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This Survey *is published on the responsibility of the Economic and Development Review Committee of the OECD, which is charged with the examination of the economic situation of member countries.*

The economic situation and policies of the Luxembourg were reviewed by the Committee on 9 February 2015. The draft report was then revised in the light of the discussions and given final approval as the agreed report of the whole Committee on 26 February 2015.

The Secretariat's draft report was prepared for the Committee by Eckhard Wurzel and Jan Strasky, under the supervision of Piritta Sorsa. Statistical research assistance was provided by Damien Azzopardi and Guillaume Bousquet with general administrative assistance provided by Anthony Bolton and Mikel Inarritu. The Survey *also benefitted from contributions at different stages by Arnaud Daymard and Giuseppe Maggio.*

The previous Survey of Luxembourg *was issued in December 2012.*

BASIC STATISTICS OF LUXEMBOURG, 2013

(Numbers in parentheses refer to the OECD average)[a]

LAND, PEOPLE AND ELECTORAL CYCLE					
Population (million)	0.5		Population density per km^2	190.0	(34.7)
Under 15 (%)	17.3	(18.2)	Life expectancy (years, 2012)	81.5	(80.2)
Over 65 (%)	15.1	(15.6)	Men	79.1	(77.5)
Foreign-born (%, 2010)	40.5		Women	83.8	(82.9)
Latest 5-year average growth (%)	0.1	(0.6)	Latest general election	October 2013	
ECONOMY					
Gross domestic product (GDP)			Value added shares (%)		
In current prices (billion USD)	60.1		Primary sector	0.3	(2.5)
In current prices (billion EUR)	45.3		Industry including construction	13.3	(26.8)
Latest 5-year average real growth (%)	0.8	(0.8)	Services	86.4	(70.5)
Per capita (000 USD PPP)	91.0	(39.2)			
GENERAL GOVERNMENT Per cent of GDP					
Expenditure	43.8	(43.1)	Gross financial debt	29.7	(110.2)
Revenue	44.5	(38.3)	Net financial debt	-48.9	(69.9)
EXTERNAL ACCOUNTS					
Exchange rate (EUR per USD)	0.753		Main exports (% of total merchandise exports)		
PPP exchange rate (USA = 1)	0.922		Machinery and transport equipment	28.1	
In per cent of GDP			Commodities and transactions, n.e.s.	20.4	
Exports of goods and services	203.3	(53.4)	Chemicals and related products, n.e.s.	13.3	
Imports of goods and services	168.2	(49.4)	Main imports (% of total merchandise imports)		
Current account balance	4.9	(-0.1)	Machinery and transport equipment	30.9	
Net international investment position	213.8		Miscellaneous manufactured articles	14.7	
			Mineral fuels, lubricants and related materials	13.4	
LABOUR MARKET, SKILLS AND INNOVATION					
Employment rate for 15-64 year-olds (%)	65.7	(65.2)	Unemployment rate, Labour Force Survey (age 15 and over) (%)	5.8	(7.9)
Men	72.2	(73.1)	Youth (age 15-24, %)	15.8	(16.1)
Women	59.1	(57.4)	Long-term unemployed (1 year and over, %)	1.8	(2.7)
Participation rate for 15-64 year-olds (%)	69.9	(71.1)	Tertiary educational attainment 25-64 year-olds (%, 2012)	39.1	(32.2)
Average hours worked per year	1 643	(1 771)	Gross domestic expenditure on R&D (% of GDP, 2013)	1.2	(2.4)
ENVIRONMENT					
Total primary energy supply per capita (toe)	8.1	(4.2)	CO_2 emissions from fuel combustion per capita (tonnes, 2012)	19.2	(9.7)
Renewables (%)	3.7	(8.8)	Water abstractions per capita (1 000 m^3, 2009)	0.1	
Fine particulate matter concentration (urban, PM_{10}, µg/m^3, 2011)	16.8	(28.0)	Municipal waste per capita (tonnes, 2011)	0.7	(0.5)
SOCIETY					
Income inequality (Gini coefficient, 2011)[b]	0.276	(0.308)	Education outcomes (PISA score, 2012)		
Relative poverty rate (%, 2011)[b]	8.1	(11.1)	Reading	488	(497)
Median equivalised household income (000 USD PPP, 2010)	36.4	(20.4)	Mathematics	490	(494)
Public and private spending (% of GDP)			Science	491	(501)
Health care (2012)	7.1	(9.2)	Share of women in parliament (%, December 2014)	28.3	(26.7)
Pensions (2011)	7.7	(8.7)	Net official development assistance (% of GNI)	1.00	(0.40)
Education (primary, secondary, post-sec. non tertiary, 2011)	3.4	(3.9)			

Better life index: www.oecdbetterlifeindex.org

a) Where the OECD aggregate is not provided in the source database, a simple OECD average of latest available data is calculated where data exist for at least 29 member countries.

b) 2010 for the OECD average.

Source: Calculations based on data extracted from the databases of the following organisations: OECD, International Energy Agency, World Bank, International Monetary Fund and Inter-Parliamentary Union.

Abbreviations and acronyms

ADEM	Local offices of the employment service
ALMP	Active labour market policies
BCL	Luxembourg central bank
BEPS	Base erosion and profit shifting
CAA	The insurance regulator
CEDIES	Financial aid system for students
CFL	*Société Nationale des Chemins de Fer Luxembourgeois*
CRD	Capital requirements directive
CRP	Public research centres
CRR	Capital requirements regulation
CSSF	Luxembourg financial market regulator
EBA	European Banking Authority
ECB	European central bank
EOI	Exchange of Information
EPC	Provisions for collective dismissals
EPL	Employment protection legislation
EU	European Union
FISIM	Financial intermediation services indirectly measured
GDP	Gross domestic product
GHG	Greenhouse gas
GNI	Gross national income
GVC	Global value added chains
ICT	Information and communications technology
IT	Information technology
KBC	Knowledge-based capital
LCSB	Luxembourg Centre for Systems Biomedicine
LFS	Labour force survey
LTV	Loan-to-value
MFI	Monetary and financial institute
MTO	Medium Term Objective
PES	Public employment service
PMR	Product market regulation
R&D	Research and development
SME	Small and medium enterprises
SMOT	*Schéma de Mobilité Transfrontalière Luxembourg-Lorraine*
SNCI	National Credit and Investment Company
SRM	Single Resolution Mechanism

SSM	Single Supervisory Mechanism
STRI	Services Trade Restrictiveness Indicators
UCITS	Undertakings for Collective Investment in Transferable Securities
VAT	Value-added tax
WTO	World Trade Organisation

Executive summary

Main findings

Luxembourg is one of the most prosperous countries in the OECD with very high levels of well-being, particularly incomes. The economy, including its financial sector, has weathered the crisis well, growth has picked up, supported by sound macroeconomic policies.

Strengthening the financial sector. Luxembourg's large financial sector still plays a pivotal role, although its share in total output has fallen. Product diversification into investment funds, wealth management and insurance is continuing. However, changing financial market regulation in Europe, increased international transparency requirements for banking and heightened international competition pose challenges. Further diversification of the financial sector into new areas requires investors' trust in regulators safeguarding financial market stability. Nevertheless, the financial sector might have reached a size where its contribution to GDP growth might fade, and high dependence on one sector poses medium-term risks.

Boosting productivity and diversifying the economic base. Potential output growth has slowed significantly in recent years, reflecting rising structural unemployment and declining trend productivity growth. Private spending on research and development (R&D) is low and falling, although public R&D spending has been boosted. The secondary education system is hampered by high repetition rates of students; female labour force participation, although it increased, is still low. Enterprise clusters do not yet fully exploit potential benefits from cooperation between enterprises and research institutions.

Medium-term fiscal pressures. The fiscal position is strong, and the main fiscal challenges are age-related spending, which is projected to rise by about 5.25 percentage points of GDP by 2030. There is some uncertainty surrounding financial-sector tax revenues, which can be subject to large fluctuations due to financial market volatility.

Key recommendations

Strengthening the performance of the financial sector

- Continue to monitor financial market risk while using a comprehensive approach to risk assessment that accounts for financial linkages between banks and non-bank financial intermediaries, notably investment funds. Continue efforts to develop resolution plans and to undertake resolvability assessments so that important banks could be resolved effectively across borders. For this end, continue to cooperate with regulatory authorities in other jurisdictions outside the EU.

Boosting productivity and diversifying the economic base

- Better evaluate the effectiveness of public R&D spending and cluster policies.
- Strengthen the cooperation between enterprises, University of Luxembourg and research institutions in Luxembourg and abroad.
- In secondary education, reduce grade repetition, provide more school autonomy and better monitor education quality.

Greening growth

- To reduce carbon emission, continue substantial investment in public transport infrastructure, using the receipts from fuel taxation for this purpose. Explore the introduction of a system of congestion charges. Increase taxes on petrol and diesel to gradually eliminate price differentials with neighbouring countries.

Medium-term fiscal pressures

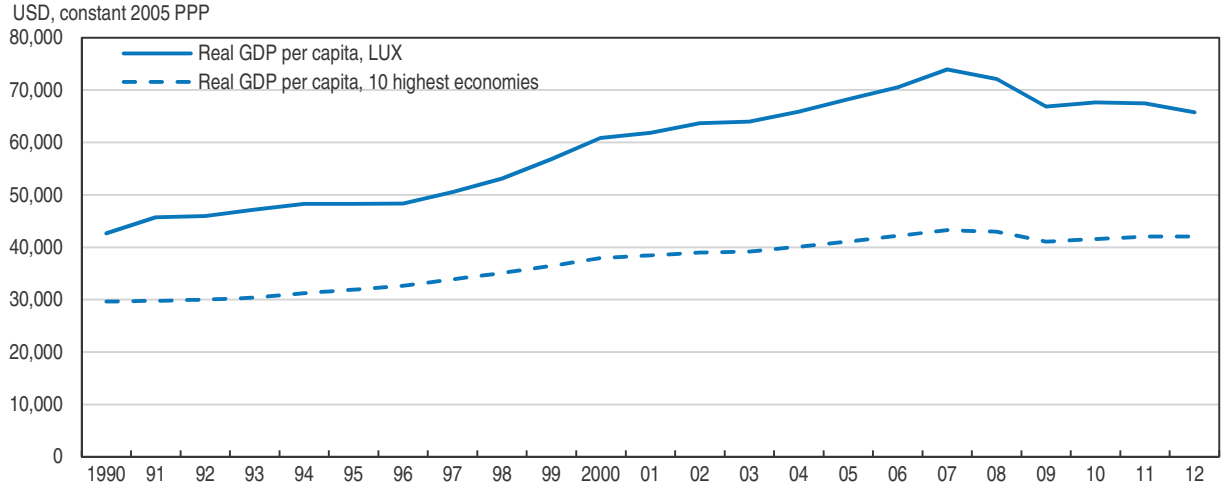
- Strengthen fiscal planning by introducing a spending review mechanism and link it to the medium-term budgeting framework. Consider introducing a spending ceiling for the general government.
- Continue to actively participate in international negotiations on co-ordinated action to combat tax base erosion and profit shifting of multinational enterprises, including action to prevent double non-taxation. Change domestic laws if necessary.

Assessment and recommendations

- *Macroeconomic outlook*
- *Strengthening the performance and resilience of the financial sector*
- *Fostering the emergence of innovative industries*
- *Greening growth*

In the two decades prior to the crisis, Luxembourg grew twice as fast as the European average and per capita incomes climbed to one of the highest in the OECD area (Figure 1). Non-residents account for a large share of the economy's employment. Thus, gross national income (GNI), which excludes factor income from domestic production that accrues to non-residents, undercuts gross domestic product (GDP) by about a third. Nonetheless, even if aggregate income per capita is measured by GNI rather than GDP Luxembourg still ranks at the top of the OECD, surpassed only by Norway. Growth has also enhanced well-being. Luxembourg exceeds the OECD average in most dimensions of the OECD's well-being index by a significant margin (Figure 2). Specialisation in fast growing, high-value-added service sectors, notably financial and related services, transformed a steel producing economy to a major financial centre. This transformation was facilitated by financial sector liberalisation and early adoption of a number of EU financial services directives. Luxembourg is an attractive business location reflecting its regulatory and tax systems, sound macroeconomic policies and openness to skilled workers from other countries.

Figure 1. **Difference in GDP per capita in the 10 OECD economies with the highest GDP**

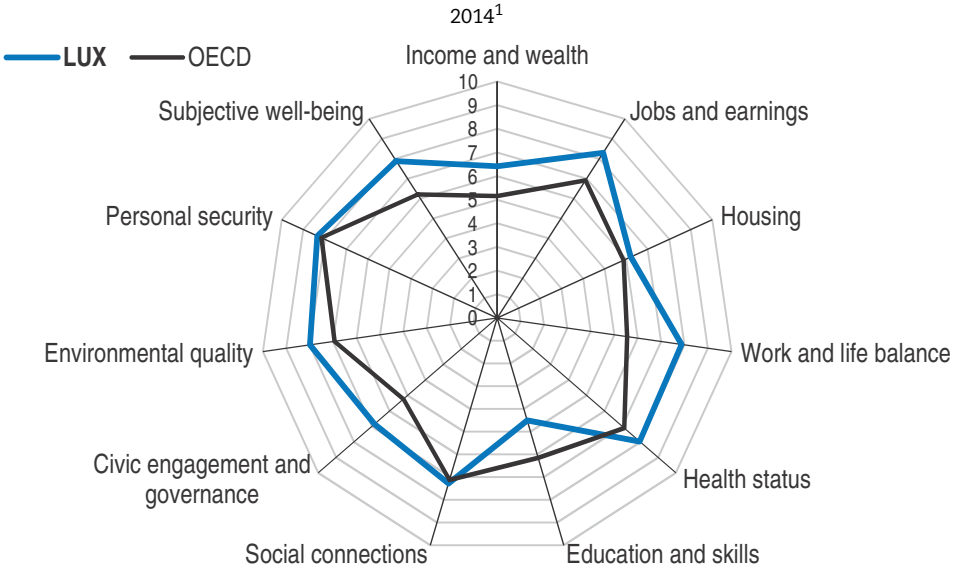


Note: Simple average of the 10 OECD countries with the highest GDP per capita (in constant 2005 PPPs) in 2012.
Source: OECD Economic Department Database.

StatLink http://dx.doi.org/10.1787/888933197870

However, the economy depends heavily on its financial sector, creating potential vulnerabilities, and the sector's contribution to the economy's growth might diminish. At the same time, labour productivity growth has trended down. Unemployment among lower skilled is relatively high reflecting challenges in the education and training systems. To raise productivity and potential growth, the economy should diversify towards such

Figure 2. **Well-being outcomes: Better Life Index**



1. Each well-being dimension is measured by one to four indicators from the OECD Better Life Index set. Normalised indicators are averaged with equal weights. Indicators are normalised to range between 10 (best) and 0 (worst) according to the following formula: (indicator value – minimum value)/(maximum value – minimum value) x 10.

Source: OECD (2014), OECD Better Life Index, *www.oecdbetterlifeindex.org*.

StatLink http://dx.doi.org/10.1787/888933197880

activities as R&D, product design or marketing (OECD, 2013a). The key messages from the *Survey* are:

- Investors' trust in financial market stability is key to the financial sector.
- Diversifying the economy would help to keep Luxembourg's living standards high.
- On unchanged policies, ageing-related government spending would steeply increase.

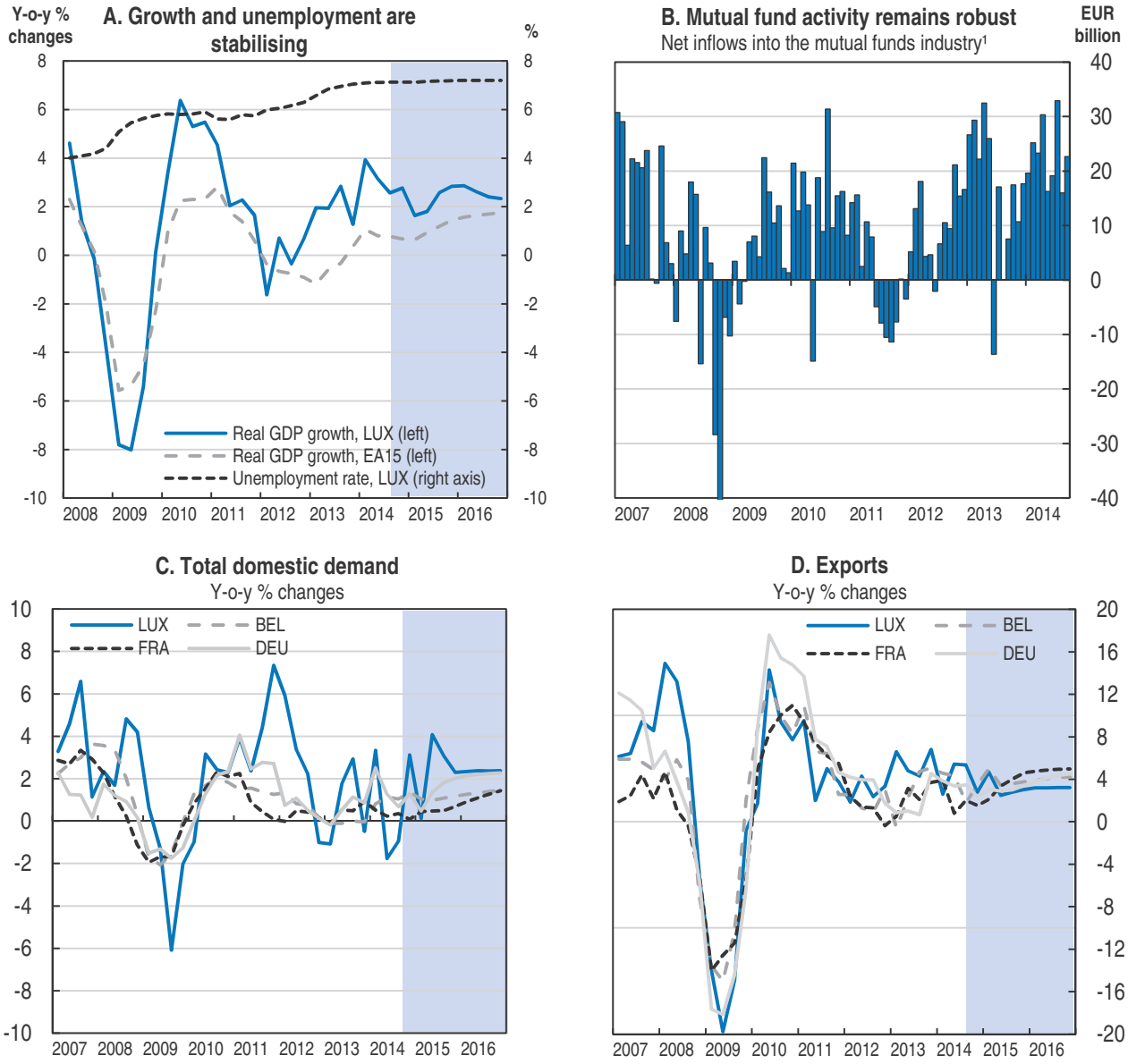
Macroeconomic outlook

Recent economic developments

Economic growth slowed in the course of 2014, but it remained significantly higher than the euro area average (Figure 3). Growth is benefiting from resilient domestic demand and robust activity in the mutual fund industry. However, unemployment has continued to rise, to 7.1% at end-2014, youth unemployment (15 to 24 year-old) has drifted up to above 15% in the first three quarters of 2014, and the share of the long-term unemployed (unemployed for a year or more) to more than 25% of total unemployment. Youth unemployment (relative to the labour force of the 15 to 24 year-old) exceeded 30% at the end of 2014 (4.7% of all persons aged 15-24 in 2012). New OECD estimates suggest that more than 80% of unemployment is structural, although structural unemployment, as well as potential output, is difficult to estimate in such a small open economy with a high share of cross-border workers and a large financial sector.

Luxembourg's external position is strong, with a persistent current account surplus and a net international asset position of 216% of GDP (Figure 4). The surplus, which has fallen from around 10% of GDP prior to the crisis to about 5% since, is entirely attributable to sustained services exports, mainly financial services.

Figure 3. **Macroeconomic developments**



1. Three-month moving average. Inflows are defined as net of markets' variations.

Source: OECD Economic Outlook 96 Database; and Commission de Surveillance du Secteur Financier (CSSF).

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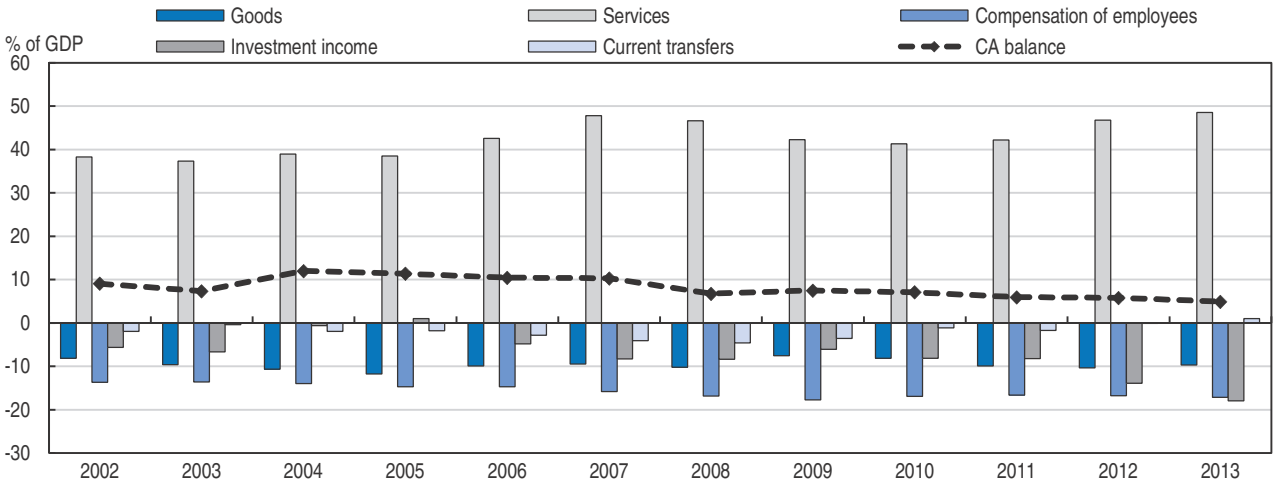
The value added share of the financial and insurance sector in Luxembourg is about 27%, well above other OECD financial centres such as Switzerland or the United Kingdom (around 10½ and 8¼ per cent). The large size of Luxembourg's financial sector reflects that the country is a major financial centre, but it also means that the economy is highly dependent on the evolution of financial sector output (OECD, 2008; and 2010b). The sector's share has declined by some 3½ percentage points since the beginning of the crisis as traditional bank business fell and financial services such as insurance and asset management increased (Figure 5). In 2013, more than 3 800 investment funds were located in Luxembourg. By end-2014, the funds had some EUR 3 trillion under management, a figure that has doubled since the trough of the financial crisis. Luxembourg is now the

Figure 4. **Current account as percentage of GDP**

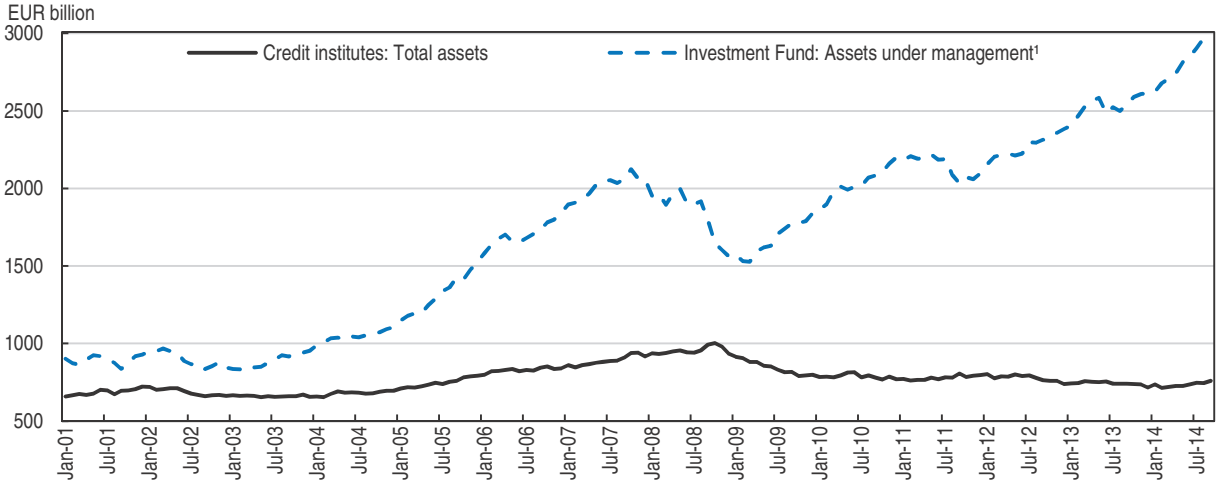


Source: STATEC.

StatLink http://dx.doi.org/10.1787/888933197903

world's second largest investment fund centre after the United States. Fund and wealth management and insurance services have been estimated to account for 80% of total financial sector, with banking services accounting for the rest (Wintersteller, 2013).

Figure 5. **Assets of banks and investment funds**



Note: Undertakings for collective investment (UCI): net assets.
Source: CSSF.

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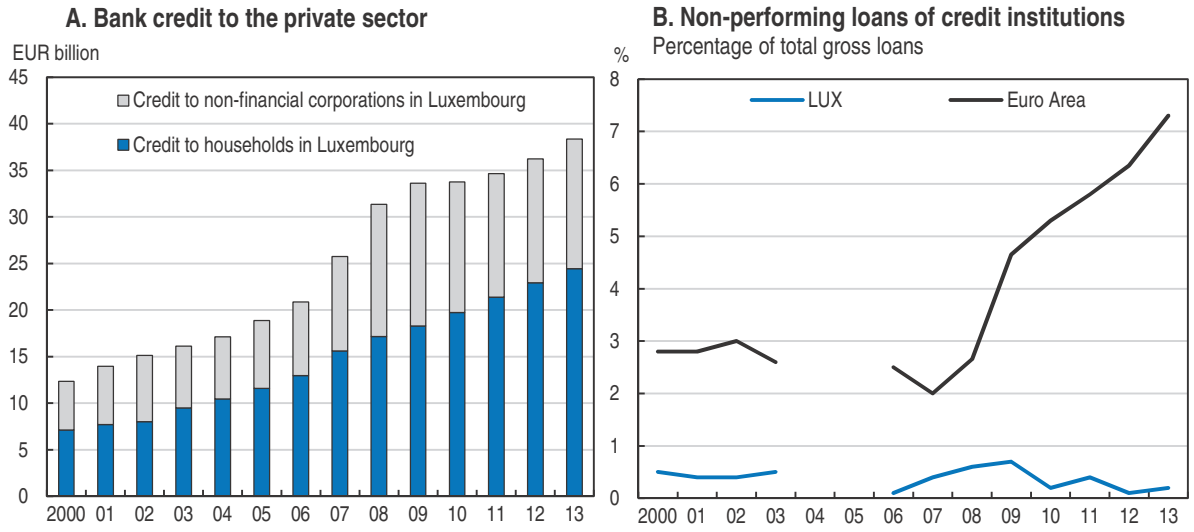
The drop in the value added share of the financial sector since the crisis is mainly due to reductions in cross-border credit by bank subsidiaries and branches to their group's foreign banks. Credit to the domestic private non-financial sector was remarkably resilient (Figure 6, Panel A). Bank balance sheets are strong. Non-performing loans account for a very small portion of total bank assets, reflecting past bank restructuring and economic growth above the EU average in recent years (Figure 6, Panel B).

Figure 6. **Bank credit and non-performing loans**



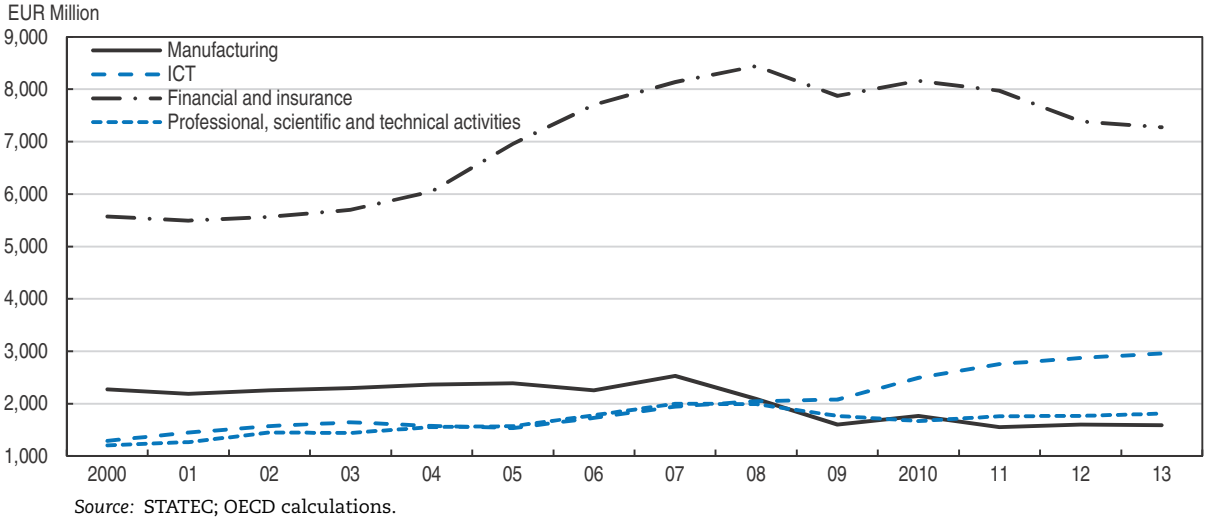
Source: BCL and World Bank, *World Development Indicators Database*.

StatLink http://dx.doi.org/10.1787/888933197926

Financial sector diversification muted the contraction following the crisis. Mutual funds and insurance business have been quite resilient, moderating the impact of the down-turn that occurred in banking activity (Figure 7). Outside the financial sector, manufacturing output was particularly hard hit, with a decline of about one third since 2007. By contrast, output of the Information and communications technology (ICT) sector continued to expanded steadily.

Figure 7. **Sectoral output diverged during the crisis**

Real value added, at constant prices, reference year = 2005



Source: STATEC; OECD calculations.

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Growth is projected to slow to 2.2% in 2015 as the shift of the EU VAT regime for e-commerce from the seller to the buyer country weakens export growth, and higher value-added tax (VAT) rates bear on demand (Table 1). Activity will firm somewhat in 2016

Table 1. **Macroeconomic indicators and projections**

	2011 Current prices, billion €	2012	2013	2014	2015	2016
GDP at market prices	42.4	-0.2	2.0	3.1	2.2	2.6
Private consumption	13.3	1.9	1.5	1.8	2.4	2.8
Government consumption	6.9	3.8	5.1	2.9	1.5	2.1
Gross fixed capital formation	7.6	2.7	-4.3	-2.9	3.3	1.9
Final domestic demand	27.9	2.6	0.8	0.9	2.4	2.4
Stockbuilding[1]	0.5	-1.6	-0.1	-1.6	-0.9	0.0
Total domestic demand	28.3	0.2	0.5	-0.8	1.2	2.5
Exports of goods and services	78.5	3.0	5.6	4.0	3.2	3.2
Imports of goods and services	64.5	3.8	5.8	2.1	3.1	3.3
Net exports[1]	14.0	-0.3	1.6	4.6	1.4	1.0
Other items						
Potential GDP		2.5	2.3	2.0	2.0	2.0
Output gap[2]		-3.9	-4.1	-3.1	-2.9	-2.4
Employment		2.4	1.9	2.2	2.3	2.3
Unemployment rate		6.1	6.9	7.1	7.2	7.2
GDP deflator		3.4	1.4	0.6	1.3	1.3
Harmonised index of consumer prices		2.9	1.7	0.9	1.2	1.5
Harmonised core consumer prices		2.1	2.0	1.4	1.4	1.5
Household saving ratio, net[3]		13.7	16.9	17.7	17.9	18.2
Trade balance[4]		33.8	35.1	38.6	39.1	39.0
Current account balance[4]		5.8	4.9	5.1	4.0	4.0
General government financial balance[4]		0.1	0.6	0.9	0.2	0.5
General government underlying primary balance[4]		1.4	2.3	2.4	1.6	1.7
General government gross debt[4]		29.6	27.9	30.6	32.0	33.3
General government debt, Maastricht definition[4]		21.4	23.6	24.4	25.9	27.1
General government net debt[4]		-48.3	-49.0	-48.1	-46.7	-45.4
Short-term interest rates		0.6	0.2	0.2	0.1	0.1
Long-term interest rates		1.8	1.8	1.4	0.8	0.8

1. Contributions to changes in real GDP, actual amount in the first column.
2. As a percentage of potential GDP.
3. As a percentage of disposable income.
4. As a percentage of GDP.

Source: OECD Database.

but the upswing will be moderate by past standards, as macro-economic activity in the euro area overall is set to remain sluggish. The national unemployment rate is projected to peak at 7.2% in 2015. No significant decline is projected for 2016. The VAT hike and wage indexation will keep inflation above the euro area average.

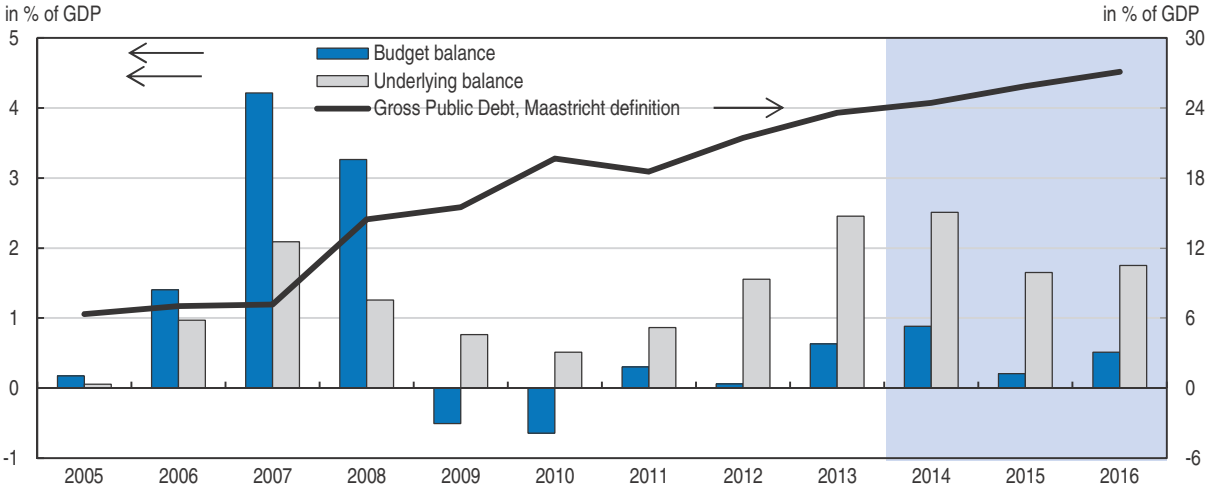
Short-term risks have been to the downside, but recent developments present upside risks. Much depends on growth in the euro area, given Luxembourg's strong trade and financial linkages. The negative effect of the new EU VAT regime on Luxembourg's position in the e-commerce industry could be larger than expected. Changes in financial sector regulation require some banks to adapt their business models and could reduce the profitability of the financial sector, at least in the short run. On the other hand, the solid reputation of Luxembourg's financial sector could help it attract larger safe haven capital inflows. A sustained drop in the oil price, the European central bank's (ECB) quantitative easing programme und euro depreciation might also support stronger growth.

Fiscal developments

The government has taken measures to contain the rise in the deficit

In 2014, the general government surplus was 0.9% of GDP and general government gross debt totalled 24.4% in the Maastricht definition, up significantly from only 7% in 2007 (Figure 8). These fiscal positions compare favourably to most other countries in the OECD area. Moreover, on a net basis, taking into account financial assets as well, the general government has net assets of 48% of GDP. The new EU VAT regime will shift the e-commerce VAT from the country of sale to the country of consumption as of January 2015, cutting government revenues by about 1.5 % of GDP in 2015. According to official estimates, this drop in revenues, if left uncompensated, would risk the structural balance falling below Luxembourg's Medium Term Objective (MTO).

Figure 8. **Evolution of the fiscal position**



Notes: The underlying fiscal balance is adjusted for cyclical fluctuations and one-offs.
Shaded area: OECD projections.
Source: OECD Economic Outlook 96 Database.

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In anticipation, the government has taken compensatory tax and spending measures. An increase in the VAT rate, to take effect in January 2015, is officially estimated to raise revenues by some 0.5% of GDP. In addition, the government has presented some 250 measures to curb spending, which is estimated to generate net savings of 0.4% of GDP in 2015. The OECD projects the general government balance to deteriorate to a surplus of 0.2% in 2015, raising to a surplus of 0.5% as the new fiscal measures become increasingly effective. General government gross debt is projected to rise to 27% (Maastricht basis) by 2016.

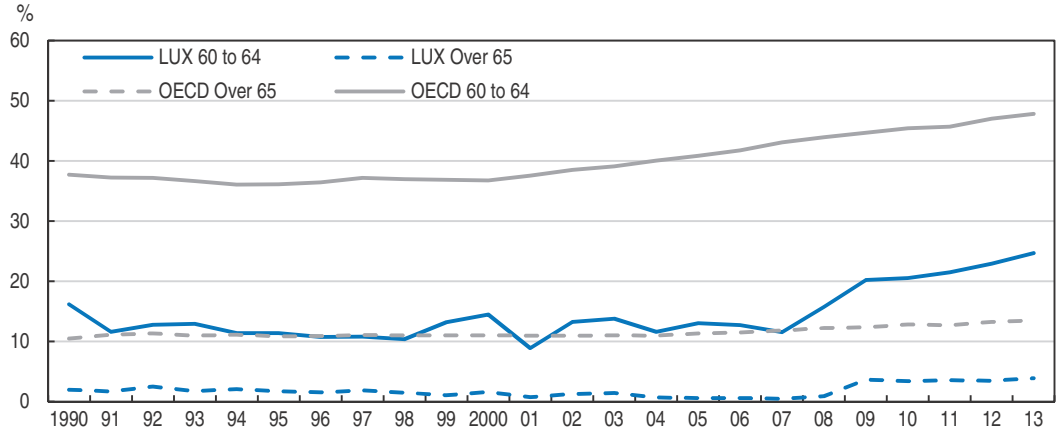
There is a risk that in the near future Luxembourg could face lower revenues from multinational enterprises as a consequence of the ongoing evolution of international tax regulations that necessarily trigger changes of tax rulings. Based on the current international tax framework, including the application of non-double taxation treaties, the interaction of the tax regimes of multiple countries could lead to a significant reduction of a company's tax burden, or even no taxation at all. In response to this challenge, work has been undertaken at the request of the G20 to develop solutions to address base erosion and profit shifting (BEPS). Luxembourg has actively participated in discussions at OECD level on

the BEPS project, which aim at achieving greater fairness in international tax matters at the global level. At the European level, in July 2014 Luxembourg supported the introduction of provisions in the Parent-Subsidiary Directive which aims to prevent the double non-taxation of groups of companies arising from hybrid loans. Luxembourg also supports the proposal to introduce a general anti-abuse clause into the Parent-Subsidiary Directive. The government's plan is to transpose the amended Directive swiftly into national law.

Fiscal policies to prepare for medium-term challenges

The pension reform of 2013 provides for a phased reduction of pensions. By 2052, the active career would need to be prolonged by approximately 3 years to achieve a level of pension comparable to the one generated by the previous system (BDO, 2013). The reform also links the adjustment of current pension payments to the financial position of the pension plan (CNAP, 2013). The reform will raise the labour force participation of older people, which is low by international comparison (Figure 9). The effects are likely to materialise only very gradually as the changes in the system's parameters are phased in over a 40-year transition period.

Figure 9. **Labour force participation rates over time**



Source: OECD Labour Force Statistics.

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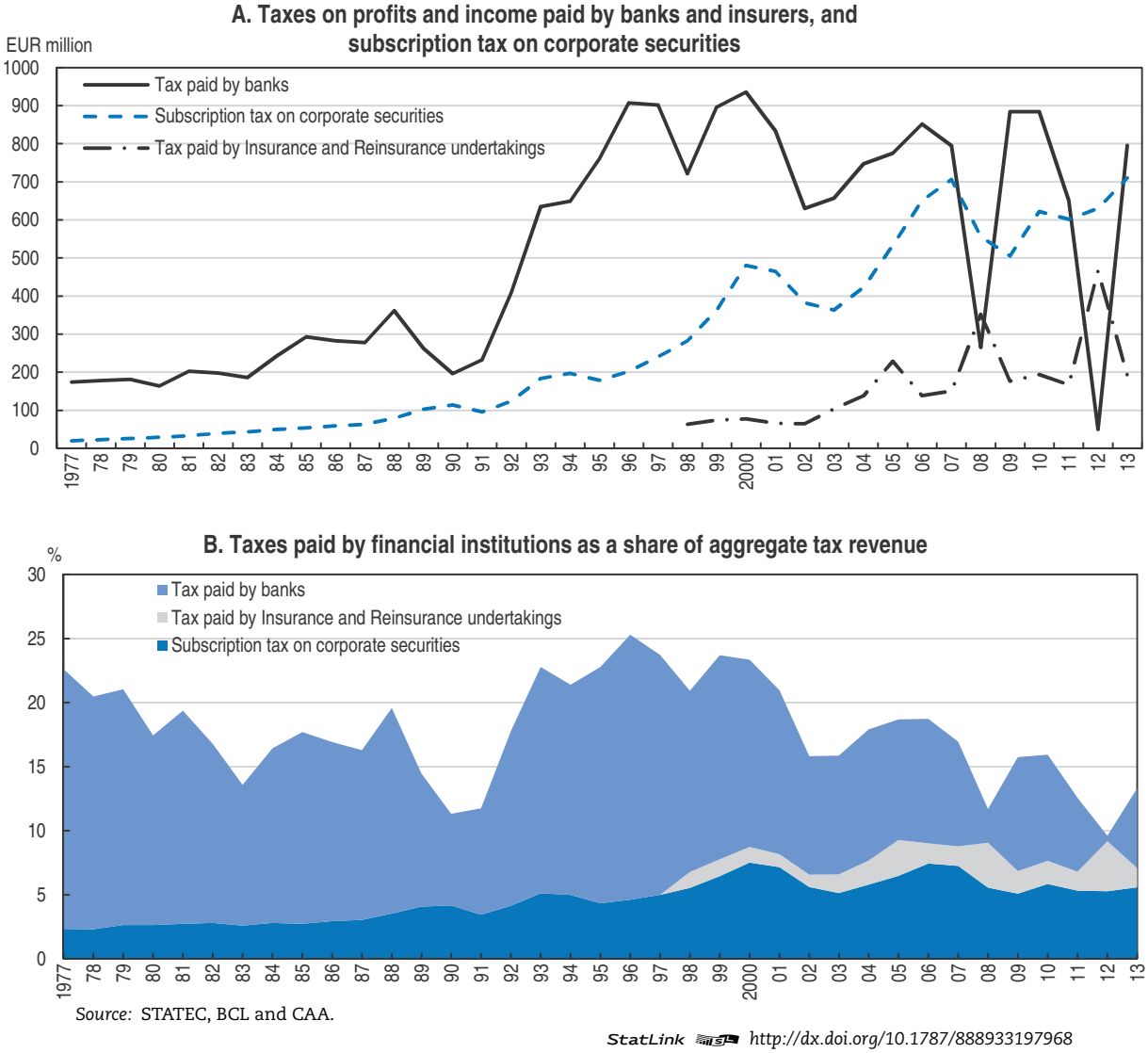
Nevertheless, work by the OECD indicates that age-related spending by the general government – old-age pensions, health care and long-term care spending – might increase by about 5¼ percentage points of GDP between now and 2030, despite the 2013 pension reform. This would be the highest increase in age-related spending in the OECD. Outlays for health care would account for more than a quarter of the increase, although the scenario assumes some cost containment (De la Maisonneuve and Oliveira-Martins, 2013). Doubt about the sustainability of Luxembourg's low-debt fiscal position would pose a risk in that the large financial sector depends not least on the market's trust in financial and fiscal stability.

Thus, pension reform should be followed up by further measures increasing the effective age of pension entitlement, either directly or indirectly via further reductions in the system's "proportional supplements", which determine the earnings-related part of pensions. Simulations by Bouchet et al. (2014) with an overlapping-generations model for Luxembourg suggest that such amendment can provide significant incentives for labour

force participation with substantial positive budgetary effects. Such measures should be supplemented by health care reform (see the 2012 *Survey on Luxembourg*, OECD, 2012a). The government is currently preparing an initiative to improve the efficiency of the hospital sector, which should be a first step in this direction.

Previous *Surveys* have pointed to the volatility of government revenues in Luxembourg (OECD, 2012a), linked to volatile taxes on the financial sector (Figure 10, upper panel). The diversification of the financial sector in recent years might reduce this volatility, as the share of bank profit taxes in total tax receipts has declined while the share of insurance profit taxes and of the subscription tax, a tax on corporate securities (essentially on mutual funds) has risen (Figure 10, lower panel). The latter have been less volatile during the crisis than the bank profit tax.

Figure 10. **Developments in tax revenues from the financial sector**



Source: STATEC, BCL and CAA.

StatLink http://dx.doi.org/10.1787/888933197968

Managing medium-term budgeting pressures would be facilitated by introducing tools for more effective spending control. The government undertook a comprehensive spending review in 2014, on which the 2015 budget is based. This can serve as a base to develop future spending priorities. Indeed, effectiveness of a medium-term budgeting framework requires underlying information to prioritise the budget. A spending review mechanism for future reviews is not yet in place in Luxembourg and should be established, as suggested in *Budgeting in Luxembourg* (OECD, 2012b). The government should consider introducing a spending ceiling for the general government into the medium-term budgeting framework. Spending grew by 6.7 per cent of GDP between 2001 and 2013, and, as in other countries, there has been a tendency to spend available revenues. A spending ceiling is one way to break such trends. The new Fiscal Council could be charged with evaluating how well budgets are adhering to the medium-term budgets and spending ceilings.

Recommendations on macroeconomic policies

Key recommendation

- Strengthen fiscal planning by introducing a spending review mechanism and link it to the medium-term budgeting framework. Consider introducing a spending ceiling for the general government.
- Continue to actively participate in international negotiations on co-ordinated action to combat tax base erosion and profit shifting of multinational enterprises including action to prevent double non-taxation. Change domestic laws as necessary.

Further recommendation

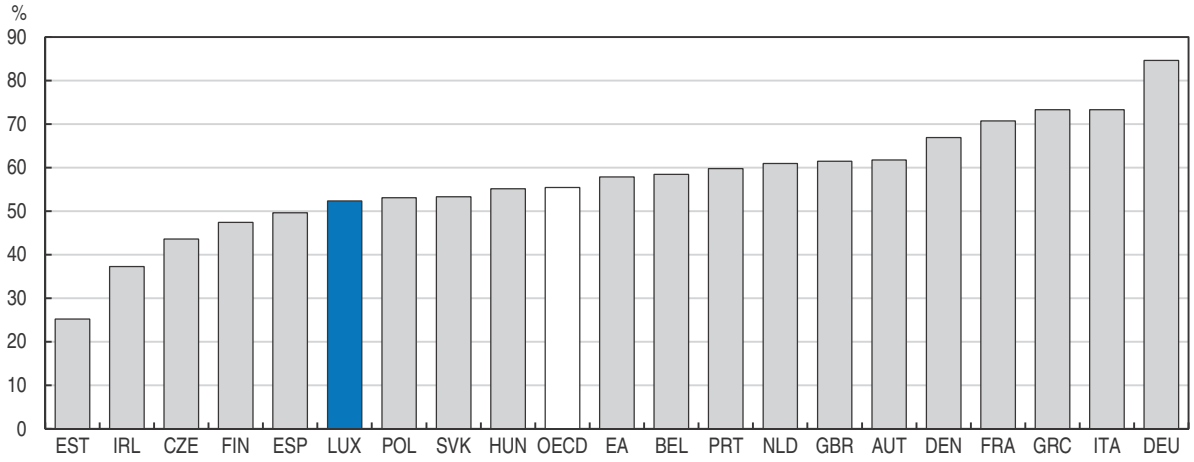
- Increase the effective age of pension entitlement, either directly or indirectly via further reductions in the system's "proportional supplements".
- Identify possible efficiency gains in the health care system.

Strengthening the performance and resilience of the financial sector

The success in diversification already achieved within the financial sector reflects the competitiveness of Luxembourg as a financial centre and safe-haven flows after the crisis. For example, the low cost-to-income ratio by OECD and euro area standards indicates a high degree of technical efficiency for banks operating in Luxembourg (Figure 11). Contestability tests for the banking sector point to some market power, which appears to be relatively low (Samantas, 2013).

However, the sector faces several challenges. Cross-border demand for credit might develop less vigorously than it did in past decades. Changing financial market regulation in Europe and the drive for more transparency reinforce the need to further adjust. High cross-border financial links between Luxembourg's banks on the one hand and their groups' foreign banks and investment funds on the other hand, could transmit external shocks into the economy, even if limited domestic inter-bank exposures of the credit institutions in Luxembourg is reducing domestic inter-bank contagion. More generally, high and rising international competition in the provision of financial services mean that Luxembourg's financial sector needs to rely on maintaining a highly qualified workforce and stability-oriented framework conditions to stay competitive.

Figure 11. **Cost-to-income ratio in the banking sector, 2011**



Source: World Bank, *Global Financial Development Indicators*, November 2013 version.

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The move towards Banking Union in the European Union, including the Single Supervisory Mechanism (SSM) for large participating banks, the Single Resolution Mechanism (SRM), common rule books for bank supervision and resolution, and stronger bank capital requirements, can be beneficial for Luxembourg in that they help to control counter-party risks stemming from the rest of the EU. In particular, Supervisory Colleges, involving the national supervisory authorities, serve to exchange information and co-ordinate key supervisory tasks across borders, and the SRM is responsible for resolution planning and resolution of cross-border European banking groups. Risks to financial sector stability are assessed by the financial market regulator *Commission de Surveillance du Secteur Financier* (CSSF) in co-operation with the Luxembourg central bank (BCL), and this has involved *inter alia* regular stress-testing of banks' liquidity. The government plans to establish a national Systemic Risk Committee, involving all authorities that are relevant for macro-prudential policy: the CSSF, the BCL, the insurance regulator (CAA) and the ministry of finance. Identifying, assessing and monitoring risks to financial stability will be a key task of the Committee. For this co-operation to be successful, it is important to elaborate the analytical framework that accounts for the financial linkages between the banks and the other relevant financial market actors, notably investment funds. For example, investment funds provided some 15% of the banks' funding at the end of 2013. While this funding remained stable during the crisis, there could be adverse spill-over effects from investment funds to banks if the former come under severe stress.

The crisis revealed that risks for banks in Luxembourg can originate from their exposure to parent groups (IMF, 2011). It is welcome that the CSSF has strengthened the criteria to be complied with when engaging in large intragroup transactions. Ownership links between banks across different legal entities and borders can provide a certain degree of risk sharing. However, it can complicate bank resolution in bad times, in particular for bank groups with dependencies located outside the European banking union. It is thus vital to ensure that resolution plans be developed and resolvability assessments undertaken so that important banks could be resolved effectively across borders.

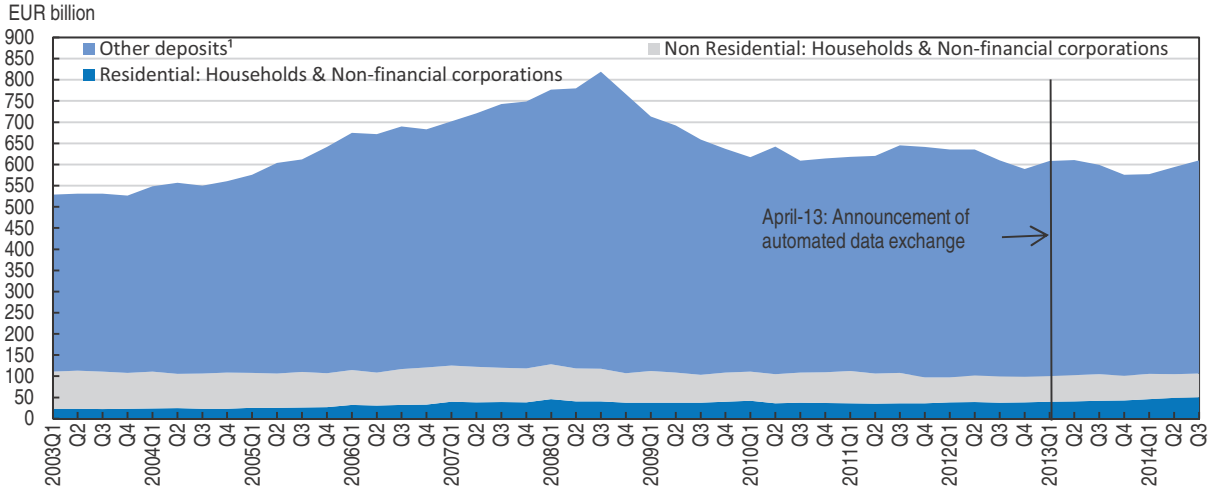
The comprehensive review of bank balance sheets by the European Central Bank, published in October 2014, showed that the capitalisation of the large banks in

Luxembourg is good on the usual metric of capital to risk-weighted assets (ECB, 2014a). It is welcome that the Luxembourg authorities have introduced the fully phased-in Basel III solvency ratio as of 2014 and have made use of the discretion left by European legislation to introduce a capital conservation buffer of 2.5% for all banks as of 2014. Draft laws providing for the anticipated full introduction of the countercyclical capital buffer as well as buffers for systemic banks and for systemic risk are in the legislative process. Maintaining high standards of capitalisation and macro-prudential norms is important to minimise systemic risk and to validate investors' trust, which is crucial for further progress in financial sector diversification.

The Phase-2 review of the Global Forum on Transparency and Exchange of Information for Tax Purposes showed that Luxembourg's tax relevant information practices during the review period were not fully in line with the standard on exchange of information on request. The legal and regulatory framework provides for the availability of ownership, accounting and bank information, and Luxembourg exchanges a considerable amount of information in a timely manner. However, information gathering and enforcement powers to obtain requested information have not been used in all instances. To improve its rating by the Global Forum, Luxembourg has reported that it has acted on all of the recommendations made in its report by the Global Forum. Also, Luxembourg has committed to implementing the new automatic exchange of information standard by 2017 and signed the Multilateral Competent Authority Agreement with 51 other jurisdictions.

Following the government's announcement, in April 2013, to introduce an automated data exchange, bank deposits from non-financial counterparties remained stable (Figure 12). Reductions in deposits by non-financial and non-residential counterparties – notably private households in neighbouring countries – were offset by increases in deposits by non-financial and residential counterparties. The remaining steps in upgrading

Figure 12. **Deposits held by credit institutions in Luxembourg**



1. Categories in Other deposits: Credit institutions, General government, Other financial intermediaries & Financial auxiliaries, Insurance corporations & Pension funds.

Source: BCL.

StatLink http://dx.doi.org/10.1787/888933197988

the tax transparency regulations should be made soon. This would increase incentives for banks to further refine their business models, benefitting Luxembourg's financial sector in the medium term.

Recommendations on the financial sector

Key recommendations

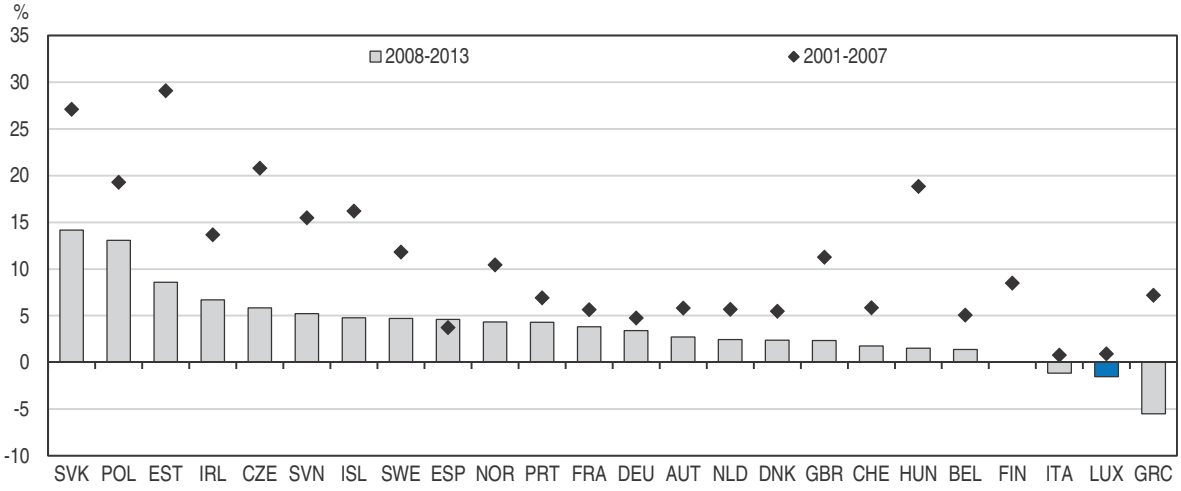
- Continue to monitor financial market risk while using a comprehensive approach to risk assessment that accounts for financial linkages between banks and non-bank financial intermediaries, notably investment funds.
- Continue efforts to develop resolution plans and to undertake resolvability assessments so that important banks could be resolved effectively across borders. For this end, continue to co-operate with regulatory authorities in other jurisdictions outside the EU.

Fostering the emergence of innovative industries

Productivity and potential growth have declined

While productivity is particularly hard to measure in Luxembourg because of the large share of the financial sector, OECD estimates point to declining and even negative growth of trend productivity (Figure 13). The economy's productivity growth, measured in real GDP per employee or, alternatively, per hour worked, is among the lowest in the OECD. Furthermore, the drop was particularly strong during the crisis.

Figure 13. **Trend productivity growth, cumulated**

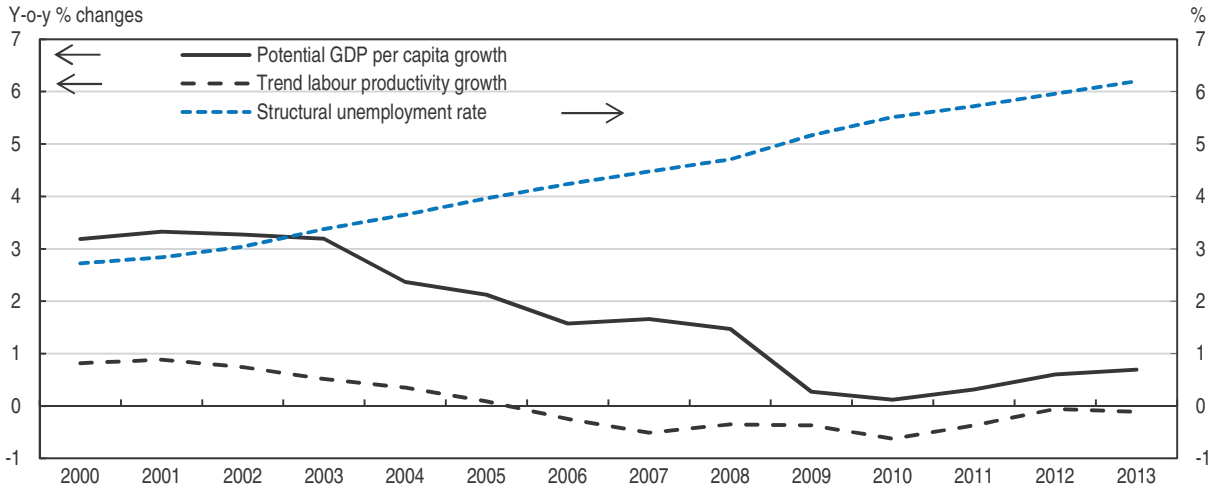


Note: Calculated as growth rate from initial level to the end-period level.
Source: *OECD Economic Outlook 96 Database.*

StatLink http://dx.doi.org/10.1787/888933197996

Potential output growth has also slowed significantly according to the recent OECD estimates (Figure 14), reflecting the decline in productivity growth but also the sharp rise in structural unemployment. Both are likely to reflect structural rigidities in the economy outside the financial sector, which weaken the mobility of resources, human capital

Figure 14. **Trend unemployment and productivity**



Source: OECD Economic Outlook 96, November 2014.

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development and capital upgrading. The booming financial sector may also have pushed up the real exchange rate, thereby raising costs in the rest of the economy and making the development of other sectors harder in a "dutch disease" type of effect.

Slowing reallocation of resources between sectors is bearing on productivity growth

Sectoral shift-share analysis, which distinguishes growth within a sector versus growth from shift in output between sectors, points to declining contribution to productivity of the traditional growth drivers of financial and other business services. Since the middle of the 1980s until the onset of the crisis, financial intermediation, manufacturing, transport, storage and communication and community and social services were the largest contributors to overall within-sector productivity growth (Figure 15, upper panel). Financial intermediation was the only sector that had a further increase in productivity growth in the decade prior to the crisis.

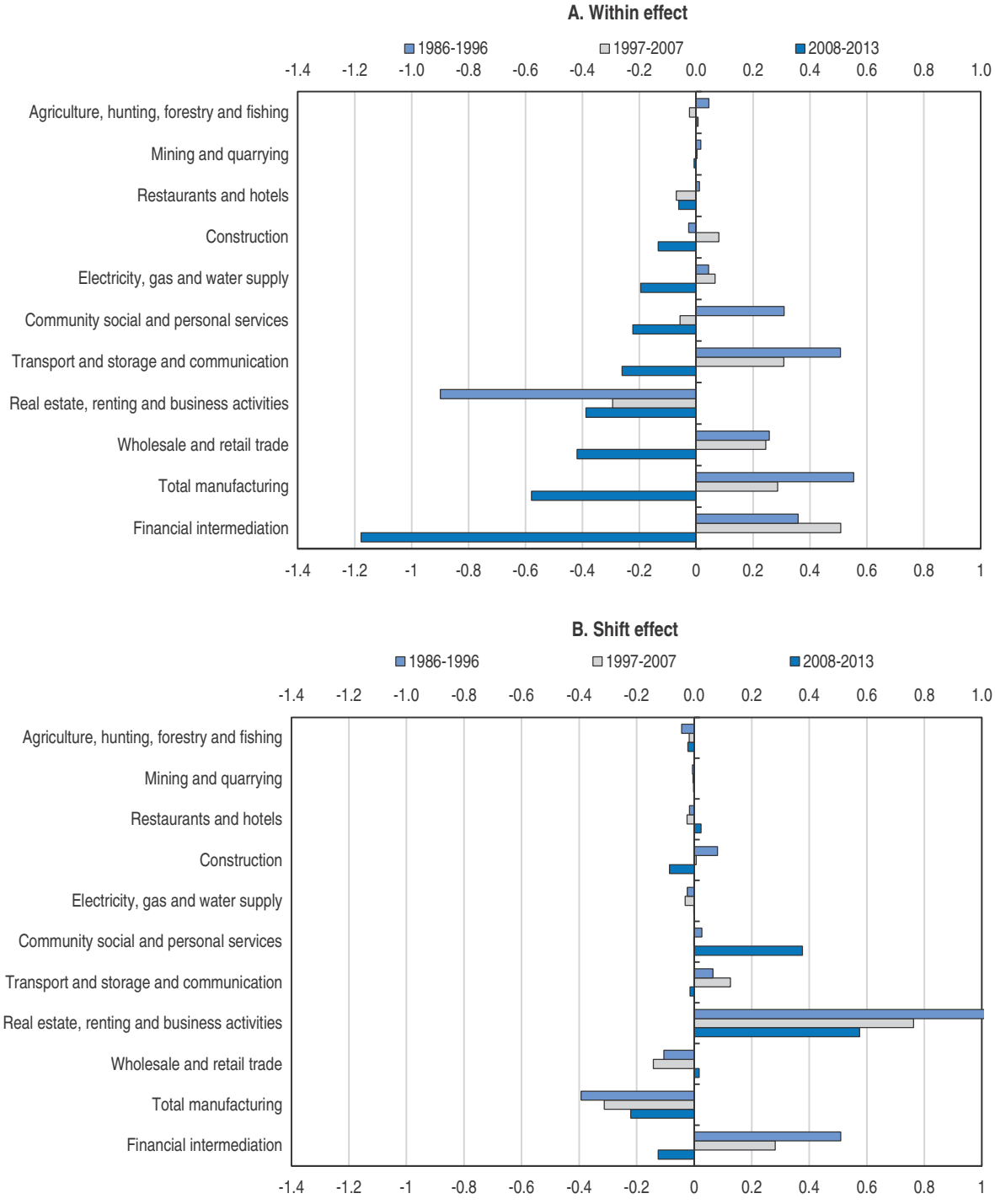
The shifting of resources towards sectors with high productivity – notably real estate, renting and business activities and financial intermediation – accounted for a significant part of overall productivity growth (Figure 15, lower panel). This positive reallocation effect slowed significantly after the crisis and turned negative in financial intermediation as its output fell. Securing and further developing Luxembourg's high living standards calls for fully exploiting the scope for structural reform to enhance reallocation of resources to new activities.

Future growth potential is likely to lie in high value-added activities

For high-income economies like Luxembourg activities that produce high value-added should be particularly important as they are relatively highly remunerated. High value-added activities tend to be technology and knowledge intensive. Indeed, in the EU value-added per employee in the high-tech manufacturing and the knowledge intensive service sectors (in the classification of the EU Commission) exceeds that in the rest of the economy by some 25% (Table 2). Thus, high-value-added activities are also less contestable because required skills are more difficult to obtain. Moreover, given the small size of the domestic

Figure 15. **Shift-share analysis of labour productivity growth**

Percentage points



Source: OECD *STAN Database*.

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economy, Luxembourg will have to rely on high integration in global value-chains, which broadens effective market size and can generate beneficial spillovers of knowledge and best practices (OECD, 2013a).

Table 2. **High-tech manufacturing and knowledge-intensive services industries**

NACE/area letter codes	Industry type
High- and medium-high technology manufacturing	
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
Knowledge-intensive services	
50	Water transport
51	Air transport
58	Publishing activities
59-60	Motion picture, video, television programme production; programming and broadcasting activities
61	Telecommunications
62-63	Computer programming, consultancy, and information service activities
64	Financial service activities, except insurance and pension funding
65	Insurance, reinsurance and pension funding, except compulsory social security
66	Activities auxiliary to financial services and insurance activities
69-70	Legal and accounting activities; activities of head offices; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development
73	Advertising and market research
74-75	Other professional, scientific and technical activities; veterinary activities
78	Employment activities
80	Security and investigation services
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation

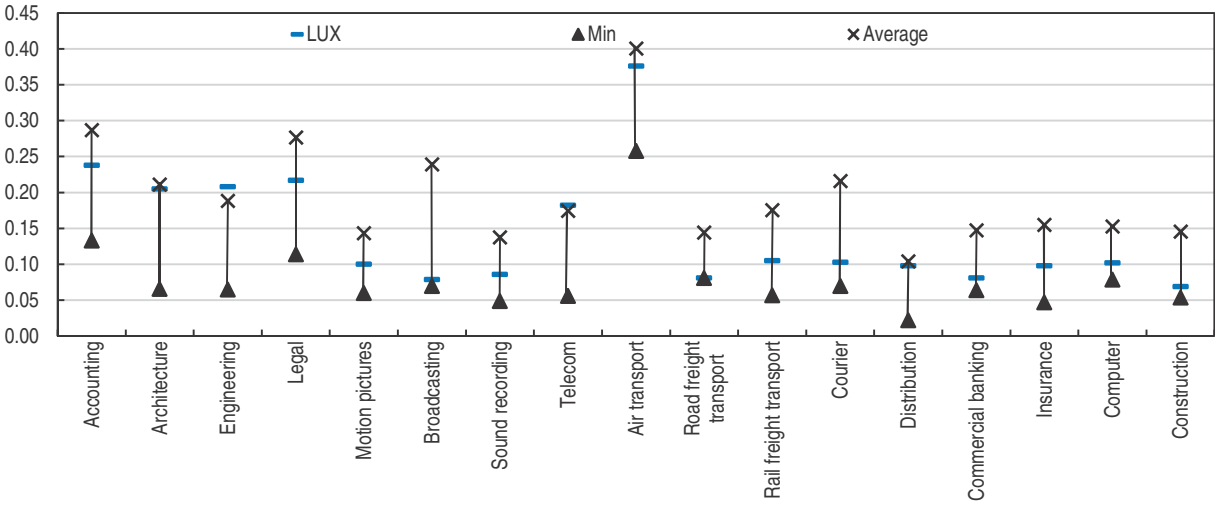
Note: Classification by Eurostat, see the ISIC Rev. 3 Technology-intensity definition; *www.oecd.org/sti/ind/48350231.pdf*.
Source: Eurostat indicators on High-tech industry and Knowledge-intensive services, Annex 2.1, *http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf*.

Luxembourg is one of the most open countries in the OECD with respect to international trade in services. The scores on the OECD's Services Trade Restrictiveness Indicators (STRIs) are below (meaning more open) the OECD average in 16 out of 17 sectors (Figure 16). The share of services value added in Luxembourg's total exports exceeds 80%, which is the largest in the OECD. In the same vein, the integration of financial services in the global value added chains (GVC) is the highest in the OECD (Figure 17). At the same time, integration is considerably lower in other knowledge-intensive services, such as transportation and telecommunications, leaving potential to raise productivity by further integration into international value chains in higher value-added non-financial activities. Integration in business services also still leaves some scope for benefitting from higher integration.

Policies to promote high value added activities to raise productivity and potential output

In high-income economies the role of innovation and knowledge-based capital (KBC) – assets that lack physical embodiment, such as computerised information, intellectual property and economic competencies – is increasingly important for productivity and growth. Overall investment in knowledge based capital as a share of GDP is lower in

Figure 16. **Services Trade Restrictiveness Index (STRI): Luxembourg**



Note: The STRI indices take the value from 0 to 1, where 0 is completely open and 1 is completely closed. They are calculated on the basis of information in the *STRI Database* which reports regulation currently in force. For further information, see *www.oecd.org/tad/services-trade/services-trade-restrictiveness-index.htm*.
Source: OECD STRI Database.

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Luxembourg than in other OECD countries (Figure 18). The economy is also below the OECD average in terms of business and overall spending on research and development (R&D) (Figure 19). Enterprise R&D spending declined from 1.4% of GDP in 2007 to 1% in 2012, widening the gap to the OECD and the EU average. On the other hand, in trademark applications Luxembourg scores highest in the OECD (Figure 20).

Stepping up investment in KBC and enterprise innovation can help Luxembourg to maintain and further develop its position in the global value added chains, raise productivity and keep its high living standards. Important policies for innovation and KBC are those related to the business environment, labour markets, education, patenting, bankruptcy law, access to finance and competition. Indeed, several of these factors are cited by entrepreneurs as important barriers for doing business (Figure 21). Lately, cluster policies have also gained in importance among policy makers. The role of these various factors in Luxembourg is discussed in more detail below.

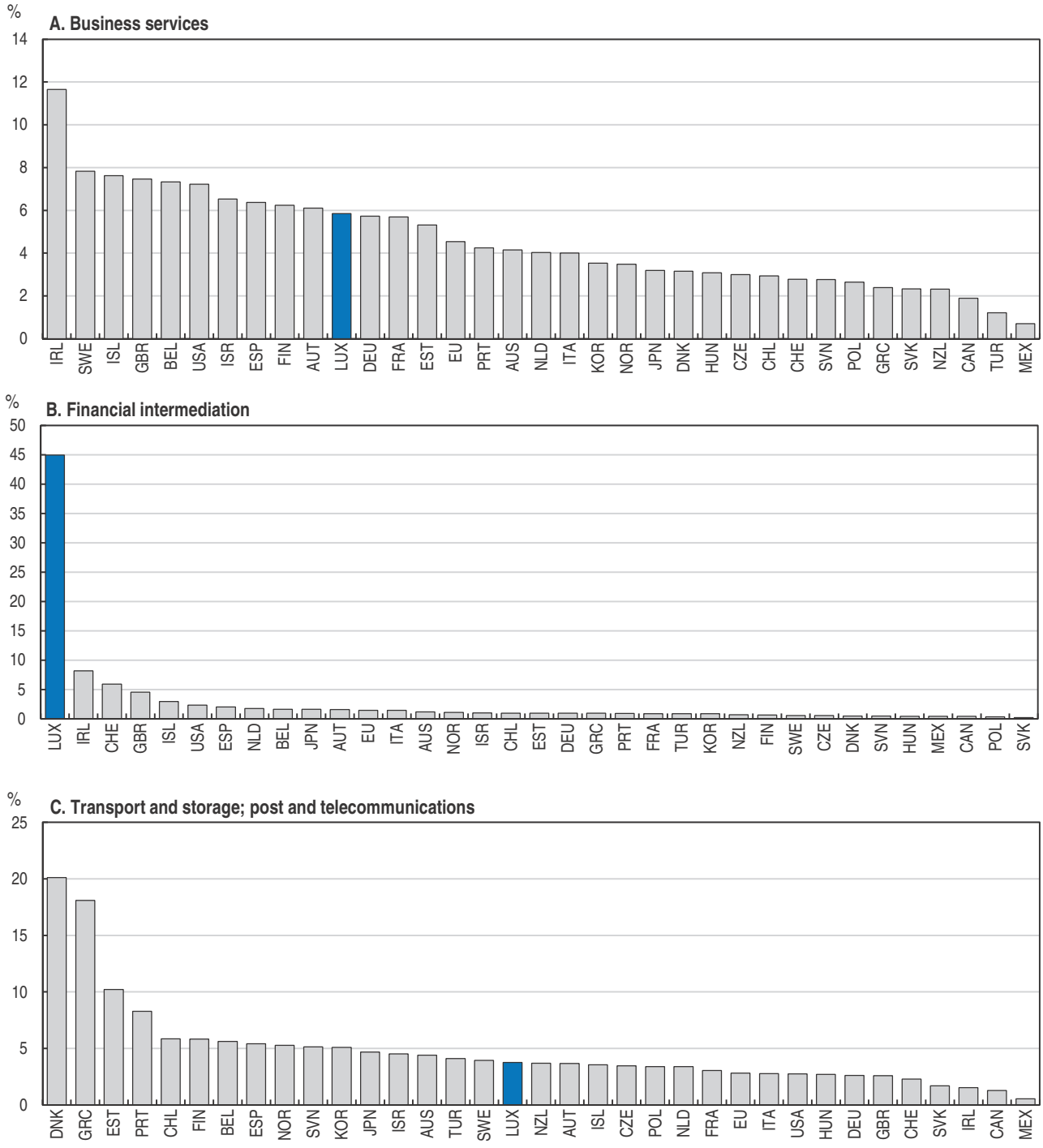
Developing entrepreneurship

Improving the business environment to foster innovation

Entrepreneurship and productivity are heavily influenced by the business environment. There is a strong negative relationship between the strictness of product market regulation (PMR) and productivity, both in the aggregate (Bouis et al., 2011) and at the firm and sectoral levels (Aghion et al., 2004; Bourlès et al., 2010). In particular, lower entry barriers increase the supply of new ideas by raising firm entry rates, which in turn increases the pressure on incumbent firms to innovate.

Overall, barriers to entrepreneurship have declined in Luxembourg between 2003 and 2013, but remain higher than those in best-practice countries (Figure 22). Administrative burden for sole proprietor firms and of barriers in network sectors declined, but in the services sector business conditions became more restrictive due to tighter regulation in licencing in retail trade. There has been little progress in making regulation in

Figure 17. **International comparison of GVC participation index for selected industries, 2009**



Note: The participation index is calculated as the sum of: i) the share of foreign inputs in overall exports, and ii) the share of gross exports that are used as inputs in other countries' exports.
Source: OECD *Global Value Chains Indicators*.

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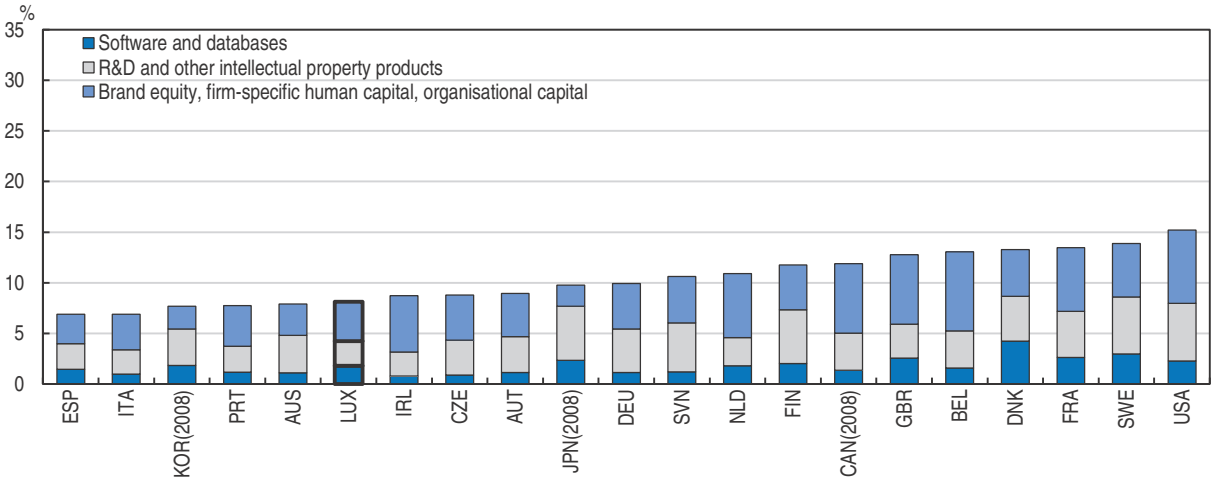
professional services, such as architecture, engineering, accounting and legal services, more competition friendly. Barriers in these sectors appear to be relatively high by international comparison due to high entry barriers, such as compulsory qualifications

Figure 18. **Investment in knowledge based capital, 2010**

As a percentage of value added of the business sector



Source: OECD *Science, Technology and Industry Scoreboard 2013*.

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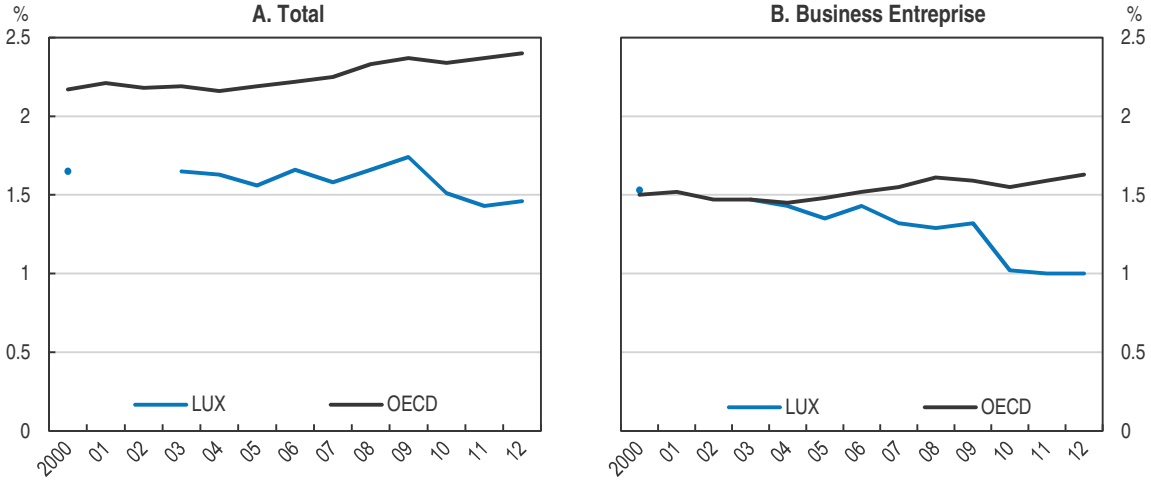
Figure 19. **Research and development expenditure**

Gross domestic expenditure in per cent of GDP



Source: OECD (2014), *Main Science and Technology Indicators*.

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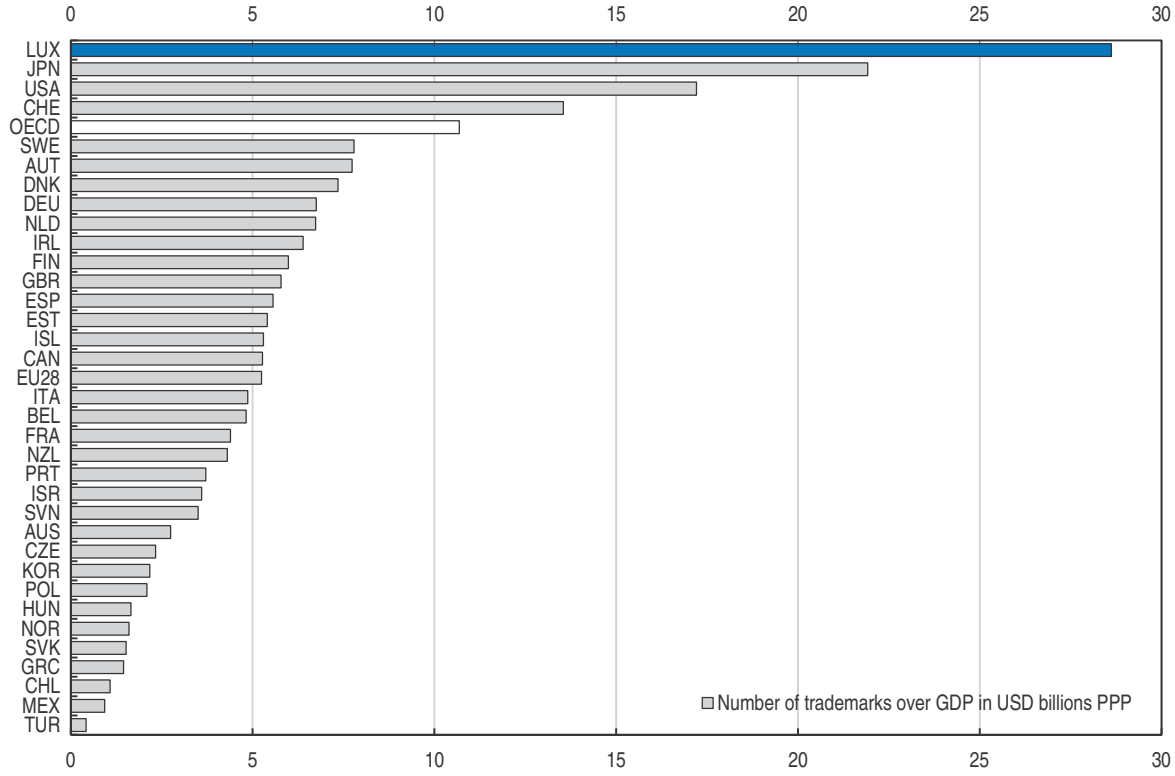
and duration of compulsory practice. However, the Competition Authority was able to abolish recommended fee structures published by several professional associations, such as architects and safety and health co-ordinators.

Entrepreneurial barriers in the network sector remain relatively high. As the government retains full ownership in the major telecommunication network operators (*Luxconnect* and *Entreprise des Postes et Télécommunications*), they are not open to investment by private firms. Opening the sector to foreign participation might lead to more investment, although the outcome is not certain and will depend on expected returns. The government should consider opening the telecommunications sector to private ownership and investment.

Figure 20. **Trademark applications, 2009-11 average**



Note: Registered at JPO (Japan Patent Office), OHIM (Office for Harmonization in the Internal Market) and USPTO (US Patents and Trademark Office).
Source: OECD *Science, Technology and Industry Scoreboard 2013*.

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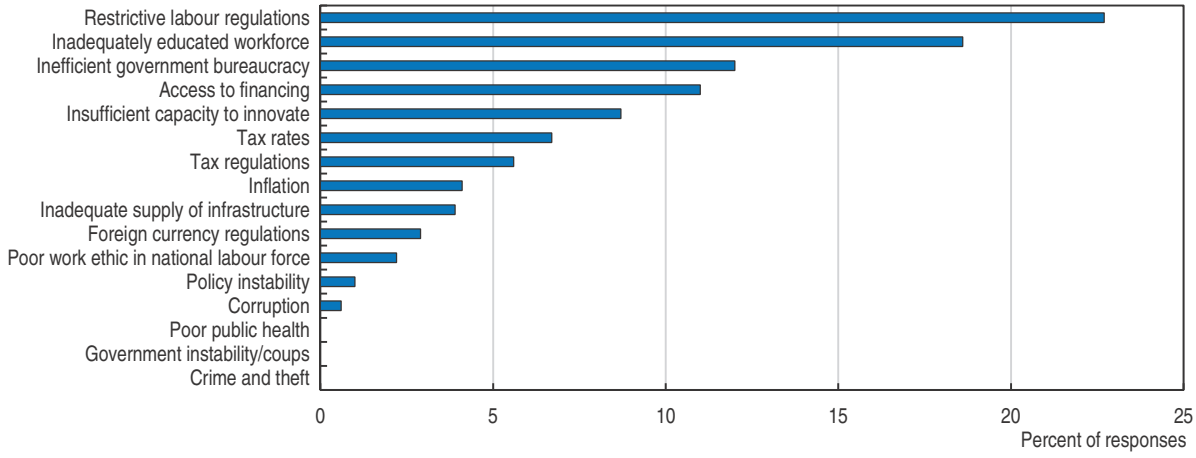
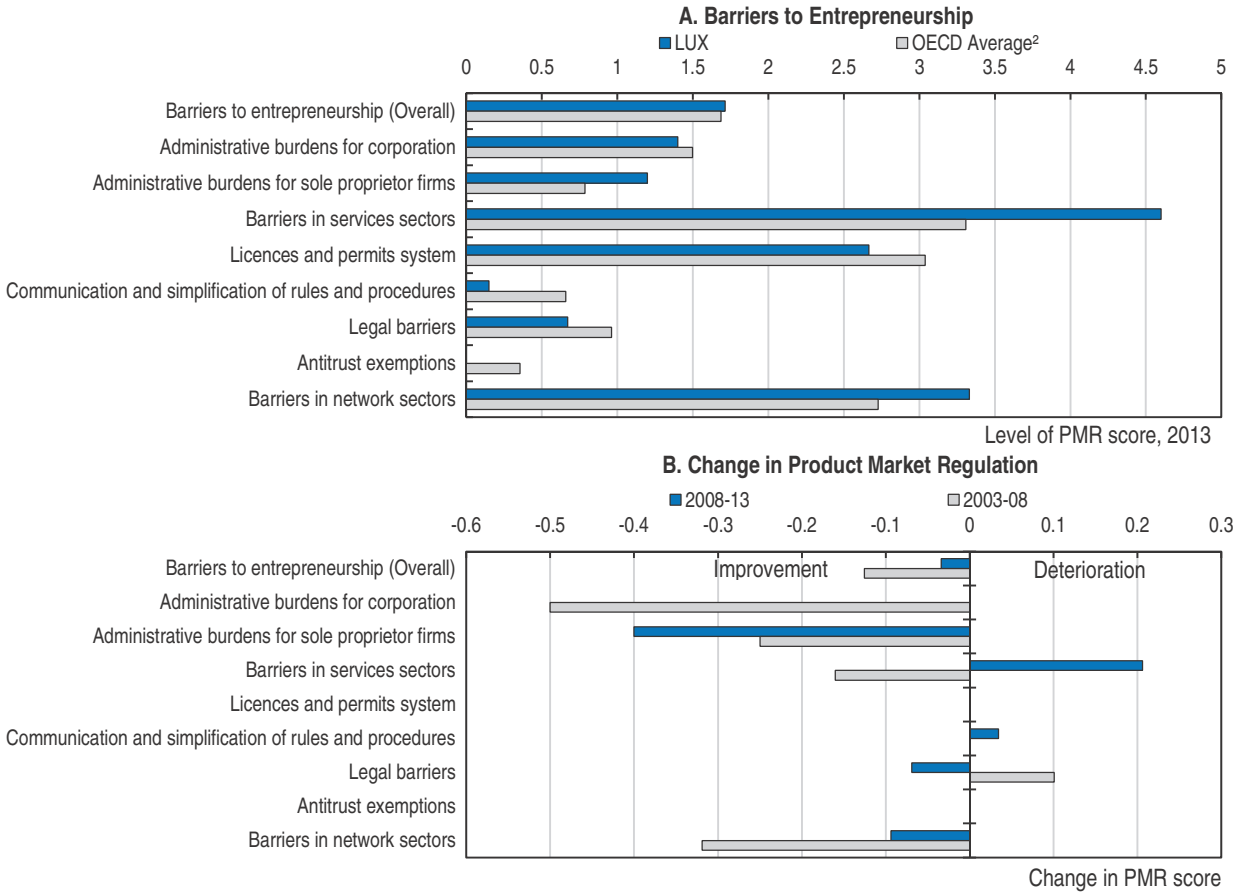
Figure 21. **Luxembourg: Factors considered most problematic for doing business**



Note: From the list of factors above, respondents were asked to select the five most problematic for doing business in their country and to rank them from the most problematic to the least problematic one. The bars in the figure show the responses weighted according to the rankings. Respondents are business executives from small- and medium-sized enterprises and large companies representing all fields of activity.
Source: World Economic Forum, *The Global Competitiveness Report* 2014-2015, *www.weforum.org/reports/global-competitiveness-report-2014-2015*.

StatLink http://dx.doi.org/10.1787/888933198074

Figure 22. **Product Market Regulation: Barriers to entrepreneurship**[1]



1. All indices below the first line are sub-indices of the index "Barriers to entrepreneurship".
2. Simple average of OECD countries, 2013 data. USA latest data is 2008.

Source: OECD *Product Market Regulation Database*, 2013 edition.

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Policies helping enterprises to form clusters could support innovation and productivity growth

The case for public policies that promote "clustering", the tendency of firms in related lines of business to concentrate geographically, rests on the idea that regional clusters might internalise spill-overs, thereby spurring innovation and productivity growth (Beaudry and Breschi, 2000). Clusters might also help firms to attract a workforce with characteristics that best match their projects.

The government is supporting the formation of enterprise clusters in sectors that it considers promising for Luxembourg. At present, the initiative comprises the following clusters: eco-innovation technologies; healthcare and biotechnologies; information and communication technologies; materials technologies; space technologies; automotive components; logistics; and the maritime transport (Box 1). These sectors fit with the usual classification of high value-added activities (Table 2). However, it is important to ensure that the approach remains flexible with respect to new demands and avoids creating disadvantages for business in sectors that are not covered by the initiative. Experience in other countries suggests that favourable regulatory framework conditions are important to the success of clusters (OECD/DSTI, 2014). In particular, this concerns: overall competition-

Box 1. **The government's cluster initiative**

In 2002, the government launched a cluster initiative, which, in its present form, pursues the following objectives:

- Foster communication and the exchange of knowledge and know-how between cluster and innovation network members.
- Stimulate the development and implementation of collaborative projects on a national, European and an international level.
- Enhance the visibility of the technological excellence and the innovation potential of cluster and innovation network members.
- Encourage the uptake of new technologies and the identification of potential business opportunities.

The aim is to create 3 000 new jobs and contribute to the establishment of 300 new businesses by 2020.

Most of the clusters are led by a president coming from the private sector, who is supported by a vice-president from public research. Designated cluster managers are in charge of the daily organisational management.

friendly product market regulation to foster the reallocation of resources; labour market regulation that raises employment and supports efficient matching of workers with jobs; and policies that raise skills. Sector-specific regulation might also be relevant. For example, the forthcoming *OECD Innovation Report on Luxembourg* found a need to adapt the legal framework regulating activity in bio-health for the relevant cluster to become a success (OECD, 2015a, forthcoming).

Studies on cluster policies suggest that they need to build on existing strengths to be successful. Policies disregarding comparative advantages can entail high economic costs and risks (OECD/DSTI, 2014). Support for clusters run the risk of "backing losers" rather than "picking winners" (Hospers et al., 2008). Several evaluations of cluster policies in OECD countries found no positive effect on employment, exports, sales, patents or R&D productivity (Martin et al., 2011; Bellego and Dortet-Bernadet, 2013; Nishimura and Okamuro, 2011). Other evaluations found modest positive effects of cluster policies such as a slightly higher share of knowledge-based firms in the locality, albeit stagnating over time (Viladecans-Marsal and Arauzo-Carod, 2012), and a somewhat higher probability that firms in a target industry would innovate (Falck et al., 2010). Also, valuation based on interviews and self-reports show that cluster policies can succeed in fostering inter-firm collaboration or business contacts (Engel et al., 2012; Uyarra and Ramlogan, 2012).

The government has undertaken substantial infrastructure investment supporting cluster activities. Luxembourg now has one of the most modern data centre parks in Europe with 19 data centres in operation that conform to high standards in security, availability and environmental benchmarks. For the bio-medicine cluster important research infrastructures were built up. The forthcoming *OECD Innovation Policy Review on Luxembourg* (OECD, 2015a) finds that the quality of research in bio-health has recently improved, largely owing to international co-operation. At the same time, the *Review* sees a need to reconsider regulatory framework conditions that are relevant for research in biomedicine and points to a number of other issues that can hamper health-related innovation such as a relatively weak industrial base in the field and a lack of linkages between researchers, business and clinicians.

To enhance the efficiency of cluster policies, outcome-oriented evaluation should be given high priority to ensure that costly infrastructure investment yield results. The government is presently establishing a comprehensive data-base containing key characteristics of the enterprises participating in clusters. This is an important step towards effective policy evaluation. Project funding should rely increasingly on private resources as cluster participants obtain benefits from the policy stimulus. Also, evaluation should go hand in hand with an assessment whether regulatory policy settings would need to be adapted. Efforts should be made to create synergies via cross-border initiatives. To enhance innovation, clusters should also be kept inclusive through impartial public co-ordination and adaptable by effective interaction of firms and research institutions. A proper assessment of market failures that the cluster policy is trying to address should be an integral part of policy formulation.

Equity financing of start-ups is subdued

Venture capital and start-up investment in Luxembourg is low by international comparison, although funding appears volatile over time (Figure 23). The government is promoting the availability of venture capital via two public investment funds set up in 2012. The funds are designed to invest in innovative small and medium-sized enterprises (SMEs) in the development phase, in sectors supported by the government's cluster initiative (such as ICT and clean technologies). Other direct support programmes exist to fund innovation, and royalties and capital gains derived from most types of intellectual property are tax deductible to some extent. OECD research suggests that R&D tax incentives benefit incumbents at the expense of entrants, suggesting that direct support is better suited for small and young firms facing constraints to access finance (Westmore, 2013; Jaumotte and Pain, 2005).

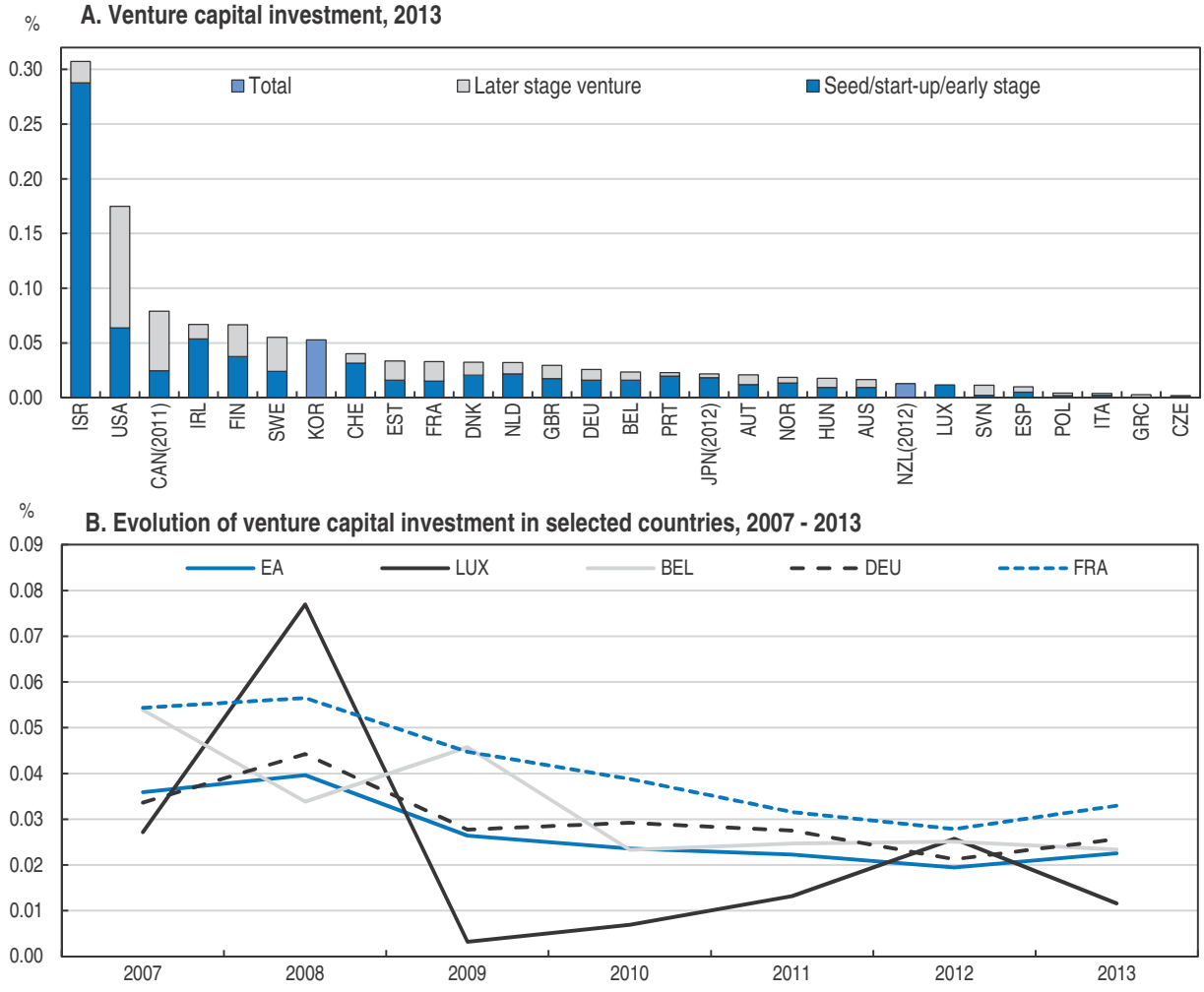
These initiatives have not yet lead to a significant boost in venture capital, however. The funding programmes should be carefully evaluated in terms of how effective they are in achieving their goals, and adjusted periodically as needed.

Collaboration with other companies, universities and research institutes can help innovation by SMEs that may otherwise have more limited resources for R&D. Innovative SMEs in Luxembourg are actively engaging in international collaboration on trademarks and patent submissions, as well as on joint marketing and distribution schemes (Figure 24, Panel A). Collaboration of enterprises with public research institutions has been relatively weak (Figure 24, Panel B), but has made progress in recent years as the governance of public research institutions improved (OECD, 2015a). Scope remains for further improving the performance of public research centres (CRP), as argued in the forthcoming OECD Innovation Policy Review on Luxembourg, notably via exploring closer co-operation of the research centres with the University of Luxembourg and foreign-based research institutes, considering the possibility of further mergers of CRPs, and utilising the merger process for developing co-operation with international institutions (OECD, 2015a).

Raising the quality of human capital

Educational attainment is high, with tertiary education rates among the adult working-age population well above the OECD average (Figure 25), and have increased over time. This upward dynamic, which is broadly in line with that in many OECD countries, should provide an increasing pool of skilled workers for Luxembourg.

Figure 23. **Venture capital investment as a percentage of GDP**



Source: OECD, *Entrepreneurship at a Glance 2014*; European Private Equity and Venture Capital Association.

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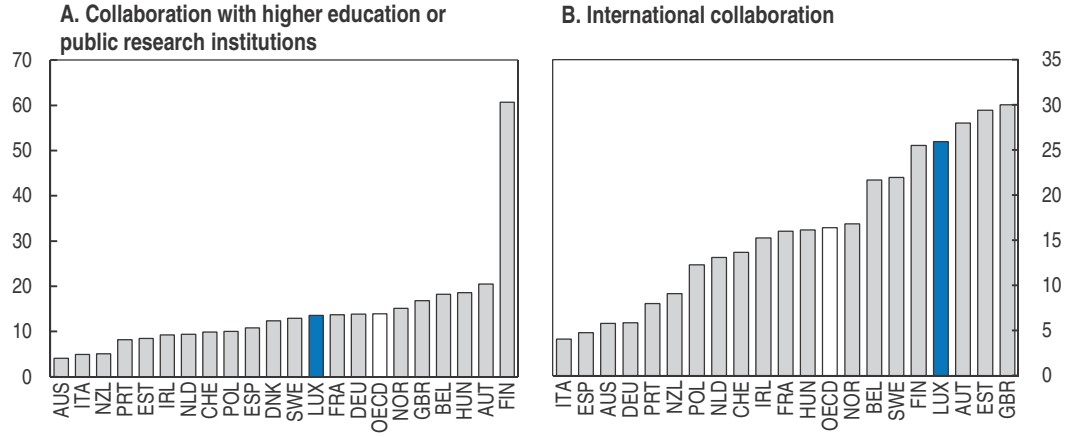
Secondary schooling also has many strengths, but PISA results for 15 year-old students show performance somewhat below the OECD average in all three components, mathematics, reading and science (OECD, 2014a). Class sizes are small and the teaching workforce is the youngest within the OECD. Teachers receive the highest salary per student within the OECD (measured in purchasing power parities).

However, the share of students needing another two years on top of the regular time for high school completion is the highest among the OECD countries, due to the widespread practice of repeating one or more years of school (Figure 26). Grade repetition is costly and studies have shown that it is largely ineffective in raising educational outcomes (OECD, 2012c). Additional support in addressing learning gaps and more use of special education techniques can be employed in decreasing grade repetition. Also, the completion rate of vocational programmes (which are part of upper secondary education) barely exceeds 60% (OECD, 2014b). Even though it is possible that some non-completing school leavers find their way back into education and gain qualifications, the window of opportunity between ages of 15 and 20 has been lost (OECD, 2010a).

Figure 24. **SMEs collaboration on innovation**

Per cent of product and/or process innovative firms, 2008-10[1]

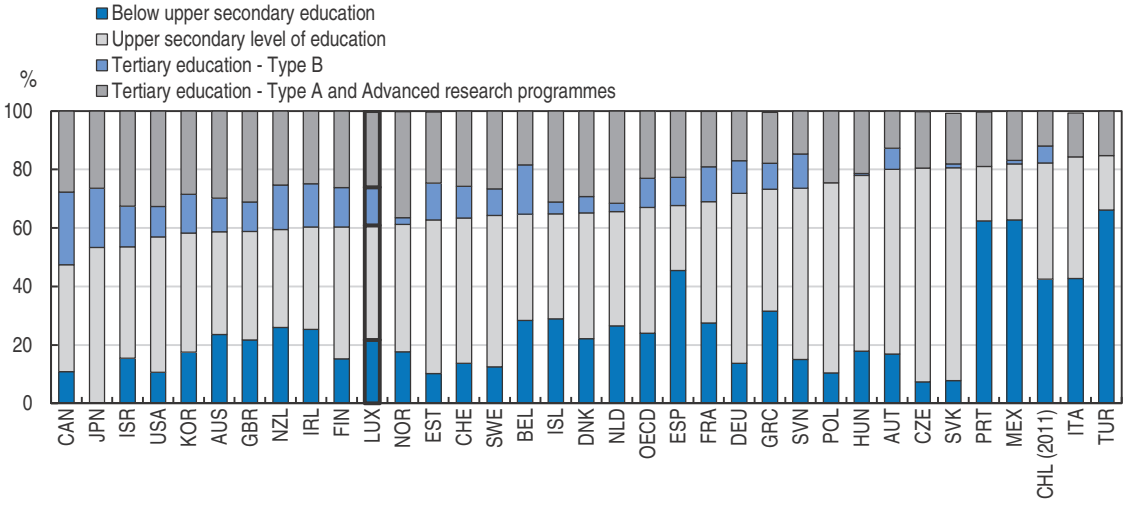


1. 2011 for Australia, 2006-08 for Ireland, 2009-10 for New Zealand and 2009-11 for Switzerland. SME: Small- and medium-sized enterprises. The OECD aggregate covers 30 countries in Panel A and 28 in Panel B.

Source: OECD (2013), OECD *Science, Technology and Industry Scoreboard 2013*.

StatLink http://dx.doi.org/10.1787/888933198108

Figure 25. **Educational attainment of 25-64 year-olds, 2012**



Source: OECD (2014), *Education at a Glance*.

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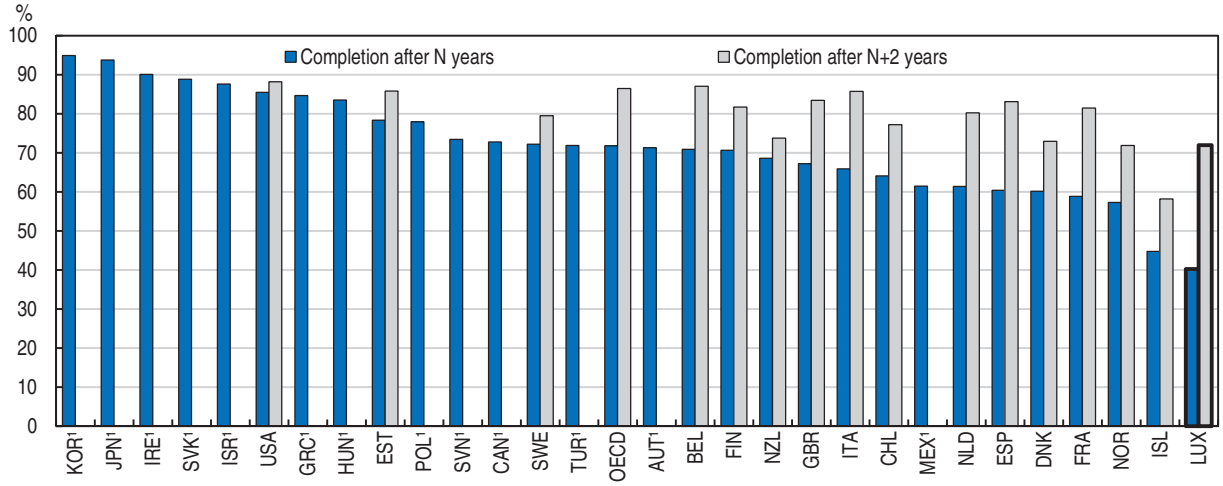
Students with immigrant backgrounds have lower performance and parents' educational attainment substantially affects student achievement (Figure 27). The government has proposed measures to raise the equality of opportunities and educational outcomes of vulnerable groups. A free childcare programme for children below 3 years will become effective in September 2016. This can improve language competences in the three official languages used in schools, and thereby raise learning outcomes among the vulnerable groups. OECD work indicates that early childhood education and care helps in improving learning outcomes and provides foundation for lifelong learning, but the magnitude of benefits is conditional on quality (OECD, 2012d). Also, in mid-2014, reform of the financial aid system for students lowered the annual sum paid to all students regardless of background, with topped up funding subject to eligibility criteria and means testing. The revised system focusses more on students with disadvantaged backgrounds.

Figure 26. **Successful completion of upper secondary programmes, 2012**
(N: theoretical duration of the programmes)



Note: Please refer to Annex for details concerning this indicator, including methods used, programmes included/ excluded, year of entry, etc.
1. N + 2 information missing.
2. Countries are ranked in descending order of the successful completion of upper secondary programmes.
Source: OECD (2014), *Education at a Glance*, Table A2.4. See Annex 3 (*www.oecd.org/edu/eag.htm*).

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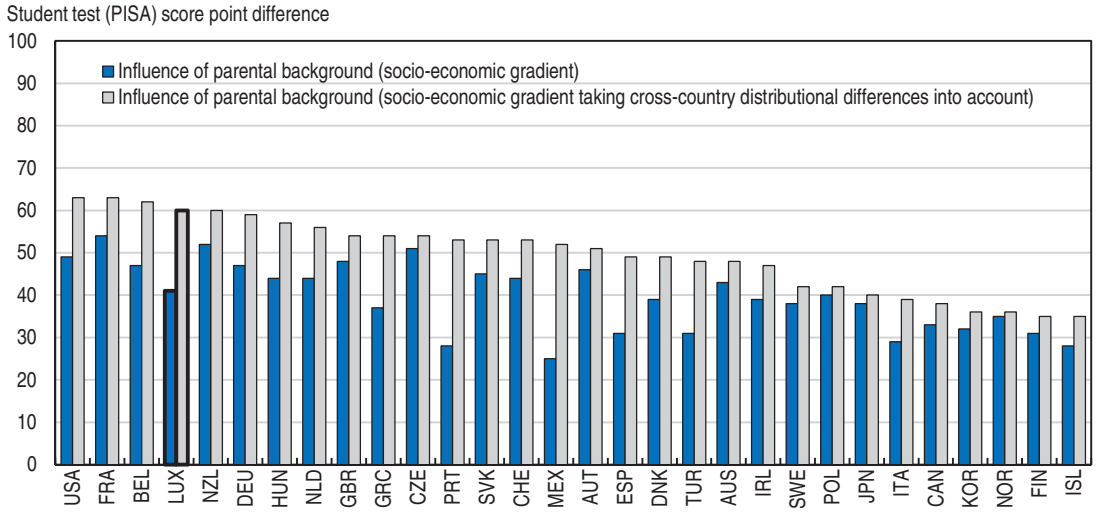
Figure 27. **The influence of parental background on student achievement in secondary education**[1]



Note: Regression of students' PISA science performance scores on their PISA economic, social and cultural status (ESCS), a broad indicator of family's socio-economic background. Country-by-country least squares regressions weighted by students' sampling probability. Robust standard errors adjusted for clustering at the school level.
1. The socio-economic gradient represents the change in PISA science score due to an improvement of one international standard deviation in the PISA index of student socio-economic background. The socio-economic gradient taking cross-country distributional differences into account is the change in PISA science score due to an improvement of one country-specific, inter-quartile change in the PISA index of student socio-economic background. Note that science literacy was the focus of PISA 2006, upon which these results are based.
Source: Causa and Chapuis (2009).

StatLink http://dx.doi.org/10.1787/888933198137

Overall, recent reform plans of the government, such as better targeting support to disadvantaged students, are welcome. Enrolment in early childhood education with emphasis on low-income and foreign-language families should be increased. Raising the educational performance of the school system suggests to broaden these initiatives, to include reforms that have proven to be effective in other OECD countries, such as providing schools with more autonomy in choosing teachers and in budgetary matters (Sutherland and Price, 2007), and better monitoring of education quality. These reforms would help potentially to reduce the structural unemployment and raise the pool of workers able to work in the higher value-added activities.

Getting workers to move to new activities

Labour market policies to improve reallocation of labour into new sectors would help diversification. This is especially the case as high wage premia in the financial sector relative to the rest of the economy can make it difficult for other sectors to attract qualified workers. Employment protection legislation (EPL) in Luxembourg is above the OECD average, with notice periods for individual dismissals relatively long (Figure 28). Therefore, further liberalisation of these requirements could facilitate reallocation of labour to growing sectors' activities (Haltiwanger et al., 2006; Bassanini et al., 2009).

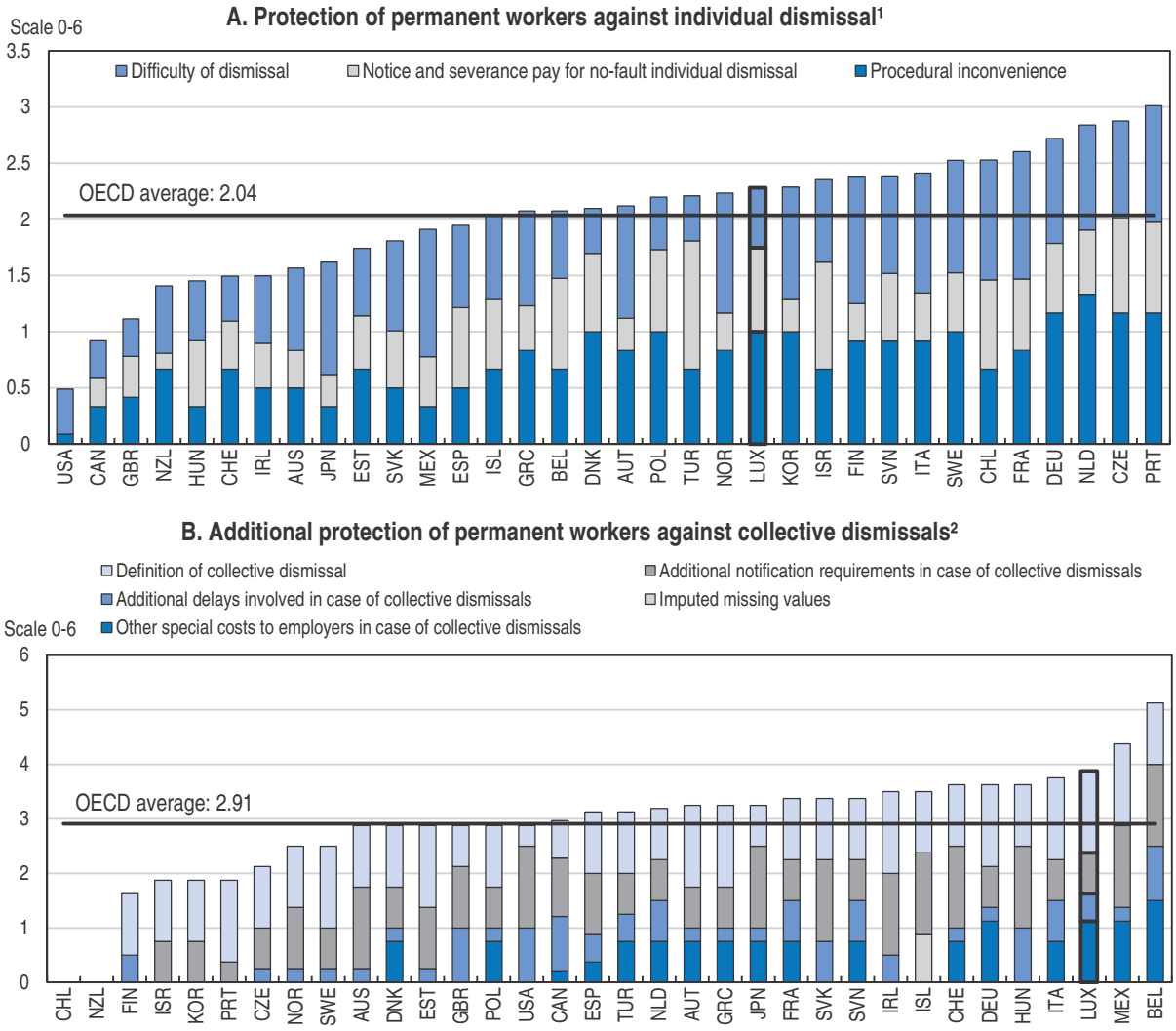
The mechanism of wage indexation has been restarted in 2015, after a temporary moderation between 2012 and 2014. The government has announced that the economic situation and the evolution of prices will be taken into consideration in the adjustment. Wage indexation can lead to increases in unit labour costs with negative implications for competitiveness. Thus the wage indexation system should be reviewed to ensure that wages reflect productivity developments and do not present risks to competitiveness (OECD, 2012).

The expenditure on active labour market policies (0.46% of GDP) in 2011 was about the same as in the EU (0.47%). The policy mix is very different, though. Active labour market policies (ALMP) in Luxembourg are heavily geared towards temporary job creation schemes (*incitations à l'emploi*) that represent 75% of active labour market policies spending, as opposed to 24% in the EU (STATEC, 2012). These schemes have been found to be generous and long, and in many cases participants return to unemployment after their completion (OECD, 2010b). On the other hand, expenditures on training represent only 9% of ALMP measures in Luxembourg compared with 43% in the EU. The authorities should review the existing ALMP programmes, evaluate their effectiveness in accelerating jobseekers employment prospects and divert resources to uses supporting stronger activation policies, such as training and start-up incentives.

Residence permits requirements for non-EU nationals have a preference for highly qualified workers, such as educational attainment, work experience and a minimum level for the annual salary to be earned in Luxembourg (a proxy for skills). Moreover, a specific residence permit is granted to persons with certain professions, such as managers, medical doctors, teachers and accountants. It has been argued that these permits do not include Physical and Engineering Science technicians (ISCO classification 311) (University of Luxembourg, 2013), which might be relevant to strengthen economic development outside the financial sector and the clustering of enterprises. It is thus worth examining whether eligibility criteria are defined broadly enough.

Non-monetary factors affecting the perceived quality of life are also relevant for attracting a highly qualified workforce. As noted, Luxembourg scores very high on all

Figure 28. **Protection of permanent workers, 2013**



1. The figure presents the contribution of different subcomponents to the indicator for employment protection for regular workers against individual dismissal (EPR). The height of the bar represents the value of the EPR indicator.
2. The figure presents the contribution of different subcomponents to the indicator for additional provisions for collective dismissals (EPC). The height of the bar represents the value of the EPC indicator. Note that this indicator quantifies only additional restrictions, over and above those for individual dismissals. For the sole purpose of calculating the EPC indicator, missing values of specific subcomponents are set equal to the average of other non-missing subcomponents for the same country.

Source: OECD *Employment Protection Database*, 2013 update, *http://dx.doi.org/10.1787/lfs-epl-data-en*.

StatLink *http://dx.doi.org/10.1787/888933198142*

measures of the OECD well-being measures (Figure 2). Traffic congestion is an increasing problem, given the large number of the cross-border workers from neighbouring Belgium, France and Germany, an increasing share of whom are highly-qualified. The government plans to build new hubs at the outskirts of Luxembourg City that will be linked by tram and tangential buses, so that commuters can avoid travelling through the city centre. This initiative should be implemented. The initiative can also contribute to reducing CO_2 emissions. Raising investment in public transport and co-operation within the greater region should continue to increase the capacity of the public transport system, reduce congestion

and thus CO_2 emissions. Introducing a system of congestion charges around Luxembourg City is worth considering (European Conference of Ministers of Transport, 2003).

Luxembourg's supply of housing may be falling short of demand, as rising real house prices indicate. The government plans to increase the VAT on building not intended for owner-occupation from the current preferential rate of 3% to the standard rate of 17%. Since projects completed before 2017 will not be affected, housing supply is likely to increase prior to the tax hike as projects are brought forward to benefit from the still-low tax rate, but the more fundamental effect is to increase taxation of those residents who are able to afford more than one property. The preferential tax treatment of housing investment is likely to be reduced, but rents may rise, too, as owners attempt to pass on the higher tax rates on tenants. The government also plans stepping up the construction of social housing. More fundamental reform appears necessary, however (OECD, 2012a). Procedures for granting construction permits should be speeded up and property taxes be raised by updating property values used as a tax base.

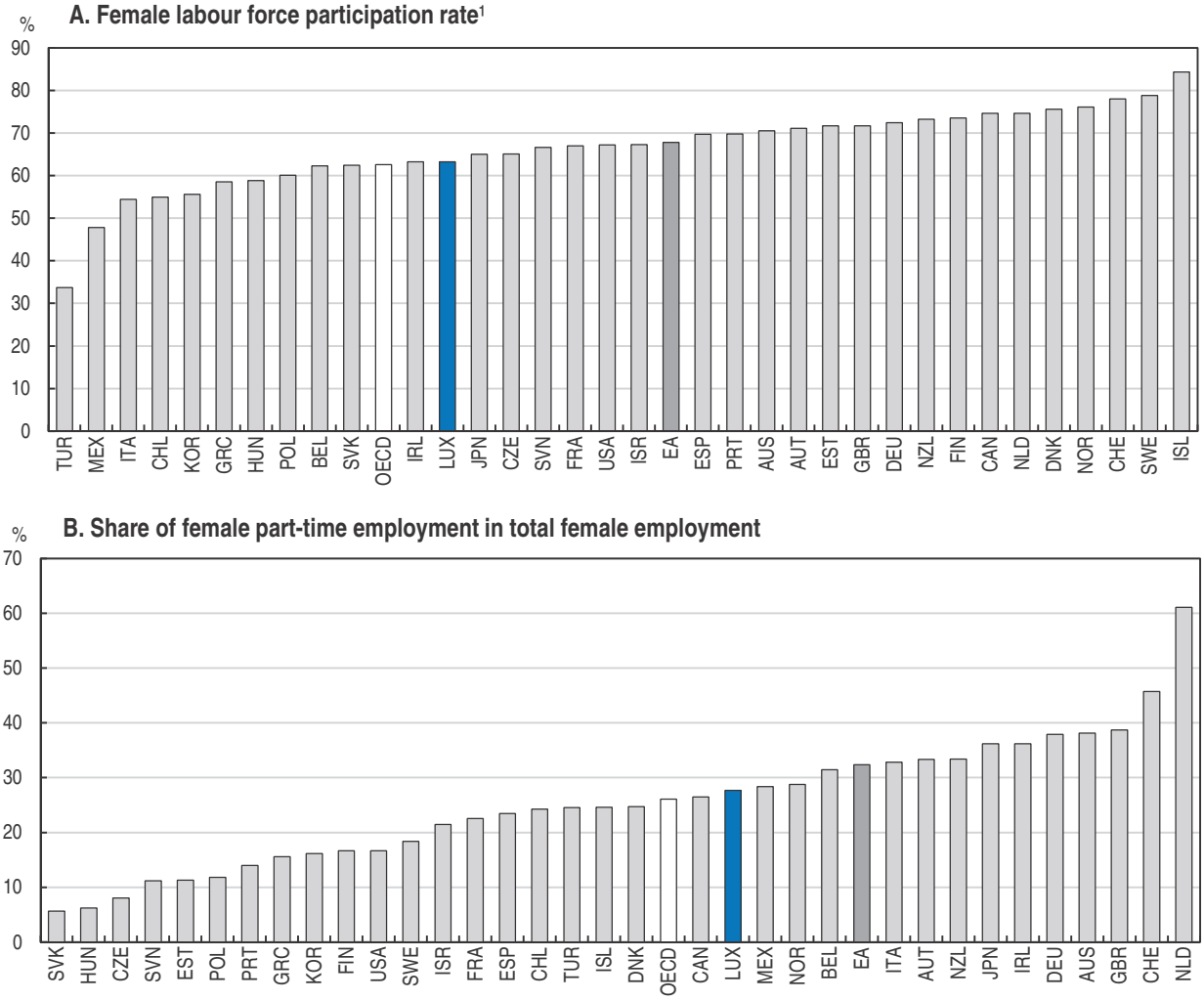
Enhance incentives to work for second earners and women

The pool of workers is also reduced by the low participation of second earners, mainly women (Figure 29). Female part-time employment also falls short of the average in the euro area. Reducing disincentives for second earners' participation can increase labour supply for new industries, which otherwise would have to come from the financial sector and abroad.

A number of provisions in the tax and transfer system discourage labour supply of second earners. In the universal health care insurance system, all family members are covered by contributing family members, effectively reducing the earnings of working spouses. Resident married couples, taxpayers living in registered partnerships, and non-resident married couples with earnings taxable in Luxembourg can file jointly and are taxed at lower average rates. This reduces work incentives for the spouse with the lower income. Also, effective marginal taxation of additional hours worked seems to be particularly high for lone parents due to the interaction of benefits and income taxation (OECD, 2007). These issues should be addressed. The government's plan to move away from joint income tax assessment for couples is welcome.

Significant fixed costs of work, notably the monetary and non-monetary costs of child care can be important impediments for higher female or spouses' labour force participation. Means-tested childcare service vouchers for children aged below 12 are addressing this issue. The government's plan to augment this system by free childcare combined with promotion of French, German and Luxembourgish language skills for all children aged 1 to 3, starting in 2016 will be financed via a tax of 0.5% on households' total revenues (with part of subsistence income exempted). This initiative could increase labour force participation by families with small children, while avoiding distortions from the financing side. The government should reduce disincentives for labour force participation of spouses and lone parents by charging health care contributions for each spouse individually.

Figure 29. **Female labour market participation, 2013**



1. The labour force participation rate is defined as the ratio of the labour force to the working age population, expressed in percentages.

Source: OECD *Labour Force Statistics*.

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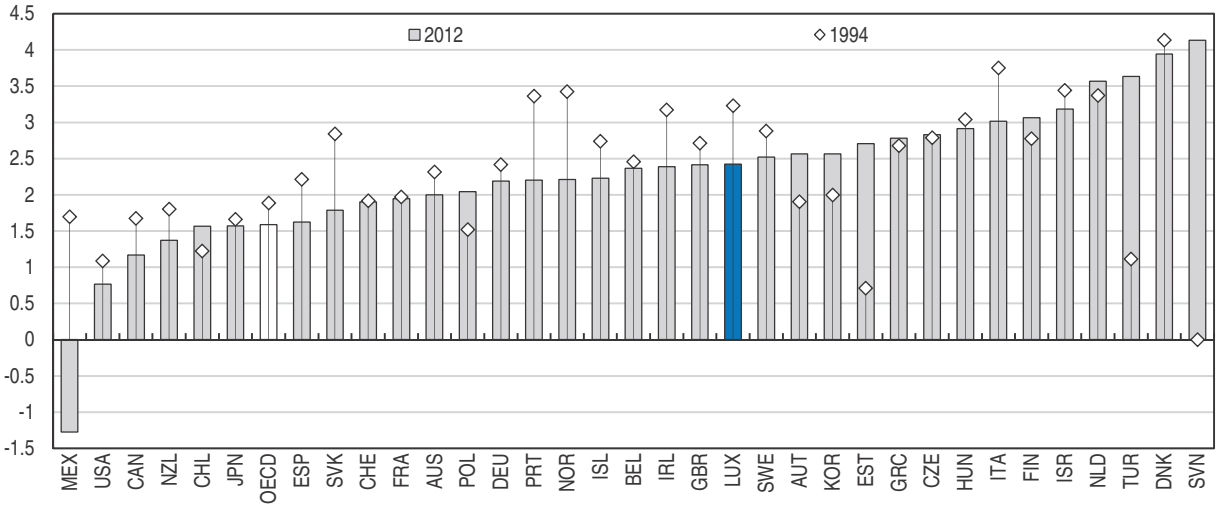
Greening growth

Luxembourg's main environmental challenges were analysed in Chapter 2 of the previous *Economic Survey* (OECD, 2012a). A key policy priority is to reduce carbon emissions, especially through further reforms in the transport sector, which accounts for more than a half of the greenhouse gas (GHG) emissions. Luxembourg's total GHG emissions in 2012 still stood about 20% above its Kyoto emissions target, although emissions have decreased by more than 8% compared to the base year (1990). Higher taxation of fuel and continuing investment into public transport are crucial for reducing GHG emissions further.

Revenues from environmental taxes as a share of GDP, just below 2.5% in 2012, have decreased since 1994 and are well above the OECD average (Figure 30). Tax rates are generally levied at or slightly above the minimum level prescribed by the EU Energy Taxation Directive. Zero rates apply to coal, coke, and natural gas not used for heating purposes. Additionally, a concessionary rate is applied to LPG used as a propellant or for

Figure 30. **Revenues from environmental taxes**

Per cent of GDP



1. Environmentally related taxes include: energy products for transport purposes (petrol and diesel) and for stationary purposes (fossil fuels and electricity); motor vehicles and transport (one-off import or sales taxes, recurrent taxes on registration or road use and other transport taxes); waste management (final disposal, packaging and other waste-related product taxes); ozone-depleting substances and other taxes.

Source: OECD(2014), "Green Growth Indicators", OECD *Environment Statistics*.

StatLink http://dx.doi.org/10.1787/888933198169

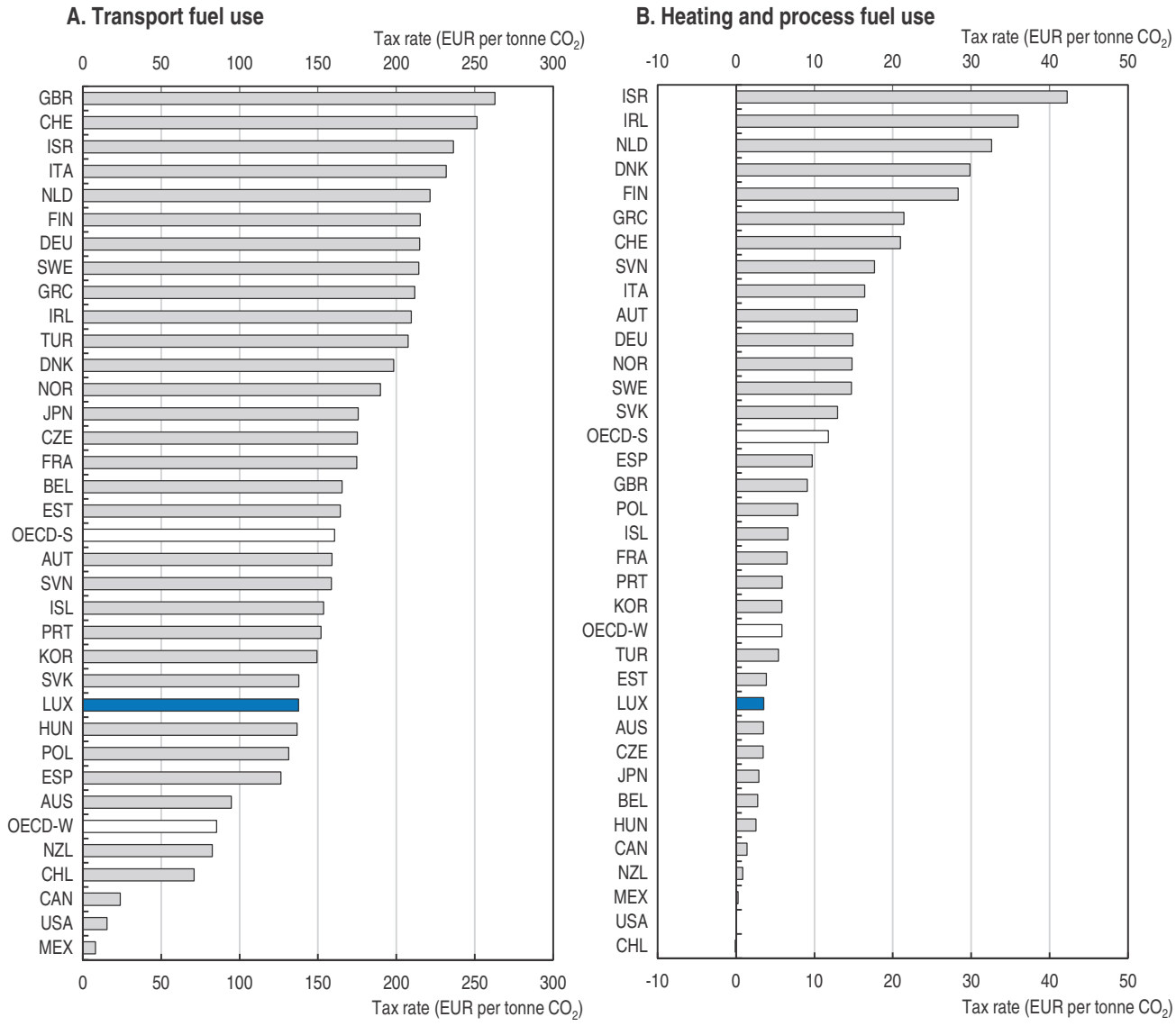
industrial/commercial use, in accordance with Article 18(1) of the Directive. Diesel and LPG are taxed at differing rates according to purpose.

Gasoline and diesel used for transport constitute 65% of energy use and 67% of CO_2 emissions from energy use in Luxembourg (OECD, 2015b). Their predominance in both bases is explained by sales of gasoline and diesel to foreign drivers, who take advantage of Luxembourg's taxes, which are lower than those of neighbouring countries notwithstanding increases in 2008, 2010 and 2015. Domestic transport is estimated to account for just one-fifth of total transport fuel sales (OECD, 2013c). This leaves Luxembourg with the highest CO_2 footprint per capita among the European OECD members.

Effective tax rate on transport fuel, below EUR 150 per tonne of CO_2, is below the OECD average (Figure 31, Panel A). Taxation of heating and process fuel use, at about EUR 3 per tonne of CO_2, is also below the OECD average (Figure 31, Panel B). The heating and process use category is dominated by natural gas and diesel, which constitute 52% and 30% of the CO_2 emissions in this category. These fuels are taxed at differing rates according to user. Diesel for commercial use is taxed at the highest effective rate (both in terms of energy and CO_2), and is twice the rate that applies to diesel used for producing commercial heat. Meanwhile, 38% of the natural gas use (both in terms of energy and CO_2) is in industry or agriculture, and is untaxed. Fuels used to generate electricity constitute less than 3% of total energy use and CO_2 emissions in Luxembourg (OECD, 2015b). In order to reduce per capita carbon emissions, Luxembourg should increase taxes on diesel and gasoline so as to gradually eliminate the price differential with neighbouring countries.

Traffic flows are also influenced by factors other than fuel taxation, such as geographic organisation of transport in the internal market or the attractiveness of public transport for commuters. It is therefore important that Luxembourg increases the capacity of the public transport system in co-operation with neighbouring countries, as mentioned above.

Figure 31. **Effective tax rates on CO_2 in OECD countries**



Note: Tax rates are as of 1 April 2012 (except 1 July 2012 for AUS); energy use data is for 2009 from IEA. Figures for CAN and USA include only federal taxes.
Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888933198177

Recommendations on raising human capital and enhancing resource allocation

Key recommendations

- Better evaluate the effectiveness of public R&D spending and cluster policies.
- Strengthen the co-operation between enterprises, University of Luxembourg and research institutes in Luxembourg and abroad.
- In secondary education, reduce grade repetition, provide more school autonomy and better monitor education quality.
- To reduce carbon emission, continue substantial investment in public transport infrastructure, using the receipts from fuel taxation for this purpose. Explore the introduction of a system of congestion charges. Increase taxes on petrol and diesel that gradually eliminate price differentials with neighbouring countries.

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ANNEX

Follow-up to previous OECD policy recommendations

This Annex reviews policy recommendations from previous Surveys. *They cover the following areas: public finance, subsidies, tax system, education, labour market, product and service markets (including public enterprises) financial reform, and infrastructure. Each recommendation is followed by a note of actions taken since the* 2012 Survey. *Recommendations that are new in this* Survey *are listed in the relevant chapter.*

Provide a framework for sustainable long-term growth

Recommendations from previous *Surveys*	Actions taken
Implement the fiscal consolidation plan in the SGP and credible medium-term consolidation plan ensuring that expenditure does not rise faster than nominal GNP.	The government has initiated, for the first time, a spending review process in 2014 to aid fiscal consolidation.
Implement reforms to the pension system linking the effective retirement age to longevity, reducing incentives for early retirement and limiting credits for years of inactivity.	In 2013, the pension reform entered into force, linking replacement rates of new pensions to life expectancy.
Remove unnecessary administrative burden.	Following the Governmental Action Plan in the policy area of reduction of administrative burdens and screening of administrative procedures, an Interdepartmental platform focused on simplification and streamlining of administrative procedures chaired by the Minister for the Civil Service and Administrative Reform and reporting directly to the Council of Ministers. A first result is the "omnibus" bill, a bill modifying 33 clauses with the aim of reducing administrative burdens in the areas of regional development, town and country planning, establishing licences for industrial sites, environmental law, housing bill. The preparatory work involved the different ministerial departments and stakeholders as NGOs acting in these specific areas. On 6 November 2014, an internet forum was set in place giving the users of public services the possibility to suggest and discuss proposals of reduction of administrative burdens (*www.vosidees.lu*). Following the principles of transparency and openness, the proposals are followed up and information is available of the current status of the proposal.

Improve public sector efficiency

Recommendations from previous *Surveys*	Actions taken
Modernise the organisation of the public sector to increase the emphasis on outputs rather than inputs through a system of performance budgeting with greater local discretion and effective central monitoring.	Budgeting reform is in preparation.
Modernise human resource management with performance-based advancements and pay, and greater openness in recruitment.	The statutory reform of civil service is planned to pass the Parliament during the 1st semester 2015. It will implement a performance management system based on management by objectives and monitoring the overall organisational performance, the results of each internal unit, the individual results and the individual competencies. The individual results and competencies are linked to training needs and training. A reform of the recruitment is on the agenda of the current governmental action plan.
Implement the law to generalise access of EU nationals to recruitment to the public service with a view to widening the pool of talent as far as possible.	The general access for EU nationals to public service recruitment is implemented, on condition of the command of the three official languages: the bill of 17 December 2010 introduced the possibility of waiving up to two of the three required languages for highly specialised candidates.
Introduce cost-benefit analysis for large investment projects.	Budgeting reform is in preparation.
Raise the efficiency of the health system by strengthening the control of costs, empowering hospital managers, and making use of health facilities in neighbouring countries.	The health care reform in 2012 introduced a cap on hospital expenditure. A budget envelope for hospital financing is fixed biannually.

Ensure financial stability

Recommendations from previous *Surveys*	Actions taken
Reduce the pay-out time of the deposit insurance scheme to a few days. Proposals to fund the scheme on an *ex ante* basis using risk-based premia should be implemented.	A law is being prepared transposing EU directive 2014/49/UE into national law.
Strengthen co-operation between the CSSF and the BCL through the creation of institutional arrangements clearly setting out the responsibilities and requirements for the two institutions.	CSSF and BCL co-operate in the new EU Single Supervisory Mechanism for banks. Legislation is underway establishing co-operation in a Systemic Risk Committee for macro-prudential supervision.

Encourage competition

Recommendations from previous *Surveys*	Actions taken
Remove unnecessary administrative burdens on starts-ups, licensing requirements and price controls.	Following the Governmental Action Plan in the policy area of reduction of administrative burdens and screening of administrative procedures, an Interdepartmental platform focused on simplification and streamlining of administrative procedures chaired by the Minister for the Civil Service and Administrative Reform and reporting directly to the Council of Ministers. A first result is the "omnibus" bill, a bill modifying 33 clauses with the aim of reducing administrative burdens in the areas of regional development, town and country planning, establishing licences for industrial sites, environmental law, housing bill. The preparatory work involved the different ministerial departments and stakeholders as NGOs acting in these specific areas. On 6 November 2014, an internet forum was set in place giving the users of public services the possibility to suggest and discuss proposals of reduction of administrative burdens (*www.vosidees.lu*). Following the principles of transparency and openness, the proposals are followed up and information is available of the current status of the proposal.
For professional services, remove restrictions on advertising and make co-operation between professions easier. Remove minimum or reference prices.	There are no restrictions on advertising except for some liberal professions such as doctors, lawyers, architects and "expert comptable". In general, there is liberty of prices through the law of *Loi du 23 Octobre 2011 relative à la concurrence*. Only prices on petroleum products, taxi services and pharmaceuticals are not free.
For the legal profession, eliminate the cap on the number of notaries, establish an independent regulator and introduce a special procedure without the need for legal representation for small claims.	No action taken.
Remove the restriction on the number of pharmacies and allow pharmacists to offer generic medicines as substitutes for prescribed drugs, as well as allowing the sale of some medicinal drugs by other retailers.	In 2014, legislation came into force allowing for generic pharmaceutical products in health insurance reimbursement.
For the retail trade, make shop opening hours more flexible. When the competition authority has sufficient capacity, remove the price ceiling for motor fuel retailing.	A feasibility study on more flexible opening-hours is in preparation.
Remove restrictive regulations fixing the number of taxis and their ability to compete.	A bill has been submitted to Parliament.

Make labour markets more flexible

Recommendations from previous *Surveys*	Actions taken
Reform the system of wage setting. As a first step, wages should be indexed to core rather than headline prices. Ultimately, the system of legislated automatic wage indexation should be abolished to ensure that wages remain competitive and allow necessary adjustments in relative wages.	Between 2012-14, automatic wage indexation has been reduced. The original system will be reintroduced in 2015.
Enhance the effectiveness of the statutory minimum wage by ensuring that the focus in setting it is the economic impact.	No action taken.
Comprehensively review existing active labour market programmes. Reallocate funding from all programmes that are not cost-effective to support stronger activation policies.	Employment contracts for youth have been revised in 2013.
Improve the public employment service and activation policies by: rationalising placement services; improving accountability of local employment centres; earlier interventions for jobseekers at risk of becoming long-term unemployed; ensuring that all RMG recipients with the potential to work are offered integration contracts; and raising resources available to ADEM.	Since 2013, the profiling system of the Employment Service is being revised and resources increased.
Improve the design of the minimum guaranteed income (RMG) to avoid situations in which additional work does not provide additional income.	No action taken.
Lower unemployment benefit replacement rates and limit young people's eligibility for unemployment insurance.	No action taken.
Taper social benefits to minimise their impact on work incentives.	No action taken.
Target social transfers better to increase their effectiveness in reducing relative poverty, while reducing their overall cost.	No action taken.

Strengthen the education system

Recommendations from previous *Surveys*	Actions taken
Improve targeting of resources to schools with disadvantaged students and increase resources for language support and remedial classes.	The department of childhood and youth has been integrated into the education ministry. Resources for fundamental schools have been increased. Further initiatives are in preparation.
Push the planned reform of secondary education, aiming at reducing grade repetition, delaying institutional tracking from 12 to 16, strengthening the autonomy and local management capacity of schools. Improve the monitoring of education quality.	In 2014, the Luxembourg Centre for Educational Testing (LUCET) has been established at the University of Luxembourg.

Improve the supply of housing

Recommendations from previous *Surveys*	Actions taken
Encourage housing supply through simplification of construction authorisation.	Administrative procedures have been simplified in 2011.
Remove tax incentives for property hoarding by widening the application of the surtax on vacant houses and land and deadlines for starting and finalising development on land zoned for construction.	No action taken.
Raise property taxes by updating property values used as a tax base.	Review envisaged.
Introduce changes to the tax system to reduce the bias in favour of housing.	No action taken.

Make green growth happen

Recommendations from previous *Surveys*	Actions taken
Continue investment and further enhance co-operation with adjacent regions to increase the capacity of the public transport system.	Revisions to transport system in preparation. Cross-border co-operation has been widened.
Increase taxes on petrol and diesel to reduce Luxembourg's carbon emissions.	No action taken.
Introduce a system of congestion charges.	Revisions to transport system in preparation.

Thematic chapters

Chapter 1

New challenges ahead – Strengthening the performance and resilience of the financial sector

Over the last two and a half decades, Luxembourg's financial sector emerged as a leading international hub for asset management and investment funds and became a key contributor to growth. Diversification into new areas of financial asset management is continuing. However, changing financial market regulation in Europe, increased international transparency requirements for banking and heightened international competition pose challenges. Moreover, the financial sector has reached a size where its contribution to the economy's overall growth might diminish.

Maintaining sound framework conditions is important for further diversification in the financial sector, building on Luxembourg's existing comparative advantage and investors' trust in its economic stability. Regulators should ensure financial intermediaries maintain strong capital ratios to address potential financial market shocks from abroad and real estate risks in the domestic economy. Assessment of systemic risks should be based on a framework that accounts for the various linkages between the banks and the other relevant financial market actors, notably investment funds. Given that the bulk of the banks in Luxembourg are affiliates of foreign bank groups, the authorities should seek clear procedures that govern the (cross-border) resolution of large banks in bad times. Moreover, implementation of the remaining steps in upgrading the tax transparency regulations Luxembourg has committed to can increase incentives for banks to further refine their business models, benefitting Luxembourg's financial sector in the medium term.

The financial sector is exceptionally large

Over the last two and a half decades, Luxembourg's financial sector has emerged as a key contributor to domestic economic activity. Banks accounted for 20% of total financial sector value-added in 2013 with the remainder from various asset management and investment fund activities. Luxembourg's comparative advantage as an international financial hub has been aided by an adaptive legislative and regulatory framework that took advantage of early adoption of EU financial regulation, low taxation, a skilled workforce and accumulation of specialised knowledge in asset management. However, more recently, the sector's share in total output has declined and the sector might have reached a size where its *contribution to the economy's overall growth might be diminishing*. This chapter addresses policy challenges to safeguard the ability of the financial sector to adjust in a new and changing international regulatory framework.

The value added share of the financial and insurance sector in Luxembourg was about 27% of GDP in 2014, well above other OECD financial centres such as Switzerland or the United Kingdom (around 10½ and 8¼ per cent). Relative to the country's GDP, total assets of the monetary and financial institutes (MFIs, credit institutes and money market funds) are exceptionally large by international comparison, although in absolute terms the size is much more modest (Figure 1.1). Measuring output and productivity in the financial sector is subject to a considerable degree of uncertainty, with output possibly overstated (Annex 1.1).

The sector has diversified substantially over the years, and diversification in new areas is ongoing. Financial market activities related to banking that have gained in importance in recent years include bond issuance, custody services for investment funds, personal wealth management for high income families and IT-related financial services (OECD, 2012; Wintersteller, 2013). Luxembourg plays an important role as a hub for euro-denominated bond issuance, hosting one of the major clearing and settlement agencies. The country is also a global hub for investment funds (see below). In addition, the financial sector has important linkages to various support activities such as legal services and IT.

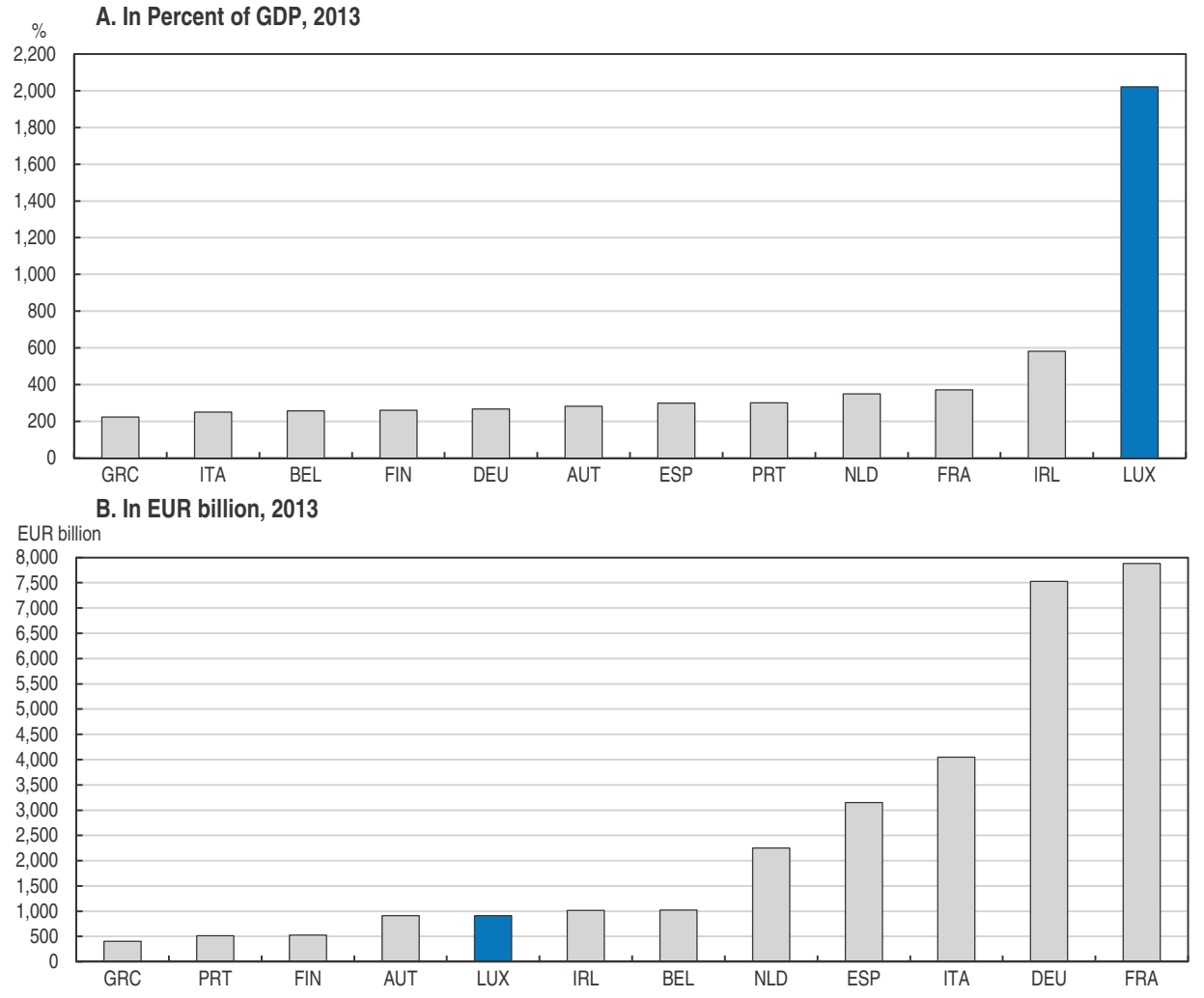
Most banks are affiliates of international bank groups with cross-border business models

Only 5 banks in Luxembourg are of Luxembourgish origin, the rest being owned by foreign credit institutions (Figure 1.2). Some 80% of the banks are of European origin, but banks from the United States, Japan, China, Brazil and other non-European countries are also represented. Some 87% of total bank assets are located in banks belonging to foreign banking groups (last quarter 2013).

In the last semester 2013, foreign lenders accounted directly for some 54% of the banks' financial obligations (Figure 1.3). Inter-bank funding within Luxembourg´s banking system made up another 17½ per cent, and money-market and investment funds located in Luxembourg contributed 17% (see below).

Most banks are engaged in international business activities. A major part of the banks' business model is to act as cross-border hubs providing liquidity to their international

Figure 1.1. **Assets of monetary and financial institutes (MFIs excluding the Eurosystem)**



Source: European Central Bank.

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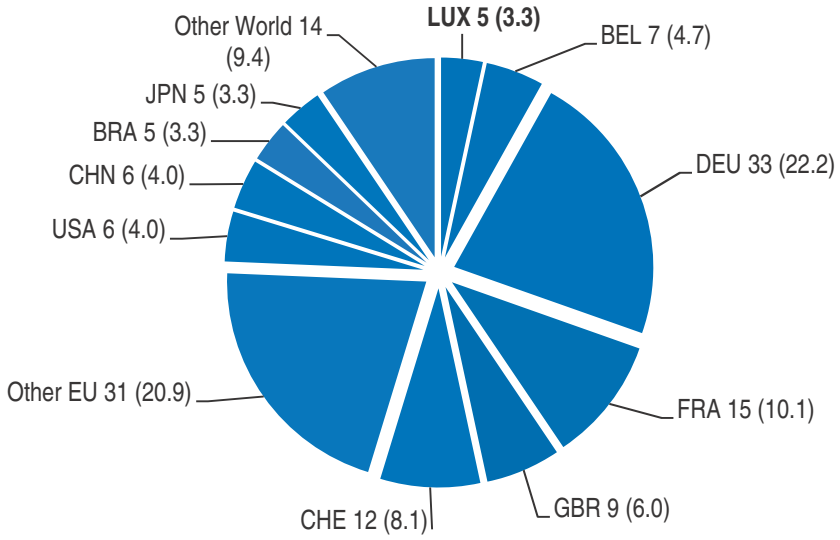
bank groups. This is because Luxembourg's banks are strongly benefitting from deposits by investment funds, insurance companies and other financial intermediaries, which accounted for 81% of total bank deposits in 2014. In particular, the working balances of investment funds act as a relatively stable source of funding for the custodian banks. The custodian banks are liquidity rich as they have only limited credit activities *vis-à-vis* the non-financial sector. Indeed, at the end of 2013, about two third of Luxembourg's banks providing inter-bank credit allocated their funds exclusively to foreign banks. Those credits accounted for 58% of overall Luxembourgish bank credit. Another 27% of total bank credit was allocated to non-bank foreign counter-parties (Figure 1.3). Loans to enterprises and households in Luxembourg and the government account for a relatively small part of the total credit that the banks in Luxembourg are extending.

At the initial phase of the 2008 crisis, some bank subsidiaries had to raise liquidity for their foreign banking groups (IMF, 2011) by drawing on the ECB's liquidity facilities. This raised the banks' indebtedness *vis-à-vis* the Central Bank. However, liquidity shortages between banks remained subdued, given the relatively limited role of the domestic

Figure 1.2. **Banks in Luxembourg by origin (end 2014)**

Number, percentage in parenthesis.



Source: CSSF.

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interbank market in channelling liquidity across banks (Figure 1.3). At the same time, Luxembourg's banks continued to act as a relatively stable provider of funding for foreign, mostly European, banks.

Since the crisis the share of the financial and insurance sector in the economy's real value added dropped by some 4 percentage points (Figure 1.4, Panel A) as banks' aggregate balance sheets contracted by 14% between 2008 and 2009. Markets for short term liquidity dried up, which led to downsizing of exposures to levels that are close to those at the beginning of the last decade. The bulk of adjustment in banks' lending occurred via reductions in cross-border credit by subsidiaries and branches to their group's foreign banks (Figure 1.4, Panel B)

Credit to domestic borrowers has held up and banks remain efficient by international comparison

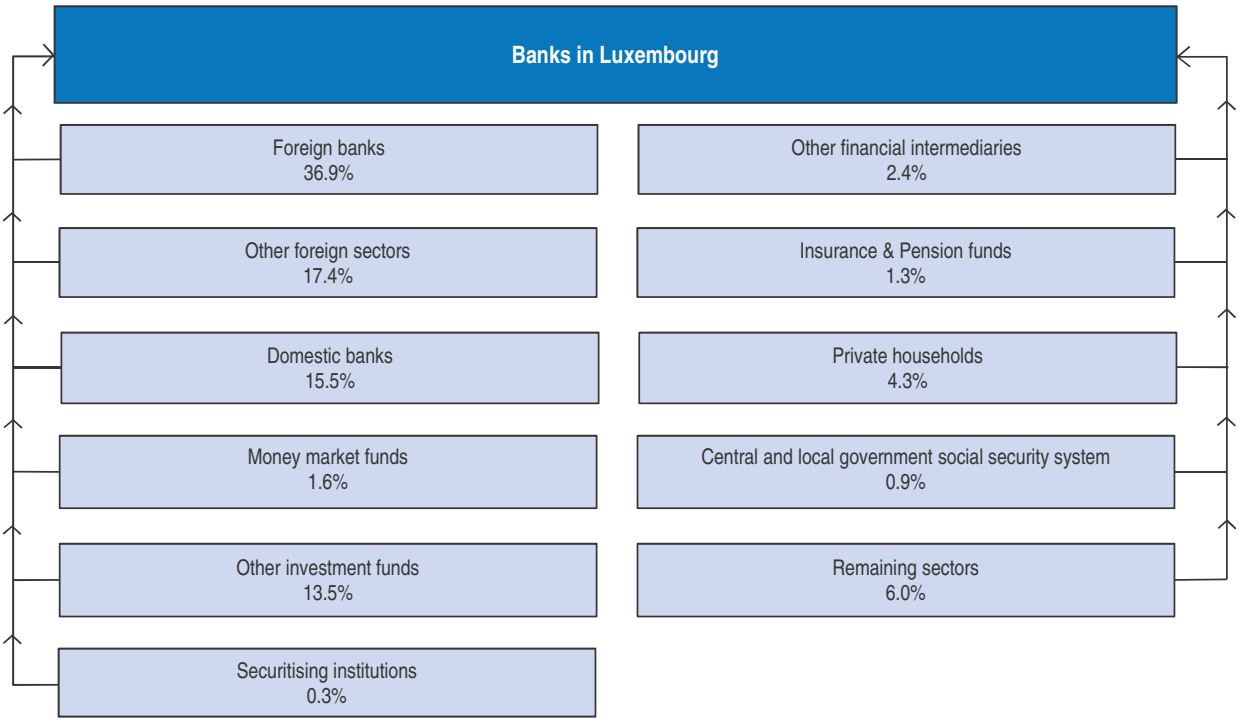
Credit to the domestic private non-financial sector, measured in terms of GDP, is below the OECD average (Figure 1.5), but was remarkably resilient since the crisis. Bank credit to non-financial enterprises continued to rise, with banks tightening credit conditions only marginally, in contrast to most other countries in the euro area (Figure 1.6, Panel A).

A number of factors underpin the relatively high resilience of bank loans to the domestic private sector. Banks were well capitalised when the crisis commenced, and the supervisory authority was early in requiring banks to raise capitalisation towards future Basel III and European Union standards. In the "comprehensive balance sheet assessment" for systemically important banks by the European Central Bank, published in October 2014, no capital shortfall has been identified for the six assessed credit institutes in Luxembourg (ECB, 2014a). The banks passed the reference capitalisation thresholds both for the "asset quality review" and for the two conducted "stress tests". The banks' assets were found to be appropriately valued. Also, the solvency ratios remained significantly above the required threshold set in the stress test.

Figure 1.3. **Funding interconnections between credit institutions and financial and non-financial sectors**

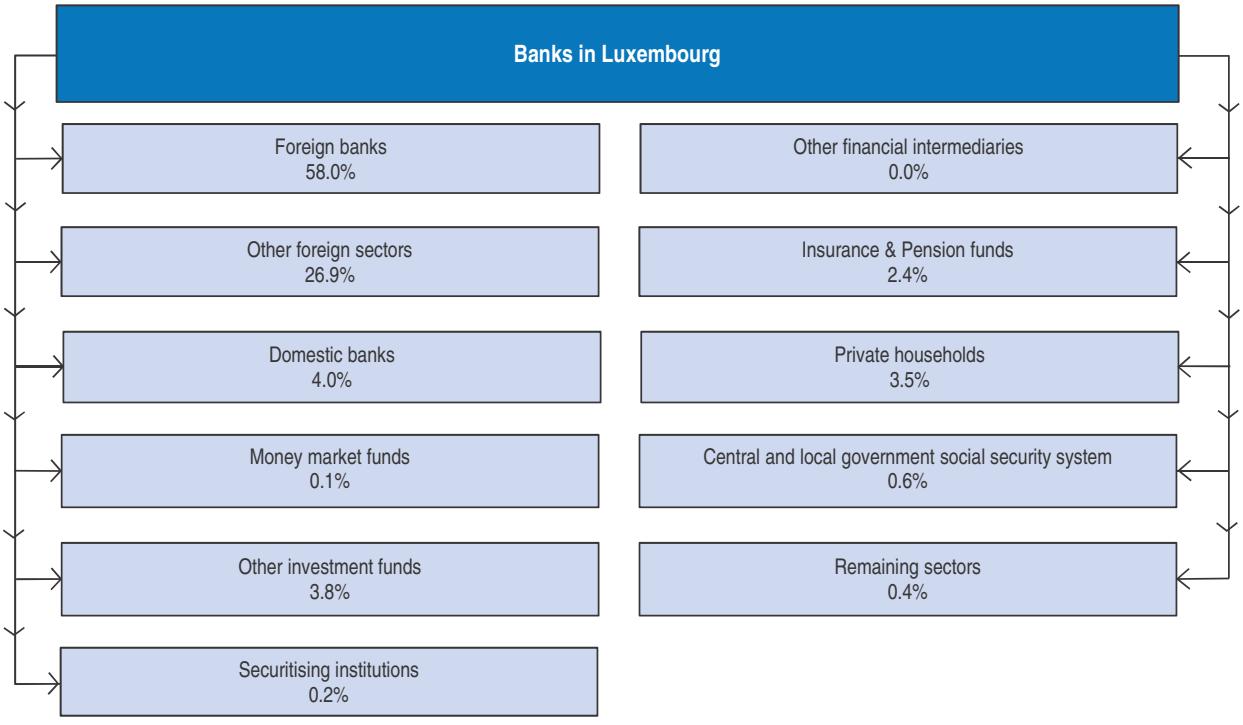
A. The sectors' contributions to the funding of credit institutions

Percentage of the banks' total obligations, 2013Q4



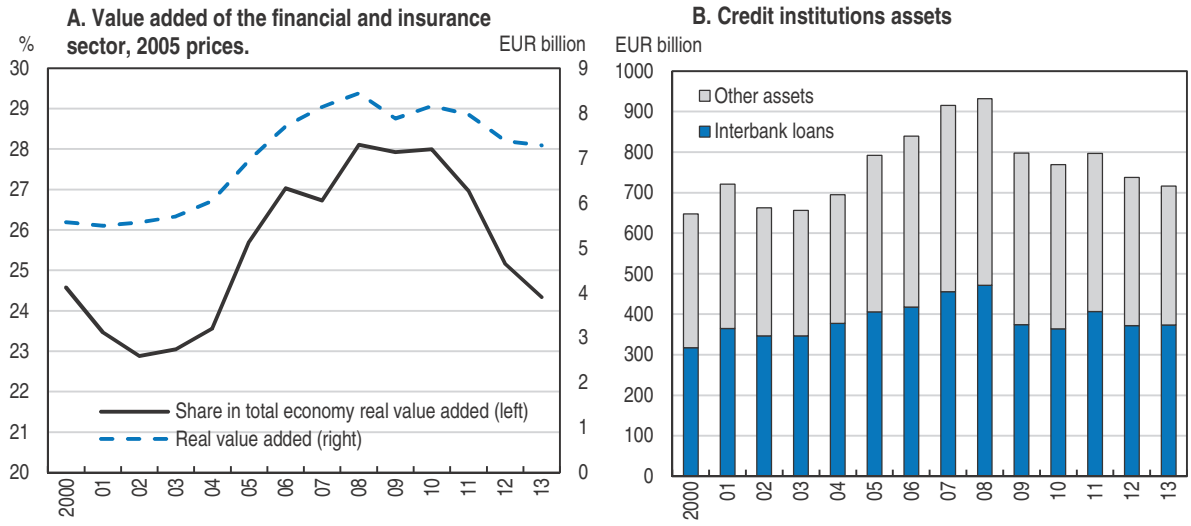
B. The credit institutions' contributions to the funding of the sectors

Percentage of the banks' total claims, 2013Q4



Source: Revue de stabilité financière 2014, BCL.

Figure 1.4. **Financial sector developments**



Source: STATEC; BCL.

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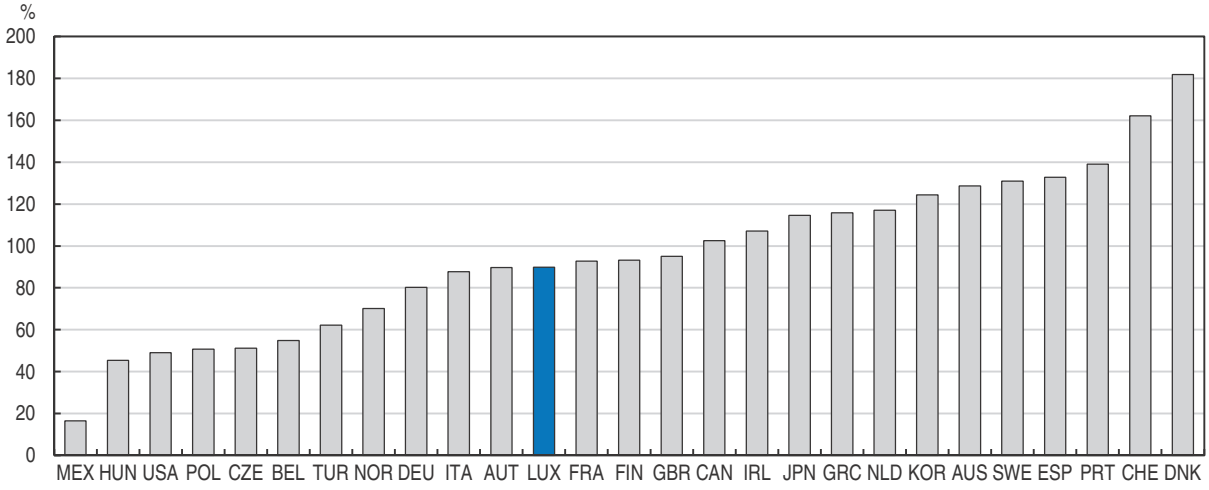
Figure 1.5. **Credit to the private non-financial sector by banks in Luxembourg**



Source: BIS.

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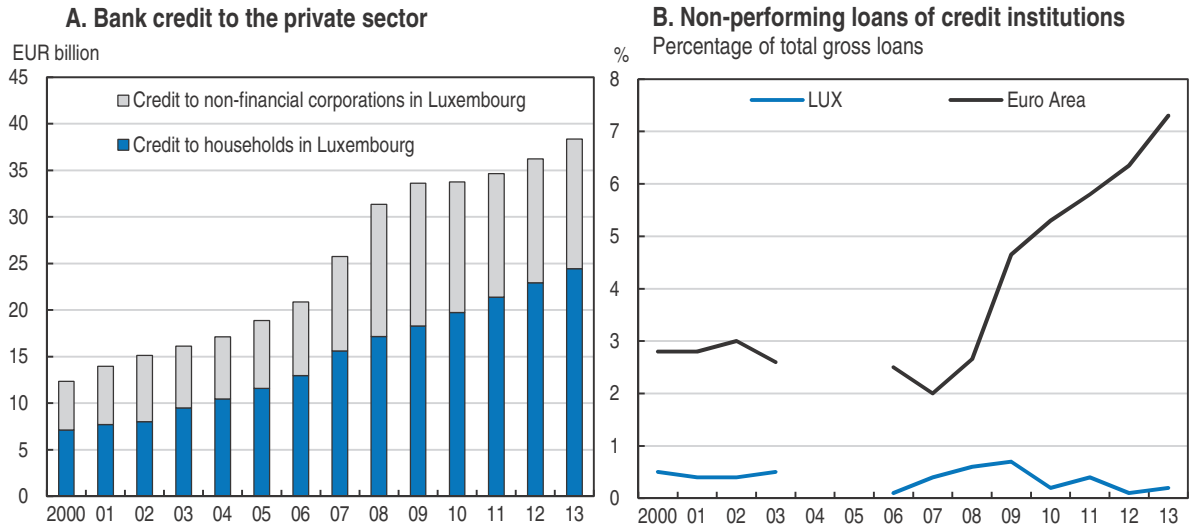
Capitalisation of the banking system overall also appears to be relatively high, based on the ratio of regulatory capital to risk weighted assets (Figure 1.7). Non-performing loans account for only a small portion of total bank credit, reflecting healthy balance sheets and a well-diversified loan portfolio prior to the crisis, past bank restructuring and economic growth above the EU average in recent years (Figure 1.6, Panel B). The banks' cost to income ratio is relatively low by international comparison, indicating a relatively high degree of technical efficiency (Figure 1.8).

Moreover, the financial safety net coped well with a number of insolvencies in the initial phase of the crisis, which originated abroad and spilled into subsidiaries in Luxembourg via cross-border funding linkages. In a few cases, the deposit insurance had to

Figure 1.6. **Bank credit and non-performing loans**



Source: BCL and World Bank, *World Development Indicators Database*.

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step in when international banks with subsidiaries in Luxembourg needed to be restructured (CSSF, 2011). The restructuring also involved financial aid by the government.

The financial sector has diversified into asset management and insurance

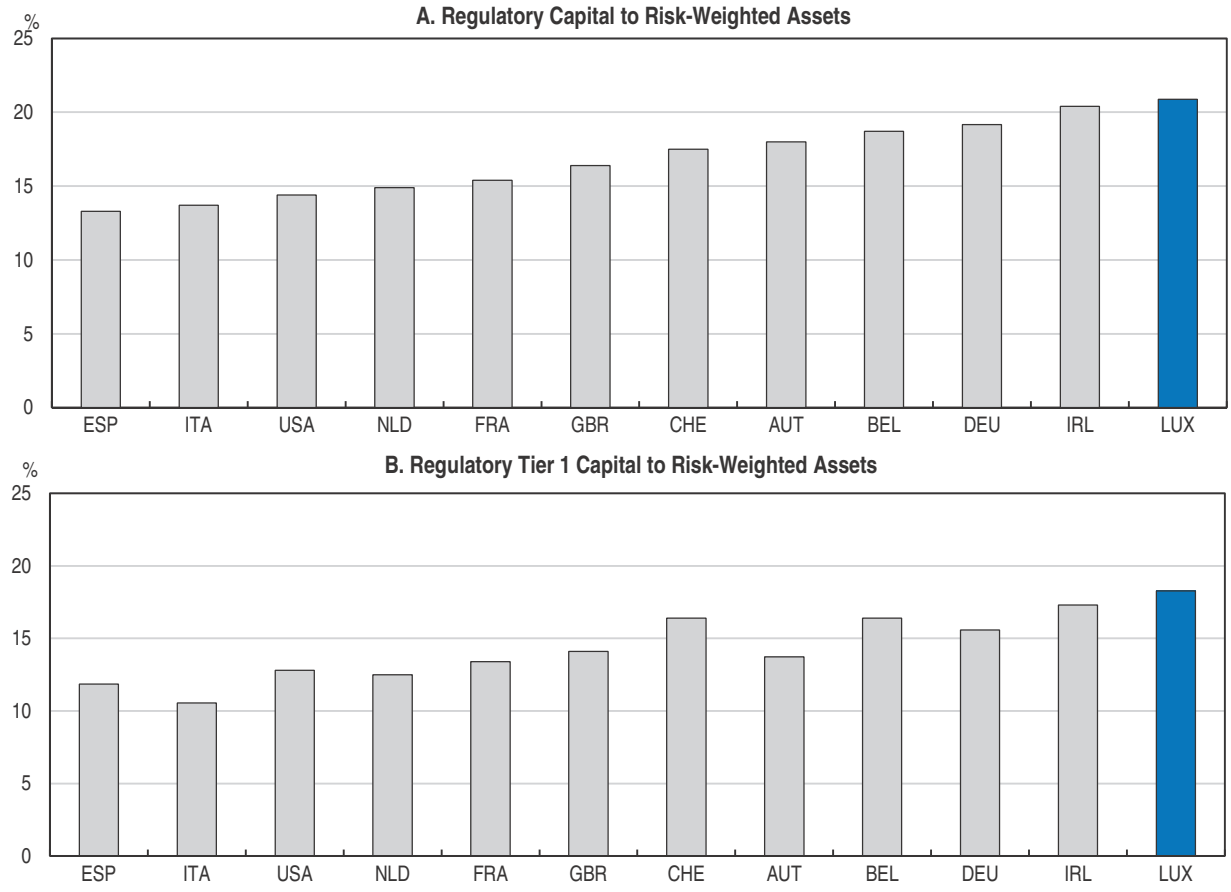
Luxembourg's funds sector benefitted from early adoption in the mid-1980s of the EU directive on Undertakings for Collective Investment in Transferable Securities (UCITS), which provided the regulation for UCITS investment funds to operate freely throughout the EU on the basis of a single authorisation. Since then, Luxembourg has developed as a hub for the administration and distribution of investment funds, with more than 3 800 investment funds located in the country in 2013 (Figure 1.9). By end-2014, the funds had EUR 3 trillion net assets under management, a figure that has doubled since the trough of the financial crisis. Luxembourg is now the world's second largest investment fund centre after the United States. Non-UCITS investment funds have also grown, with Luxembourg having been of the first countries to adopt the EU's directive on Alternative Investment Funds at the beginning of the decade.

Benefitting from Luxembourg's financial infrastructure, the insurance sector has also recorded strong growth, driven by rapid expansion of life insurance, which accounts for almost 60% of insurance products, and (to a lesser extent) re-insurance (Figure 1.10). 95% of the risks insured by Luxembourg's insurers are outside Luxembourg.

Investment funds were also hit by the crisis. Total assets under management declined by 24% in 2008 on account of falling asset prices and subdued investors demand, but recovered quickly to resume buoyant growth (Figure 1.9). Overall, diversification within the financial sector has contributed to limiting the contraction of financial sector output and helped employment in the financial sector to recover after a decline during the first years of the crisis.

The strong competitive position of the financial and insurance sector is reflected in the sector's strong export performance. Eighty per cent of the output of the financial and insurance sector is exported. Financial services account for about 50% of total exports, as compared to some 11% in the United Kingdom, 5.5% in Switzerland and 4.2% in the

Figure 1.7. **Banks' capital ratios**



Note: Based on quarterly data as of December 2013; where these are not available the most recent available data are taken, extending back to December 2012.

Source: IMF *Financial Soundness Indicators Report*, data submitted by national authorities to the IMF for dissemination through FSIs website, *http://fsi.imf.org/*, data submitted to the IMF Area Department, and IMF staff estimates.

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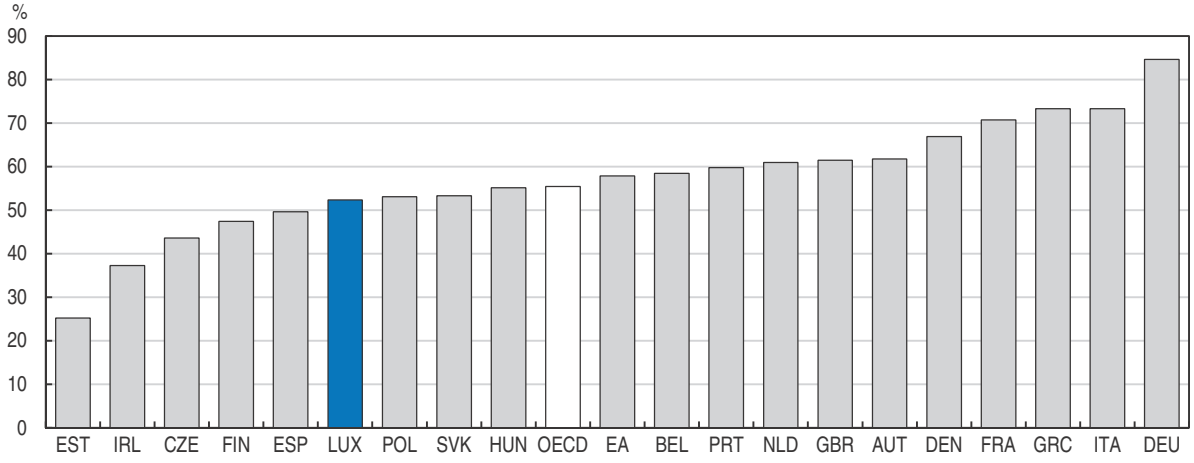
Figure 1.8. **Cost-to-income ratio in the banking sector, 2011**



Source: World Bank, *Global Financial Development Indicators*, November 2013 version.

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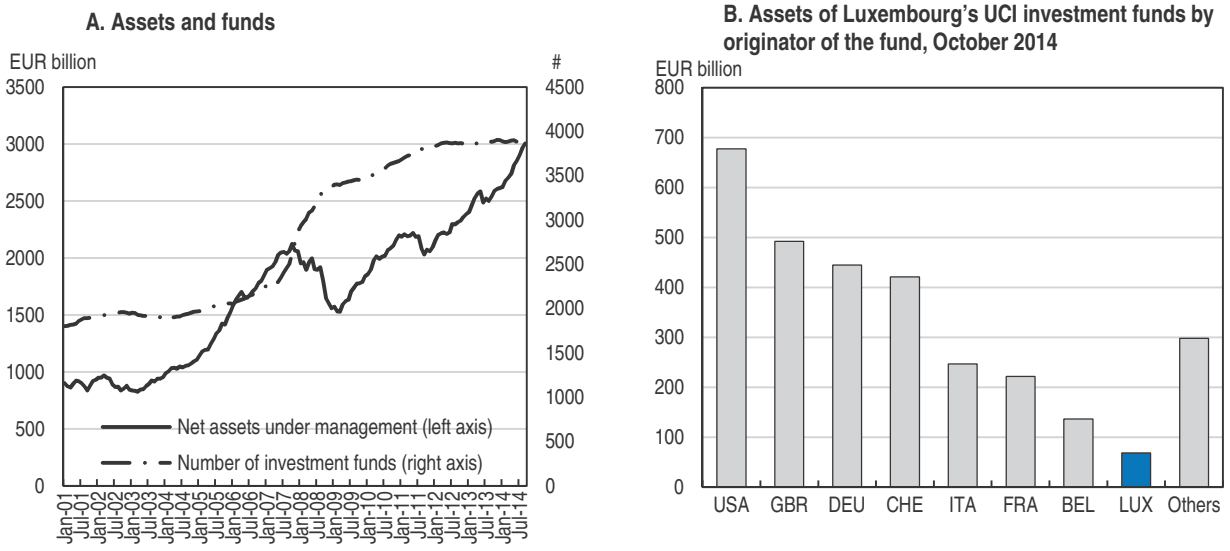
Figure 1.9. **Investment funds**



Note: Undertakings for collective investment (UCI).
Source: Commission de Surveillance du Secteur Financier, Luxembourg.

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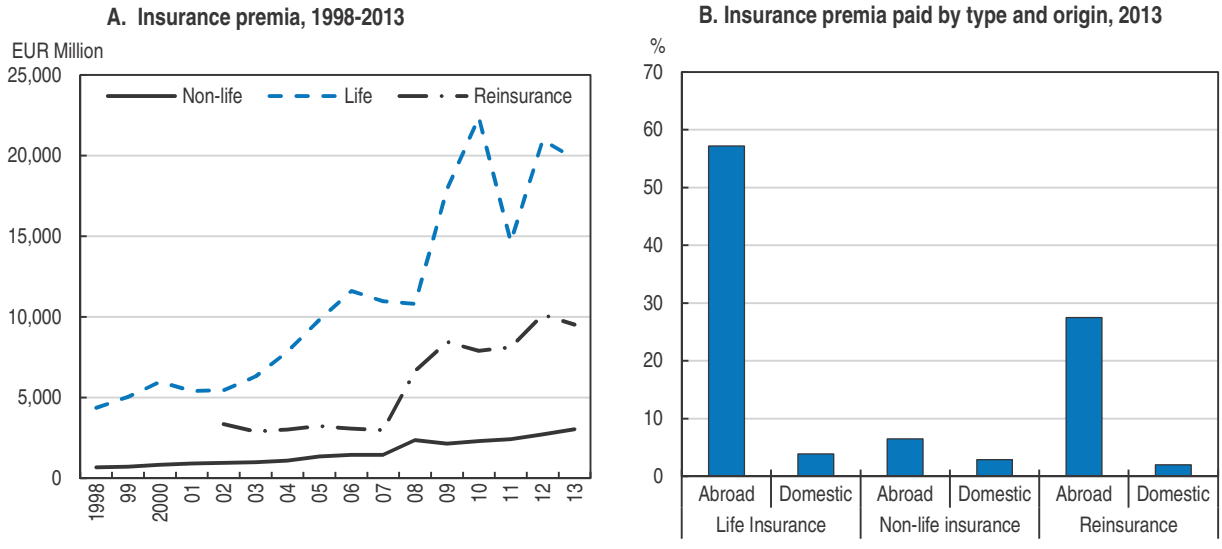
Figure 1.10. **The insurance sector**



Source: Commissariat aux Assurances, Luxembourg.

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United States. The economy has long run a large current account surplus (some 5% of GDP in 2014), which is entirely attributable to services exports, with financial services accounting for their largest part. The share of financial sector output in the overall trade surplus has recently declined, however, reflecting both the adverse impact of the financial crisis and strengthening exports of other services, notably ICT services.

Challenges

Since the middle of the 1980s, Luxembourg's economy has strongly benefitted from the upswing in the demand for financial services in industrialised countries, which interacted with the first-mover advantages from past financial sector liberalisation and at times early adoption of EU financial services directives. Cross-border demand for intermediated credit might be less vigorous going forward than it was in past decades. Emerging financial centres elsewhere, notably in China and South America, are increasing competitive pressure. Luxembourg's financial sector needs to rely on maintaining a highly qualified workforce and stability-oriented framework conditions to stay competitive. Changing financial market regulation in Europe and the drive for more transparency can pose challenges for banks to adjust.

Limits to growth?

Time series analysis by Guarda and Rouabah (2011) suggests that growth innovations in Luxembourg's financial sector are leading those in other sectors. However, several recent econometric studies have found a hump-shaped relationship between the size of an economy's financial sector and economic growth (Arcand et al., 2012; Cecchetti et al., 2012; Beck et al., 2014; Law et al., 2014; OECD, 2014a and b; see also European Systemic Risk Board, 2014). A larger financial sector is linked to higher aggregate economic growth at lower levels of financial development, but further expansion of an already large financial sector can be associated with slowing GDP growth.

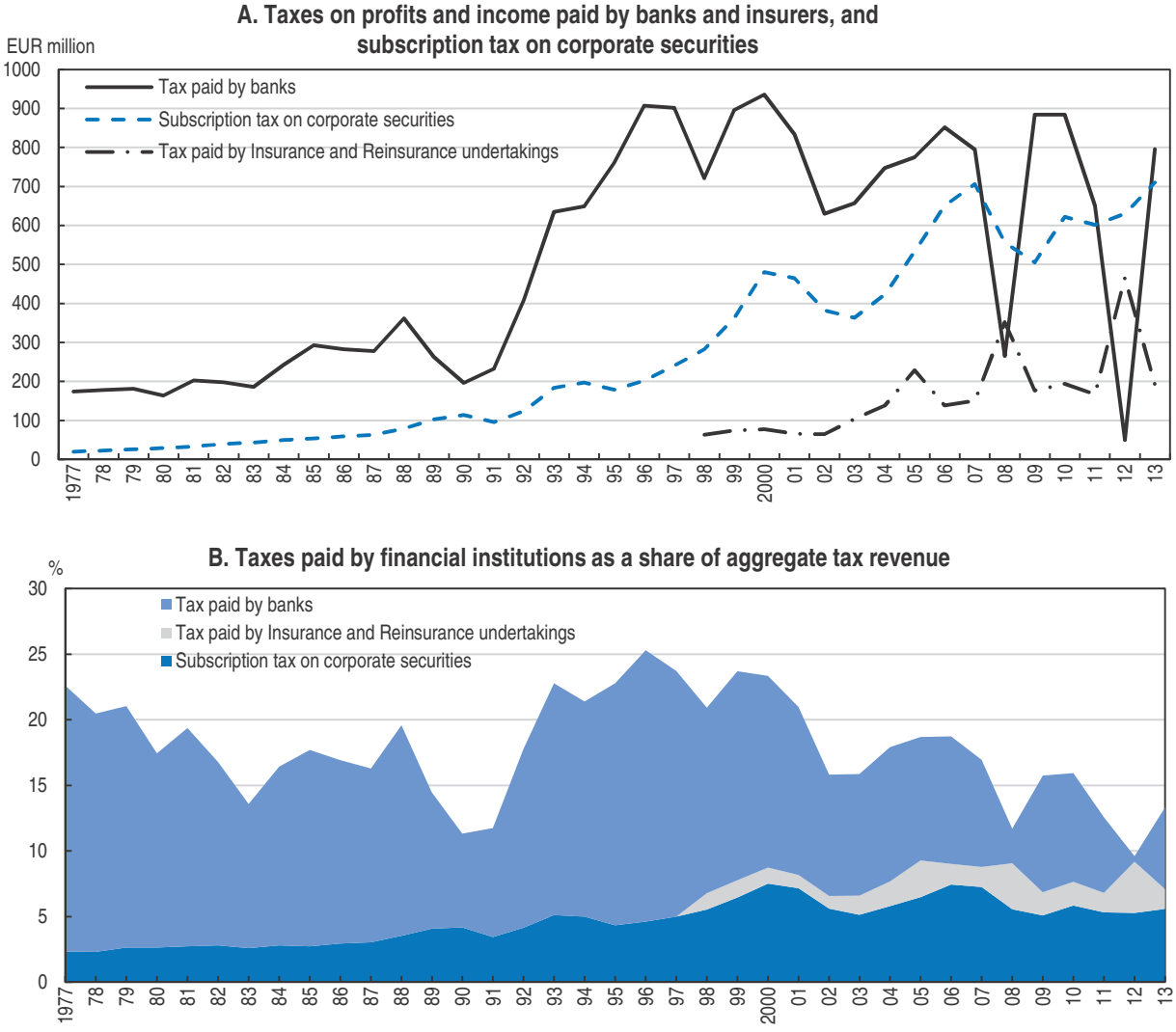
Generally, limits to growth contribution can reflect a number of factors: resource misallocation due to rent seeking and implicit government guarantees; exposure to financial shocks and increases in growth raising income inequality. Based on these estimates, intermediated credit in Luxembourg might have reached a size where its growth contribution diminishes. To some extent, implicit (or explicit with public sector owned banks) bank guarantees might have encouraged risk-taking of banks and their customers in Europe and Luxembourg, expanding the size of the banking sector at the expense of other activity. Estimates suggest that one of the banks that had to be resolved during the financial crisis was enjoying a significant implicit debt guarantee (Schich and Lindh, 2012). However, the work by the OECD (2014b) suggests that a potentially adverse effect associated with size is less relevant for international financial centres, such as Luxembourg, that export a large share of financial sector output.

Nonetheless, if further financial sector expansion fails to be beneficial for economic growth in many countries, international demand for financial sector services could slow. Moreover, tightening capital requirements for banks in Europe and elsewhere and more effective risk control in the EU Banking Union (see below) might put deleveraging pressures on banks, possibly reducing the size of international bank groups and their affiliates in Luxembourg. These contingencies support the case in favour of improving framework conditions that foster the diversification of economic activity.

Increased volatility of tax revenues from financial sector activities?

Previous *Surveys* have pointed to a link between the volatility of government revenues in Luxembourg and the volatility of tax returns from the financial sector (OECD, 2012). In particular, taxes on bank profits have turned out to be quite volatile (Figure 1.11, Panel A). The diversification in the financial sector has also diversified the tax base and might have

Figure 1.11. **Developments in tax revenues from the financial sector**



Source: STATEC, BCL and CAA.

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reduced the volatility of tax revenues. The share of bank profit taxes in total tax receipts has declined while the share of insurance profit taxes and of the subscription tax, a tax on corporate securities (essentially on mutual funds), have risen (Figure 1.11, Panel B). Ongoing financial sector output diversification could further reduce the positive correlation between financial sector tax returns and thus overall tax volatility. However, any major turmoil in financial markets could bring back revenue volatility, thus reinforcing the need to diversify the tax bases.

Increased tax transparency

The Phase-2 review of the Global Forum on Transparency and Exchange of Information for Tax Purposes showed that Luxembourg's tax relevant information practices during the review period were not fully in line with the standard on exchange of information on request. The legal and regulatory framework provides for the availability of ownership, accounting and bank information, and Luxembourg exchanges a considerable amount of

information in a timely manner. However, information gathering and enforcement powers to obtain requested information have not been used in all instances. To improve its rating by the Global Forum, Luxembourg has reported that it has acted on all of the recommendations made in its report by the Global Forum (see Box 1.1). A supplementary review process has been launched at the beginning of January 2015, to evaluate the changes made and a supplementary report is expected to be published by the Global Forum by the end of July 2015. Also, Luxembourg has committed to implement the new automatic exchange of information standard by 2017 and signed the Multilateral Competent Authority Agreement with 51 other jurisdictions.

Box 1.1. **Luxembourg's response to the recommendations by the Global Forum on Transparency and Exchange of Information for Tax Purposes**

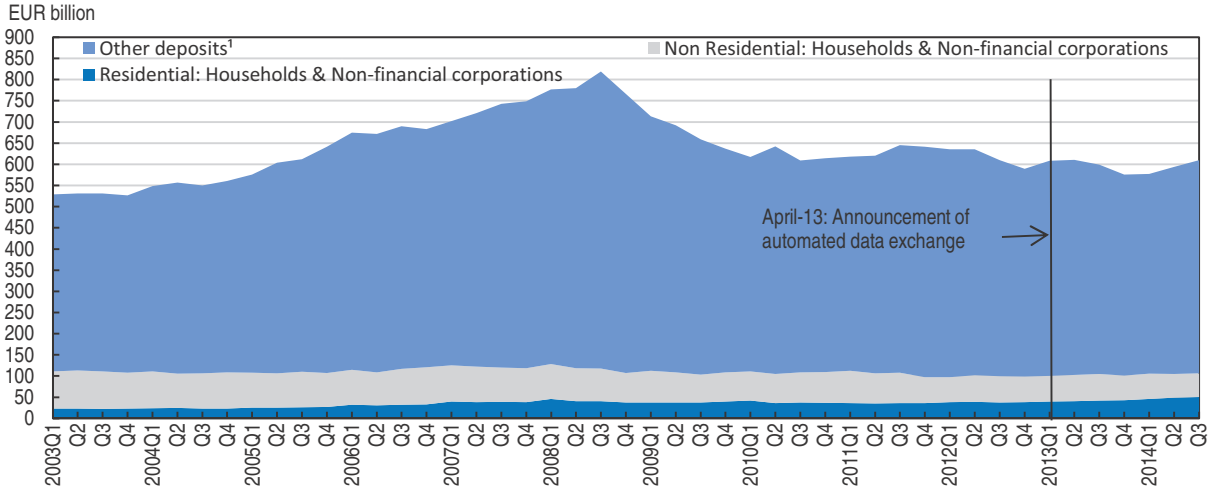
Luxembourg has reported that it has acted on all of the recommendations made in the country report for Luxembourg of the Global Forum on Transparency and Exchange of Information (EOI) for Tax Purposes. This includes:

- Luxembourg has signed and ratified the Multilateral Joint Council of Europe/OECD Convention on mutual administrative assistance in tax matters and its Protocol, hence enlarging its EOI network to all 83 parties to this Convention. The Convention entered into force on 1 November 2014. To date Luxembourg has an EOI relationship with 105 jurisdictions of which 97 are to the standard.
- In August 2014, a law immobilising all bearer shares entered into force ensuring that information relating to bearer securities holders will be available in any circumstance. Regarding the ownership information relating to SICARs taking the form of a Secs, a law of 12 July 2013 assures that SICARS taking the form of a Secs will be subject to the common registration and publication obligations provided for by commercial law.
- As of 1 January 2014, a circular of the Director of the direct tax administration concerning the procedure for the exchange of information on request came into force which clarifies the procedure and inter alia addresses the issues relating to the interpretation of the foreseeably relevance and to the exercise of compulsory powers by the competent authority.
- The law of 25 November 2014 modifying the procedure applicable for exchange of information on request, applicable since 1 December 2014, clearly states that the competent authority can compel communication of any documents or information sought by the requesting jurisdiction. It forbids alteration of the requested information by the information holder and abolishes the right to appeal of the information holder and the taxpayer against the request. Courts can no longer interpret the foreseeable relevance of requests.

Following these changes, Luxembourg has submitted a request to the Global Forum for launch of a supplementary report so that these changes can be evaluated. After a decision is taken regarding the launch by the Global Forum's Peer Review Group, a supplementary report is expected to be published by the end of July 2015. This report will also determine whether any upgrades to its compliance ratings are warranted.

Following the government's announcement, in April 2013, to introduce an automated data exchange, bank deposits from non-financial counterparties remained stable (Figure 1.12). Reductions in deposits by non-financial and non-residential counterparties

Figure 1.12. **Deposits held by credit institutions in Luxembourg**



1. Categories in Other deposits: Credit institutions, General government, Other financial intermediaries and Financial auxiliaries, Insurance corporations and Pension funds.

Source: BCL.

StatLink http://dx.doi.org/10.1787/888933197988

– notably private households in neighbouring countries – were offset by increases in deposits by non-financial and residential counterparties. The remaining steps in upgrading the tax transparency regulations should be made soon. This would increase incentives for banks to further refine their business models, benefitting Luxembourg's financial sector in the medium term.

Containing systemic risks

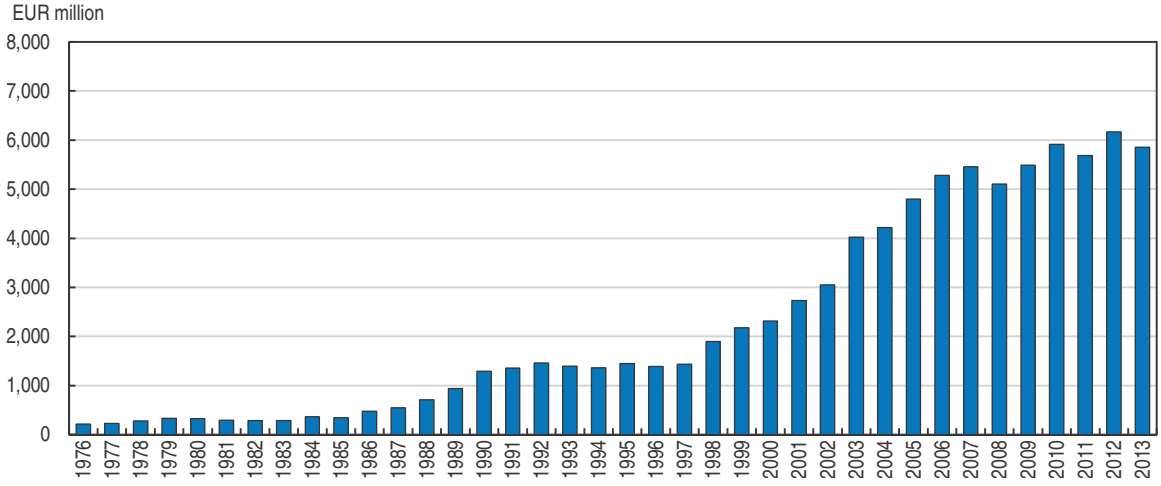
Securing stability in the financial sector is of utmost importance for Luxembourg's economic development. The crisis illustrated that shocks to the financial sector can have a profound impact on the economy, with Luxembourg's GDP having dropped steeply at the outset of the crisis, although the economy's subsequent recovery was quicker than in many other OECD economies, particularly in the euro area (see the *Assessment and Recommendations* above on macro developments). An econometric study carried out in the early phase of the crisis concluded that a 1% decline in financial-sector real value added can be associated with a decline in GDP by 0.6% in the first year and another 0.3% in each of the following two years (STATEC, 2008).

More fundamentally, the diversification of the financial sector into new areas of activity, such as the investment fund industry, builds on investors' trust in stable framework conditions. Uncertainty about Luxembourg's capacity to keep systemic risk at the minimum could thus be very disruptive for further financial sector development, given the high mobility of international capital flows. Thus, strong bank capitalisation and a strong regulatory framework are required to validate investors' trust. It is therefore welcome that Luxembourg's authorities have introduced the fully phased-in Basel III solvency ratio as of 2014 and introduced a 2.5% capital conservation buffer for all banks as of 2014, making use of the discretion allowed by the relevant EU legislation. Draft laws providing for the full introduction of the countercyclical capital buffer and buffers for systemic banks and systemic risk are in the legislative process.

The prevalence in the banking sector of ownership and credit linkages across borders implies a certain degree of risk sharing with foreign banks if adverse events in Luxembourg's banking sector materialise. At the same time, cross-border inter-bank linkages are a transmission channel for financial market shocks that can raise the default probabilities of individual banks and systemic risk in the sector overall. The crisis revealed that liquidity risks for banks in Luxembourg can originate from their exposure to parent groups (IMF, 2011). In response, financial market supervisors adopted a number of micro- and macro-prudential measures to tackle underlying risks, notably a daily liquidity reporting requirement for credit institutions, reinforced liquidity oversight via onsite visits, macro-liquidity stress test on a regular basis, as well as measures to strengthen banks' capital base.

In addition, investment funds and other financial intermediaries matter for the financial health of the banking system due to their significant financial linkage (Figure 1.3). In particular, investment funds provided some 15% of the banks' funding at the end of 2013 (Figure 1.3, Panel A). While this funding remained stable during the crisis, showing resilience of the investment funds, there could be adverse spill-over effects from investment funds to banks if the former come under severe stress. Recent econometric research also points to the relevance for shock transmission of funding links from investment funds to banks (Jin and de Simone, 2014).

Figure 1.13. **Credit granted by credit institutions for real estate located in Luxembourg**



Source: BCL.

StatLink http://dx.doi.org/10.1787/888933198261

Dealing with the specificities of Luxembourg's financial market requires a comprehensive approach to risk assessment, efficient financial market supervision and prudent capital and liquidity provisioning of both banks and interlinked financial market actors. The move towards a Banking Union in the EU, including the Single Supervisory Mechanism (SSM) for large participating banks, the Single Resolution Mechanism (SRM), common rule books for bank supervision and resolution and stronger capital requirements implied by the capital requirements regulation and directive (CRR/CRD IV) can be beneficial for Luxembourg in that they help controlling counter-party risks stemming from the rest of the EU.

The SSM brought half of the 148 individual banks in Luxembourg, representing some 80% of the banks' assets, under the direct supervision of the ECB (European Central bank, 2014; IMF, 2014). However, effective risk control by the SSM requires efficient co-operation

of the supervisory institutions at the EU level with the national competent authorities. The resource endowment of the *Commission de Surveillance du Secteur Financier* (CSSF), which is Luxembourg's supervisor for credit institutions, investment funds and other financial intermediaries, has been strengthened in recent years, bank stress testing techniques have been improved and investor protection was strengthened (IMF, 2014).

Risks to financial sector stability are assessed by the financial market regulator CSSF in co-operation with the Luxembourg Central Bank (BCL). The government plans to establish a national Systemic Risk Committee, involving all authorities that are relevant for macro-prudential policy: the CSSF, the BCL, the insurance regulator (CAA) and the ministry of finance. Identifying, assessing and monitoring risks to financial stability will be a key task of the Committee. For this co-operation to be successful it is important to elaborate the analytical framework that accounts for the financial linkages between the banks and the other relevant financial market actors, notably investment funds. The assessment framework should include indirect links via market prices and return correlations, as recent empirical research suggests (see Jin and de Simone, 2014).

The capital requirements of the banks in Luxembourg are driven by credit exposures (Table 1.1). By contrast, proprietary trading, which is often considered a major potential source for systemic risk (Blundell-Wignall and Atkinson, 2013; European Commission, 2014), plays only a minor role. The CSSF implemented a series of measures to strengthen banks' capital base. Some of these requirements exceed future Basle and EU minimum capital requirements (Box 1.2). Macro-prudential measures were also taken to address real estate market risks of the domestic banks. Regulators should maintain strong capital buffers to account for the various potential sources of risks in Luxembourg's financial sector. This should include maintaining high prudential capital provisions for mortgage loans. These loans appear to have stabilised recently, after a vigorous upswing over several years (Figure 1.13), but account for a high portion of the banks' credit. The EU CRRD IV allows bank supervisors to limit intra-group exposure. Depending on risk assessment, activation of this provision should be evoked as a preventive tool to minimise systemic risks.

Table 1.1. **Capital adequacy requirements for banks in Luxembourg**

Requirements (% of total)	2012	2013
To cover credit risk	88.4	86.4
To cover foreign exchange risk	0.4	0.3
To cover interest rate risk	0.1	0.1
To cover the risk in relation to equities	0.0	0.0
To cover the risk in relation to commodities	0.0	0.0
According to internal models	0.2	0.2
To cover settlement/delivery risk	0.0	0.0
To cover operational risk	7.8	8.5
Other capital adequacy requirements	3.1	4.5
Total capital adequacy requirements	100	100

Source: Commission de surveillance du secteur financier, Luxembourg.

As of 2013, 74% of Luxembourg's affiliates of international banks were subsidiaries, the rest being branches (Figure 1.14). For the subsidiaries, claims on the resources of Luxembourg's deposit insurance system and demands to finance resolution can arise, even if the subsidiaries are well capitalised. Branches fall under the policies of the mother

Box 1.2. **Macroprudential measures taken by the CSSF and the BCL**

Over the last four years of financial market tensions, the Commission de Surveillance du Secteur Financier, which shares financial market supervision with the Banque Centrale du Luxembourg and, more recently, with the European Central Bank, implemented a series of macro-prudential measures. These were designed to address exposure to developments on real estate markets and to strengthen the banks' capital base. The main measures were:

Measures addressing real estate exposures

- Effective since July 2013, the risk-weight requirement for new mortgage loans that exceed a loan-to-value (LTV) ratio of 80% was tightened. These exposures can no longer receive the preferential 35% risk weight.
- Various qualitative requirements include bank internal limits to exposures to real estate developers, fixation of a repayment date of the credit exposure and the prohibition of rollover of interest payments at maturity.
- Until beginning of 2014, a capital surcharge of 2% was applied to the domestically-oriented banks issuing mortgage credits. The 2% surcharge was the result of a stress testing exercise conducted by CSSF, showing that a severe downturn in the Luxembourg real estate market could potentially result in a capital depletion of up to 2%. With the European Union's CRD IV package, as per beginning of 2014, this was replaced by the capital conservation buffer of 2.5% for all banks.

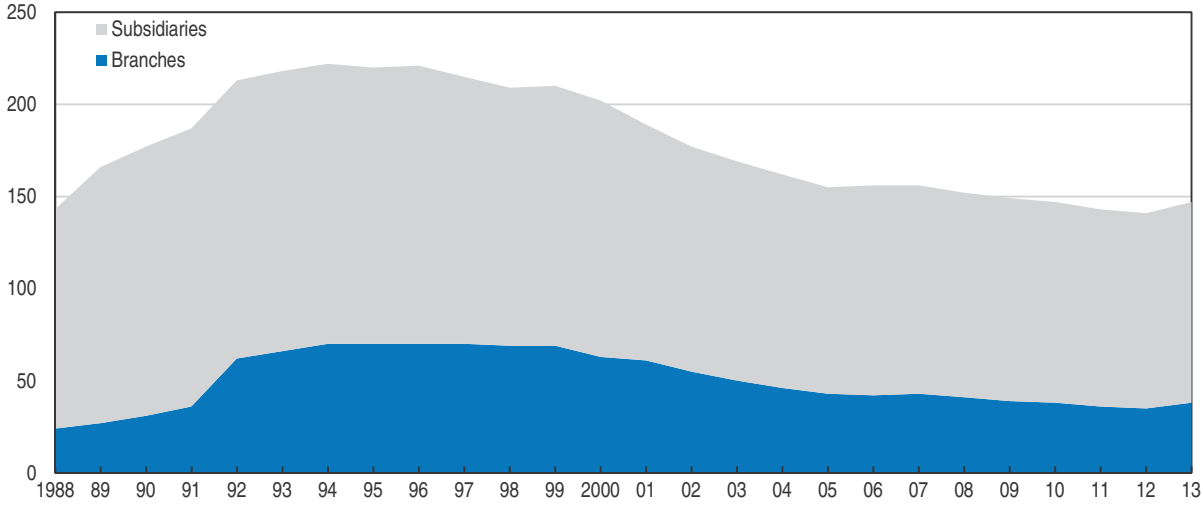
Capital strengthening measures

- In 2011, the European Banking Authority issued its recommendation on the creation and supervisory oversight of temporary capital buffers to restore market confidence (EBA/REC/2011/1) to build a temporary capital buffer to reach a 9% Core Tier 1 ratio by 30 June 2012. The EBA recommendation directly applied to only one (domestic) bank in Luxembourg. CSSF chose to apply the measure to all banks in Luxembourg.
- With the entry into force of the Basel III rules, CSSF has opted for a CET1 capital requirement of 4.5% instead of 4% (CRR, Article 465).
- There will be no phasing in of unrealised gains in the capital ratio until end of 2017 (CRR, Article 467).
- An additional capital conservation buffer of 2.5% for all banks has been introduced as per beginning of 2014, as mentioned above (CRDIV, Article 129).
- By the end of 2014, a new CSSF Regulation will enter into force prohibiting dividend payments based on unrealised gains.
- Unrealised gains for investment properties must not be reflected in the capital ratio.

Other macro prudential measures

- CSSF and BCL have issued directives via common circulars to mitigate risks associated with bank lending in foreign currency and asset encumbrance.
- According to part four of the CRR, Luxembourg banks can exempt exposures to group-related entities from the large exposure limit. Per Regulation 14-01 (Article 20), the CSSF has been empowered to limit or suspend the aforementioned exemption in case the waiver would lead to material risks for the solvency or liquidity position of the Luxembourg bank.

Figure 1.14. **Branches and subsidiaries in Luxembourg by foreign credit institutes**



Source: Commission de surveillance du secteur financier, Luxembourg.

StatLink http://dx.doi.org/10.1787/888933198274

country. Adaptation of Luxembourg's deposit insurance scheme is under way to meet future pre-funding requirements of the EU Deposit Guarantee Schemes Directive. Moreover, it is welcome that the CSSF has strengthened the criteria to be complied with when engaging into large intragroup transactions. Ownership links between banks across different legal entities and borders can provide a certain degree of risk sharing. Within the EU, Supervisory Colleges, involving the national supervisory authorities, serve to exchange information and co-ordinate key supervisory tasks across borders. In the European banking union, banking groups are supervised by the SSM via joint supervisory teams, and the SRM is responsible for resolution planning and resolution of cross-border European banking groups. However, financial linkages across borders can complicate bank resolution in bad times in particular for bank groups with dependencies located outside the European Banking Union. Thus, the authorities should ensure that resolution plans continue to be developed and resolvability assessments undertaken so that important banks could be resolved effectively across borders if necessary. Credible bail-in and resolution provisions contribute to better resource allocation and can thus benefit Luxembourg's position as a major financial centre.

Recommendations on the financial sector

Key recommendation

- Continue to monitor financial market risk while using a comprehensive approach to risk assessment that accounts for financial linkages between banks and non-bank financial intermediaries, notably investment funds.
- Continue efforts to develop resolution plans and to undertake resolvability assessments so that important banks could be resolved effectively across borders. For this end, continue to co-operate with regulatory authorities in other jurisdictions outside the EU.

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ANNEX 1.1

Measuring output and productivity in the financial sector

The output of banks at current prices is measured directly in the case of explicitly-priced services (such as fees for current accounts or fees for management of investment funds). This is augmented by implicitly-priced services, the so-called financial intermediation services indirectly measured (FISIM), provided in relation to loans and deposits, which are more difficult to measure.

FISIM on loans is computed as $(r_L - r)Y_L$, where r_L is the interest rate on loans, r is a reference rate (measured as a rate between bank interest rates on deposits and loans) and Y_L is the nominal amount of outstanding loans. Banking services to borrowers are thus measured as a margin between the interest paid by borrowers and the (risk free) interest rate. The reference rate may be calculated as an average of the rates on loans and deposits. An alternative is to use, for example, the rate of inter-bank loans. Similarly, depositor services are measured as $(r - r_D)Y_D$, where r_D is the interest paid to depositors and Y_D is the value of deposits. Depositors will normally be paid a rate that is below the reference rate and the difference corresponds to the services that a bank provides to depositors. The total value of banking services at current prices is then (approximately) given as $(r_L - r)Y_L + (r - r_D)Y_D + S$, where S stands for the value of explicitly-priced banking services.

To translate this into volumes, the explicitly-priced services S are typically deflated using a suitable price index. In the case of margin-type explicit service charges, e.g. for managing investment portfolios or sales and purchases of securities or currencies, an implicit price index is calculated that reflects both the changes in the percentage charged and the changes in the prices of the underlying assets (stocks or flows) to which this percentage rate is applied. If, for example, the stock market goes up and fund managers' fees are rising proportionally, the implicit price index will thus also rise, and applying it to the fees means that the volume service by fund managers remains relatively stable. The same logic, with inverted signs, applies in a period of downturn. As a consequence, constant price fees would be relatively unaffected by stock market movements. In the case of currencies or money funds, a volume indicator could be based on the amounts transacted or managed, deflated by a price index that measures the change in the underlying purchasing power of money.

To obtain a measure of constant-price FISIM, the values of the interest margins $(r^{t-1} - {r_D}^{t-1}){Y_D}^{t-1}$ and $({r_L}^{t-1} - r^{t-1}){Y_L}^{t-1}$ of a base year $t - 1$ are extrapolated by applying a volume index of the intermediated funds. The volume indexes ${V_D}^t$ and ${V_L}^t$ reflect the evolution of the value of the stock of deposits and loans respectively, deflated by the price

index of domestic demand, P^t/P^{t-1}, so that $V_D{}^t = [Y_D{}^t/Y_D{}^{t-1}]/[P^t/P^{t-1}]$ and $V_L{}^t = [Y_L{}^t/Y_L{}^{t-1}][P^t/P^{t-1}]$.

So, constant price FISIM for year t is then:
$[(r_L{}^{t-1} - r^{t-1})Y_L{}^tV_L{}^t + (r^{t-1} - r_D{}^{t-1})Y_D{}^tV_D{}^t] = [(r_L{}^{t-1} - r^{t-1})Y_L{}^t + (r^{t-1} - r_D{}^{t-1})Y_D{}^t]/[P^t/P^{t-1}]$

FISIM is allocated to depositors and to borrowers, where the latter typically are corporations or households with a mortgage loan. As a result, most of $(r_L{}^{t-1} - r^{t-1})Y_L{}^{t-1}V_L{}^t$ is a real intermediate input that does not affect GDP unless it is exported. FISIM on consumer credits will normally feed into final consumption expenditure. On the other hand, depositors are typically households, so GDP volumes would be more affected by $(r^{t-1} - r_D{}^{t-1})Y_D{}^{t-1}V_D{}^t$.

Because of the above methods for calculating direct bank charges and FISIM in constant prices, the growing share in GDP of value added generated by financial services can be mainly attributed to increasing relative (implicit) prices, not to the volume changes in financial services which contribute to economic growth. Furthermore, it is not immediately clear how the economic and financial crisis shows up in the measure of FISIM-output unless the stock of deposits and bonds is affected in which case V^t would grow more slowly than otherwise. Because the interest margins are kept fixed between adjacent years in the volume calculations, a narrowing or widening of interest margins would not show up in year-to-year volume growth rates. Also, FISIM is measured only on loans and deposits and not on any other assets or liabilities on the balance sheets, let alone any off-balance sheet items.

Looking at developments in (labour) productivity, these will mainly reflect changes in the volume of intermediated loans and deposits (FISIM), the changes in the underlying volumes of traded financial instruments or stocks of investment portfolios managed (direct charges), etc., per unit of labour input. Lower or higher margins would typically not feed into changes in productivity.

The increasing share of financial services in GDP has generated a debate on the measurement of financial services, on whether or not the value of bank output is exaggerated. The issue is the inclusion of risk elements in the calculation of FISIM, of which the most prominent examples are maturity risk and credit default risk. Recent revisions of the System of National Accounts (SNA, 2008) and the European System of Accounts (ESA, 2010), agreed to include maturity risk, as the management of differences in maturities of loans and deposits is normal business of banks. On credit default risks some countries prefer to exclude (a smoothed measure of) loan charge-offs from the FISIM – e.g. the United States plans to exclude the latter costs from FISIM, while European countries will not. In the case of the economic and financial crisis, showing quickly increasing charge-offs, the exclusion will most certainly affect the value of financial services negatively. However, generally speaking, it will not affect the measurement of FISIM at constant prices and thus the volume changes in financial services.

Chapter 2

Fostering the emergence of innovative industries

Developing activities in areas other than finance would help to sustain growth and deal with the declining potential output and trend productivity growth that Luxembourg's economy is facing. Given the relatively high labour costs, Luxembourg's future comparative advantages are likely to lie in higher value-added and skill intensive activities. Further development of Luxembourg's high living standards thus requires strengthening the economy's growth potential via further diversification of activity in high value-added sectors.

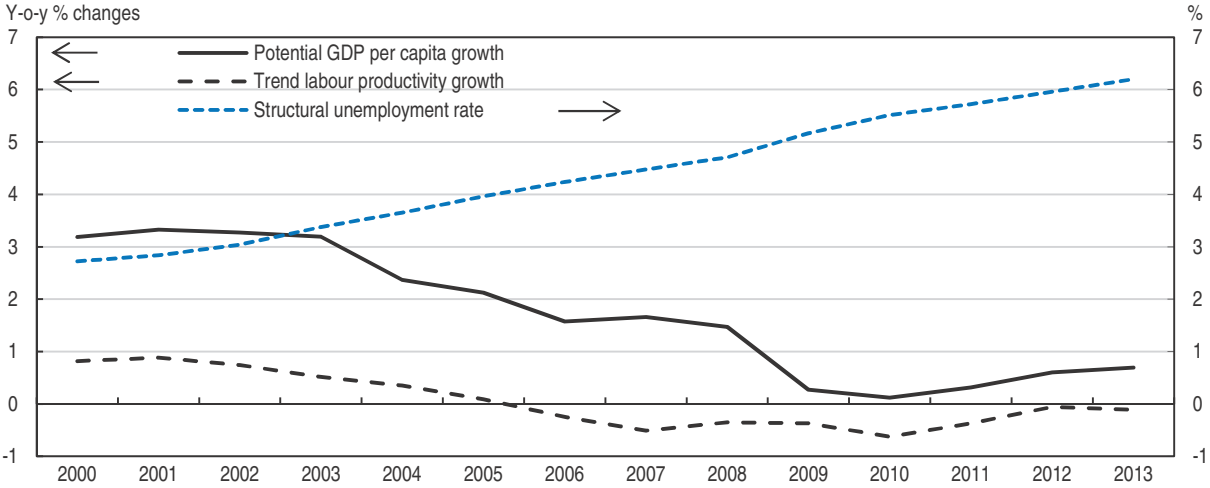
Stepping up investment in knowledge based capital and enterprise innovation can help Luxembourg to maintain and further develop comparative advantages in high value-added activities. The government is promoting the formation of enterprise clusters by providing networking, infrastructure investment and financial support for research and development. To enhance the efficiency of the government's policy, high priority should be given to outcome-oriented evaluation. This is required to ensure that costly infrastructure investment yields good results. Further efforts should be made to create synergies via cross-border initiatives, in particular with respect to research. Experience in other countries points to the importance of regulatory framework conditions in product and labour markets to spur enterprise dynamics. Regulation in professional services can be made more competition friendly, and impediments to labour force participation, notably for women, can be reduced. Productivity and innovation are also affected by the effectiveness of the secondary education system to produce skilled workers, which in Luxembourg is hampered by high repetition rates among students.

Diversifying growth

Dependence on the financial sector and potential limits to its expansion highlight the need to develop activities in other areas to sustain growth. Given the relatively high labour costs, Luxembourg's future comparative advantages are likely to lie in higher value-added and skill-intensive activities. Securing high growth and employment will also require reinvigorating the declining productivity growth. This chapter considers key policy issues related to diversifying the economy towards higher value-added activities and raising productivity more broadly.

The slowdown in potential per capita output growth is driven by rising structural unemployment and declining trend labour productivity growth (Figure 2.1). However, estimates of potential growth and its components are surrounded by a high degree of uncertainty, which is larger for Luxembourg than for most other OECD countries (Annex 2.1). This is due to the large share of cross-border workers in the labour force, and difficulties in measuring the value-added of the financial sector with large in and outflows of capital. However, these OECD estimates try to take these factors into account.

Figure 2.1. **Trend unemployment and productivity**



Source: OECD Economic Outlook 96 Database and *Analytical Database* annual (2014).

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Future growth potential is likely to lie in high value-added activities

For high-income economies such as Luxembourg, activities that produce high value-added should be particularly important as they are relatively highly remunerated. High value-added activities also tend to be technology and knowledge intensive. Indeed, in the EU value-added per employee in the high-tech manufacturing and the knowledge intensive service sectors (according to the EU Commission classification) exceeds that in the rest of the economy by some 25% (Table 2.1).

Table 2.1. **High-tech manufacturing and knowledge-intensive services industries**

NACE/area letter codes	Industry type
High- and medium-high technology manufacturing	
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
Knowledge-intensive services	
50	Water transport
51	Air transport
58	Publishing activities
59-60	Motion picture, video, television programme production; programming and broadcasting activities
61	Telecommunications
62-63	Computer programming, consultancy, and information service activities
64	Financial service activities, except insurance and pension funding
65	Insurance, reinsurance and pension funding, except compulsory social security
66	Activities auxiliary to financial services and insurance activities
69-70	Legal and accounting activities; activities of head offices; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development
73	Advertising and market research
74-75	Other professional, scientific and technical activities; veterinary activities
78	Employment activities
80	Security and investigation services
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation

Note: Classification by Eurostat, see the ISIC Rev. 3 Technology-intensity definition; *www.oecd.org/sti/ind/48350231.pdf*.
Source: Eurostat indicators on High-tech industry and Knowledge-intensive services, Annex 2.1, *http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf*.

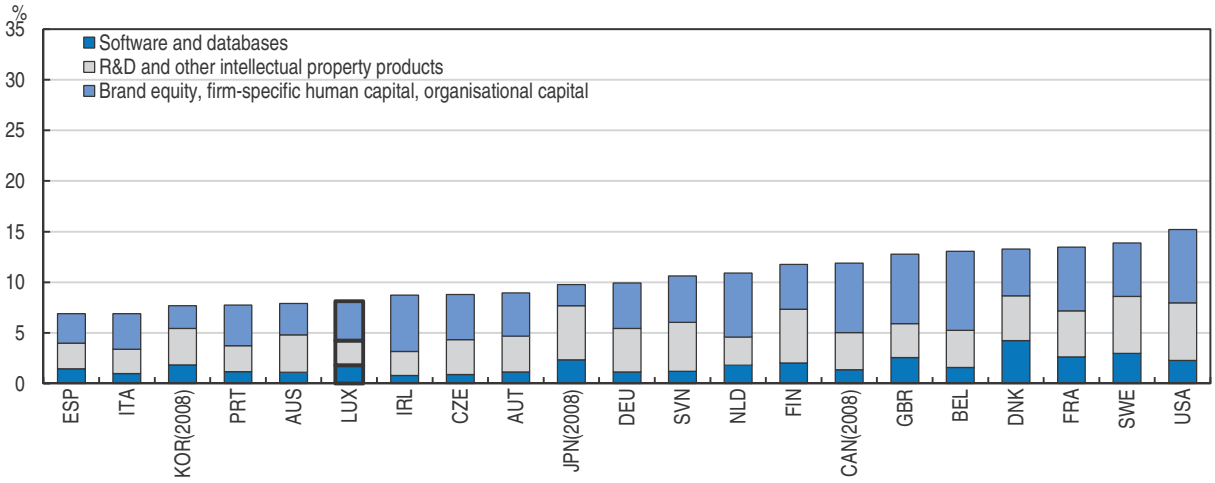
Thus, in developed economies that are close to the technological frontier, further increases in long-term growth need to come from improvements in multifactor productivity. Recent studies have shown that this is mainly driven by innovation and knowledge-based capital (KBC) – assets that lack physical embodiment, such as computerised information, intellectual property and economic competencies (OECD, 2013a). In the decade prior to the financial crisis, business investment in KBC was indeed an important driver of overall investment and accounted for 20% to 34% of the average labour productivity growth in the EU and the US (Corrado et al., 2012).

Investment in knowledge-based capital in Luxembourg is lower as a share of GDP than in other OECD countries (Figure 2.2). This points to unexploited growth and employment potential. Countries that invest more in KBC are also more effective at channelling capital and labour to young innovative firms. Thus the growth potential of KBC tends to also depend on the ability to reallocate labour and capital to their most productive uses, given that KBC is prone to misallocation (Andrews and Criscuolo, 2013).

Given the small size of the domestic economy, Luxembourg will also have to rely on high integration in global value-chains (GVCs) to broaden effective market size. With the

Figure 2.2. **Investment in knowledge-based capital, 2010**

As a percentage of value-added of the business sector



Source: OECD *Science, Technology and Industry Scoreboard 2013.*

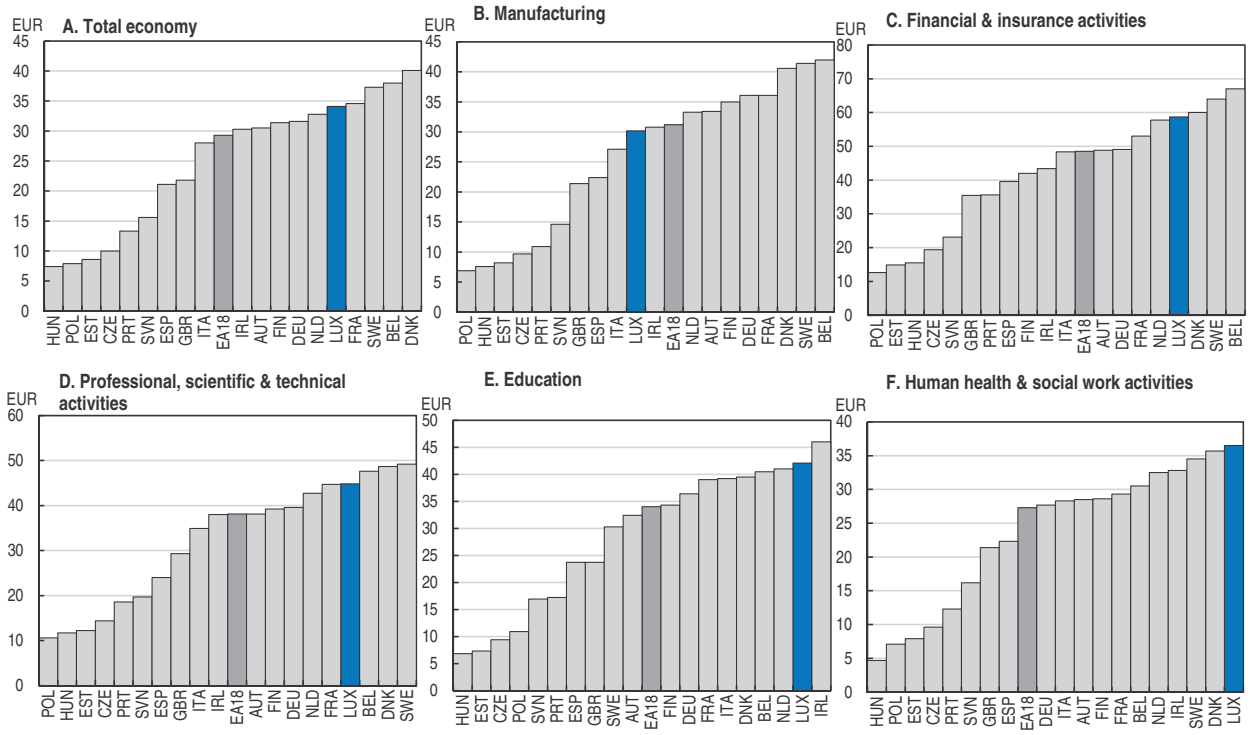
StatLink http://dx.doi.org/10.1787/888933198046

rise of GVCs, some factors of production have become more mobile. At the same time, firms are sourcing more activities and resources across borders. In this context, it is increasingly important for further development of advanced economies with high labour cost, such as Luxembourg (Figure 2.3), to focus on factors that yield comparative advantage in the global value-added chain: human capital, education and skills, high-quality infrastructure, well-developed links between enterprises and research institutes or universities and sound institutions (Baldwin, 2012). High value-added activities are less contestable because required skills are more difficult to obtain. The deeper the integration into the global value chain, the more competitive advantages can be exploited to generate income at home. Moreover, high integration can generate beneficial spillovers of knowledge and best practices (OECD, 2013b).

Luxembourg is one of the most open countries in the OECD with respect to international trade in services and well integrated in some GVCs. More than 60% of final demand in Luxembourg stems from abroad (OECD, 2013b). The share of services value-added in total exports exceeds 80%, which is the largest in the OECD. The participation of the economy in GVCs through exports is mainly driven by the use of foreign intermediates (i.e. a high degree of "backward participation"), as is typical for small economies that source a large share of their intermediate inputs from abroad. In terms of the geographical origin of inputs, Luxembourg has a relatively small sourcing from other euro area countries compared to EU countries outside the euro area, particularly the United Kingdom, Denmark, Sweden, and also the United States. This distribution is mainly explained by a relatively large presence of multinational companies in Luxembourg stemming from non-euro area countries (Amador et al., 2013).

Financial services trade is more integrated into the global value-added chain than in all other countries (Figure 2.4). Integration is considerably lower in other sectors, leaving potential to raise productivity by further integration into international value chains in higher value-added non-financial activities. For example, the value-chain analysis seems to suggest that Luxembourg would benefit from better exploiting opportunities offered by

Figure 2.3. **Hourly labour costs by economic sector, 2012**



Note: Total Labour Costs refer to the total expenditure borne by employers in order to employ staff. They cover wage and non-wage costs less subsidies. They do include vocational training costs or other expenditures such as recruitment costs, spending on working clothes, etc.

Source: Eurostat. Data refer to employees working in enterprises with at least 10 employees and NACE Rev. 2 Sections B to S excluding O.

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deeper participation in business and transport services. Luxembourg's exporters of computer services tend to be located at the upstream end of the value chain, as measured by distance to final demand. This position is associated with high value-added research and development (R&D) or with design (Figure 2.5).

Stepping up investment in KBC and enterprise innovation can help Luxembourg to maintain and further develop its position in the global value chains and develop comparative advantages in high value-added activities. Important policies for innovation and KBC are those related to R&D, the business environment, access to finance, competition, labour markets, and education. Cluster policies have also gained in importance among policy makers. The role of these various factors in Luxembourg is discussed in more detail below.

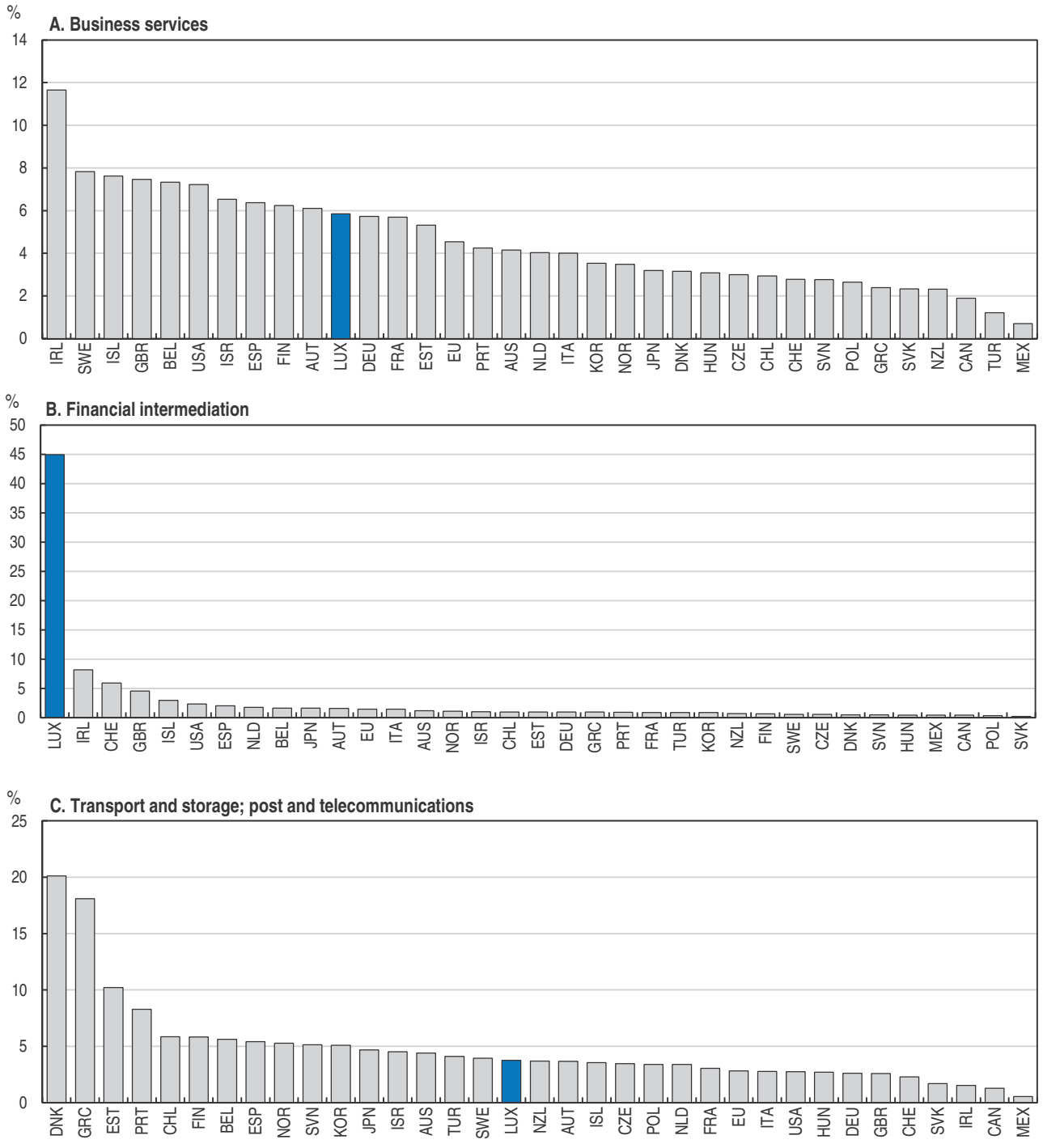
Fostering entrepreneurship

Investing in research and development

Innovative ability includes R&D spending that leads to development of new products and services, copyrights and licences, as well as novel designs that translate into quality improvements and enhanced processes. Luxembourg's position among OECD countries in patents and trademarks is relatively strong in per capita terms, largely owing to the strong position in trademarks abroad (Figure 2.6). Per capita registration of triadic patents (patents registered at the European, Japanese and US patent offices), which may require

Figure 2.4. **International comparison of GVC participation index for selected industries (2009)**

Sum of the share of foreign inputs in overall exports and the share of gross exports that are used as inputs in other countries' exports



Source: OECD Global Value Chains indicators.

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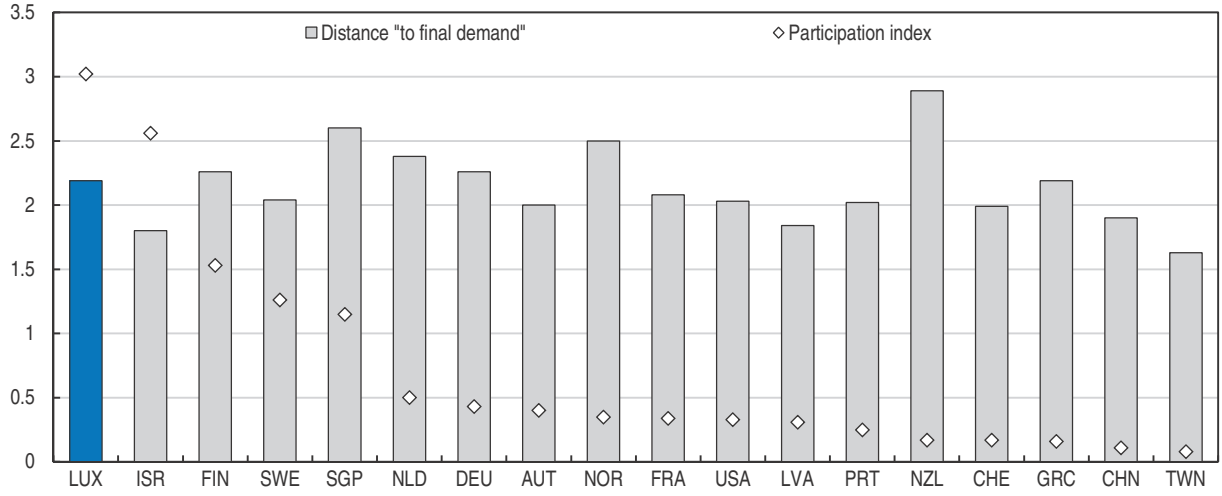
Figure 2.5. **Participation and position in computer services global value chains, 2008**



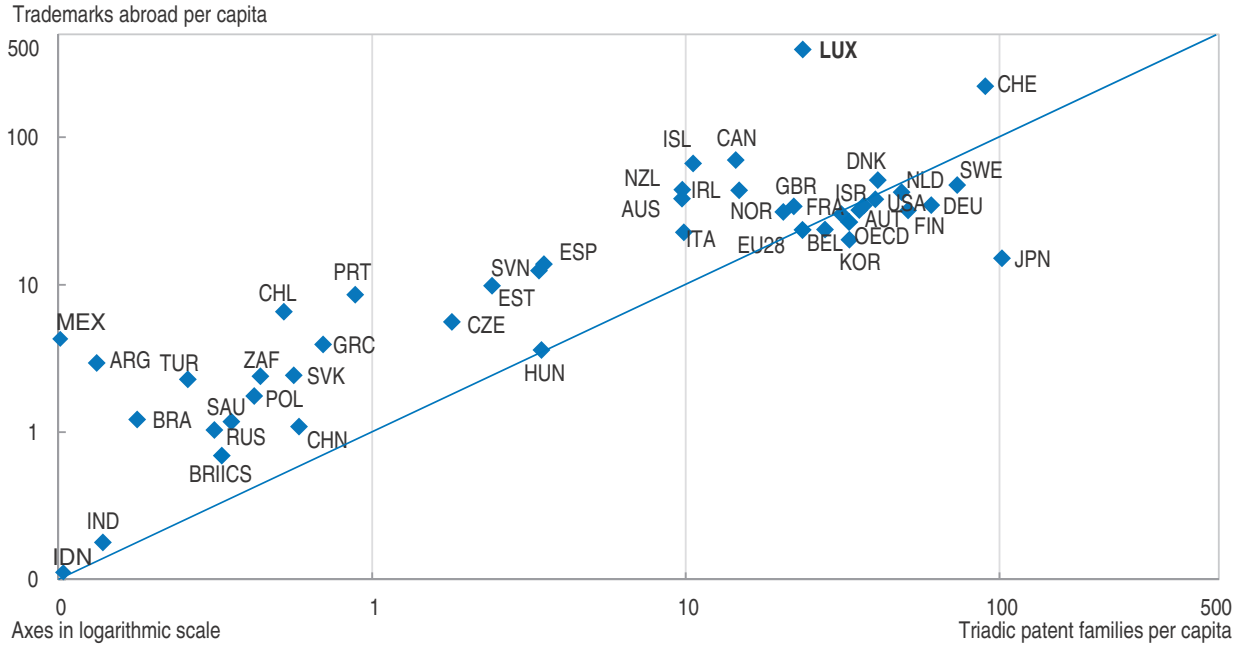
Source: OECD (2012), Policy Dialogue on Aid for Trade, Mapping Global Value Chains.

StatLink http://dx.doi.org/10.1787/888933198308

How to read this figure: The participation index is calculated as the sum of foreign inputs and domestically-produced inputs used in third countries' exports, as a share of gross exports. The distance to final demand is a measure of upstreamness in a global value chain. Longer distances indicate a specialisation in producing inputs closer to the beginning of the value chain.

Figure 2.6. **Patents and trademarks per capita, 2009-11**

Average number per million population, OECD and G20 countries



Source: OECD *Science, Technology and Industry Scoreboard 2013.*

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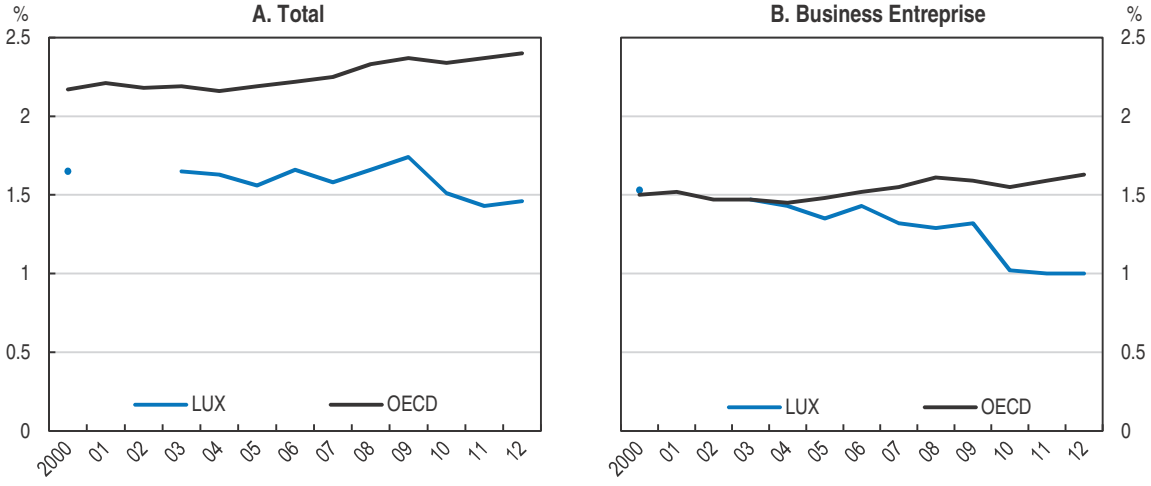
more innovative and higher value-added research, is about average in the EU. The latest EU Community Innovation Survey (EU Commission, 2010) also suggests that a large majority of firms introduced product, process, organisational or marketing innovations

(either new-to-market or new-to-firm). However, the share of SMEs in turnover derived from sales of product innovations is relatively low (EU Commission, 2014).

Luxembourg is lagging the OECD average in terms of both total and business R&D expenditure, which is an important determinant of the ability to innovate (Figure 2.7). R&D expenditure by the public sector increased over the last years, largely owing to larger outlays for the University of Luxembourg and for public sector research institutes, which are also relevant for the government's cluster initiative (see below). At the same time, business spending on R&D, in terms of gross domestic product (GDP), trended down already prior to the crisis and dropped further by 0.3 percentage points when the crisis set in, undercutting the EU average by a quarter of a percentage point. While measuring private sector R&D spending might be subject to a considerable degree of uncertainty in an economy with a large sector of financial market and related services, other factors, relating to the business environment and access to venture capital, are likely to be at play in hampering R&D spending.

Figure 2.7. **Research and development expenditure**

Gross domestic expenditure in per cent of GDP



Source: OECD (2014), *Main Science and Technology Indicators*.

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The government financially supports private sector R&D by various direct programmes (mainly based on the 2009 law for the Promotion of Research, Development and Innovation). Support is geared towards SMEs, with rates of support declining with the size of the enterprise, although various maximum intensities and thresholds apply, depending on the type of the recipient (Table 2.2). In particular, one of the measures, *Aid for Young Innovative Enterprises*, exclusively targets small private firms or research units. Programme participation of SMEs has significantly increased since the introduction of the new system (Box 2.1). Also, royalties and capital gains derived from most types of intellectual property are tax deductible to some extent. OECD research suggests that R&D tax incentives benefit incumbents at the expense of entrants, suggesting that direct support is better suited for small and young firms facing constraints to access finance (Westmore, 2013; Jaumotte and Pain, 2005).

In 2009, before the law for the Promotion of Research, Development and Innovation came into force, more than 90% of private R&D spending sponsored by the government was

Table 2.2. **Maximum aid intensities and amounts of the aid schemes established by the Law of 5 June 2009**

Per cent

Type of scheme	Type of R&D project or programme	Large enterprise or large private research organisation	Medium-sized enterprise or medium sized private research organisation (including 10 bonus)	Small enterprise or small research organisation (including 20 bonus)	Public research organisation
R&D project or programme	Experimental development	25	35	45	n.a.
	Experimental development + collaboration (incl. 15 bonus)	40	50	60	n.a.
	Industrial research	50	60	70	n.a.
	Industrial research + collaboration (incl. 15 bonus)	65	75	80	n.a.
	Fundamental research	100	100	100	n.a.
Technical feasibility studies	Prior to experimental development	40	50	50	n.a.
	Prior to industrial research	65	75	75	n.a.
Protection of technical industrial property	Following experimental development	n.a.[1]	25	25	n.a.
	Following experimental development + collaboration (incl. 15 bonus)	n.a.[1]	40	40	n.a.
	Following industrial research	n.a.[1]	50	50	n.a.
	Following industrial research + collaboration (incl. 15 bonus)	n.a.[1]	65	65	n.a.
	Following fundamental research	n.a.[1]	100	100	n.a.
Aid for young innovative enterprises		n.a.	n.a.	EUR 1 000 000	n.a.
Innovation advisory services and innovation support services		n.a.[1]	EUR 200 000 maximum aid per 3-year period	EUR 200 000 maximum aid per 3-year period	n.a.
Temporary secondment of highly qualified personnel		n.a.[1]	50	50	n.a.
Process and organisational innovation in services		15	25	35	n.a.
Investment in innovation clusters		15	25	35	50
Animation of innovation clusters		50 on average, over a maximum period of 5 years	50 on average, over a maximum period of 5 years	50 on average, over a maximum period of 5 years	75 over a maximum period of 10 years
De minimis measures		EUR 200 000 maximum per period of 3 fiscal years	EUR 200 000 maximum per period of 3 fiscal years	EUR 200 000 maximum per period of 3 fiscal years	n.a.

1. *De minimis* measures may apply.

Source: Luxinnovation, *State Aid for Research, Development and Innovation for the Benefit of Luxembourg's Economy*.

undertaken by large enterprises (Figure 2.8). At the same time, empirical cross-country evidence points to the important contribution of young enterprises in innovation processes (Lerner, 2010; OECD, 2013c). More profound, "radical" innovations are often pioneered by young, enterprises, while older firms tend to produce more incremental innovation along established paths. It is thus important to monitor to what extent young enterprises benefit from support, and if necessary adjust support programmes to target a larger share of the support to younger enterprises.

There is also room to improve the structure of the programmes, as suggested by the non-utilisation of two of the measures (*support of temporary secondment of highly qualified personnel* and *animation of innovation clusters*). Low utilisation of some programmes could also reflect barriers in the economic environment that reduce the expected returns from engaging in R&D. Moreover, the low share of female researchers, and their high

Box 2.1. **R&D aid schemes in 2013**

In 2013, the government spent almost EUR 87 million in R&D aid under the Law of 5 June 2009, more than in the two years before (see Table 2.3). In these three years, at least 80% of the R&D aid in Luxembourg has been channelled through R&D projects and programmes, followed by aid for "young innovative enterprises". Other schemes, including those targeted at investment in clusters, are relatively small.

Table 2.3. **Amounts of R&D aid under the Law of 5 June 2009**

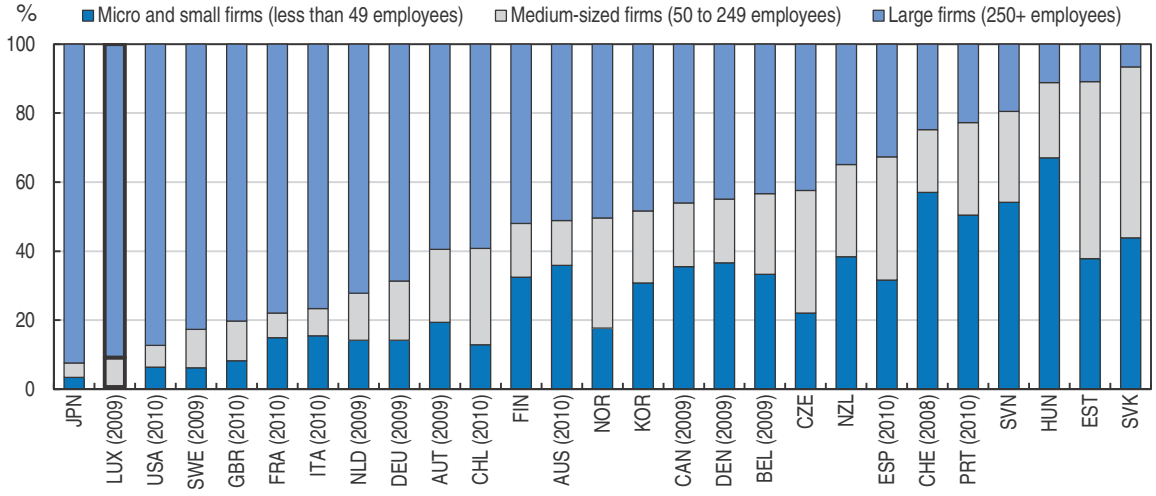
EUR million

	2011	2012	2013	
	Total amount of state aid	Total amount of state aid	Total amount of state aid	Total expenditure by recipients
R&D projects and programmes	27.21	33.56	74.90	199.50
Technical feasibility studies	0.62	0.73	1.32	2.69
Protection of technical industrial property	0.00	0.00	0.09	0.38
Aid for young innovation enterprises	2.49	4.64	6.23	15.25
Innovation advisory services and innovation support	0.08	0.04	0.02	0.04
Temporary secondment of highly qualified personnel				
Process and organisational innovation in services	0.18	0.21	3.32	11.6
Investment in innovation clusters		1.40	0.35	1
Animation of innovation clusters		1.11		
De minimis measures	0.53	0.26	0.53	
Total	**31.11**	**41.95**	**86.76**	**230.46**

Source: Ministry of Economy, *Annual Report 2013*.

The number of projects supported by the "R&D projects and programmes" tool has been steadily increasing from 31 in 2009 to 87 in 2013 (Ministry of the Economy, 2014). The number of SMEs supported by this measure also increased, from 7 in 2009 to 28 in 2013. By field, 53% of the programmes were allocated to scientific and technical activities, 29% in manufacturing industries, 12% in ICT and 2% in finance and insurance.

Figure 2.8. **Government financed R&D in the business sector, by the size of the firm, 2011**



Note: For some countries other years apply, as indicated in the parentheses.
Source: OECD, *Entrepreneurship at a Glance 2014*.

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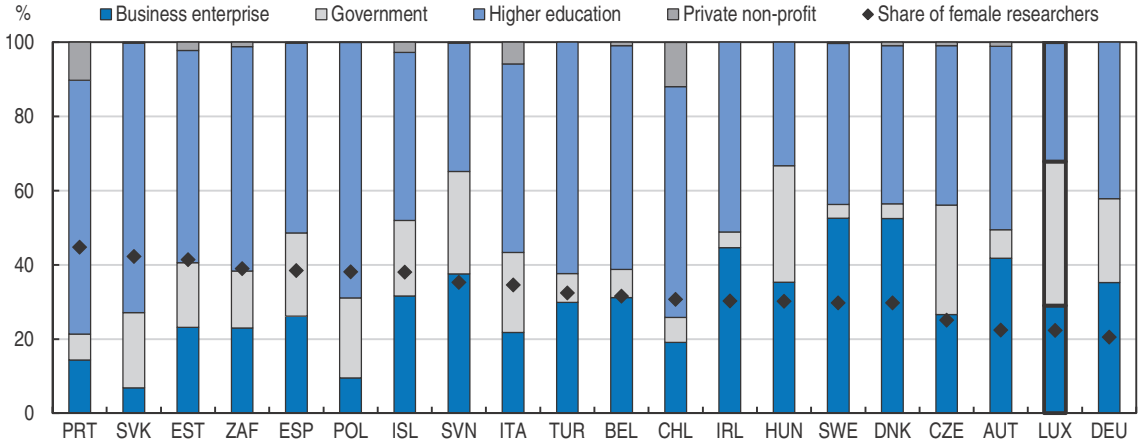
Figure 2.9. **Female researchers by sector of employment, 2011**

As a percentage of female researchers, full time equivalent



Source: OECD Science Technology and Industry Scoreboard, 2013.

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concentration in the public sector, could point to disincentives to female participation, and thus unexploited opportunities to step up research (Figure 2.9).

Further improvements in the business environment to foster innovation

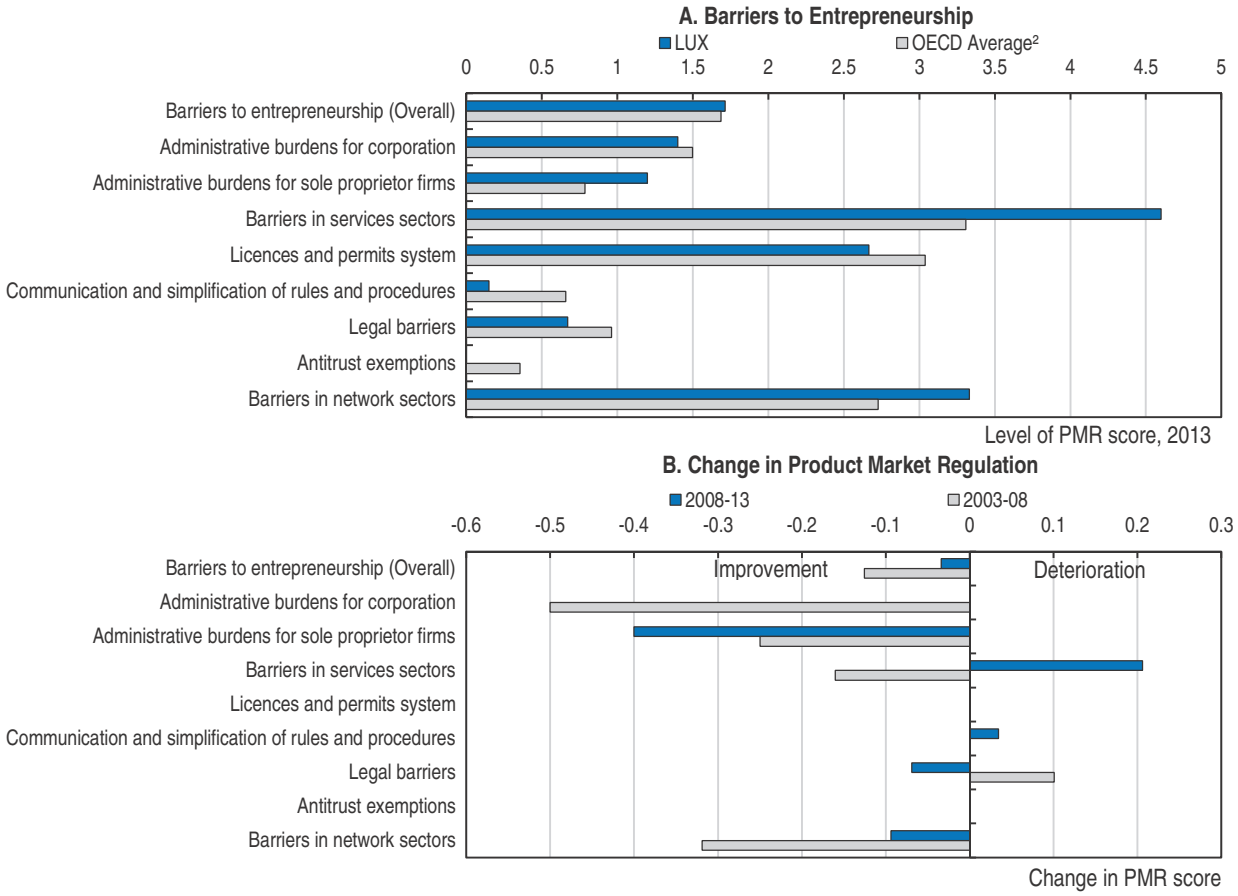
Entrepreneurship and productivity are heavily influenced by the business environment. There is a strong negative relationship between the strictness of product market regulation (PMR) and productivity, both in the aggregate (Bouis et al., 2011) and at the firm and sectoral levels (Aghion et al., 2004; Bourlès et al., 2010). In particular, lower entry barriers increase the supply of new ideas by raising firm entry rates, which in turn increases the pressure on incumbent firms to innovate. In addition, reforms that lead to less stringent PMR can also raise the incentives for firms to incorporate foreign technologies (Parente and Prescott, 2000; Holmes et al., 2008).

Overall, barriers to entrepreneurship in Luxembourg are close to the OECD average, but remain relatively high compared to best practice (Figure 2.10, Panel A), despite some decline between 2003 and 2013. Administrative burden for sole proprietor firms and of barriers in network sectors declined, but in the services sector, business conditions became more restrictive due to tighter regulation of licencing in retail trade relating to retail surface (Figure 2.10, Panel B).

There has been little progress in making regulation in professional services, such as architecture, engineering, accounting and legal services, more competition friendly. Barriers in these sectors appear to be relatively high by international comparison due to high entry barriers, such as compulsory qualifications and duration of compulsory practice. However, the Competition Authority was able to abolish recommended fee structures published by several professional associations, such as architects and safety and health coordinators.

Entrepreneurial barriers in the network sector remain relatively high. As the government retains full ownership in the major telecommunication network operators (*Luxconnect* and *Entreprise des Postes et Télécommunications*), in contrast to most other OECD countries, they are not open to investment by private firms. Opening the sector to foreign

Figure 2.10. **Product Market Regulation: Barriers to entrepreneurship**[1]



1. All indices below the first line are sub-indices of the index "Barriers to entrepreneurship".
2. Simple average of OECD countries, 2013 data. USA: latest data from 2008.

Source: OECD Product Market Regulation Database, 2013 edition.

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participation might lead to more investment, although the outcome is not certain and will depend on expected returns.

The entry to the rail sector is limited to a single firm (*Société Nationale des Chemins de Fer Luxembourgeois*, CFL). Passenger and freight transport are provided by a single operator and the separation between the operation of infrastructure and provision of railway services, although not as important in a small country as in other countries, is limited to accounting separation. Some 75% of the employees of the CFL group are civil servants while the rest is on private sector contracts. It should be considered whether a move towards universal private sector contracts would be efficiency enhancing.

Policies helping enterprises to form clusters could support innovation and productivity growth

The case for public policies to ease "clustering", the tendency of firms in related lines of business to concentrate geographically, rests on the idea that clusters might help internalising spill-over effects that generate improvements in innovation and productivity (Fabiani et al., 2000; Beaudry and Breschi, 2000). Clusters might help ease the way for firms to attract a workforce with characteristics that match best the firms' projects and can also

support important knowledge spill-overs, such as knowledge of market opportunities and the transfer of technologies.

Studies on cluster policies also suggest that they need to build on existing strengths to be successful. Policies disregarding comparative advantages can entail high economic costs and risks (OECD/DSTI, 2014). Support for clusters run the risk of "backing losers" rather than "picking winners" (Hospers et al., 2008). Several evaluations of cluster policies in OECD countries found no positive effect on employment, exports, sales, patents or R&D productivity (Martin et al., 2011; Bellego and Dortet-Bernadet, 2013; Nishimura and Okamuro, 2011). Other evaluations found modest positive effects of cluster policies such as a slightly higher share of knowledge-based firms in the locality, albeit stagnating over time (Viladecans-Marsal and Arauzo-Carod, 2012), and a somewhat higher probability that firms in a target industry would innovate (Falck et al., 2010). Also, valuation based on interviews and self-reports show that cluster policies can succeed in fostering inter-firm collaboration or business contacts (Engel et al., 2012; Uyarra and Ramlogan, 2012).

Experience from other countries with clusters suggests that favourable overall regulatory framework conditions for the economy are of high importance for successful cluster policies (see e.g. Uyarra and Ramlogan, 2012). In particular, this concerns competition-friendly product market regulation to foster the reallocation of resources; labour market regulation that activates the employment potential of the labour force and supports efficient matching of labour supply; and policies that secure the availability of a high-skilled workforce. Direct financial subsidy to firms' location decisions, on the other hand, appears to have only modest effects on location decisions while giving rise to inefficiencies, such as wasteful competition and the lack of comparative advantage (OECD/DSTI, 2014).

The government is supporting the formation of enterprise clusters within a special initiative in sectors that it considers promising for Luxembourg. At present, the initiative comprises the following clusters: eco-innovation technologies, healthcare and biotechnologies, information and communication technologies, materials technologies, space technologies, automotive components, logistics, and maritime transport (Box 2.2). These sectors fit with the usual classification of high value-added activities (Table 2.1). The initiative includes information networking between the private sector participants and the administration and R&D support via public sector research institutes or Luxembourg University.

Moreover, the government has undertaken substantial public infrastructure investment supporting cluster activities. In information and communication technologies this has been quite successful (Figure 2.11). The government's April 2010 National strategy for very high-speed networks aims to give access to optical fibre connections to all by 2020. Already, most of the country is covered by high-speed broadband and 68% of households were connected to some version of broadband in 2011 (OECD, 2013a). These investments position Luxembourg well to attract new technology activities such as cloud computing, trusted data management and the development of the internet economy. It has one of the most modern data centre parks in Europe with 19 data centres in operation that conform to high standards in security, availability and environmental benchmarks. Based on these strengths, many private and public sector institutions, including financial sector enterprises and the European Commission, established data centres in Luxembourg. The absence of taxation of servers also contribute to the comparative advantage, and energy prices, which account for a large part of data centres' operating costs, are competitive.

Box 2.2. **The government's cluster initiative**

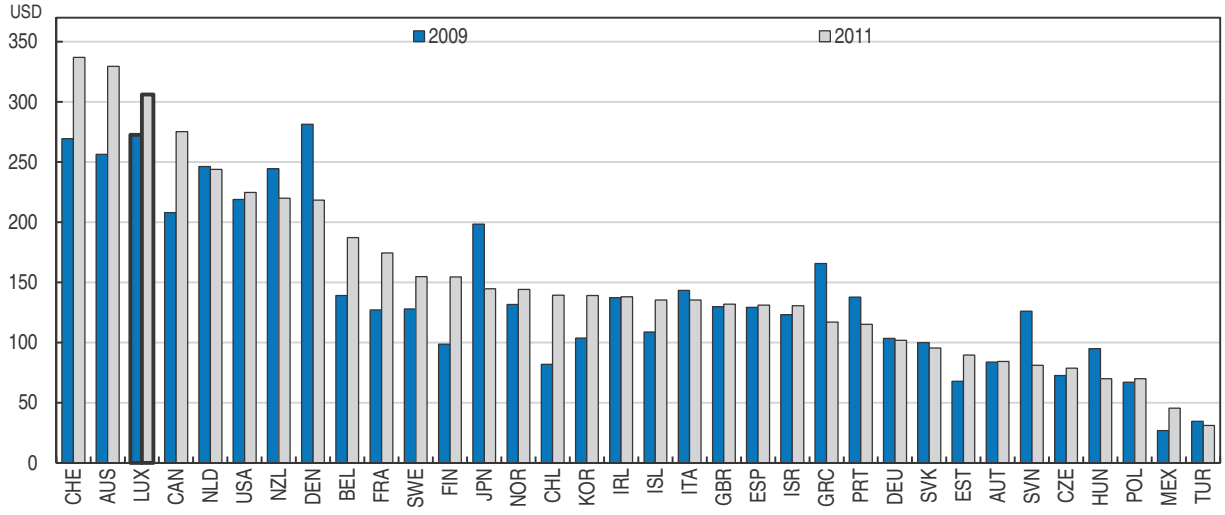
In 2002, the government launched a cluster initiative, which, in its present form, pursues the following objectives:

- Foster communication and the exchange of knowledge and know-how between cluster and innovation network members.
- Stimulate the development and implementation of collaborative projects on a national, European and an international level.
- Enhance the visibility of the technological excellence and the innovation potential of cluster and innovation network members.
- Encourage the uptake of new technologies and the identification of potential business opportunities.

The aim is to create 3 000 new jobs and contribute to the establishment of 300 new businesses by 2020.

Most of the clusters are led by a president coming from the private sector, who is supported by a vice-president from public research. Designated cluster managers are in charge of the daily organisational management.

Figure 2.11. **Public telecommunications investment per capita**



Source: OECD Communications Outlook 2013.

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Similarly, the government's decision to create a health care and bio-medicine cluster was followed by heavy investment to create the Luxembourg Centre for Systems Biomedicine (LCSB) and the Integrated BioBank of Luxembourg. So far, the success was mixed. The forthcoming OECD Innovation Policy Review on Luxembourg (OECD, 2015a) found that the quality of public sector research in biotechnology improved in recent years, largely owing to better international co-operation through the LCSB. Moreover, it seems that not enough attention was paid to the regulatory framework concerning health technologies, e.g. around genetic testing. The Review thus sees a need to reconsider the regulatory framework as a condition for reaping the full benefits from the biomedicine initiative, and points to a number of other issues that can hamper health-related

innovation such as a relatively weak industrial base in the field and a lack of linkages between researchers, business and clinicians.

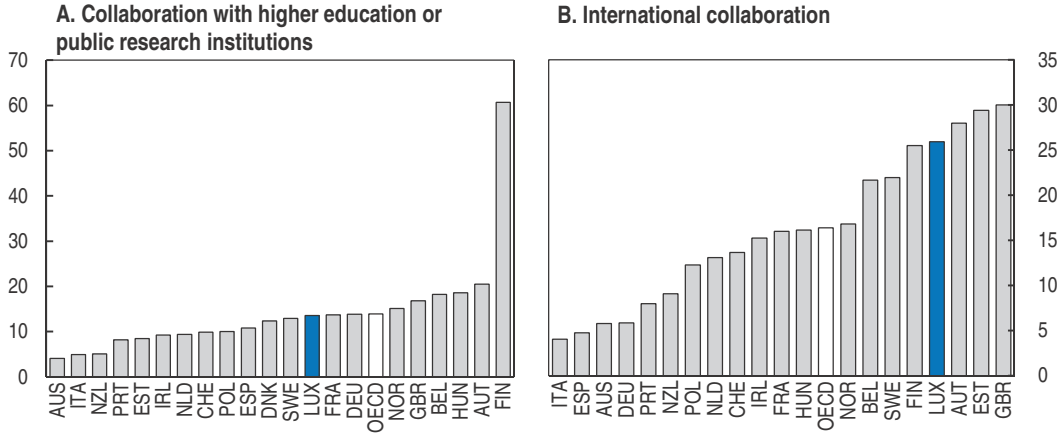
To enhance the efficiency of cluster policies the government should give high priority to outcome-oriented evaluation. The government is establishing a comprehensive database containing key characteristics of the enterprises participating in clusters. This is an important step towards effective policy evaluation. Project funding should rely increasingly on private resources as cluster participants obtain benefits from the policy stimulus. Also, evaluation should go hand in hand with an assessment whether regulatory policy needs to be adapted. Efforts should be made to create synergies via cross-border initiatives. To enhance innovation, clusters should also be kept inclusive through impartial public co-ordination and adaptable by effective interaction of firms and research institutions.

Other types of collaboration arrangements to enhance innovation

Collaboration with other companies, universities and research institutes can help innovation by small and medium enterprises (SMEs) that may otherwise have more limited resources for R&D. Innovative SMEs in Luxembourg are actively engaging in international collaboration on trademarks and patent submissions, as well as on joint marketing and distribution schemes (Figure 2.12, Panel A). Collaboration of enterprises with public research institutions has been relatively weak (Figure 2.12, Panel B), but has made progress in recent years as the governance of public research institutions improved (OECD, 2015a). Scope remains for further improving the performance of public research centres (CRP), as argued in the forthcoming OECD Innovation Policy Review on Luxembourg, in particular by exploring closer co-operation of the research centres with the University of Luxembourg and with research institutes based abroad Moreover, the possibility of further mergers of CRPs should be considered. Mergers can be a welcome opportunity to strengthen cross-border co-operation among institutions (OECD, 2015a).

Figure 2.12. **SMEs collaboration on innovation**

Per cent of product and/or process innovative firms, 2008-10[1]



1. 2011 for Australia, 2006-08 for Ireland, 2009-10 for New Zealand and 2009-11 for Switzerland. SME: Small and medium-sized enterprises. The OECD aggregate covers 30 countries in Panel A and 28 in Panel B.

Source: OECD Science, Technology and Industry Scoreboard 2013.

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The government has prepared legislation designed to include non-profit organisations and private foundations in the funding of research co-operation between enterprises and research institutions. This initiative is welcome, because it can widen the supply of ideas and increase competition in the R&D sector. A network for promoting spin-offs and intellectual property from public research is being developed in the "City of Sciences" in Belval, which houses or will house many relevant infrastructures for promoting spin-offs from public research, such as Technoport and the House of Biohealth. The co-location of activities in the new City of Sciences is expected to result in synergies and facilitate public-private partnerships. Other structures promoting technology transfer, such as an interdisciplinary centre focussing on intellectual property issues (Centre de veille technologique), are hosted by the University of Luxembourg and the public research centres. The legal office of the University provides assistance in matters related to intellectual property (OECD, 2015a).

Start-ups face difficulties in accessing early-stage financing

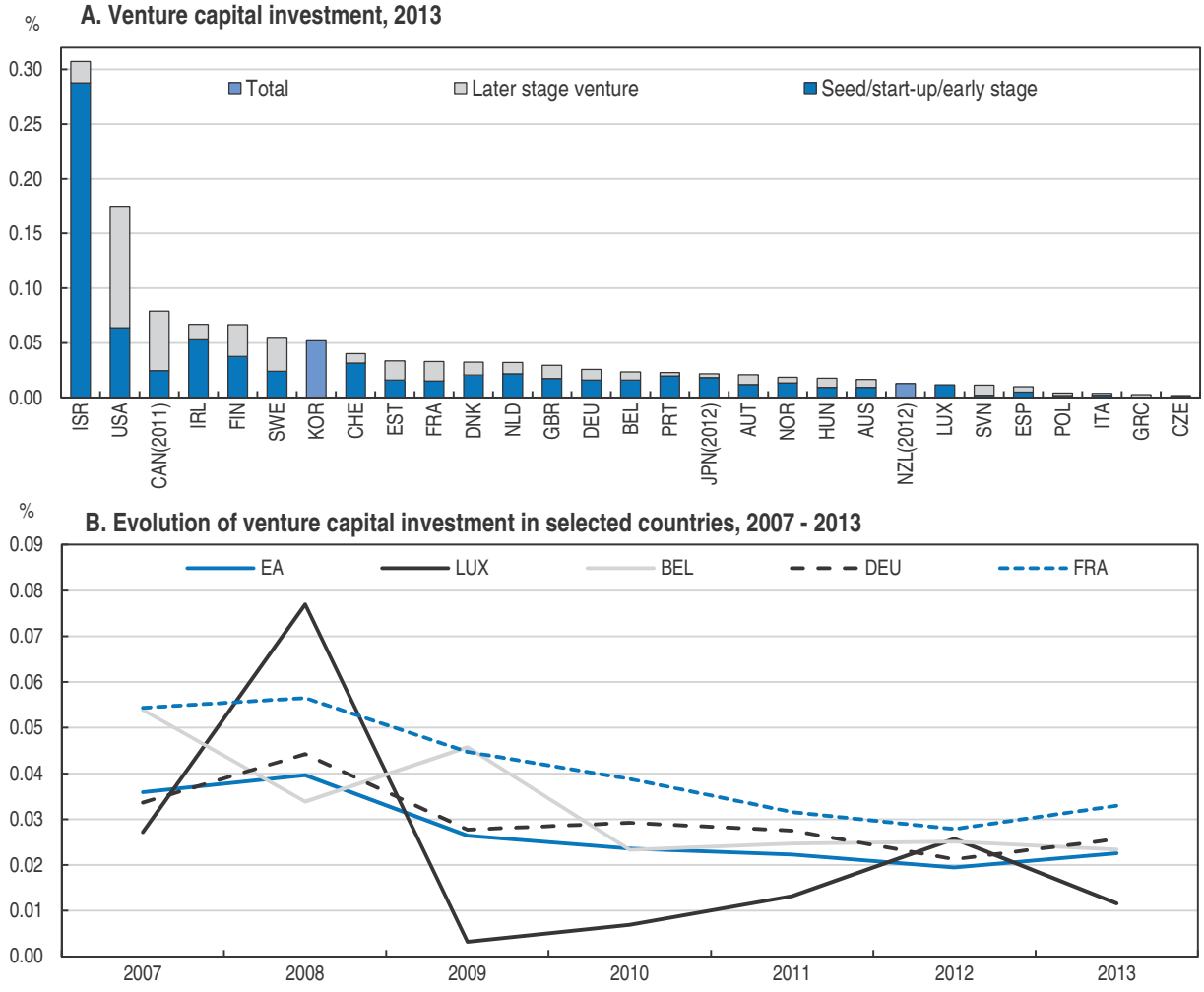
Venture capital and start-up investment in Luxembourg is low by international comparison (Figure 2.13, Panel A), although funding appears volatile (Figure 2.13, Panel B). Many start-ups with limited own capital may not be able to benefit from venture capital due to lack of tangible assets that could serve as collateral. Suitable projects might also be missing. Indeed, start-ups appear to be small in Luxembourg by international comparison (Figure 2.14).

The government is promoting the availability of venture capital via two public investment funds that were established in 2012. The funds are designed to invest in innovative small- and medium-sized enterprises in the development phase, in sectors supported by the government's cluster initiative (such as information and communications technology (ICT) and clean technologies). First, *The Life Sciences Fund*, supports the government's programme in bio-technology through a venture capital fund specialising in biomedicine. The fund envisages investing 80% of its funds in start-ups, with 70% of the capital to be invested in European countries. Second, *The Luxembourg Future Fund*, with capital of EUR 150 million, managed by the European Investment Fund, extends equity participations as a minority shareholder. Both funds are still young and more time is needed to assess how successful they are.

Financial support benefitting start-ups is also provided as loans by the National Credit and Investment Company (SNCI) (Table 2.4). The Equipment Loans are targeted at SMEs with business permits in certain areas, including craftsman, tradesman, industrialist, and certain liberal professions for the purpose of financing professional equipment and land. Equity financing for SMEs is also provided through equity loans and participating interests used to promote creation, development and rationalisation of businesses. This includes loans for SMEs with equity properties, to promote the creation, development and rationalisation of businesses. The SNCI's research, development and innovation financing has been displaced by the 2009 state-aid measures discussed above.

These initiatives have not yet lead to a significant boost in venture capital. The instruments should carefully be evaluated in terms of how effective they are in achieving their goals, and adjusted periodically as needed. This, together with structural reform in product and labour markets could help to increase the number of quality projects put forward for financing.

Figure 2.13. **Venture capital investment as a percentage of GDP**



Source: OECD, *Entrepreneurship at a Glance 2014*; *European Private Equity and Venture Capital Association.*

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Raising the quality of human capital

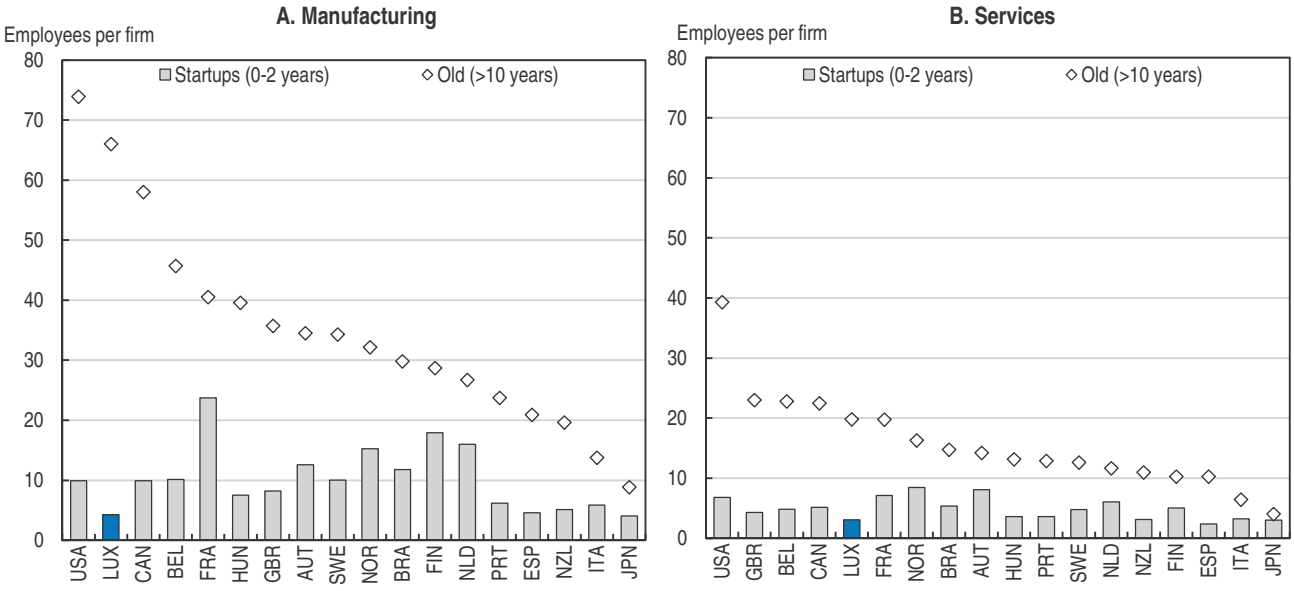
Diversification into high value activities is facilitated by availability of highly-skilled human capital. On the one hand, Luxembourg has a large pool of specialised and highly qualified labour in financial and professional services and in the ICT sector, constituting a base from which further sectoral development could spread. Luxembourg has also been able to attract highly qualified labour from abroad when needed, although congestion in transport and housing supply within the city are becoming constraints.

On the other hand, the constant sharp rise in structural unemployment points to potential skill shortages among the resident population. Ensuring that the educational and skill training systems continue to produce high-skilled workers is thus a key challenge for developing innovative industries and raising potential output.

Quality of education

Overall educational attainment is high, with tertiary education rates among the adult working-age population well above the OECD average (Figure 2.15). Type A tertiary

Figure 2.14. **Average size of start-up and old firms across industries and countries**



Source: C. Criscuolo et al., 2014.

StatLink http://dx.doi.org/10.1787/888933198362

Table 2.4. **National Credit and Investment Company, overview of operations 1978-2013**

EUR million

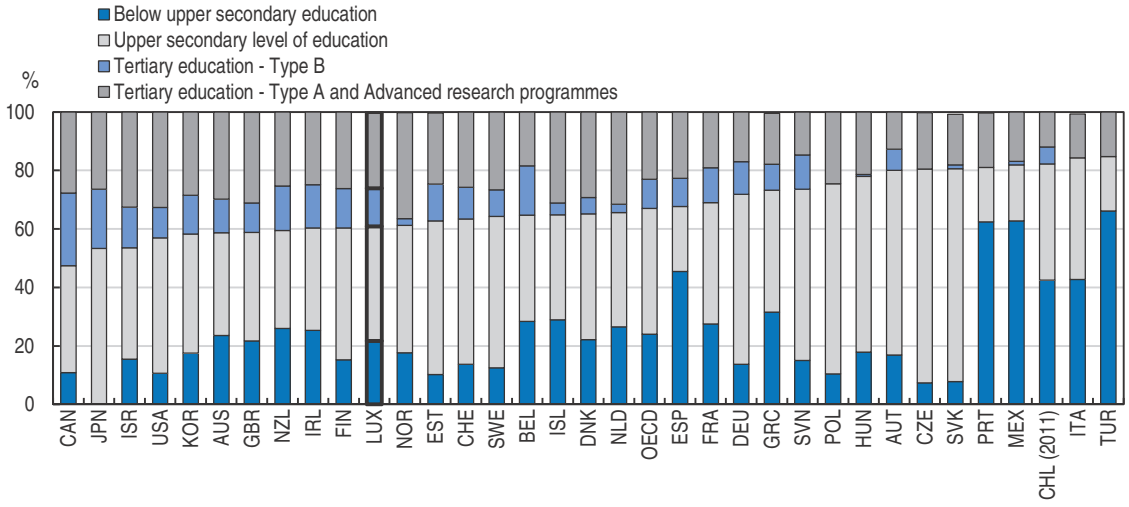
	1978-2008	2009	2010	2011	2012	2013	Total
Investment loans	2 371.5	50.8	24.2	20.5	19.6	10.6	2 497.2
Equipment loans	734.4	32.1	22.7	17.9	9.8	4.6	821.5
Medium and long term loans	1 395	18.7	1.5	2.3	9.8	6.0	1 433.3
Foreign investment financing	5.7	0.0	0.0	0.3	0.0	0.0	6.0
Steel industry loans	194.9	0.0	0.0	0.0	0.0	0.0	194.9
Loans BEI/CECA	41.5	0.0	0.0	0.0	0.0	0.0	41.5
RDI financing	104	0.3	0.0	0.0	0.0	0.0	104.3
Innovation loans	103.7	0.3	0.0	0.0	0.0	0.0	104.0
UNI CRP facility	0.3	0.0	0.0	0.0	0.0	0.0	0.3
Export loans	110.4	0.0	0.0	0.0	0.0	0.0	110.4
Equity transactions	380.5	32.6	1.5	28.2	126.1	31.5	600.4
Start up and business transfer loans	9.3	1.7	0.9	1.0	0.1	0.3	13.3
Equity loans	186.4	0.0	0.1	0.1	0.2	3.3	190.1
Participating interests	184.8	30.9	0.5	27.1	125.8	27.9	397.0

Source: SNCI Annual Report 2013.

attainment (university degree) is higher across all age cohorts than Type B tertiary attainment (vocationally oriented degrees). The tertiary attainment of the youngest cohort in Luxembourg has increased from 37% in 2005 to 50% in 2012, opening the tertiary attainment gap between the youngest cohort (aged 25-34) and the second youngest cohort (aged 35-44) of about 5 percentage points (OECD, 2014a). The improvement has been similar to the OECD average.

Secondary schooling also has many strengths. Teachers receive the highest salary per student within the OECD (measured in purchasing power parities) and that together with other factors, such as status and initial teacher training, should be attracting high

Figure 2.15. **Educational attainment of 25-64 year-olds, 2012**



Source: OECD (2014), *Education at a Glance*.

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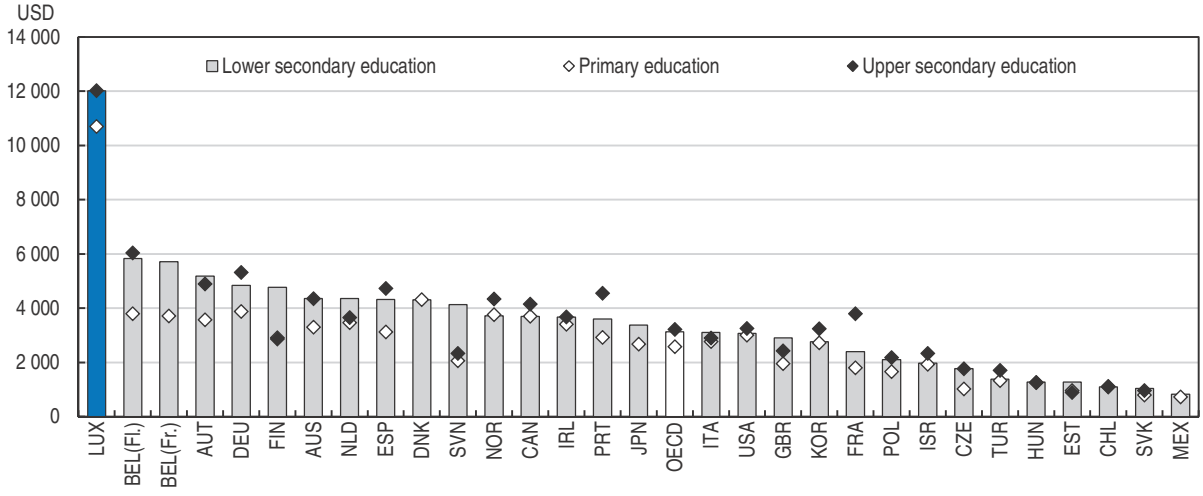
quality people into the profession (Figure 2.16). Indeed, the social status of teachers in Luxembourg is high; they are expected to study abroad and speak several languages. However, there is no well-defined career path for established teachers, which is likely to undermine the links between teacher appraisal, professional development and career development (Shewbridge et al., 2012). Also, the professional development provisions have been found to be not sufficiently linked to school development and needs.

Figure 2.16. **Salary cost of teachers per student**

By level of education, 2012



Notes: Countries are ranked in descending order of the salary cost of teachers per student in lower secondary education.
Source: *Education at a Glance 2014*, Table B7.1. See Annex 2.1 for notes.

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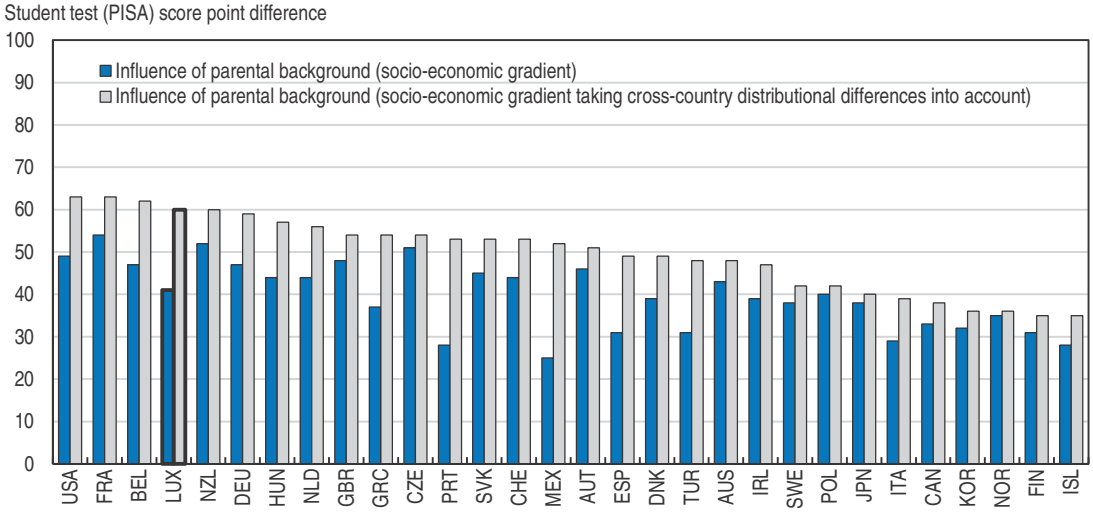
State schools in Luxembourg require virtually all teaching staff to speak Luxembourgish, as well as French, German and English, which largely closes the sector to outsiders. Recently, the proficiency requirement in Luxembourgish has been applied less

stringently in technical disciplines like physics and mathematics, but teachers with insufficient knowledge of Luxembourgish are still expected to learn it on the job. Wages in state schools, where teachers are civil servants, are higher and working hours shorter than in private international schools that are open to cross-border competition and whose teachers do not have the civil servant status.

However, PISA results for 15 year-old students show performance somewhat below the OECD average in all three components, mathematics, reading and science (OECD, 2014b). There is a positive trend in PISA results in Luxembourg and the 2012 results represent improvement from 2009 in both reading and science. The variation in mathematics scores is similar to the OECD average. Differences between genders in mathematics and science performance are among the largest in the OECD, and the performance gaps between top and bottom deciles in reading and science are also above-average. This suggests that the education system in Luxembourg is less successful in closing performance gaps and thus in unlocking students' full potential.

Similarly, skill training and educational outcomes of certain vulnerable groups can be improved. Students with immigration background have lower performance and socio-economic background has substantial impact on students' achievement. The sensitivity of the mean PISA score to a change in the PISA index of student socio-economic background – adjusted for cross country distributional differences – is the fourth highest in the OECD (Figure 2.17).

Figure 2.17. **The influence of parental background on student achievement in secondary education**[1]



Note: Regression of students' PISA science performance scores on their PISA economic, social and cultural status (ESCS), a broad indicator of family's socio-economic background. Country-by-country least squares regressions weighted by students' sampling probability. Robust standard errors adjusted for clustering at the school level.

1. The socio-economic gradient represents the change in PISA science score due to an improvement of one international standard deviation in the PISA index of student socio-economic background. The socio-economic gradient taking cross-country distributional differences into account is the change in PISA science score due to an improvement of one country-specific, inter-quartile change in the PISA index of student socio-economic background. Note that science literacy was the focus of PISA 2006, upon which these results are based.

Source: Causa and Chapuis (2009).

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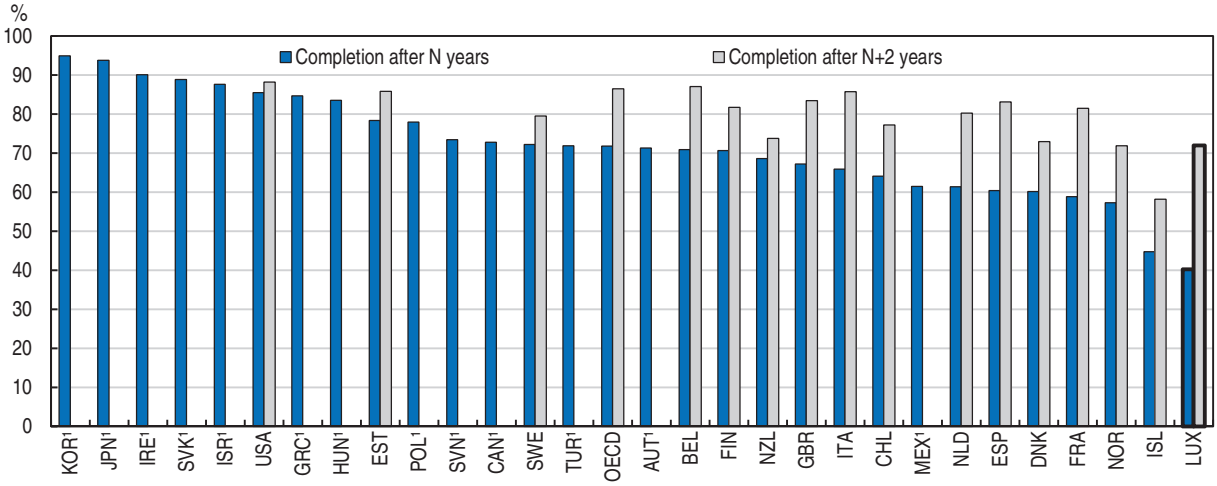
Students in Luxembourg spend longer in school than their OECD peers – 914 compulsory hours in school per year compared to the OECD average of 835.5 (OECD, 2014b). At the same time, 30% of students fail to complete upper secondary education. The share of students needing another two years on top of the regular time for high school completion is the highest among the OECD countries (Figure 2.18). This is due to the widespread practice of repeating one or more years of school, even though grade repetition is costly and largely ineffective in raising educational outcomes (OECD, 2012a). Additional support in addressing of learning gaps, and more use of special education techniques can be employed to decrease grade repetition (OECD, 2012a).

Figure 2.18. **Successful completion of upper secondary programmes, 2012**



Notes: Please refer to Annex 2.1 for details concerning this indicator, including methods used, programmes included/excluded, year of entry, etc. N: theoretical duration of the programmes. Countries are ranked in descending order of the successful completion of upper secondary programmes.

1. N + 2 information missing.

Source: OECD (2014), *Education at a Glance*, Table A2.4. See Annex 3 (*www.oecd.org/edu/eag.htm*).

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Also, the completion rate of vocational programmes (which are part of upper secondary education) barely exceeds 60% (OECD, 2014a). Although it is possible that some non-completing school leavers eventually find their way back into education and gain their qualifications, the window of opportunity between ages of 15 and 20 has been lost (OECD, 2010a).

The government has proposed measures to raise equality of opportunities and educational outcomes of vulnerable groups. A free childcare programme for children below 3 years will become effective in September 2016. This can improve language competences in the three official languages used in schools. OECD work indicates that early childhood education and care helps in improving learning outcomes and provides foundation for lifelong learning, but the magnitude of benefits is conditional on quality (OECD, 2012b). In mid-2014, the government also reformed the financial aid system for students (CEDIES) and lowered the annual sum paid to all students regardless of background. The revised system, with topped up funding subject to eligibility criteria and means testing, focusses more on students with disadvantaged background. These are steps in the right direction.

Moreover, the government plans to give secondary schools more autonomy in three important dimensions: teachers' development; curricula; and financial matters (OECD, 2015b). These plans are in line with reforms that have been proven to be effective in other OECD countries, such as providing schools with more autonomy in choosing teachers and in budgetary matters (Sutherland and Price, 2007). The reform of curricula is planned to include schools with education tracks in other languages than French and German (such as English) that currently exist in private schools (such as the public Aggregated European School), but are not available free of charge. Plans include further diversification of the curricula and the resulting qualifications (international baccalaureate, A-levels, etc.). In rolling out these reforms, the government should also consider whether teachers at public schools should keep the civil servant status. Both models exist in different OECD countries, and some, such as Austria, have moved to abolishing civil servant requirements to increase flexibility.

The education reform could be used as an opportunity to give economics-related education more prominence in school curricula. Perception of entrepreneurship as a desirable career choice appears to be weak in Luxembourg and media attention given to entrepreneurship relatively sparse (EU Commission, 2014). At the same time, surveys show that entrepreneurs in Luxembourg are mainly driven by opportunity and desire for independence (GEM, 2014).

Getting workers to move to new high value-added activities and raising labour force participation

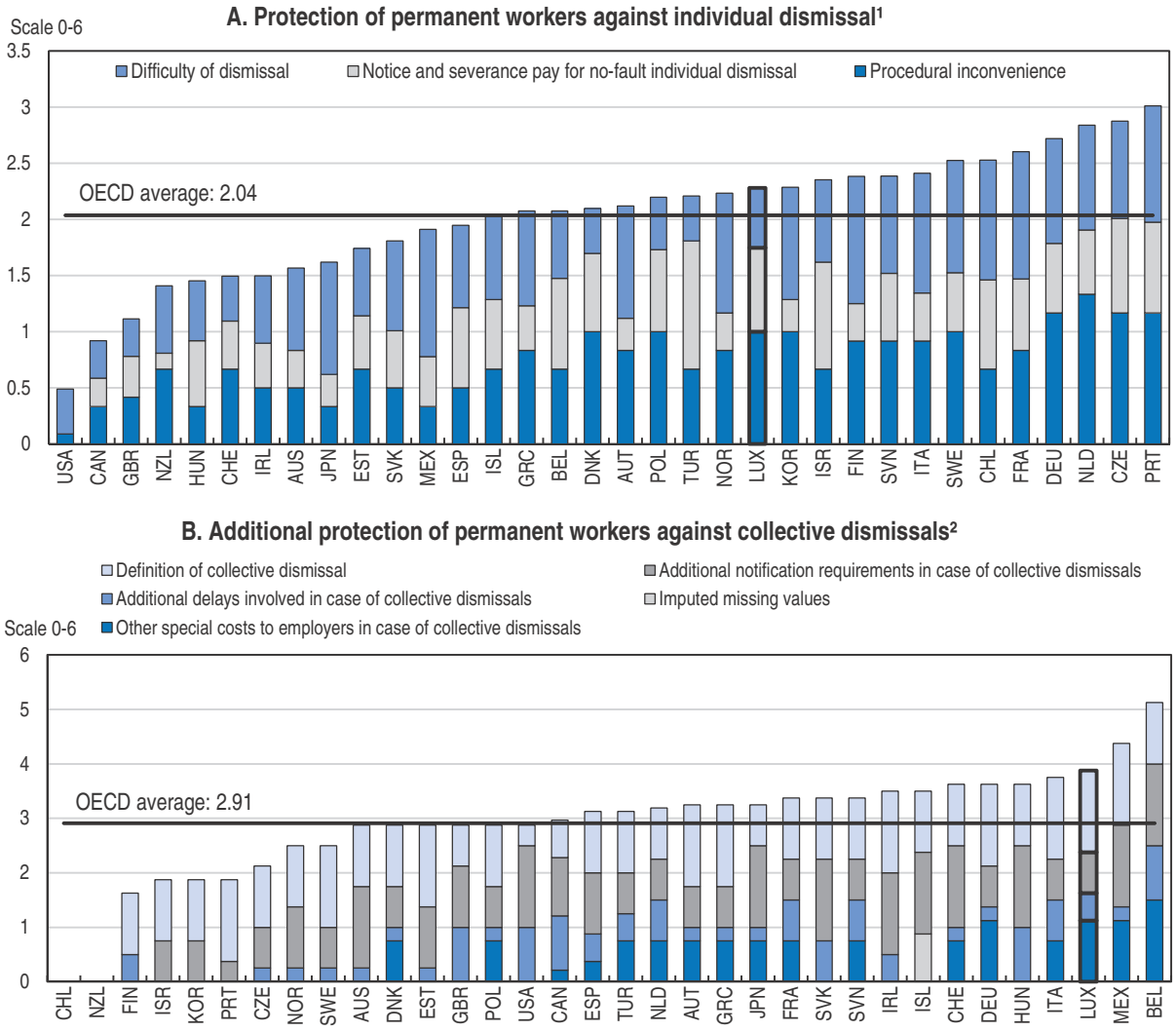
Reducing the stringency of the employment protection legislation and raising working time flexibility

Labour market policies that allow reallocation of labour into new sectors will help diversification. This is especially the case as high wage premia in the financial sector relative to the rest of the economy can make it difficult for other sectors to attract qualified workers (see Chapter 1 on the financial sector). Cross-country empirical evidence suggests that overall labour utilisation rates are not robustly correlated with the tightness of employment protection legislation (EPL), because tight EPL has offsetting effects on employers' hiring incentives while limiting employers' ability to shed labour (Bassanini and Duval, 2006). However, there is evidence that strict EPL increases the average duration of unemployment spells as well as employment rates of older workers at the expense of younger workers. Both effects inhibit the reallocation of labour across sectors and firms, thus reducing labour productivity (OECD, 2010b).

EPL in Luxembourg is above the OECD average. The protection of permanent workers, in terms of notice periods, from individual dismissal, is only slightly above the OECD average (Figure 2.19, Panel A), but protection against collective dismissal is one amongst the highest in the OECD (Figure 2.19, Panel B). Relaxation of these requirements could facilitate reallocation of labour to growing sectors' activities and increase aggregate productivity growth (Haltiwanger et al., 2006; Bassanini et al., 2009). Less stringent employment protection legislation may shift risk from entrepreneurs to workers, however, which should be balanced by effective job placement policies.

Severance payments, at 6 months' salary for 20 years of service, are not particularly high by OECD standards (OECD, 2013c). However, they are to be paid in full at the end of the prescribed notice period and may then drag down a firm's cash-flow. The government may consider introducing a fee-based insurance scheme or individual saving accounts, with

Figure 2.19. **Protection of permanent workers, 2013**



1. The figure presents the contribution of different subcomponents to the indicator for employment protection for regular workers against individual dismissal (EPR). The height of the bar represents the value of the EPR indicator.
2. The figure presents the contribution of different subcomponents to the indicator for additional provisions for collective dismissals (EPC). The height of the bar represents the value of the EPC indicator. Note that this indicator quantifies only additional restrictions, over and above those for individual dismissals. For the sole purpose of calculating the EPC indicator, missing values of specific subcomponents are set equal to the average of other non-missing subcomponents for the same country.

Source: OECD Employment Protection Database, 2013 update, *http://dx.doi.org/10.1787/lfs-epl-data-en*.

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employers' contributions payable as a percentage of payroll, which can be accessed by workers upon dismissal. Such schemes have the advantage of inducing no disincentives for dismissals or voluntary separations, while insuring workers against dismissal. The schemes are considered best practice in the OECD, and several countries have them. Providing for flexibility, reinstatement of employees cannot be enforced; employers can choose additional compensation to employees instead.

In order to reduce the negative effects of tight EPL, the 2010 *Survey* recommended additional reform, including a longer total duration of fixed-term contracts and a possibility of more renewals; lifting thresholds for collective dismissals; reducing

additional notice periods and severance payments following the negotiation of social plans; and extending trial periods for regular contracts, so that protection for younger workers with lower productivity does not unduly reduce employers' incentive to hire them. These recommendations should be introduced.

Restrictions on working time make overtime costly. This can lower the competitiveness of firms that engage in global competition, especially in the higher value-added portion of the value chain, and need the flexibility to respond quickly to demand and offer just-in-time delivery (WTO, 2013; OECD, 2013b). The maximum working time in Luxembourg is 48 hours per week, in line with the EU Working Time Directive, and not more than 10 hours a day. However, in addition, the weekly average of 40 hours must not be exceeded over a consecutive 4-week period.

Working time accounts, extending over several weeks, months or even more than a year, can increase flexibility and cost efficiency, benefitting firms' competitiveness within global value chains (Flecker et al., 2009). Some evidence suggests that other flexible working-hours arrangements, such as home-office and flexi-time can also improve productivity. A recent study of five thousand German firms concluded that adoption of flexible working-hours arrangements leads to an increase in innovation over and above the impact of working time accounts (Godart et al., 2014). The Minister of Labour is preparing a framework allowing social partners to freely negotiate details of working time account schemes at the company or sectoral level, while securing employee claims against the risk of employer's insolvency. Indeed, as experience in Germany shows, insurance against insolvency is crucial for workers' protection and acceptance of working time accounts.

The mechanism of wage indexation has been restarted in 2015, after a temporary moderation between 2012 and 2014. The government has announced that the economic situation and the evolution of prices will be taken into consideration in the adjustment. Wage indexation can lead to increases in unit labour costs with negative implications for competitiveness. Thus the wage indexation system should be reviewed to ensure that wages reflect productivity developments and do not present risks to competitiveness (OECD, 2012c).

Active labour market policies

Empirical evidence indicates that employment rates are higher in countries that spend more per unemployed person on active labour market policies (ALMPs) such as training, job creation schemes and wage subsidies to firms (Bassanini and Duval, 2006). The design of the measures is important though.

The magnitude of government spending on ALMPs in Luxembourg (0.46% of GDP in 2011) is about the same as in the EU (0.47%). The policy mix is different though. ALMPs in Luxembourg are heavily geared towards temporary job creation schemes (*incitations à l'emploi*) that represent 75% of ALMP spending (2010 shares), as opposed to 24% in the EU (STATEC, 2012). These schemes have been found to be generous and long, and in many cases participants return to unemployment after their completion (OECD, 2010b). On the other hand, expenditures on training represent only 9% of ALMP measures in Luxembourg compared to 43% in the EU.

The government is moving from subsidising employment to spending on training and lifelong learning. In the "*aide au réemploi*" programme, entitlement periods are planned to be reduced from 4 to 3 years and the maximum replacement to be limited from 90% of the previous wage to the minimum social wage. At the same time, more use is made of training

programmes that are being designed to better meet qualification needs of regional business, such as "Fit for Finance" and "Green Jobs" in construction. These steps go in the right direction. The authorities should review existing ALMP programmes with respect to their effectiveness in raising jobseekers' employment prospects, and continue to reallocate resources in favour of training. Experience in other OECD countries shows that the effectiveness of such policies depend on appropriate organisation of the public employment service (PES), which needs sufficient resources to profile and advise job seekers. The 2012 PES reform in Luxembourg increased the number of case workers and local offices of the employment service (ADEM) as well as investment in IT infrastructure. While both are appropriate, policy makers should make sure that ADEM is further adjusted if necessary to facilitate efficient administration of the new policies. At the same time, disincentives for job search inherent in Luxembourg's unemployment insurance and social assistance systems should be reduced, as recommended in the 2012 *OECD Survey on Luxembourg*.

Luxembourg's adult participation rates in lifelong learning exceed the EU average (14% compared with 9% in 2013). Emphasising life-long-learning is needed to raise the responsiveness of the workforce to changing demands, raise the productivity of older workers and support the competitiveness of domestic workers with cross-border labour supply (EU, 2014). In 2013, the government has increased its financial contribution to enterprises' investment in lifelong learning of their employees. The effectiveness of this policy should be monitored.

Attracting highly qualified workers to Luxembourg

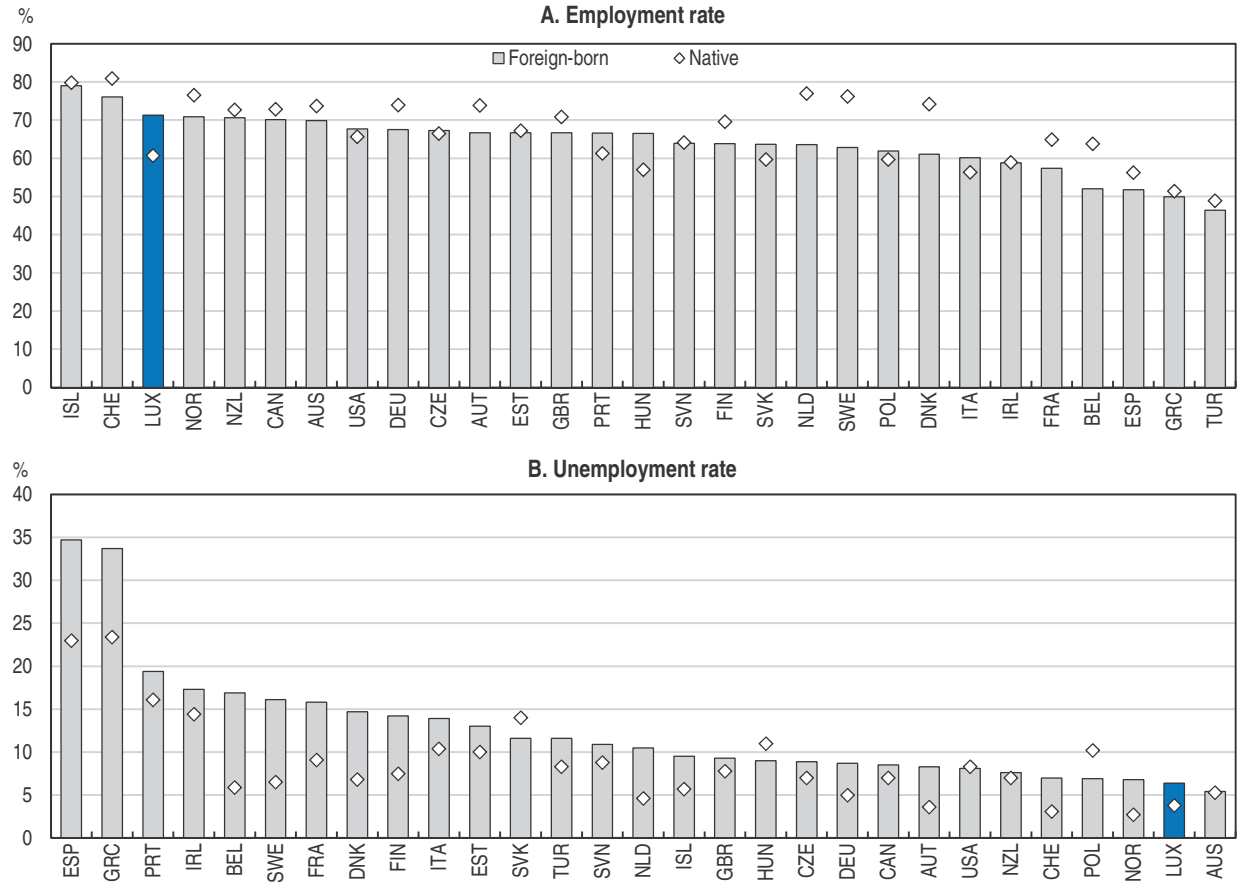
Luxembourg has been successful in the past in attracting highly qualified labour from abroad, and foreign workers are well integrated into the domestic labour market (Figure 2.20). Further progress in diversifying the economy in high value-added activities will require continued inflows of qualified foreign labour. For example, around 90% of the staff in Luxembourg's public research organisations consists of foreigners (Ministry of Education, 2013).

The requirements to obtain residence permits for non-EU nationals have a preference for highly qualified workers, such as educational attainment, work experience and a minimum level for the annual salary to be earned in Luxembourg. In exceptional circumstances, highly-qualified workers who do not speak the three official administrative languages can also be hired in the public sector. These permits do not include Physical and Engineering Science technicians (ISCO classification 311) (University of Luxembourg, 2013), which might be relevant to strengthen economic development outside the financial sector and the clustering of enterprises. It is thus worth revisiting entitlements for special residence, possibly extending eligibility to more technical and IT qualifications, and to clarify the handling of applications for entrepreneurs (OECD, 2013d).*

In order to attract high-skilled foreign workers, employers often have to pay a significant portion of the workers' relocation, accommodation and travel expenses. The state alleviates the incurred cost to the employer, who is allowed to pay these expenses as benefit in kind, without them being considered a part of the highly-skilled worker's

* International students also have a possibility to stay in Luxembourg after graduating, in order to acquire a first working experience, for up to two years. The student has to finds a job before graduation, however, as there is no possibility of granting supplementary stay period for the purpose of job search.

Figure 2.20. **Gaps in labour market performance between natives and foreign-born in OECD countries**



Source: OECD International Migration Policies Database, 2013.

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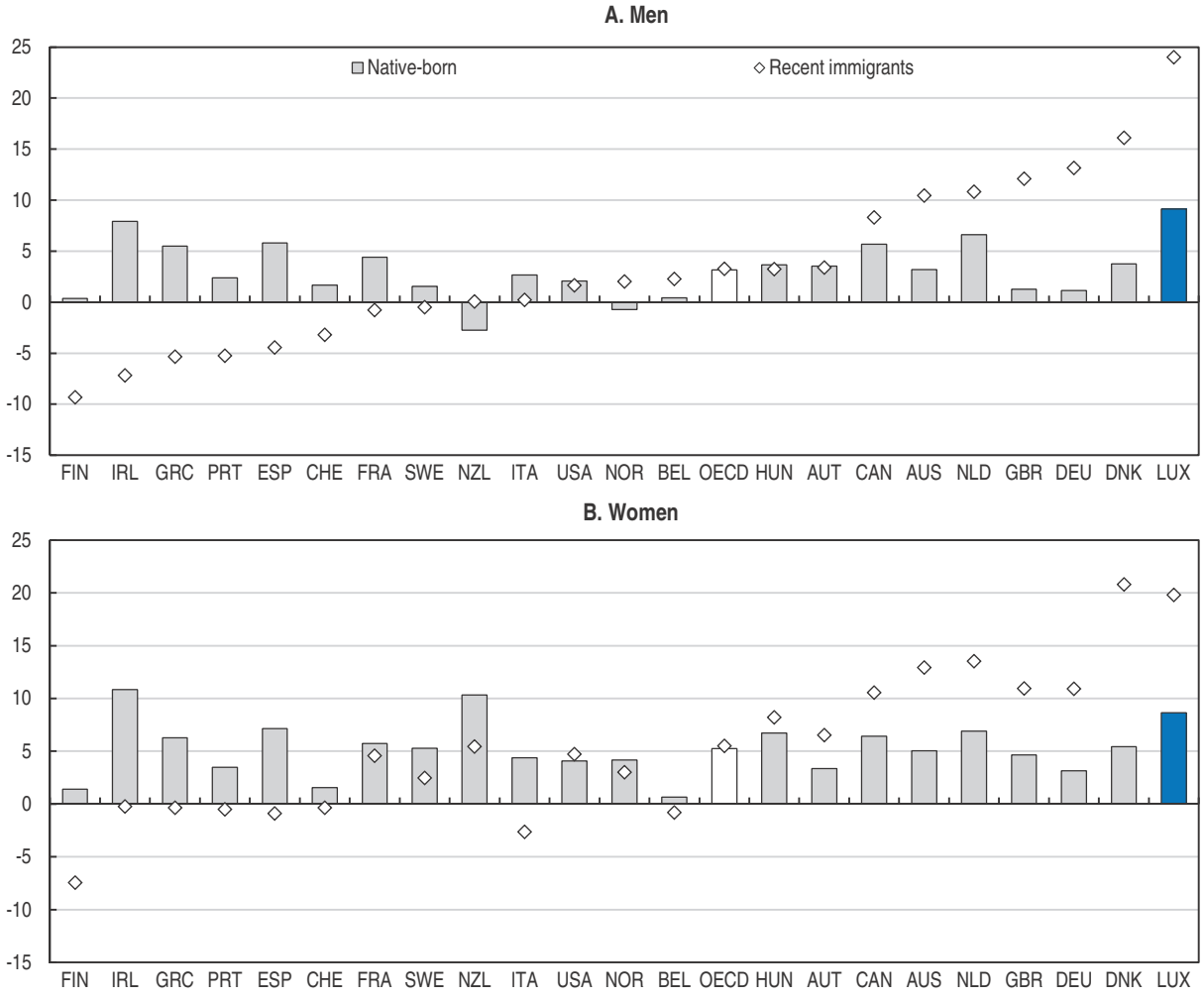
income. These expenses are declared as an operating expense of the company and not taxed. This is an explicit cost that the government should weigh against more spending on improving non-monetary factors affecting the perceived quality of life in Luxembourg, such as traffic congestion, housing quality and the schooling system that are also relevant for attracting a highly qualified workforce.

Cross-border workers from neighbouring Belgium, France and Germany account for some 30% of Luxembourg's workforce, with an increasing share among them high-qualified (Figure 2.21). A recent study put Luxembourg's delay due to congestion at 80 hours per year for a 30 minutes commute (TomTom, 2013). The government plans to build new hubs at the outskirts of Luxembourg City that will be linked by tram and tangential buses, so that commuters can avoid travelling through the city centre. The first commercial tram service is expected in 2017. This initiative should be implemented. It can also contribute to reducing CO_2 emissions. Further co-ordination with adjacent regions in neighbouring countries should be explored to promote public transport and develop cross-border mobility schemes similar to the scheme with the French region of Lorraine (SMOT). Improvements in high-speed links to, in particular, Germany and Belgium should also be considered.

Figure 2.21. **Change in the proportion of highly educated men and women among recent immigrants and the native-born population between 2000-01 and 2009-10**

Change in percentage points



Note: Recent immigrants have arrived in the last five years.

Source: *European Union Labour Force Survey* (Eurostat) for Austria, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Spain and Sweden; *2000 Census* and *2010 New Zealand Labour Force Survey*; *Database on Immigrants in OECD Countries* (DIOC) 2000; and 2005-06 for data on all other countries.

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Moreover, introduction of a system of congestion charges around Luxembourg City should be explored to provide incentives for a shift towards public transport or car sharing. In order to address the existing externalities effectively, congestion charges should be combined with higher taxes on fuel and higher parking charges (European Conference of Ministers of Transport, 2003). The effective tax rate on transport fuel, below EUR 150 per tonne of CO_2, is below the OECD average. Excise taxes on gasoline and diesel should be increased to gradually narrow price differentials with neighbouring countries. Increasing parking prices are likely to be more efficient than restricting parking spaces in new office developments, which is likely to bring only gradual changes (OECD, 2012c).

Luxembourg's supply of housing may be falling short of demand, as rising real house prices indicate. The Ministry of Housing projects that some 2 600 new housing units are needed every year to keep up with growing demand (OECD, 2010b). The total number of new housing units stayed above this threshold for some years, but decreased to below

2 200 units in 2011. The supply of land and housing is constrained by numerous regulations and low property taxation encourage land hoarding. Permissions to build are often delayed by administrative procedures involving complex coordination among different actors. Barriers in housing markets could also weigh on the optimal level of clustering, which is influenced by the balance of economic benefits (Aghion et al., 2013).

The government has taken steps to promote more flexible housing supply. Municipalities now have the possibility to surtax vacant land and buildings. The government plans to increase the VAT on building not intended for owner-occupation from the current preferential rate of 3% to the standard rate of 17%. Since projects completed before 2017 will not be affected by this measure, housing supply is likely to increase prior to the tax hike as projects are brought forward to benefit from the still-low tax rate. However, this supply response would only be temporary. More fundamentally, cutting the preferential tax treatment of housing investment contributes to reducing tax distortions. However, rents may rise too, as owners attempt to pass on the higher tax rates on tenants. The government also plans to build 10 500 new housing units, mainly for renting, and plans to reform the Housing Pact law, using part of the subsidy therein to finance the construction of subsidised housing. More fundamental reform appears necessary, however, such as making the building permit system more efficient and raising property taxation by updating property values used as a tax base, as described in the last *Economic Survey of Luxembourg* (OECD, 2012c).

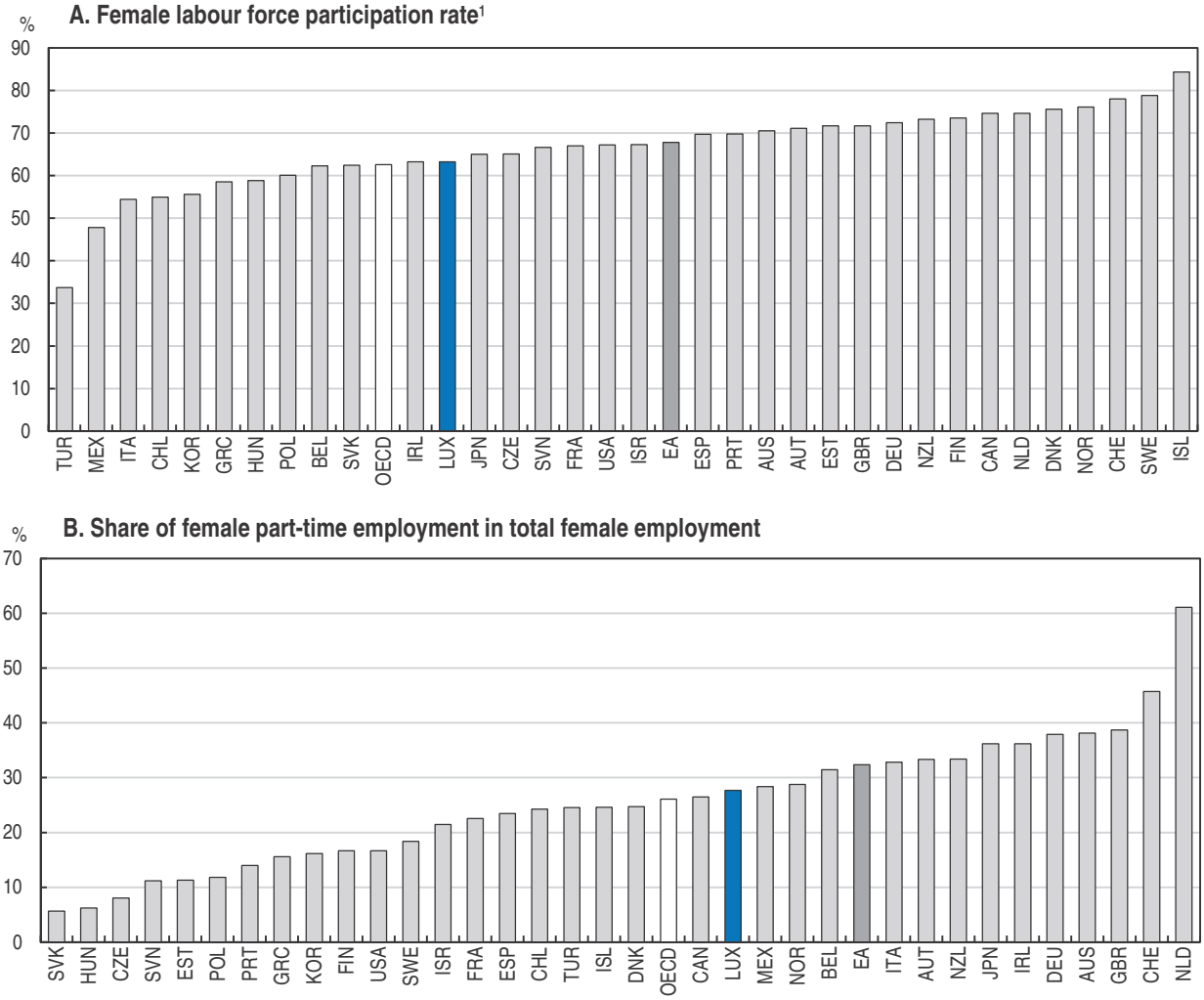
Enhance incentives to work for second earners and women

The pool of workers is smaller than it could be, due to low participation of second earners, mainly women (Figure 2.22, Panel A). Female part-time employment also falls short of the average in the euro area (Figure 2.22, Panel B). Low female labour market participation suggests reducing disincentives for second earners' participation to increase labour supply for new industries, which otherwise would have to come from the financial sector and abroad.

Some provisions in the tax and transfer system discourage labour supply of second earners. In the universal health care insurance system, all family members are covered by contributing family members, effectively reducing the earnings of working spouses. Resident married couples, taxpayers living in registered partnerships, and non-resident married couples with earnings taxable in Luxembourg can file jointly for income tax and are taxed at lower average income rates. This reduces work incentives for the spouse with the lower income. Also, effective marginal taxation of additional hours worked seems to be particularly high for lone parents due to the interaction of benefits and income taxation (OECD, 2007). These issues should be addressed. The government's plan to move away from joint income tax assessment for couples is welcome.

Significant fixed costs of work, notably the monetary and non-monetary costs of child care can be important impediments for higher female or spouses' labour force participation. Means-tested childcare service vouchers for children aged below 12 address this issue. The government's plan to augment this system by free childcare combined with promotion of French, German and Luxembourgish language skills for all children aged 1 to 3, starting in 2016 will be financed via a tax of 0.5% on households' total revenues (with part of subsistence income exempted). This could increase labour force participation by families with small children. The government should reduce disincentives for labour force participation of spouses and lone parents by charging health care contributions for each spouse individually.

Figure 2.22. **Female labour market participation rate, 2013**



1. The labour force participation rate is defined as the ratio of the labour force to the working age population, expressed in percentages.

Source: OECD Labour Force Statistics.

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Recommendations on raising human capital and enhancing resource allocation

Key recommendations

- Better evaluate the effectiveness of public R&D spending and cluster policies.
- Strengthen the co-operation between enterprises, University of Luxembourg and research institutes in Luxembourg and abroad.
- In secondary education, reduce grade repetition, provide more school autonomy and better monitor education quality.
- Increase excise taxes on gasoline and diesel to gradually narrow price differentials with neighbouring countries.

Recommendations on raising human capital and enhancing resource allocation *(cont.)*

- Continue substantial investment in public transport infrastructure, using the receipts from fuel taxation for this purpose. Explore the introduction of a system of congestion charges. Increase taxes on petrol and diesel that gradually eliminate price differentials with neighbouring countries.
- Reduce disincentives for labour force participation of women by charging health care contributions for each spouse individually and introducing separate income tax assessment of spouses.

Further recommendations

- Speed up procedures for granting construction permits. Raise property taxes by updating property values used as a tax base.
- Increase enrolment in early childhood education with emphasis on low-income and foreign-language families.
- Consider opening the telecommunications sector to private ownership and investment.

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ANNEX 2.1

Luxembourg: Potential output

Luxembourg is a small open economy with a comparatively high share of foreign workers in total employment (some 40%) and of services – notably financial – in total output. These features imply that national account measures of output and productivity should be interpreted with care.

Gross domestic product *versus* gross national income in Luxembourg

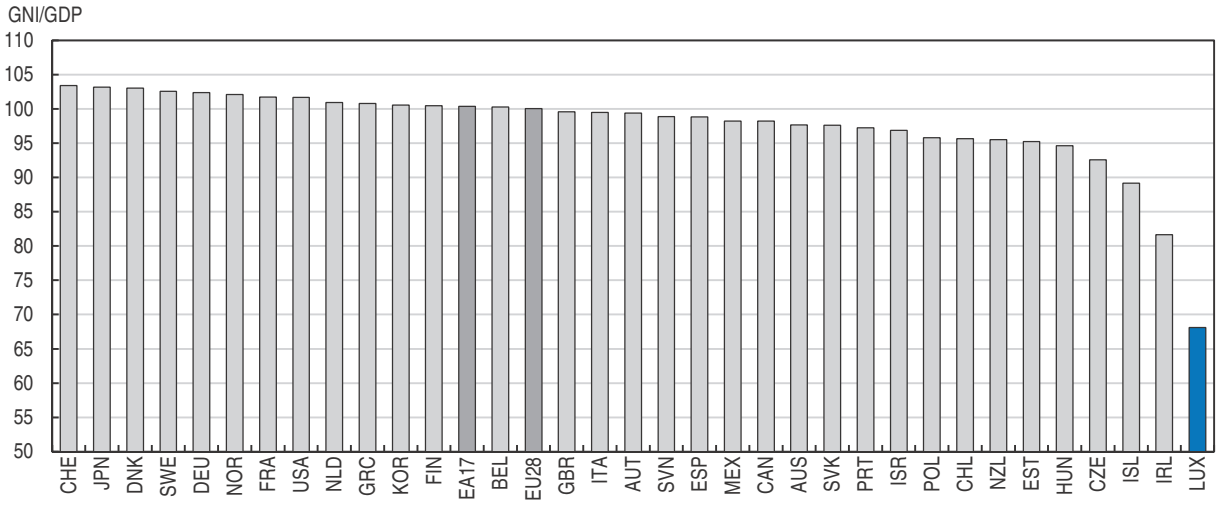
Gross domestic product (GDP), the factor income measure that is most frequently used to characterise an economy's production, measures total factor income generated within the economy within a certain period (a year). Thus, GDP includes income that is generated at home even if it accrues to non-residents, while it does not include income accruing to residents that is generated abroad. By contrast, gross national income (GNI) denotes all income accruing to residents. Thus, GNI also includes factor income accruing to residents that is generated abroad, but it excludes factor income from domestic production that accrues to non-residents.

For most countries, the difference between GDP and GNP is quite modest. However, if – as in Luxembourg – non-residents contribute a large share of the economy's production factors (labour or capital) GDP and GNI can diverge significantly. For Luxemburg, GNI undercuts GDP by 32% (Figure 2.A1). However, even if aggregate income per capita is measured by GNI rather than GDP Luxembourg is still ranked at the top of the OECD, surpassed only by Norway (Figure 2.A2).

The OECD's method of estimating potential output and structural unemployment

Assessing potential output is inherently difficult because it is an unobservable quantity. Analysis for Luxembourg is further complicated by the economy's cross-border openness in terms of labour and capital flows. High factor mobility means that production can be very sensitive to small changes in circumstances (Krugman, 2009). Moreover, a large share of Luxembourg's economy is accounted for by the financial services sector, whose output might be over-estimated (see Annex 1.1 in Chapter 1). Also, the prospects of the financial sector after the crisis might be particularly uncertain. Overall, potential output estimates for Luxembourg are associated with a higher degree of uncertainty than for most other OECD countries.

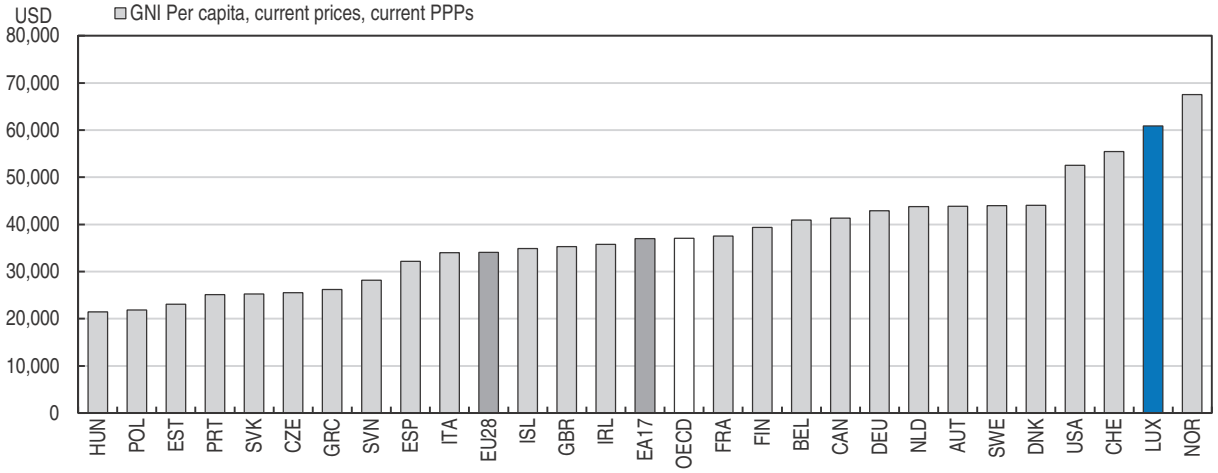
Figure 2.A1. **Ratio of GNI to GDP, 2012**



Source: OECD National Accounts, 2014.

StatLink http://dx.doi.org/10.1787/888933198401

Figure 2.A2. **GNI per capita, 2012, USD, current prices, current PPPs**



Source: OECD National Accounts, 2014.

StatLink http://dx.doi.org/10.1787/888933198412

The OECD estimates potential output based on a Cobb-Douglas production function with constant returns to scale:

$$Y_{it} = K_{i,t}^{\alpha}(E_{it}H_{it}N_{it})^{1-\alpha} \quad [1]$$

where *Y*, *K*, *E*, *H* and *N* denote output, physical capital, labour-augmenting technological progress ("labour efficiency", defined as the residual of the production function), human capital per worker and employment. Subscripts *t* and *i* denote year and country, (α) is calibrated to 1/3.

A potential output series is calculated by substituting trend variables, denoted by an asterisk, in the production function, maintaining actual capital:

$$Y_{i,t}^{*} = K_{i,t}^{\alpha}(E_{i,t}^{*}H_{i,t}^{*}N_{i,t}^{*})^{1-\alpha} \quad [2]$$

or in terms of growth accounting:

$$Y^*_{i,t} = \alpha k_{i,t} + (1-\alpha)(n^*_{i,t} + e^*_{i,t} + h^*_{i,t}) \quad [3]$$

where lower letters denote logarithms.

Each component of this quantity is estimated separately. Given an initial (unsmoothed) estimate of labour efficiency, a Hodrick-Prescott filter is applied to provide an estimate of trend labour efficiency. To reduce end-point problems associated with the use of the HP-filter, data on GDP and factor-inputs are extended with short-term forecasts of these variables.

The physical capital stock is represented by the non-housing capital stock. This corresponds to the accumulation of past non-housing investment flows, taking into account that the efficiency of assets typically falls as its life expectancy diminishes (Schreyer, 2003):

$$K_{it} = K_{it-1}(1 - r_{it}) + I_{it}, \quad [4]$$

where r is the implicit rate of loss of productive capacity, and I is the non-housing investment flow. The capital stock is not detrended, because the maximum potential contribution of capital is given by the full utilisation of the existing capital in the economy.

Human capital is derived from empirical estimates of the return to average years of schooling with falling marginal returns at higher level of education, as in Morrison and Murtin (2010). The resulting series is smoothed using a Hodrick-Prescott filter.

Potential employment (N^*) is computed as the combination of equilibrium unemployment rate (U^*), the working age population (PWA), the trend participation rate ($LFPR^*$) and the trend ratio between the domestic concept of employment from national accounts to employment from the labour force survey ($CLFS$):

$$N^*_{it} = LFPR^*_{it} PWA_{it}(1 - U^*_{it}) CLFS_{it} \quad [5]$$

The equilibrium unemployment rate is estimated using a reduced form Philips-curve approach by means of a Kalman filter. In this new approach, inflation expectations are anchored to inflation targets (OECD, 2014).

Potential employment is based on the domestic concept of employment from the national accounts to preserve consistency with the definitions and sources for output and capital (Beffy et al., 2006). The domestic concept takes into account employment in resident production units irrespective of the residence of the employed person. However, all the other data regarding the labour force (e.g. unemployment, participation rate, etc.) are only available from the labour force survey (*LFS*), thus relating to the employment concept of the labour force survey. The *LFS* concept covers resident households only. In the estimation of N^*, the *LFS* data are therefore adjusted (with the factor *CLFS*) to align them with the national accounts concept of employment. The adjustment is relatively high for Luxembourg due to the high share of cross-border workers.

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