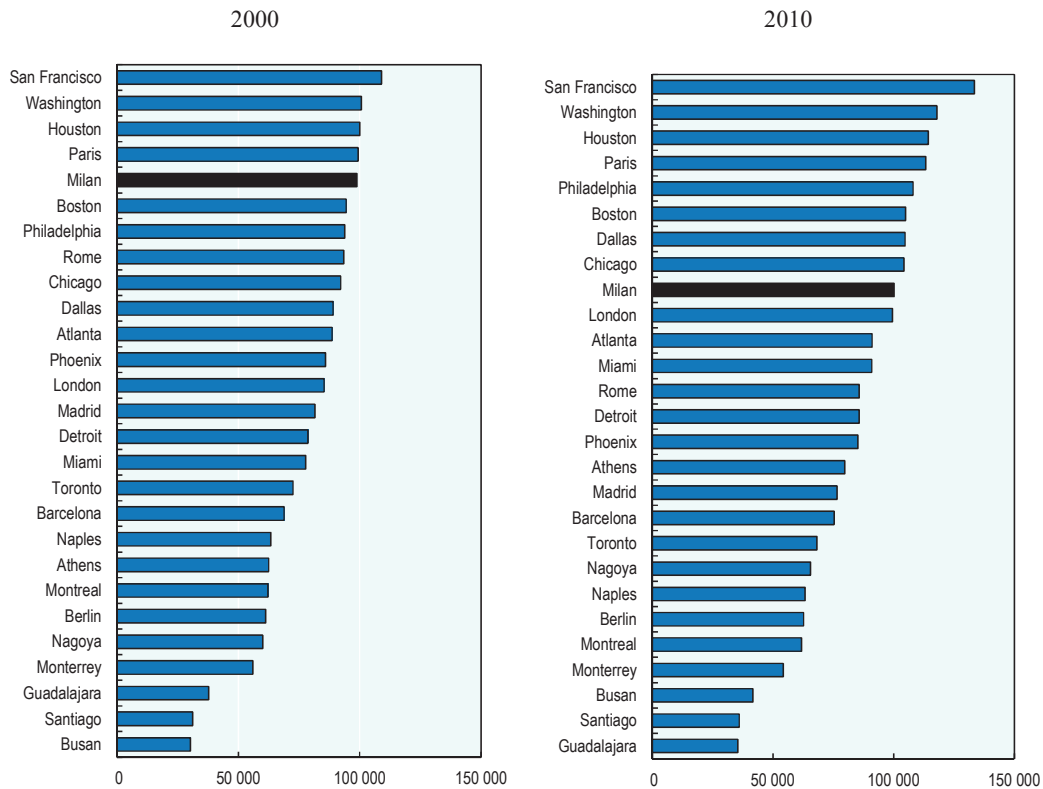
In recent years, Milan's position as a world-class city has been reduced to that of a secondary global hub. When comparing the labour productivity gaps in 2000 and 2010 (Figure 1.33), Milan was outperformed by US cities, Paris and London. The OECD rankings do not show metropolitan regions from the emerging economies or from the People's Republic of China, which is now the second-largest economy in the world.

Figure 1.31. Performance of Milan compared with that of other Italian metropolitan areas



Source: Based on data from OECD (2016b), “Metropolitan areas”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/data-00531-en> (accessed July 2016).

Figure 1.32. Labour productivity in large metropolitan areas, 2000-10

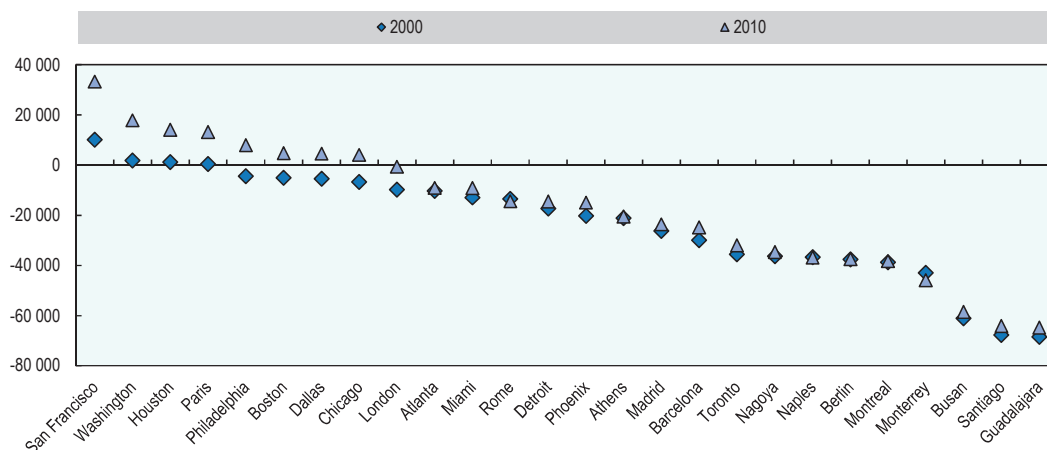


Source: OECD (2016b), “Metropolitan areas”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/data-00531-en> (accessed July 2016).

The loss of competitiveness of Milan’s metropolitan area may have a negative influence on the performance of Bergamo, as the metropolitan area may have reduced its capacity to produce global services for Bergamo’s increasingly export-oriented economy. As discussed in Chapter 2, Bergamo’s most successful manufacturing firms have tended to increase their presence in foreign markets, especially outside the EU. In this respect,

Milan may have lost its relative importance as an international broker in helping firms from Bergamo to internationalise. Internationally dynamic firms need highly specialised business services and infrastructural requirements that should be planned at the level of the whole Lombardy economy. For instance, airport connections to destinations outside the EU present a possible bottleneck for the competitiveness of Bergamo's firms in international markets.

Figure 1.33. Differences in productivity relative to Milan



Note: Positive values indicate higher productivity than Milan's; negative values indicate lower productivity than Milan's.

Source: OECD research based on data from OECD (2016b), "Metropolitan areas", *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/data-00531-en> (accessed July 2016).

For all these reasons, Bergamo may need to enhance its capacity to co-ordinate with Milan, without necessarily losing its identity. The challenge of governance co-ordination is actually a regional issue. Lombardy is one of the Italian regions whose number of provinces has increased in the past ten years. An example is the province of Monza and Brianza, which is quite central in the metropolitan region of Milan and was created in the past decade.

Italy needs specific policies designed to promote regions like Bergamo

Bergamo's competitiveness also depends on the framework conditions in Italy, so it is important to enhance co-operation between the central and local levels, to promote regional competitiveness. The impact of national policy and trends on regional competitiveness in Bergamo is multifaceted; as already noted, some key issues must be noted. In particular:

- The sovereign debt crisis in 2011 led to a severe reduction of public spending, an increase of taxation and a squeeze on lending. SMEs were particularly affected by these conditions, and it is possible that the reduction of the overall number of SMEs in Italy is also a result of these trends.
- Tax payment and contract enforcement in Italy may restrict small firms from developing and expanding. According to the World Bank's Doing Business survey, Italian firms spend on average 269 hours per year dealing with tax-related documents. This compares with an average of 176 hours in high-income

countries. In enforcing contracts, the World Bank notes that the enforcement of a commercial contract in Italy requires more than 40 months and 41 procedures. This compares to an OECD average of 17 months and 31 procedures.

- SMEs in Italy may suffer from the lack of formal skills. This is a result of Italy's low public spending on formal education, which is below the OECD average. Another limit of the national system is that vocational educational training is relatively weak (OECD, 2014c). Since the percentage of citizens with a tertiary education is also relatively low, SMEs may suffer from a lack of human capital at all levels and for different productive activities.
- Equity finance, including venture capital, is another sector in which Italy is relatively weak compared to other OECD countries. In 2012, Italy had the lowest venture capital investment as a percentage of GDP of any major economy in Europe: 0.003% (OECD, 2014c). At a time when SMEs have limited access to credit, it is important to explore alternative methods of accessing finance.
- Finally, Bergamo needs the support of national framework conditions to improve its capacity to attract FDI. The low level of incoming FDI is a national feature that relies on several factors, including onerous bureaucracy, slow commercial justice, high taxation and high energy costs.

The key issue is to understand how local stakeholders can connect and co-ordinate with the central level, providing feedback and advocating for the production of public goods and services. The recent administrative reform, by abolishing the political role of provinces and reducing financial resources for intermediate institutions such as the Chamber of Commerce, may have reduced the regions' capacity to interact with the central level. This could hurt regional competitiveness just as Bergamo needs the support of the national system to secure its position in international markets and attract foreign investment.

Bergamo's innovation system could be further developed

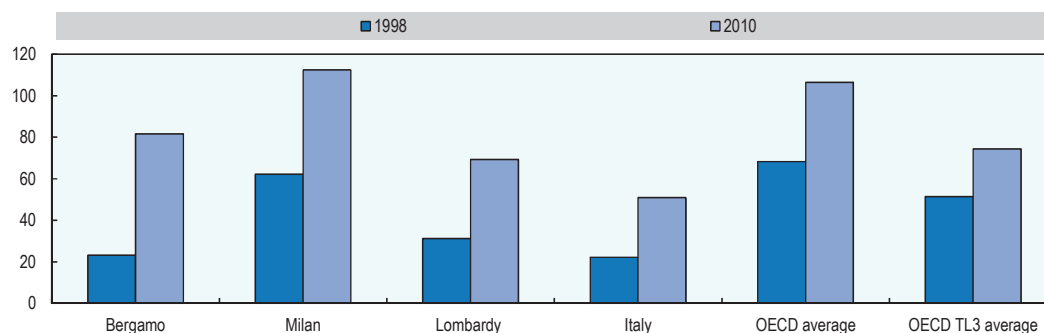
Most data on innovation concern only science and technological activities. This section provides a general diagnosis of innovation activity in Bergamo by benchmarking some indicators with respect to other regions and countries. Chapter 3 provides an in-depth analysis of the innovation system in Bergamo, considering additional sources of information.

The capacity to innovate is an important element in Bergamo's competitiveness. Innovation activity ranges from process innovation to product innovation and less visible forms of innovation, such as governance improvements. One of the main indicators of efficiency in terms of resources used in research and development is patent activity.

Patent applications (weighed by population size) increased in the province of Bergamo between 1998 and 2010, putting the region below the average among OECD member countries, but slightly above the average among OECD TL3 territories. It is noteworthy that the number of patent applications in Bergamo is below that of the province of Milan but above Lombardy as a whole and Italy (Figure 1.34). In comparison to other OECD TL3 regions, however, the province of Bergamo is appreciably below northern European regions (Figure 1.35), offering scope for improvement.

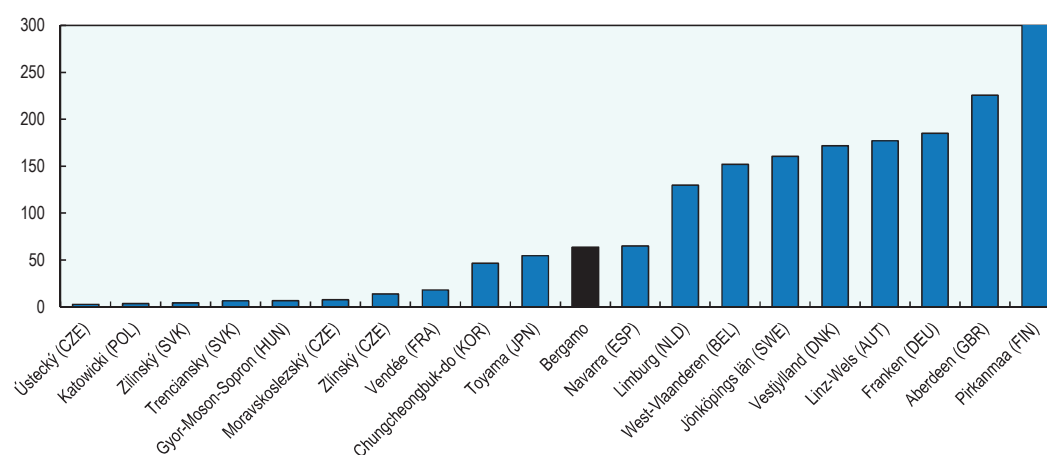
In terms of evolution, the province of Bergamo has been more dynamic than other OECD TL3 regions, on average. Furthermore, the crisis seems to have had a negligible impact on the innovation patterns for the province of Bergamo (Figure 1.36).

Figure 1.34. Patent applications per 1 million inhabitants



Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

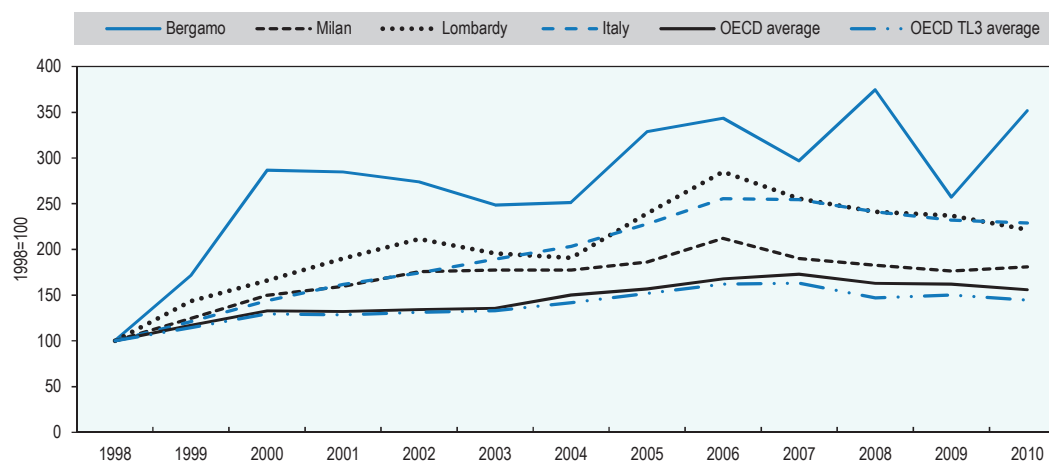
Figure 1.35. Patent intensity, average, 1998-2010



Note: Due to strong fluctuations in patent data over time, the graph depicts the average value for 1998-2010.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en>.

Figure 1.36. Evolution of patent applications



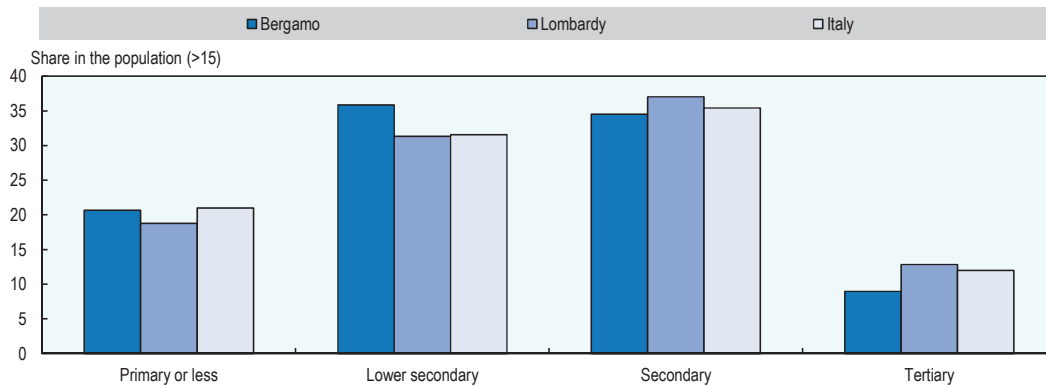
Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en>.

Educational outcomes have improved, but the skills of older workers should be upgraded...

The other important factor for competitiveness is the level of human capital. The skills of the population (in particular, the skills and level of education of the employed labour force) have a substantial impact on productivity. Human capital is the result of two elements: education acquired in schooling, and the training and experience acquired during a worker's career.

In terms of education levels, the percentage of the population with secondary and tertiary degrees in the province of Bergamo falls below the regional and national levels. The number of those with a tertiary education is particularly low, considering that Italy ranks the lowest among European countries.

Figure 1.37. **Educational attainment for Italy, Lombardy and Bergamo, 2013**



Source: Own elaboration based on data from the Chamber of Commerce of Bergamo.

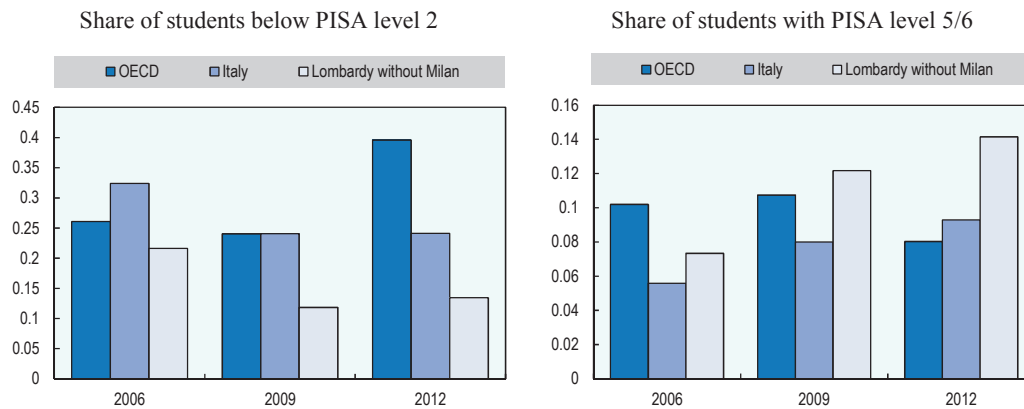
The OECD conducts two separate projects related to skills: the Programme for International Students Assessment (PISA), aimed at measuring the level of skills acquired by students during their schooling, and the Programme for International Assessment of Adults Competences (PIAAC), which measures the level of general skills acquired by the working population. Unfortunately, both programmes consider indicators aggregated at a level above the provincial one, so that information is available only at the TL2 (regional) level. In considering the skills of the adult population, the analysis is conducted at the level of the region of Lombardy, and for the performance of students, the analysis considers the region of Lombardy excluding the city of Milan.

PISA survey results show that education scores in Lombardy (excluding Milan) appear to have improved, reducing the percentage of students at the lower end of the distribution (level 2) and increasing the percentage in the higher distribution (level 5/6). The right-hand panel of Figure 1.38 shows that the scores of the student population are better than the average level in Italy and among OECD countries.

Some concerns remain over the level of skills of the adult population. Figure 1.39 compares the score of adult workers on literacy and numeracy with the average score in Italy and among OECD member countries. On both indicators, Lombardy scores in line with the Italian average, but far below the OECD average.

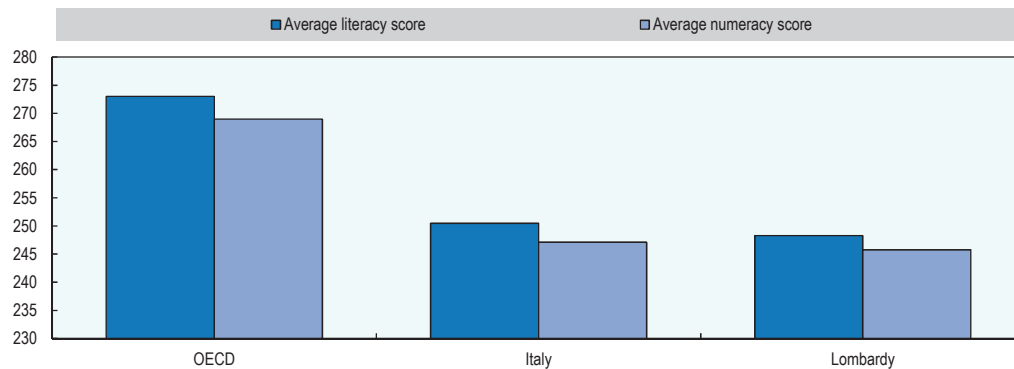
In training employed workers, Lombardy fares better than Italy as a whole, but generally below the OECD (Europe only) average.

Figure 1.38. Students' performance in mathematics



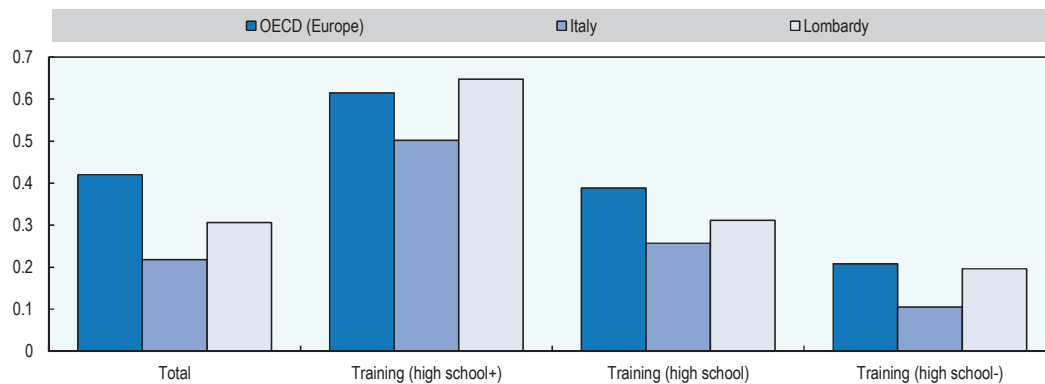
Source: OECD (2016c), *PISA Database*, www.oecd.org/pisa/data (accessed 20 November 2015).

Figure 1.39. Adult skills



Source: OECD (2016d), *PIAAC Database*, <http://www.oecd.org/skills/piaac/publicdataandanalysis/#d.en.408927> (accessed 20 November 2015).

Figure 1.40. Training in the last 12 months



Source: OECD *PIAAC database*, <http://www.oecd.org/skills/piaac/publicdataandanalysis/#d.en.408927>.

The indicators for adult skills and training suggest that the labour force in Bergamo does not perform well in terms of general skills. This suggests that workers only acquire

skills specific to their job through learning by doing. The lack of generic skills may reduce their flexibility in adapting to new working conditions or relocating to other sectors (e.g. to services). However, improvement in student scores is encouraging and indicates the effort that has been expended to increase the skills and general education of the new generation of workers.

Infrastructure: Bergamo's airport represents an important asset for regional development

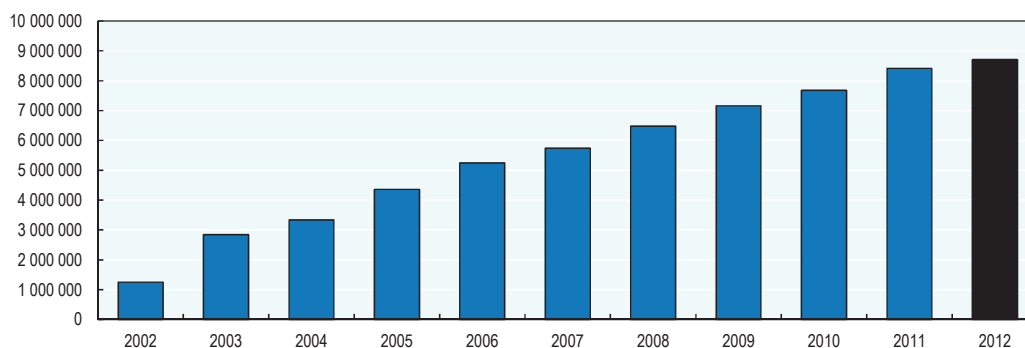
Infrastructure is a key element in economic development. The 2001 *OECD Territorial Review of Bergamo* noted the need to improve infrastructure in the province. In the past ten years, much has been achieved in this respect. The most important improvement in terms of transport infrastructure is the expansion of the Bergamo airport, which has become *de facto* Milan's third airport. The Orio al Serio Airport is a key piece of infrastructure in regional development. With Milan's Malpensa and Linate Airports, it is a major regional asset, providing international accessibility in the globalised economy. One of the busiest airports in Italy, it handles around 9 million passengers annually. It was recently ranked third in Italy for the number of passengers served.

Bergamo airport has grown with the rise of low-cost carriers. In the first decade of the 2000s, when low-cost carriers were flourishing in Europe, the airport expanded its network as the base of Ryanair, one of the largest low-cost carriers in the world. Bergamo has been successful in increasing its non-resident population through this opportunity.

The catchment area of Bergamo airport is identified with a prosperous area in northern Italy, one of the most populated areas in Europe, with the highest density of companies. Italy's most important business and industrial hub, Milan is only 45 kilometres from the airport.

Air transport has a wide economic impact. Its contribution to the regional economy includes the output and jobs directly attributable to civil aviation, as well as the multiplier or ripple effects on other industries in the province. Direct effects include employment on site at airports, and employees' spending generates induced effects. Along with the direct, indirect and induced effects, further catalytic, or location, effects can benefit the region's other industries.

Figure 1.41. Passenger trends and destinations for Bergamo's airport



Source: Orio al Serio International Airport (n.d.), Bergamo airport website, www.orioaeroporto.it/en (accessed February 2016).

These catalytic effects include off-airport expenditures directly related to the use of air travel and shipment of freight and mail. Travel and tourism are notable beneficiaries.

Spending by visitors arriving by air, for instance, creates a substantial number of jobs in tourist businesses such as hotels and restaurants, travel agencies, tour operators and retailers.

Bergamo airport is in the heart of Lombardy, a major tourist destination in northern Italy. In addition to the close proximity of Milan, the airport is an ideal gateway for the Alpine lakes such as Como and Iseo, Alpine ski resorts and cities of cultural, historical and architectural importance, such as Bergamo's old town.

Catalytic effects can increase as the number of air passengers grows. This is an area that Bergamo could exploit further. One possibility would be to increase air passengers' off-airport expenditure, to generate more catalytic effects. Bergamo's airport, only 45 kilometres from the centre of Milan, is easily accessible by shuttle bus. Its proximity to the metropolitan city has turned the airport into a secondary airport, increasing the number of air passengers. It is also only five kilometres from the city centre, with its rich tourism resources and well-preserved medieval architecture.

To maximise tourism, connections with the city centre of Bergamo could be improved. This could be achieved with a mix of policy and strategies ranging from improved public transport, services that are co-ordinated with flight timetables and better tourist information. The aim should be to make Bergamo an intermediate stop for tourists whose main destination is Milan or other destinations in Lombardy.

From a governance perspective, it makes sense to assess strategies to leverage the airport for Bergamo's regional development. It is important to discuss and plan the vision to implement concrete actions. Collaborative initiatives can be generated, employing new approaches (e.g. providing new bus routes to the city centre, welcoming seasonal charters, opening new shops at the airport) to boost the province's economy.

Labour market

The level of employment in the labour market in Bergamo's industrial sectors exceeds the Italian average. This section focuses on the aggregated labour market performance (for the whole economy), the participation rate, the employment rate and the unemployment rate. Given the heavy toll that the recent financial crisis has had on the younger generation, the unemployment rate is considered for different age tranches. A final point of consideration is the female employment rate, which may be a source of untapped growth.

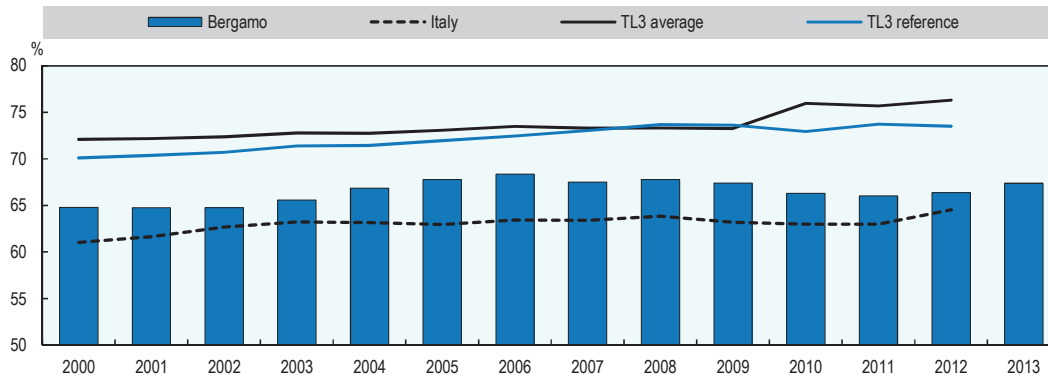
As for the labour participation rate, its value for the province of Bergamo has consistently fallen below the average of comparable OECD TL3 regions and the average for all OECD TL3 regions. This performance is in line with the national situation. The participation rate is a potential bottleneck for Italy's economic development.

The employment rate for the province of Bergamo is higher than that for Italy, almost double the Italian level in the period considered (Figure 1.43). Comparison with OECD TL3 regions, however, shows a widening gap starting in 2006. Until 2006, Bergamo's employment rate was in line with (if slightly lower than) the average of the comparison TL3 regions. Since then, the gap has been widening, and during the financial crisis, Bergamo's employment rate fell more steeply than the average of TL3 regions.

The crisis seems to have negatively affected the employment rate in Bergamo more than in comparable TL3 regions and the average of all predominantly urban regions (PU). In 2011, its employment rate was almost 65%, compared to an average of almost 69% in comparable TL3 regions and more than 72% in regions of a similar urban system (FUA ref).

In the period 1999-2011, the employment rate in Bergamo increased by 1.17 percentage points, as compared with an increase of 3.1 percentage points in OECD predominantly urban regions, 3.8 percentage points in comparable TL3 regions and 4.46 percentage points in regions with a similar urban system.

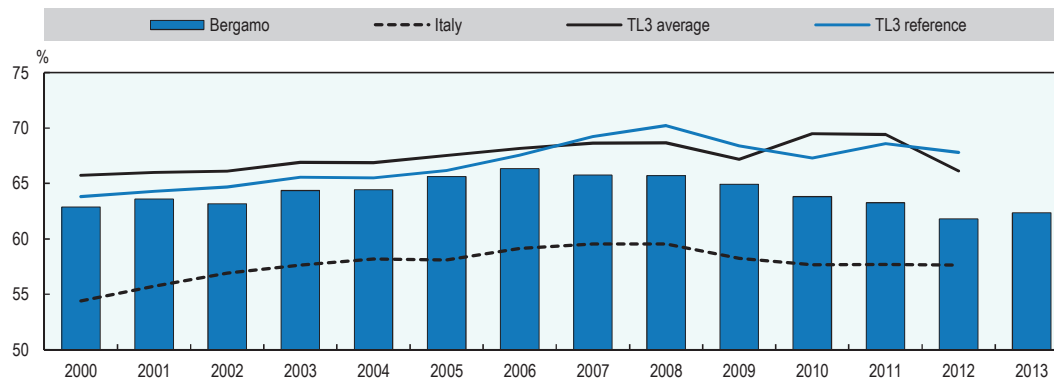
Figure 1.42. Participation rate for Bergamo and Italy



Note: TL3 average is the average value across all OECD TL3 regions; TL3 reference represents the average among a selected group of TL3 regions whose economic structure and size is similar to that of Bergamo.

Sources: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed February 2016) and Bergamo Chamber of Commerce.

Figure 1.43. Employment rate in Bergamo compared with that of Italy and OECD TL3 average



Note: TL3 average is the average value across all OECD TL3 regions; TL3 reference is the average among a selected group of TL3 regions whose economic structure and size is similar to that of Bergamo.

Sources: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> and Bergamo Chamber of Commerce.

The employment rate trend raises concern about the long-term sustainability of Bergamo's economy. In particular, a comparison with similar TL3 regions shows that Bergamo is much less dynamic than its potential competitors.

As for the unemployment rate, the province appears to have experienced an overall upward trend in the period 2001-13, with a sharp increase after 2011 as a result of the global economic crisis. Figure 1.44 shows that although Bergamo's level of unemployment is still lower than Italy's and the average in OECD TL3 regions, a worrying upward trend followed the effects of the economic crisis. The increasing trend

in the period 2001-04 is probably due to a change in the statistical methodology that makes it difficult to compare the data for Bergamo before and after 2004.

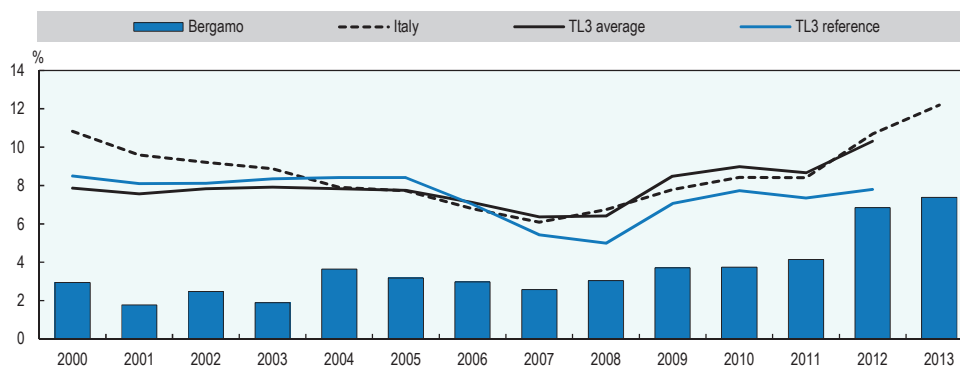
Table 1.11. **Employment rate and its change, 1999-2011**

	Employment rate 2011	Percentage point change between 1999 and 2011
Bergamo	64.93%	1.17
All OECD	67.50%	2.31
Predominantly urban	67.32%	3.13
TL3 reference	68.95%	3.86
FUA reference	72.53%	4.46

Note: “TL3 ref” refers to a subset of OECD TL3 regions of an economic structure and size similar to that of Bergamo; “FUA reference” refers to a subset of OECD TL3 regions whose FUA size and proximity to a large metropolitan area are comparable to that of Bergamo.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Figure 1.44. **Unemployment rate in Bergamo compared with that of Italy and OECD TL3 average**



Note: TL3 average is the average value across all OECD TL3 regions; TL3 reference is the average among a selected group of TL3 regions of an economic structure and size comparable to that of Bergamo.

Sources: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> and Bergamo Chamber of Commerce.

The rising trend in unemployment, particularly among young workers, is even more worrying. Figures for the province of Bergamo show that the unemployment rate of people aged 15-24 rose 20.3 percentage points after the global financial crisis, from about 9% in 2007 to almost 30% in 2013. The rise was 19.7 percentage points for Italy and 17.9 percentage points for Lombardy.

Table 1.12. **Bergamo’s unemployment rate compared with that of other regions**

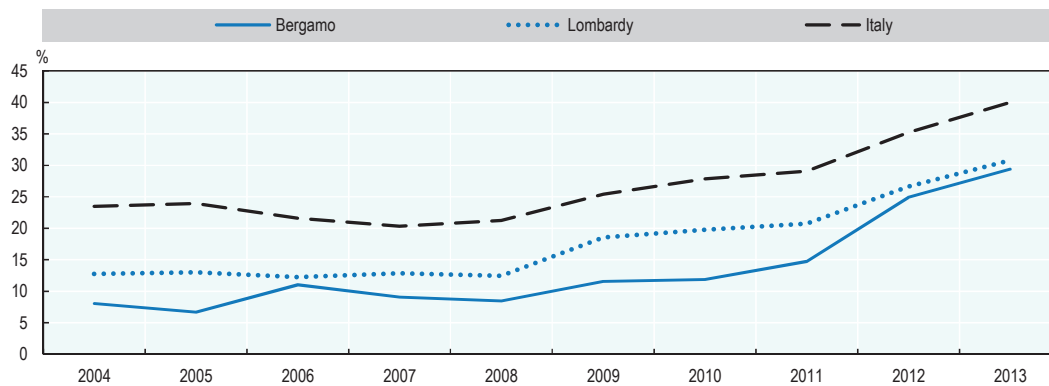
	2008	2011	Percentage point change	1999-2008	2008-11	1999-2011
Bergamo	3.04%	3.70%	0.66	0.11	0.66	0.77
All OECD	6.46%	8.55%	2.09	-1.94	2.15	0.20
Predominantly urban	6.35%	8.24%	1.89	-1.45	1.94	0.46
TL3 reference	4.99%	7.23%	2.24	-3.15	2.44	-0.75
FUA reference	5.44%	7.44%	2.00	-1.09	2.23	1.23

Notes: “TL3 reference” refers to a subset of OECD TL3 regions of an economic structure and size similar to Bergamo’s; “FUA reference” refers to a subset of OECD TL3 regions whose FUA size and proximity to a large metropolitan area are comparable to that of Bergamo.

Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed 11 July 2016).

Although Bergamo's rate of youth unemployment is lower than the average for all of Lombardy's provinces, Figure 1.45 shows an alarming catching-up process due to the impact of the crisis.

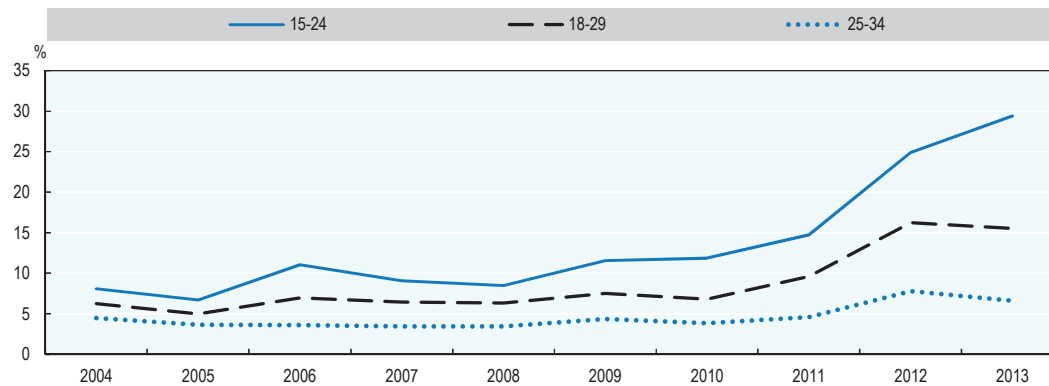
Figure 1.45. Rate of youth unemployment (ages 15-24)



Source: Own elaboration based on data from the Chamber of Commerce of Bergamo.

The poor performance in the youth unemployment rate is partly a symptom of a structural change in the labour market triggered by the global financial crisis. Bergamo's labour market has traditionally exhibited a high activity rate, thanks to the easy absorption of teenagers into the labour market, crowding out further investment in education. Although triggered by the financial crisis, it may reflect a profound change in the industrial structure of the province of Bergamo, which requires workers with a higher level of education. Figure 1.46 shows that the negative trend has reversed since 2012 for workers between the ages of 18 and 34, at the age for secondary and tertiary education.

Figure 1.46. Unemployment trends in Bergamo according to age

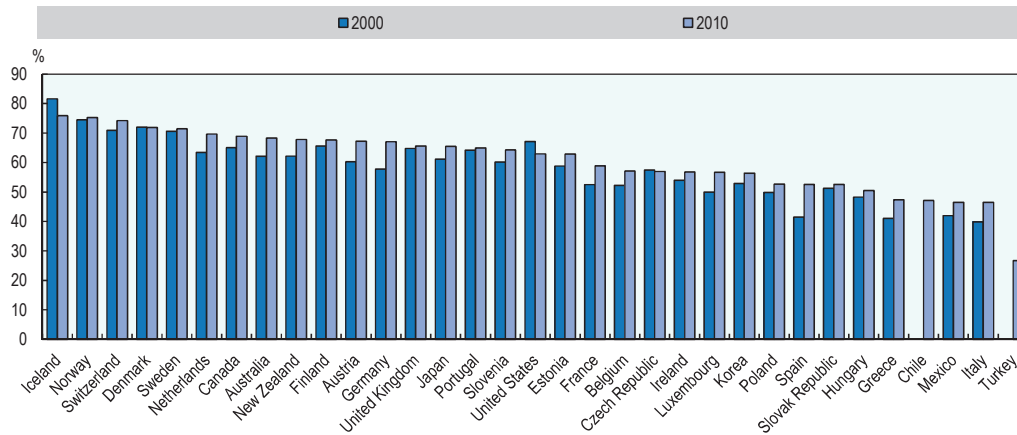


Source: Own elaboration based on data from the Chamber of Commerce of Bergamo.

Bergamo's labour market has a low female participation rate, 51.5% in 2013, which represents a source of untapped growth potential. This low rate is characteristic of the Italian labour market as a whole, the legacy of social norms under which women are seen as housekeepers and caretakers of children and the elderly. In recent years, several policies have been instituted to correct this, and the situation has improved. Figure 1.47 shows that although Italy still has the lowest female participation rate among OECD

countries, the rate has increased 6.5 percentage points, from 40% in 2000 to 46.5% in 2010 (the most recent figures confirm a participation rate of 46.5% for 2013).

Figure 1.47. Female participation rate across OECD countries

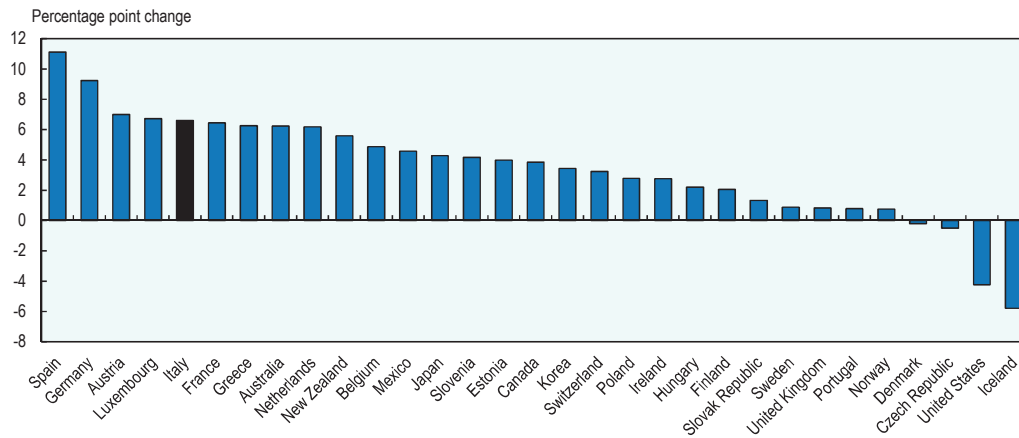


Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

Amongst OECD countries, the female participation rate in Italy is among the lowest, with less than 50% of females in the labour force in 2010, compared to more than 75% in Iceland and Norway and an average among OECD member countries of 60.5%. On the positive side, it is possible to appreciate the positive change between 2000 and 2010. Figure 1.48 shows Italy as among the most dynamic countries, with an increase of 6.6 percentage points on the 2000 value. Only Germany and Spain have done significantly better in the period.

Figure 1.48. Variation in female participation rate among OECD countries

Percentage point difference between 2000 and 2010

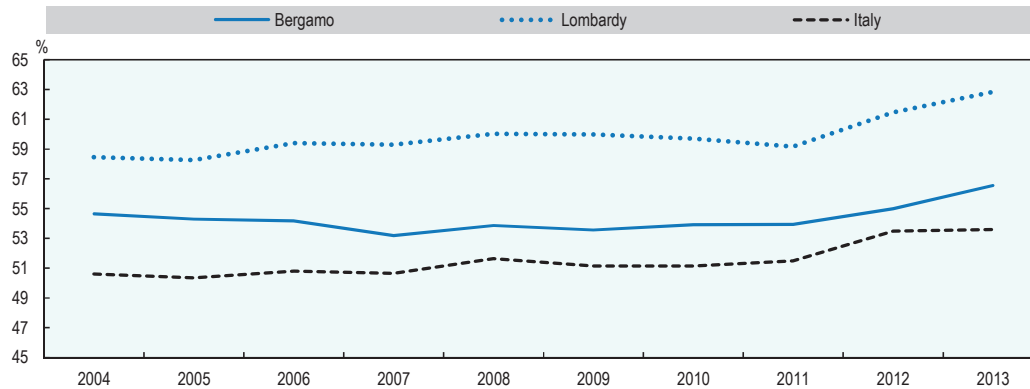


Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en>.

In the national context, Bergamo is in fact performing better than the Italian average. In 2013, its female participation rate was 51.5%, compared to an Italian average of 46.5%, but lower than the average for Lombardy of 57.3%. While Italy showed a slight trend upward in the period 2004-13, the trend in Bergamo remained substantially flat,

with a rate between 51% and 52%. Figure 1.49 shows that the gap with the rest of Lombardy did not close over the period 2004-13. Indeed, the level of female participation in the region Lombardy as a whole showed an increase of 2.2 percentage points in the period considered, compared to a reduction of 0.4 percentage points for the province of Bergamo.

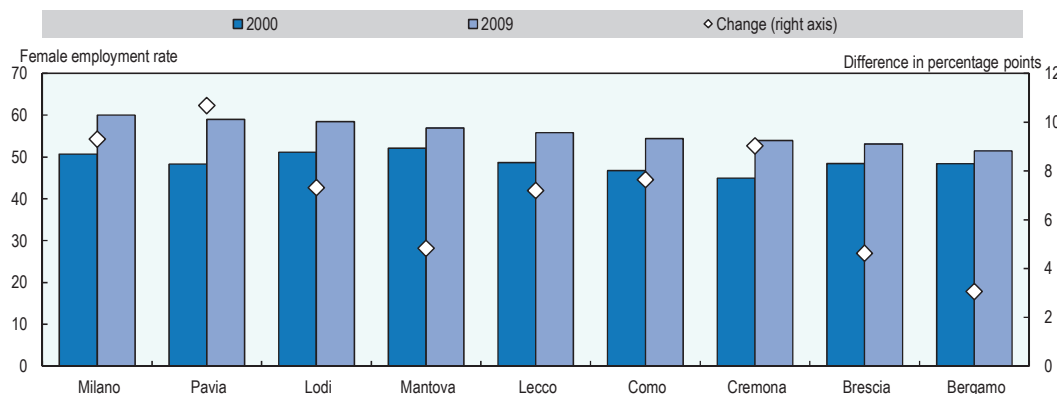
Figure 1.49. Female participation rate in Bergamo, Lombardy and Italy



Source: OECD research-based data from ISTAT Labour Force Survey, *Rilevazione sulle forze di lavoro*, National Institute of Statistics, Rome.

Compared with the other provinces in the region of Lombardy, the female participation rate in Bergamo is among the lowest. Figure 1.50 shows that Bergamo's female participation rate as the lowest for Lombardy provinces in 2009, having been overtaken by the provinces of Cremona, Como and Pavia, which had lagged behind Bergamo in 2000. Indeed, Bergamo was not only the province with the lowest level of female participation rate in 2009, but that with the smallest upward trend between 2000 and 2009.

Figure 1.50. Female participation rate in Lombardy's provinces



Source: OECD (2016a), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed July 2016).

The province of Bergamo seems not to have benefited from the positive trend in the female participation rate that Italy as a whole has experienced since 2000. Participation of female workers in the labour market is a challenge Bergamo must face, because it may present a bottleneck for the economic performance of the economy in the medium and long term.

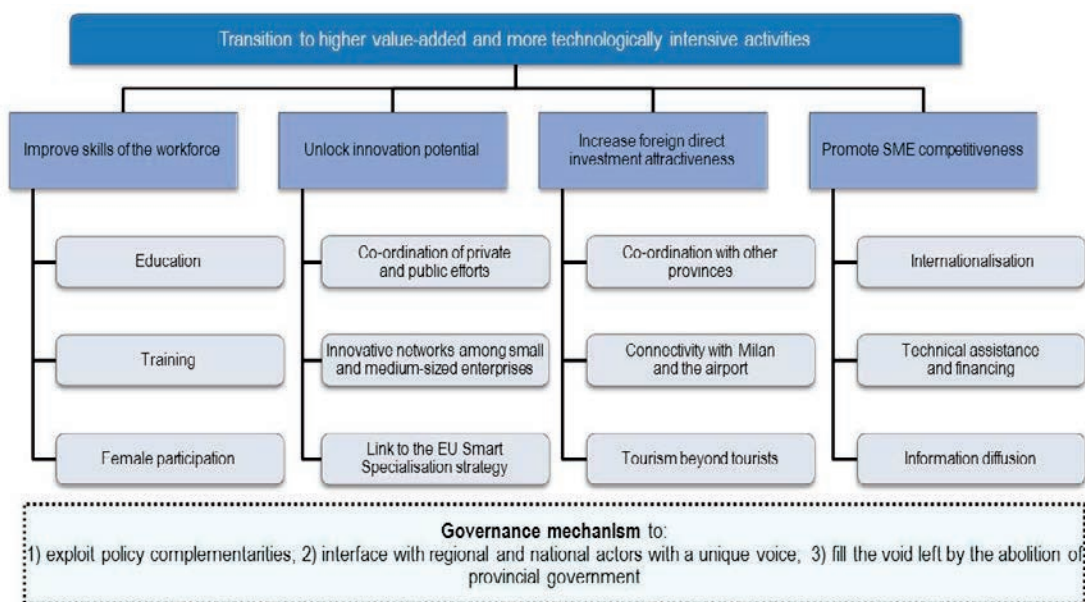
A strategic approach to local governance

The province of Bergamo has lost its competitive edge in the last decade. Nonetheless, strong private sector activity and the manufacturing hub are key assets that can restore its competitiveness internationally. This will require that all the key actors in the province develop a common and shared strategy for the development strategy of the province. Building upon the experience of other successful OECD regions that have managed to restore their competitiveness, this section provides some guidelines on institutional arrangements that can help improve co-ordination and develop a common vision.

To regain momentum, Bergamo's economy must address four main areas of concern: 1) improving the skills of the labour force; 2) unlocking innovation potential; 3) increasing appeal to FDI; and 4) promoting the competitiveness of SMEs. The analysis of the industrial structure in this chapter and Chapter 2, and of skills and innovation in Chapter 3, provides evidence for policy recommendation in these four areas.

As shown in Figure 1.51, the formulation of policy should be supported by an adequate governance structure. Policy complementarities can be exploited in the four areas of intervention. Meanwhile, communication with regional and national government can help fill the void left by the abolition of the provincial level of government.

Figure 1.51. **Main objectives and structure of development**



Source: author's own elaboration.

Given the current institutional uncertainty in Italy, and building on the recommendations of the 2001 *OECD Territorial Review of Bergamo*, local stakeholders such as the chambers of commerce, research institutes and the Mayor of Bergamo will have to fill the institutional void left after the administrative reform and tightening of fiscal policy. Key local actors could take the initiative to develop a common development strategy. Its goal would be to improve co-ordination and collaborate on improving Bergamo's competitiveness and quality of life in the medium and long term.

Other institutions at the provincial level could potentially help shape policy. The Bergamo Chamber of Commerce, one of the oldest institutions in Italy, is dedicated to the promotion of economic activity at the regional level and offers a forum where economic actors can meet to discuss and formulate solutions for the region's economic development. The Chamber of Commerce has traditionally promoted such activities by, for example, training workers, introducing innovations, providing business services, organising business events (*fiere*) and promoting tourism in Bergamo and the province. Meanwhile, Italy's chambers of commerce have also been subject to reform. So far, the changes have not yet been determined, but it seems likely that the number of the institutions will be reduced and the jurisdiction of those that remain expanded. At the time of writing, however, the impact of the reform is not clear.

Sectoral associations also play an important role, representing the interests of the province's many industrial and commercial sectors. Unlike the chamber of commerce, they focus on the interests of a specific economic sector, which gives them a better understanding of the needs of the sector. Such groups can represent the link between firms in the sector and other organisations, the chamber of commerce and political institutions. Workers' unions represent the interests of the labour force. Such organisations and institutions, in promoting sectoral development, also promote development in Bergamo as a whole.

Finally, education and research institutions have played an increasing part in development. The University of Bergamo has played a crucial role, pushing the frontiers of research and providing education for an educated and highly skilled labour force. The close links between the university and research institute with the associations of entrepreneurs and firms has helped provide a better match between knowledge and the skills of students and the needs of the labour market.

A strong manufacturing sector is the region's greatest asset. The gradual dispersion of the value chain in manufacturing toward lower wage economies, however, is putting pressure on firms in this sector. This will require that manufacturing activities in the Bergamo region focus on higher value-added and technologically intensive activities, and much closer collaboration between the university, the private sector and public administration. Table 1.13 shows some of the key actors in Bergamo that could play a key role in developing a common development strategy.

Table 1.13. **Key public, private and research stakeholders in Bergamo**

Public	<ul style="list-style-type: none"> – Regional government – Provincial government – Mayor of Bergamo – Bergamo Chamber of Commerce (private governance)
Private	<ul style="list-style-type: none"> – Associations of industrial sectors – Associations of other relevant sectors – Representatives of leading companies – Labour unions
Research and innovation centres	<ul style="list-style-type: none"> – Dean of the University of Bergamo – Representatives of research centres – Representatives of the hospital – Representatives of the Mario Negri Institute

Source: author's own elaboration.

While no general solutions exist to bring all these actors together, lessons from other regions in the OECD offer the example of three key features that Bergamo will have to put in place:

1. The need to create a **common platform** for dialogue (Box 1.9). This platform can serve various purposes, such as reducing conflict, improving co-ordination, sharing information, developing a common vision and discussing the future course of action.
2. The dialogue should be formalised and not depend on occasional meetings or personal relationships. It should be **institutionalised** to ensure continuity over time.
3. The formal institutional setting should be **inclusive**, with equal participation and ownership by representatives from the private, public and research institutions.

Practical examples of co-operation among local actors

The “triple helix” is the term for a process bringing together academic institutions, government and industry to collaborate on innovation. By engaging in a mutually beneficial process to leverage resources, the aim is to create or discover new knowledge, technology, or products and services to fulfil a social need. This and a number of institutional approaches that regions in the OECD have adopted could be helpful to bring key local stakeholders together in Bergamo to share information, reach common agreement and contribute to common plans of action.

Box 1.9. Asturias’ initiative to bring actors together to reduce conflict

The steel and mining sectors in Asturias have traditionally been very powerful, with strong labour union representation. The phasing out of this industry in recent decades increased tensions among unions, business representatives and regional authorities. However, negotiation and conflict resolution helped to mobilise the key stakeholders. The Mayor of Gijón reached out to the different actors, bringing them to the negotiating table to sign a key agreement (the tripartite accords) in July 1999. This agreement was a key element in re-establishing a social compact and bringing stability back to the region. It created confidence and involved the key actors in decision making and development. In subsequent years, the region’s economic performance made a remarkable recovery.

Brainport, Region of Eindhoven

The Dutch region of Eindhoven in the Netherlands has used the triple helix process in an effort that is instructive for the region of Bergamo. Eindhoven’s economy has achieved a remarkable turnaround. This has largely been due to a new institutional structure adopted by the local authorities in response to a crisis driven by international competition and higher authorities’ failure to produce policy solutions to address the challenges at hand.

The region of Eindhoven suffered a significant economic crisis in the 1980s, and an important economic event in 2000, with serious consequences for its manufacturing sector. Problems at the electronics giant Philips, its largest employer, led to an employment crisis and period of restructuring in the 1990s. The Netherlands has traditionally concentrated on trade, banking, transport and distribution, but the region has benefited from the strength of its private sector and industry. In 1891, the Philips brothers established a light bulb

factory in Eindhoven. Within 40 years, the company had become the most important company in the region, employing more than 22 000 workers and becoming involved in many social initiatives such as housing, education and hospitals. Philips subsequently became a major multinational firm and the backbone of the region's economy.

In the late 1980s, in a stagnating world economy, Philips faced competition from Japanese and Korean companies, fast-changing demands in the world market and some failing megaprojects. These forced the largest reorganisation in Dutch history. In 1997, Philips decided to relocate its headquarters to the capital. Its workforce in the region was cut by almost half, from 40 000 employees in the 1960s to 25 000 in the early 1990s, at a time when other large firms in the region were experiencing financial difficulties and laying off workers. These events led to a structural change, including changing the overall mindset in the region, new policies and forms of governance and new institutions, all based on the idea of enhancing innovation to compete internationally and adopting the concept of open innovation.

In response to this challenge, the private sector, led by Philips, took the lead, opening the first knowledge campus, and creating many spinoffs of existing business operations. New higher educational institutions were established and the government adopted a “triple-helix”¹ form of governance based on co-operation and enhancing links between the private, public and educational centres. All these initiatives introduced a period of prosperity in the region, which has become one of the key knowledge hubs in the EU and in the OECD area. In 1995, the gap in GDP per capita was around 9% below the national average and 26% above the OECD average. In the decade before the crisis, the region's rate of growth outperformed that of the Netherlands and the OECD average, closing the national gap to just 2% below the national average and exceeding the OECD average by 30%. Eindhoven has been recognised as one of the fastest-growing high-tech hotspots in the world and was nominated the world's smartest region by the Intelligent Community Forum in 2011.

Eindhoven's strategy is to bring together the expertise and knowledge of different actors in a common territory. In Eindhoven's case, the Mayor of the city, the head of Philips, the main industrial company and the head of the university decided to work together to find a solution for the region's declining economy. After an initial phase, the agreement developed into a formal institution, Brainport (Box 1.10).

Box 1.10. Brainport regional development

Eindhoven is one of the few regions in the Netherlands where regional government has been successful, as a complement to national and local government. The Eindhoven Regional Co-operation organisation (SRE) is an alliance of 21 local governments organised on a voluntary basis.

Part of its success stems from the fact that the 21 local governments are willing to contribute financially, and to co-fund projects for which only partial funding is available (as is generally the case for both Dutch and EU-level regional policy). Nevertheless, it has only been truly effective in policy areas where consensus exists. For example, it has struggled to deal with problems of traffic congestion and an oversupply of office space, but it has proven effective in facilitating high-tech industry.

By the 1990s, three factors were in place :

1. a history of pro-active local government
2. a number of leading firms with a long history in the region and/or a strong feeling of attachment to it, which were willing to assume responsibility for the region's well-being on their own initiative or if called upon to do so
3. an effective regional-scale co-operation organisation (SRE), backed politically and financially by local governments.

These conditions made it possible to set up a special public-private organisation that grew out of the temporary projects to fight the crisis (Stimulus and Horizon), organised by local and regional actors. This organisation, the Brainport Foundation, is a permanent public-private partnership responsible for implementing and, increasingly, for formulating, regional economic policy, through its subsidiary, Brainport Development.

Source: Van Winden, W. et al. (2012), The Innovation Performance of Regions: Concepts and Cases.

Catalonia and “Plus Industry”

The Industry Plus initiative is the response of Catalan society to the effects of the global crisis. The agreement was promoted in 2013 by the two main trade unions in Catalonia (CCOO and UGT), two business associations (Foment del Treball Nacional and Pimec), the three biggest universities (the University of Barcelona, the Universitat Autònoma de Barcelona [UAB] and the Polytechnic University of Catalonia [UPC]), and three professional associations (of economists, engineers and technical engineers). It represents the commitment of these leading social institutions and a new impetus to industry in Catalonia.

The pact is accompanied by a document entitled “Proposals for a new impetus for industry in Catalonia”, whose covenant urges Catalan society and its institutions of government to promote an active industrial recovery policy, to revive industry and the productive economy. The document was presented in January 2014 to the President of the Catalan government.

The agreement rejects the notion that industrialism is not a circumstantial topic and insists that in Catalonia's economy and society: “There cannot be a strong economy without a strong industry”. The proposals' document recognises that a major social pact is necessary to lay the foundation for this industrial revival. Agreement must be reached on the cornerstones for development, to make it safe, steady and sustainable, learning from past mistakes as well from successful international models. The notion of competitiveness adopted in the document goes beyond reaching or maintaining a certain quota in international trade: it is about improving citizens' standard of living, increasing employment and social cohesion, and respecting the environment.

The agreement called for the co-operation of leading industry experts in Catalonia. After an initial analysis of the major challenges, 8 working groups were created, enlisting the efforts of more than 100 experts to draw up a final synthesis of 138 proposals.

The principles of the pact, and the participation of a wide array of experts and partners, ensure that the reflection and proposals are based on strong consensus and relevant issues. These elements lend the document the legitimacy to represent social and economic stakeholders in the Catalonian industrial policy. In the summer of 2013, the agreement and its proposals (Box 1.11) were presented for adoption to the President of the regional government.

Box 1.11. “Plus Industry”, an agreement for the industrial platform in Catalonia (Spain)

The proposal elaborated in the Plus Industry framework consists of the following building blocks:

- Identifying and defining the industrial sector
 - Provide better information and statistics for analysis and decision making. Develop information on industrial activities vertically and horizontally.
 - Define more clearly the scope of the industry over time, and identify and follow domestic value chains.
 - Adapt political and administrative structures so that they are more appropriate for promoting a new industrial policy.
- Funding
 - Lack of funding, for both current and long-term investments, is an obstacle to the creation and survival of industrial companies, and their expansion. To help overcome this problem, the creation of an observatory for business financing is proposed. Other proposals include refining the mechanism of public administration to avoid administrative bottlenecks and fragmentation of funding; increasing public-private resources for credits and loans; developing and reinforcing institutional conditions to attract angel investors; and the creation of a specialised unit to secure and manage European public funding.
 - The public administration can help avoid delays in payments to firms and revisit business taxation for productive firms, to benefit investors and firms that make productive investments.
 - Encourage the financial system to create new products to fund industrial investment, disseminate information on alternative sources of funding (angel investors, crowd-funding, etc.), encourage banks not to use real estate assets to secure loans, to avoid diverting resources from the productive economy and incentivise bubbles in the construction sector. Promote a financial culture that prioritises long-term relationships with firms and their needs.
- Education and training
 - Promote efforts to align university education with the needs of firms; support public procurement of technology developed in co-operation between academia and firms, and promote the participation of enterprises (especially small and medium-sized enterprises) in the education of university students.

Box 1.11. “Plus Industry”, an agreement for the industrial platform in Catalonia (Spain) *(continued)*

- Formulate policy agreements on vocational training between the administration and social partners, to give more importance to firms. Integrate information on vocational training and labour market demand. Encourage careers in industry. Motivate students and reduce school failure. Promote dual vocational training. Establish corporate training plans for teachers. Give firms access to the network of centres of vocational training. Improve matching between firms and workers through horizontal instruments (continuous curriculum, upgrading qualifications). Emphasise the value of entrepreneurship in the educational system.
- Energy
 - Promote competition and interconnection in the wholesale energy market. Work on an environmentally sustainable energy mix. Encourage investments in R&D.
 - Enhance measures to reduce the impact of the different costs in the respective regulated access tariffs, and improve adjustment mechanisms.
 - Promote measures to improve retail markets and create a natural gas hub.
- Infrastructure
 - Promote initiatives to create the Mediterranean rail corridor and Ebro road corridor. Increase investments in the ports of Barcelona and Tarragona. Promote strategic gains through improved port management.
 - Propose independent management for Barcelona Airport. Attract investment, legal rights, 24-hour opening. Control temperature in specialised terminals.
 - New sources of energy for transport and logistics, water and opportunities for the agro-food industry, improve telecommunications and waste management.
 - Land for industrial and logistic activities structuring territorial management plans and urbanism, co-operation across municipalities (integrated management of industrial land), criteria of economic rationality in land provision.
- Research, development and innovation
 - Increase expenditures in R&D to 3% of GDP in 2025, optimise and strengthen the research system, encourage the growth of innovative companies, make Barcelona the capital of innovation in the Mediterranean, introduce public-private instruments for the creation of innovative firms, create a census of innovative firms, undertake frontier research.
- Co-operation, clusters and internationalisation
 - Enhance models of governance of clusters, types of specialisation of clusters, clusters bottom-up, use the university to transfer technology, use technological centres as the departments of R&D of SMEs, foster co-operation in industrial research, foster open innovation, technological and scientific parks as platforms of innovation and business incubation.

Box 1.11. “Plus Industry”, an agreement for the industrial platform in Catalonia (Spain) (continued)

- Promote internationalisation, including market research, export of comprehensive solutions and services, co-ordination for firms to establish relations in strategic markets, explicit institutional support to companies located abroad, use of existing international networks, personal contacts networks, support onshoring, startups working with global markets. Introduce an industrial Erasmus programme, foreign languages and business training.

Source: + *indústria* (2013) *Propostes per a un nou impuls a la indústria a Catalunya*, http://www.economiadigital.es/es/downloads2/propostes_mes_industria.pdf.

The “Five Clusters Initiative” in the region of Västra Götaland

The importance of co-operation and partnership among different institutional actors has also been demonstrated in the region of Västra Götaland in Sweden. A recent initiative, the “Five Clusters Initiative”, is an example of successful co-operation among businesses, research institutes and the public sector in the region. The initiative is a joint effort initiated by the West Sweden Chambers of Commerce; the main universities; the principal city, Gothenburg; and the region of Västra Götaland, which is responsible for regional development. This process began with a mutual understanding that sustainable development in all its aspects and dimensions would be the basis for discussion.

After bringing the actors together for joint discussions, five clusters were identified: 1) the urban future; 2) transport solutions; 3) green chemistry and bio-based products; 4) life sciences; 5) the marine environment. For each cluster, the aim was to identify world-class resources in research, education and industry and move toward developing the regional economy from them (vgregion.se/fiveclusters). The initiative resulted in a clearer focus for all organisations in the areas represented in the clusters, and also in day-to-day operations. The universities have even in some instances adapted their internal organisation to better focus on the chosen challenges.

As a result of a more focused approach, a new large-scale collaboration in clinical research between the leading companies, the region and the academy, with strong outside back-up, was announced in the autumn of 2014. Mistra Urban Futures, a national centre with international ambitions located in Gothenburg, is now a player in rebuilding part of the city centre in Gothenburg Old Harbour, with 40 000 residents and 20 000 working places. In the marine sector, Lighthouse is guiding the Swedish shipping industry, with a vision of zero harmful emissions to air and water, zero accidents, and a competitive shipping industry (lighthouse.nu).

The cluster initiative is also a vital part of the region’s common overall strategy for development for the year 2020 – VG2020. One out of four of its 32 priorities, focusing on process and activities to develop the region in a broader sense, have the cluster initiative as the basis for action. These priorities range from attracting students and research, strengthening the environment for research and investment, creating arenas for testing and demonstrations, stimulating national and international co-operation in R&D, strengthening science parks and other collaborative sites for R&D, and making the public sector in Västra Götaland a leading developer of sustainable solutions.

This initiative is consistent with the region’s efforts to create a more dynamic and sustainable society (Box 1.12). West Sweden’s economy has flourished in the past ten

years, with economic growth three times higher than the average for other countries in Western Europe. This growth was based on an increase in productivity and a growing workforce. A principal reason for the rapid growth in productivity was continued structural change, in which business services and general urban sectors play a more important role as driving forces for economic development. Making societal challenges the basis for regional economic development creates linkages between the development of society, business and industry that should provide strong opportunities for growth in the future.

Lessons from triple helix co-operation

A number of key lessons emerge from these case studies:

- Empowerment and active involvement of the different actors was achieved by sharing roles and responsibilities on an equal basis. This conveys the importance of stakeholder commitment and ownership and avoids incentives to free-ride or not to invest in the common project.
- The collaborations started on a personal basis, but soon evolved into an institutional framework that permitted:
 - continuity in the forms of collaboration beyond personal relationships
 - the involvement of further actors in other forms of co-operation.
- The involvement of a broad set of actors: Planning a coherent regional policy or strategy requires good information about the different priorities and needs at hand. Without a clear understanding of a region’s challenges and potential, policies may not allocate efforts and resources fully or effectively. The involvement of a broad set of public and private actors and higher education helps develop an informed and comprehensive regional development policy.
- Continuity in policy programmes and goals. The case of Eindhoven offers a valuable lesson in this respect. After the economic crisis in the region, representatives from the three communities (private, public and academia) established a plan between 1993 and 1995 that was formalised into a regional development plan in 1996. The aim of the plan was quite defensive, with the goal of getting through the crisis, and was heavily funded by external resources. The programme, also known as the “Stimulus”, combined resources from the EU (both from the European Social Fund and from the Structural Funds), the national government, the provinces and the 21 municipalities. Funds were allocated to enhance the triple helix structure, supporting high-tech business development with close links to higher education. At the outset, the focus has been on bringing low-skilled unemployed workers back into the workforce. The external sources were gradually phased out, especially with the Horizon programme, established in 2000, which strengthened the links between the sectors and was more pro-active and market-driven, but provided continuity with the previously established goals. The Brainport Navigator 2013 programme, established in 2005, was also a joint initiative from the triple helix partners, defining projects in four domains: 1) technology (more public and private R&D, better linkages); 2) business (startups, attracting FDI, new business on the axes of societal challenges and technological excellence); 3) people (more students, lifelong learning, attracting knowledge workers); and 4) basics (living climate, cultural facilities,

accessibility). Finally, the Brainport 2020 strategy and action programme, with a mandate from the national government, was established by the regional triple helix in 2011. This programme focuses on the same domains as the Brainport Navigator, but involves more participants, both at the regional and national level. Each of the programmes is thus based on strengthening links and aligning goals among the region’s private, public and educational communities.

- This facilitated the development of a common vision that originated from the involvement of all the relevant actors in the territory. The vision eventually resulted in a common policy framework with a clearly articulated roadmap that: 1) identified key policy goals; 2) outlined the parameters for actions and evaluation; and 3) is supported by political commitment.
- A common voice is a great asset for communicating with the central government. Through the close links between the private, public and education sectors, Brainport’s coherent agenda and goals in the different policy areas have been effective in increasing its leverage relative to other regions and the central government. Its consistent message, whether articulated by the chairman of Philips Nederland or by the Mayor of Eindhoven, has contributed to the region’s success in bargaining and negotiations.
- Co-ordination mechanisms should be established to enable information flows, whether horizontal, inter-sectoral or vertical, among levels of government co-operation and co-ordination.
- Financial strategies are needed that match policy priorities, provide sufficient levels of funding and promote credible commitments. An institution backed by stakeholders from private, public and higher education institutions can pool financial resources for common projects. It can also facilitate private-public partnership financing arrangements.
- A common project is fundamental if all stakeholders are to work in concert and to benefit from policy complementarity (Box 1.13) rather than providing conflicting signals to the economy.

Box 1.12. Entrepreneurship: Changing norms for a more dynamic and sustainable society

In the past two decades, Sweden’s population has undergone a fundamental change of attitude. Entrepreneurs and small companies were often the object of suspicion in the past. Today, many citizens dream of becoming an entrepreneur and running their own company. Privatisation is now deeply embedded in the publicly financed sectors of health care, social care and education.

An important part of this change in attitudes has been driven by the educational sector itself. As a deliberate strategy, Nutek, the national board responsible for entrepreneurship, innovation and regional development, started a programme in 1998 for entrepreneurship in school. Its goal was to increase focus on creativity in education and to change the perception that the aim of education is simply to get a job. Instead, the emphasis was placed on giving an education so that each student could shape his or her own future, and even run their own business.

The programme, called “Entrepreneurship in School”, was successfully adopted by teachers and schools all over the country. New projects evolved into better-organised programmes with carefully tested methods. The curriculum incorporated a study of entrepreneurship as something important to understand and do. Sweden, once a nation of workers, can be now seen as a haven for entrepreneurship.¹

Box 1.12. Entrepreneurship: Changing norms for a more dynamic and sustainable society (continued)

In the Västra Götaland region, entrepreneurship has been at the centre of development policy for 15 years. Support for organisations like “Young Entrepreneurship” and other organisations running programmes at every educational level has been strong and consistent. The region has also started its own programme for entrepreneurship in society, focusing on how civil servants in municipalities and other public organisations perceive entrepreneurship. One element of the programme has allowed public officials in cities to be “entrepreneurs for a day”. This experience is often an eye-opener for the participants. The programme has now been adopted by the national association for regions and municipalities, and is being implemented in 160 of Sweden’s 290 municipalities.

This focus on entrepreneurship has clearly paid off. Västra Götaland today has the highest proportion of young people in Sweden who say that they can envisage becoming entrepreneurs or starting a company. This is a remarkable change in a region known as Sweden’s manufacturing “district”. Three out of four inhabitants between the ages of 18 and 30 in Västra Götaland report that they could see themselves running a company. The Swedish average is two out of three.

Four out of ten young people in Västra Götaland would rather run a company than work for an employer. Six out of ten say that they would like to work independently and fulfil their own dreams. Four out of ten mention personal development as an important motivator. Sharp differences emerge in the attitudes of different age groups that can be explained by changes in the education system. One out of three persons under the age of 30 say that they have learned in school what it would be like to run a company. Among the rest of the working-age population, only one in six agree. Almost four out of ten of the young say that they have been encouraged to become an entrepreneur in school. For the workforce as a whole, the figure is only one in ten.

Sweden and Västra Götaland are still clearly behind the EU average and in particular Italy, in comparing the percentage of people running their own company. However, Sweden’s rate of start-up companies is higher than those of Italy, France, Germany, Belgium and Denmark according to the Global Entrepreneurship Monitor 2013 (GEM, 2014).

The crux of this story is the possibility of changing the values, norms and eventually habits of society, into something more dynamic and sustainable. Clearly, following such a trajectory is not easy, and requires not only persistence but a sense that society itself is changing in the same direction.

Note: see: www.economist.com/news/leaders/21571136-politicians-both-right-and-left-could-learn-nordic-countries-next-supermodel (accessed 6 May 2016).

Source: Regional Development Västra Götaland.

Box 1.13. Policy complementarity: What is it, and how does it work?

The concept of policy complementarity refers to the mutually reinforcing impact of different actions on a given policy outcome. Policies can be complementary because they support the achievement of a given target from different angles. For example, production development policy, innovation policy and trade policy all support the competitiveness of national or regional industry. Alternatively, a policy in one domain can reinforce the impact of another policy.

Sequencing is also important in policy complementarity. Some policies are best put in place simultaneously. For example, innovation, industrial and trade policies must be synchronised to address the issue of industrial competitiveness from all angles. Other policies realise their synergies sequentially. For example, investments in broadband infrastructure need to be followed up with specific policies on access and disseminating those services among the population.

Box 1.13. Policy complementarity: What is it, and how does it work? (continued)

Complementarities between policies can be “latent”, but can also be encouraged by specific governance arrangements. For example, mechanisms that facilitate co-ordination across levels of government (vertical co-ordination) can help attain complementarity across policies from various levels. Triple helix arrangements can develop a strategic common framework involving all relevant actors in a region. Alternatively, they can be induced, by combining different policies through conditionality schemes, or when the complementarities are the result of strategic planning. Opportunities to create jobs, for example, can be attached to direct cash transfers to enlist those with the least resources in production, so that they can avoid becoming dependent on income transfers. Policy complementarities can also be spontaneous when they emerge as positive side effects of independent actions of ministries or bodies.

Source: (2014e), OECD Territorial Reviews: Netherlands 2014, <http://dx.doi.org/10.1787/9789264209527-en>.

Manufacturing has great potential as part of a sustainable path of development for the province of Bergamo, but its success depends not only upon continuous innovation in business strategies, and continuous innovation in products, processes, organisation and marketing, but also on skills and human capital.

To attain these common objectives, the region will have to develop a common vision so all stakeholders can make their contributions. Based on the analysis conducted in the previous *OECD Territorial Review of Bergamo*, a recommendation emerged to form a “Bergamo regional alliance” to guide development in the province. Building on this recommendation, all the relevant actors in the region can be enlisted to take ownership of a common vision. This must take into account the values and assets that have contributed to the province’s industrial success in recent decades. Such values reside not in a particular company, but in local society: ethics, quality, satisfaction, pride in doing things well, health, safety, family, community. They are part of a new version of capitalism with a human face, set up to promote human welfare.

Given the institutional uncertainty generated by the reform of the provincial government, it is important that the work on a common vision take place in a formal institutional setting that can provide continuity, improve co-ordination, pool financial resources and strengthen Bergamo’s economic position.

Conclusions

Bergamo is strategically located in the north of Italy close to Milan, Turin and Genoa. It is a predominantly urban region with a strong industrial legacy which remains an economic strength. Bergamo’s SME-based manufacturing sector remains a key asset. Most of these firms specialise in tradeable activities and as a result innovation and productivity growth are critical to the economic performance of the region.

The 2001 *Territorial Review of Bergamo* acknowledged these strengths and identified a number of areas that required further improvement. The level of formal education in the workforce was low and infrastructure improvements to better connect Bergamo to Milan and external markets were required. Collaboration between key actors needed to be enhanced to implement a more strategic and integrated approach to regional development policy. These weaknesses remain today and now there is a more compelling case for policy reform.

In the years since the 2001 review Bergamo has experienced further deterioration in its economic performance. Productivity growth has declined and this has further reduced the competitiveness of Bergamo relative to comparable OECD regions. The employment rate is falling further behind the OECD average while the unemployment rate, particularly for young people, is increasing. These trends are also apparent at the national level. For more than a decade Italy has experienced sustained low productivity and economic growth. The global economic and financial crisis has made matters worse. Weaknesses in external markets, flat domestic demand, fiscal tightening, and institutional and regulatory weaknesses have continued to affect economic performance across the country. As other OECD economies have recovered from the crisis, improvements in productivity and employment are not evident in Italy.

Restoring Bergamo's growth and competitiveness will depend upon addressing priorities in an integrated way. This is more challenging due to the changing governance landscape of the province. A national decentralisation process has strengthened the role of regions and municipalities. The shift of the provincial level to a non-elected institution made up of representatives from the municipalities could potentially weaken the capacity to deliver an integrated approach to economic development. It will be important that municipalities work with other stakeholders to develop an inclusive and co-ordinated approach to economic development at a provincial level.

Note

1. Combined triple helix innovation is a process by which academia, government and industry collaborate (i.e. engage in a process of mutually beneficial leveraging of resources) to create or discover new knowledge, technology, products and services, to fulfil a social need.

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Annex 1.A1. Functional urban areas and comparison regions

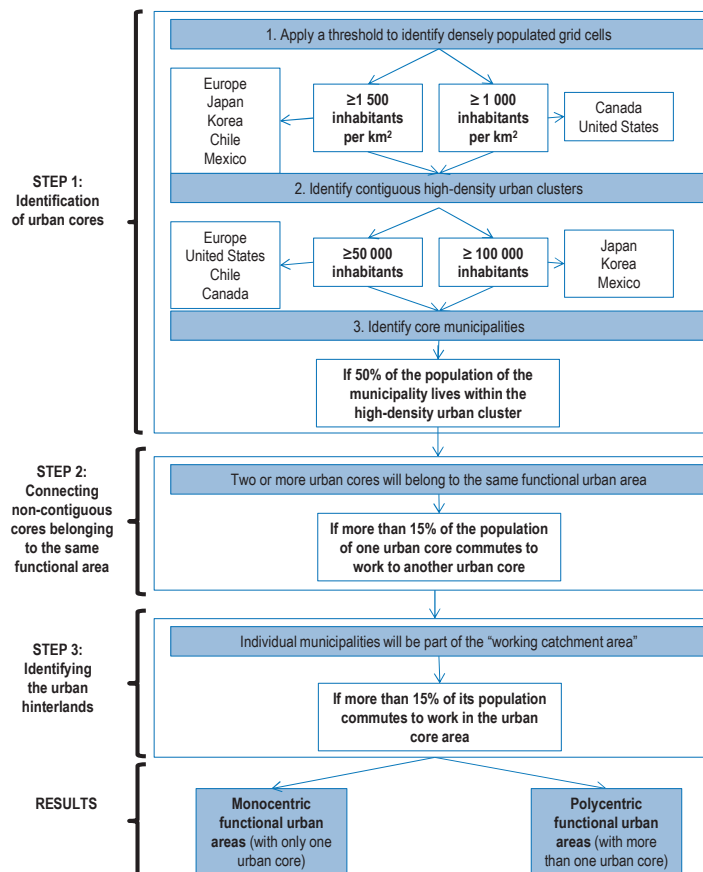
Functional urban area methodology

The “functional urban area” (FUA) is a definition that for statistical purposes includes areas beyond the administrative borders of urban areas. Economic and social activities expand, while administrative borders are less flexible. As a result, the size of an urban agglomeration rarely coincides with the original administrative borders of a city or region.

The advantage is to create a homogeneous base of FUAs among OECD countries that allows a comparison more meaningful than the formal administrative unit.

The OECD, together with the European Commission, has developed a methodology to consider the economic links of an urbanised core with its periphery, regardless of municipal boundaries. The methodology is based on a criterion of density to define the urban core, and a criterion of commuting for work-related purposes within the neighbouring municipalities. Figure 1.A1.1 provides a visual representation of the criteria adopted.

Figure 1.A1.1. EU-OECD methodology for the definition of functional urban areas



Source: OECD (2013c), *OECD Regions at a Glance 2013*, OECD Publishing, Paris, http://dx.doi.org/10.1787/reg_glance-2013-en.

Identification of comparison regions

Two methodologies are used to identify comparison regions for Bergamo. First, a multivariate distance measure is used to find regions that show similar characteristics in terms of size, industrial structure and income. Second, geo-referenced information on urban systems is used to identify regions whose urban systems are comparable to that of the province of Bergamo: i.e. which include a small FUA in close proximity to a large FUA (Milan, in Bergamo's case).

The first measure uses OECD data from 2009 and 2010 on the size of the region (measured by total employment), its percentage of employment in manufacturing and the gross value added (GVA) created in the region. For each OECD TL3 area, the distance of Bergamo along these three lines is calculated and aggregated into a single distance measure. To account for the important role of the manufacturing sector in Bergamo, the weight for the percentage of manufacturing employment in the aggregation is larger than the weight of the other two factors. Based on the distance measure, the TL3 region with the smallest distance is selected, excluding countries that either lack sufficient data to match all three factors or that have no comparable TL3 regions. The final selection includes 19 regions from 16 countries (Table 1.A1.1 left-hand columns).

Table 1.A1.1. OECD TL3 comparison regions for Bergamo

Distance-based measure		Urban system-based measure	
TL3 identifier	TL3 name	TL3 identifier	TL3 name
AT312	Linz-Wels	CZ032	Plzeňský kraj
BE25	Prov. West-Vlaanderen	DE23	Hildesheim
CZ042	Ústecký kraj	DE89	Ingolstadt
CZ072	Zlínský kraj	ES211	Álava
CZ080	Moravskoslezský kraj	JPB06	Yamagata
DE69	Franken	NL41	Noord-Brabant
DK041	Vestjylland	PT112	Cávado
ES220	Navarra	SE121	Uppsala län
FI197	Pirkanmaa	UKG38	Walsall
FR515	Vendée	UKM36	North Lanarkshire
HU221	Gyor-Moson-Sopron		
JPE16	Toyama		
KR052	Chungcheongbuk-do		
NL42	Limburg (NL)		
PL22A	Katowice		
SE211	Jönköpings län		
SK022	Trenciansky kraj		
SK031	Zilinský kraj		
UKM50	Aberdeen City and Aberdeenshire		

Source: author's own elaboration.

The second methodology considers the urban system around Bergamo. A key characteristic is that the province of Bergamo contains a medium-sized urban agglomeration, the city of Bergamo, and is adjacent to one of the largest metropolitan areas in Italy. The resulting list of comparison regions consists of ten TL3 regions from eight OECD countries (Table 1.A1.1 right-hand columns).

Table 1.A1.2 Functional Urban Areas

ID	Functional urban area	ID	Functional urban area
IT001	Roma	IT039	Pesaro
IT002	Milano	IT040	Como
IT003	Napoli	IT041	Pisa
IT004	Torino	IT042	Treviso
IT005	Palermo	IT043	Varese
IT006	Genova	IT044	Busto Arsizio
IT007	Firenze	IT045	Asti
IT008	Bari	IT046	Pavia
IT009	Bologna	IT047	Massa
IT010	Catania	IT048	Cosenza
IT011	Venezia	IT049	Carrara
IT012	Verona	IT050	Benevento
IT013	Cremona	IT051	San Remo
IT014	Trento	IT052	Savona
IT015	Trieste	IT053	Vigevano
IT016	Perugia	IT055	Viareggio
IT017	Ancona	IT056	Acireale
IT019	Pescara	IT057	Avellino
IT020	Campobasso	IT058	Pordenone
IT021	Caserta	IT059	Biella
IT022	Taranto	IT060	Lecco
IT023	Potenza	IT501	Messina
IT024	Catanzaro	IT502	Prato
IT025	Reggio di Calabria	IT503	Parma
IT026	Sassari	IT504	Livorno
IT027	Cagliari	IT505	Reggio nell'Emilia
IT028	Padova	IT506	Ravenna
IT029	Brescia	IT507	Ferrara
IT030	Modena	IT508	Rimini
IT031	Foggia	IT509	Siracusa
IT032	Salerno	IT511	Bergamo
IT033	Piacenza	IT512	Forli
IT034	Bolzano	IT513	Latina
IT035	Udine	IT514	Vicenza
IT036	La Spezia	IT515	Terni
IT037	Lecce	IT516	Novara
IT038	Barletta	IT517	Matera

Source: Author's own elaboration.

Chapter 2

Bergamo's strong industrial sector

This chapter evaluates the economic performance of Bergamo to identify strengths and areas for improvement. The chapter has three sections. The first provides a diagnosis of the industrial sector, identifying the importance of the tradeable sector to the regional economy. The manufacturing sector has been particularly important to regional economic performance and has maintained its share of the economy whilst its composition is changing. The second section focuses on some key drivers of productivity for Bergamo's industry and finds that greater investment in human capital and innovation is required to overcome stagnant productivity growth and declining competitiveness. Section three examines the process of internationalisation for industry in Bergamo. Although export performance is strong, further effort is required to attract foreign investment to shift from lower to higher technological activities.

Introduction

A reduction in the relative size of the agricultural and manufacturing sectors and an increase in the service sector is a common structural trend across OECD countries. In spite of these broader trends, Bergamo's industrial base – in particular manufacturing – remains important to the regional economy. This chapter examines the performance of Bergamo's industrial base, the productivity and growth performance of different sectors, and how they are integrated into global value chains.

Bergamo has an export-oriented economy and manufacturing continues to account for more than a third of the province's economic activity (35.1% of gross value added [GVA] and 34% of employment in 2012). Manufacturing is primarily specialised in five sub-sectors (metal products, machinery and equipment, rubber and plastics, textiles, and electrical equipment), which together account for 51.8% of manufacturing employment.

Due to this strength in manufacturing Bergamo generates a high volume of exports compared to the national average. This strong export performance presents challenges and opportunities. International competition exposes firms to offshoring and external market conditions. Tradable activities typically have higher productivity growth than non-tradable ones and strong multiplier effects on the economy as a whole. Competitiveness in tradable sectors also means that Bergamo need not to depend on external transfers to generate internal growth.

A transition to higher value production will be critical to maintaining competitiveness in international markets. Bergamo has also experienced an outsourcing of industry and parts of value chain operations have been relocated to the People's Republic of China (hereafter "China") and India and other locations in emerging markets. Small and medium-sized enterprises (SMEs) will need to develop new strategies to develop and apply new technologies, and integrate into more complex global value chains. This will present challenges to Bergamo's traditional industrial model based on dense networks and linkages between local firms.

Industry remains the centrepiece of Bergamo's economy

The *OECD Territorial Review of Bergamo* (2001) highlighted Bergamo's traditional heavily industrialised base, mainly specialised in industry and construction. In 1996, the industrial and construction sectors generated 50.4% of added value and 51% of the employment in the province, while in Lombardy and Italy as a whole, the corresponding figures were 37% and 28.7%, respectively. The contribution of the construction sector was unusually high (12% of those employed), and the main anomaly was the unusually low contribution of the services sector (37% of employment).

Almost two decades later, the industrial sector is still the centrepiece of Bergamo's economy. Its contribution in terms of GVA in 2013 (35.1%) remains close to that of 2000, a proportion that is greater than that of other OECD regions. In 2012, its industrial sector accounted for 14 percentage points more than the average for EU28 countries (33.2% of GVA as opposed to 19.4%). This was 4.5 percentage points more than a sample of comparable OECD Territorial Level 3 (TL3, or small) regions (28.6%), 14 percentage points above the Italian average (18.9%) and 9 percentage points above the average for Lombardy (25.1%).

Before the economic crisis, the value of industrial production was growing in real terms, from around EUR 8.8 billion in 2000 to a peak of EUR 10.3 billion in 2007, representing an annual growth rate of 2.2% for the period 2000-07. During the crisis, however, from 2007-13, it fell by 2.9% per year (Table 2.1).

Table 2.1. **Industrial sector growth rates, chain-linked volumes**

	European Union (28 countries)	Euro area (18 countries)	Italy	Lombardy	Bergamo
2000-07	1.9	2	0.8	1	2.2
2007-13	-0.8	-0.9	-3.1	-2.5	-2.9
2000-13	0.7	0.7	-1	-0.6	-0.1

Source: Eurostat, <http://ec.europa.eu/eurostat/web/regions/data/database> (accessed 21 June 2016); ISTAT (2014a), *Censimento industria e servizi* National Institute of Statistics, Rome.; and Prometeia, <http://www.prometeia.it/brief> (accessed June 2016).

The trends in Bergamo are similar to those observed in Italy and in Lombardy: industrial production expanded before the crisis and suffered a decline in its aftermath. The patterns observed in a sample of TL3 regions comparable to Bergamo (see Table 1.A1.1 in Chapter 1 for the list of regions) show distinct differences: these regions enjoyed robust growth before the crisis and no subsequent decline:

- Before the crisis, the increase in Bergamo's industrial GVA (3.9% annually over 2000-07) exceeded that of Italy (2.6%) and the average for EU28 countries (2.9%). This growth, however, was less than in comparable OECD TL3 regions (4.5%).
- After the crisis, Bergamo's industrial GVA contracted (at -2.3% annually over 2007-11) at a greater rate than in Italy (-2.1%), Lombardy (-1.5%) and among the EU28 (-0.4%). In contrast, the 16 similar OECD TL3 regions experienced an average annual growth of 1.5% for this period.

The most recent estimates (Unioncamere Lombardia, 2014) show an increase in industrial GVA from the second quarter of 2013 through to the end of the second quarter of 2014, the latest available data. Thus, 2013 still recorded a slight cumulative decline of -0.1%, but in the first two quarters of 2014, the industrial GVA showed some signs of recovery, at 2.8% and 1.5% respectively.

Despite the relative losses of Bergamo's industrial sector since the crisis, it remains a vital part of the provincial economy, representing more than one-third (35.1%) of production in 2012. As noted, the net effect of the gains before the crisis and the losses since have left the relative size of the industrial sector close to the value obtained in 2000. In terms of employment, the industrial sector contracted after the crisis at an average annual rate of 2.6%. From 2000 to 2006, it grew almost 2% annually, while many OECD regions and 16 comparable OECD regions were in decline. Employment in industry represents more than one-third of the workforce (34.3%), more than twice the average of the EU28 countries (16.1%) and of the province of Milan (17.2%), 15 percentage points above the Italian average (19.3%), and 9 percentage points above the average of Lombardy (25.3%). The value is also higher than the average among the sample of similar TL3 regions (24.1%).

Bergamo's service sector is relatively small

Given Bergamo's large industrial sector, its service sector is proportionately smaller than that of other regions. The service sector accounted for 56% of Bergamo's GVA

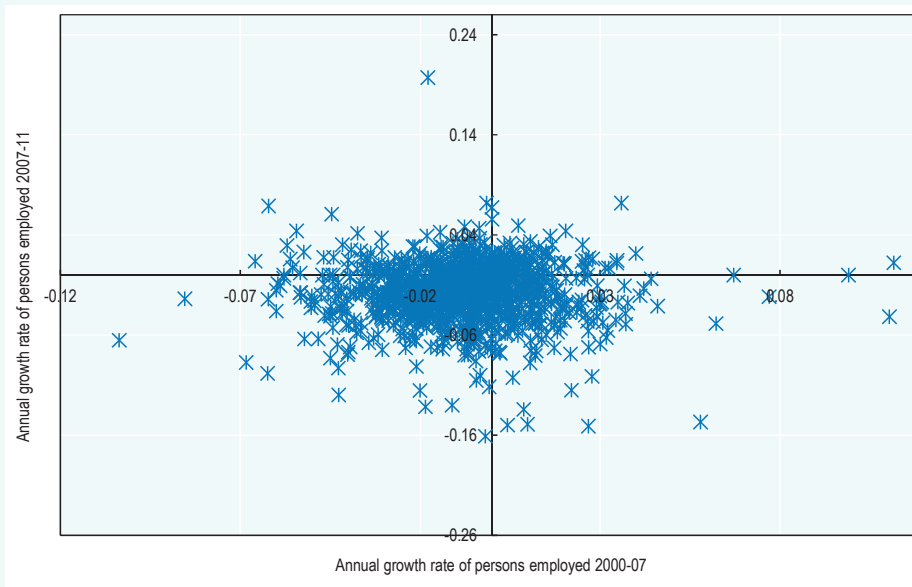
in 2011, less than the figure for the sample of comparable OECD TL3 regions (63%), the EU28 regions (73%) and for Italy (73%).

Box 2.1. How widespread is deindustrialisation?

One of the conclusions of “The changing nature of manufacturing in OECD economies” (Pilat et al., 2006) is that many OECD economies have experienced a decline in the number of manufacturing jobs and their share of overall employment. On the other hand, manufacturing and value added have continued to experience robust growth, and the share of manufacturing in value added at current prices has declined slowly. In some areas, declines in employment in manufacturing and as a share of overall employment have been acute enough to constitute “deindustrialisation”.

However, deindustrialisation has not been a generalised process, neither before nor during the economic crisis. Figure 2.1 shows the cumulative annual growth rates of larger urban zones, or LAU 3 (NUTS 3, or nomenclature of territorial units for statistics, in the European Union nomenclature) in Europe for the periods 2000-07 and 2007-11 for those provinces where sufficient data are available (87% of the EU28 NUTS 3 regions). During the period 2000-07, 30% of the provinces in the sample (334 regions) showed positive growth in industrial employment. In the period 2007-11, 26% of the regions showed positive growth in industrial employment (299 regions). Over the entire period, 107 regions (9.5%) showed positive growth in both periods.

Figure 2.1. Annual growth rate of employed in the industrial sector



Note: European NUTS 3 regions with data for 1 121 regions with available information for the period.

Source: Eurostat, <http://ec.europa.eu/eurostat/web/regions/data/database> (accessed 21 June 2016).

In terms of dynamics, before the crisis, the GVA of the service sector grew at an annual cumulative growth rate of 1.5% (Table 2.3). During the crisis, the GVA of the service sector decreased on average by 1.7% annually. As a consequence, the net growth rate over the entire period has been close to 0%. This growth rate for the period 2000-07 (1.5% in real terms) was quite similar to that of Italy and Lombardy (1.4%), although lower than the EU28 average (2.5%) and that of the euro area (2.1% annually) (Table 2.3). In the subsequent period, from 2007-13, while Italy and Bergamo

experienced a contraction of the service sector, the growth rate in most other European countries fell but did not contract, at 0.5% for the EU28 and 0.3% for the euro zone.

Table 2.2. **Percentage contribution to gross value added by main economic sectors**

	Agriculture			Industry			Construction			Services		
	2000	2007	2011	2000	2007	2011	2000	2007	2011	2000	2007	2011
Bergamo	1.3	0.9	0.9	36.8	36.2	34.1	7.6	9.1	8.9	54.3	53.9	56.0
Lombardy	1.6	1.1	1.0	30.1	28.2	25.1	4.6	5.8	5.6	63.7	65.0	68.3
Italy	2.8	2.1	2.0	22.6	20.5	18.9	5.1	6.3	6.0	69.5	70.8	73.2
EU28	2.2	1.7	1.7	22.2	20.1	19.4	5.8	6.4	5.7	69.8	71.8	73.2
Comparable TL3	2.5	1.7	1.7	30.0	29.0	28.6	6.6	7.2	6.8	60.9	62.1	62.9

Source: Eurostat, <http://ec.europa.eu/eurostat/web/regions/data/database> (accessed 21 June 2016); ISTAT (2014a), *Censimento industria e servizi*; and Prometeia, <http://www.prometeia.it/home> (accessed June 2016).

Table 2.3. **Percentage of total gross value added of the service sector**

Growth rates of chain-linked volumes at 2005 exchange rate

	European Union (28 countries)	Euro area U(18 countries)	Italy	Lombardy	Bergamo
2000-07	2.5	2.1	1.4	1.4	1.5
2007-13	0.5	0.3	-0.6	0.2	-1.7
2000-13	1.5	1.3	0.5	0.8	0.0

Source: Eurostat, ISTAT and Prometeia.

Producer services are closely linked to the manufacturing sector and include: electricity, gas, steam and air-conditioning supply; water supply; sewerage, waste management and remediation activities; transportation and storage; financial and insurance activities; information and communication; real estate activities; professional, scientific and technical activities; and administrative and support service activities. In Bergamo, producer services accounted for 26.6% of the economy. This contribution is low when compared with the figures for the EU28 (34.3%), Italy (34.2%) and Lombardy (36.8%) (Table 2.4). This lower share producer services in Bergamo may be an indication that manufacturing firms source services outside of the boundaries of the province from places such as Milan.

Table 2.4. **Gross value added for producer services**

	% GVA		
	2000	2007	2011
EU28	31.7	33.7	34.3
Italy	30.7	32.9	34.2
Lombardy	31.9	34.9	36.8
Bergamo	25.8	27.6	26.6

Note: Electricity, gas, steam and air-conditioning supply; water supply; sewerage, waste management and remediation activities; financial and insurance activities; information and communication; real estate activities; professional, scientific and technical activities; and administrative and support service activities. Activities of transportation and storage are not included in the comparison, in order to allow direct comparison with the EU28.

Source: Eurostat and ISTAT.

Bergamo's extensive construction sector entails considerable volatility

In contrast to services, the construction sector in Bergamo is relatively large, contributing to 7.5% (in chain-linked volume) to GVA. This is substantially higher than in the EU28 (5%), the euro zone (4.7%), Italy (4.9%) and Lombardy (4.7%) (Table 2.5). Given the cyclical behaviour of the construction sector, which is characterised by higher rates of growth and decline than the other sectors during the phases of expansion and decline of the economy, the larger construction sector present in Bergamo will bring more volatility to its economy, other things being equal.

This higher volatility is evident over the period 2000-13. Before the crisis, the construction sector in Bergamo grew more rapidly than across the EU over the same period. Nonetheless, the effects of the crisis on this sector have been more severe in Bergamo than across the EU. Indeed, since the crisis, the construction sector in Bergamo contracted on average by 5% annually, more than in the EU28 (-3.3%), the EU18 (-3.9%) and in Lombardy (-3.6%) but less than in Italy, which experienced a more severe contraction (-5.2%). Over the entire period (2000-13), the construction sector declined by 1.1 percentage points (pp) in Bergamo.

Table 2.5. **Growth rate in the construction sector**

Million EUR, chain-linked volumes at 2005 exchange rates

	European Union (28 countries)	Euro area U(18 countries)	Italy	Lombardy	Bergamo
2000-07	1.6	1.1	2.5	2.4	2.1
2007-13	-3.3	-3.9	-5.2	-3.6	-5.0
2000-13	-0.6	-1.2	-1.1	-0.3	-1.1

Source: Eurostat, <http://ec.europa.eu/eurostat/web/regions/data/database> (accessed 21 June 2016); ISTAT(2014a), *Censimento industria e servizi*; and Prometeia, <http://www.prometeia.it/home> (accessed June 2016).

There is potential for growth in the tourism sector

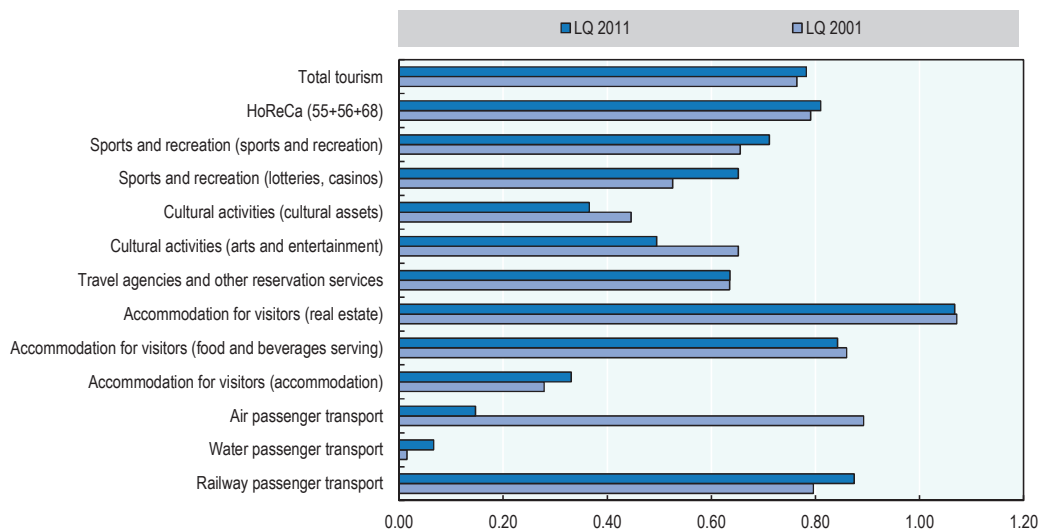
According to United Nations World Tourism Organization's long-term forecast, *Tourism Towards 2030*, international tourist arrivals worldwide are expected to increase by 3.3% a year from 2010 to 2030, reaching 1.8 billion by 2030. The *OECD Tourism Trends and Policies 2014* notes that Italy is one of the most important international tourist destinations, receiving 76.3 million foreign visitors in 2012. The Tourism Satellite Account for Italy indicates that in 2010 and 2011, tourism accounted for 6% of the total value added in the Italian economy (EUR 82.2 million), and that its total contribution to employment (direct, indirect and induced) was 13.8%.

There is potential for Bergamo to increase employment in tourism-related services building on the rich natural, cultural and historical heritage of the region. These services include recreation, retail, accommodation, tour operators, transport activities, food and beverage, and leisure and support services. In 2011, 9.35% of the workforce was employed in tourism-related services, which was less than in the province of Milan (11.83%), Lombardy (10.72) and Italy (11.75%). The annual growth rate of employment in tourism-related services from 2001 to 2011 was slightly higher in Bergamo (2.77%) than in Milan (2.13%), Lombardy (2.36%) and Italy (2.32%).

The province of Bergamo is less specialised than Italy in regards to tourism-related services, with the exception of real estate (Figure 2.2). Overall, the changes in

specialisation between 2001 and 2011 were slight. There was an increase in specialisation in sports and recreation and accommodation services, and reductions in other areas such as air passenger transport and cultural activities.

Figure 2.2. Location quotient of the tourism chain in the province of Bergamo



Note: Location quotients are calculated as follows: $LQ_{ij} = [L_{ij}/L_i] / [L_j/L]$, where L_{ij} is the number of persons employed in a sector i in a region j , L_i is the total number of persons employed in the sector i , L_j is the number of persons employed in a local region j , and L is the total employment in the country. LQ greater than 1 indicates that the agglomeration of the sector i in the region j is greater than the national average, suggesting that the local region is specialised in the sector. The HoReCa sector represents hotel, restaurant and café employees.

Source: ISTAT(2014a), *Censimento industria e servizi*. National Institute of Statistics, Rome.

Concentration and specialisation in industrial activities remains high

This section analyses the degree of concentration and specialisation of economic activities, with a special focus on the industry composition within the industrial sector. These indicators provide an assessment of the specialisation of the economy in Bergamo in terms of employment, compared to the national economy. The analysis reveals that Bergamo's industrial sector is very specialised and concentrated. In 2011, only five sectors accounted for more than half (51.8%) of total manufacturing employment in the province. These include metal products (16.5%), machinery and equipment (14.8%), rubber and plastics (7.8%), textiles (16.5%), and electrical equipment (6.1%).

The distribution of the main sectors is not very different from that of Lombardy and Italy. In Lombardy, the two sectors that employ the most workers include metal products (15.7% of the employment in the industrial sector) and machinery and equipment (13.3%). In Italy, metal products account for 13% of the industry employment, followed by machinery and equipment (10.8%), food products (5.3%), manufacture of apparel (5.3%), and manufacture of other non-metallic mineral products (4.8%).

The concentration of the economic structure of the province of Bergamo is measured in terms of the Gini Index. This index, typically used to measure income concentration, assumes values between 0 and 1, with 0 indicating a low concentration. Values above 0.5 are sufficient to indicate that the degree of concentration is high, meaning that most of the

employment is allocated within a few sub-sectors. The calculations are based on census data (ISTAT, 2014), at a level of two-digit International Standard Industrial Classification (ISIC) Revision 4 (Table 2.7).

Table 2.6. **Employment in two-digit industrial sectors in Bergamo**

In %

Code	Class	2001	2011
25	Manufacture of fabricated metal products, excluding machinery and equipment	16.4	16.5
28	Manufacture of machinery and equipment not elsewhere classified (n.e.c.)	10.4	14.8
22	Manufacture of rubber and plastic products	6.2	7.8
13	Manufacture of textiles	10.7	6.6
27	Manufacture of electrical equipment	6.2	6.1
24	Manufacture of basic metals	4.5	5.0
20	Manufacture of chemicals and chemical products	3.9	4.7
10	Manufacture of food products	3.5	4.4
14	Manufacture of apparel	6.2	4.0
23	Manufacture of other non-metallic mineral products	3.9	3.6
33	Repair and installation of machinery and equipment	7.1	3.5
18	Printing and reproduction of recorded media	3.2	3.3
29	Manufacture of motor vehicles, trailers and semi-trailers	2.1	3.2
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	2.7	3.0
32	Other manufacturing	2.3	2.6
26	Manufacture of computer, electronic and optical products	1.5	1.8
31	Manufacture of furniture	2.1	1.7
38	Waste collection, treatment and disposal activities; materials recovery	0.8	1.4
17	Manufacture of paper and paper products	1.5	1.3
30	Manufacture of other transport equipment	0.9	1.0
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.8	0.8
35	Electricity, gas, steam and air-conditioning supply	0.9	0.7
11	Manufacture of beverages	0.6	0.6
15	Manufacture of leather and related products	0.8	0.5
08	Other mining and quarrying	0.5	0.3
36	Water collection, treatment and supply	0.2	0.3
37	Sewerage	0.1	0.1
39	Remediation activities and other waste management services	0.0	0.1
19	Manufacture of coke and refined petroleum products	0.2	0.0

Note: Data on those employed in the local units from the censuses of 2001 and 2011 (ISTAT, 2014). Data on those employed include the private sector, non-profit institutions and the public sector. The data allow comparison using the same ISIC Rev. 4 for both years, 2001 and 2011.

Sources: ISTAT (2014a), *Censimento industria e servizi*; Eurostat (2009), http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf; and Boix et al. (2014), http://www3.uah.es/iaes/sermed/Boix_Hervas_Miguel.pdf.

Table 2.7. **Concentration of two-digit industrial structure, Gini Index**

	Total sectors		Industrial sectors	
	2001	2011	2001	2011
Bergamo	0.62	0.63	0.57	0.59
Milan	0.58	0.60	0.54	0.55
Lombardy	0.58	0.60	0.57	0.56
Italy	0.60	0.62	0.56	0.56

Sources: ISTAT (2014), *Censimento industria e servizi*; Eurostat (2009).

The value of the Gini Index in 2011 is 0.63 for all sectors in Bergamo and 0.59 for industrial activities, indicating that the concentration of the sectoral structure of employment is medium-high. The value of the Gini Index, and therefore the concentration, is slightly higher than in Milan (0.60), Lombardy (0.60) and Italy (0.62).

Specialisation within the manufacturing sector has increased slightly over the last decade. In Bergamo, concentration increased from 0.62 in 2001 to 0.63 in 2011. The Gini Index also increased in Milan, Lombardy and Italy. The value of the index for manufacturing activities in Bergamo increased from 0.57 to 0.59.

A second indicator of employment specialisation of the economic sectors in Bergamo is the location quotient (see Annex 2.A1.1). A value greater than 1 indicates that the specialisation of the sector i in the region j is greater than the national average, suggesting that a region is specialised in the sector. Location quotients above 2 imply a very high specialisation (at least twice the national average).

The analysis measuring location quotients reveals that the province of Bergamo is highly specialised in: textiles (3.01), rubber and plastics (2.76), chemical products (2.75), basic metals (2.56), electrical equipment (2.40), printing and reproduction of recorded media (2.28), and machinery and equipment (2.08). Other areas of specialisation are: metal products, wood (except furniture), repair and installation of machinery and equipment, other manufacturing, transport equipment, beverages, non-metallic mineral products, clothing, paper, and electrical equipment.

Within the services sector Bergamo shows specialisation in construction and in particular the construction of buildings (1.59), civil engineering (1.29) and specialised construction activities (1.02). In contrast, services do not appear very concentrated in Bergamo, with only weak specialisation in warehousing and support activities for transportation (1.02), real estate activities (1.07), professional scientific and technical activities (1.01), and employment activities (1.45) (Table 2.8). These features stand in contrast to the profile of Lombardy as a whole, which has widespread specialisation in manufacturing activities but also in services.

By contrast, the province of Milan has moved from manufacturing to an increasing specialisation in service-based activities, as one would expect of a big metropolitan city.

Many of Bergamo's areas of specialisation did not change significantly in the period 2001-11. Most of the sectors in which it specialised in 2001 remained the same in 2011 (with the exception of residential care activities and social work activities not including accommodation). However, new sectors of specialisation are emerging, including computers and electronics, motor vehicles, repair activities, warehousing and financial services.

The relationship between specialisation (in 2001) and employment growth (2001-11) in Bergamo appears to be negative, with a correlation coefficient of -0.225 for all sectors, -0.226 for industrial activities, and -0.193 for construction and services. This phenomenon is not surprising, given that specialisation and clustering is usually detected in more mature stages of the cluster's life cycle, where employment growth is small (or even negative in some activities). However, it also reflects the emergence of dynamic new sectors in which the province is becoming specialised.

Table 2.8. Evolution of location quotients

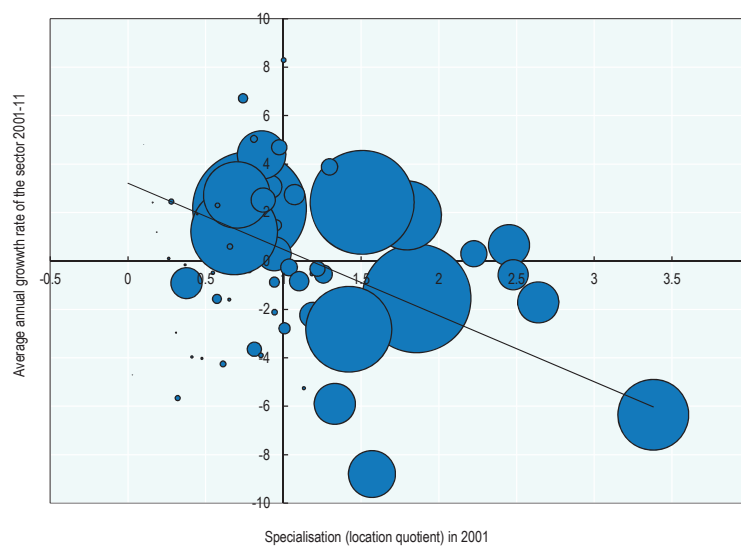
Code	Class	Bergamo		Lombardy		Milan	
		2001	2011	2001	2011	2001	2011
A	Agriculture, forestry and fishing	0.24	0.28	0.34	0.28	0.10	0.07
B	Mining and quarrying	0.95	0.62	0.92	1.34	1.07	2.20
C	Manufacturing	1.55	1.60	1.23	1.21	0.85	0.74
D	Electricity, gas, steam and air-conditioning supply	0.61	0.51	0.89	0.87	0.90	1.09
E	Water supply, sewerage, waste management and remediation activities	0.65	0.71	0.68	0.66	0.70	0.65
F	Construction	1.45	1.48	0.92	0.95	0.63	0.67
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	0.82	0.87	0.97	0.95	1.04	0.96
H	Accommodation and food service activities	0.78	0.83	0.92	0.96	1.17	1.23
I	Transportation and storage	0.72	0.75	0.82	0.86	0.86	0.92
J	Information and communication	0.53	0.55	1.29	1.28	2.43	2.36
K	Financial and insurance activities	0.89	0.91	1.21	1.26	1.81	1.86
L	Real estate activities	1.07	1.07	1.45	1.21	1.79	1.28
M	Professional, scientific and technical activities	0.81	0.82	1.15	1.15	1.65	1.59
N	Administrative and support service activities	0.82	0.83	1.16	1.19	1.63	1.79
O	Public administration and defence; compulsory social security	0.38	0.40	0.52	0.53	0.54	0.56
P	Education	0.68	0.78	0.69	0.77	0.65	0.67
Q	Human health and social work activities	0.78	0.78	0.89	0.90	0.82	0.77
R	Arts, entertainment and recreation	0.61	0.57	0.79	0.78	0.99	0.95
S	Other service activities	0.81	0.89	0.90	0.93	0.89	0.85
T	Activities of households as employers; undifferentiated goods- and service-producing activities of households for own use	..	..	..	..	..	..
U	Activities of extraterritorial organisations and bodies	..	..	..	..	..	..

Notes: indicates that data is not available.

Location quotients are calculated as follows: $LQ_{i,j} = [L_{ij}/L_i] / [L_j/L]$, where L_{ij} is the number of persons employed in a sector i in a region j , L_i is the total number of persons employed in the sector i , L_j is the number of persons employed in a local region j , and L is the total employment in the country. An LQ greater than 1 indicates that the agglomeration of the sector i in the region j is greater than the national average, suggesting that the local region is specialised in the sector.

Source: ISTAT (2014a), *Censimento industria e servizi*.

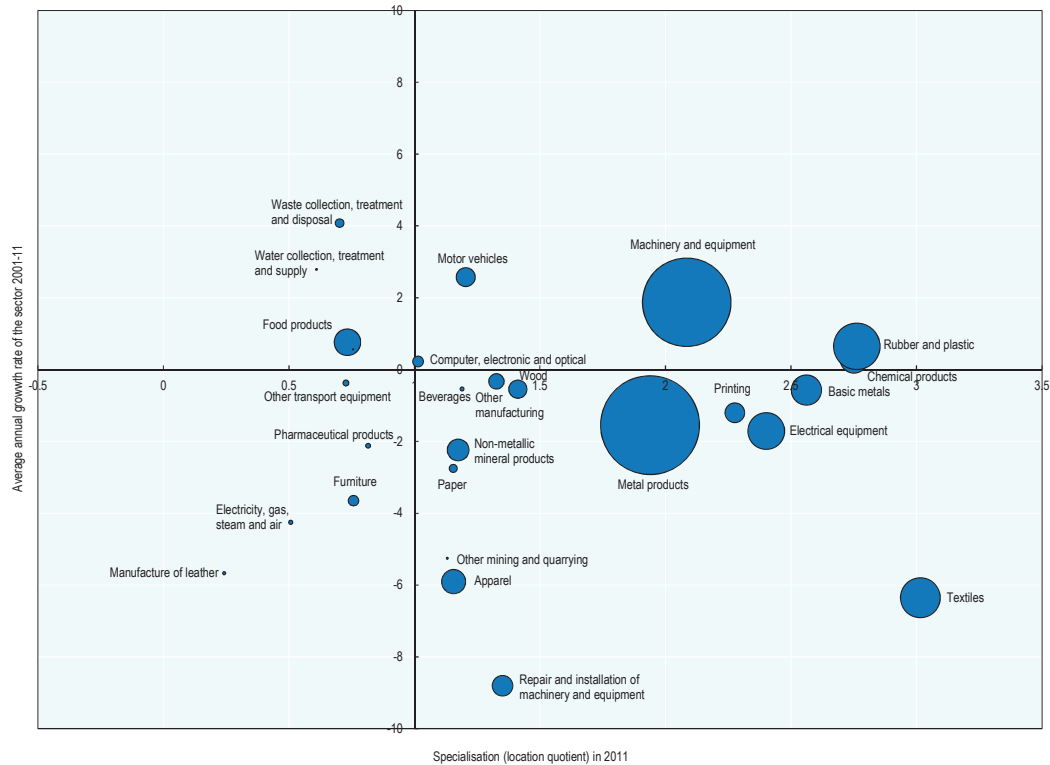
Figure 2.3. Dynamics of employment in the province of Bergamo, by sector



Note: Bubble size denotes number of people employed in 2011: biggest bubble = 27 866 persons employed.

Source: ISTAT (2014), *Censimento industria e servizi*.

Figure 2.4. Dynamics of employment in the industrial sectors in the province of Bergamo



Note: Bubble size denotes persons employed in 2011: biggest bubble = 22 832 employed.

Source: ISTAT (2014a), *Censimento industria e servizi*.

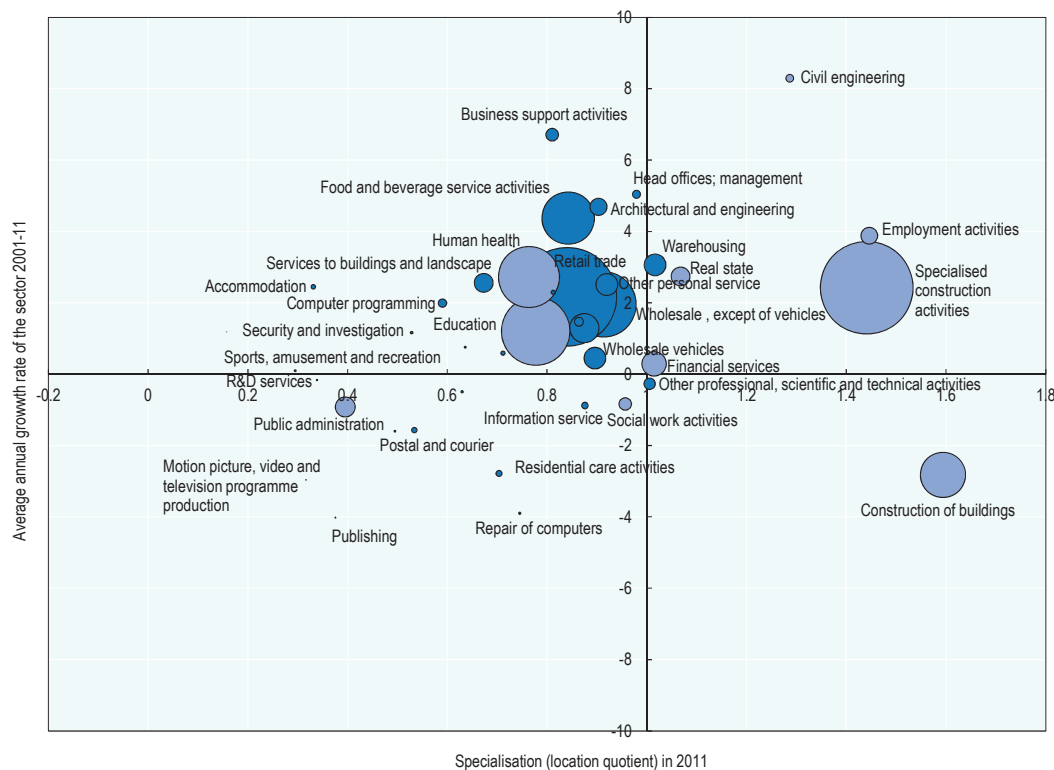
These overall correlations mask interesting dynamics amongst sub-sectors in terms of specialisation and employment growth. The analysis identifies sectors falling into four different types of dynamics in Bergamo, as follows:

1. Activities in which the province was specialised in 2001 that record positive employment growth during the period 2001-11. Most are in the industrial sector, including chemicals (annual growth rate 0.30%); rubber and plastics (0.65%); computer, electronic and optical equipment (0.22%); machinery and equipment (1.87%); civil engineering activities (8.29%); and specialised construction services (2.42%). Within services, only two sub-sectors fall into this category: real estate (2.74%) and employment activities (3.88%).
2. Activities in which the province was not specialised in 2001 that recorded positive annual growth rates in employment in the decade that followed. These include few industrial sectors, and only one manufacturing sector: food products (0.76%). The rest are: water supply (2.78%), sewerage (0.56%) and waste management (4.07%). There are also 29 service activities that fall into this group, ranging from consumer services to business services (Figures 2.3 and 2.4). In 23 of these sectors, the relative specialisation has increased, although it remains below the national average.
3. Activities in which the province was specialised in 2001 and that had a negative annual growth rate in the period 2001-11. Most are industrial sectors, particularly

in manufacturing. The drop in employees is remarkable in textiles (-6.35%), clothing (-5.90%), and repair and installation of machinery and equipment (-8.80%). However, specialisation in textiles remains very high compared to the Italian average (the location quotient in 2011 was 3.02). All other specialised industries that have fallen into negative territory are either very small (other mining and quarrying), or have shown more moderate negative growth rates. Outside the industrial sector, two activities that show similar patterns include: construction (-2.82%), and other professional, scientific and technical activities (-0.27%).

- The final group includes activities in which the province is not specialised and that displayed negative annual employment growth in 2001-11. They include primary activities (crop and animal production, fishing and aquaculture), several industrial activities (leather; coke and refined petroleum products; pharmaceutical products; other transport equipment; and electricity, gas, steam and air conditioning), and several service activities (air transportation, postal and courier service, publishing, the motion picture industry, video and television programme production, sound recording and music publishing activities, and information service activities).

Figure 2.5. Dynamics of employment in the construction and service sectors, Bergamo



Note: Bubble size denotes persons employed in 2011: biggest bubble = 34 618 persons employed. Dark blue = tradable sector; light blue = non-tradable sector.

Source: ISTAT (2014a), *Censimento industria e servizi*.

In terms of tradable and non-tradable activities (tradable activities include agriculture, industry and tradable services, and non-tradable activities include construction, finance,

real estate and public services),¹ Bergamo's economy is mainly specialised in tradable activities from the manufacturing sector (Figures 2.3 and 2.4). This represents both a strength and a vulnerability of the province's economy. On the one hand, tradable activities depend on external, rather than internal, demand. This was particularly important for Bergamo in the recent period of stagnant national growth. On the other hand, it renders it vulnerable to offshoring and external developments over which the region has little or no control, and the volatility and fluctuations associated with export prices and export markets.

Bergamo is also specialised in three types of non-tradable activities: construction and real estate, financial services, and employment activities (Figure 2.5, light blue bubbles). However, it is difficult to consider these activities as entirely non-tradable, since for the construction sector, a share of the output is traded to other provinces in Lombardy, real estate activities are partially related to the tourist sector, and financial and employment services also provide services of support for exports. In all other services, tradable or non-tradable, the specialisation remains low, although in most of them, the growth rate was positive between 2001 and 2011 (Figure 2.4).

Four-digit disaggregation provides detail on the dynamics of specialisation. Using the location quotients (LQ) and data for firms (public sector and non-profit institutions are not included), and focusing on sub-sectors with a staff of more than 1 000 in the province of Bergamo in 2011 (see Table 2.A1.2 in Annex 2.A1), the analysis reveals that:

- Bergamo is highly specialised, almost 15 times the Italian average, in the sub-sectors of man-made fibres (LQ 14.9) and manufacture of cement (14.6). In these sectors, the province accounts for 35% of all those employed in Italy.
- Other sectors with very high specialisation, between five and ten times the Italian average, are: wiring devices (9.3), tubes and pipes (7.7), retail sale in non-specialised stores (6.5), manufacture of electricity distribution and apparatus (6.5), rubber products (5.9), and other manufacturing (5.2). In each of these sub-sectors, the province of Bergamo accounts for between 12% and 22% of those employed in Italy.
- In 17 other sub-sectors, the specialisation of Bergamo is between 2.5 and 5 times the Italian average: 14 are in the manufacturing sector, 2 in retail sale and 1 in the construction sector (roofing activities). Among the manufacturing specialisations are those related to textiles, apparel and related machinery, several sub-sectors of machinery – including lifting and handling – and two sectors related to the construction sector (ready-mixed concrete and concrete products for construction).
- In another 40 sub-sectors, specialisation is up to 2.5 times higher than the national average: 16 are in the manufacturing sector (these have the higher LQs inside this group). Another group of nine sub-sectors is in the construction sector. The rest are service activities, basically related to retail, cargo and transport, and wholesale.
- Sub-sectors in the province with an LQ lower than 1 and with a staff of more than 1 000 fall, with some exceptions, in the service sector.

The analysis found Bergamo's economy to be highly concentrated and specialised in industrial activities and in the construction sector. It also determined that specialisation has not declined in recent decades, but rather that it persists and remains. Within the manufacturing sector, however, Bergamo has undergone major structural changes in the past ten years, with a gradual shift from manufacturing activities, including textiles, repair and installation of machinery and apparel towards machinery and equipment, rubber and

plastics, and chemicals. In other words, manufacturing is shifting from traditional medium- and low-tech activities towards medium-high activities with higher productivity and value-added potential.

Industry remains a key driver of productivity in Bergamo

The analysis in Chapter 1 highlights substantial stagnation in Bergamo's labour productivity growth in the early 2000s and then a drop in 2007 as a consequence of the financial crisis, compared with other OECD TL3 regions. The analysis highlights two distinct phenomena: 1) a structural stagnation that started in the early 2000s; 2) a deterioration in productivity caused by the global crisis. The drop in productivity during the crisis can be partly attributed to an employment benefit programme (Cassa Integrazione Guadagni, or CGI) that allows firms with more than 15 employees to release employees from work for a predetermined period. As a consequence, the drop in productivity was inflated by the large number of workers idled at home but still registered as employed. By contrast, the stagnation of productivity (low growth by comparison with other countries/regions) occurred in a period of relative expansion of the economy, when use of the CGI benefit scheme was limited. The industrial sector is a key driver of productivity and competitiveness across OECD countries. This section examines the industrial sector in Bergamo, and its performance and effects on overall productivity growth. It focuses on the potential to further increase its productivity by adopting new technology, shifting to more value-added activities, enhancing internationalisation and ensuring that industry clusters continue to evolve.

Tradable activities are key drivers of productivity

Across the OECD, the trends in productivity and multi-factor productivity over the medium term during the decade prior to the crisis (1995-2008) reveal that manufacturing-related activities display a higher productivity growth and multi-factor productivity growth than services. Within services in almost all OECD countries, labour productivity and multi-factor productivity growth have been lower in wholesale and retail trade, restaurants and hotels, as compared to productivity growth in industry (including energy). Multi-factor productivity growth has also been lower in finance, insurance and business services than in industry, as illustrated by Figure 2.8.

Box 2.2. Relative prices and the economic structure between tradable and non-tradable sectors

One of the main drivers of the allocation of resources between the service sector and the rest of the economy is the relative price between non-tradable (P_n) and tradable (P_t) sectors. This relative price is close to the real exchange rate ($E.P/P$). An increase in this ratio (a real appreciation) indicates that production in non-tradables is likely to be more profitable than in tradables, and thus provides an incentive for resources to move from the latter to the former sector (Edwards, 1989). Note that, by and large, the service sector is still mostly a non-traded sector and that, above all, many service activities have a strong local component.

Box 2.2. Relative prices and the economic structure between tradable and non-tradable sectors (continued)

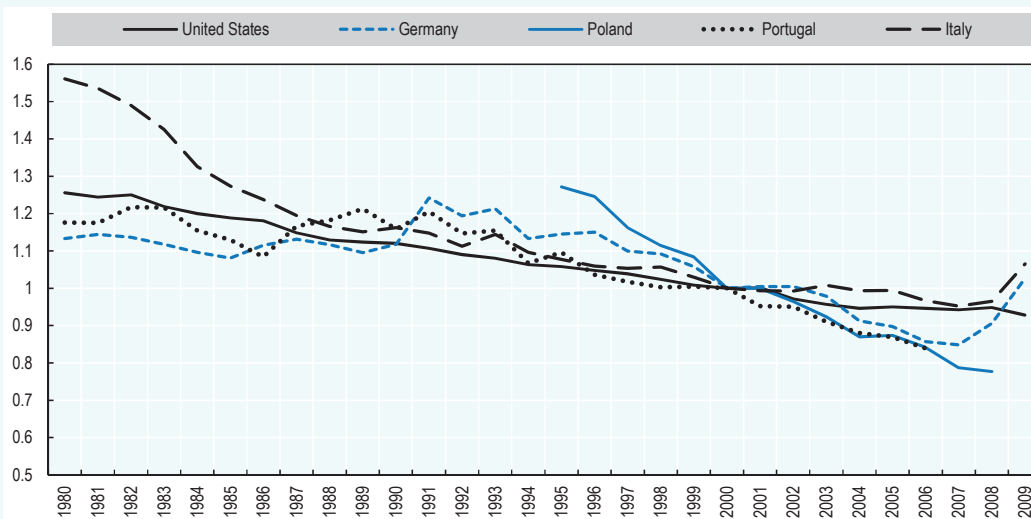
In the long run, the real exchange rate and the relative price (P_n/P_t) tend to follow an equilibrium upward trend due to the so-called Balassa-Samuelson effect. This trend is generated by higher productivity in tradable than in non-tradable sectors. Given that wages tend to equalise throughout the economy, the productivity differential generates an upward pressure in unit labour costs (wages divided by the productivity) in the non-tradable sector. This pushes up the relative prices of non-tradables to tradables and raises the real exchange rate. This real exchange rate appreciation can be viewed as compatible with the underlying productivity trends and is a stylised fact of economic development.

However, a misalignment of relative prices is possible, as the result of factors such as government spending, capital inflows or trade shocks. The use of fixed exchange-rate regimes to stabilise inflation typically also induced excessive shifts in relative prices, as occurred in Latin America in the 1990s (Baldi and Mulder, 2004). More recently, the integration of less developed economies of southern Europe in the euro area also led to an appreciation of their real exchange rate and a shift towards the service non-tradable sectors. This may have exceeded what was justified by productivity fundamentals (Darvas and Pisani-Ferry, 2011).

While the tertiarisation of economies is desirable over the long run, an excessive or too rapid shift towards the non-tradables sectors may have important implications for aggregate productivity. Indeed, services often have lower performance in this respect than industrial sectors (see below). This is due to the non-tradability that reduces competitive pressures (both in terms of prices and innovation) compared with those experienced in the tradable sector. Several service sectors are also affected by significant restrictions and regulatory issues compared with more open sectors of the economy (Conway et al., 2006).

To illustrate the productivity performance of service sectors compared with the industry, Figure 2.6 displays the evolution of relative labour productivities for three European countries (Germany, Poland and Portugal) compared with the United States.

Figure 2.6. Evolution of relative labour productivity, 1995-2008

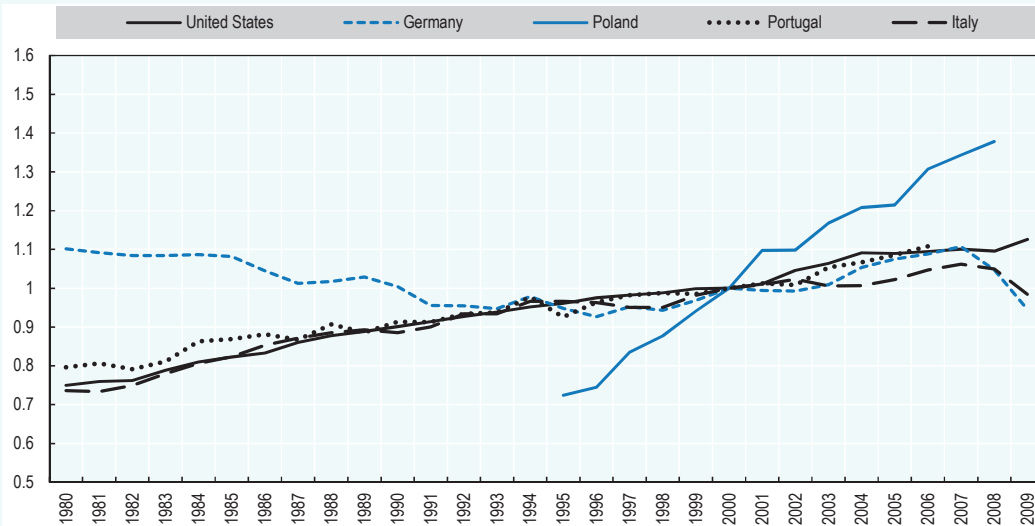


Source: OECD Unit Labour Costs Database. <https://data.oecd.org/lprdy/labour-productivity-and-utilisation.htm> (accessed 21 June 2016).

Box 2.2. Relative prices and the economic structure between tradable and non-tradable sectors (continued)

Relative productivity in service sectors has steadily declined since the early 1980s, in particular in recent years, with the advent of the new members to the EU and the euro zone, such as Poland and Portugal. This relative decline in productivity compared with Germany and the United States translates into an increase in the relative unit labour costs in the service sector compared with industry (Figure 2.7). This increase has been particularly rapid in countries such as Poland and Portugal, compared with Germany.

Figure 2.7. Evolution of relative labour costs

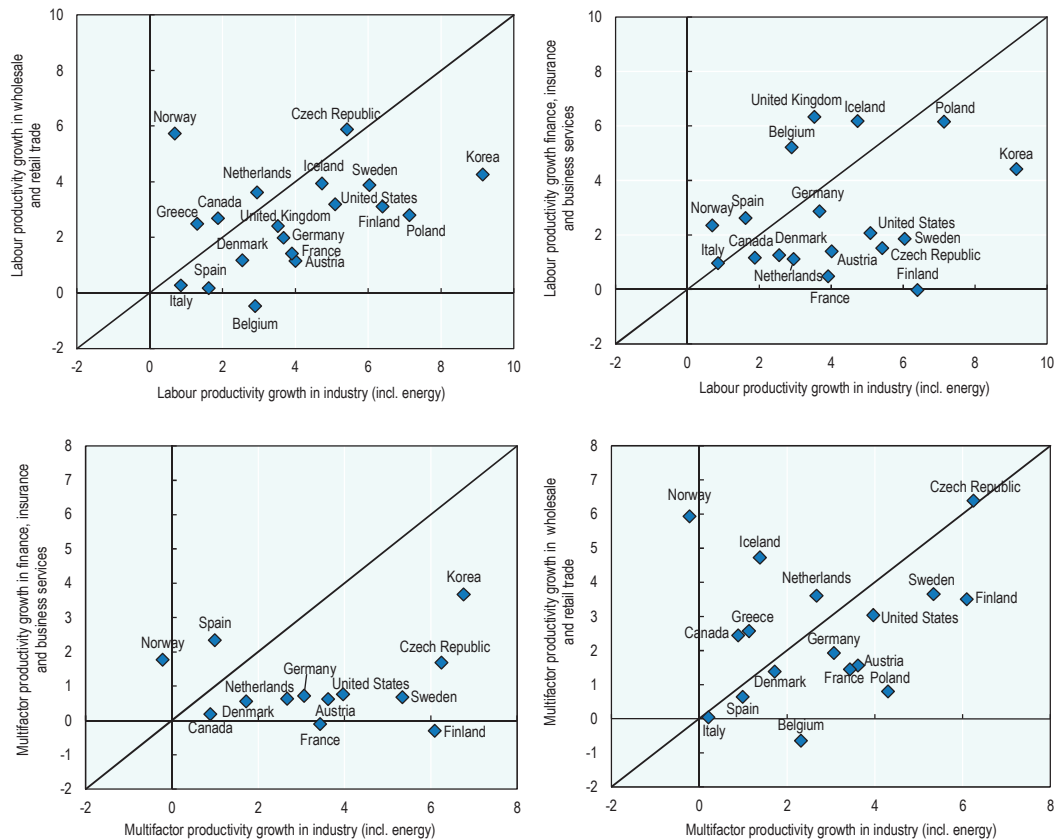


Source: OECD Unit Labour Costs Database, <https://data.oecd.org/lprdy/unit-labour-costs.htm> (accessed 21 June 2016).

The implications of these trends for regional economics and policy highlight the importance of boosting productivity in the manufacturing sector to enhance overall productivity.

- The real exchange rate (in logs) is $q = e + p - p^*$, with e nominal exchange rate (expressed in foreign currency per unit of national currency), p domestic price and p^* foreign price levels. Price levels can be defined as $p = a.pN + (1-a).pT$, with a being the share of the non-tradable sector in GDP. For simplicity, we assume the same for p^* . By rearranging: $q = [e + pT - pT^*] + a [(pN - pT) - (pN^* - pT^*)]$. The term $q = [e + pT - pT^*]$ is the real exchange rate in the tradable sector and $[(pN - pT) - (pN^* - pT^*)]$ the difference between the tradable and non-tradable price differentials of two countries. With law of one price in the tradable sector ($E.PT = PT^*$), a constant share of non-tradables in aggregate price indices a , and a given foreign price differential between tradables and non-tradables, we have: $\Delta q \approx \Delta pN - \Delta pT$.
- Note that this result also depends on the wage equalisation across sectors and the fact that productivity increases in the tradable sector are typically higher in less developed countries, due to convergence forces.

Figure 2.8. Annual average growth of labour and multi-factor productivity in industry and services, 1995-2008



Source: OECD Unit Labour Costs Database, <https://data.oecd.org/lprdy/unit-labour-costs.htm> (accessed 21 June 2016).

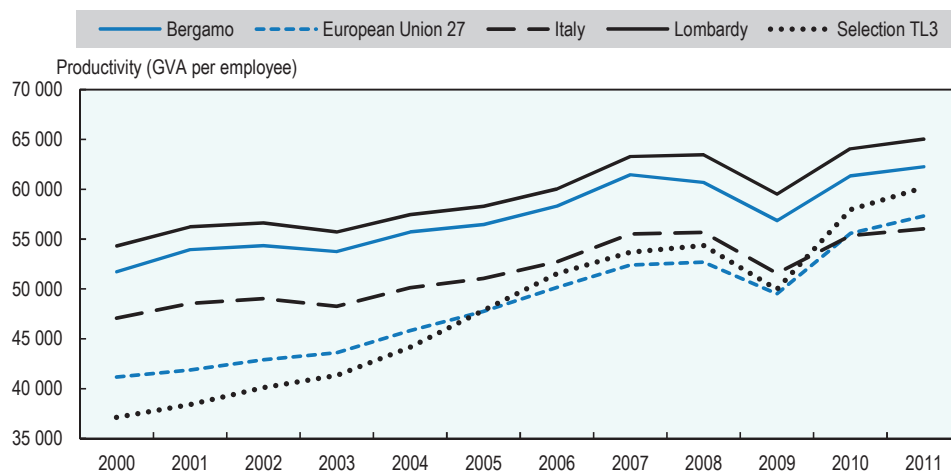
Bergamo's labour productivity (62 254 employed) is higher than the EU28 average (EUR 57 302) and also exceeds that of comparable TL3 regions (EUR 60 137) in 2011. Despite this high level, it has been losing ground with respect to other manufacturing regions: between the years 2000 and 2011 labour productivity was lower in Bergamo (1.69%) than the EU average (3%) and in the comparable TL3 regions (4.4%).

One of the main problems in the industrial sector in Bergamo, Lombardy and Italy is the fact that industrial productivity as a whole has not seen a net increase in 12 years and remains at around the value of the year 2000. The productivity of the industrial sector in Bergamo (as in Lombardy and Italy) has increased for short periods of time (e.g. 2003-07) but decreased in others (e.g. 2000-03 and 2007-12). The problem is aggravated when compared to EU patterns, given that productivity of the industrial sector in the EU28 increased by 1.95% and in the euro zone by 1.36%. This suggests that Bergamo's industry could run into problems of competitiveness over the medium and long term.

Inflation in the non-tradable sector can affect the competitiveness of the tradable sector, by artificially increasing domestic cost of production, all things being equal. This has been the case in Italy and in Bergamo: between the years 2000 and 2013, the price index of industrial products in Italy increased by 20%, while that of services increased by 31% and that of construction by 65% (Figure 2.10). The prices of non-tradable items are

strongly determined by domestic influences, consistent with their lower exposure to international competition.

Figure 2.9. Benchmarking productivity in Bergamo, current prices



Note: The selection of comparable TL3 regions includes Aberdeen, Álava, Cávado, Gyor-Moson-Sopron, Hildesheim, Ingolstadt, Kreisfreie Stadt, Jönköpings län, Katowicki, Limburg (NLD), Linz-Wels, Moravskoslezský kraj, Navarra, Noord-Brabant, North Lanarkshire, Pirkanmaa, Plzenský kraj, Prov. West-Vlaanderen, Trenciansky kraj, Uppsala län, Ústecký kraj, Vestjylland, Walsall, Zilinský kraj, Zlínský kraj,

Sources: ISTAT and Eurostat.

Table 2.9. Annual average growth rates of industry productivity in constant volumes

Productivity	Bergamo	European Union (28 countries)	Euro area (18 countries)	Italy	Lombardy	Milan
2000-03	-2.42%	1.79%	0.72%	-1.60%	-1.58%	-1.40%
2003-07	3.89%	3.52%	3.49%	2.24%	1.95%	-0.12%
2007-12	-1.89%	0.80%	-0.03%	-0.83%	-0.58%	-4.18%
2000-12	-0.09%	1.95%	1.36%	-0.11%	0.01%	-2.11%

Notes: Data from the European Union and Italy come from Eurostat in chain-linked volumes (reference year 2000). In the case of Lombardy, Bergamo and Milan, due to differences between the old statistics and new ISTAT *Nova statistica regionale* NACE (the EU Statistical Classification of Economic Activities) Rev. 2, data from 2000 to 2007 have been weighted using 2007 as a common year for both series, and converted to chain-linked values (reference year 2000) using Eurostat index of volume for the industry. Data for Bergamo and Milan in 2012 have been projected using growth rates estimated by Istituto Tagliacarne.

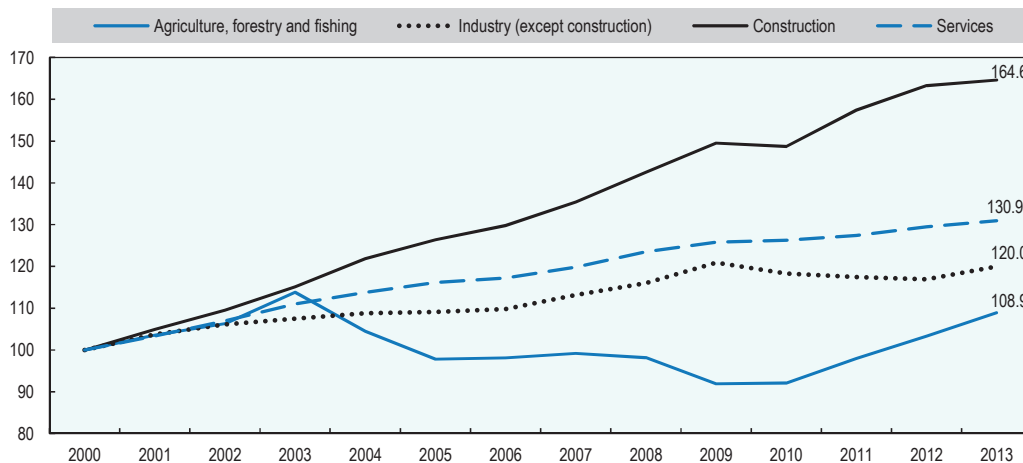
Sources: Eurostat; ISTAT (2016), *Anuario Statistico Provinciale di Bergamo*; Istituto Tagliacarne.

Bergamo remains highly specialised in manufacturing, which offers great potential for restoring overall productivity and competitiveness in the region. Its low growth in productivity, however, is driven by numerous factors, in addition to inflation in the non-tradable sector. These include national factors, increased international competition, agglomeration benefits, innovation intensity, governance, quality of skills and human capital. The sections that follow and Chapter 3 will further explore this issue.

Bergamo's manufacturing sector is becoming more technologically intensive

To analyse the components of technology and technological progress in the economy, OECD and Eurostat classify the manufacturing sectors into four categories of technological intensity (high, medium-high, medium-low and low), and the service sectors into two categories of knowledge intensity (intensity and non-intensity). This classification has shed some light on the generation of knowledge in European regions (Box 2.3).

Figure 2.10. Evolution of price index for the main sectors in Italy



Source: OECD research based on Eurostat.

Box 2.3. Knowledge and industry at the regional level

Recently, the study of industry locations has acquired a new dimension: instead of limiting the localisation of different industries and services at separate levels, the focus is on the interactions between aggregated macro-sectors (e.g. industry and services) and on technological and knowledge-based classifications; Vence and González [2008]) that allow a first comparable approach to the different models of knowledge and innovation.

O'Donoghue and Gleave (2004) remark that whereas initial research mainly focused on manufacturing, the study of the service sector has increased due to its growing importance for the regional economies. Pilat and Wölfl (2005) have pointed out that the increase in the study of the service sector is the result of the relationship between manufacturing and service industries and because the former tends to subcontract some activities to firms with specialised services located in the same country or in a foreign country. Studies such as the one by Heidenreich (2009) found that regions specialise either in manufacturing or in services, while Wood (2006) pointed out the dependence of manufacturing on services, especially knowledge-intensive services.

In the last 25 years, the use of technology-based classifications of innovation or knowledge-based approaches has shed new light on the specialisation and development paths of regional economies by providing new toolkits to policy makers. The most aggregated analyses focus separately on high-, medium- and low-technology manufacturing and service sectors or merge manufacturing and services to obtain only two categories of high and low knowledge. This approach has been particularly relevant in the increasing number of studies focusing on services. This is because the existence of the relationship between the manufacturing and service sectors has allowed the latter to transfer knowledge to the former, as well as to create it (Miles, 2008). This is also why the analysis of knowledge-intensive services predominates in the services industry: they are associated with the knowledge-based economy (Strambach, 2008).

Box 2.3. Knowledge and industry at the regional level (*continued*)

In studies currently being carried out on maps at the aggregate level, some patterns have been detected with respect to the importance of knowledge-intensive sectors in manufacturing and services, in relation to the generation of knowledge and to regional wealth (measured by GDP per inhabitant). However, there is no agreement about which categories are more important to regional wealth and development.

There is an overall trend within European regions towards a geographic concentration of high-tech sectors in manufacturing and services and that this concentration takes place in regions with the greatest GDP per inhabitant (Vence and González, 2008). For Heidenreich (2009), the regions with highest GDP have a higher percentage of jobs in high-tech and medium-high tech manufacturing sectors and in knowledge-intensive services. The Center for Strategy and Competitiveness (2009), in its study on knowledge-intensive business services sectors in Europe, found that regions with strong knowledge-intensive business services sectors had the highest prosperity levels in Europe. Contrary to this finding, Bishop (2008) argues that for the United Kingdom, development depends on diversification rather than solely on knowledge-intensive services sectors or on any other single sector. This is not an unexpected conclusion for the United Kingdom, a country that places great importance on the role of its creative industries. However, Leydesdorff and Fritsch (2006) and Leydesdorff, Dolfsma and Van der Panne (2006), in two studies conducted for Germany and the Netherlands, verified that medium-tech sectors are much more important than high-tech sectors to the knowledge base of a region or country.

Source: Center for Strategy and Competitiveness (2009), <http://www.clusterobservatory.eu/system/modules/com.gridnine.opencms.modules.eco/providers/getpdf.jsp?uid=df8aef22-aadd-4266-bc68-41795115e76b> (accessed April 2016); Bishop (2008), “Spatial spillovers and the growth of knowledge intensive services”; Leydesdorff and Fritsch (2006), “Measuring the knowledge base of regional innovation systems in Germany in terms of a triple helix dynamics”; Leydesdorff, Dolfsma and Van der Panne (2006), “Measuring the knowledge base of an economy in terms of triple-helix relations among technology, organization and territory.”

The economy of Bergamo cannot be considered intensive in technology and knowledge, although the share of knowledge activities in its employment structure in 2011 was significant: 35.5% of the persons employed (Table 2.10). The percentage of those employed in knowledge- and technology-intensive sectors in the province of Bergamo is below the average and the median for EU regions (about 44%) (Figure 2.11). This is due to the small proportion of knowledge-intensive services in the region's economy.

By contrast, Bergamo is included in a group of 25 European regions with the highest proportion of people employed in high- and medium-high technology manufacturing (Figure 2.12), with 10.3% of the workforce (the European median is about 4.5%).

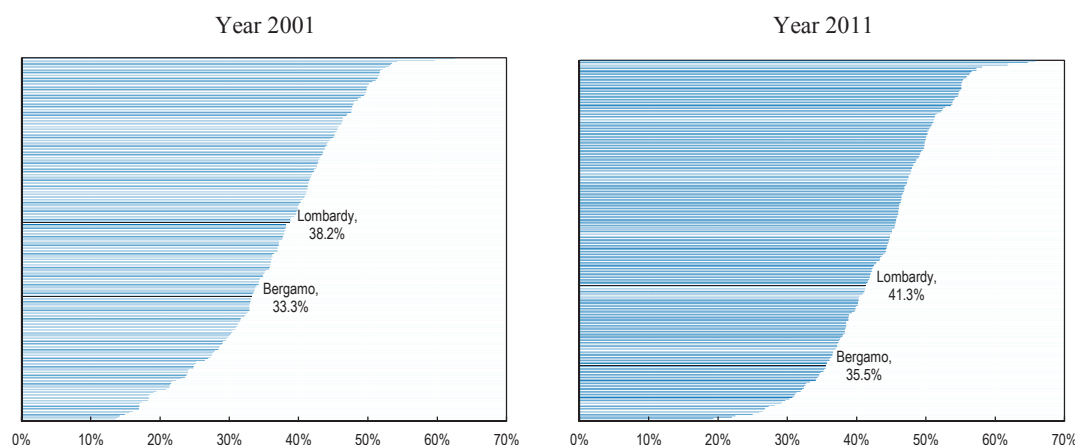
Table 2.10. Employment in knowledge-intensive sectors (shares of total)

	Bergamo		Milan		Lombardy		Italy	
	2001	2011	2001	2011	2001	2011	2001	2011
Technology and knowledge-intensive	33.3	35.5	46.1	45.7	39.0	40.5	39.4	39.8
Manufacturing, high-technology	0.9	0.8	2.9	1.6	2.0	1.6	1.1	0.9
Manufacturing, medium-high technology	9.3	9.5	5.9	4.4	7.2	6.5	5.2	4.9
Knowledge-intensive services	23.0	25.1	37.4	39.7	29.8	32.5	33.1	34.0
Technology and knowledge non-intensive	66.7	64.5	53.9	54.3	61.0	59.5	60.6	60.2
Manufacturing, medium-low technology	15.1	11.7	6.6	4.0	11.3	8.0	8.4	6.2
Manufacturing, low-technology	13.3	9.0	5.7	4.3	10.2	7.5	10.1	7.5
Less knowledge-intensive services	25.6	30.9	35.3	39.2	30.8	35.1	32.0	36.6
Non-classified	12.7	12.9	6.3	6.8	8.7	8.9	10.0	9.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Aggregation of sectors based on NACE Rev. 2 at two digits.

Sources: Based on ISTAT (2014a), *Censimento industria e servizi*; Eurostat (2009).

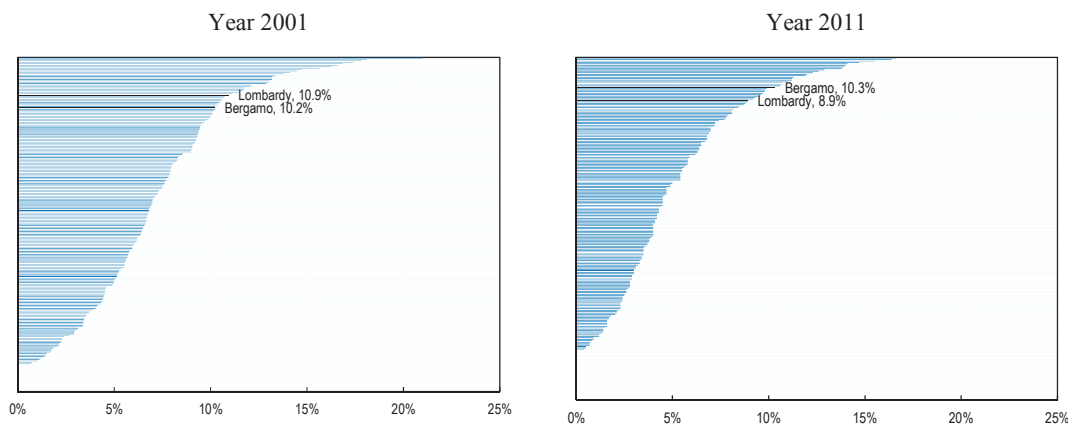
Figure 2.11. European NUTS 2 regions ranked by share of employment in knowledge-intensive sectors



Notes: Figures refer to the sum of the percentages of persons employed in high and medium-high technology manufacturing plus knowledge-intensive services. Data for European NUTS 2 in the year 2001 are based on ISIC Rev.3 and in 2011 on ISIC Rev.4. Two hundred thirty-nine NUTS plus Bergamo with information available for 2001 and 2011: LAU 0 for Bulgaria and Denmark; Croatia, Poland, Helsinki-Uusima; Etelä Suomi, Pohois-ja Itä-Suomi have been not included because of data problems.

Sources: Eurostat, <http://ec.europa.eu/eurostat/data/database> (accessed May 2016); ISTAT (2014a), *Censimento industria e servizi 2001 e 2011*, National Institute of Statistics, Rome.

Figure 2.12. Share of persons employed in high- and medium-high technology manufacturing



Notes: Data for European NUTS 2 in the year 2001 are based on ISIC Rev.3 and in 2011 on ISIC Rev.4. Two hundred thirty-nine NUTS plus Bergamo with information available for 2001 and 2011: LAU 0 for Bulgaria and Denmark; Croatia, Poland, Helsinki-Uusima; Etelä Suomi, Pohois-ja Itä-Suomi have been not included because of data problems.

Sources: Eurostat; ISTAT (2014a), *Censimento industria e servizi 2001 e 2011*.

The structure of employment in the province of Bergamo continued to evolve between 2001 and 2011, with production gradually shifting towards more knowledge- and technology-intensive activities. In 2001, 136 659 people were employed in knowledge- and technology-intensive activities, increasing to 153 333 in 2011. The growth rate was 1.2% per year (Table 2.11). As a result, knowledge- and technology-intensive activities have grown from 33.3% to 35.5% of employment in the province.

The intensification of technology and knowledge in Bergamo has focused on knowledge-intensive services and medium-high technology manufacturing. However, employment in high-technology manufacturing has decreased (Table 2.11). The development of the knowledge economy has been led by knowledge-intensive services, which have grown at 1.4% per year: from 94 684 persons employed in 2001 to 108 522 in 2011. Their share of total employment has risen from 23% to 25.1% (Table 2.10):

- The number of those employed in high-technology manufacturing has fallen slightly, from 3 796 to 3 589. This drop was confined to pharmaceutical products (from 2 425 to 2 480 employees), while computer, electronic and optical products have experienced weak but positive growth, from 2 425 to 2 480. Nevertheless, the percentage of those employed in high-technology manufacturing in the province of Bergamo (0.8%) is higher than the European average (0.3%).
- Employment in medium-high technology manufacturing grew at 0.8% per year from 2001 to 2011: from 38 179 to 41 222 employed. This was higher than in the province, which grew from 9.3% to 9.5% employed. However, in Bergamo's case, this has not been uniform within the aggregate. Three sectors show positive growth: machinery and equipment, chemicals, and motor vehicles; whereas two, electrical equipment and other transport equipment, have lost jobs. Growth has been particularly strong in machinery and equipment, rising from 16 951 to 20 455 employed. This sub-sector has become the second-most important manufacturing activity (behind metal products), increasing its share of total

employment from 10.4% to 14.8%. Conversely, electrical equipment showed the steepest decline in the aggregate, from 10 080 to 8 495 persons employed.

Table 2.11. **Employment in knowledge-intensive sectors, growth rate**

Annual growth rate of persons employed

Knowledge intensity	Bergamo	Milan	Lombardy	Italy
Technology and knowledge-intensive	1.2	0.4	0.7	0.4
Manufacturing, high-technology	-0.6	-5.1	-2.1	-1.7
Manufacturing, medium-high technology	0.8	-2.5	-0.7	-0.4
Knowledge-intensive services	1.4	1.1	1.2	0.6
Technology and knowledge non-intensive	0.1	0.6	0.1	0.2
Manufacturing, medium-low technology	-2.1	-4.4	-3.1	-2.9
Manufacturing, low-technology	-3.3	-2.2	-2.7	-2.7
Less knowledge-intensive services	2.4	1.5	1.6	1.6
Non-classified	0.6	1.3	0.6	0.1
Total	0.5	0.5	0.3	0.3

Note: Aggregation of sectors based on NACE Rev. 2 at two digits.

Sources: Based on ISTAT (2014a), *Censimento industria e servizi*; Eurostat (2009), <http://ec.europa.eu/eurostat/data/database> (accessed May 2016).

Employment in activities non-intensive in knowledge has increased from 274 270 to 278 324 persons employed, with modest annual growth of 0.1%, although its share in the structure of employment has fallen from 66.7% to 64.5%. Growth has been positive in less knowledge-intensive services (Tables 2.10 and 2.11) and negative in medium-low and low-technology manufacturing:

- Medium-low technology manufacturing has fallen from 62 238 to 50 431 employed, for a negative annual growth rate of -2.1%. The decline has occurred in all the activities of the group, except rubber and plastics, where employment has increased slightly, from 10 067 to 10 742 people. The major job losses have occurred in metal products (falling from 26 655 to 22 832 employees), repair and installation of machinery and equipment (11 538 to 4 785 employees), and other non-metallic mineral products (6 309 to 5 043 employees).
- However, the biggest drop has been in low-technology manufacturing, which has fallen from 54 499 to 39 059 persons employed, at an annual growth rate of -3.3%. The share of these activities of total employment has fallen from 13.3% to 9%. The number of those employed has fallen in all activities of the group, with the exception of food products (which increased from 5 674 to 6 123 employed), with a particularly steep drop in textiles (from 17 370 to 9 202 employed) and clothing (from 10 058 to 5 573 employed).

The structure and behaviour of categories of knowledge and technology in the province of Bergamo differs from that of the rest of Lombardy and Italy, and especially in the neighbouring province of Milan. Compared with these areas, the weight of knowledge- and technology-intensive activities in the province of Bergamo is low: 35.5% of employment in 2011, compared with 39.8% in Italy, 40.5% in Lombardy and 45.7% in Milan. The province of Bergamo also has a distinct profile: the proportion of high-technology manufacturing, and especially of knowledge-intensive services, is low compared to the other areas. This is particularly true of knowledge-intensive services, at 25.1% in Bergamo, compared to 32.5% in Lombardy, 34% in Italy and 39.7% in Milan. Correspondingly, knowledge and technology non-intensive activities are significantly higher in Bergamo,

due to the greater weight of medium-low and low-technology manufacturing by comparison with Milan, Lombardy and Italy.

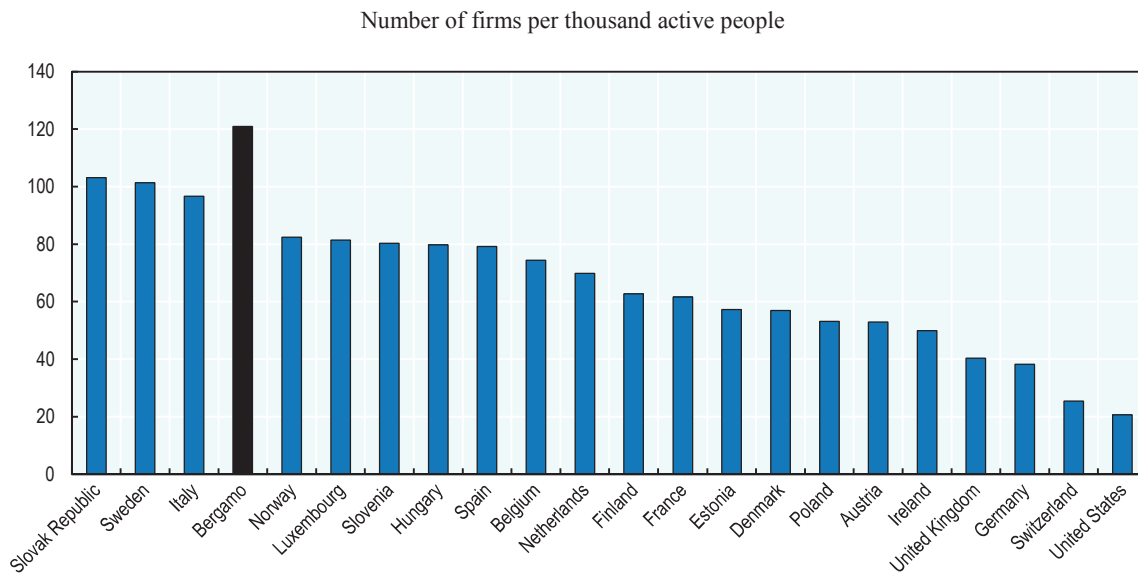
Despite these lower levels, the trend between 2001 and 2011 shifted towards more knowledge intensity. Knowledge- and technology-intensive activities increased in Bergamo by 1.2% per year, a growth rate higher than in Milan (0.4%), Lombardy (0.7%) and Italy (0.4%). Nevertheless, the loss of jobs in high-technology manufacturing has been widespread in all these places, if not as much in the province of Bergamo. Medium-high technology manufacturing has expanded in Bergamo, whereas the trend in each of the other places has been negative. The growth rate in the number of persons employed in knowledge-intensive services has been positive in all the places, if slightly higher in the province of Bergamo.

In sum, these patterns confirm that Bergamo's economy has gradually shifted towards more knowledge-intensive activities, even though it has yet to catch up with Milan, Lombardy and Italy.

Maximising the returns of Bergamo's industrial districts

Bergamo's specialisation in manufacturing is also driven by a historical path dependency. The province is located at the margin of the so-called industrial triangle of Italy, the Milan-Turin-Geneva area, where Italy's industrialisation took off after World War II. Bergamo is one of the territories in which Italian industrial districts developed. Industrial districts are clusters of small and medium enterprises where the agglomeration of business generates positive externalities and then higher productivity at the firm level (Box 2.4). In industrial districts, the local community is closely associated with productive activity. The result is that the rules that regulate the community are those that govern business.

Figure 2.13. **Business density in selected OECD countries and Bergamo, 2013**



Source: OECD (2014a), *Italy: Key Issues and Policies*, OECD Studies on SMEs and Entrepreneurship, <http://dx.doi.org/10.1787/9789264213951-en>; Business registry data provided by the local team and OECD (2016), *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-data-en> (accessed May 2016).

Box 2.4. Marshallian industrial districts

An industrial district (ID) is “a socio-territorial entity which is characterised by the active presence of both a community of people and a group of firms in a naturally and historically bounded area” (Becattini, 1992). This community shares a system of values and common practices that spread into the district through shared customs and institutional structures (markets, firms, professional schools, trade unions, employers’ organisations, etc.).

In 1890, the economist Alfred Marshall (1890) documented the existence of a form of organisation of production based on the concentration, in some districts of English industrial cities, of people and small and medium-sized enterprises (SMEs) specialised in different parts of a production process. In these “industrial districts”, internal large-scale economies were substituted by external economies related to the existence of skilled workers, specialised suppliers and an informal system of knowledge diffusion.

The notion of the Marshallian industrial district (MID) was taken up by Giacomo Becattini (Becattini, 1975) to explain why specialised local production systems of SMEs in the Italian region of Tuscany were so successful at a time when the large-firm production model of Turin and Milan was in serious decline. Today, industrial districts have become a widespread mode of production in many countries, and in Italy have become an instrument of economic analysis and a tool for policy strategies.

Source: OECD (2009), *OECD Rural Reviews: Italy 2009*, <http://dx.doi.org/10.1787/9789264056237-en>.

Italy has one of the highest concentrations of small firms in the OECD. The vast majority of Bergamo-based firms are of a small and medium size. Industrial firms increased in size during the 1980s and 1990s, reaching an average of 12.6 persons employed per firm, similar to Lombardy (12 persons employed per firm) and higher than the Italian average (9.1 persons employed per firm). Moreover, the percentage of micro enterprises (those with less than ten workers) to total enterprises in Bergamo stood at 73.8%, less than the Lombardy (78.1%) and Italy (82.9%).

Data for the most recent period show that the enterprises in the province of Bergamo are still very small on average, although in industry, the average size of enterprises is larger:

- In 2011, the average size was 4.2 employees per local unit (Table 2.12). The average firm size is similar to that of Lombardy (4 employees per local unit) and higher than that of Italy (3.5 employees per local unit), although significantly lower than the EU average (5.7 employees per local unit).
- In the industrial sector, the average firm size in Bergamo is 11.5 persons employed by local unit, almost four times higher than in the construction and service sectors. The average size of industrial firms increased slightly between 2004 and 2011, from 11.1 to 11.5 persons employed per local unit.

A comparison of the size of firms in Bergamo’s industrial sector with those of Lombardy and Italy shows Bergamo to have more large firms. This is probably due to the characteristically small size of firms in Italy as a whole. Indeed, the size of firms in Bergamo is lower than the average in the EU countries (13.1 employees per local unit) and much lower than the European regions with larger companies in the manufacturing sector, particularly in Germany. Indeed, of the 20 regions with larger local units, 17 are German, with an average size of between 33 and 58 people employed per local unit.

Table 2.12. Average firm size by economic activity

Year		Industry	Construction	Services	Total
2004	Bergamo	11.1	3.0	2.9	4.2
	Milan	8.9	2.8	3.6	4.2
	Lombardy	9.4	2.8	3.2	4.0
	Italy	7.9	2.9	2.9	3.5
2007	Bergamo	11.2	3.2	3.0	4.3
	Milan	9.0	3.3	3.8	4.0
	Lombardy	9.6	2.5	3.3	4.1
	Italy	8.1	2.4	3.0	3.6
2011	Bergamo	11.5	2.9	3.0	4.0
	Milan	9.0	3.0	4.0	4.3
	Lombardy	9.9	2.7	3.3	4.0
	Italy*	8.2	2.5	2.8	3.4
	EU28	13.1	3.7	5.0	5.7

Note: The sector classification is based on ISIC Rev. 4; data for 2001 not available in ISTAT. The source of the data is Eurostat Structural Business Statistics.

Sources: Eurostat; ISTAT; and *Anuario ASR Lombardia*,

http://www.stamet.unioncamere.it/Annuario-Statistico-Regionale-della-Lombardia--ASR_6A209B302 (accessed April 2016).

The small size of local units in Bergamo is confirmed by analysing the share of firms by employment classes (see Annex 2.A2):

- 93.19% of firms' local units in Bergamo are micro-firms (0-9 employees per local unit) and account for 45% of the employees. The share of micro-firms is lower in mining (69.09%); manufacturing (75.88%); electricity and gas (79.11); and water, sewerage and waste (74.18%). In agriculture, construction and services, the percentage of micro-firms is above 90% (the exception is accommodation and food service activities, where it is 86.53%).
- Another 5.95% of firms' local units in Bergamo can be considered small firms of between 10 and 49 employees per local unit and account for 27% of the total employees. The share of small firms of between 10 and 49 employees is higher in mining (30.91%); manufacturing (19.90%); electricity and gas (20.25%); and water, sewerage and waste (22.55%). In the service sector, only accommodation and food service activities has about twice the average number of firms between 10 and 49 employees (11.09%), whereas the figure is lower than 2% in sectors such as real estate (0.23%); professional, scientific and technical activities (1.44%); education, human health and social work (0.53%); and other service activities (1.58%).
- Using an intermediate class (0-15 employees per local unit), 96.4% of the firms in Bergamo have 15 or fewer employees and account for 54.5% of employees. Even in such sectors as mining, manufacturing, and electricity and gas, the percentage of local units with 15 or fewer employees is above 85%. In agriculture, construction and all the service groups considered, the percentage of local units with 15 or less employees is always above 91%, and in most, covers more than 98% of local units.

- The share of medium firms (50-249 employees per local unit) is only 0.79% in Bergamo (Table 2.18), although it accounts for 18.5% of all employees. The share of medium firms is slightly higher in manufacturing (3.89%); water, sewerage and waste (3.27%); accommodation and food services (2.08%); and administrative and support service activities (1.75%). In the other sectors, the share of medium-sized firms is always below the average (0.79%).
- Large firms (with 250 or more employees) account for only 0.07% of local units and 9.24% of employment in the business sector. The share of large firms is slightly higher in manufacturing (0.33%) and accommodation and food service activities (0.3%).

Italy has more firms per unit of GDP than any other major European economy (OECD, 2013b). Organising small and medium firms in clusters helps increase the efficiency of the system due to the presence of positive externalities, collective goods and institutions that facilitate co-ordination and thus buffering the lack of economies of scale. The presence of informal systems of co-ordination make it possible that “ten lathes in ten different rooms can be operated as efficiently as ten lathes in one room” (Brusco and Sabel, 1981).

It should be noted that co-ordination among firms is often an unintended outcome of social and economic interactions within the business community. This informal co-ordination can take place along the supply chain: a given buyer can influence the strategic behaviour of its suppliers at any stage of the local supply chain (Lorenzoni, 1990). Another way in which SMEs can co-ordinate is through regional intermediate institutions, such as banks, industrialist associations, local governments, etc. (Arrighetti and Seravalli, 1999). The fact that co-ordination is unintended avoids collusion among local actors, thus guaranteeing a level of competition within the system.

As already noted, Bergamo's economy and industrial base must move to higher value-added and knowledge-intensive activities in which human capital plays a key role and where entrepreneurship is essential for translating human capital into economic value (Chapter 3 will address these topics in depth). The medium to low value-added industrial structure that prevails in parts of the Bergamo economy is largely incompatible with what are commonly assumed to be the drivers of a knowledge-based economy. However, its strong SME structure is well suited to the establishment of a modern knowledge-based economy. Bergamo currently has a promising firm structure, but there is an urgent need to acquire new skills, enhance innovation across a broader range of economic activities, attract foreign direct investment (FDI) and improve governance around a common vision.

Bergamo has become the hub of large production networks. Medium-sized firms, in particular, co-ordinate large satellite firms abroad, including in emerging economies. The internationalisation strategy aims to reduce production costs but also to adapt products to the specific needs of international markets. A number of medium-sized enterprises have managed to become important international players in market niches such as brake systems (Brembo), the ready-mixed concrete sector (Italcementi), or in tubing, casing, connections and accessories (Tenaris Dalmine).²

There are, however, some worrying signals that should be taken into account by regional and national authorities. First, regional labour productivity has stagnated in the past 12 years (see Chapter 1). This exposes Bergamo to international competition, especially from emerging countries and other newcomers. Second, several local entrepreneurs and managers have a strong attachment to Bergamo and remain in the

region despite the potential gains of relocating overseas. Third, the process of internationalisation must be accompanied by a transition to higher value-added and more technologically intensive activities in Bergamo, if it is to remain a key actor within the value chain and not to be relegated to a peripheral role.

Given these circumstances, Bergamo should capitalise on its strong SME structure, and put in place pilot projects and policies to help generate new and exclusive sources of competitive advantage. The aim of the regional development strategy should be to increase the concentration of assets and capital in Bergamo, including investment, human capital, knowledge and amenities. However, it is important to recognise that the original industrial district model must also evolve, given that the “cluster premium effect” in Italy, which traditionally gave Bergamo an edge, may no longer be relevant in the face of international competition.

A recent OECD report on SMEs in Italy has diagnosed the fading of the “industrial district effect” (OECD, 2014a). Firms draw locational benefits from an “agglomeration effect” (quality of infrastructures, business services and human capital available to all firms in a cluster), and a “specialisation effect” (knowledge spillovers, specialised labour pool, and high-quality inputs, which are available to firms in the main sector of specialisation of the cluster). The main finding of the analysis is that the specialisation effect has not contributed to positive growth over the period examined (1993-2008), while the agglomeration advantage is slightly positive up to 2006, and then vanishes. These results are consistent with consolidated evidence that local external economies matter most during the early stages of an industry development cycle (Audretsch and Feldmann, 1996).

Additional studies (Fitjar and Rodríguez-Pose, 2011; Gertler, 2003; Moodysson, 2008; Uzzi, 1996), have also pointed to the dangers of lock-in effects and over-embeddedness associated with local interactions with the same partners over an extended period of time, as is typical of industrial districts. Instead, the studies advocate the use of partners outside the comfort zone of local interaction through the development of global pipelines (Bathelt et al., 2004; Morrison et al., 2013).

These findings suggest that there is a need to evolve the traditional industrial district concept to remain competitive over the medium and long term. Over the last century Bergamo has been able to make a transition from the “old industrial paradigm” based on the basic idea that firm’s competitiveness stems from large economies of scale towards the industrial district system, where competitiveness is place-based including social capital.

The industrial district model is highly competitive when production activities are self-contained within a location. However, as supply chains internationalise firms that use local informal rules and systems to co-ordinate production may not be open to global opportunities. As a result Bergamo may become peripheral within the international network that it has created, and eventually may lose connection to international markets.

Table 2.13 illustrates the kind of transition Bergamo needs to put in place. In some cases, the industrial district model is still a valid option, especially when it comes to the flexibility and capacity to adopt innovative processes rapidly. However, the system will have to integrate new functions so that it can deal with global value chains, more complex corporate governance and knowledge-intensive outputs.

Table 2.13. Evolution of industrial paradigms

	Large-size industries	Industrial districts	Global industrial networks
Strategic focus	Efficiency-driven	Knowledge-driven	Knowledge-driven
Competitive strategy	Cost leadership	Process innovation-based differentiation	Innovation breakthroughs and product diversification
Source of competitive advantage	Tangible resources, market power	Human and intangible resources	Local and international human resources
Keys for competitiveness	Scale efficiencies Process innovation	Flexibility Strategic innovation	Flexibility Strategic innovation
Productive objectives	Quantity	Quality	Large quantity and high quality
Capital focus	Financial capital	Social and human capital	Social and human capital that attract foreign direct investment
Organisational structure	Rigid organisational structure	Flexible organic structure	Flexible organic structure
Preferred leadership style	Managerial	Entrepreneurial	Mixed managerial and entrepreneurial
Dominant firm size	Large corporations	Small and medium-sized enterprises	Medium size and start-ups

Source: authors' own elaboration based on various sources.

The transition to a new and more competitive way of organising production in Bergamo – to tap into global industrial networks – requires increasing innovation capacity, openness to international actors and foreign investment, and access to qualified managers who can handle large companies. These points are discussed in turn below.

- Innovation capacity, including the possibility of generating breakthrough innovations. On the one hand, some local firms (especially SMEs) are unable to satisfy demand for innovation stemming from research institutions and universities because they are often simply not aware of the innovations available. On the other hand, research institutions and universities lack the incentive to collaborate with small firms, either due to their prevailing interest in research rather than in the diffusion of technology, or due to the higher transaction costs in dealing with small (and often micro-) firms. Therefore, policy should not only support R&D investment and the production of innovation but also its diffusion throughout the economy and close linkages between firms, research institutions and universities (OECD, 2006).
- Openness to international actors. The region of Bergamo should improve its attractiveness. Local workers have been a key asset for the region's competitiveness, but Bergamo's future may depend on its capacity to attract highly skilled individuals specialised in knowledge-intensive industries and R&D. This requires better co-ordination of local policies, including spatial planning, transport and service delivery.

Box 2.5. Enhancing attractiveness in Bergamo

Bergamo's economic and industrial base must move to a higher value-added and knowledge-intensive phase in which human capital plays a key role and where entrepreneurship is essential in translating human capital into economic value. The medium to low value-added industrial structure that prevails in Bergamo's economy is largely incompatible with what are commonly accepted to be the drivers of a knowledge-based economy. However, its strong small and medium-sized enterprise structure is well suited to the establishment of a modern knowledge-based economy. Bergamo's firm structure shows promise, but there is an urgent need to acquire the new skills and attract foreign direct investment and to improve its common vision in order to make the most of this structure.

The adjustment of Bergamo's industrial fabric will require a shift in the nature and availability of the local labour supply, but this will not occur unless skilled workers find Bergamo an attractive place to live and work. This will help attract people, ideas and investment to the region, not least by increasing the incentives and opportunities for skilled young people from the region to remain or return. However, relying on young local workers will not be enough. It will also be necessary to attract qualified labour, including migrants and foreign students from outside the region. In addition, the local industrial fabric will need to be modernised. This will require a more strategic approach to promoting entrepreneurship, paying greater attention to the retention and expansion of existing businesses and helping them adapt to the new, knowledge-based competitive environment.

Ensuring a highly qualified and dynamic labour supply will depend in no small measure on perceptions of the region's attractiveness, in terms both of quality of life and of job development opportunities. Three areas are key to help make Bergamo an attractive place: first, its natural assets and amenities and their potential to contribute to regional development; second, the scope for strengthening and diversifying the framework for business competitiveness; and third, ways of improving regional connectivity to promote regional development.

- Encourage the development of knowledge-intensive businesses. Bergamo has a promising firm structure to increase knowledge-intensive activities but there is an urgent need to acquire the new skills required to make the most of that structure. The new regional productive framework should become a mix of small firm networks, medium-sized multinationals and knowledge-based start-ups. This blend of different productive systems should keep a common identity represented by the attachment to Bergamo and to its key tangible and intangible assets. The challenge is to keep strengthening the link between the local *milieu* and the globalised market, avoiding to become “localistic” as well as to suffer from centripetal forces that attract key assets out of Bergamo.
- A multifaceted internationalisation strategy focusing on FDI may help this transition. Bergamo has been successful in promoting exports, but it has not formulated a regional strategy to attract FDI. Foreign investors could help contribute to entrepreneurship in the province, which has been stagnating since the early 2000s, and could also enlarge the scope of skills available within the regional economy. Most importantly, FDIs would boost the investment propensity – and hence the growth potential – of the region. There is evidence that the presence of a multinational located within an industrial district can contribute to the competitiveness of the overall cluster and help other firms in the supply chain, both as a buyer of their products and by positively affecting the quality of business services available in the area.

Box 2.6. Synergies between multinational firms and clusters

A recent OECD report on small and medium-sized enterprises (SMEs) in Italy illustrates how the presence of multinationals has been significant in the development of industrial clusters over the last decade. Examples are the sports goods cluster in Montebelluna, with the local presence of Nike, Salomon and Rossignol, and Louis Vuitton Moët Hennessy (LVMH), the French luxury goods group, which acquired Rossi Moda, one of the flagship companies in the Brenta shoe cluster, and Loro Piana, a family-owned cashmere and fine woollen business located in Biella, Piedmont.

One recent development has been inward investment by emerging market corporations, such as Jac Motors and Chang'an of China, which established product design, development and testing centres in Turin's automotive cluster (Pietrobelli et al., 2011). The involvement of cluster firms in global value chains (GVCs) also enhances their innovation performance through the quality and product variety requirements with which they must comply when entering a high-value market chain. This may also involve disinvesting from and outsourcing ancillary activities. This allows GVC firms to shift resources towards core activities, as illustrated by Capasso and Morrison (2013) with the Castel Goffredo textiles and shoes cluster. The number of Italian cluster firms participating in the GVCs is growing, although foreign outsourcing tends to be greater among clusters operating in low-end market segments, which are facing strong international competition on costs. Clusters operating in high-end market segments are, by contrast, maintaining stronger local supply relations, since the advantages of quality and short lead times are often considered more important than a possible reduction of costs (Capasso et al., 2013; Amighini and Rabellotti, 2006).

In both cases, however, the involvement of cluster firms in GVCs is primarily limited to individual, often medium to large, firms, rather than small firms or networks of small firms (Bronzini and Piselli, 2013; Chiarvesio et al., 2010).

Source: OECD (2014a), *Italy: Key Issues and Policies*, <http://dx.doi.org/10.1787/9789264213951-en>.

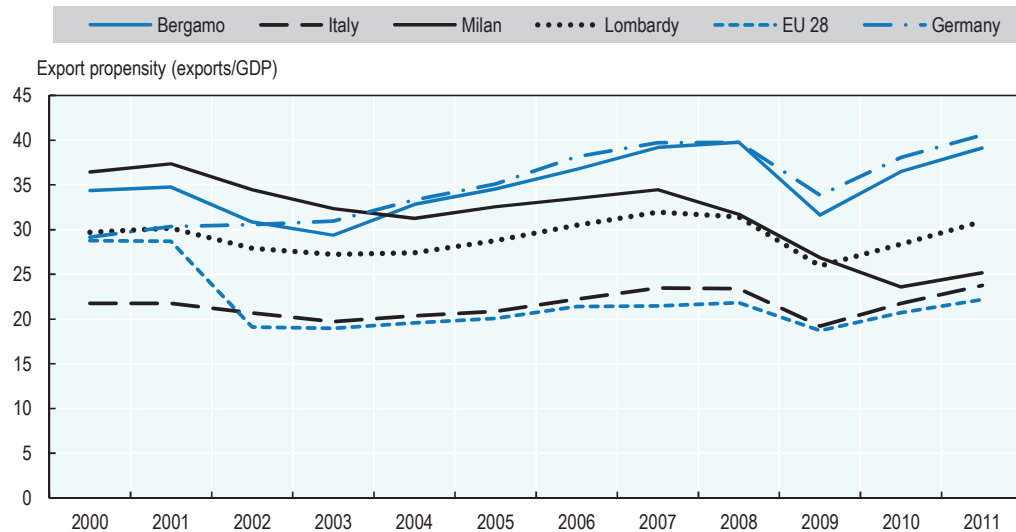
Rising trade and internationalisation

As shown in previous sections, tradable activities represent one of the main drivers of productivity, both in countries and in regions. They are part of value chains facing international competition that can enhance innovation and spillover effects to other sectors. Opening Bergamo's economy to international markets is one important way of boosting its competitiveness, especially given Italy's stagnant performance during the last decade, and low internal demand. Firms' process of internationalisation can increase the demand for tradable activities in the region and can also ensure that Bergamo's industrial clusters and medium-sized firms are exposed to new and fresh ideas. The internationalisation process should not be confined to exports but also should also aim to attract FDI and firms to the region.

Exports have been rising in Bergamo

Bergamo's economy generates a high volume (and growth) of gross exports, with high export propensity.³ In 2013, the value of exports in the province was EUR 13 131 million (Figure 2.14). The export propensity (share of exports of GDP) in 2011 was 39.1%, close to that of Germany (40%) and surpassing those of Italy (23.8%), Milan (25.2%), Lombardy (30.9%) and the EU28 country average (22.2%).

Figure 2.14. Export propensity in Bergamo benchmarked with other economies

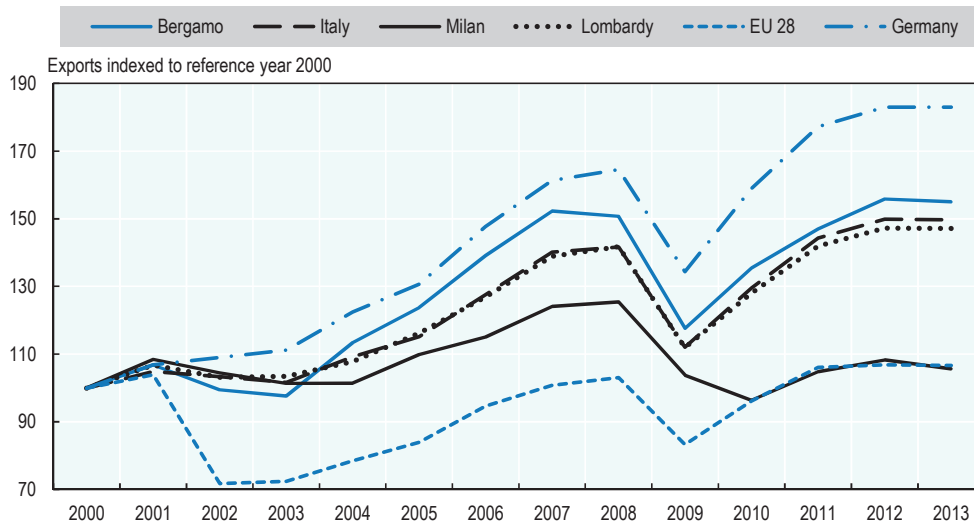


Sources: ISTAT (2014b), *Statistiche del commercio estero*, National Institute of Statistics, Rome; and Eurostat (2014) Annual national accounts (ESA 95) <http://ec.europa.eu/eurostat/data/database> (accessed April 2016).

The evolution of Bergamo's exports has been remarkable in recent years (Figure 2.15 and Table 2.14). In 1991, they accounted for EUR 2 895 million, and in 2000, they increased to EUR 8 469 million, representing an annual growth rate of 11.9% in nominal terms. Between 2000 and 2007, exports continued to grow at a rate of 6% per year, reaching EUR 12 898 million. The trend reverted in subsequent years, dropping in 2008 and in 2009, but recovering in 2010. Between 2007 and 2013, the average annual growth rate of exports was only 3% in nominal terms, and in 2013, the value of the exports reached EUR 13 131 million. The evolution of exports between 2000 and 2013 was (slightly) more dynamic than that of Lombardy and Italy, and significantly more dynamic than that of Milan and the average for the EU28 (Figure 2.12), falling slightly below that of Germany. In addition, the export propensity of the province of Bergamo increased from 34.4% in 2000 to 39.1% in 2011 (Figure 2.11).

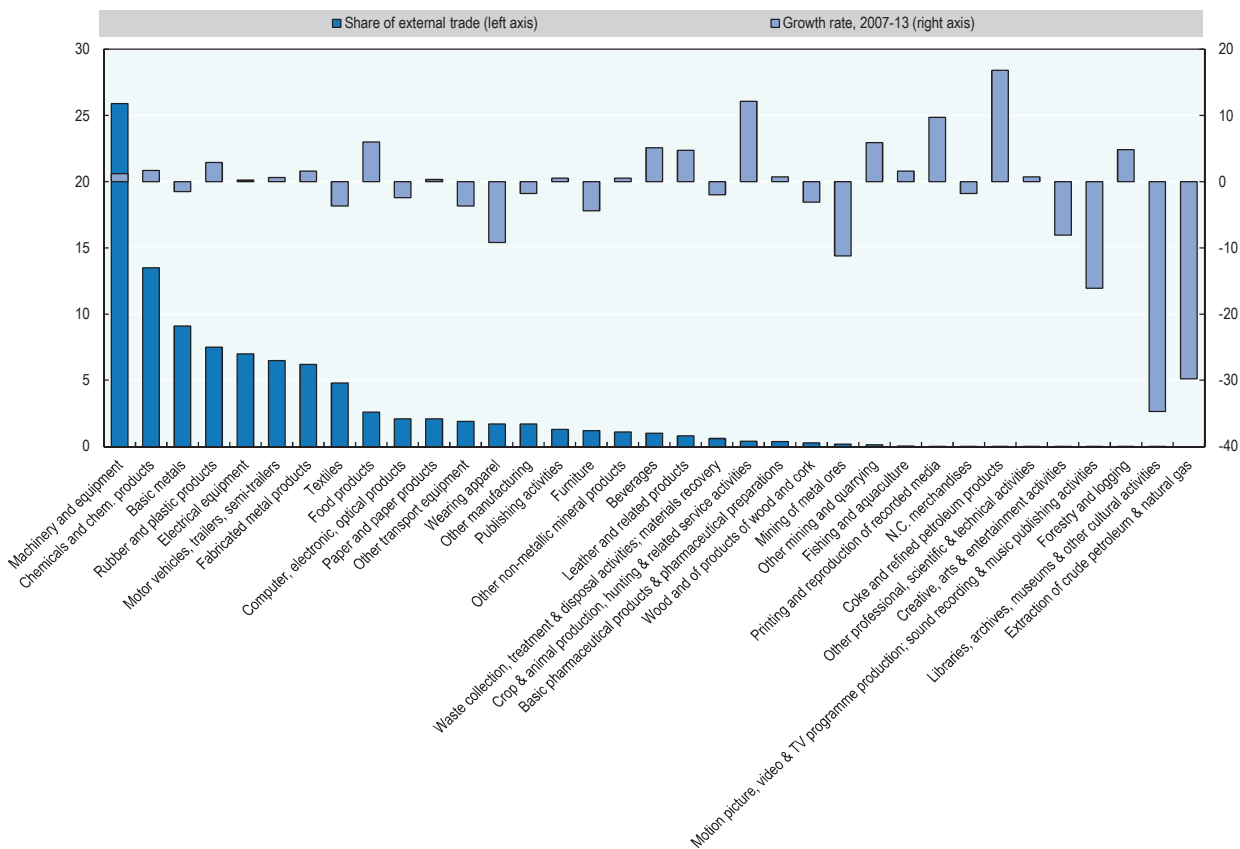
The analysis of the economic structure, at two digits, reveals that only seven activities account for 76% of the value of exports in the province of Bergamo and that, in general, the pattern of specialisation and evolution of manufacturing exports coincides with that of the GVA and employment. The two activities with the greatest share in the exports of the province of Bergamo are: machinery and equipment (25.9% of exports) and chemical products (13.5% of exports), which together account for almost 40% of exports. The growth rate of these activities was positive in the period 2007-13, growing at 1.2% per year in the case of machinery, and at 1.7% in the case of chemicals. Both activities are classified by the OECD and Eurostat as medium-high technology manufacturing activities.

Figure 2.15. Evolution of exports



Sources: ISTAT (2014b), *Statistiche del commercio estero*, National Institute of Statistics, Rome; and Eurostat (2014) Annual national accounts (ESA 95) <http://ec.europa.eu/eurostat/data/database> (accessed April 2016).

Figure 2.16. Percentage of external trade and annual growth rate by sector in Bergamo



Source: ISTAT, (2014b), *Statistiche del commercio estero*, National Institute of Statistics, Rome.

Another five activities account for between 5% and 10% of the value of exports in the province: basic metals (9.1%), rubber and plastics (7.5%), electrical equipment (7%), motor vehicles (6.5%), and metal products (6.2%). The growth rate of the value of the exports of these activities has been positive: between 0.2% and 2.9% per year, with the exception of basic metals, whose growth rate fell to -1.5% per year. These activities combine medium-high and medium-low technological intensity.

A closer look at the machinery and equipment sector, using four-digit classification, reveals that it is quite diversified, with a dominance of general purpose machinery and lifting and handling equipment, in terms of value of exports: (other) general purpose machinery (13.7% of exports), lifting and handling equipment (13% of exports), agricultural and forestry machinery (11.9% of exports), and other taps and valves (10% of exports). The sub-sectors of machinery that experienced the fastest growth in terms of exports are the ones with the lowest initial share: office machinery and equipment (17.6% annual growth rate), machinery for food and beverages (15.6% annual growth rate), engines and turbines (8.1% annual growth rate), bearings and gears (7.2%), rubber machinery (6.15%), and pumps and compressors (6.1%).

The detailed analysis of exports at four-digit level reveals that:

- 76% of the chemicals and chemical product sector are concentrated in only four sectors: other organic basic chemicals (25.5%), plastics in primary form (28%), man-made fibres (12.3%), and perfumes and toilet preparations (10.5%). The first three displayed positive growth between 2007 and 2011, particularly perfumes and toilet preparations (9.9%). By contrast, man-made fibres displayed an average drop of -2.6% per year in the same period.
- Other important activities (more than 1% of total exports) for which the value of exports in the province of Bergamo has grown include food products (6% annual growth rate), beverages (5.1% annual growth rate), paper (0.3% annual growth rate), publishing (0.5% annual growth rate), non-metallic mineral products (0.5% annual growth rate).
- The rates that dropped include textiles (-3.7% annual growth rate), apparel (-9.2% annual growth rate), computer and electronic products (-2.4% annual growth rate), other transport equipment (-3.7% annual growth rate), other manufacturing (-1.8% annual growth rate), and furniture (-4.4% annual growth rate).

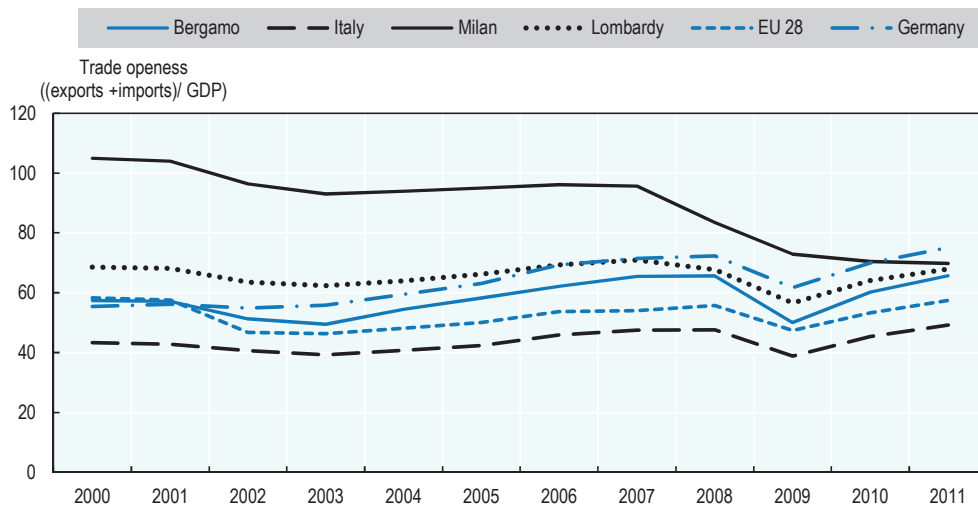
During a period of flat domestic demand, Bergamo has experienced an increasing level of trade openness (measured as the ratio between the sum of exports and imports and the GDP of the province), rising from 57.4% in 2000 to 67.5% in 2011, compared to the trend in Milan. The degree of trade openness in 2011 is in line with the values for the province of Milan and the whole region of Lombardy, 69.8% and 67.9%, respectively. Nevertheless, they show a high degree of openness compared with country averages, e.g. 49.1% in Italy, 58.7% in Germany and 55.5% in the EU28.

Bergamo's share of exports to imports is higher than for Italy, Milan, Lombardy and the EU28. In 1991, the ratio was 142%, rising to 149% in 2000 and remaining stable until 2007. With the unfolding of the crisis, it rose to 175%, due to the decline of exports (Figure 2.18).

The Index of Contribution to Trade Balance (ICTB) is an index of revealed comparative advantage, measuring the contribution of sectors to the overall trade balance and providing a measure of competitiveness for the various sectors. The sector in which

Bergamo has the highest comparative advantage in machinery (ICTB =14.89%), followed by rubber and plastics, and metal products. By contrast, chemicals and computers and electronics display the lowest comparative advantage in Bergamo (Figure 2.19).

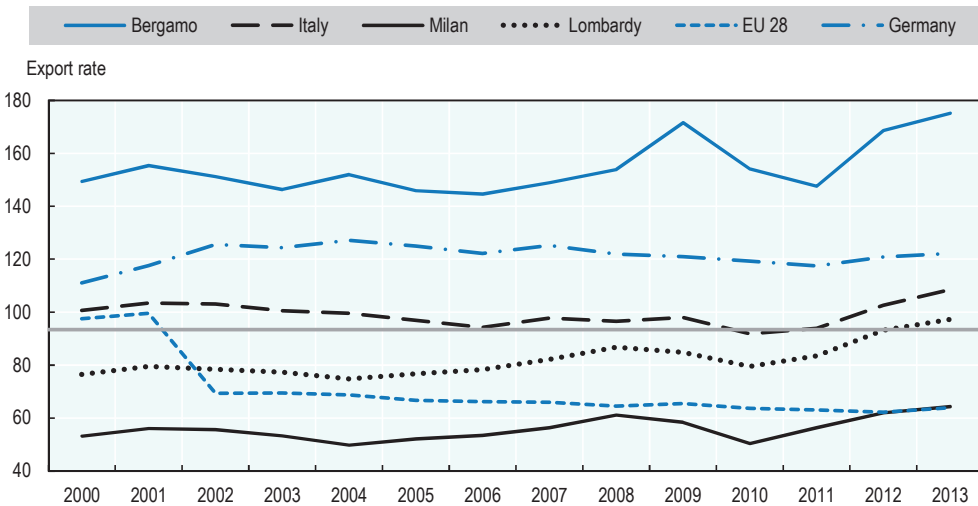
Figure 2.17. Trade openness



Note: Trade openness is defined as the sum of exports and imports divided by GDP.

Sources: ISTAT (2014b), *Statistiche del commercio estero*, National Institute of Statistics, Rome; and Eurostat (2014) Annual national accounts (ESA 95) <http://ec.europa.eu/eurostat/data/database> (accessed April 2016).

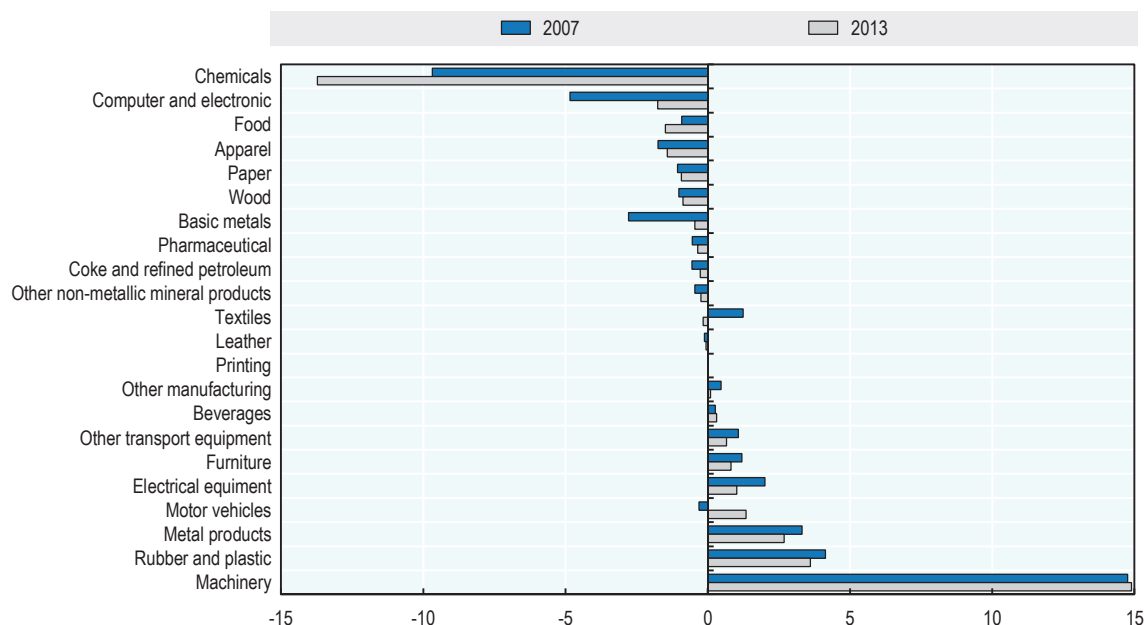
Figure 2.18. Ratio of exports to imports



Sources: ISTAT (2014b), *Statistiche del commercio estero*, National Institute of Statistics, Rome; and Eurostat (2014) Annual national accounts (ESA 95) <http://ec.europa.eu/eurostat/data/database> (accessed April 2016).

The province of Bergamo's manufacturing sector is competitive not only within the EU, but also beyond. Bergamo-based firms have developed strong ties with international markets, particularly due to the role played by leading regional companies. The province of Bergamo is one of Italy's most productive in terms of exports. It alone generates 12% of the exports of Lombardy, Italy's wealthiest province. Moreover, Bergamo has become the hub of multiple international productive networks, particularly in Eastern Europe, which also involve emerging economies, such as Brazil, China and India.

Figure 2.19. Index of contribution to trade balance of the manufacturing sector in Bergamo



Note: The Index of Contribution to Trade Balance is defined as $ICTB = \left(\frac{X_i - M_i}{X_i + M_i} - \frac{\sum_{i=1}^N X_i - \sum_{i=1}^N M_i}{\sum_{i=1}^N X_i + \sum_{i=1}^N M_i} \right) \cdot \left(\frac{X_i + M_i}{\frac{\sum_{i=1}^N X_i + \sum_{i=1}^N M_i}{2}} \right) \cdot 100$. The index is an indicator of revealed comparative advantage that evaluates the weighted participation of each sector on the aggregated balance of the external trade. The index has been computed for all the activities at two digits ISIC Rev. 4.

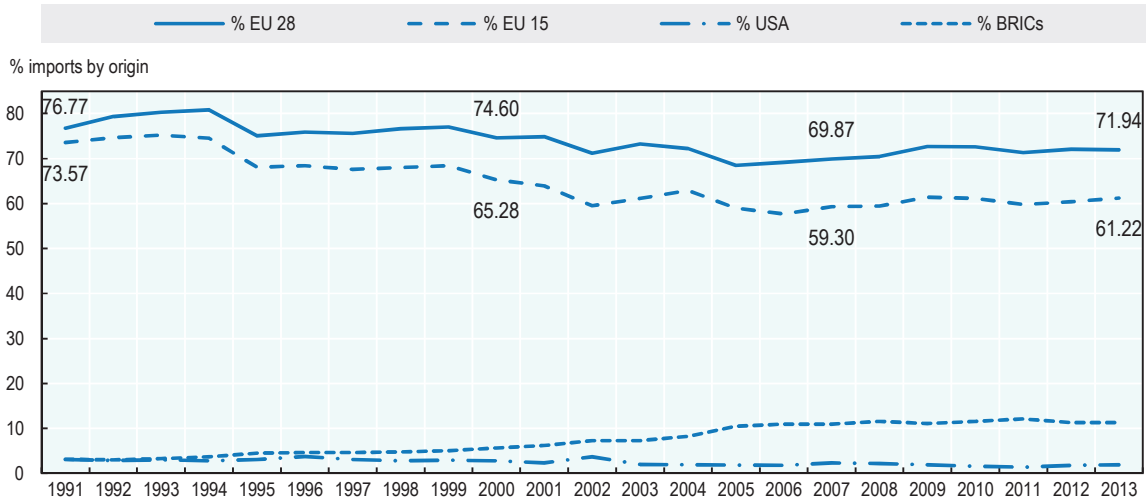
Source: ISTAT, (2014b), *Statistiche del commercio estero*, National Institute of Statistics, Rome.

Over time, the share of exports directed to the EU28 has fallen gradually, from 72% in 1991 to 62% in 2013, reflecting weak demand from EU countries, against an increasing demand from BRIC countries (Brazil, Russian Federation, India and China) and a relatively stable trend in the United States. This suggests that firms' internationalisation, particularly since the early 2000s, has been quite active in emerging economies. Notwithstanding this trend, EU28 countries are still the chief export destinations for local firms.

Export performance can be linked to the size of each sector and its level of specialisation. The relationship between the size of the local units and exports per person employed appears positive, with a correlation of 0.27. The correlation increases to 0.62 when the pharmaceutical sector is removed, suggesting a positive link between scale economies and export performance. This is especially clear for motor vehicles, basic metals, chemicals and machinery.

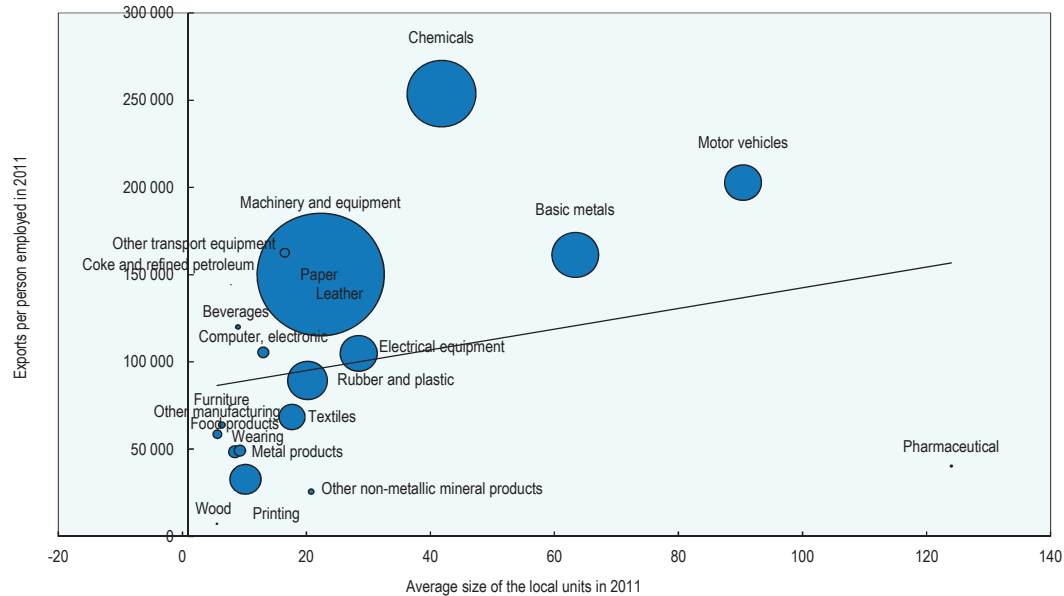
In terms of specialisation (localisation economies), the correlation with export performance is also positive, if less pronounced, with a correlation coefficient of 0.16. There are indeed some sectors where high/low specialisation corresponds to high/low export performance, such as pharmaceutical, machinery and equipment, and chemicals. Despite this, there are also sectors with high specialisation and low export performance (textiles and metal products) and sectors with low specialisation and high export performance (motor vehicles and other transport equipment).

Figure 2.20. Evolution of the share of imports by country of origin



Source: ISTAT, (2014b), *Statistiche del commercio estero*, National Institute of Statistics, Rome.

Figure 2.21. Exports per worker and firm size (manufacturing sector)

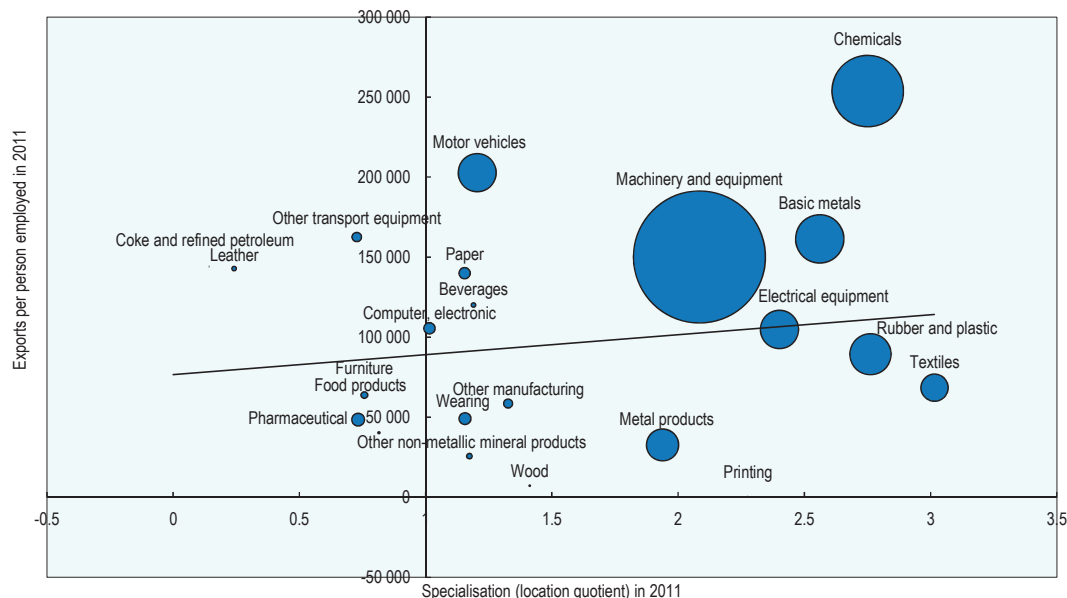


Note: Bubble size denotes total value of exports.

Source: ISTAT (2014a), *Censimento industria e servizi*.

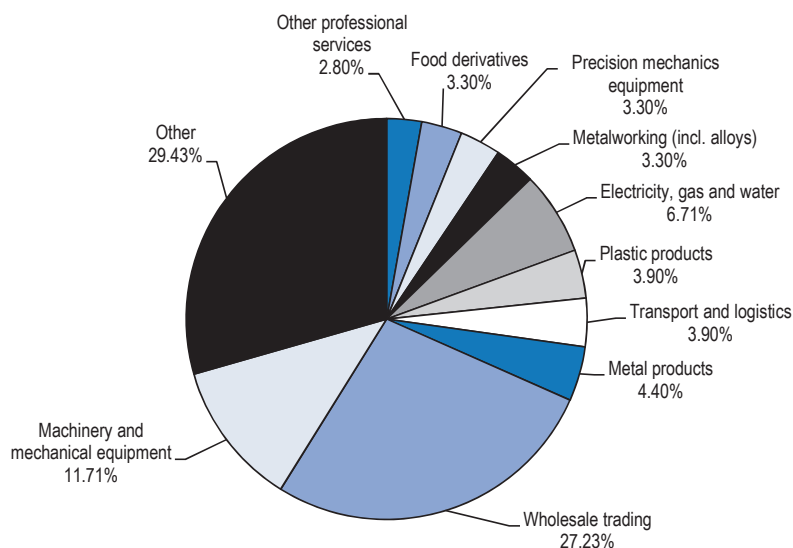
The province of Bergamo has also attracted FDI. Data from Invest in Lombardy, a service promoted by the regional Chamber of Commerce, show that in 2013, 180 foreign companies were operating in the province of Bergamo and employed approximately 36 000 people. Milan had 2 832 foreign-owned firms that employed more than 400 000 people. In Bergamo, FDI was concentrated in wholesale and trading and in machinery and mechanical equipment (Figure 2.23).

Figure 2.22. Exports per worker and specialisation (manufacturing sector)



Source: ISTAT (2014a), *Censimento industria e servizi*.

Figure 2.23. Sectoral breakdown of foreign direct investment in Bergamo, 2013



Source: Invest in Lombardy, www.investinlombardy.it (accessed 11 May 2016).

The industrial sector can benefit from openness to international actors and attractiveness to FDI. Bergamo has been successful in promoting exports, but it has not formulated a regional strategy to attract FDI. Foreign investors could help encourage entrepreneurship in the province, which has stagnated since the early 2000s, and could also enlarge the scope of skills available in the regional economy. Most importantly, FDI would positively affect the region's investment propensity – and thus its growth potential. International evidence suggests that the presence of a multinational in an industrial district contributes to the competitiveness of the whole cluster and helps other firms along the supply chain, both as a buyer of their products and by positively affecting the quality of the business services available in the area.

Trade in value added and global value chains

Most of the economic activity in manufacturing sectors involves the transformation of inputs into other products (outputs). The value of the output therefore depends on the value of the inputs and the value added by the production (manufacturing) process. In terms of competitiveness and integration into international markets, it is important to assess the share of value in the produced output that comes from imported inputs, and the share of domestic value that is subsequently embedded in foreign products.

Trade in added value takes into account the part of the gross export value that has been generated in other countries through global value chains, and provides a net measurement of the value generated in the country. To conduct this type of analysis, the flows of goods and services need to be arranged according to an input-output table, which gives a precise account of the value (and origin) of the input contained in any output. This table, however, is available only at the national level and not for the province of Bergamo. Therefore, when considering the analysis in terms of global value chains, only foreign inputs are considered, because it is not possible to distinguish input originated in Bergamo from the inputs originated in other Italian provinces.

Box 2.7. Measuring trade in value added

Trade in value added describes a statistical approach used to estimate the source(s) of value (by country and industry) that is added in producing goods and services for export and import. It recognises that growing global value chains mean that a country's exports increasingly rely on significant intermediate imports (and thus value added by industries in upstream countries). For example, a motor vehicle exported by country A may require significant parts, such as engines, seats, etc. produced in other countries. In turn, these countries will use intermediate inputs imported from other countries, such as steel, rubber, etc., to produce the parts exported to country A. The trade in value added approach traces the value added by each industry and country in the production chain and allocates the value added to these source industries and countries.

Compared to traditional measures of trade, based on imports and exports, in the context of increasing circularity across places in production, trade in value added takes into account that multiple calculations of trade can to some extent overstate the importance of exports to GDP and, at the same time, treat imports as a negative item for economic performance.

Trade in value added methodology identifies every product in a value-added chain. The aim is to identify where the value added originated, by tracing the value added throughout a production chain in countries and industries (OECD and WTO, 2012). To undertake this exercise, the OECD formulates a global input-output table and combines it with bilateral measures of trade flows. Identifying backward linkages from the export-oriented sectors

Box 2.7. Measuring trade in value added (*continued*)

producing tradable goods (agriculture, manufacturing) makes it possible to map where the domestic value added was really created (domestic value added embodied in gross exports) and to break down this domestic content by direct and indirect sectoral value added. This breakdown is particularly important when identifying the sources of competitiveness, which may lie in upstream sectors that are not considered to be exporters under traditional statistical methods, or measuring the employment impact of export production. Another benefit of measurement of trade in value added is that it makes it possible to follow in time and space the processes of offshoring and eventually, onshoring.

The measurement of trade in added value is complex when the territorial units are regions, particularly provinces or cities. This requires an input-output table for the territorial unit of measurement, and detailed regional trade flows are not always available. Since Bergamo does not have a provincial input-output table, the national table must be used, assuming that productive relationships between sectors in Bergamo are reasonably similar to those for the whole of Italy. This assumes that the concentration of trade in added value of the home sector in the province of Bergamo is similar to that of the whole of Italy. The added value can be obtained by multiplying the gross export flows of each sector in Bergamo by the content embodied in domestic value added in gross exports of each unit in the sector for the whole of Italy. One limitation of this approach is that the lack of trade statistics across provinces precludes identifying what part of the domestic added value of the province has been generated in Italy's other provinces.

In terms of trade in value added, the analysis shows that most of the value added in the exports of Bergamo is produced domestically (either in Bergamo or Italy). In 2009, 79.9% of the value of gross exports of Bergamo (EUR 7 643 million) was generated in the domestic part of the value chain (in the province and the country). By contrast, 20.1% of gross trade flows (EUR 2 319 million) was generated in the foreign part of the global value chain. In comparison with other provinces and countries, the share of the value chain generated in the foreign part of the value chain is slightly lower than the world average (24.1%).

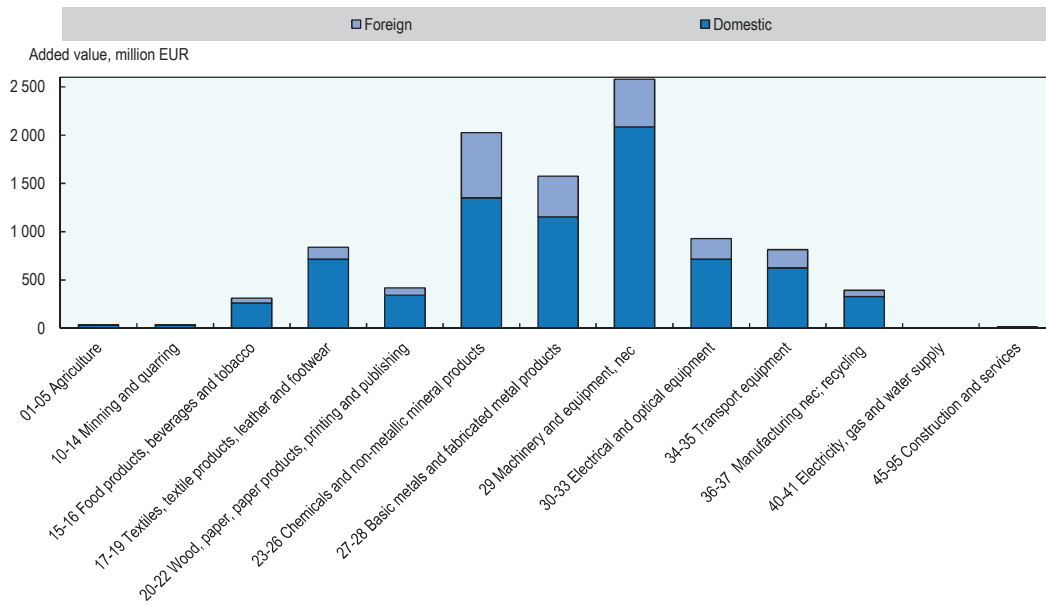
In terms of integration of the economy in the global value chain, the analysis shows that there is a strong domestic value chain involving many sectors (Figure 2.25): 36.6% of the gross exports have been generated directly in the same sector, and another 43.1% have been produced in other related sectors, indicating strong inter-sectoral linkages. Only 0.2% corresponds to reimported domestic value added. The share of exports originated in domestic intermediaries is significantly higher than the world average (33%).

The intensity of domestic input-output interactions can also be seen sector by sector (Figures 2.26, 2.27 and 2.28): in all the sectors, the share of foreign value added of total gross exports is lower in Bergamo and Italy than the world average. The difference is low in chemicals (33% versus 34%); paper, printing and publishing (18% versus 21%); basic metals (27% versus 30%); and food and beverages (15% versus 20%). The difference is high in electrical and optical equipment (23% versus 37%); transport equipment (23% versus 31%); other manufacturing (17% versus 27%); and textiles, leather and footwear (15% versus 25%). On the contrary, the share of value added generated in domestic value chains is higher in Bergamo and Italy than in the rest of the world, with differences of between 5 and 12 percentage points. Domestic value chains for exports are particularly important in food and beverages (54% of the value of gross exports), textiles and leather

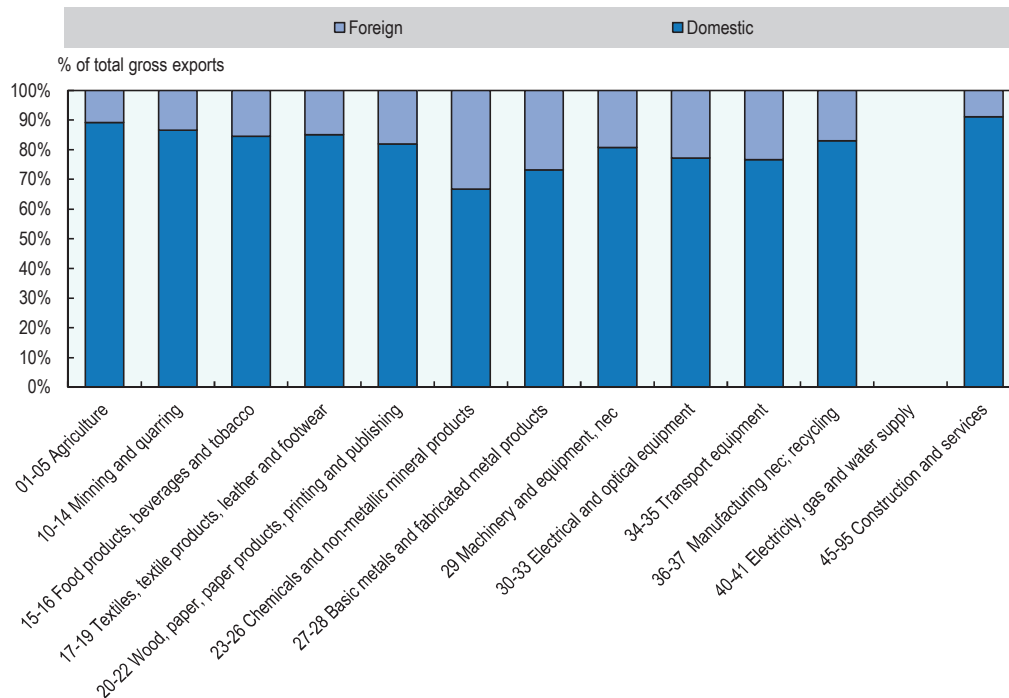
(51%), and transport equipment (51%), although it is never lower than 38% in the other sectors.

Figure 2.24. Trade in value added, 2009

A. Added value in millions of euros of exports



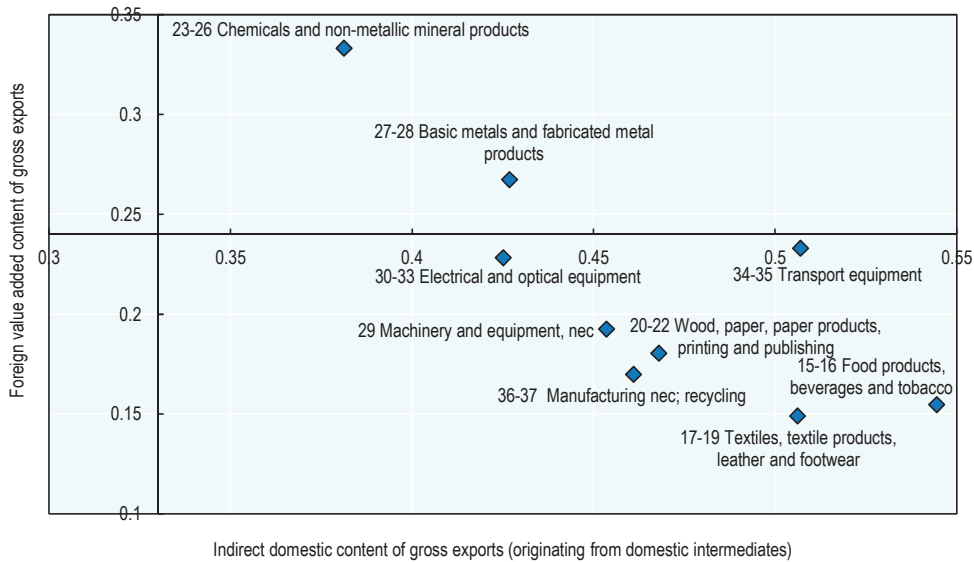
B. Domestic and foreign shares in total gross exports for each sector



Note: Sectors based on ISIC Rev. 3.

Sources: OECD and WTO (2010), "Trade in value-added: concepts, methodologies and challenges", www.oecd.org/sti/ind/49894138.pdf; and ISTAT (2014a), *Censimento industria e servizi*.

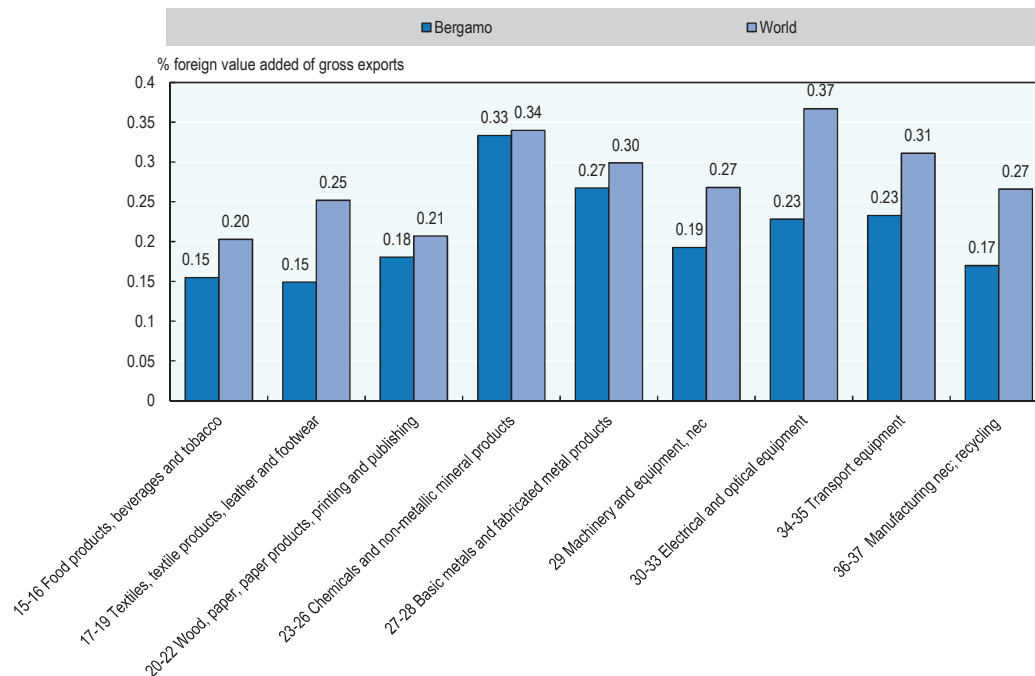
Figure 2.25. Trade in value added: Indirect domestic content of gross exports from domestic intermediaries, and foreign value added of gross exports, 2009



Note: Sectors based on ISIC Rev. 3. The axis cuts in the average world values.

Sources: OECD and WTO (2010), “Trade in value-added: concepts, methodologies and challenges”, www.oecd.org/sti/ind/49894138.pdf; ISTAT (2014a), *Censimento industria e servizi*.

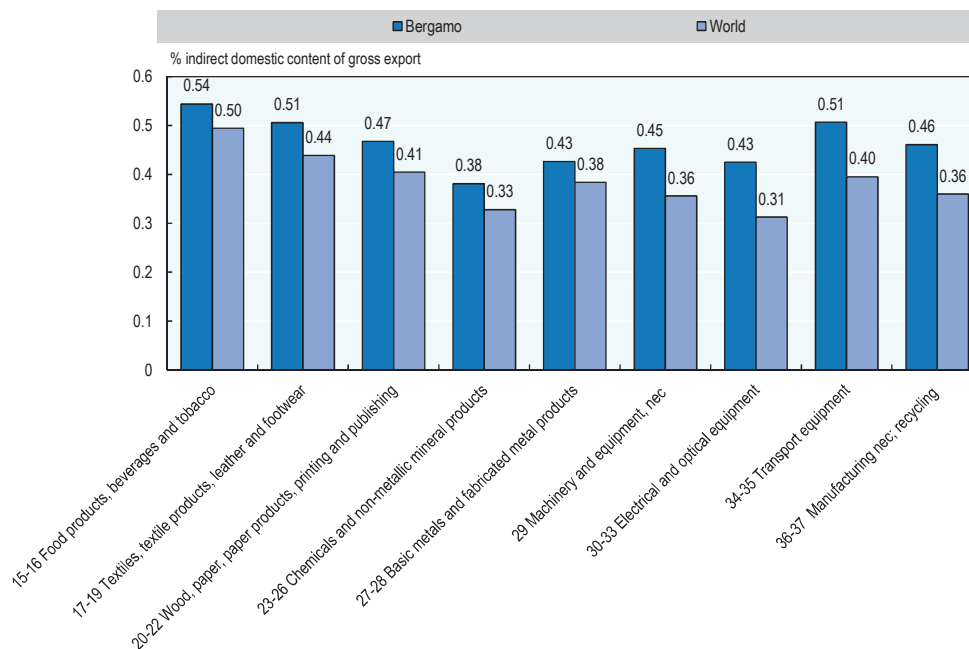
Figure 2.26. Trade in value added for Bergamo: Foreign value added of gross exports, 2009



Note: Sectors based on ISIC Rev. 3.

Sources: OECD and WTO (2010), “Trade in value-added: concepts, methodologies and challenges”, www.oecd.org/sti/ind/49894138.pdf; ISTAT, (2014a), *Censimento industria e servizi*.

Figure 2.27. Trade in value added: Indirect domestic content of gross exports from domestic intermediaries, 2009



Note: Sectors based on ISIC Rev. 3.

Sources: OECD and WTO (2010), "Trade in value-added: concepts, methodologies and challenges", www.oecd.org/sti/ind/49894138.pdf; ISTAT (2014a), *Censimento industria e servizi*.

Conclusions

The industrial sector in Bergamo has experienced important structural changes during the last ten years. There has been a marked shift in employment from traditionally strong sectors like textiles and clothing, and repair and installation of machinery towards production of machinery and equipment, rubber and plastics, and chemicals. This change involves an increase in technological intensity within manufacturing, which has been shifting from medium- and low-tech manufacturing activities towards medium-high tech.

This structural change is closely linked to the province's growing reliance on exports. Against the backdrop of relatively weak domestic demand, Bergamo recorded export growth rates of 6% per year during 2000-07 and 3% during 2008-11. The direction of exports has also shifted in the last years from the EU to world markets, reflecting the increasing integration of Bergamo in the world economy and the weakness of demand in much of the European Union.

The increasing internationalisation has been a positive development, increasing competition and introducing new innovation to the industrial sector and the province's economy as whole. However, it has not yet translated into higher productivity growth as documented in Chapter 1. In order to remain internationally competitive, Bergamo's economy needs to move from a standardised to a more sophisticated, flexible or customised type of production. The process of internationalisation must go hand in hand with a transition to higher value added and more technology-intensive activities to remain a key actor within the value chain and not be relegated to a peripheral role in the process of offshoring.

Table 2.14. Trade in value added in Bergamo, 2009

	Million EUR					
	Gross exports	Domestic value added embodied in gross exports	Direct domestic industry value added content of gross exports	Indirect domestic gross exports (originating from domestic intermediates)	Reimported domestic value added content of gross exports	Foreign value-added content of gross exports
01-05 Agriculture	35.0	31.2	21.5	9.7	0.0	3.8
10-14 Mining and quarrying	34.7	30.1	20.2	9.8	0.0	4.7
15-16 Food products, beverages and tobacco	310.9	262.8	93.1	169.3	0.4	48.1
17-19 Textiles, textile products, leather and footwear	838.3	713.4	287.4	424.3	1.7	124.9
20-22 Wood, paper, paper products, printing and publishing	416.2	341.1	145.5	194.8	0.8	75.1
23-26 Chemicals and non-metallic mineral products	2 026.1	1 351.0	572.5	772.5	6.1	675.1
27-28 Basic metals and fabricated metal products	1 576.3	1 154.7	476.2	672.8	5.7	421.6
29 Machinery and equipment n.e.c.	2 581.4	2 084.5	906.3	1 170.8	7.4	496.9
30-33 Electrical and optical equipment	928.3	716.4	318.8	394.6	3.0	211.8
34-35 Transport equipment	813.1	623.7	208.4	412.2	3.0	189.4
36-37 Manufacturing n.e.c.; recycling	393.0	326.2	144.3	181.1	0.8	66.7
40-41 Electricity, gas and water supply	0.0	0.0	0.0	0.0	0.0	0.0
45-95 Construction and services	8.4	7.7	4.7	3.0	0.0	0.7
Total	9 961.7	7 642.8	3 199.0	4 414.9	28.9	2 318.9

Notes: Sectors based on ISIC Rev. 3. Gross exports = domestic value added embodied in gross exports + foreign value-added content of gross exports. Domestic value added embodied in gross exports = direct domestic + indirect domestic + reimported domestic.

Sources: OECD and WTO (2010), "Trade in value-added: concepts, methodologies and challenges", www.oecd.org/sti/ind/49894138.pdf; ISTAT (2014a), *Censimento industria e servizi*.

Table 2.15. Share of trade in value added in the province of Bergamo, 2009

	Gross exports	Domestic value added embodied in gross exports	Direct domestic industry value added content of gross exports	Indirect domestic gross exports content of gross exports (originating from domestic intermediaries)	Reimported domestic value-added content of gross exports	Foreign value-added content of gross exports
01-05 Agriculture	100.0%	89.2%	61.5%	27.6%	0.1%	10.8%
10-14 Mining and quarrying	100.0%	86.6%	58.1%	28.3%	0.1%	13.4%
15-16 Food products, beverages and tobacco	100.0%	84.5%	30.0%	54.4%	0.1%	15.5%
17-19 Textiles, textile products, leather and footwear	100.0%	85.1%	34.3%	50.6%	0.2%	14.9%
20-22 Wood, paper, paper products, printing and publishing	100.0%	81.9%	35.0%	46.8%	0.2%	18.1%
23-26 Chemicals and non-metallic mineral products	100.0%	66.7%	28.3%	38.1%	0.3%	33.3%
27-28 Basic metals and fabricated metal products	100.0%	73.3%	30.2%	42.7%	0.4%	26.7%
29 Machinery and equipment, n.e.c.	100.0%	80.7%	35.1%	45.4%	0.3%	19.3%
30-33 Electrical and optical equipment	100.0%	77.2%	34.3%	42.5%	0.3%	22.8%
34-35 Transport equipment	100.0%	76.7%	25.6%	50.7%	0.4%	23.3%
36-37 Manufacturing n.e.c.; recycling	100.0%	83.0%	36.7%	46.1%	0.2%	17.0%
40-41 Electricity, gas and water supply	100.0%	70.8%	37.5%	33.1%	0.2%	29.2%
45-95 Construction and services	100.0%	91.1%	55.4%	35.6%	0.1%	8.9%
Total	100.0%	79.9%	36.6%	43.1%	0.2%	20.1%

Notes: Sectors based on ISIC Rev. 3. Gross exports = domestic value added embodied in gross exports + foreign value-added content of gross exports. Domestic value added embodied in gross exports = direct domestic + indirect domestic + reimported domestic.

Source: OECD and WTO (2010), "Trade in value-added: concepts, methodologies and challenges", www.oecd.org/sti/ind/49894138.pdf; and ISTAT (2014a), *Censimento industria e servizi*.

Making this transition to higher value-added activities will require changes to the traditional industrial district model. The manufacturing sector in Bergamo has a high concentration of SMEs. This industrial structure is common to northern Italy where clusters of related firms have developed within industrial districts characterised by thick networks that facilitate the transfer of knowledge and technologies. These industrial districts have been historical; however, there is also danger of “lock in” effects in an increasingly open and fast-changing global economy. It is important that this system evolves and integrates new functions that allow it better to deal with global value chains, more complex corporate governance and knowledge-intensive activities.

Notes

1. Current research suggests producing an *ad hoc* index of tradability for each place, using external trade statistics. This approach is good for manufacturing sectors, but is problematic for services, given the limitations of data, since part of the consumption by foreigners is in the place of production. This analysis uses the more traditional approach, based on global tradability of sectors.
2. Italy's medium-sized firms, of between 50 and 250 employees, display a high level of productivity and also the capacity to penetrate international markets. However, Italy is one of the OECD countries with the lowest proportion of medium-sized firms (50-249 employees) (0.5%), well below Germany (2.5%) and the United Kingdom (1.5%) (OECD, 2014a).
3. For simplicity, aggregate data for all product sectors are used in the analysis. Manufacturing accounts for 97.5% of the total value of exports in 2013.

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Annex 2.A1. Location quotients

Location quotients are calculated as $LQ_{ij} = [L_{ij} / L_i] / [L_j / L]$ where L_{ij} is the number of persons employed in a sector i in a region or province j , L_i is the total number of persons employed in sector i , L_j is the number of persons employed in a region or province j , and L is the overall employment in Italy.

Table 2.A1.1. Evolution of two-digit location quotients

Code	Class	Bergamo		Lombardy		Milan	
		2001	2011	2001	2011	2001	2011
01	Crop and animal production, hunting and related service activities	0.41	0.57	0.57	0.51	0.17	0.13
02	Forestry and logging	0.10	0.17	0.14	0.23	0.03	0.05
03	Fishing and aquaculture	0.03	0.02	0.06	0.07	0.02	0.02
05	Mining of coal and lignite	0.00	0.00	0.10	0.00	0.00	0.00
06	Extraction of crude petroleum and natural gas	0.00	0.00	3.07	2.36	7.26	5.14
07	Mining of metal ores	0.00	0.00	0.00	0.14	0.00	0.35
08	Other mining and quarrying	1.13	1.13	0.66	0.70	0.24	0.19
09	Mining support service activities	0.00	0.19	0.95	0.29	1.99	0.68
10	Manufacture of food products	0.66	0.73	0.81	0.84	0.51	0.55
11	Manufacture of beverages	1.18	1.19	0.72	0.79	0.65	0.87
12	Manufacture of tobacco products	0.00	0.00	0.00	0.00	0.00	0.00
13	Manufacture of textiles	3.38	3.02	1.83	1.89	0.62	0.63
14	Manufacture of apparel	1.33	1.16	1.01	1.03	0.40	0.51
15	Manufacture of leather and related products	0.32	0.24	0.44	0.41	0.39	0.51
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1.26	1.41	0.81	0.95	0.26	0.27
17	Manufacture of paper and paper products	1.34	1.15	1.15	1.15	0.83	0.80
18	Printing and reproduction of recorded media	1.87	2.28	1.45	1.34	1.90	1.45
19	Manufacture of coke and refined petroleum products	0.52	0.14	0.76	0.68	1.01	0.79
20	Manufacture of chemicals and chemical products	2.23	2.75	1.95	2.02	2.20	1.99
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.94	0.82	2.24	1.92	4.02	3.04
22	Manufacture of rubber and plastic products	2.45	2.76	1.61	1.59	1.00	0.88
23	Manufacture of other non-metallic mineral products	1.19	1.17	0.64	0.66	0.31	0.31
24	Manufacture of basic metals	2.48	2.56	1.75	1.77	0.76	0.62
25	Manufacture of fabricated metal products, except machinery and equipment	1.86	1.94	1.50	1.42	0.77	0.67
26	Manufacture of computer, electronic and optical products	0.82	1.01	1.67	1.69	2.01	1.21
27	Manufacture of electrical equipment	2.64	2.40	1.63	1.49	1.33	1.04
28	Manufacture of machinery and equipment n.e.c.	1.79	2.08	1.44	1.45	1.14	0.94
29	Manufacture of motor vehicles, trailers and semi-trailers	0.95	1.20	0.75	0.59	0.48	0.25
30	Manufacture of other transport equipment	0.78	0.73	0.81	0.80	0.24	0.22
31	Manufacture of furniture	0.81	0.76	0.95	0.97	0.24	0.23
32	Other manufacturing	1.22	1.33	0.84	0.94	0.69	0.69
33	Repair and installation of machinery and equipment	1.57	1.35	1.25	1.02	1.01	0.79
35	Electricity, gas, steam and air-conditioning supply	0.61	0.51	0.89	0.87	0.90	1.09
36	Water collection, treatment and supply	0.61	0.61	0.36	0.51	0.30	0.41
37	Sewerage	0.64	0.76	0.86	0.79	0.59	0.55
38	Waste collection, treatment and disposal activities; materials recovery	0.66	0.70	0.74	0.68	0.82	0.70

Table 2.A1.1. Evolution of two-digit location quotients (*continued*)

Code	Class	Bergamo		Lombardy		Milan	
		2001	2011	2001	2011	2001	2011
39	Remediation activities and other waste management services	0.12	1.58	0.80	0.86	1.49	1.10
41	Construction of buildings	1.42	1.59	0.81	0.94	0.46	0.59
42	Civil engineering	1.00	1.29	0.73	0.73	0.67	0.59
43	Specialised construction activities	1.51	1.44	1.02	0.98	0.77	0.71
45	Wholesale and retail trade and repair of motor vehicles and motorcycles	0.87	0.90	0.87	0.90	0.74	0.73
46	Wholesale trade, except of motor vehicles and motorcycles	0.87	0.91	1.26	1.18	1.63	1.41
47	Retail trade, except of motor vehicles and motorcycles	0.78	0.84	0.81	0.82	0.75	0.74
49	Land transport and transport via pipelines	0.80	0.87	0.85	0.87	0.99	1.00
50	Water transport	0.02	0.07	0.14	0.10	0.07	0.18
51	Air transport	0.89	0.15	0.84	1.38	0.82	1.29
52	Warehousing and support activities for transportation	0.92	1.02	1.18	1.22	1.73	1.81
53	Postal and courier activities	0.57	0.53	0.80	0.75	0.97	0.88
55	Accommodation	0.28	0.33	0.52	0.53	0.59	0.58
56	Food and beverage service activities	0.86	0.84	0.91	0.93	0.94	0.99
58	Publishing activities	0.48	0.38	1.93	1.82	4.33	4.06
59	Motion picture, video and television programme production, sound recording and music publishing activities	0.31	0.32	1.06	1.12	2.25	2.07
60	Programming and broadcasting activities	0.19	0.16	0.96	1.41	2.24	3.24
61	Telecommunications	0.26	0.29	0.95	1.00	2.00	2.14
62	Computer programming, consultancy and related activities	0.52	0.59	1.41	1.33	2.67	2.41
63	Information service activities	0.94	0.88	1.27	1.25	1.75	1.73
64	Financial service activities, except insurance and pension funding	0.94	1.01	1.22	1.26	1.81	1.81
65	Insurance, reinsurance and pension funding, except compulsory social security	0.16	0.19	1.61	1.76	3.87	4.20
66	Activities auxiliary to financial services and insurance activities	0.95	0.86	1.07	1.12	1.17	1.37
68	Real estate activities	1.07	1.07	1.45	1.21	1.79	1.28
69	Legal and accounting activities	0.75	0.75	1.00	0.97	1.29	1.20
70	Activities of head offices; management consultancy activities	0.81	0.98	1.64	1.70	3.05	3.14
71	Architectural and engineering activities; technical testing and analysis	0.97	0.90	1.06	1.03	1.37	1.15
72	Scientific research and development	0.37	0.34	0.70	0.76	1.21	1.28
73	Advertising and market research	0.55	0.63	2.04	1.95	4.34	4.03
74	Other professional, scientific and technical activities	1.04	1.01	1.10	1.29	1.09	1.61
75	Veterinary activities	0.55	0.73	0.84	0.94	0.75	0.75
77	Rental and leasing activities	0.73	0.72	1.00	0.91	1.39	1.18
78	Employment activities	1.30	1.45	1.56	1.86	1.92	2.99
79	Travel agency, tour operator reservation service and related activities	0.64	0.64	1.14	1.00	1.82	1.50
80	Security and investigation activities	0.64	0.53	0.96	0.88	1.33	1.06
81	Services to buildings and landscape activities	0.71	0.67	1.01	1.01	1.47	1.46
82	Office administrative, office support and other business support activities	0.74	0.81	1.24	1.19	1.84	1.87
84	Public administration and defence; compulsory social security	0.38	0.40	0.52	0.53	0.54	0.56
85	Education	0.68	0.78	0.69	0.77	0.65	0.67
86	Human health activities	0.70	0.76	0.84	0.90	0.83	0.80
87	Residential care activities	1.01	0.70	1.25	0.79	0.96	0.44
88	Social work activities without accommodation	1.10	0.96	0.91	0.94	0.66	0.85
90	Creative, arts and entertainment activities	0.65	0.49	1.04	1.00	1.67	1.56
91	Libraries, archives, museums and other cultural activities	0.45	0.37	0.51	0.52	0.52	0.74
92	Gambling and betting activities	0.53	0.65	1.09	0.86	1.09	0.81
93	Sports activities and amusement and recreation activities	0.66	0.71	0.74	0.76	0.81	0.76
94	Activities of membership organisations	0.58	0.81	0.73	0.77	0.92	0.81

Table 2.A1.1. Evolution of two-digit location quotients (*continued*)

Code	Class	Bergamo		Lombardy		Milan	
		2001	2011	2001	2011	2001	2011
95	Repair of computers and personal and household goods	0.86	0.75	1.04	1.04	1.09	1.02
96	Other personal service activities	0.87	0.92	0.93	0.95	0.85	0.84
97	Activities of households as employers of domestic personnel	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
98	Undifferentiated goods- and services-producing activities of private households for own use	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
99	Activities of extraterritorial organisations and bodies	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Source: ISTAT (2014a), *Censimento industria e servizi*.

Table 2.A1.2. Activities with more than 1 000 employees and location quotients, Bergamo

Code	Class	Employees Bergamo	Employees Italy	LQ Bergamo
2060	Manufacture of man-made fibres	1 047	3 017	14.91
2351	Manufacture of cement	2 673	7 839	14.65
2733	Manufacture of wiring devices	1 414	6 489	9.36
2420	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel	3 149	17 571	7.70
4719	Other retail sale in non-specialised stores	7 344	48 168	6.55
2712	Manufacture of electricity distribution and control apparatus	3 583	23 772	6.48
2219	Manufacture of other rubber products	3 995	28 977	5.92
3299	Other manufacturing n.e.c.	2 120	17 348	5.25
4799	Other retail sale not in stores, stalls or markets	2 097	23 364	3.86
2894	Manufacture of machinery for textile, apparel and leather production	1 149	14 539	3.40
1414	Manufacture of underwear	1 683	23 320	3.10
4764	Retail sale of sporting equipment in specialised stores	2 499	35 329	3.04
1392	Manufacture of made-up textile articles, except apparel	1 336	19 907	2.88
1320	Weaving of textiles	2 358	35 780	2.83
2363	Manufacture of ready-mixed concrete	1 028	15 666	2.82
2829	Manufacture of other general purpose machinery n.e.c.	4 585	72 228	2.73
2229	Manufacture of other plastic products	4 409	71 015	2.67
2849	Manufacture of other machine tools	1 301	21 068	2.65
2891	Manufacture of machinery for metallurgy	1 343	22 059	2.62
1330	Finishing of textiles	1 707	28 554	2.57
2562	Machining	5 988	101 786	2.53
7111	Architectural activities	1 697	74 021	0.99
9609	Other personal service activities n.e.c.	1 076	47 732	0.97
4782	Retail sale via stalls and markets of textiles, clothing and footwear	1 172	52 691	0.96
7490	Other professional, scientific and technical activities n.e.c.	2 388	111 254	0.92
2512	Manufacture of doors and windows of metal	1 901	88 664	0.92
4511	Sale of cars and light motor vehicles	2 105	103 127	0.88
8623	Dental practice activities	2 052	101 669	0.87
6311	Data processing, hosting and related activities	2 144	107 934	0.85
4771	Retail sale of clothing in specialised stores	4 710	238 396	0.85
9602	Hairdressing and other beauty treatment	4 801	244 867	0.84
6622	Activities of insurance agents and brokers	2 040	104 881	0.84
6920	Accounting, bookkeeping and auditing activities; tax consultancy	4 936	255 151	0.83
7112	Engineering activities and related technical consultancy	3 695	194 129	0.82
5630	Beverage serving activities	6 042	318 968	0.81

Table 2.A1.2. **Activities with more than 1 000 employees and location quotients, Bergamo** (*continued*)

Code	Class	Employees Bergamo	Employees Italy	LQ Bergamo
4520	Maintenance and repair of motor vehicles	3 864	204 315	0.81
4726	Retail sale of tobacco products in specialised stores	1 009	57 891	0.75
3109	Manufacture of other furniture	1 817	105 277	0.74
7820	Temporary employment agency activities	2 808	164 082	0.74
7022	Business and other management consultancy activities	1 612	95 018	0.73
8299	Other business support service activities n.e.c.	2 454	145 942	0.72
5610	Restaurants and mobile food service activities	9 462	563 508	0.72
4711	Retail sale in non-specialised stores with food, beverages or tobacco predominating	7 173	444 792	0.69
4759	Retail sale of furniture, lighting equipment and other household articles in specialised stores	1 628	101 137	0.69
8621	General medical practice activities	1 184	73 696	0.69
8121	General cleaning of buildings	4 968	336 512	0.63
8690	Other human health activities	1 678	113 778	0.63
5629	Other food service activities	1 625	111 563	0.63
1413	Manufacture of other outerwear	1 770	123 296	0.62
4773	Dispensing chemist in specialised stores	1 192	83 580	0.61
1071	Manufacture of bread; manufacture of fresh pastry goods and cakes	1 850	131 647	0.60
8622	Specialist medical practice activities	1 254	89 322	0.60
6910	Legal activities	2 611	218 090	0.51
4931	Urban and suburban passenger land transport	1 006	96 832	0.45
6201	Computer programming activities	1 316	141 616	0.40
5510	Hotels and similar accommodation	1 255	174 779	0.31

Source: ISTAT (2014a), *Censimento industria e servizi*.

Annex 2.A2. Distribution of firms by size class

Table 2.A2.1. Share of firms' local units by size class in Bergamo, 2011

Size class	0	1	2	3-5	6-9	0-9	10-15	16-19	20-49	10-49	50-99	100-199	200-249	50-249	250-499	500-999	≥ 1 000	≥ 250
Total Bergamo	4.89	52.17	15.26	14.96	5.91	93.19	3.20	0.92	1.84	5.95	0.53	0.22	0.03	0.79	0.05	0.02	0.01	0.07
A. Agriculture, forestry and fishing	7.41	51.11	17.78	18.52	2.22	97.04	0.74	0.00	1.48	2.22	0.00	0.74	0.00	0.74	0.00	0.00	0.00	0.00
B. Mining and quarrying	7.27	23.64	7.27	18.18	12.73	69.09	16.36	3.64	10.91	30.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Manufacturing	2.80	25.92	13.38	20.31	13.47	75.88	9.53	3.29	7.08	19.90	2.54	1.17	0.18	3.89	0.22	0.08	0.03	0.33
D. Electricity, gas, steam and air-conditioning supply	35.44	19.62	5.70	12.66	5.70	79.11	9.49	2.53	8.23	20.25	0.63	0.00	0.00	0.63	0.00	0.00	0.00	0.00
E. Water supply, sewerage, waste management and remediation activities	8.36	22.91	11.27	17.45	14.18	74.18	7.27	3.27	12.00	22.55	2.55	0.73	0.00	3.27	0.00	0.00	0.00	0.00
F. Construction	4.50	57.26	13.53	13.71	5.64	94.63	2.97	0.84	1.27	5.08	0.21	0.05	0.02	0.28	0.01	0.00	0.00	0.01
G. Wholesale and retail trade; repair of motor vehicles and motorcycles	2.32	49.67	20.64	17.31	5.41	95.35	2.39	0.73	1.15	4.28	0.23	0.09	0.01	0.33	0.03	0.00	0.00	0.00
H. Accommodation and food service activities	4.30	40.19	15.77	17.11	9.17	86.53	5.38	1.19	4.53	11.09	1.52	0.52	0.04	2.08	0.26	0.04	0.00	0.30
I. Transportation and storage	3.06	26.32	24.64	29.91	10.24	94.17	3.95	0.60	1.03	5.58	0.13	0.08	0.02	0.23	0.02	0.00	0.00	0.02
J. Information and communication	5.19	55.99	13.32	13.67	5.99	94.16	3.14	0.85	1.30	5.29	0.35	0.15	0.05	0.55	0.00	0.00	0.00	0.00
K. Financial and insurance activities	4.26	49.38	9.28	20.96	8.88	92.76	4.29	0.98	1.38	6.66	0.25	0.15	0.04	0.44	0.11	0.04	0.00	0.15
L. Real estate activities	27.86	51.38	13.49	6.47	0.55	99.75	0.17	0.02	0.05	0.23	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00
M. Professional, scientific and technical activities	2.21	77.45	9.21	7.33	2.28	98.48	0.91	0.14	0.40	1.44	0.04	0.02	0.00	0.06	0.02	0.00	0.00	0.02

Table 2.A2.1. Share of firms' local units by size class in Bergamo, 2011 (continued)

Size class	0	1	2	3-5	6-9	0-9	10-15	16-19	20-49	10-49	50-99	100-199	200-249	50-249	250-499	500-999	≥ 1 000	≥ 250
N. Administrative and support service activities	9.75	47.12	13.76	14.46	5.58	90.67	3.76	1.05	2.61	7.42	1.18	0.51	0.06	1.75	0.10	0.03	0.03	0.16
P. Education	5.30	63.36	12.14	12.80	3.75	97.35	0.88	0.22	0.88	1.99	0.44	0.22	0.00	0.66	0.00	0.00	0.00	0.00
Q. Human health and social work activities	0.64	79.82	9.93	7.41	1.46	99.27	0.29	0.07	0.18	0.53	0.04	0.09	0.00	0.13	0.00	0.07	0.00	0.07
R. Arts, entertainment and recreation	8.36	61.20	11.66	11.25	3.72	96.18	2.27	0.52	0.83	3.61	0.21	0.00	0.00	0.21	0.00	0.00	0.00	0.00
S. Other service activities	1.45	56.50	23.49	14.35	2.56	98.35	1.13	0.20	0.25	1.58	0.07	0.00	0.00	0.07	0.00	0.00	0.00	0.00

Source: ISTAT (2014a), *Censimento industria e servizio*.

Chapter 3

Developing innovation and workforce skills in Bergamo

This chapter focuses on innovation and skills, first analysing trends in investment in research and development, as well as patented innovations. It then examines the role that supply chains and networks play in creating and disseminating innovation and assesses Bergamo's academic infrastructure. Skills, which play a central role in creating and adapting to innovations, are considered in the second part of the chapter, with a particular focus on adult skills and training.

Introduction

Restoring growth and competitiveness will depend upon Bergamo's ability to transition towards higher value-added and technology-intensive activities. Although Bergamo is a relatively strong innovation performer, this performance has stagnated since the early 2000s. There is potential to better link and co-ordinate the activities of small and medium-sized enterprises (SMEs) with those of the university and research institutions. Low levels of educational attainment will need to be addressed to support a transition to higher value activities. This chapter examines these innovation- and skills-related issues to identify ways to help facilitate this economic transition.

On the map of Europe, the most innovative regions form a stylised V-pattern that stops at Italy's northern border. The challenge for Bergamo, Lombardy and its neighbours is to extend that innovation belt southwards so that they can join the ranks of Europe's most innovative regions. Important obstacles they face include a high percentage of non-innovating enterprises, especially among SMEs, and funding constraints, which affect both innovating firms and non-innovators. Lombardy, where the province of Bergamo is located, is one of Italy's most innovative regions, but R&D expenditure has stagnated relative to the national and European averages in recent years. Although the region has seen a significant shift towards more knowledge-intensive and high-technology production, Lombardy ranks only as a moderately innovative region by EU standards, with an aggregate innovation performance of between 50% and 90% of the EU average. The province still has untapped innovation potential. Employment in knowledge-intensive services grew slightly between 2001 and 2011. The more pronounced change was in high- and medium-high tech manufacturing. While in most of Europe, employment in technology-intensive manufacturing dropped, Bergamo retained its specialisation. Medium-sized and large firms have a high propensity for producing innovations. Among smaller enterprises, it is mainly those that are internationally active that tend to be innovators. Small enterprises do, however, constitute the overwhelming majority of businesses active in the province, and only a minority among them sell products internationally.

A key challenge associated with the transition to more knowledge- and technology-intensive production is a lack of general skills in the adult workforce in Bergamo. Many adult workers have few transferable skills. Bergamo's traditional strength in manufacturing used to make school-to-work transitions relatively easy. As a result, young people often joined the labour market as soon as they had completed compulsory schooling, without finishing secondary education or obtaining a degree. They found work and acquired job-specific skills in the workplace. Overall, more than half of the province's employees did not complete high school. The result is a large percentage of employees who are highly skilled in job- or firm-specific tasks but who lack the general skills required to adapt to modern production techniques and to implement innovative practices.

Innovation and growth

Innovation and technological progress are generally believed to be among the main drivers of long-term economic growth.¹ Innovation allows production factors – capital and labour – to be used in new and better combinations, thereby increasing output and ultimately, well-being. In the absence of technological progress, the increase in labour in the economy is the determining factor for economic growth. Given the adverse demographic trend in recent decades, the need to compensate by enhancing the productivity of the existing workforce is even more urgent.

Innovation is more than an invention or an idea. It requires the implementation of the idea in the production process, either as a new product or a new process of providing, creating or marketing that product. Innovation is relevant for delivering both goods and services and often requires the combination of inventions with new organisational structures, work routines or novel marketing. Improvements in police performance – an important public service – in the United States have been attributed to a combination of modern IT infrastructure with new organisational practices.² Investment in new technology makes it possible to analyse real-time geolocalised data, but this can only be used to its full potential if the infrastructure is accompanied by the right incentives for local police forces. Significantly, local leaders are given the required support in resources, but are also held accountable for outcomes.

Innovation is, in part, geared towards introducing new technologies, production processes or internal practices. Often, however, the strongest potential for growth can be found in more modest innovations that allow firms to adapt their processes to examples of better practices in their industry or supply chain and to help these firms advance on the technological level. It can also mean introducing to a firm's market a product that has already been available in other markets. In short, innovation also includes firms' attempts to catch up with the frontier (Box 3.1).

Box 3.1. What is innovation?

Innovation is a broad concept and thus difficult to define precisely. The classical economist's view of innovation is focused on firms and based on the seminal work of Joseph Schumpeter (1934). Schumpeter argued that “creative destruction” – replacing existing technologies and practices with new ones – drives economic growth. This classical view distinguishes between five types of innovation:

1. introducing new products
2. introducing new methods of production
3. opening new markets
4. developing new sources of supply for raw materials or other inputs
5. creating new market structures in an industry.

A guiding principle in all these aspects is that innovation is more than simply an idea or invention, but involves implementing ideas and creating new goods, processes or practices. More broadly, innovation captures planned changes in a firm's activities geared towards improving a firm's performance (OECD and Eurostat, 2005). Equally important is the fact that these changes refer to innovations for the individual firm. Not all innovation pushes the technological frontier and creates something completely new. In fact, in most cases, innovation means adopting and adapting existing technologies or practices.

While the main focus in defining innovation is on firms, the concept is not limited to the private sector. Innovation in the public sector, for example in service delivery or funding investments, is an important mechanism for efficacy and efficiency in the public sector. Similarly, changing demands of the labour market and increased international migration flows require educational institutions to adapt and realign their services to keep pace with national and international developments.

Sources: OECD and Eurostat (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, <http://dx.doi.org/10.1787/9789264013100-en>; Schumpeter, J. (1934), *The Theory of Economic Development*.

Finding concrete and quantifiable measures for innovation is difficult, given the multifaceted nature of innovation and the interaction of different factors required to facilitate it. The main indicators considered in the literature are focused on two aspects. The first is research and development (R&D), for which mainly R&D expenditure and R&D personnel are used. The second is patenting activity. Both of these indicators capture a part of the overall picture, but cannot cover all innovation that occurs in firms. More recently, survey-based indicators have become available. These surveys can paint a broader picture of innovation, and the European Union's Community Innovation Survey (CIS) has made comparable data for the majority of EU member countries available.

Innovation at the firm level is complemented and often supported by local research institutions. The stakeholders who influence the performance of Bergamo's innovation system come from different sectors and administrative levels. Research and development of new products and processes is conducted mainly by the private sector and is supported by private and public institutions and academia. All administrative levels have policies that support innovation, with the initiatives of the Chamber of Commerce at the provincial level, up to the European level and the European Union's Smart Specialisation Strategy. In the academic sector, three institutions – the hospital (Ospedali Riuniti di Bergamo "Papa Giovanni XXXIII"), the university (Università degli Studi di Bergamo) and a private research centre (Laboratori Negri Bergamo) are the main focus of research in the province.

The remainder of this chapter starts by analysing the innovative performance of Bergamo and Lombardy, using data for Lombardy when it is not available at the provincial level. This is the case for R&D measures as well as the CIS. The second part takes a detailed look at the characteristics of innovating firms, followed by a discussion of network effects within the region and across its boundaries. Finally, Bergamo's challenges and opportunities are assessed, in light of its current performance.

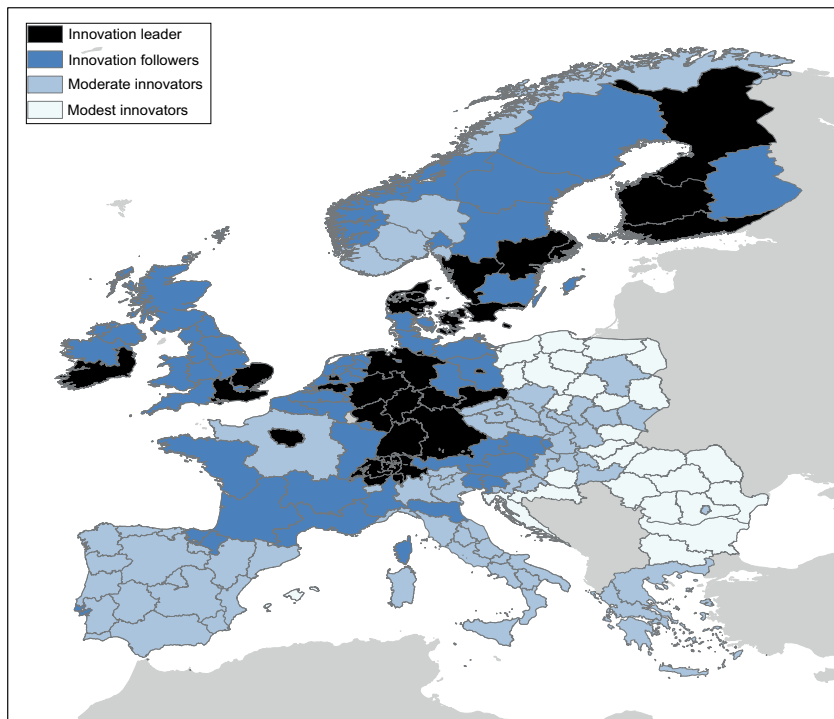
Innovation performance in Bergamo and Lombardy

A first impression can be gleaned from an aggregate measure of innovative capacity, for example the European Union's Regional Innovation Scoreboard (RIS), which combines 11 indicators into a single performance index. The RIS is available for large European regions (Territorial Level 2, or TL2). Under the RIS classification, Lombardy ranks as a moderate innovator, that is, at between 50% and 90% of the EU average, indicating that it has considerable catch-up potential. The same classification applies to large parts of southern Europe and non-peripheral Eastern European regions, and only regions in the eastern fringe lag farther behind the European average. The most innovative regions in Europe are spread out north of Lombardy in a roughly V-shaped pattern (Figure 3.1). The remainder of the section, bearing in mind the objective of transforming this V shape into a Y, will focus on individual aspects of innovation and the corresponding gaps and opportunities.

A large percentage of R&D activity within Italy is located in Lombardy. More than 21% of Italian R&D personnel work in Lombardy, and more than 15% of R&D expenditures are concentrated in the region. This is exactly the opposite of the demographic and economic weight of Lombardy, where 16% of Italy's population is located and which produced 21% of the Italian gross domestic product (GDP) in 2011. The relevance of Lombardy with respect to the number of researchers has been fairly stable over the last two decades, although it went through a slump in the early 2000s, recovering to pre-2000 levels by 2010. R&D investment, however, has been slowly drifting towards other

regions within Italy since Lombardy’s contribution peaked in the mid-1990s (Figure 3.2). The crisis of 2008 saw a slight reversal of the trend, but it is not clear whether this reversal is sustainable.

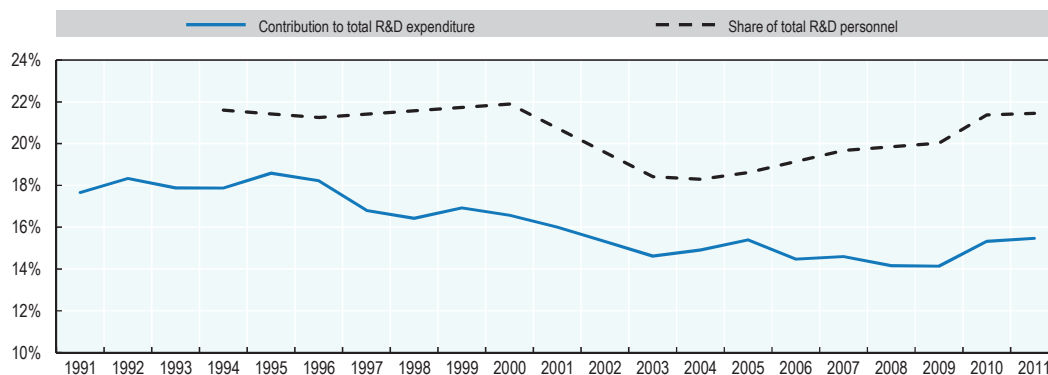
Figure 3.1. Regional innovation performance, 2014



Notes: Regional innovation leaders perform at 20% or more above the EU average. Regional innovation followers are regions that perform at between 90% and 120% of the EU average. Regional moderate innovators perform between 50% and 90% of the EU average and regional modest innovators perform below 50% of the EU average.

Source: EU (2014a), *Regional Innovation Scoreboard 2014*.

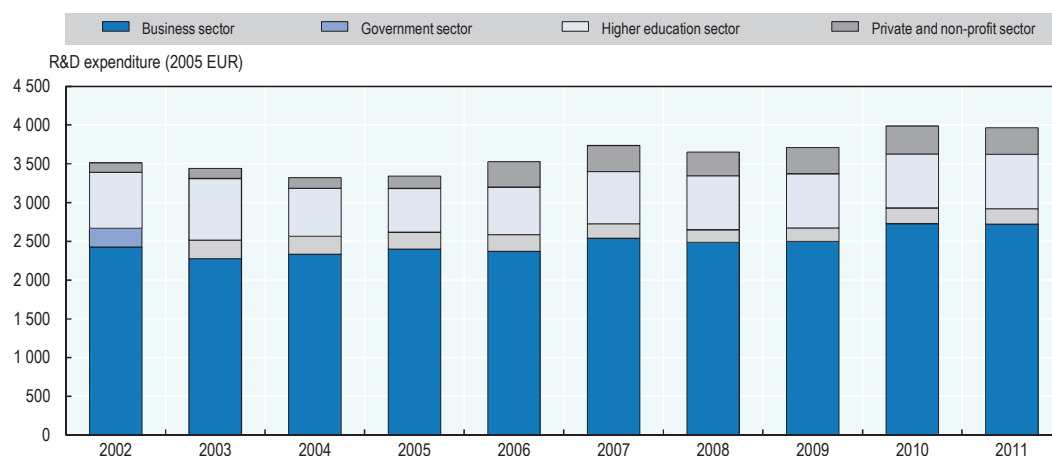
Figure 3.2. R&D contribution of Lombardy



Source: OECD calculations based on OECD (2014a), “Large regions”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-tl2-data-en> (accessed 11 July 2016).

The main contributor to R&D spending in Lombardy is the business sector, which accounts for more than two-thirds of total expenditure. Governmental R&D expenditure accounted for more than 20% of total expenditure in the early 2000s, but has declined to about 15% since 2007 and contributes less than both the higher education sector and the non-profit sector (including private household). After declining in the early 2000s, total R&D expenditure has been increasing in real terms (Figure 3.3). Even though the 2008 crisis resulted in a slight setback, 2011 R&D expenditure exceeds 2002 levels by more than 10%. The two sectors that contributed most to the growth are the private business sector and non-profit sector (including private households). Both governmental and higher education expenditure remained below 2002 levels, but trends in the two sectors prior to 2002 were quite different. While governmental expenditure steadily declined before 2002, expenditure by the higher education sector peaked in 2002, after an increase in excess of 50% since the mid-1990s.

Figure 3.3. Total R&D spending and contribution by sector in Lombardy



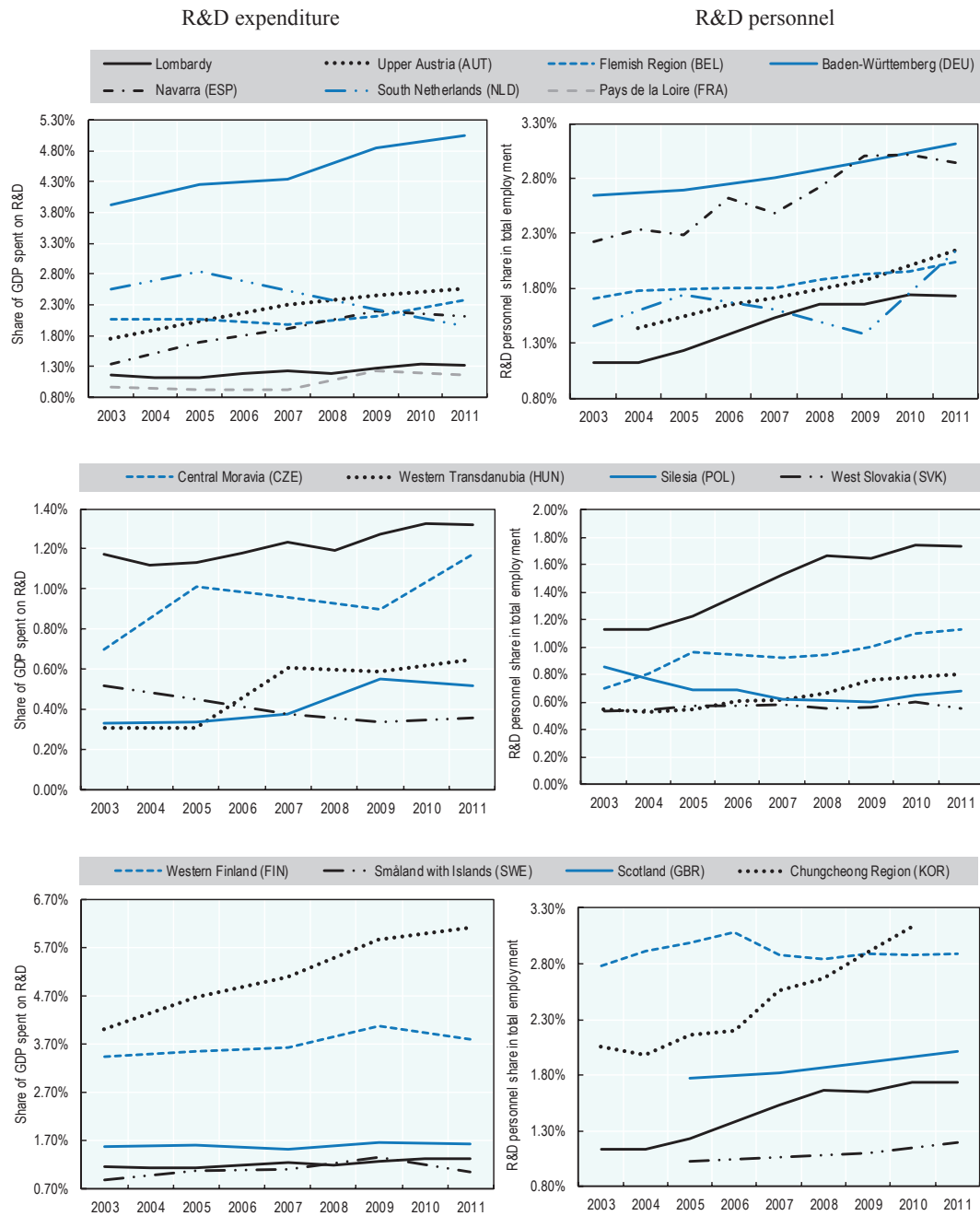
Source: OECD calculations based on OECD (2014a), “Large regions”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-tl2-data-en> (accessed 11 July 2016).

Two groups of regions have been identified to compare with the performance of Bergamo and Lombardy. For Bergamo, the first are OECD Territorial Level 3 (TL3, or small) regions of similar size and industrial structure; and the second TL3 regions of similar urban structure, i.e. a medium-sized city like Bergamo adjacent to a metropolitan area (see Annex 3.A1 for details on the selection of comparison regions). For Lombardy, the TL2 regions that include the selected TL3 comparison regions are selected. As in Lombardy, both R&D expenditure and the percentage of researchers employed increased in most comparison regions. Considerable regional variations nevertheless exist, both in terms of trends and investment levels.

A comparison of R&D inputs in other OECD regions shows that Lombardy, which started at a fairly low level, was not able to significantly improve its position between 2003 and 2011. Excluding Eastern Europe, most regions have investment levels of at least 1.7% of their GDP – some exceeding 3% – to Lombardy’s 1.3%. Only manufacturing regions in Eastern Europe remain consistently below that level, and meanwhile, Eastern Europe has started to catch up. The Czech region of Central Moravia, for example, saw an increase in R&D spending from 0.7% to 1.1% of GDP – an increase of more than 50% – in seven years. The emerging picture is similar for R&D personnel, albeit with a

slightly smaller gap between Lombardy and other southern and western European regions (Figure 3.4).

Figure 3.4. **International comparison for R&D expenditure and personnel (industrial structure comparison group)**

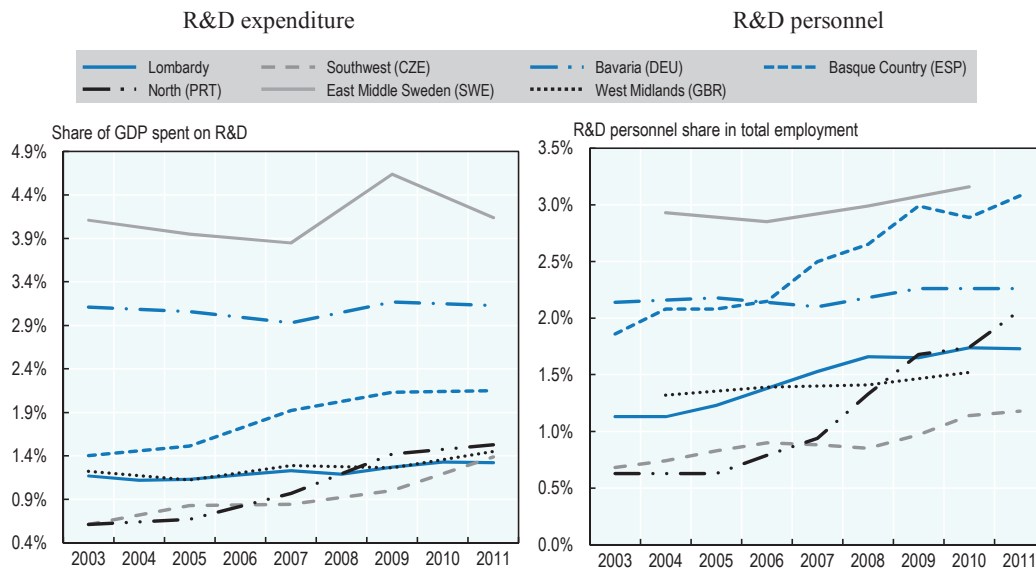


Note: The solid black line denotes values for Lombardy.

Source: OECD calculations based on OECD (2014a), "Large regions", *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-tl2-data-en> (accessed 11 July 2016).

The diverging trend between Lombardy and other large regions is even more pronounced when comparing regions of similar urban structure. In 2011, Lombardy had the lowest R&D expenditure percentage of the seven regions considered, even though the Southwest region in the Czech Republic and the Northern region in Portugal had expenditure levels significantly below Lombardy's in 2003 (Figure 3.5). In terms of employment, researchers still make up a larger percentage of the workforce in Lombardy than in the West Midlands (England) or the Southwestern region (Czech Republic), but the general pattern suggests that other regions were more successful in using their urban structure to its full potential.

Figure 3.5. **International comparison for R&D expenditure and personnel**
(urban structure comparison group)



Source: OECD calculations based on OECD (2014a), "Large regions", *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-tl2-data-en> (accessed 18 July 2016).

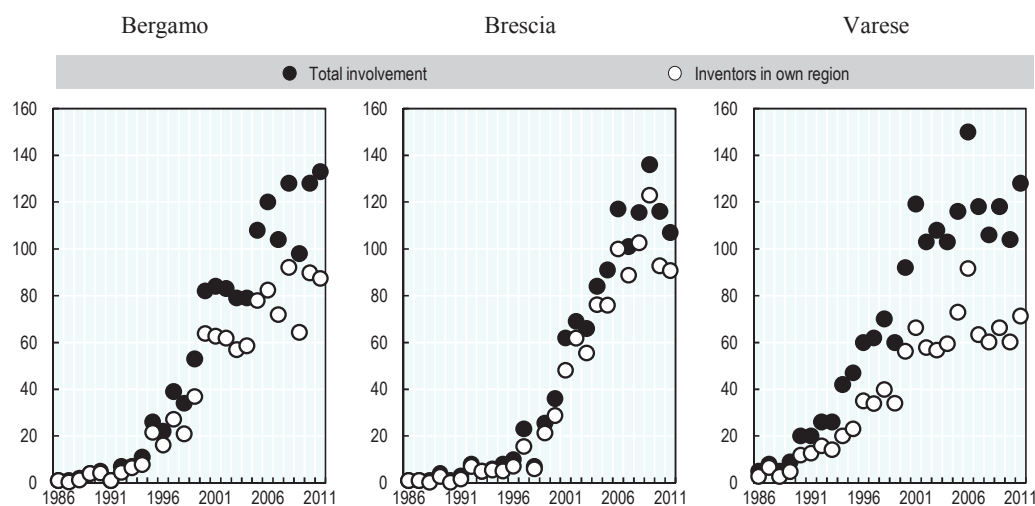
Patenting activity has surged in Bergamo

R&D expenditure and personnel capture some aspects of the innovation process but are unlikely to reveal the whole picture. Tax incentives, or the lack thereof, can influence firms' decisions to enter expenditures as R&D in their books and therefore create a misleading picture in expenditure comparisons. The number of research personnel is less prone to this bias, but suffers from its own complications. An alternative is to consider patents. Depending on the purpose of the firm, a patent might be the outcome, e.g. for research institutions that create patents to license or sell them to other companies. But a patent might also be an intermediate input in the innovation process. When the Apple iPhone was introduced in 2007, it included inventions that led to more than 200 patent filings (Jobs, 2007). While patents are a useful and easily quantifiable measure, they involve some potential drawbacks. For example, they tend to be commonplace in large firms, but smaller firms can be deterred by the cost of filing for them. Other reasons can also prevent a firm from filing patents. Their products may be highly customised and thus naturally protected from competition. Pressure from key partners in the supply chain can

also stop firms from protecting their intellectual property rights in order to avoid conflict and potentially lose major clients.

Despite these potential drawbacks, international patenting activity has surged in the last decades. The trend in filings by inventors from Bergamo follows the pattern. While there were barely any filings under the international Patent Co-operation Treaty (PCT) during the 1980s, the number increased to 50 patents by the end of the 1990s and averaged around 80 to 120 patents in each year in the early and late 2000s respectively. A second common trend is reflected in Bergamo. Co-patenting, the joint filing of patents by several inventors, is becoming more prevalent, as is co-operation across regional – and even national – boundaries. In the latest years for which data are available, around one-third of the contribution to patents with Bergamese inventors came from outside Bergamo (Figure 3.6, left panel).

Figure 3.6. Patenting activity in selected Italian provinces



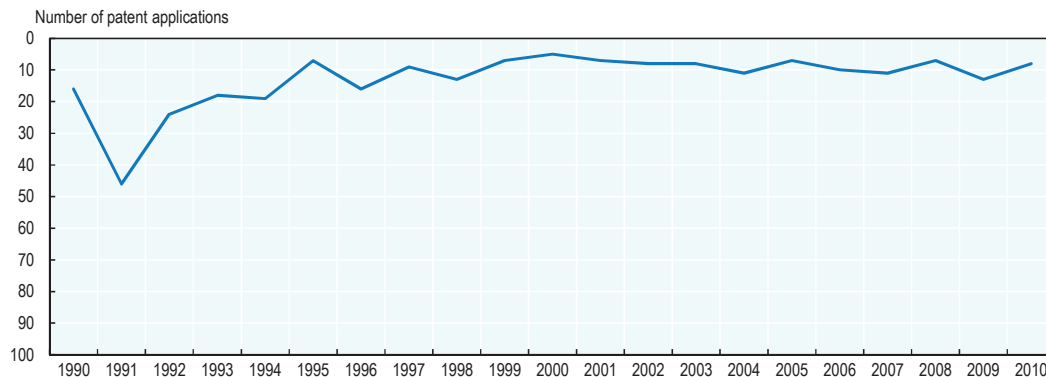
Note: Inventors in own region measures the fractional count of patents filed under the Patent Co-operation Treaty (PCT) and priority date. Total involvement counts all patents with at least one inventor from the province. There is a lag between an invention and filing for international recognition under the PCT. The priority date corresponds to the first filing worldwide and is thus closest to the invention date.

Source: OECD calculations based on EPO (2014), *Worldwide Patent Statistical Database*.

Both the total number of patents and co-patenting activity increased after the 1980s, but Bergamo's development was uneven. A steady increase in the number of innovating enterprises was accompanied by surges when innovative medium-sized and large firms applied for a relatively large number of patents in a single year. The trend for Bergamo suggests that the rapid expansion of patenting in the 1990s has come to an end. Other Italian provinces show similar trends. In Lombardy, the provinces of Brescia and Varese have comparable levels of patenting activity. While this is driven by a strong network of out-of-region collaborations in the case of Varese, inventors in Brescia work almost exclusively with local collaborators (see Figure 3.6, right and centre panels). The slowdown in patenting since the onset of the crisis was typical across Italy. Relative to the other 107 Italian provinces, Bergamo has improved its innovative position, as measured by patents, since the early 1990s. In 10 of the 16 years from 1995 to 2010, it

ranked among the top 10 patenting regions in Italy and among the top 15 in all but one year, a clear improvement on its lower rankings in the early 1990s (Figure 3.7).

Figure 3.7. Bergamo's rank among Italian provinces in terms of patent applications



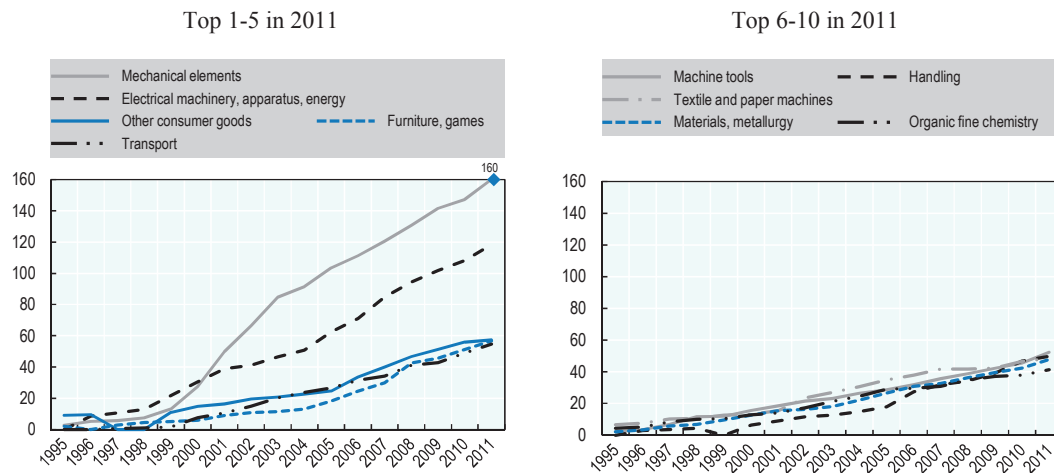
Source: OECD (2014b), “Small regions”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-tl3-data-en> (accessed 18 July 2016).

A basic quantitative measure, like the number of patents filed, can overstate the increase in innovative activity. Not all inventions filed as patents create value, or an innovation. In 1994, for example, a patent for a rubber ladder to help spiders escape from a bath or basin was filed in the United Kingdom.³ A possible way to qualify patents is to consider their technological fields. Both specialisation and technological intensity of innovative activity within the region can be assessed in this manner. Based on the patents' detailed technological classification, 35 technology groups are identified.⁴ These categories are not exclusive: a patent for software that models complex proteins can fall into different technological categories. In Bergamo, two medium-high tech sectors – mechanical elements and electrical machinery – dominate the picture. The cumulative stock of filed patents has increased steadily since the early 2000s (Figure 3.8). Patenting in typical high-tech fields such as biotechnology, ICT, medical technology, nanotechnology and pharmaceuticals, is limited, including only organic chemistry among the top 10 patent fields.

Innovation in the business sector

Few firms patent and a minority of firms perform R&D themselves. In Lombardy, less than 20% of all firms with more than ten employees develop new products or processes. This percentage is in line with the Italian average but below the median value for European countries (Figure 3.9). The gap between Lombardy and the country averages should be considered a lower limit, given the Lombardy's relative economic strength in Italy. However, pooling all firms ignores the influence of the manufacturing sector in Lombardy's industrial composition. A comparison of data based on manufacturing firms only reveals the focus of innovation in Lombardy. Nearly 30% of its manufacturing firms conduct in-house R&D, a number significantly above the Italian average. The higher percentage, does not, however, constitute more than a midfield position in Europe.

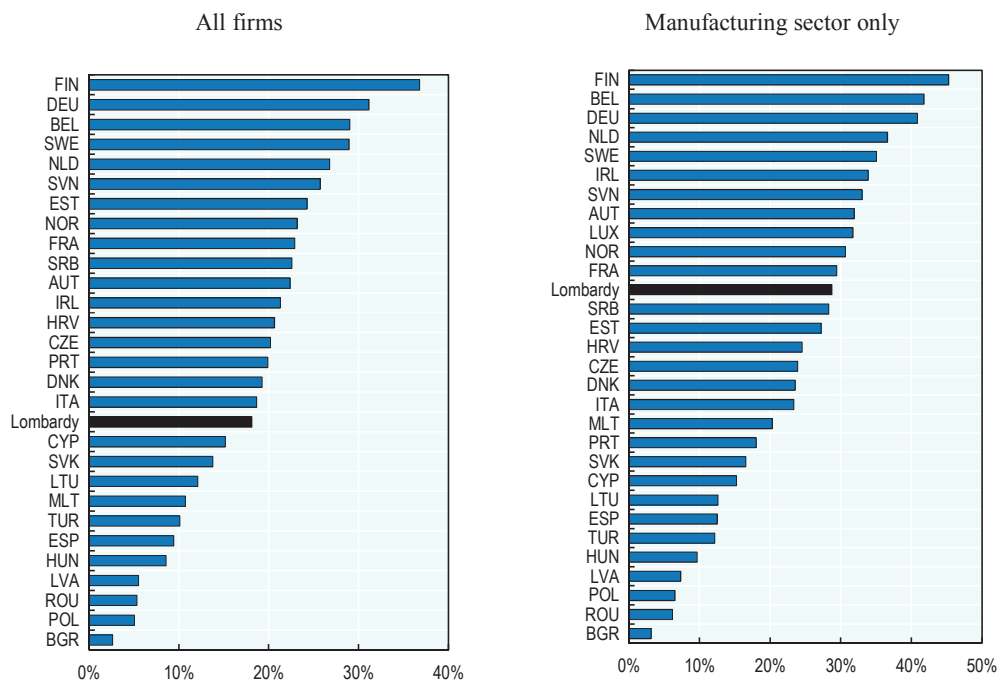
Figure 3.8. Cumulative number of patents by technology field involving inventors from Bergamo



Notes: Cumulative fractional count of patents filed under the Patent Co-operation Treaty (PCT) and priority date. There is a lag between an invention and filing for international recognition under the PCT. The priority date corresponds to the first filing worldwide and is thus closest to the invention date. Technology fields according to the World Intellectual Property Organization classification (last update January 2013, based on Schmoch, 2008). A patent can fall into more than one technology category.

Source: OECD calculations based on EPO (2014), *Worldwide Patent Statistical Database*.

Figure 3.9. Percentage of firms with in-house R&D activity, 2008-10



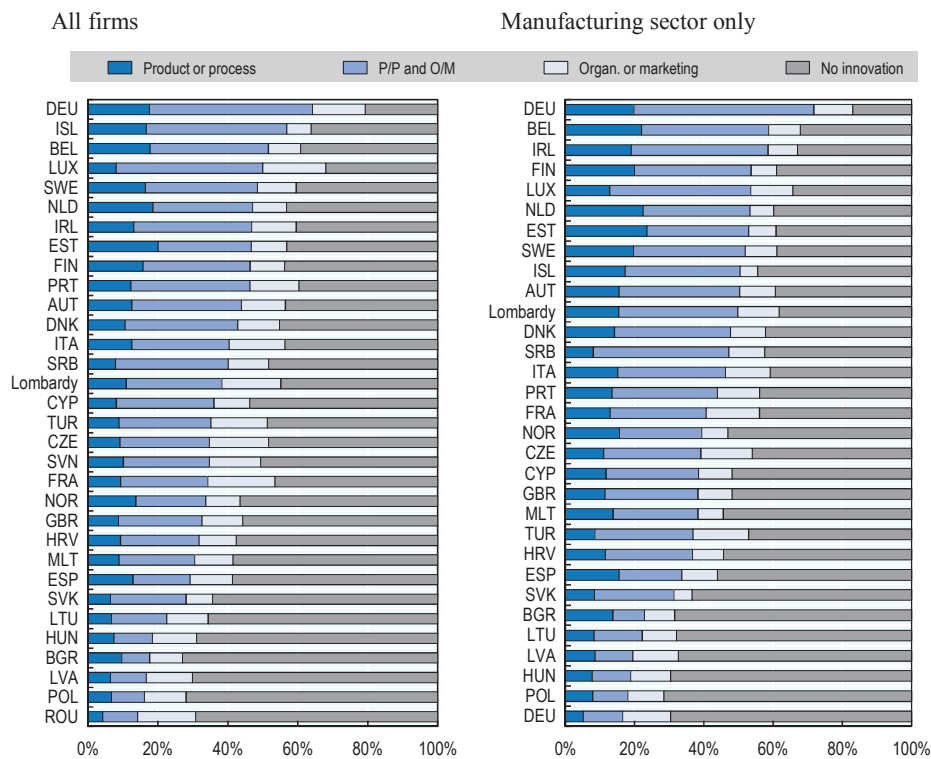
Note: The Community Innovation Survey (CIS) only includes firms with ten or more employees.

Sources: OECD calculations based on EU (2014b), “Results of the community Innovation Survey 2010”, <http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database>; ISTAT (2014a), *Rilevazione statistica sull'innovazione nelle imprese: Lombardia 2008-2010*.

Patents and R&D cover an important part of innovative activity, but innovation in firms extends beyond both. Instead of spending resources on in-house R&D, firms may outsource their research and acquire machines or patents from other companies. For smaller firms that find the cost of establishing in-house product or process development is too steep for them, the option of finding specialised research partners or co-operating with other companies for R&D can be attractive. In addition, not all innovation introduces a new product or production process. It may, for example, involve new ways of marketing goods or services.

In Lombardy, the majority of firms with at least ten employees introduced some innovation between 2008 and 2010. Among manufacturing firms, the percentage of innovators is even higher than among firms in general, and exceeds 60%. Of innovators, about half combine product or process innovation with new forms of marketing or management practices within the firm. In international comparison, Lombardy performs close to the Italian average, occupying a midfield position compared to the 31 countries participating in the EU Community Innovation Survey. Lombardy's ranking also reflects the higher percentage of innovating firms in the manufacturing sector. Among manufacturing firms, Lombardy ranks in the upper third, outperforming the Italian average (Figure 3.10).

Figure 3.10. Percentage of innovative firms, 2008-10



Notes: P/P: Product or process; O/M: Organisational or marketing. The Community Innovation Survey (CIS) only includes firms with ten or more employees. The percentage shows firms that introduced an innovation between 2008 and 2010. Observations are sorted by the percentage of firms that introduced a product or process innovation (regardless of other types of innovation).

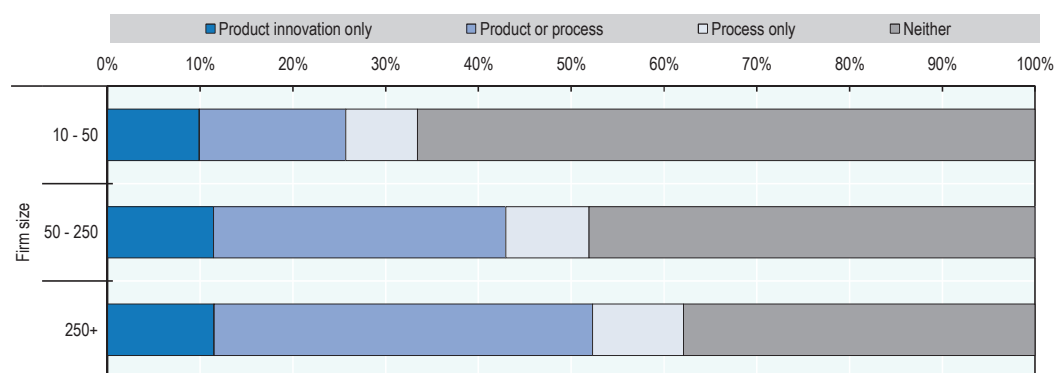
Sources: OECD calculations based on EU (2014b), "Results of the community Innovation Survey 2010", <http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database>; ISTAT (2014a), *Rilevazione statistica sull'innovazione nelle imprese: Lombardia 2008-2010*.

Although a sizeable percentage of firms innovate, a percentage of almost equal size does not. While this is true not only for Lombardy, but across nearly all countries participating in the survey, it is important to keep in mind that Lombardy is one of Italy's economically strongest regions – especially in manufacturing – and comparisons with country averages are likely to exaggerate Lombardy's position. The average also masks variations across firms that help evaluate an area's potential.

Medium-sized firms in Lombardy are an important source of innovation

The size of a firm is important in determining its innovative capacity and activity. Small enterprises are less likely to introduce product or process innovations than medium-sized firms, which in turn are less likely to innovate than large firms. The gap between small and large firms is mainly in the percentage of firms that integrate both new products and processes, rather than focusing on one dimension alone. In Lombardy, the difference between the percentage of large firms with more than 250 employees that introduce either only new products or only new production processes is nearly identical to the percentage of small firms with 10-50 employees. Large firms are twice as likely to introduce an innovation as small firms. The difference between the two groups arises from the big discrepancy in the percentage of firms that innovate in more than one area (Figure 3.11).

Figure 3.11. **Product and process innovation by firm size, 2008-10**



Source: OECD calculations based on ISTAT (2014a), *Rilevazione statistica sull'innovazione nelle imprese: Lombardia 2008-2010*.

Comparing the performance of firms in Lombardy with that of other countries shows that medium-sized firms tend to perform relatively better than either small or large firms. But even among medium-sized firms, Lombardy ranks below the upper third of countries with available CIS data. The rank of firms in Lombardy is slightly higher if only product innovations are considered: small and large firms occupy a midfield position, and medium-sized firms rank 8th out of 29 observed.⁵

Small and young enterprises contribute significantly to innovation and job creation

When considering percentages by firm size, it is worth noting that even though only one-third of small firms innovate, their considerable numbers make these enterprises an important source of innovation. The CIS estimates suggest that the number of small innovative enterprises in Lombardy is nearly 12 200. In contrast, slightly less than

2 700 medium-sized and about 600 large firms are innovators. The variety of new ideas and products created by dynamic small enterprises is therefore highly relevant for the overall growth of ideas. Supporting such firms is an important factor in determining future innovation and overall growth.

In 2001, Bergamo's Chamber of Commerce started a business incubator to support young enterprises (Box 3.2). In 2014, the incubator's facilities were moved to the more extensive science park Il POINT, where more space is available. This made it possible to include manufacturing firms, one of the main sectors of Bergamo's economy, which had hitherto been excluded due to lack of space. This increased the possibility of cross-fertilisation, which was already enhanced by the connection with a broad network of national and international science parks. Firms that participate in the incubator are selected on an annual basis and benefit from shared facilities and services. Within the incubator, firms have access to free and targeted consultancy services and coaching on a range of topics, such as marketing, property rights protection or fiscal law. These are intended to facilitate the transition from innovative concept to marketed product.

Box 3.2. Supporting start-ups in Bergamo: The business incubator at Il POINT in Dalmine

Bergamo Sviluppo (Bergamo Development), a special branch of Bergamo's Chamber of Commerce, supports innovative start-ups in its business incubator. The incubator supports innovative ideas and start-ups in the early phases of activity. The support mainly takes the form of consulting services (such as legal and business services) and workspace that can help to turn innovative ideas into commercial enterprises. Since its establishment in 2001, the business incubator has catered to 124 projects in the trade and commerce sectors, of which about 77% have become successful enterprises. Bergamo Sviluppo has been awarded a national innovation prize for its incubator.

Since January 2014, the incubator has been strategically located at Il POINT (*Polo per l'innovazione tecnologica della provincia di Bergamo*). Il POINT is a science park located in the old industrial plants of the Dalmine manufacturing company. The facilities have been restored and converted for firms operating in advanced scientific sectors, including environmental research, energy, information and communication technology, engineering, logistics and business services. All these activities are in close proximity to the business incubator, which can profit from the services and experience of established firms, and from cross-fertilisation in various scientific disciplines. Firms located in Il POINT can also benefit from the adjacent engineering department of Bergamo's university. This proximity reduces the cost of access to researchers and can help open up synergies between academia and the private sector.

The new location represents an important change for the business incubator. First, it has workspace areas suitable for manufacturing projects, thereby extending the scope of the business incubator to manufacturing, a sector of particular importance in Bergamo. Second, Il POINT has increased the access to and interaction with a wide range of firms and research institutes that can provide valuable support to start-ups.

Sources: Bergamo Sviluppo, www.bergamosviluppo.it/sito/index.php (accessed 18 July 2016); SERVITEC, www.servitec.it (accessed 18 July 2016).

Fostering young enterprises is especially important in creating jobs. The employment growth in young firms is a key driver for overall job creation, as OECD research for 18 countries shows (Box 3.3). The research distinguishes between job creation by small firms according to their age, and can show that it is not small firms *per se* that drive

employment growth, but young, dynamic enterprises. A decline in firm creation rates can therefore be seen as an early warning sign for future problems in the labour market.

Support for firms should be focused on allowing for flexible reallocation of resources towards high-growth enterprises. Employment growth is particularly strong at the top end of the growth distribution. The 10% of fastest-growing firms exhibit growth rates that typically exceed the growth rate in other firms by a factor of five or more. In addition, for both countries and industries, high growth at the top end of the distribution and the rapid decline of firm size at the bottom end coincide, potentially indicating large efficiency gains from reallocating resources.⁶

Box 3.3. DynEmp: Analysing the contribution of firms to job creation

The OECD has collected and analysed a novel database from harmonised micro-aggregated firm-level information from national business registers. This provides new cross-country evidence on the contribution of firms at different ages and sizes to job creation. The DynEmp database contains information on gross job creation and gross job destruction for different groups of firms classified according to size, age and sectoral dimensions, for 17 OECD countries plus Brazil over the period 2001-11. The analysis reveals several important facts:

- Among small and medium-sized enterprises (SMEs), young firms play a central role in creating jobs and enhancing growth and innovation. On average across all countries and years, young firms account for 17% of employment but create 42% of jobs.
- The data show a clear decline in start-up rates in many countries.
- The financial crisis hit young firms particularly hard, but given their larger weight in the economy, most jobs were destroyed by older businesses.

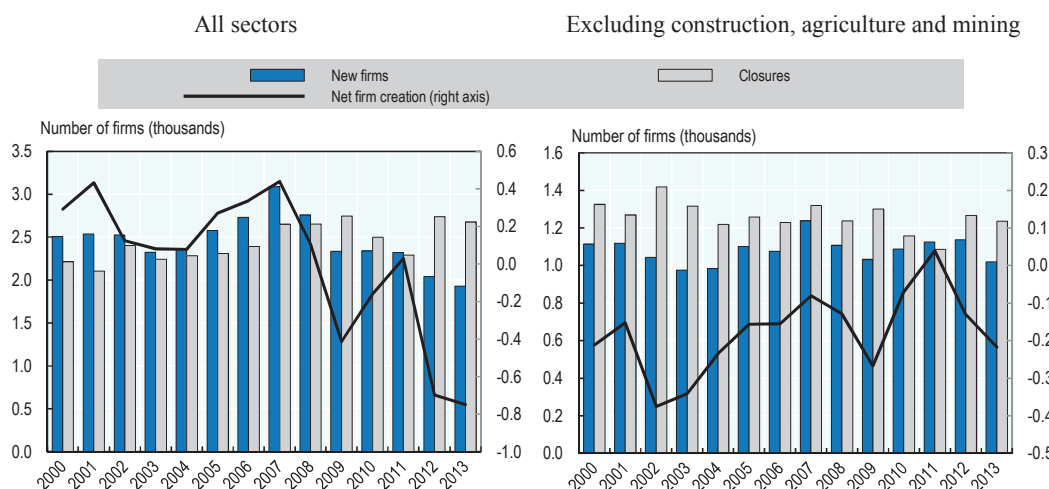
Public policies can help unleash the growth potential of young, innovative firms by enabling them to experiment with new business models and by fostering the reallocation of resources towards the most productive firms. Structural reforms – for example, improving the functioning of product, labour and capital markets, as well as promoting bankruptcy laws that do not overly penalise failure – are essential in this regard.

Source: Criscuolo, C., P.N. Gal and C. Menon (2014), “The dynamics of employment growth: New evidence from 18 countries”, <http://dx.doi.org/10.1787/5jz417hj6hg6-en>.

In Bergamo, net firm creation – the difference between firm openings and firm closures – was positive throughout the early 2000s. A steep decline in new firm creation starting in 2008 – with firm closures remaining fairly constant – has resulted in negative net firm creation since the onset of the crisis, with no respite visible in 2013 (Figure 3.12, left panel). However, the aggregate image indicates an underlying systemic problem.

Nearly half of newly founded firms in Bergamo are in the construction sector – typically a sector that thrives with growth but, for the most part, not an engine for sustainable growth itself. Excluding the construction sector, as well as agriculture and mining, results in a very different picture. With the exception of 2011, net firm creation was negative from 2000 to 2013. A marked decline in new firm openings, coupled with an increase in the number of firms closed in the early 2000s, was followed by a gradual narrowing of the gap between openings and closures. In 2011, the trend led to parity between the two, but the subsequent decline in net firm creation suggests that parity cannot be maintained and that there is a trend reversal towards negative net firm creation.

Figure 3.12. New firms and firm closures in Bergamo, 2000-13



Source: OECD calculations based on data provided by Bergamo's Chamber of Commerce from the local business registry (*Registro Imprese Bergamo serie storica*).

An important challenge for the growth of new firms is fundraising. Access to funds via venture capital is only weakly developed.⁷ The equity market in Italy is among the smallest in the OECD, partly due to barriers on the supply side, but also due to barriers on the demand side. Italy has few venture capital funds, even though the majority of existing funds are based in Milan.⁸ SMEs tend to be reluctant to open up to external investors, partly due to a prevailing loan culture, but also due to the reluctance of family-owned firms to accept external stakeholders. “Angel” funds or business-to-business investment might help overcome some of these limitations. Funding from successful entrepreneurs not only helps with liquidity but introduces knowledge and experience to the firm.

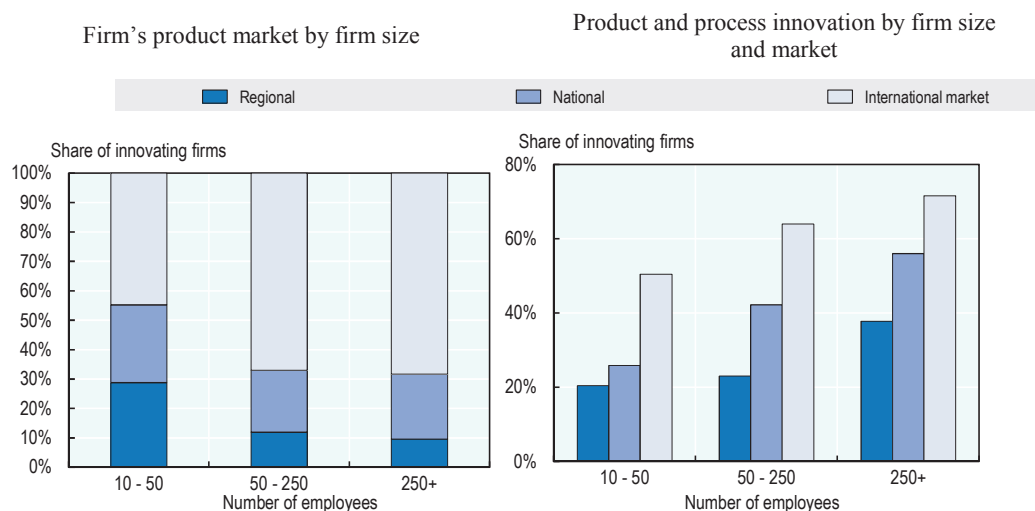
Internationalisation in Bergamo is closely associated with innovation

Firm size and the dynamics of young firms clearly influence innovative activity. Another complementary factor is the market that firms serve. Small firms are substantially more likely than larger firms to sell their products only regionally or nationally. In Lombardy, less than half of firms with 10-50 employees sell their goods beyond Italian borders. Among medium-sized and large enterprises, the percentage is two-thirds (Figure 3.13, left panel). The complementarity of firm size and product market for innovative activity becomes apparent when both factors are jointly considered. While only about one-third of all small firms in Lombardy introduced product or process innovation, the percentage among internationally active small firms is 50%. The same pattern exists for medium-sized and large firms. The wider the scope of the market, the higher the chance that the firm innovates (Figure 3.13, right panel).

One explanation for this effect is competitive pressure. When selling their products on international markets, firms face competition from a wide range of international firms. This can create incentives to innovate. This might seem counterintuitive at first glance. As competition increases, the value of an innovation will depreciate. Other firms will adapt to the latest innovation, and innovators will lose their competitive advantage. Competition also reduces profit margins and the rents of new products or processes. However, it can also have the opposite effect. Since increased competition reduces profit

margins on existing products, firms have an incentive to introduce product variants that create temporary market power and allow for profits, which can be sustained by constantly innovating. These two effects lead to a hump-shaped link between market competition and innovation. Monopolies and firms in highly competitive markets have less incentive to innovate than firms that face moderate competition.⁹

Figure 3.13. **Firms' product markets and innovation in Lombardy**



Notes: Product market is the geographically largest market served by a firm. Product and process innovation refers to innovations introduced between 2008 and 2010.

Source: OECD calculations based on ISTAT (2014a), *Rilevazione statistica sull'innovazione nelle imprese: Lombardia 2008-2010*.

Some evidence indicates that this is true of Bergamo. The province's main exports are basic metals, motor vehicle parts, machinery and equipment (such as lifts), and chemical products.¹⁰ In all these sectors, large or medium-sized firms are active in the province that specialise in specific products for which they compete with a moderate number of international competitors. What unites these firms is a strong integration into global value chains, with both forward and backward linkages, and a strong focus on constantly improving existing and developing new product lines.

Networks and innovation

International supply chains can be a valuable source of information

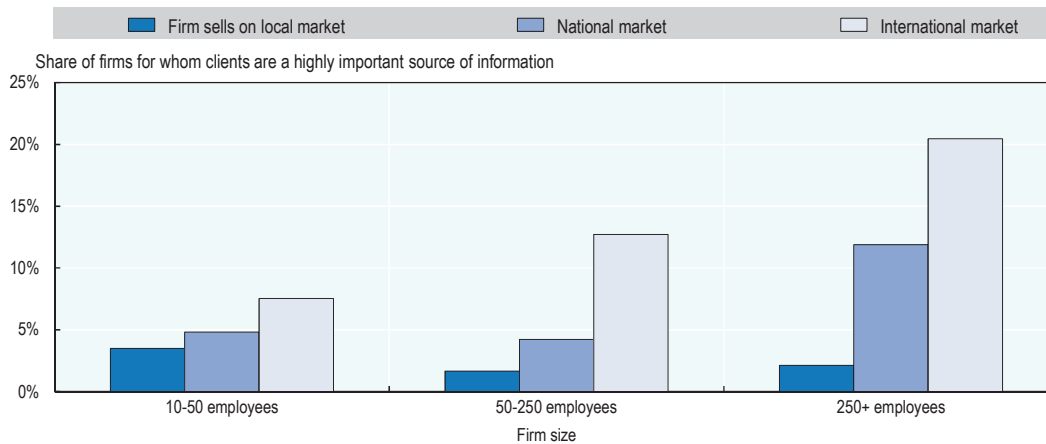
Firms that sell their products internationally can be more innovative out of necessity, as a larger number of producers requires keeping up with – or ahead of – the competition. But they might also be more innovative out of opportunity: having a wider range of clients creates greater opportunities to learn from other firms and adapt ideas from different places to improve their own products or processes.

For example, a company providing highly specialised tools for the production of cars has to adapt its products to the location where the tool will be used and the processes their client has implemented. A production process that is labour-intensive requires different tools from production in an environment where labour costs are high. To be successful in

such an environment requires a strong integration of clients in the design processes. In general, firms that are part of a longer, possibly global, value chain, i.e. firms that do not sell their products directly to individual customers but provide other firms with required inputs, can strongly benefit from integrating both customers and their supply chain into their innovative activity.

In Lombardy, it is mainly firms that sell internationally that report their clients are an important source of information for innovation. Small innovative firms integrate their customer base much less (Figure 3.14). Firms that are only locally active report that their clients do not play any significant role in the innovation process. This is surprising, since sharing knowledge locally is less costly than across long distances, and suggests how important diversity is in creating knowledge.

Figure 3.14. Firms in Lombardy that learn from their supply chain



Source: OECD calculations based on ISTAT (2014a), *Rilevazione statistica sull'innovazione nelle imprese: Lombardia 2008-2010*.

Local knowledge spillovers can contribute to innovation

The academic literature tends to find that local interactions are an important determinant of productivity. Agglomeration economies – the benefits of concentrating economic activity – tend to be highly localised, with some evidence pointing towards cities being able to “borrow” benefits from larger cities close by.¹¹ Traditional production of tradable goods created agglomeration economies by minimising distance and thereby reducing the transport costs between suppliers, producers and customers. Today, other factors that affect firms’ productivity are more relevant. The main factors that explain current agglomeration economies are the sharing of inputs and knowledge spillovers.¹²

Shared inputs, for example the services of a law firm that specialises in rules and regulations for exporting to specific regions, require a critical mass of demand. Suppliers therefore have an incentive to locate close to one another, and other firms in the region can benefit from the local expertise as the cost of accessing the international market becomes less of a burden. Empirical evidence from Spain supports the important role of this aspect of agglomeration economies. Exporters that target difficult markets, i.e. markets with language barriers or uncertain rule of law, show a tendency to locate in clusters within Spain.¹³ The benefit of sharing inputs and the opportunity for workers to specialise can also benefit workers. Those with specialised skills have an incentive to move to such

clusters, since their skills will be valued by a wider range of employers. Cluster formation can be supported by the presence of industrial or science parks.

The province of Bergamo has two science parks, the privately funded Kilometro Rosso (Box 3.4) and the public-private partnership Il POINT (*Polo per l'innovazione tecnologica*). About 1 400 employees work in the former, 250 in the latter. Both parks are expanding their capacity and increasing the number of local partners. Kilometro Rosso has the capacity to grow to about twice its current size, and Il POINT recently added new facilities to expand the space available for manufacturing sector start-ups and young firms.

Both parks are connected to local universities. The University of Bergamo holds a minority stake in Il POINT, which is located next to the university's Faculty of Engineering. It also has a presence at Kilometro Rosso, with interdisciplinary research facilities in mechatronics, bioengineering and an "Entrepreneurial Lab". Kilometro Rosso also houses spin-offs from the engineering departments of the University of Bergamo and the University of Milan (Università degli Studi di Milano), which focus not only on research, but also on product development.

Box 3.4. Cluster building in Bergamo: The Kilometro Rosso Science and Technology Park

Founded in 2003 and opened in 2004, the science and technology park Kilometro Rosso hosts 42 enterprises with about 1 400 employees. It was founded at the initiative of Alberto Bombassei, chairman of Brembo – a global leader in the production of automotive brakes. The R&D facility of Brembo remains the largest single employer in the park. The conspicuous red wall of the park along the A4 highway used to stretch a full kilometre, but the addition of "i.lab", the award-winning research complex for advanced materials and chemicals of the Italcementi Group, the world's fifth-largest cement producer, reduced it by a few metres.

Kilometro Rosso has close relationships with regional academic institutions. It signed a partnership agreement with the University of Bergamo in 2007, includes a spin-off of the University of Milan involved in R&D in advanced ceramic materials, and houses the new biotechnology laboratories of the private Mario Negri Institute. A significant increase in the employment of new university graduates is expected.

The park has not reached capacity and expects to double in size by 2020. Part of the growth is expected to come from the park's incubation projects. Starting with two start-ups in 2009, the number of firms in incubation had increased to seven by 2012.

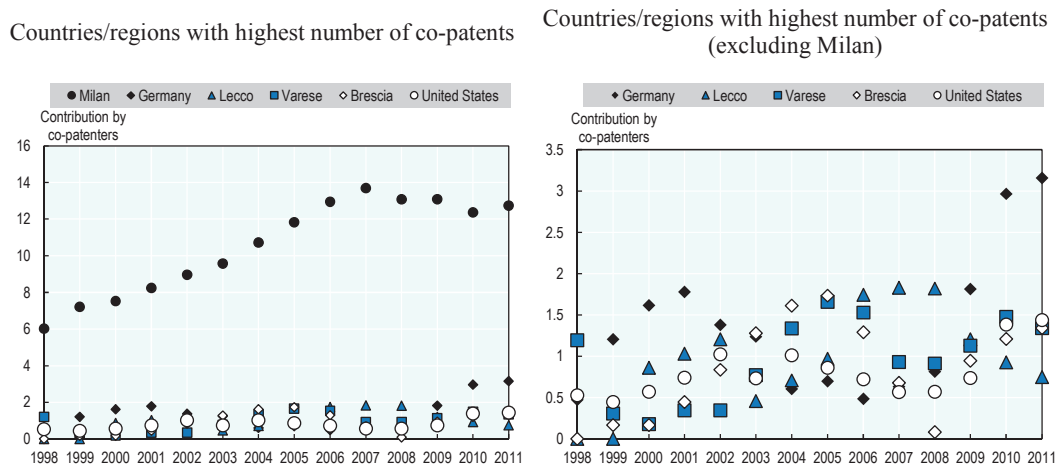
Source: Kilometro Rosso; Italcementi Group, www.italcementigroup.com/ENG/Italcementi+Group (accessed 11 July 2016).

Sharing inputs and knowledge spillovers are increasingly important for modern economies in creating agglomeration economies. Knowledge spillovers, the benefits of learning from local firms or workers, tend to be highly localised, often disappearing within a radius of a few kilometres around the source of knowledge. For example, inventors are more likely to refer to patents filed by other inventors in their neighbourhood than to patents by inventors who live even an hour's drive away.¹⁴

In Bergamo, this localisation effect is apparent in the pattern of co-patenting. The vast majority of collaborations of the province's inventors are with inventors from Lombardy, i.e. the surrounding region. Figure 3.15 shows the aggregate contribution by inventors from outside Bergamo to patents that involve at least one Bergamese inventor. Since the

late 1990s, the contributions by inventors from Lombardy have doubled, from 6 to 12 patents per year. In contrast, the second most important co-patenting region for Bergamo only exceeded an aggregate of two patents in 2010 and 2011. Outside Lombardy, inventors from Germany and the United States are the most important partners for joint inventions.

Figure 3.15. Co-patenting partners of Bergamo



Notes: Contribution by co-patenters is the sum of the fractions attributed to inventors outside of Bergamo to patents with at least one inventor from Bergamo. The figure depicts the three-year moving average of contributions. The figure shows patents filed under the Patent Co-operation Treaty (PCT) by priority date. There is a lag between an invention and filing for international recognition under the PCT. The priority date corresponds to the first filing worldwide and is thus closest to the invention date. Milan, Lecco, Varese and Brescia are all also located in Lombardy.

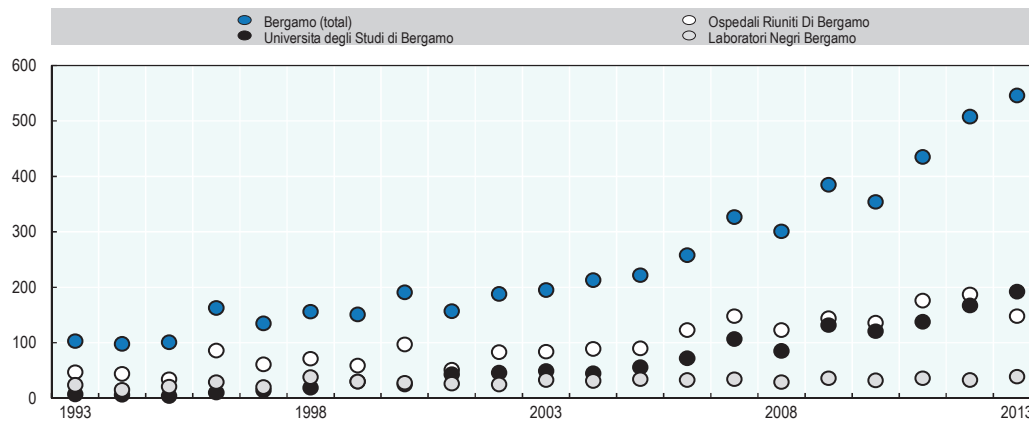
Source: OECD calculations based on EPO (2014), *Worldwide Patent Statistical Database*.

The relationship with Milan is particularly important for innovation in Bergamo. Among the Italian provinces, inventors from Milan account for the largest number of patents in Italy. Their number of filed patents is about twice the number filed in Rome, which has the second-largest number of filed patents. Another important advantage of Bergamo's proximity to Milan is the access it provides to academic institutions in the city. Universities in Milan are top-ranked among Italian universities in fields like medicine, engineering and economics.¹⁵ For firms in Bergamo, this opens a large pool of graduates as potential applicants and reduces the cost of co-operating with academia. This effect comes in addition to the opportunities offered by Bergamo's academic institutions.

Research activities closely rely on networks

Bergamo's academic infrastructure includes three institutions that account for nearly all academic publications in the province: the university (Università degli Studi di Bergamo), the hospital (Ospedali Riuniti di Bergamo) and the private research centre (Laboratori Negri Bergamo). The annual volume of academic output measured by the number of published articles originating in Bergamo has steadily risen since the mid-2000s. The increase has been significant for both the hospital and the university. The number of articles published by authors affiliated with the hospital doubled, and the university's output tripled between 2005 and 2013.

Figure 3.16. Number of academic articles published in Bergamo and its three main research institutions

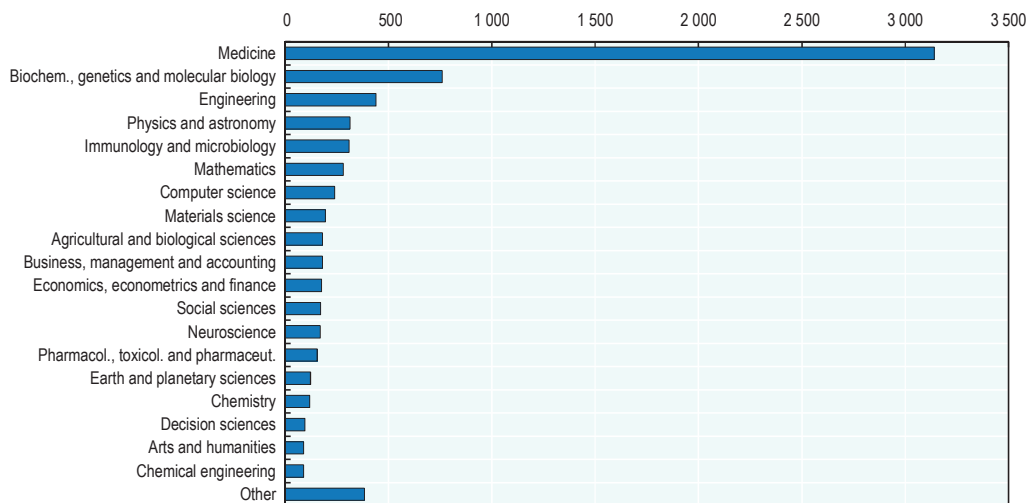


Note: Articles published in academic journals with at least one author with an affiliation in Bergamo.

Source: OECD calculations based on SCOPUS (2014), *Scopus database*, www.scopus.com (accessed 11 July 2016).

The synergy with Milan is most apparent in the fields where Bergamo's research institutions are strongest, which are closely related to those of Milan. Medical science and its related fields, as well as engineering, are the main fields of research. Bergamo's strong academic track record in medicine is not reflected in patenting activity, and medical technology patents play a minor role. One possible explanation is that physicians at the hospital tend also to be affiliated with universities in Milan and that patents are not filed from Bergamo. This also suggests greater potential for local co-operation between businesses and researchers. Given Bergamo's strong manufacturing sector, the relevance of engineering in the region's research output is not surprising and suggests strong local synergies.

Figure 3.17. Academic articles published by authors with an affiliation in Bergamo, by subject area



Note: Total publications 1993 to 2013.

Source: OECD calculation based on SCOPUS (2014), *Scopus database*, www.scopus.com (accessed July 2016).

A university's international links can be leveraged to support local businesses. About 5% of the student body at the University of Bergamo comes from outside Italy. The percentage increased by 25% between 2009 and 2012, and the higher number of courses taught in English is now likely to increase the university's appeal for international students. An OECD example of governmental support for private and academic sector collaboration is a recent initiative by the British government department UK Trade and Investment that aims to link the knowledge of international students, especially their language and cultural knowledge, with local businesses (Box 3.5). This scheme could benefit not only firms, but students, as they gain work experience, possibly abroad, establishing contacts for their future career as they study.

Box 3.5. Creating opportunities: The Postgraduates for International Business service

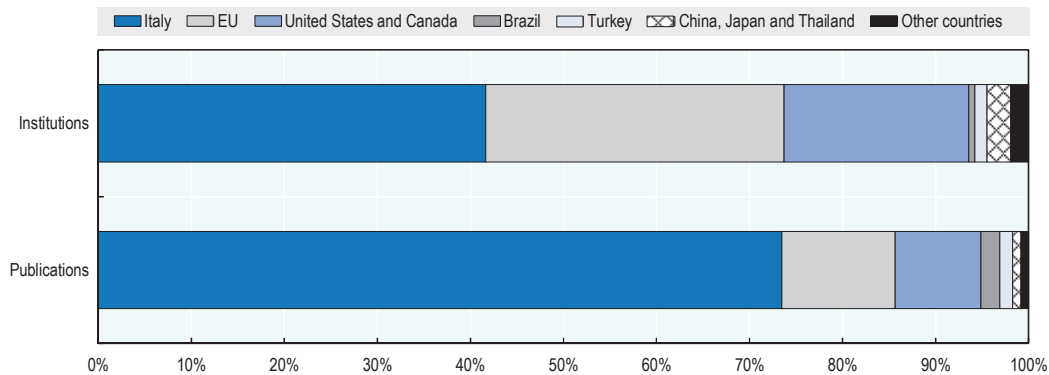
To help firms overcome language and cultural barriers when trying to enter international markets, the British government department UK Trade and Investment has created a service to tap into the potential of the United Kingdom's large pool of international students. Advisers from the department help firms identify whether they can benefit from hiring a student who speaks the language of a potential new export country. If this is the case, the department feeds the firm's job specification to the appropriate higher education institutions and the firm initiates recruitment. The service is aimed at medium-sized enterprises, but is open for all businesses. The student can assist the firm in a range of fields:

- website development
- research on new markets and strategy development
- market visit support
- development of international contacts
- customer/supplier liaison and customer service
- cultural issues
- marketing
- lead follow-up.

University courses are typically delivered in three terms with a significant break. Visa restrictions allow international students to work up to 20 hours during term time and full-time during vacations.

Source: www.gov.uk/postgraduates-for-international-business; www.gov.uk/government/news/postgraduate-students-recruited-to-boost-uk-exports (accessed 11 July 2016).

Researchers' collaborations and affiliations outside their own university are another important source for international linkages of universities. They provide visibility to the university and the regions, as well as learning opportunities on both sides. The main ties of researchers at the University of Bergamo tend to be local and the vast majority are within Italy. Most collaborations are with researchers from Milan's universities. But some reach far further, with many collaborations in Europe and the United States, the main partner in international collaborations (Figure 3.18).

Figure 3.18. **Main affiliations of authors and co-authors from the University of Bergamo**

Note: Affiliations of authors from the University of Bergamo and their co-authors in articles in academic journals, 1993-2013.

Source: OECD calculations based on SCOPUS (2014), *Scopus database*, www.scopus.com (accessed 11 July 2016).

Innovation bottlenecks and drivers

Funding and uncertain demand limit innovation

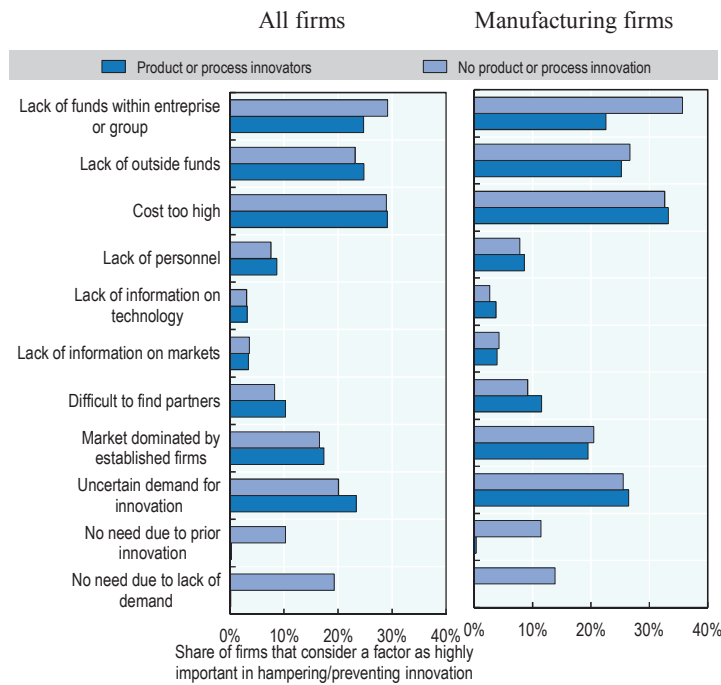
Bergamo benefits from its academic institutions and its access to highly skilled graduates from adjacent provinces. In assessing the obstacles to innovation that they face, fewer than 10% of firms report that a lack of qualified personnel is a concern for their product or process innovation. More often cited as limiting factors are financial considerations – lack of funding or high costs – followed by market conditions, including the dominance of incumbent firms and uncertainty about future demand (Figure 3.19).

It is worth noting that the majority of obstacles reported as highly important in preventing innovation by firms that do not innovate are also considered a hindrance by innovators. Both types of firms perceive the lack of funds or high project costs as a hurdle, but the innovators appear to be able to overcome these challenges. Significant differences among the perceived difficulties arise only in three areas. Among manufacturing firms, a differential between innovators and non-innovators is evident in firms lacking internal funds: 36% of non-innovators but considerably fewer, that is, 23%, of innovating firms, report this factor as a major obstacle. Among firms of all sectors, this difference is less pronounced. The main difference between innovators and non-innovators is their assessment of market conditions. Innovators do not agree that prior innovation or a lack of demand in the market constrains their opportunities.

That there may be a lack of demand for innovation may indeed be true of some markets. But firms often lack information on the value of innovation and the opportunities for it. Impact evaluation studies in several OECD countries where innovation vouchers have been distributed to SMEs have concluded that the external impetus created by the vouchers helped initiate R&D efforts and facilitated co-operation with academic institutions and research organisations. The vouchers also helped raise awareness of the benefits of R&D in SMEs (OECD, 2011a). These results are also true in Lombardy, where SMEs are more likely than large firms to consider a lack of demand as an important reason to forgo innovation. A more pronounced difference – especially

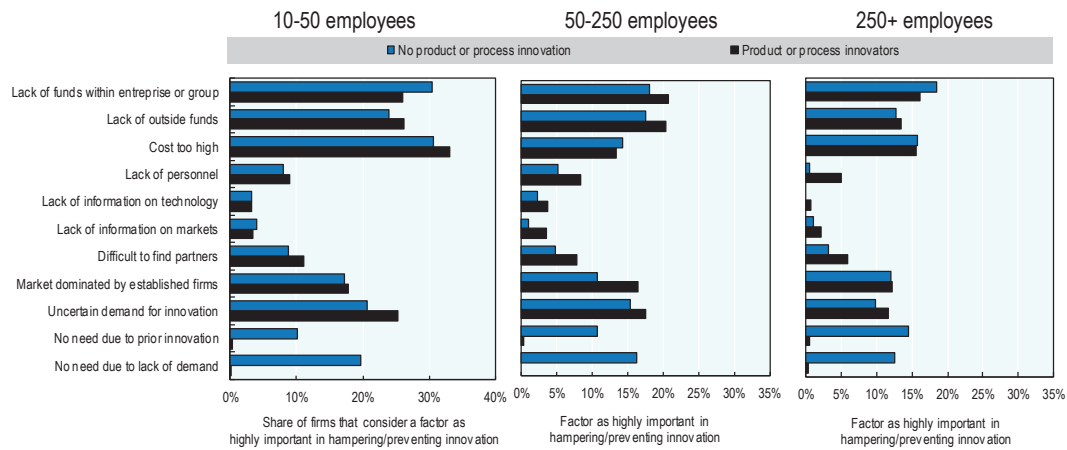
between small and large firms – is, however, apparent in the percentage of firms for which lack of funds inhibits innovation.

Figure 3.19. Factors cited as inhibiting innovation in Lombardy, 2008-10



Source: OECD calculations based on ISTAT (2014a), *Rilevazione statistica sull'innovazione nelle imprese: Lombardia 2008-2010*.

Figure 3.20. Factors that hindered or prevented innovation for firms of different sizes in Lombardy, 2008-10

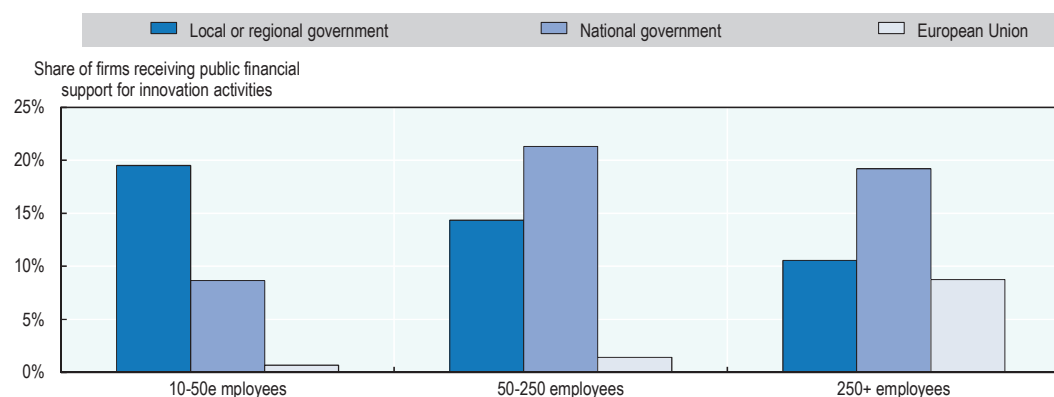


Source: OECD calculations based on ISTAT (2014a), *Rilevazione statistica sull'innovazione nelle imprese: Lombardia 2008-2010*.

Public funds could be better co-ordinated

Public support can help overcome some barriers, but it neither can – nor should – replace firms’ own investments. Around 30% of innovating firms in Lombardy received some form of public financial support for their activities between 2008 and 2010.¹⁶ Important differences arise in the source of support. Subnational governments are the most important source for public funding for small enterprises. National funds are more relevant for medium-sized and large companies. Funds provided by the European Union support only a very small percentage of SMEs and are mainly channelled into large firms (Figure 3.21). Given the relevance of SMEs for the innovation process and the strained budgets of subnational governments, one important challenge is to boost support levels for small enterprises. Incentivising co-operation among smaller firms and providing support structures that help SMEs apply as conglomerates for funds from higher tiers of government can help bridge the financing gaps these firms face.

Figure 3.21. **Public funding for innovation by source and firm size in Lombardy, 2008-10**



Source: OECD calculations based on ISTAT (2014a), *Rilevazione statistica sull’innovazione nelle imprese: Lombardia 2008-2010*.

Accessing European funds demands adequate capacity and also experience of both the application process and the administration of grants. Recipients of grants under the European Union’s Seventh Framework Programme for Research and Technological Development (FP7) have included 45 stakeholders from Bergamo in 69 out of 25 814 projects. The ratio between stakeholders and projects shows that experience and the fixed investment made when applying for EU grants is an important determinant of success. Detailed analysis of the funded projects shows that more than 25% of funded institutions participate in more than one project (Table 3.1). Bergamo’s university alone participated in 11 projects and co-ordinated a 12th.¹⁷ The public sector (the province of Bergamo) and the employers’ associations (Confindustria) have also successfully applied for FP7 funds. Confindustria was the co-ordinating organisation for a project that involved 12 participants from 6 countries and a total contribution under FP7 of EUR 2 113 045. However, less than 8% of the total remained in Bergamo.¹⁸

Pooling interests of innovation stakeholders in Bergamo could help improve its visibility and channel funds towards Bergamo. This is especially relevant for supporting the local agenda at the national and supranational level. The European Union’s Smart Specialisation Strategy, for example, is targeted at the regional level, i.e. at Lombardy. Bergamo therefore needs to ensure that its needs and initiatives are adequately

represented on Lombardy’s agenda. Forums that can promote Bergamo’s agenda include the working groups Lombardy has set up to assess its territory’s technological and innovative potential. Other OECD countries have successfully created similar structures (Box 3.6). Within Lombardy, Bergamo’s university has been acknowledged as a contributor to the region’s overall strategic innovation agenda in three out of seven specialisation areas, and the Kilometro Rosso in one. Both the university and the Kilometro Rosso are part of the research system for “sustainable mobility”. The university is also part of the research systems for advanced manufacturing and “green industry”.¹⁹

Table 3.1. Recipients in Bergamo of funding from the European Union’s Seventh Framework Programme for Research and Technological Development (FP7)

Total projects with participation from Bergamo	Co-ordinated in Bergamo	Participating institutions from Bergamo (more than one project)	Start dates	End dates
69	9	45 (12)	2008-13	2010-17

Source: OECD calculations based on EU (2015), “CORDIS – EU research projects under FP7 (2007-2013)”, <http://open-data.europa.eu/data/dataset/cordisfp7projects>.

Box 3.6. Denmark’s regional growth forums: Public-private advisory councils

Denmark’s local government reform in January 2007 created forums to advise on regional growth initiatives. The growth forums bring together representatives of the business community, knowledge and educational establishments, and the labour market, as well as local and regional authorities. All these actors have first-hand knowledge of the challenges of the business community and the regional conditions for growth. They are responsible for:

- advising on regional business development strategy
- monitoring regional and local growth conditions
- recommending co-financing to the region
- recommending structural assistance
- the bulk of EU regional and social funds in their region.

They also participate in the Danish Growth Council, to ensure coherence between national and regional growth efforts.

Source: www.evm.dk/arbejdsomraader/vaekst-og-konkurrenceevne/regional-vaekst (accessed 11 July 2016).

Civil society can play an important role in innovation

Civil society forms an integral part of the province of Bergamo. More than 100 000 volunteers supported non-profit organisations in 2011, accounting for nearly 3.7% of its GDP.²⁰ Foundations are active in a wide range of sectors, ranging from cultural and heritage preservation, as in the case of the Congregazione Misericordia Maggiore Bergamo, to well-being, such as the Fondazione della Comunità Bergamasca, which has raised an endowment of EUR 16.5 million since its inauguration in 2000. Bergamo’s non-profit sector and private investors have played an increasingly important role in innovation. Among its research institutions, the laboratory of the Mario Negri Institute, a non-profit group founded in Milan in 1962, is now the biggest non-profit private foundation in Italy. The institute has operated in Bergamo since 1984, thanks to its collaboration with practitioners at the province’s hospital.

Culture is an important element in encouraging innovation and entrepreneurship. The visibility of role models and success stories can boost innovative activity by raising interest and awareness. Potential entrepreneurs and innovators can be attracted by well-publicised award schemes (Box 3.7). But to create a substantial and sustained impact on local culture, initiatives should also target future generations. One such initiative in Bergamo is the annual science fair, Bergamo Scienza (see Box 3.12).

Box 3.7. PPP for innovation: The Irish Times InterTradeIreland Innovation Awards

Since 2008, the Irish Times, in co-operation with InterTradeIreland – a support organisation for trade and innovation in small and medium-sized enterprises, sanctioned and supported by the governments of both Ireland and Northern Ireland – has presented firms with the Irish Times' InterTradeIreland Innovation. Industry experts create a shortlist of innovations from the pool of applicants, from which a panel of judges selects winning entries within six categories, as well as an overall winner. The panel of judges consists of entrepreneurs and public representatives. The award comes with a substantive communications and advertising prize package, in addition to a scholarship for an executive development programme.

In addition to the direct benefit to the winning firm, the award also reinforces an overall culture of innovation by raising awareness of the importance and value of innovation. An additional advantage of cross-border projects like the Irish Times InterTradeIreland Innovation Award is the potential to raise awareness of possible cross-border innovation partners and help create a cross-border regional identity.

Sources: OECD (2013a), *Regions and Innovation: Collaborating across Borders*, <http://dx.doi.org/10.1787/9789264205307-en>; www.irishtimes.com/business/innovation/innovation-awards.

Worker skills are critical drivers of innovation. Skilled researchers and brilliant inventors are important, but implementation in the workplace requires both the skill to bring ideas to market and the workforce to adapt. General skills that can be used for more than a specific task or job are vital if workers are to adapt to new technologies, production processes and new markets. A significant percentage of Bergamo's workforce has high specific human capital, but workers are highly specialised and productive in their jobs. International competition and the increasing speed of progress require workers to adapt easily to production processes and products. The next section considers this challenge in detail.

Shifting demand for skills

A traditional manufacturing region, Bergamo must now adapt to the current business environment. Standardised or labour-intensive production today tends to move to countries with cost advantages in factor inputs. Specialised, flexible and cost-efficient production is required, and firms depend on integrating into the global supply chain. This creates pressure to increase the information intensity of the industrial structure. Bergamo's proximity to the economic hub of Milan presents both an advantage and a challenge, a dilemma that other regions in the OECD also face (Box 3.8). On the one hand, its firms and researchers benefit from close ties with their counterparts in Milan, but conversely, agglomeration economies from knowledge spillovers can incentivise firms and workers to move to the big city.

The structure of employment in the province of Bergamo underwent considerable change between 2001 and 2011, slowly shifting production towards more knowledge- and

technology-intensive activities. In 2001, about 137 000 workers were employed in knowledge- and technology-intensive activities, but the number increased to about 153 000 in 2011 (Figure 3.22, left panel). The increase was mainly concentrated in knowledge-intensive services and medium-high technology manufacturing. Employment in high-technology manufacturing has fallen (Figure 3.22, right panel). Employment in medium-low and low-technology manufacturing also fell between 2001 and 2011, a trend offset by a strong increase in less knowledge-intensive services.

Box 3.8. Restructuring and identifying new frontiers in Lower Austria (Niederösterreich)

Lower Austria (Niederösterreich) is a region with a moderate degree of specialisation in high- and medium-technology. It surrounds the knowledge-intensive region of Vienna and borders two EU member countries, the Czech Republic and the Slovak Republic. This has presented several challenges. The proximity of Vienna can undercut regional resources. Meanwhile, at the time these member countries joined the EU, the proximity to them offered regional companies new markets, but also put pressure on jobs, given that labour was now available at a lower cost. Lower Austria's main development challenges lie in developing more value-added and innovative activities, especially within the traditional regional sectors. Regional innovation is seen as a response to these challenges. Since the mid-1990s, regional authorities have thoroughly reworked their priorities, in a series of strategic exercises. The region's innovation strategy now includes the following priorities.

- Knowledge exploitation: The region has developed and fine-tuned an extended network of business support and advisory services that help regional small and medium-sized enterprises access knowledge and develop innovative strategies. Funding “innovation assistants” in companies addresses one bottleneck, the lack of appropriate human resources in smaller companies. A wide range of support services is also available for the creation of new firms: incubators, seed capital and “soft” support.
- Knowledge diffusion: Linkages with the knowledge-intensive region of Vienna are encouraged, and regional actors are encouraged to operate in wider regional networks. Technology centres have a mission to transfer technology. The Innovation Assistant Programme not only improves firms' absorptive capacities but builds connections with graduates' university of origin.
- Knowledge generation: Regional budgets for R&D and technology are low by national standards, but the region is intent on developing technology sources, for example by establishing competence centres.

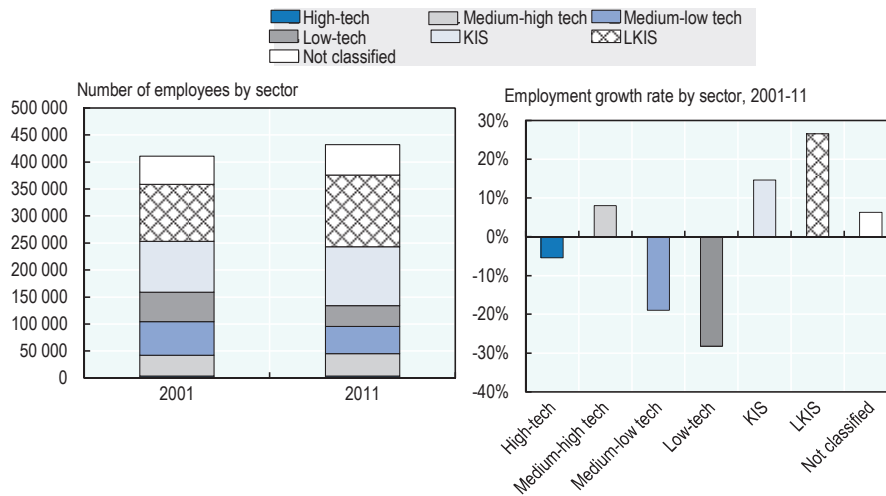
Source: OECD (2011a), *Regions and Innovation Policy*, <http://dx.doi.org/10.1787/9789264097803-en>.

While Bergamo's industrial structure has shifted towards more knowledge- and technology-intensive sectors, it nevertheless lags behind other European regions. Bergamo remains a manufacturing region with technology-intensive producers, but the pace at which its service sector is moving towards knowledge-intensive services is relatively slow. Between 2001 and 2011, the combined percentage of employment in high- and medium-high technology manufacturing remained constant in Bergamo, while it dropped in most European regions. With more than 10% of employees in Bergamo working in high-tech and medium-high tech manufacturing, the province ranks among the top 25 most technology-intensive regions. Bergamo differs in this respect from its surrounding region, Lombardy, which has seen a strong shift away from high-tech employment (Figure 3.23, right panel).

While employment in technology-intensive manufacturing fell throughout Europe, the percentage of employment in knowledge-intensive services experienced a strong upward shift. This was also true in Bergamo and Lombardy, but at a slower pace than in other

regions. By 2011, Lombardy had dropped into the lower half of regions in employment in knowledge-intensive services, and Bergamo ranked among the bottom 20%.

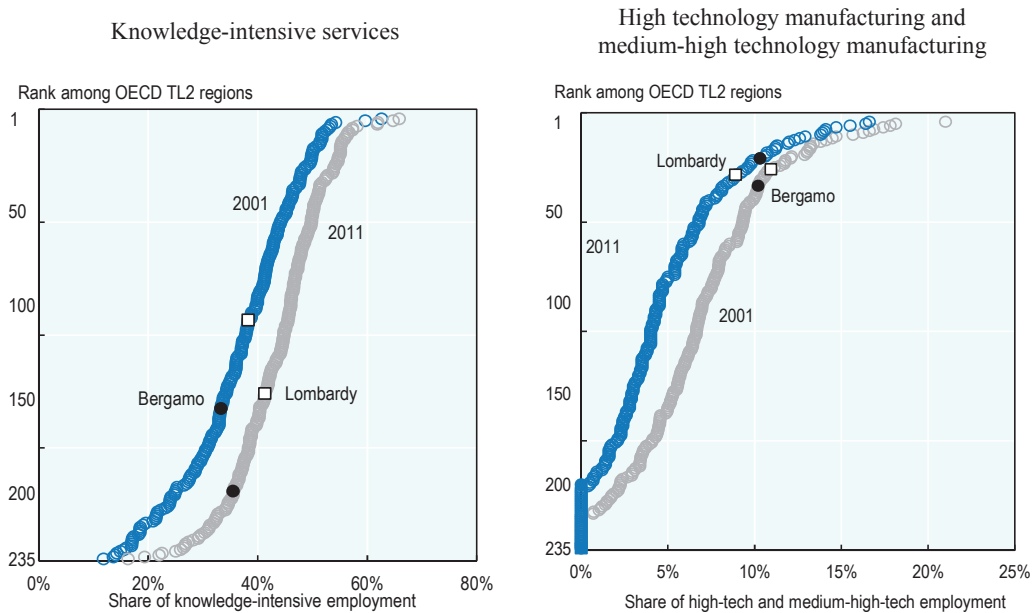
Figure 3.22. Employment by technology and knowledge intensity in Bergamo



Notes: High-tech: high technology manufacturing; medium-high tech: medium-high technology manufacturing; medium-low tech: medium-low technology manufacturing; low-tech: low technology manufacturing; KIS: knowledge-intensive services; LKIS: less knowledge-intensive services.

Sources: OECD calculations based on ISTAT (2014c), *Censimento industria e servizi: 2001 e 2011* and EU (2014c), “Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E)”, <http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database> (accessed 22 June 2016).

Figure 3.23. Percentage of employment in knowledge-intensive services and high-tech employment in European regions, 2001 and 2011



Notes: The figures show the percentage of employment in the respective industries in 2001 (blue) and 2011 (grey) among OECD TL2 regions. Lombardy's position is highlighted in white, Bergamo's position in black. Comparable data at the TL3 level was not available. Bergamo (TL3) is therefore compared to TL2 regions.

Sources: OECD calculations based on ISTAT (2014c), *Censimento industria e servizi: 2001 e 2011* and EU (2014c), "Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E)", <http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database>.

Skills and employment

Technical progress and innovation are essential for long-term growth, but a skilled workforce is also vital. First, skills enhance productivity in their own right. A long-term forecast to raise students' performance, even by a moderate amount, has potential for significant GDP growth. Using internationally comparable test scores from the Programme for International Student Assessment (PISA), one study suggests lifetime benefits for the next generation of school children in OECD countries of about USD 115 trillion, for an average improvement in PISA performance that translates into half an additional school year.²¹

Second, skills are required both to create inventions and to utilise them for innovative products and practices. Researchers and engineers alone are not sufficient; creative or operational skills are needed. Commercialising an idea requires a particular set of skills, and the people best suited to create value from an invention are often not those who originally generated the invention. Finally, technological advances and upgrading of production processes require workers to adapt. In Germany, the last generation of car mechanics began their training in 2003, and since then, apprentices have been trained as mechatronics technicians – acknowledging the need for greater integration between mechanical and electronic skills.

Third, spillovers from increasing the level of highly skilled workers raise employment levels and the productivity of all workers in a region. Estimates for the United States suggest that each additional high-skilled job in the US tradable sector creates 2.5 jobs in local goods and services. Estimates for Europe are slightly lower, but nevertheless substantial.²² Empirical evidence from five OECD countries suggests that the productivity of all workers in a city increases – on average – with the percentage of highly educated workers in the city. An increase in the percentage of university graduates by 10 percentage points is associated with 2.7% higher productivity.²³

The shift in Italy's industrial structure has been accompanied by a shift to a higher percentage of highly educated workers. The percentage of university graduates in the workforce increased by nearly 50% in Lombardy and the country as a whole, from about 13% in 2001 to 19% in 2011. This followed a strong upward trend in the preceding decade. The percentage of university graduates in the workforce in Bergamo is lower than in Lombardy and was lower in 2011. But the increase between 2001 and 2011 was nearly 60%, a rate of increase that is higher than in Lombardy or Italy as a whole (Figure 3.24, left panel).

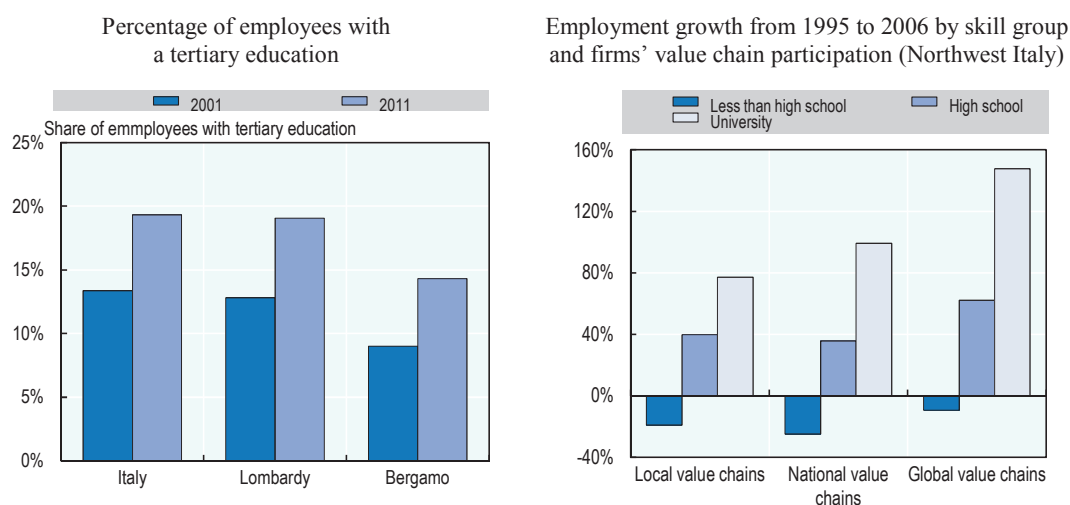
Skill upgrading is not evenly distributed across firms, but is related to their degree of internationalisation. Recent evidence suggests that firms that are part of international value chains increase the employment of highly educated workers. Employment of workers who have not completed high school fell across all firms, but even in their case, the lowest reductions occurred in firms that are internationally active (Figure 3.24, right panel). This suggests both a greater need for skills in globally active firms, as well as a

complementarity between the skills of highly educated workers and those with little formal education, which alleviates pressure on the market for workers without a degree.

The evidence on skills: PISA and PIAAC

Education is indicative of skill, but the two are not synonymous. On average, a higher percentage of highly skilled individuals will also have higher levels of education, but there can also be substantial variations. For a more accurate assessment of the broad concept of skills, survey-based measures are needed. The OECD co-ordinates two large-scale international surveys to assess the skill levels of both students (PISA) and adults (Programme for the International Assessment of Adult Competencies, PIAAC). For Italy, data are available at the regional level, and the PISA test allows for the identification of large cities, so that it is possible to exclude the results for Milan from the regional figures.

Figure 3.24. Educational attainment and (un)employment



Sources: OECD calculations based on ISTAT (2014d), *Censimento della popolazione e delle abitazioni: 2001 e 2011* (left panel) and Cherubini, L. and B. Los (2014) “Regional employment patterns in a globalising world: A tale of four Italies” (right panel).

Significant improvements in PISA performance

In 2006, students in Lombardy's provinces, excluding Milan, performed in line with the average among the 30 participating OECD countries in mathematics, and slightly above the average in science and literacy. The students significantly outperformed the Italian average. Between 2006 and 2009, the gap between the Italian average and Lombardy increased, and Lombardy established a significant lead over the OECD average. The improvement averages around 30 points on the PISA scale, which translates to three-quarters of a year of additional schooling.²⁴ The substantial gains achieved by 2009 were maintained in 2012 (Figure 3.25).

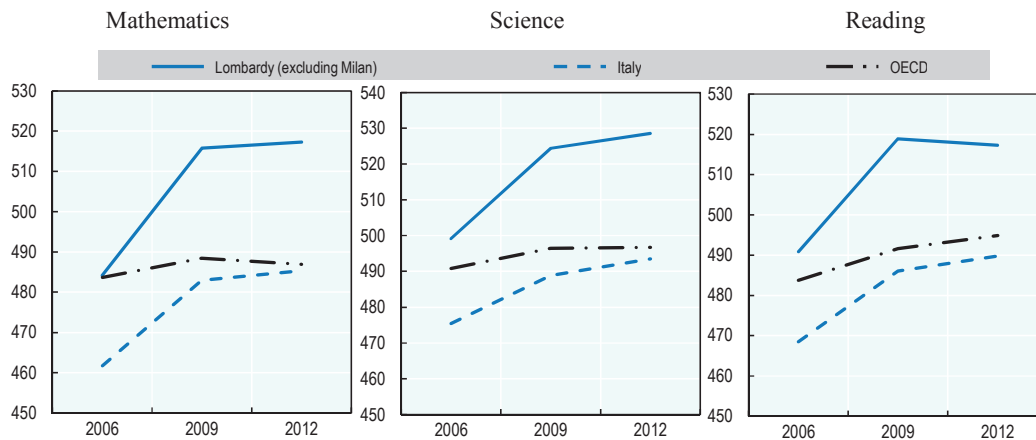
The improvement in student performance was achieved at both ends of the skill distribution. Between 2006 and 2012 in Lombardy (excluding Milan), the percentage of low-performing students dropped by nearly 40%, while the percentage of students in the top two performance categories doubled.²⁵ By contrast, across the OECD, the percentage

of high-performing and low-performing students remained fairly constant. Lombardy's progress in reducing the percentage of low-performing students slowed between 2009 and 2012, but the percentage of high performers increased steadily.

Adult skills remain a concern

A very different picture emerges when adult skills are considered. PIAAC, the adult skills survey, assesses skills in literacy, numeracy and general problem solving in technology-rich environments. These skills are considered “key information-processing competencies”, which are highly relevant for both social interactions and for the workplace.²⁶ As data are only available at the regional level, Lombardy is compared to OECD regions of a similar industrial structure.²⁷

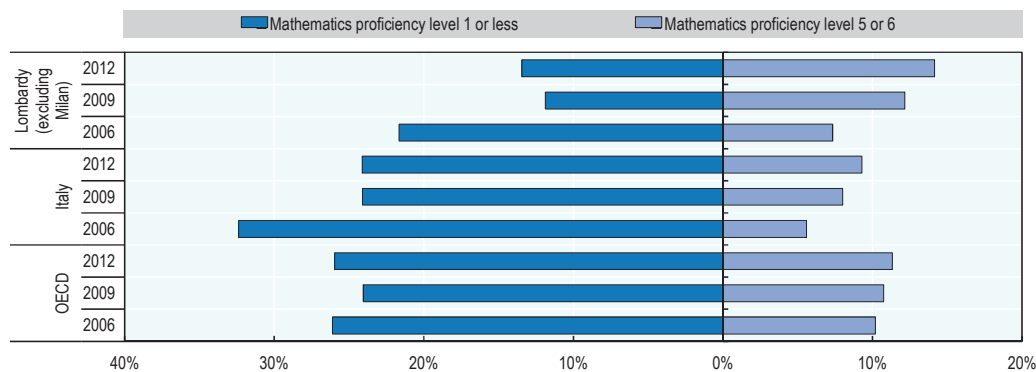
Figure 3.25. PISA results



Note: 2006 OECD average based on results from: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Norway, New Zealand, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. 2009 and 2012 also includes Chile, Estonia, Israel and Slovenia.

Source: OECD calculations based on PISA (2006; 2009; 2012), “Programme for International Student Assessment International Database”, www.oecd.org/pisa/pisaproducts (accessed July 2016).

Figure 3.26. PISA mathematics proficiency



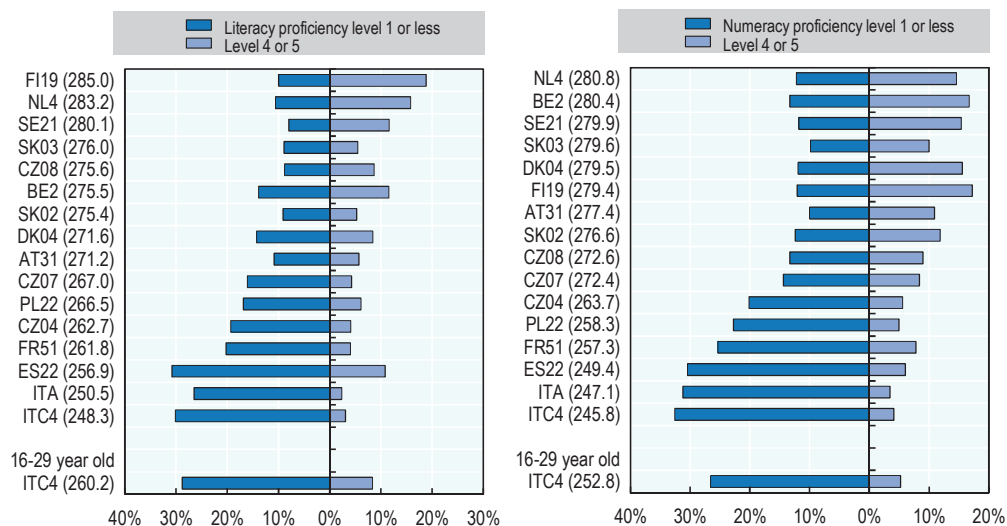
Note: 2006 OECD average based on results from: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Norway, New Zealand, Poland, Portugal, the Slovak Republic, Spain, Sweden,

Switzerland, Turkey, the United Kingdom and the United States. 2009 and 2012 also includes Chile, Estonia, Israel and Slovenia.

Source: OECD calculations based on PISA (2006; 2009; 2012), “Programme for International Student Assessment International Database”, www.oecd.org/pisa/pisaproducts (accessed July 2016).

In both literacy and numeracy, the average score obtained by respondents in Lombardy in 2011/12 was significantly lower than in any other industrial comparison regions. The scores in Lombardy are in line with – although slightly below – the Italian average. The low average comes from both ends of the skill distribution. Very few adults show high levels of proficiency in literacy or numeracy – high proficiency in numeracy is slightly more prevalent – and more than 30% of adults fall into the lowest proficiency category or do not even reach this basic level.²⁸ Restricting the sample to young adults between 16 and 29 years of age yields a marginally better picture, but by no means reflects the strong improvements found for PISA test takers (Figure 3.27).

Figure 3.27. Proficiency in literacy and numeracy of 16- to 65-year-olds, 2011/12



Note: ITC4: Lombardy; ITA: Italy; AT31: Upper Austria; BE2: Flemish Region; CZ04: Northwest; CZ07: Central Moravia; CZ08: Moravia-Silesia; DK04: Central Jutland; ES22: Navarra; FI19: Western Finland; FR51: Pays de la Loire; NL4: South Netherlands; PL22: Silesia; SE21: Småland with islands; SK02: West Slovakia; SK03 Central Slovakia. Average score in parentheses.

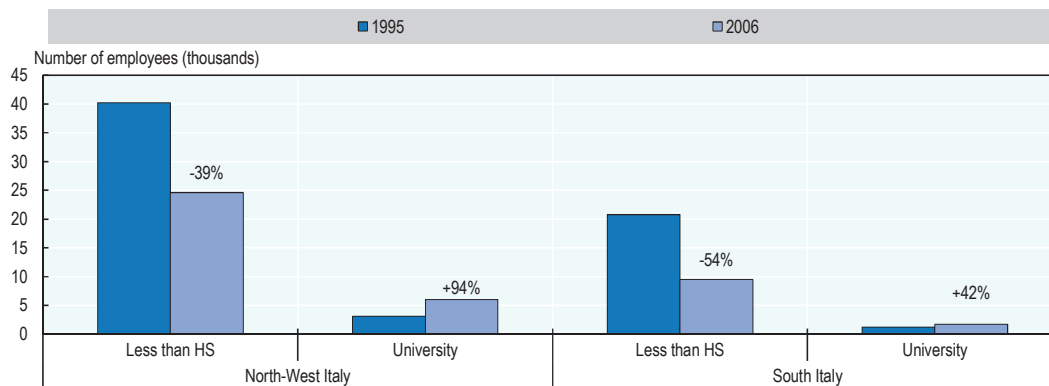
Source: OECD calculations based on PIAAC (2011/12), “Literacy, numeracy and problem solving in technology-rich environments”, <http://dx.doi.org/10.1787/9789264128859-en> (accessed July 2016).

This result needs to be addressed, because the skills assessed in PIAAC are critical in adapting to both product and process innovations, as well as in preparing workers for increased international competition. An example is the change experienced in the Italian fashion industry, traditionally a major sector for low-tech employment, which is particularly relevant in the north of Italy. The developments in recent decades have changed the face of this industry. Textile manufacturing used to be a major sector of employment, especially for low-skilled workers. Changing demand and increased competition from international suppliers have led to a change in the skill composition in the industry. The percentage of low-skilled jobs in firms that participate in the international fashion industry declined by more than 40% between 1995 and 2006. At the

same time, the number of high-skilled jobs (especially in northern Italy) rapidly increased (Figure 3.28). The key challenges in this transformation are providing enough skilled workers and how to compensate for the drop in the total number of jobs.

Formal schooling plays an important role in skill formation and in laying foundations for successful future training. But this foundation has to be supplemented by a process of lifelong learning. Lifelong learning includes both formal and informal training, which is acquired chiefly on the job. The evidence on training received by PIAAC respondents in Lombardy is mixed, however. Within Lombardy, about 30% of the workforce participated in training in the 12 months prior to the 2011/12 survey. This number is comparable to the percentage that received training in the workplace in Bergamo.²⁹ The percentage was 33% in 2011 and declined to about 28% in the following two years. The percentage is evenly split between workers who pursued education beyond high school, workers who finished high school and those who did not. Across the industrial comparison regions, better-educated workers typically make up the bulk of trained workers. Lombardy, however, differs in one important way from most of the comparison regions: the percentage of workers who have never completed high school is roughly 50%, higher than in any of the other ten regions considered. Only 20% of these workers received training. By contrast, in the two regions with the closest percentage of workers with a comparably low level of education – Navarra in Spain and South Netherlands – more than one-third participated in training.

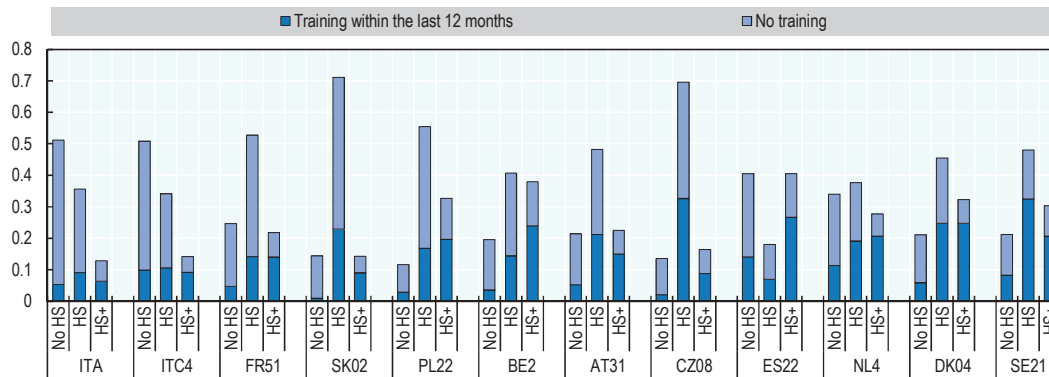
Figure 3.28. Employment from global value chains in the fashion industry



Note: Less than HS: no high school degree; university: university degree.

Source: Cherubini, L. and B. Los (2014) “Regional employment patterns in a globalising world: A tale of four Italies”.

Figure 3.29. Training participation by educational attainment, 2011/12



Note: ITC4: Lombardy; ITA: Italy; AT31: Upper Austria; BE2: Flemish Region; CZ08: Moravia-Silesia; DK04: Central Jutland; ES22: Navarra; FR51: Pays de la Loire; NL4: South Netherlands; PL22: Silesia; SE21: Småland with islands; SK02: West Slovakia.

Source: OECD calculations based on PIAAC (2011/12), “Literacy, numeracy and problem solving in technology-rich environments”, <http://dx.doi.org/10.1787/9789264128859-en> (accessed July 2016).

Organising and financing training can be a challenge for firms, especially for SMEs. A further obstacle to skill development is the lack of incentives for firms to invest in “general” skills. The acquisition of such skills can create opportunities for workers outside the investing firm and create a situation where the firm pays twice for its employee’s skills: first for the training and then again in higher wages to retain its employee.³⁰ The latter challenge can be addressed in different ways. One option is to create the possibility for workers to invest in their own training, and another is to impose training requirements on all firms. Overcoming organisational and financial constraints can be achieved by pooling resources within new or established institutions, as in the footwear sector in Riviera del Brenta (Box 3.9).

Box 3.9. A collaborative strategy to move to higher value-added production in the Riviera del Brenta, Italy

In the Riviera del Brenta industrial district in northern Italy, firms in the footwear sector have pooled their investment in training to compete in high-quality international markets. Meanwhile, they have also collectively upgraded product-market strategies. Not far from Venice, the region traditionally hosted cottage-based industries that mainly employed low-skilled, blue-collar workers. However, the area has now become a global centre for the production of high-quality women’s footwear (supplying Giorgio Armani, Louis Vuitton, Chanel, Prada and Christian Dior) by developing an international brand through the local employers association, ACRIB.

The population of high-skilled workers in design, R&D, management and marketing has been steadily growing in the region over the past two decades. Before the 1993-94 repositioning, almost all workers in shoe manufacturing were blue-collar workers; today, some 40% of workers are blue-collar, while 50% are designers and 10% are commercial staff. Close co-operation with local unions ensured that improvements in productivity were accompanied by wage increases and improved working conditions, particularly in health and safety.

The privately run local polytechnic Politecnico Calzaturiero employs firms’ managers to train local workers and job seekers after hours, while also offering management training, and investing in research, innovation and technology transfer. It thus invests in skills supply while

optimising the use of skills by developing new products and improving human resource management. The fact that firms are members of ACRIB means that they are less concerned about pooling training, technology and new innovations, and more aware that investment in local human capital will improve prospects not only for individual firms, but for the global brand as a whole.

Sources: Froy, F., S. Giguère and M. Meghnagi (2011), “Skills for competitiveness: A synthesis report”, <http://dx.doi.org/10.1787/5k98xwskmvr6-en>; Destefanis, S. (2012), “Skills for competitiveness: Country report for Italy”, <http://dx.doi.org/10.1787/5k9bb1vhzmr2-en>; OECD (2012a), *Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies*, <http://dx.doi.org/10.1787/9789264177338-en>.

Adult learning

Lifelong learning has been identified as an essential component for sustainable growth, and strategies to support learning have been developed in many countries. For Bergamo, the biggest challenge is that a large percentage of the labour force has little formal education. Policies aimed at enhancing the skills of people who left school at an early age and received mainly informal training require a response tailored to the specific situation. Experience from OECD member countries suggests that it is important to offer opportunities that allow for the combination of training opportunities with other public support, in order to guarantee both adequate incentives and time to acquire new qualifications (Box 3.10). In Bergamo, as well as in Italy as a whole, employees who are temporarily made redundant are an important target group for training. These workers remain with their employer, but either work reduced or even zero hours. During this time they receive payments from a wage guarantee fund (Cassa Integrazione Guadagni), without being systematically channelled into training programmes.

Box 3.10. Adult education for adults with low skills

Adults with low levels of education or in low-skilled occupations are less likely to participate in or have the opportunities to participate in adult learning programmes (OECD, 2003). Providing learning opportunities for this group of adults is thus an important policy issue in many OECD countries.

The Basic Competence in Working Life programme (BKA) in Norway, Adult Education Initiative in Sweden and WeGebAU programme in Germany are three examples of such programmes for adults without upper secondary education (Albrecht, van den Berg and Vroman, 2004; Ericson, 2005).

In 2006, the Norwegian government launched the BKA programme, which is now administered through Vox, the Norwegian Agency for Lifelong Learning. It aims to strengthen basic skills in reading, writing, numeracy, and information and communication technologies (ICT). Courses are aligned with competence goals under a Framework for Basic Skills, developed by Vox, and are adapted to the needs of participants. BKA learning activities are often linked with work and other job-related practices. More than 30 000 adults have participated in the programme so far (European Commission, 2011).

The Swedish Adult Education Initiative was implemented in all municipalities in 1997 and ran until 2002, when it became the basis for a municipal adult education and training reform. The programme focused on providing general basic skills, such as Swedish, English and mathematics, at upper secondary level. More than 10% of the overall labour force participated in this programme between 1997 and 2000. Participation in courses provided by the initiative was free of charge. Unemployed participants received supplementary “special education support”, equivalent to unemployment insurance payments, for a maximum of one year. Some studies found that young

men participating in this initiative had better chances of returning to the labour market than those who did not take part in the programme (Albrecht, van den Berg and Vroman, 2004; Ericson, 2005).

The German WeGebAU programme was started in 2006 to provide educational support for workers without certified vocational qualifications and limited skills, and for older workers, to improve their employability. The Federal Employment Agency covers the cost of training courses, travel and lodging. In addition, participants can receive extra unemployment compensation if they are not able to work while they are taking the courses. At the end of the programme, participants receive a recognised vocational qualification or partial qualification. About 340 000 adults have participated in the programme since 2006 (Federal Institute for Vocational Education and Training, 2013).

Sources: OECD (2013b), *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*, <http://dx.doi.org/10.1787/9789264204256-en>; Albrecht, J., G. van den Berg and S. Vroman (2004), “The knowledge lift: The Swedish adult education program that aimed to eliminate low worker skill level”, www.ifau.se/Upload/pdf/se/2004/wp04-17.pdf; Ericson, T. (2005), “Trends in the pattern of lifelong learning in Sweden: Towards a decentralized economy”, <https://gupea.ub.gu.se/bitstream/2077/2735/1/gunwpe0188.pdf>; European Commission (2011), “Country report on the action plan on adult learning: Norway”; Federal Institute for Vocational Education and Training (2013), “Data report to accompany the report on vocational education and training”, <http://datenreport.bibb.de/html/index.html>; OECD (2003), “Upgrading workers’ skills and competences”, http://dx.doi.org/10.1787/empl_outlook-2003-7-en.

Such training opportunities for adults in Bergamo are offered by a variety of institutions. The academic sector, through the university, provides courses, and the Chamber of Commerce offers training on a range of topics, from core skills such as language training or IT skills, to classes in advanced subjects, such as innovation, internationalisation or practical entrepreneurship. For basic adult education, the region’s permanent local centres for adult education (*centri provinciali per l’istruzione degli adulti*, CPIA) offer both school-level education for adults who want to acquire a high school degree (*diploma di istruzione secondaria superior*) and preparatory Italian language classes for immigrants.³¹

While initially focused on lifelong learning activities, the CPIAs and their predecessor institutions (*centro territoriale permanente per l’educazione in età adulta*) have been shifting their target client base towards social inclusion of immigrants since the 1990s. Classes are mainly taught in the evenings, to allow employees to attend classes outside work hours, but because of their institutional design, the CPIAs do not focus on access to the labour market, nor are they connected to employment-oriented training.³²

One of the recommendations of the OECD’s 2001 review of the province of Bergamo was that local initiatives should be pooled into a “one-stop shop” for adult education and training (OECD, 2001). In 2012, in co-operation with the employers’ associations, the Chamber of Commerce created the Bergamo Sviluppo (Bergamo Development) agency to amalgamate in one entity its training activities and activities for promoting business development, innovation and technological transfer, as well as internationalising firms. The newly founded agency pools existing efforts, especially the science park and training activities, under one umbrella. This is a clear improvement that allows for synergies across the three areas. But it is in its early stages and leaves room for further development.

The Chamber of Commerce and its development agency provide training directly, but they could also co-ordinate training opportunities among different agencies. From the perspective of an adult worker, participation in education and further training requires an investment, not only financially, but in terms of time and commitment. Potential students may be deterred if there are too many options to choose from, whose different advantages

may not be clear. A combined database of the province's options for adult training could help create more transparency and identify both potential synergies and areas where effort has been duplicated.

Formal training outside the workplace can play an important part, but most learning occurs informally within firms. To maintain and improve firms' competitiveness, adequate training opportunities and upgrading of skills must be provided, but covering the cost of training can be an obstacle, especially for small firms. The vast majority of firms in Bergamo are small, accounting for about two-thirds of workers in the province. Finding funding for training in SMEs is a key policy challenge. However, while firms tend to be small, they also tend to be part of strong local supply chains. In other OECD countries, such connections have been successfully used to create critical mass in demand for training, using larger firms in the supply chain as catalysts (Box 3.11).

Box 3.11. SME training consortia in Korea

The Korean government finances training grants to enterprises from the employment insurance fund (EIF), under the Vocational Ability Development Programme (VADP). The EIF is funded through a payroll tax on enterprises.¹ The VADP provides subsidies to firms that: 1) conduct in-plant training; 2) assign workers to paid education or training leave; and 3) provide offsite training courses. It also helps employees pursue education and training – including training for older workers – and provides tuition loans. One of the main drawbacks of the VADP is that the prime beneficiaries are large firms; small and micro enterprises benefit much less from it (although they also pay smaller contributions).

Given the low response of smaller enterprises for grant applications, the Korean government is supporting training consortia that involve large enterprises (including multinationals) in organising training for small and medium-sized enterprises (SMEs). The initiative provides an interesting and innovative example of how to tackle low training participation among SMEs.

Under this system, training institutions of large enterprises pool resources to create a joint training centre to cater to suppliers, distributors and subcontractors. This collaboration benefits all partners by increasing the efficiency and quality of training, streamlining the training programmes of partner enterprises, encouraging employees of partner enterprises to participate in training, and ultimately improving product quality. Moreover, training consortia organised by multinational enterprises or technologically advanced domestic firms may facilitate technology spillovers.

Two training consortia established by Samsung Heavy Industries and Volvo are good examples of this initiative. Facing shortages of skilled labour and inadequate product quality among partner enterprises, Samsung Heavy Industries created a joint training facility for its partners. The pilot project began in 2001 by developing and delivering training programmes and materials that reflected the skill demand of partner enterprises. In 2002, 92% of Samsung's partner enterprises participated in the training programme, and 98% of participating individuals completed their courses. The Volvo consortium also pooled training resources to improve the skill level of suppliers and subcontractors. This scheme benefited not only Volvo, by raising the quality of inputs from its suppliers, but also the partner companies (mostly SMEs), by improving their productive efficiency.

Note: 1. Korea adopted a “train-or-pay” scheme in 1976-94, but decided to move towards the new EIF-based scheme, given the low enrolment in training. The train-or-pay scheme initially had some success, but the percentage of eligible firms utilising its financial incentives fell from two-thirds in 1977-80 to less than one-fifth in 1991-93 (OECD, 2000).

Sources: OECD (2005), *Promoting Adult Learning*, <http://dx.doi.org/10.1787/9789264010932-en>, p.63, based on Ra, Y.S., J.H. Choi and S.H. Kim (2005), “OECD thematic review on adult learning: Korea background report”; OECD (2000), *Pushing Ahead with Reform in Korea: Labour Market and Social Safety-net Policies*, <http://dx.doi.org/10.1787/9789264181922-en>.

Enhancing skills and innovation potential

Skills, the creativity required for innovation and the willingness to engage in entrepreneurship are to a large degree intrinsic to an individual's background. The experiences of early childhood and adolescence influence adults' behaviour and attitudes, even into old age. Initiatives that support children's natural curiosity are therefore an invaluable contribution for a region's future prospects. Making science and research accessible to children, as, for example, during the annual science fair in Bergamo (Box 3.12), can help increase interest in these subjects, and reduce the perception that topics or occupations are exclusive to men or women. Another incentive for students to

pursue education beyond the minimum school-leaving age is the university in Bergamo. Attending a local university reduces the cost of higher education and having access to the university locally can create the opportunity to obtain a university education for students who would otherwise consider the cost too high.³³

Box 3.12. Attracting the next generation: The Bergamo Science Fair (Bergamo Scienza)

Founded as a private initiative by a group of friends, Bergamo Scienza (Bergamo Science) is an annual festival aimed at bringing science “to the streets” and to making it accessible for everyone – especially for young people. Following two successful first festivals, the private initiative was institutionalised within its own non-profit association. The association’s work is co-ordinated by several committees and overseen by the board of governors, which is supported by a scientific advisory council. Collaboration with local schools and universities is essential for the association, since its events and initiatives rely on volunteers, mainly from high schools and universities.

The concept of making science accessible has proved highly successful. Starting from 4 events held over 3 days, the association’s flagship festival has grown to 180 events on 17 days in 99 different locations across the province of Bergamo. In 2014, more than 150 000 visitors attended the festival, which included national and international academic speakers – including two Nobel laureates – as well as writers, journalists and entrepreneurs.

Sources: www.bergamoscienza.it/en; www.bergamonews.it/cultura-e-spettacolo/bgscienza2014-record-152-mila-presenze-e-uninondazione-di-tweet-196266.

Utilising the potential of Bergamo’s university

The University in Bergamo can play an important role in adult training. Officially founded in 1968, it has expanded its student body in recent years, bucking national trends. By 2012, the number of enrolled students was almost 15 500. This growth is based on two principles: a strong focus on links with local actors, such as the employers’ associations and the Chamber of Commerce, and a continuous process of intensifying international collaborations and increasing its appeal internationally. The university already offers 20% of its courses in English and aims to increase that percentage to one-third. A key element of this strategy is to bring in academic staff from all over the world.

The university co-operates with the local entrepreneurial community through a number of formal and informal links. Informally, it engages with the local community in over 400 events a year. Formal links include the selection of the university’s board of governors, meetings between the university and the Chamber of Commerce and other industrial representatives, and representation of unions and employers’ associations in committees that decide on academic curricula. As a result of these ties, it has expanded its language department’s courses to Asian and Arab languages at the request of the employers’ associations, and it has increased the focus on practical experience to prepare graduates for the labour market.

The national university reform of 2010 (Law 240/2010) is a key instrument in supporting these ties.³⁴ It provides changes in university management in three key areas: governing bodies, recruitment, and funding and salaries. It stipulates that the university’s board must include at least two external experts with financial or managerial skills. Additionally, it allocates an increasing percentage of funds based on teaching and

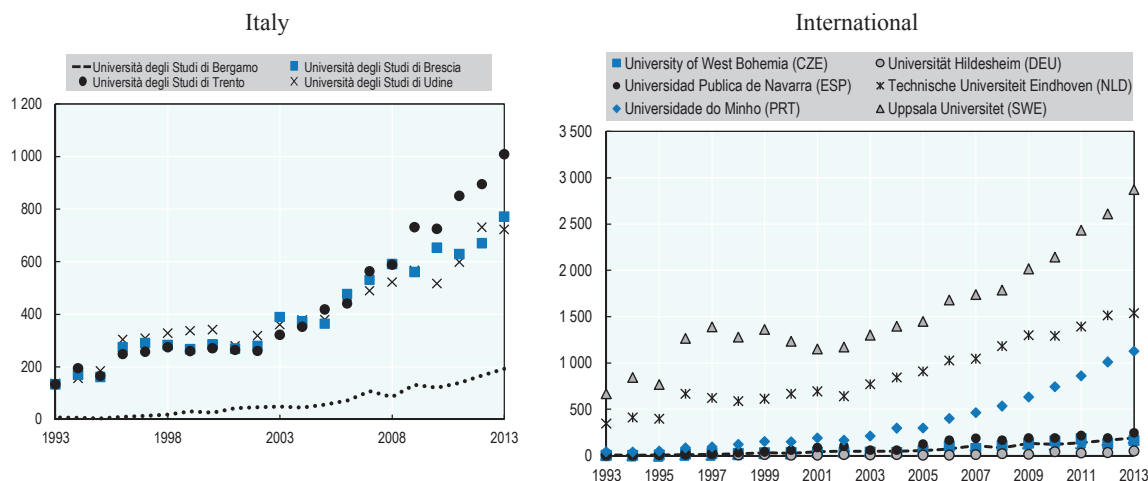
research performance. The reform was intended to enhance institutional autonomy and accountability by better monitoring performance and by linking rewards to performance. While there is room to delegate further powers to the local level, the reform is an important first step and has the potential to create useful incentives to improve the provision of services.³⁵ For the University of Bergamo, the adjustment of the funding allocation is a great opportunity, as it promises to financially reward the university's strong focus on teaching excellence. It is also a challenge, however, given the university's output gap in comparison with other Italian universities of comparable size.

Ties between the academic and the private sector can support firms that are struggling to enhance their competitiveness, as well as leaders in their sector. The demands of firms across the spectrum vary, however. Recent evidence suggests that the impact of collaborations between firms and universities on productivity is stronger on firms that were originally less productive. Collaboration might facilitate technological diffusion by providing the firms access to modern technologies or knowledge, (i.e. researchers), both of which are typically associated with significant costs. When choosing to collaborate, these firms are likely to focus on projects close to their current business model, which means that benefits will manifest relatively quickly. Leading firms, on the other hand, are more likely to engage in ground-breaking research that involves both a higher risk and fewer immediate gains in productivity. Such research tends to be more focused on fundamentals and more closely associated with strong basic academic research than excellence in engaging and teaching.

Compared to other Italian universities of similar size and age, the recent growth in academic publications in Bergamo has resulted in levels comparable to those achieved by other universities in the mid-1990s. In part, this is due to the smaller size of the academic faculty in Bergamo. The university employs slightly more than half the number of academics (*docenti: ordinari, associati, ricercatori*) than are employed in the other three universities.³⁶ But in part, this is also due to a lower number of publications per faculty member. The per capita research output in the other three universities is at least twice as high as in Bergamo. An international comparison, using universities in medium-sized cities close to a metropolis as comparison group, yields a more diverse picture. Academic output is generally increasing, with sizeable and growing gaps between highly productive academic institutions and universities with lower levels of output. But both the national and the international context reveal potential for rapid growth (Figure 3.30).

Unlocking hidden skill potential

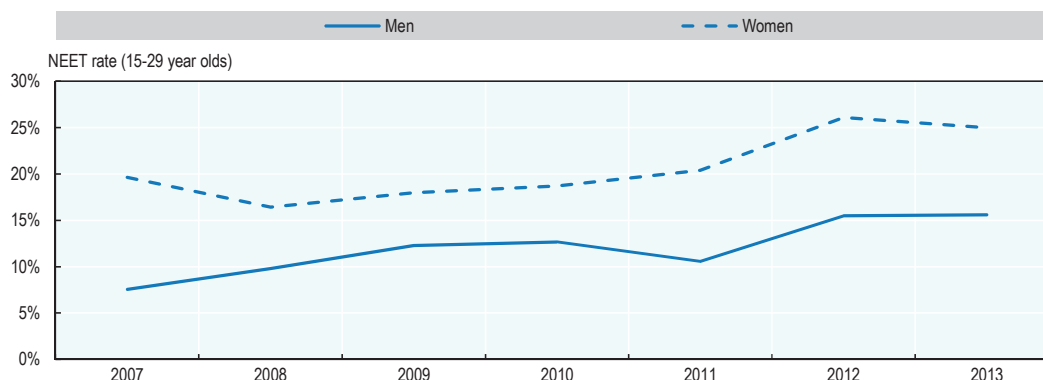
Figure 3.31 shows the unemployment trends before and after the financial crisis. The trend is particularly grim for the cohort of ages 15-29, a significant percentage of whom are neither employed, in education nor in other training (NEET). The need for opportunities, especially among these people, who have their most of their working life ahead of them, has been increasing in Bergamo. Among those aged 15-29, the percentage of NEETs was about 15% before the 2008 crisis and has since increased. Among young women, the NEET rate rose from less than 20% to 25%, and for young men, it increased from about 10% to 15%. This lack of employment and training imposes a double penalty on skills. First, workers who do not use the skills they have acquired may lose them, forgetting useful knowledge. Technological advances may also make certain skills obsolete. Second, opportunities are missed to increase skills and human capital. This can have significant consequences on a young person's career prospects and well-being.³⁷

Figure 3.30. **Increases in academic publications for selected universities**

Left panel note: The University of Bergamo is compared with other Italian public universities founded after 1960 with around 15 000 students.

Right panel note: The University of Bergamo (black dotted line) is compared with universities in comparable TL3 areas (see Annex 3.A1 for a selection of the regions).

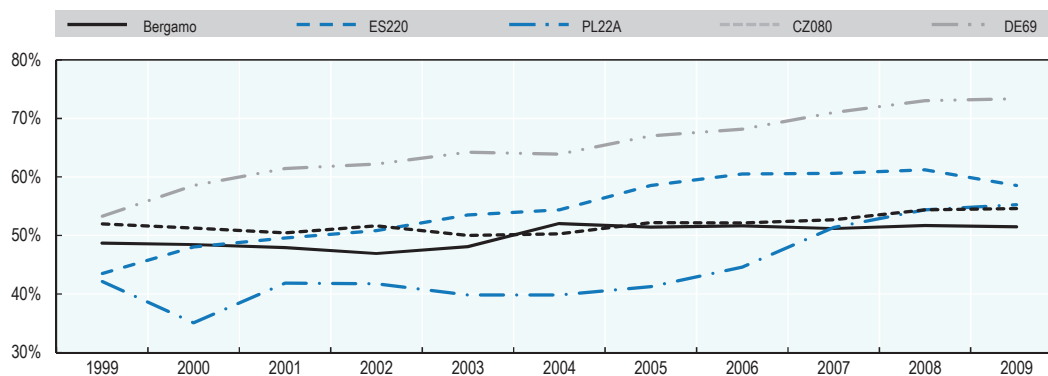
Source: OECD calculations based on SCOPUS (2014), *Scopus database*, www.scopus.com (accessed 1 July 2016).

Figure 3.31. **Young workers who are not employed, in education or training in Bergamo**

Source: OECD calculations based on ISTAT (2014e), *Rilevazione sulle forze di lavoro*.

The underutilised skills of women are a particular concern. As noted in Chapter 1, Bergamo's female labour force participation rates are comparatively low. The four industrial comparison regions with the lowest participation rate in 1999 have all achieved higher increases than Bergamo. In 1999, Bergamo's participation rate was about average among the five regions, but by 2009, it had fallen to the lowest. The lack of participation is also reflected in the percentage of businesses with female owners. Lombardy, with 20% female-owned enterprises, ranks last among Italian regions, nearly 15% less than the Italian average.³⁸

Figure 3.32. Female employment rate in Bergamo and selected comparison regions



Note: CZ080: Moravskoslezský kraj; DE69: Franken; ES220: Navarra; PL22A: Katowice.

Sources: OECD calculations based on OECD (2014b), “Small regions”, *OECD Regional Statistics* (database), <http://dx.doi.org/10.1787/region-tl3-data-en>; OECD (2012b), *Redefining “Urban”: A New Way to Measure Metropolitan Areas*, <http://dx.doi.org/10.1787/9789264174108-en>.

Conclusions

Bergamo’s transition towards higher value-added and technology-intensive activities will require actions in several key areas that reinforce and complement each other. The analysis presented in this chapter has a number of key policy implications including enhancing innovation potential, promoting SMEs’ competitiveness and improving the skills of the workforce.

To re-energise its innovation system Bergamo needs policies that strengthen local links. Potential participants in the innovation process should have better access to information. Many local firms (especially SMEs) fail to generate demand for innovation stemming from research institutions, universities or other providers, as they are often simply not aware of the available options. Research institutions and universities should be given stronger incentives to collaborate with the business sector. The current incentive structures that focus on teaching and academic research create bottlenecks for the diffusion of technology, which are further exacerbated by the high transaction costs for the institutions in organising collaborative projects with small (and often micro) firms. Any policy put in place should therefore not only support R&D investment and the production of innovation, but also promote its diffusion throughout the economy, including through close co-operation between firms, research institutions and universities. Bringing the agents of innovation together more effectively will need to involve institutions representing different sectors, as well as different administrative levels.

The province is the seat of several highly competitive global businesses that invent, create and produce in specialised market niches. These businesses and their knowledge – especially their managerial and entrepreneurial knowledge – can be of great benefit to Bergamo, if further links to global markets can be forged. Small and medium-sized businesses that lack the critical mass to engage in innovative activity on their own resources can benefit from co-operation with leading local firms. Establishing an “angel” network that offers financial or technical help to young, innovative firms could help to facilitate co-operation between private businesses. Another initiative could aim to harness the financial strength of Milan, especially in the field of venture capital. This could be

achieved, for example, by creating an annual fair for investors, venture capitalists and businesses looking to expand their portfolios on the one side, and start-ups and growing businesses in need of financing on the other. To enhance the appeal of the fair and to raise the profile of the province, the fair should not be limited to local entrepreneurs or investors.

Specialised skills are valuable in production, but in an environment where globalisation and international competition require constant adjustments of products, processes and practices, job-specific skills alone are not enough to ensure high levels of productivity. A lack of general skills can impede workers' mobility and limit an individual worker's ability to seize new employment opportunities and reduce the overall efficiency of the labour market. Furthermore, the nature of required specialised skills is evolving. For example, advanced manufacturing techniques require fewer manual skills, but increasingly demand familiarity with ICT equipment and software.

Provision of adequate training opportunities and upgrading of skills is crucial to maintain and improve firms' competitiveness. The cost of training can be an obstacle, especially for small firms. Given that about two-thirds of employees work in small firms, addressing these concerns is a key policy challenge. However, while Bergamo's firms tend to be small, they also tend to be integrated into strong local supply chains. OECD experience suggests that such connections have been successful in creating a critical mass of demand for training, by using larger firms within the supply chain as a catalyst for training.

A key recommendation in the 2001 *OECD Territorial Review of Bergamo* was to create a "one-stop shop" for training. This recommendation remains as relevant today as it was 15 years ago. This "one-stop shop" should be aimed at employers as well as residents of the province. Training in Bergamo is provided by a variety of private and public actors. Provision for public training is partly organised at the provincial, partly at the regional and even at the national level. The resulting array of options makes it difficult for employers or individuals to pick the right programme for their needs. In the current context, such a "one-stop shop" could take the form of an interactive, web-based platform to inform all those interested about available training opportunities.

Notes

1. See for example the review by Aghion and Howitt (2005).
2. See Garicano and Heaton (2010) for details.
3. Patent number GB2272154, http://worldwide.espacenet.com/publicationDetails/biblio?CC=GB&NR=2272154&KC=&locale=en_ep&FT=E (last accessed 13 October 2014). The patent was cited in another patent filed in 2007.
4. See Schmoch (2008) for details on the technology classification scheme.
5. OECD calculations based on EU (2014b).

6. See Criscuolo et al. (2014) for early evidence on this topic.
7. See OECD (2014c) for details.
8. Based on data from European Private Equity & Venture Capital Association (2014).
9. See Aghion et al. (2005).
10. OECD calculations based on ISTAT (2014b) for the province of Bergamo.
11. See Ahrend et al. (2014) for details.
12. See Carlino and Kerr (2014) for a review of the evidence on agglomeration and innovation.
13. See Ramos and Moral-Benito (2013).
14. See, for example, Kerr and Kominers (2015) for the case of patent citations of firms around Silicon Valley.
15. See, for example, the Times Higher Education World University Rankings 2014-2015 at: www.timeshighereducation.co.uk/world-university-rankings/2014-15/world-ranking or the QS World University Ranking 2014 at: www.topuniversities.com/university-rankings/world-university-rankings/2014 (both accessed 26 November 2014).
16. The percentages are 27% for small, 32% for medium and 30% for large enterprises.
17. OECD calculations based on EU (2015).
18. Project details and fund: http://cordis.europa.eu/project/rcn/95349_en.html (last accessed 10 January 2015).
19. See Regione Lombardia (2013).
20. The exact number of volunteers is 104 356. Expenditure by non-profits was EUR 1.17 billion (ISTAT, 2014c) and GDP contribution in 2011 was EUR 31.83 billion (OECD, 2014b).
21. See OECD (2010).
22. See Moretti (2010) for the United States, and Moretti and Thulin (2013) for a comparison with Sweden.
23. Estimates pool data from Germany, Mexico, Spain, the United Kingdom and the United States. See Ahrend et al. (2014) for details.
24. Forty points are considered the equivalent of one additional year of schooling.
25. See Table 3.A1.2 in Annex 3.A1 for a description of PISA proficiency levels.
26. See OECD (2013b) for details.
27. See Table 3.A1.1 in Annex 3.A1 for a definition of comparison regions.
28. See Table 3.A1.3 in Annex 3.A1 for a description of PIAAC proficiency levels.
29. See Table 27 in *Sistema Informativo Excelsior* (2012), Table 45 in *Sistema Informativo Excelsior* (2013) and Table 46 in *Sistema Informativo Excelsior* (2014).
30. See Becker (1964) for details.
31. Courses at high school level (upper secondary) are provided by schools; www.istruzione.it/urp/cpia.shtml (accessed 25 November 2014).

32. See OECD (2014d) for details.
33. See Card (2001) for a discussion of this argument.
34. See OECD (2011b) for details.
35. See Donina, Meoli and Paleari (2015) for a critical view on the differences between the rhetoric and reality of the reform.
36. The University in Bergamo had 331 academics in 2012, while those in Brescia, Trento and Udine had 562, 590 and 690 in 2013, respectively. Sources: www.data.unibg.it/dati/bacheca/200/53611.pdf; www.unibs.it/organizzazione/ateneo/ateneo-cifre; www.unitn.it/alfresco/download/workspace/SpacesStore/ca65656b-da3c-45c5-8bbd-7f24f7378160/piano-strategico-2014-2016_1.pdf; <http://nuva.uniud.it/scon/ateneo-in-cifre/personale-docente/docenti-al-31-12-2014> (all accessed 26 January 2015).
37. E.g. Winkelmann and Winkelmann (1998).
38. The Italian average percentage is 23.5%. See OECD (2014c) for details.

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Annex 3.A1.

Comparison regions and PISA/PIAAC proficiency levels

Identification of comparison regions

Two methodologies are used to identify comparison regions for Bergamo. First, a multivariate distance measure is used to find regions that show similar characteristics in terms of their size, industrial structure and income. Second, georeferenced information on urban systems is used to identify regions whose urban system is similar to that of the province of Bergamo.

The first measure uses OECD data from 2009 and 2010 on the size of the region (measured by total employment), its percentage of employment in manufacturing, and the gross value added (GVA) created in the region. For each OECD TL3 area, the distance of Bergamo along these three lines is calculated and aggregated into a single distance measure.¹ To account for the important role of the manufacturing sector in Bergamo, the weight for the percentage of manufacturing employment in the aggregation is set 50% above the weight of the other two factors combined. Based on the distance measure, the TL3 region with the smallest distance is selected, excluding countries that either lack sufficient data to match all three factors or have no comparable TL3 regions. The final selection includes 19 regions from 16 countries (Table 3.A1.1, left panel). The proximity of several regions in the Czech Republic and the Slovak Republic is very close, so more than one region has been selected for these countries.

Table 3.A1.1. OECD TL3 comparison regions for Bergamo

Distance-based measure		Urban system-based measure	
TL3 identifier	TL3 name	TL3 identifier	TL3 name
AT312	Linz-Wels	CZ032	Plzeňský kraj
BE25	Prov. West-Vlaanderen	DE23	Hildesheim
CZ042	Ústecký kraj	DE89	Ingolstadt
CZ072	Zlínský kraj	ES211	Álava
CZ080	Moravskoslezský kraj	JPB06	Yamagata
DE69	Franken	NL41	Noord-Brabant
DK041	Vestjylland	PT112	Cávado
ES220	Navarra	SE121	Uppsala län
FI197	Pirkanmaa	UKG38	Walsall
FR515	Vendée	UKM36	North Lanarkshire
HU221	Gyor-Moson-Sopron		
JPE16	Toyama		
KR052	Chungcheongbuk-do		
NL42	Limburg (NL)		
PL22A	Katowice		
SE211	Jönköpings län		
SK022	Trenciansky kraj		
SK031	Zilinský kraj		
UKM50	Aberdeen City and Aberdeenshire		

Source: OECD calculations based on OECD (2014), “Small regions”, <http://dx.doi.org/10.1787/region-tl3-data-en> and OECD (2012), *Redefining “Urban”: A New Way to Measure Metropolitan Areas*, <http://dx.doi.org/10.1787/9789264174108-en>.

The second methodology considers the urban system around Bergamo. A key characteristic is that the province of Bergamo contains a medium-sized urban agglomeration, the city of Bergamo, and is adjacent to one of largest metropolitan areas within Italy. Using a coherent and comparable definition of cities developed jointly by the OECD and the EU, it is possible to identify similar urban systems in other OECD countries.² The regions identified as comparison regions are monocentric TL3 areas with a medium-sized urban agglomeration that are adjacent to a metropolitan area situated in another TL3 area. The resulting list contains ten TL3 regions from eight OECD countries (Table 3.A1.1, right panel).

Where data for TL3 areas are not available, the TL2 areas in which the comparison region is located are chosen for comparison.

PISA and PIAAC proficiency levels

PISA proficiency is categorised into six levels and an implicit “0” level for students, with proficiency below the least proficient category. In mathematics, for example, the qualification in each proficiency group is given in Table 3.A1.2.

Table 3.A1.2. PISA proficiency levels in mathematics

Level	Proficiency
6	At Level 6, students can conceptualise, generalise and utilise information based on their investigations and modelling of complex problem situations. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply their insight and understanding, along with a mastery of symbolic and formal mathematical operations and relationships, to develop new approaches and strategies for attacking novel situations. Students at this level can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments and their appropriateness to the original situations.
5	At Level 5, students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations and insight pertaining to these situations. They can reflect on their actions and formulate and communicate their interpretations and reasoning.
4	At Level 4, students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including those that are symbolic, linking them directly to aspects of real-world situations. Students at this level can utilise well-developed skills and reason flexibly, with some insight, in these contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments and actions.
3	At Level 3, students can execute clearly described procedures, including those that require sequential decisions. They can select and apply simple problem-solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They can develop short communications when reporting their interpretations, results and reasoning.
2	At Level 2, students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures or conventions. They are capable of direct reasoning and making literal interpretations of the results.
1	At Level 1, students can answer questions involving familiar contexts, where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are obvious and follow immediately from the given stimuli.

Source: OECD (2013a), *PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy*, <http://dx.doi.org/10.1787/9789264190511-en> (accessed 1 July 2016).

PIAAC uses five levels, again with an implicit “0” level, to assess both numeracy and literacy. For example, for numeracy, the survey evaluates respondents’ ability to access, use, interpret and communicate mathematical information and ideas for the demands faced in a range of situations in their life.

Table 3.A1.3. PIAAC proficiency levels in numeracy

Level	Types of tasks completed successfully at each level of proficiency
5	Tasks at this level require the respondent to understand complex representations and abstract and formal mathematical and statistical ideas, possibly embedded in complex texts. Respondents may have to integrate multiple types of mathematical information where considerable translation or interpretation is required; draw inferences; develop or work with mathematical arguments or models; and justify, evaluate and critically reflect upon solutions or choices.
4	Tasks at this level require the respondent to understand a broad range of mathematical information that may be complex, abstract or embedded in unfamiliar contexts. These tasks involve undertaking multiple steps and choosing relevant problem-solving strategies and processes. Tasks tend to require analysis and more complex reasoning about quantities and data; statistics and chance; spatial relationships; and change, proportions and formulas. Tasks at this level may also require understanding arguments or communicating well-reasoned explanations for answers or choices.
3	Tasks at this level require the respondent to understand mathematical information that may be less explicit, embedded in contexts that are not always familiar and are represented in more complex ways. Tasks require several steps and may involve the choice of problem-solving strategies and relevant processes. Tasks tend to require the application of number sense and spatial sense; recognising and working with mathematical relationships, patterns and proportions expressed in verbal or numerical form; and interpretation and basic analysis of data and statistics in texts, tables and graphs.
2	Tasks at this level require the respondent to identify and act on mathematical information and ideas embedded in a range of common contexts, where the mathematical content is fairly explicit or visual with relatively few distractors. Tasks tend to require the application of two or more steps or processes, involving calculation with whole numbers and common decimals, percentages and fractions; simple measurement and spatial representation; estimation; and interpretation of relatively simple data and statistics in texts, tables and graphs.
1	Tasks at this level require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit, with little text and minimal distractors. Tasks usually require one-step or simple processes involving counting, sorting, performing basic arithmetic operations, understanding simple percentages such as 50%, and locating and identifying elements of simple or common graphical or spatial representations.
Below Level 1	Tasks at this level require the respondents to carry out simple processes such as counting, sorting, performing basic arithmetical operations with whole numbers or money, or recognising common spatial representations in concrete, familiar contexts where the mathematical content is explicit, with little or no text or distractors.

Source: OECD (2013b), *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*, <http://dx.doi.org/10.1787/9789264204256-en> (accessed 1 July 2016).

Notes

1. See Abadie and Gardeazabal (2003) for a statistical derivation of the properties of such multivariate distance-based comparison groups.
2. See OECD (2012) for a functional definition of cities – beyond their administrative boundaries.

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