ITF Transport Outlook 2013

FUNDING TRANSPORT

OECD

International Transport Forum

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OECD
BETTER POLICIES FOR BETTER LIVES

International Transport Forum

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The International Transport Forum was created under a Declaration issued by the Council of Ministers of the ECMT (European Conference of Ministers of Transport) at its Ministerial Session in May 2006 under the legal authority of the Protocol of the ECMT, signed in Brussels on 17 October 1953, and legal instruments of the OECD.

The Members of the Forum are: Albania, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Canada, Chile, China, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, FYROM, Georgia, Germany, Greece, Hungary, Iceland, India, Ireland, Italy, Japan, Korea, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Mexico, Moldova, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom and the United States.

The International Transport Forum's Research Centre gathers statistics and conducts co-operative research programmes addressing all modes of transport. Its findings are widely disseminated and support policymaking in Member countries as well as contributing to the annual summit.

Further information about the International Transport Forum is available at
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PREFACE

The 2013 *ITF Transport Outlook* examines scenarios for the development of global transport volumes through 2050. The analysis highlights the impact of alternative scenarios for economic growth on passenger and freight flows and the consequences of rapid urbanisation outside the OECD on overall transport volumes and CO_2 emissions.

The approach taken is to explore the factors that could drive supply and demand for transport services to higher or lower bounds. Rather than attempting to establish a likely central forecast for the evolution of transport volumes, the *ITF Transport Outlook* instead focuses on scenarios that illustrate the potential upper and lower tracks that might unfold depending on policies adopted and key external factors including oil prices and overall GDP. Under any scenario, transport volumes grow very strongly in non-OECD economies and curbing negative side-effects, including greenhouse gas emissions, local pollution and congestion, will be a major challenge.

As in earlier editions, the 2013 *ITF Transport Outlook* addresses topics discussed at the annual ITF Summit. The 2013 Summit focused on Funding Transport and the Outlook incorporates insights from debate at the Summit. This edition discusses the challenge of establishing sustainable funding mechanisms for the transport sector, emphasising the need for long run funding strategies in a context of growing global investment demand. It also integrates the previously distinct *Trends in the Transport Sector* publication.

The *ITF Transport Outlook* also provides the starting point for discussions at the ITF's 2014 Annual Summit which takes the theme of "Transport for a Changing World".

José Viegas

Secretary-General, International Transport Forum at the OECD

FOREWORD

The *ITF Transport Outlook* brings together statistics on recent trends in transport and scenario analysis for the long term. It identifies the drivers of past trends and possible future trends and discusses their relevance to policy making. The Outlook aims to be an aid to the analysis of strategic policy concerns.

The *ITF Transport Outlook* is a collaborative effort. This expanded edition is produced in close co-ordination with OECD Publishing. The long term scenario analysis is based on the International Energy Agency's MoMo-model in combination with tools developed by the International Transport Forum. The IEA's willingness to share the model is gratefully acknowledged. At the ITF, Aimée Aguilar Jaber and Martin Clever deserve credit for model development and implementation. The statistics team, Jari Kauppila, Mario Barreto and Edouard Chong produced most of the factual information discussed in Chapter 1. Kurt Van Dender co-ordinated the work and developed the analytical framework and conclusions, drawing from recent work of the ITF's research centre among other sources.

EXECUTIVE SUMMARY

Transport activity still affected by the economic crisis. In the run up to 2008, transport flows generally evolved in sync with strong economic growth and rising trade. The financial and economic crises halted the trend, strongly reducing trade and transport flows. Recovery has been uneven: developed regions have seen only tepid growth while some of the main emerging economies have seen a faster recovery.

This mixed recovery is reflected in global transport activities. In maritime transport, the total amount of goods unloaded (in tonnes) in developing economies in 2012 was 19% above pre-crisis peak levels; by contrast, in developed economies volumes were still down by 10%.

In the longer term, growth is expected to resume. Based on GDP projections, vehicle-kilometre volumes for surface passenger transport in OECD countries could rise by about 60% between 2010 and 2050. If growth falls below these projections, the rise in transport volumes will be lower, but not by much, around 50% according to scenarios examined in this report. This is because passenger transport demand has become less responsive to output growth over the last decade. Outside the OECD, passenger transport volumes, measured in vehicle-kilometres, could be four to five times as high in 2050 as in 2010.

Surface freight volumes correlate strongly with economic production. There is evidence that this relationship changes with rising per capita incomes, with higher incomes leading to lower increases in demand for surface freight transport. Freight transport demand is particularly subject to uncertainty, especially in low income countries where several different development paths could unfold.

Depending on GDP growth and the freight intensity of such growth, surface freight could grow by between 40% and 125% in the OECD and by between 100% and 430% elsewhere over the 2010-2050 period.

Developing countries will drive rising carbon dioxide emissions. Emissions from all surface transport could rise by between 30% and 170%, with much of that growth outside the OECD. Globally, the share of freight in emissions from surface transport is expected to rise from about 40% to just under 50%.

Emissions of carbon dioxide from surface passenger transport rise by 20% in the lowest growth scenario and by 130% in the highest scenario. A central case sees emissions rising by 50% for low GDP projections and by 80% for baseline GDP projections. Emissions fall in the OECD countries but rise elsewhere.

In a low-GDP growth scenario combined with a decoupling of growth from freight transport, carbon emissions from surface freight decrease by up to 4% in OECD countries. However, stronger, more freight-intensive growth could see emissions rise by up to 50%. In non-OECD economies, emissions are set to rise strongly, by between 100% and 460% depending on growth scenario.

Uneven trade growth may shift international freight transport flows. Global value chains, dependent on relatively inexpensive, reliable transport links, are now central to economic development. Supply chain configuration is volatile and the shift in the global economic centre of gravity to emerging regions may see reduced growth on traditional trade routes, such as the North Atlantic.

Cities are shaping passenger transport flows. The rising pace of urbanisation means cities increasingly shape global transport trends. This puts a premium on the need to develop urban and transport policies that both support growth and protect the urban and global environment. The challenges vary: cities in some developed countries are seeing low, or declining, population growth; by contrast, cities in many developing countries are seeing rapid expansion. Containing urban sprawl and expanding public transport could help slow growth in the number of vehicle-kilometres travelled each year by private vehicles without sacrificing overall passenger mobility but reducing CO_2 emissions. This requires long-term strategic planning, rather than isolated actions.

Investment needs will rise. As per capita income rises, the share of GDP invested in transport infrastructure has tended to fall. For the highest income countries, investment in inland transport infrastructure has averaged around 1% of GDP since the 1980s. Over the coming decades, the volume of investment will need to rise. Advanced economies will need to maintain or improve the quality of infrastructure as networks age. Emerging economies will need to invest more in infrastructure to support economic growth. The challenge here is not only to fund the necessary investments but also to ensure they meet transport needs without running up excessive debt.

Better transport project appraisal could foster growth. With advanced economies facing lacklustre growth, could transport policy do more to enhance growth? Even though transport networks are largely complete in advanced economies, opportunities to promote growth through transport infrastructure investment still exist. However, the way in which projects are currently selected does not always guarantee delivery of the projects most likely to unlock growth. In many jurisdictions, project appraisal could make more systematic use of cost-benefit assessment. Where very large projects are expected to deliver wider economic benefits than those reflected in time savings, additional analysis on productivity and agglomeration effects is worthwhile and could facilitate access to new resources of funding, for example from the main beneficiaries of investment.

Funding poses challenges. Transport investment is funded from general tax revenue or from charging users or indirect beneficiaries of transport infrastructure. The case for increasing reliance on user charges is strong, in both public and private transport. There can be a case for earmarking revenue flows to fund transport infrastructure, as this can improve the reliability of funding over the long run. Decisions on how much to earmark and the source of such funds should be based on meeting transport needs and not simply on bringing in extra revenue. Transport infrastructure funds with explicitly defined revenue-raising mechanisms and with a clear and expiring mandate may provide a reasonable compromise between accountability and long-run reliability.

With tightening government budgets, interest in public-private partnerships (PPPs) has increased. At the same time, the squeeze on credit has led to a fall in the availability of debt finance for infrastructure finance. Institutional investors (pension funds etc.) are a large potential source of equity for investment in transport infrastructure PPPs. They are, however, extremely risk-averse and will only be drawn in gradually, through the development of long-term partnerships with project developers, building on successful investment. Overall, the impact of PPPs is limited: only in the few cases where PPPs offer real cost savings through innovation, or where they facilitate introducing new funding instruments (most notably user charges), do they relieve restrictions on public budgets.

READER'S GUIDE

Definitions of terms as used most frequently in this report

Mode:	Contrasting types of transport service relevant to the comparison being made. For example, road versus rail or waterway; or private car versus powered two-wheelers, bus, metro or urban rail.
Modal split / modal share:	Percentage of total passenger-kilometres accounted for by a single mode of transport; percentage of total freight tonne-kilometres or tonnes lifted accounted for by a single mode.
Four-wheelers:	Passenger cars and light trucks.
Two-wheelers:	Powered two-wheeled vehicles, motorcycles and scooters.
Land-use:	Density of urban development.
Public transport service:	Vehicle-kilometres travelled by public transport per capita.
Quality of public transport:	Share of rapid vehicle-kilometres offered as a percentage of total public transport service. Rapid vehicle kilometres are those provided by rail systems, metro or bus rapid transit in segregated corridors.
Road intensity:	Kilometres of roads per capita in urban areas.

GDP scenarios

Baseline growth scenario:	GDP growth scenario in which there is a slight slowdown of growth compared to previous decades, arising as large economies mature.
Low growth scenario:	GDP growth scenario towards the lower end of the spectrum, assuming a prolonged period of slow growth, compared to the baseline scenario, in the near to medium term. The difference with the baseline scenario is especially marked in the emerging economies.

Oil price scenarios

High oil price:	Strong upwards divergence of real oil prices relative to the baseline oil price scenario.
Baseline oil price:	The reference oil price scenario used by the International Energy Agency 2012 New Policy Scenario.
Low oil price:	Strong downwards divergence of real oil prices relative to the baseline oil price scenario.

Urban scenarios

Baseline GDP: Output in urban centres in each country grows according to the national *Baseline* GDP scenario simulated by the ITF for each country.

Low growth GDP: Output in urban centres in each country corresponds to the national *Low growth* GDP scenario simulated by the ITF.

Land-use scenarios (used in the urban Latin America pilot model)

Baseline: The surface area of each urban agglomeration expands in relation to population in line with the average national observed historical trend. The urban density of the average city increases slightly.

High sprawl: All urban agglomerations grow in surface area following the historical Argentinean surface expansion to population growth-path (the highest observed with available data from the region). The urban density of the average city decreases.

Low sprawl: All urban agglomerations grow in surface area following the Colombian surface expansion to population growth-path (the lowest observed with available data from the region). The urban density of the average city increases.

Public transport service scenarios

Baseline: Public transport expands according to the *baseline* evolution of urban density in each country. It follows the observed positive relation between urban density and public transport service intensity. Public transport services grow in pace with urban population growth.

High public transport: Public transport services expand more rapidly than the observed relation between urban density and service intensity. Public transport vehicle-kilometres grow significantly faster than urban population.

Low public transport: Supply of public transport service develops in this case according to the *High sprawl* evolution of density in cities. Total vehicle kilometre growth lags behind population growth.

Public transport quality scenarios

Baseline: Economic growth in cities is only partially translated into improvement of public transport quality. As a result, the share of rapid public transport vehicle-kilometres grows only moderately.

High quality: Economic growth in urban centres is more directly translated into improvement of public transport. The result is expansion of the share of rapid public transport vehicle-kilometres.

Road infrastructure scenarios

Baseline: Per capita road infrastructure expands at a rate that corresponds to the evolution of urban density under the *Baseline sprawl scenario*. It follows the observed negative relation between urban density and road intensity. Urban road expansion grows at similar rates to the urban population.

High roads: Urban roads expand at higher rates than urban populations.

Low roads: Urban road infrastructure per capita grows following the *Low sprawl* evolution of urban density. Urban roads expand at lower rates than urban population.

Vehicle technology scenarios

IEA New Policy Scenario (NPS): Corresponds to a context in which the broad policy commitments and plans that have been announced by governments to date are implemented. Under this scenario fuel economy standards are tightened and there is progressive but moderate uptake of advanced vehicle technologies.

IEA 450 technology scenario: A scenario presented in the *IEA World Energy Outlook* that sets out an energy pathway consistent with the IPCC goal of limiting the concentration of greenhouse gases in the atmosphere to around 450 parts per million of CO_2 equivalent.

Urban policy pathway scenarios

Baseline: Land-use and public transport service intensity and quality develop according to their *Baseline* scenarios; fuel prices follow their reference scenario.

Private transport-oriented: Land-use is modelled according to the *High sprawl* scenario; public transport service expands following the *Low public transport* scenario; public transport quality increases at the rate of the *Baseline* scenario; fuel price evolution corresponds to the *Low oil price* scenario.

Public transport-oriented: Land-use is modelled according to the *Low sprawl* scenario; public transport service expands following the *High public transport* scenario; public transport quality increases at the rate of the *High quality* scenario; fuel price evolution corresponds to the *High oil price* scenario.

Overall passenger and freight transport scenarios

Passenger transport

Highest:	Corresponds to the *Private transport-oriented* urbanisation path, combined with the *High road*s case.
Central:	Combines *Baseline* urbanisation path, with the *Baseline* road infrastructure case.
Lowest:	Simulates *Public transport-oriented* urbanisation under the *Low roads* infrastructure case.
Lowest with low GDP:	Corresponds to the *Lowest passenger transport* scenario modelled under the *Low growth* economic scenario case.

Surface freight transport

Central case:	Supposes a gradual decline in the transport intensity of GDP. Per capita income growth leads to lower surface freight transport demand per unit of GDP.
Unitary:	Transport volumes develop with a unitary relationship to GDP over the entire projected time period and for all regions. Combined with baseline GDP this forms the highest scenario.
Decoupling:	A freight transport scenario in which the trend of a decoupling of freight transport volumes from GDP is strong and increases over time. Combined with low GDP growth this forms the lowest scenario.

Regional aggregates

Africa:	Sub-Saharan Africa and North Africa
Asia:	South and East non-OECD Asia excluding China and India
EEA + Turkey:	EU28 + Switzerland, Norway, Iceland and Turkey
Emerging economies:	Brazil, China, India, Indonesia, Russian Federation, South Africa, Saudi Arabia

EU27:	European Union countries as of 1 August 2013 excluding the non-ITF member country Cyprus.[1] [2]
Latin America:	South America and Mexico
Middle East:	Middle East including Israel
North America:	United States and Canada
ODA:	Afghanistan, Bangladesh, Mongolia, Nepal, Pakistan, Papua New Guinea, North Korea, Chinese Taipei, Sri Lanka, Samoa
OECD:	All OECD countries, except in Figures 1.10, 1.11, 1.12 and 1.16 which exclude non-ITF states Israel and Chile (at the time of data collection).
OECD Pacific:	Australia, Japan, New Zealand and South Korea
Transition economies:	Former Soviet Union countries + Non-EU South-Eastern Europe

Abbreviations and acronyms

ACI:	Airport Council International
BRT:	Bus Rapid Transit
IATA:	International Air Transport Association
IEA:	International Energy Agency
ITF:	International Transport Forum
MoMo:	International Energy Agency's Mobility Model
PPP:	Public-private partnership
UNCTAD:	United Nations Committee for Trade and Development

1 Footnote by Turkey. The information in this document with reference to « Cyprus » relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

2 Footnote by all the European Union Member States of the OECD and the European Commission. The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

International Energy Agency's Mobility Model (MoMo)

The IEA has been developing its Mobility Model for over 10 years. It is a global transport model for making projections to 2050, with considerable regional and technology detail. It includes all transport modes and most vehicle and technology types. MoMo is used to produce the periodic IEA Energy Technology Perspectives report. MoMo covers 29 countries and regions. It contains assumptions on technology availability and cost at different points in the future and how costs could drop if technologies are deployed at a commercial scale. It allows fairly detailed bottom-up "what-if" modelling. Energy use is estimated using a bottom-up approach. MoMo is used to produce projections of vehicle sales, stocks and travel, energy use, GHG emissions (on a vehicle and well-to-wheel basis). It allows a comparison of marginal costs of technologies and aggregates to total cost across all modes and regions for a given scenario. More information on MoMo is provided in IEA (2009).

CHAPTER 1. TRANSPORT AND THE MACROECONOMY – CURRENT SITUATION AND NEAR-TERM EXPECTATIONS

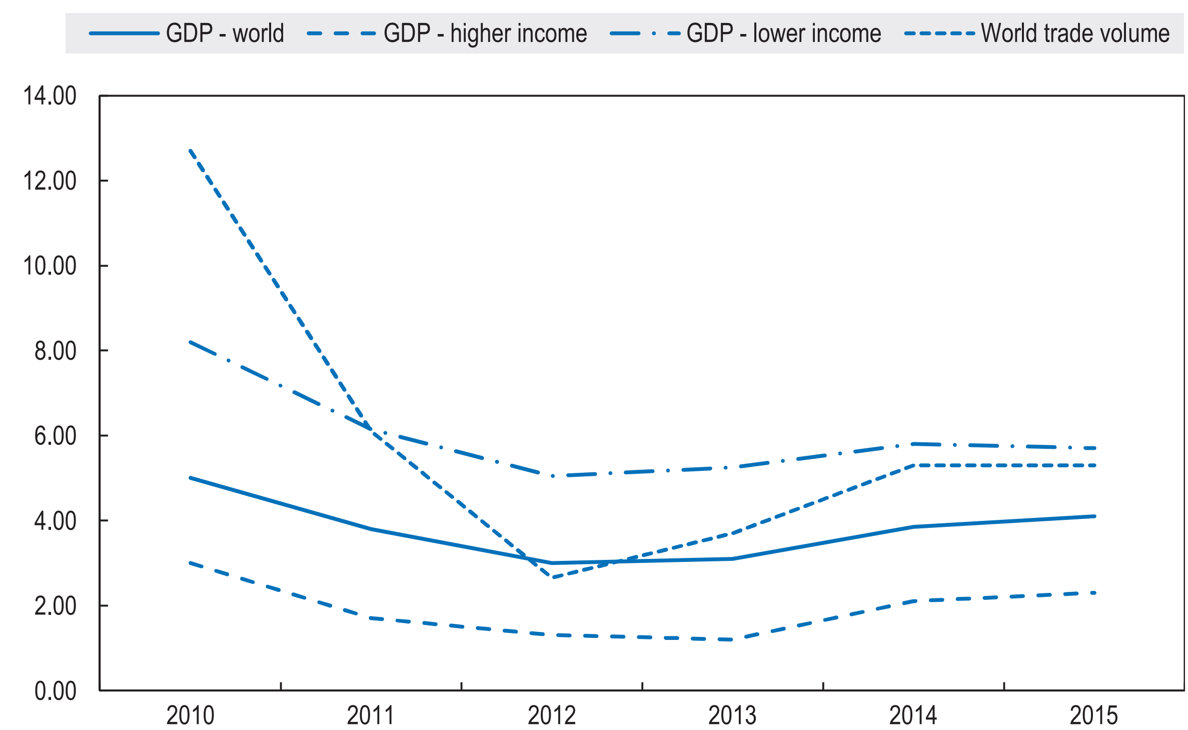
This chapter reviews some of the recent trends in economic development, trade and transport. Based on historical data on gross domestic product, trade and global transport together with near term economic projections, the chapter discusses some of the main expectations for freight and passenger transport for the near-term future. It discusses the recent observation of a shift of economic mass to emerging economies and provides evidence of some rebalancing of trade and transport flows. The chapter also reviews trends in car use in high-income economies and highlights rising uncertainty over future mobility choices.

GDP and trade volumes

Activity in the transport sector is closely tied to the level of economic development and to business cycle fluctuations. This section presents and discusses changes in the recent past and expectations for the near future in that context. In recent decades, global economic development has been characterised by the gradual shift of economic mass from developed to emerging economies. In the more recent past, there are regional differences in paths of recovery following the financial and economic shocks of 2007/2008 and after. Table 1.1 and Figures 1.1 and 1.2 illustrate both phenomena.

Table 1.1 shows Gross Domestic Product (GDP) and trade growth measures for recent years and expectations for the coming years from the most recent economic outlooks produced by the Organisation for Economic Co-operation and Development (OECD), the International Monetary Fund (IMF) and the World Bank. The figures from these different sources are sufficiently similar that they can be summarised as in Figure 1.1. The world GDP growth rate is expected to rise to around 4% in 2014 and 2015 after a two-year spell of somewhat weaker performance following the initially quick rebound after 2008, particularly in lower income economies. As is well known, this global average is the result of high growth rates in emerging economies (around 6%) and slow growth in higher income countries (2% or less). For 2014 and 2015, growth is expected to pick up somewhat in the latter, while in emerging economies growth flattens out as challenges to key emerging economies' growth models are mounting.

Figure 1.1. **GDP and trade growth, annual % change**
2010–2012: observed, 2013–2015: expected



Source: OECD Economic Outlook 93, May 2013, Table 1.1; IMF World Economic Outlook, Update July 2013, Table 1; World Bank Global Economic Prospects, June 2013, Table 1.

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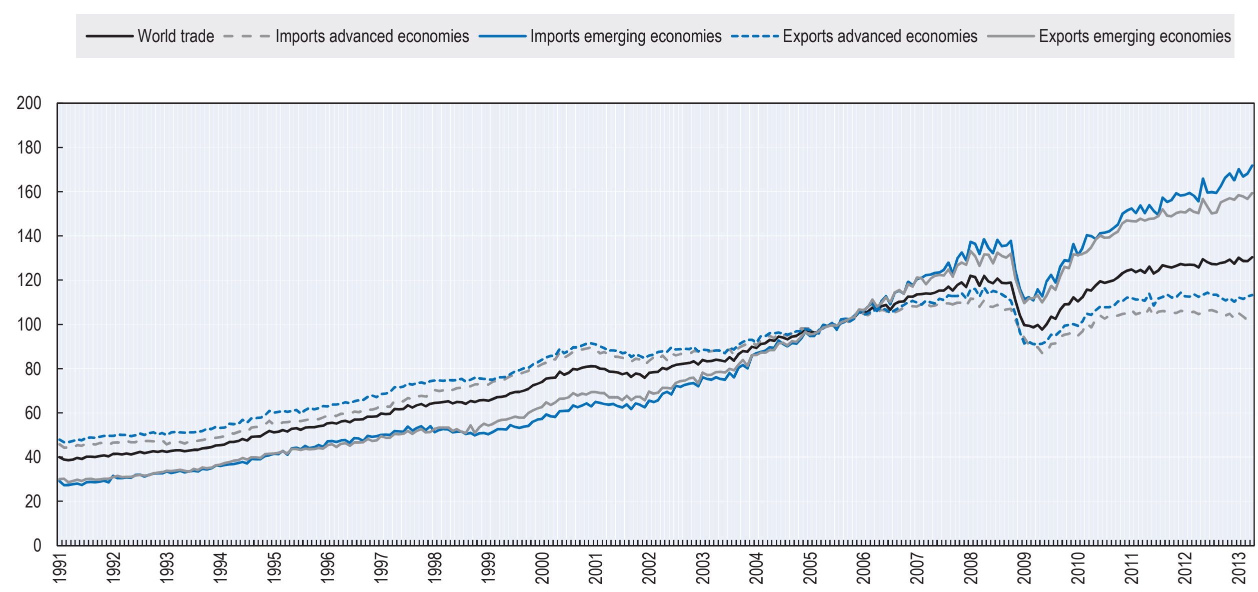
Recent growth and near-term expectations differ within the broad groups of 'higher' and 'lower' income economies. Notably, the performance of the Euro area has been weak and is expected to remain so, despite some improvement, over the next two or three years. The World Bank forecast is for 1.5% growth in 2015, compared to 3% for the United States. In contrast to the Euro area, Japan has avoided negative growth rates in 2012 and 2013, and the expectation for 2015 is of 1.3% growth. Among the lower income economies, growth is to remain strongest in the East Asia and Pacific region, although growth in China is likely to be lower than in the recent past (7 to 8%) in 2014 and 2015, as a result of low growth in high income economies and limits to strongly investment-oriented domestic growth strategies. Developing Europe and Central Asia have seen low growth in recent years, at least partly because of the fall-out of the Euro area turmoil. Growth is expected to pick up to around 4.2% by 2015.[1]

Global growth expectations are more pessimistic now than in the recent past. This is most clear from the IMF projections, which in July 2013 are considerably lower than in April 2013 (see Table 1.1), and the April 2013 projections themselves were lower than those of January 2013. The IMF points mainly to downside risks for emerging economies, to protracted recession in the Euro area, and to diminishing global growth impacts of stricter monetary and fiscal policy in the United States. The IMF's Chief Economist commented that he sees the lower growth in emerging economies as structural, not cyclical, so with no expectation of returning to the high growth rates of before 2008.[2] China has boosted growth by strong reliance on export and on debt-financed domestic investment. This has resulted in a very low share, 35%, of household consumption in GDP. Future development will require raising this share, so that household consumption must grow faster than GDP. China-expert Michael Pettis argues that fast consumption growth will force GDP growth rates down, as wage pressure will be upwards. As long as household incomes grow, reduced growth rates need not pose a problem for China domestically, but it does mean reduced investment growth.[3]

Figure 1.2. **Monthly index of world trade**
Advanced and emerging economies, 2005=100



Source: CPB Trade Monitor, June 2013.

StatLink http://dx.doi.org/10.1787/888932943780

Passenger and freight transport correlate closely with overall growth,[4] but the development of global trade is a specific driver of maritime and air transport volumes. Trade between countries has grown faster than global output over the past decades, as a consequence of rising levels of development and trade liberalisation in emerging economies, increasing exchange of similar goods, and strong geographic fragmentation of production. The result is that the ratio of international trade in manufactured goods to production of these goods was twice as high in 2010 as it was in 1990.[5]

For the recent past, Figure 1.1 shows how world trade grew very strongly in 2010 but growth was slower after. As discussed in the 2011 *ITF Transport Outlook*, and as can be seen in Figure 1.2, the economic shock of 2008 had a dramatic impact on trade volumes, and this was because the drop in aggregate consumer and investment demand was particularly pronounced for traded goods. The rebound was equally quick and spectacular immediately after the shock, but growth rates slowed down strongly as of 2011. Expectations are for stronger growth in 2014 and 2015.

Figure 1.2 highlights the difference in trade growth between emerging and advanced economies, with the latter on a higher growth path since the early 2000s and the high growth resumed post–2008. It is not surprising that growth is slower over the long run in advanced economies, but the very weak performance since late 2010 is a cause for concern. The low growth rates of global trade in recent years can be attributed to tepid export growth from advanced economies and in particular to weak demand in these economies, with low import demand growth and – correspondingly – slower growth of exports from emerging economies. Similar to GDP growth expectations, global trade growth projections are now more pessimistic than a couple of months ago (see the change in IMF projections in Table 1.1).

Figure 1.3 shows the development of trade volumes for subgroups of advanced and emerging economies for 2004 through 2013. The top left panel confirms Euro area weakness, with the volume of imports declining after a quick rebound post 2008. In contrast to the United States and Japan, imports remain well below pre-crisis peak levels and are now back to the level of 2005. In terms of exports, however, the Euro area performs relatively well. In the emerging economy regions, imports grow strongly throughout whereas export volume growth is stronger and more volatile outside emerging Asia.

Table 1.1. **GDP and trade growth, percentage change over previous year**

OECD 2010–2014

	Observed		Projected		
	2010	**2011**	**2012**	**2013**	**2014**
GDP					
World	5.0	3.7	3.0	3.1	4.0
OECD	3.0	1.9	1.4	1.2	2.3
Non-OECD	8.2	6.3	5.1	5.5	6.2
Trade volume					
World	12.7	6.1	2.7	3.6	5.8

IMF 2011–2014

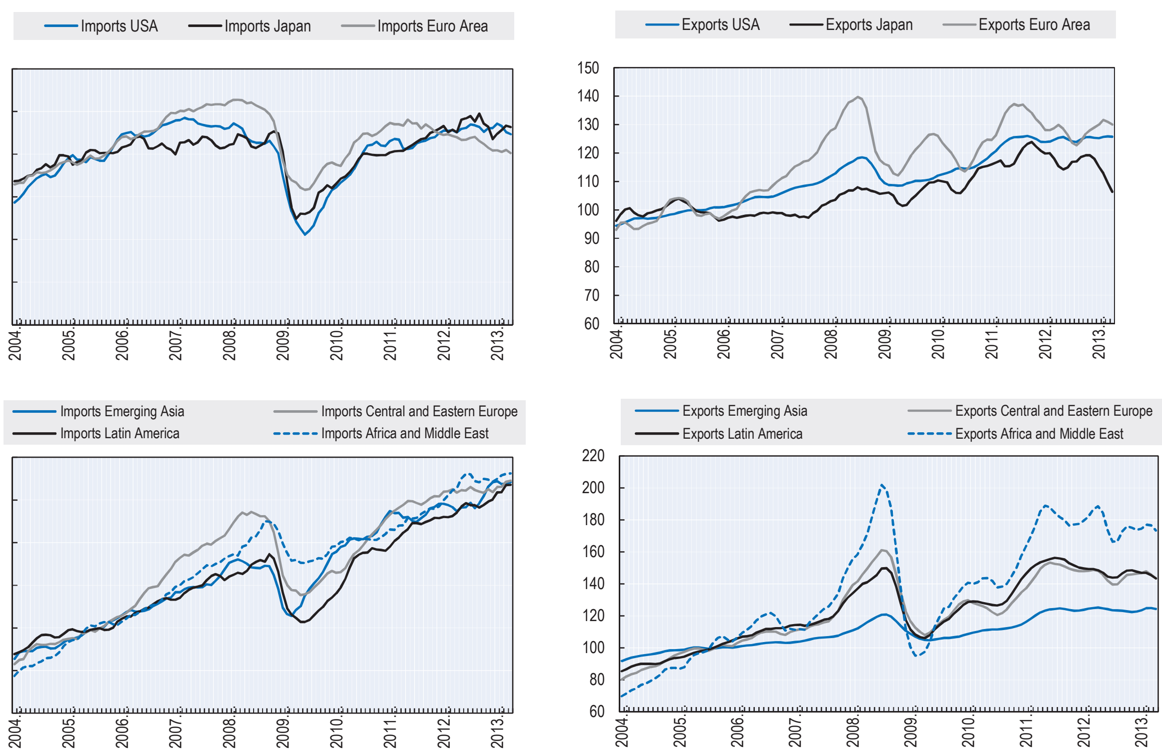
	Observed		Projected July 2013		Difference with April 2013 projection	
	2011	**2012**	**2013**	**2014**	**2013**	**2014**
GDP						
World	3.9	3.1	3.1	3.8	-0.2	-0.2
Advanced econ.	1.7	1.2	1.2	2.1	-0.1	-0.2
Em. & dev. econ.	6.2	4.9	5.0	5.4	-0.3	-0.3
Trade volume						
World	6.0	2.5	3.1	5.4	-0.5	0.1
Imports adv.	4.7	1.1	1.4	4.3	-0.8	0.1
Imports em. & dev.	8.7	5.0	6.0	7.3	-0.2	0.0
Exports adv.	5.6	2.0	2.4	4.7	-0.4	0.2
Export em. & dev.	6.4	3.6	4.3	6.3	-0.5	-0.2

World Bank 2011–2015

	Observed		Projected		
	2011	**2012**	**2013**	**2014**	**2015**
GDP					
World (PPP weighted)	3.8	2.9	3.1	3.8	4.1
High income countries	1.7	1.3	1.2	2.0	2.3
Developing countries	6.0	5.0	5.1	5.6	5.7
Trade volume					
World	6.2	2.7	4.0	5.0	5.4

Source: OECD Economic Outlook 93, May 2013, Table 1.1; IMF World Economic Outlook, Update July 2013, Table 1; World Bank Global Economic Prospects June 2013, Table 1.

Figure 1.3. **Index of imports and exports, 3-month moving average**
Advanced and emerging economies, 2005=100



Source: CPB World Trade Monitor, June 2013.

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Transport volumes

Maritime and air freight volumes

Maritime transport is the backbone of international trade, with over 80% of world cargo volumes transported by sea. Following the 2009 recession, world seaborne trade experienced robust growth in 2010 (see Figure 1.4). The United Nations Committee for Trade and Development (UNCTAD) preliminary data show that seaborne trade, measured in tonnes loaded, grew by 4% to 8.7 billion tonnes in 2011. This is 6%

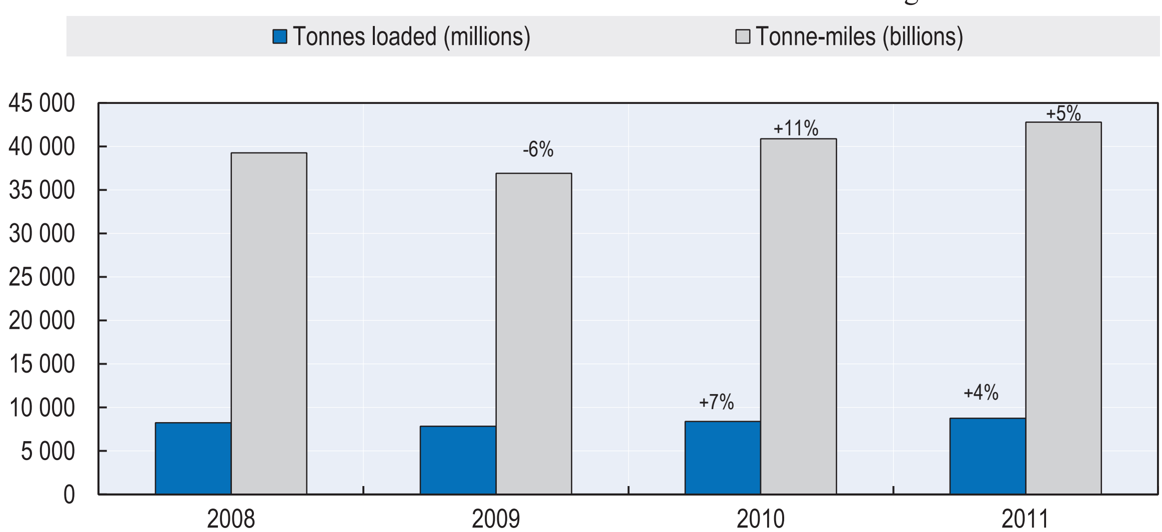
above the pre-crisis peak in 2008. In tonne-miles, the maritime transport grew by 5%, reaching 42.8 billion tonne-miles.

The movement of seaborne freight reflects the two-speed growth in the world economy, with developing economies faring better than developed economies (Figure 1.5). The total amount of goods unloaded (in tonnes) in developing economies grew to 19% above pre-crisis peak levels while in developed economies volumes were still 10% below their 2008 peak. Growth of cargo loaded in developed countries outpaced that in developing countries, indicating relatively strong growth of import demand in developing economies. In 2011, 58% of world seaborne cargo was unloaded in developing countries.

Asia was by far the most important region for container trade. The world's ten leading container ports are all located in East and Southeast Asia, with only one of the ten biggest ports, in terms of container traffic, located outside this area; see Figure 1.6.

Figure 1.4. **World seaborne trade 2008-2011**

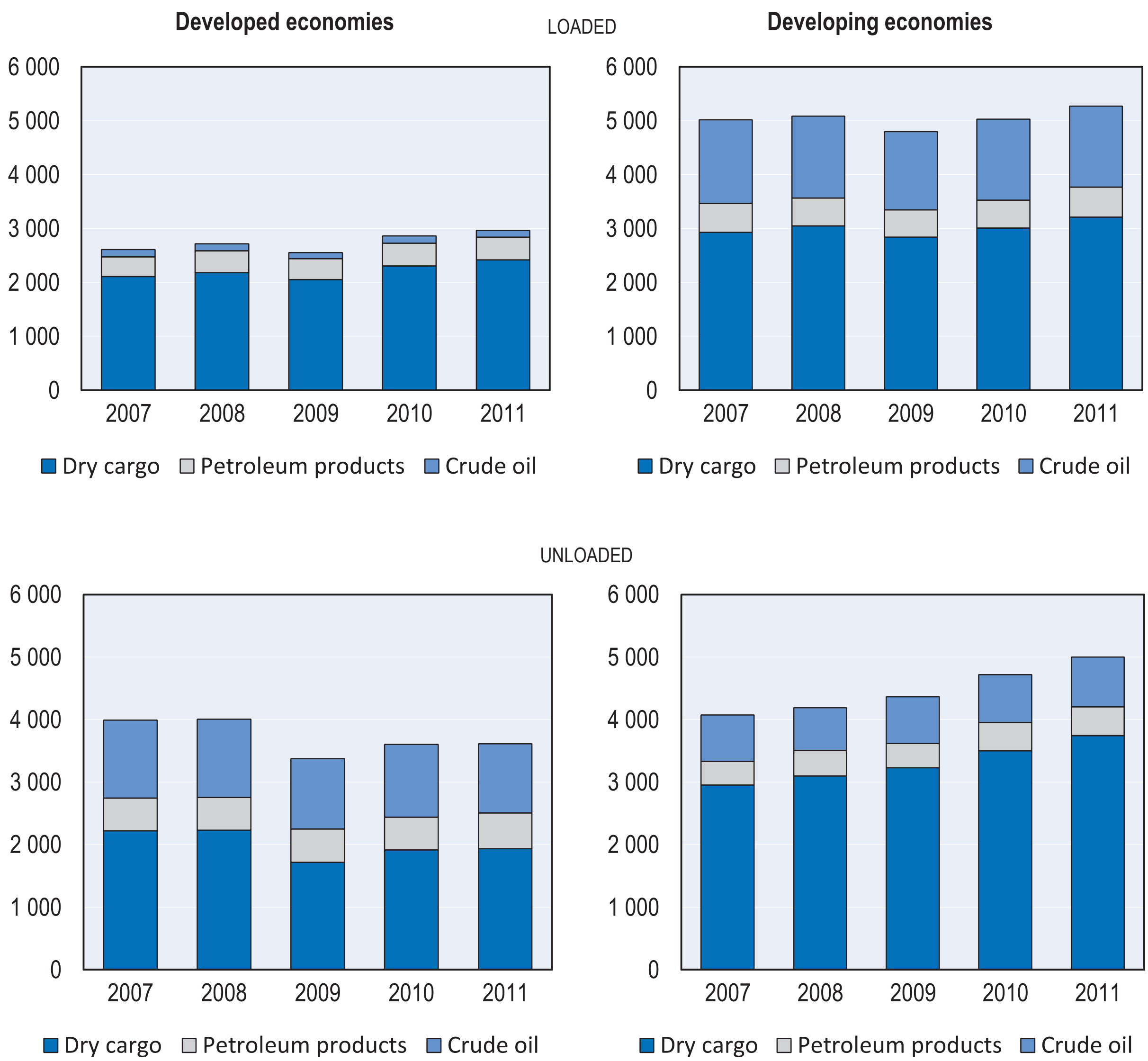
Million tonnes and billion tonne-miles and annual % change



Source: UNCTAD Review of Maritime Transport 2012.

StatLink http://dx.doi.org/10.1787/888932943818

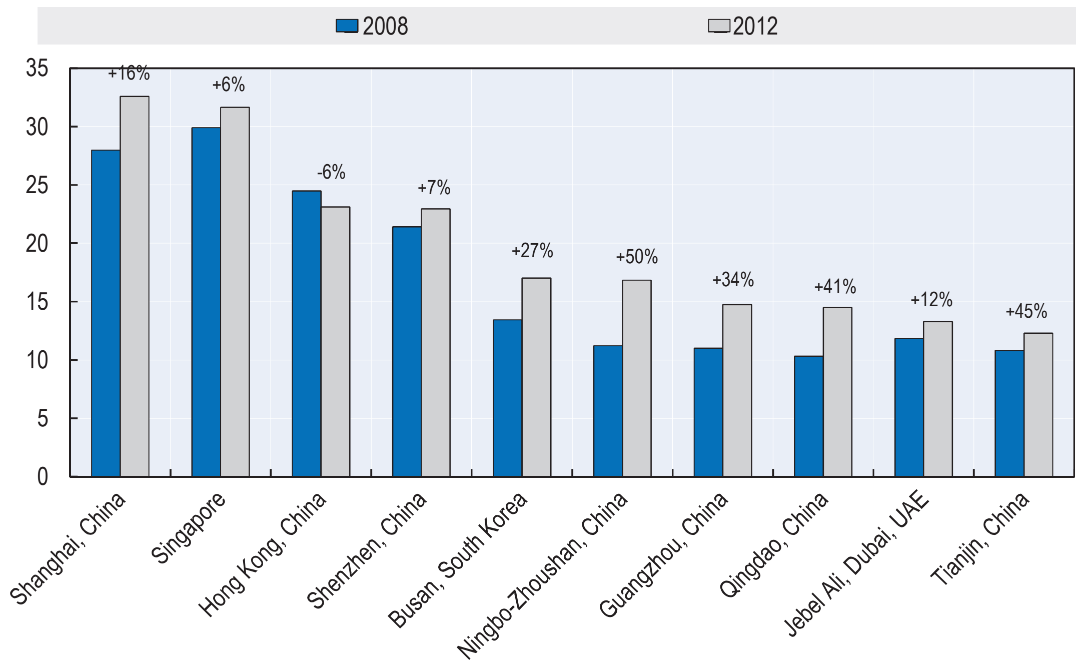
Figure 1.5. **World seaborne trade by type of cargo and country group**
Million tonnes



Source: UNCTAD Review of Maritime Transport 2012.

StatLink http://dx.doi.org/10.1787/888932943837

Figure 1.6. **The 10 leading world ports in terms of container traffic**
20 foot equivalent units (TEU) and annual % change



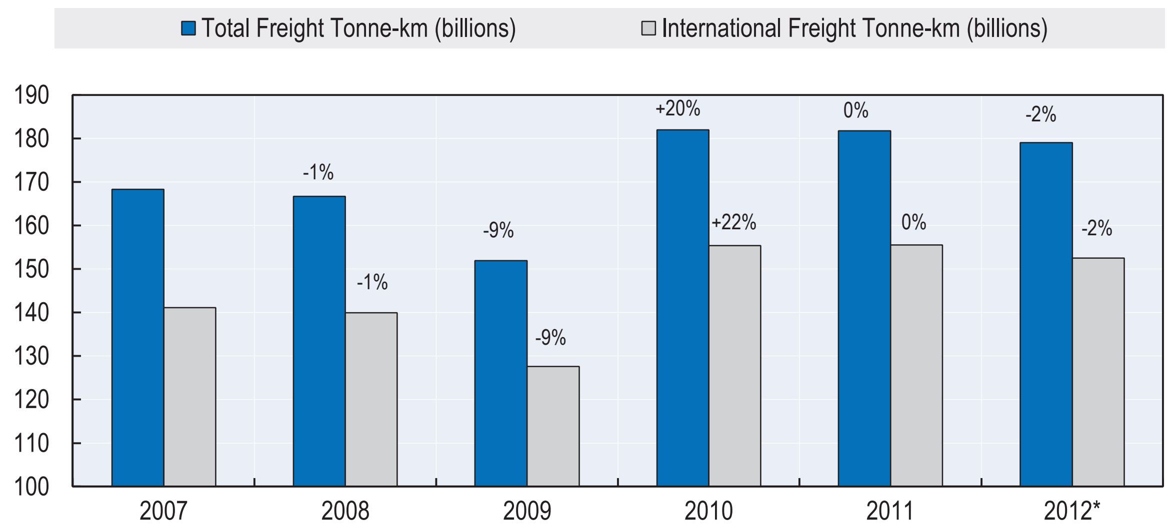
Source: Based on World Shipping Council and Containerisation International. TEU: Container traffic measured in twenty-foot equivalent unit as all containers handled, including full, empty and transhipped containers.

StatLink http://dx.doi.org/10.1787/888932943856

As can be seen in Figure 1.7, following two consecutive years of negative growth due to the economic crisis, air freight transport rebounded in 2010 and grew 20% from the previous year to a new high of 172 billion freight tonne-kilometres. The strong performance of air freight in 2010 was partly led by inventory rebuilding after the economic downturn, together with rising consumer demand. This growth did not sustain, however, and air freight stagnated to zero growth in 2011, followed by a decline of 1.5% in 2012, measured in freight tonne-km. International air freight traffic outperformed domestic traffic in the recovery. International traffic increased to 10% above the pre-crisis peak, while domestic air freight traffic remained just below the pre-crisis peak of 2007.

The slowdown in world trade growth, shifts in the commodity mix favouring sea transport and continuing economic weakness in developed countries are among the factors contributing to the negative growth in the air freight market in 2012 (IATA Air Transport Market Analysis 12/12). Asia Pacific airlines were the most affected (-5.5%), followed by European (-2.9%) and North American carriers (-0.5%).

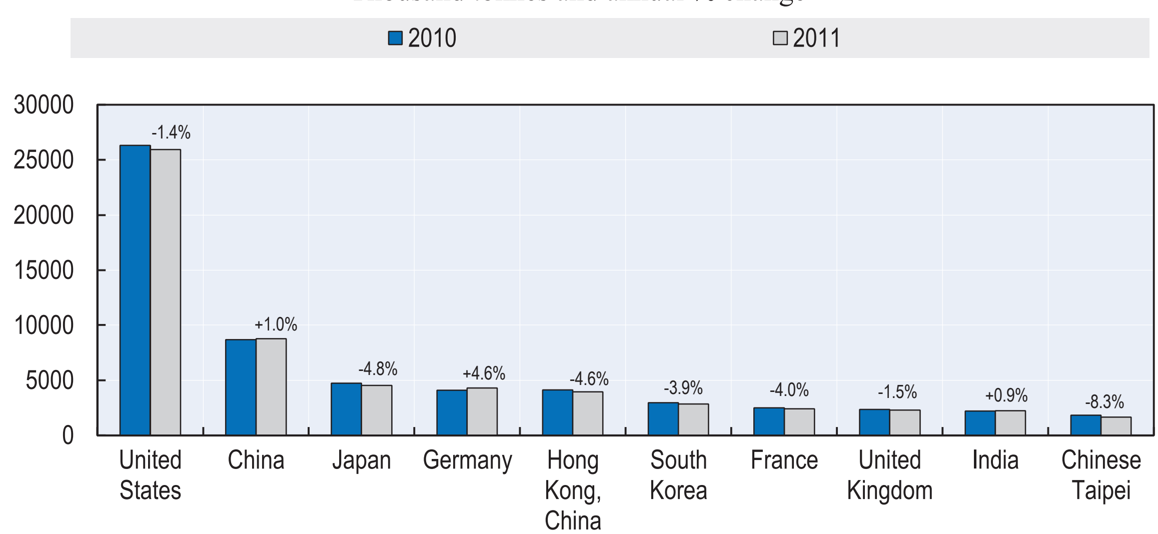
Figure 1.7. **World airline freight traffic**
Total and international



Source: Based on IATA Annual Review 2013 and ICAO Annual Report of the Council 2011. Data for 2012 a preliminary estimate.

StatLink http://dx.doi.org/10.1787/888932943875

Figure 1.8. **Air freight volume by country**
Thousand tonnes and annual % change



Source: Airport Council International.

StatLink http://dx.doi.org/10.1787/888932943894

Finally, we provide an overview of the evolution of transport volumes, measured in tonnes instead of value. Data are from the ITF Trade and Transport database, which compiles data from several sources to obtain a picture of weights transported by sea and by air from the EU27 and the United States point of view. Figures 1.9a through 1.9d show tonnes imported to and exported from the EU27 and the United States, from and to major global regions.

Broadly, the patterns emerging from the figures mirror those discussed earlier. The main messages are as follows:

- *Tonnes moved by air from and to the EU27* declined strongly after the shock of 2008, then rebounded quickly but more recently have been on a downward path again. The recent decline affects both exports and imports. The overall pattern is similar for most regions with which the EU trades but plays more strongly for the United States (itself hard hit by the crisis but recovering more quickly) than for Latin America, Asia and Africa (on average less affected by the crisis), so that air transport volumes are about as high for the latter regions in December 2012 as they were in July 2008. The downward tendency, however, does not bode well for the near future, as air transport volumes are a good leading indicator of economic performance.

- *Tonnes moved by sea from and to the EU27* fell strongly in the second half of 2008 and the rebound was slower and more gradual, so that tonnes moved remain below pre-crisis levels for most regions. For North America, exports remain 23% below the peak level and imports are nearly at the peak level in December 2012. For the other regions, exports increase strongly and imports decline markedly, in line with the weak internal performance of the European Union and the stronger economic momentum in emerging economies.

- *Tonnes moved by air from and to the United States* exhibit a pattern resembling that of the EU27, with the initial rebound following the crisis-induced drop reverting to renewed decline. One difference, however, is that in the most recent months reported in the Figures, exports to and imports from Asia increased, as did imports from Europe (but not exports to Europe). This change is suggestive of improved economic performance in the United States.

- *Tonnes moved by sea from and to the United States* have not changed very strongly from the pre-crisis peak, but this is the result of opposite movements in imports (declining from all regions) and exports (increasing from the main trading regions). This can be seen as a correction to the strong consumption- and import-orientation of the United States economy in the decade before the crisis, a correction initiated by weak domestic demand and facilitated by the deprecation of the US dollar.

In short, data on tonnes moved by air and sea reinforce the observation of a shift of economic mass to emerging economies, and of weak recovery from the crisis in advanced economies and in Europe in particular. There is some rebalancing of trade and transport flows, that is to say a move away from the strong export surplus in some emerging economies and a heavy import-orientation in some of the advanced economies. However, this rebalancing appears to be driven mostly by the weak performance of the advanced economies, and less by more domestically oriented development models in the emerging economies. The challenge of structural change in, for example, China's growth strategy remains strong as ever, with increasing downside risks to continuing along the path of export orientation and a domestic focus on investment rather than consumption.

Reconnecting with solid growth in advanced economies appears to be no easier than converting to other growth sources in emerging regions. Chapter 3 briefly discusses what contribution transport policy might be able to make to this challenge in the short and long run.

Figure 1.9a. **Freight transported by air to and from the EU27, monthly trend from pre-crisis peak June 2008**
Tonnes, % change

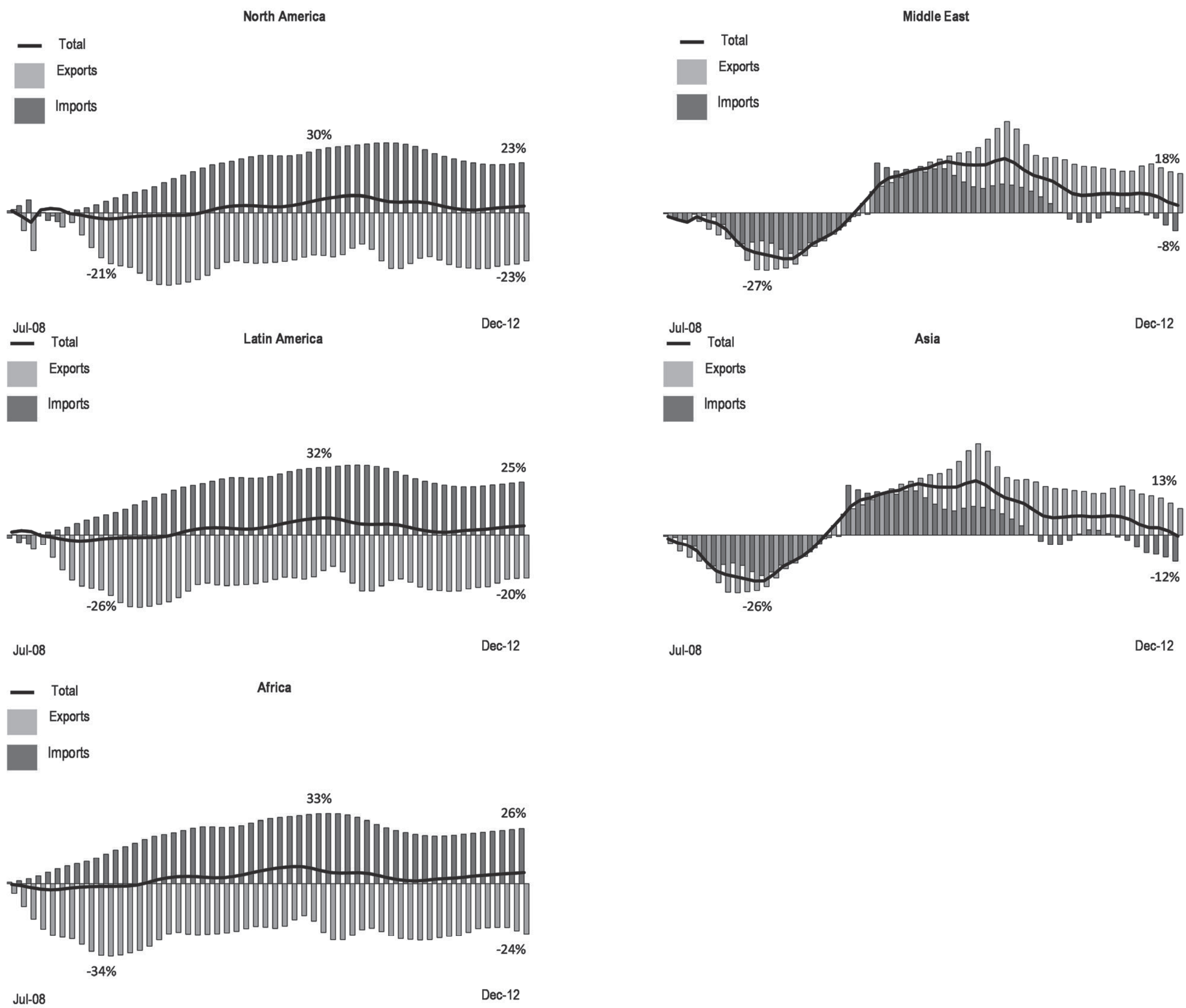


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Figure 1.9b. **Freight transported by sea to and from the EU27, monthly from pre-crisis peak June 2008**

Tonnes, % change

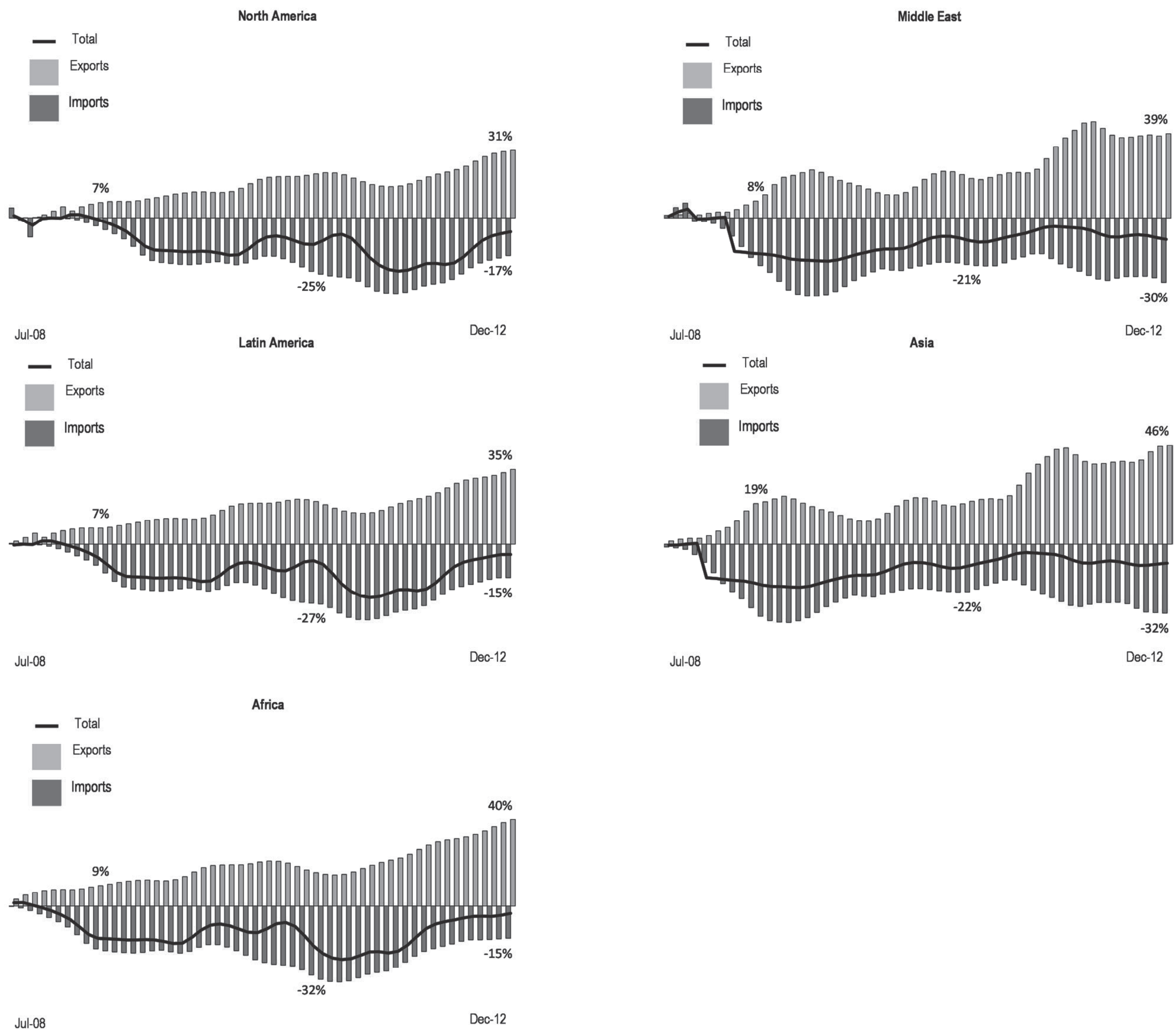

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Figure 1.9c. **Freight transported by air to and from the United States, monthly trend from pre-crisis peak June 2008**

Tonnes, % change

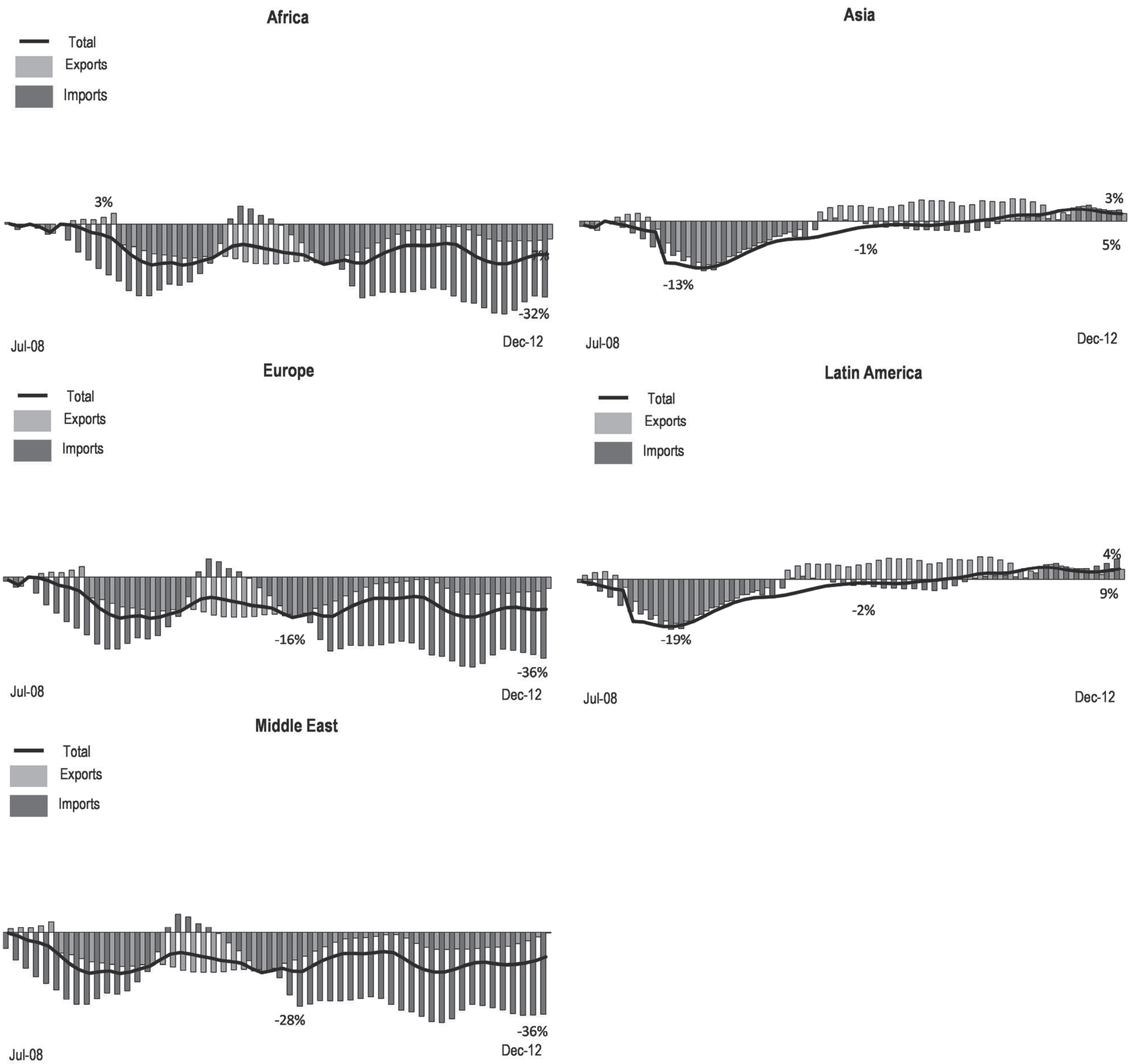

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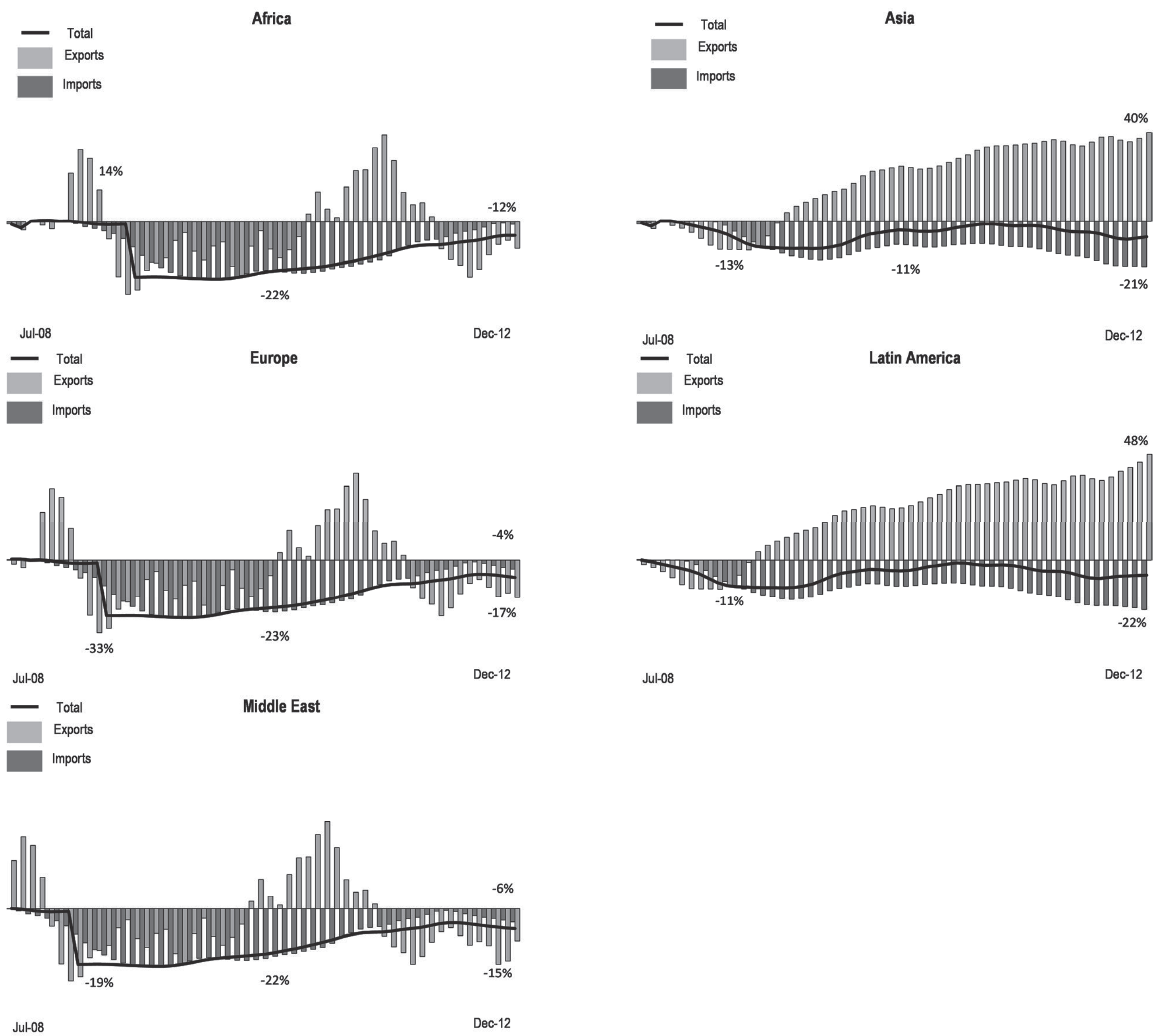
Figure 1.9d. **Freight transported by sea to and from the United States, monthly trend from pre-crisis peak June 2008**

Tonnes, % change



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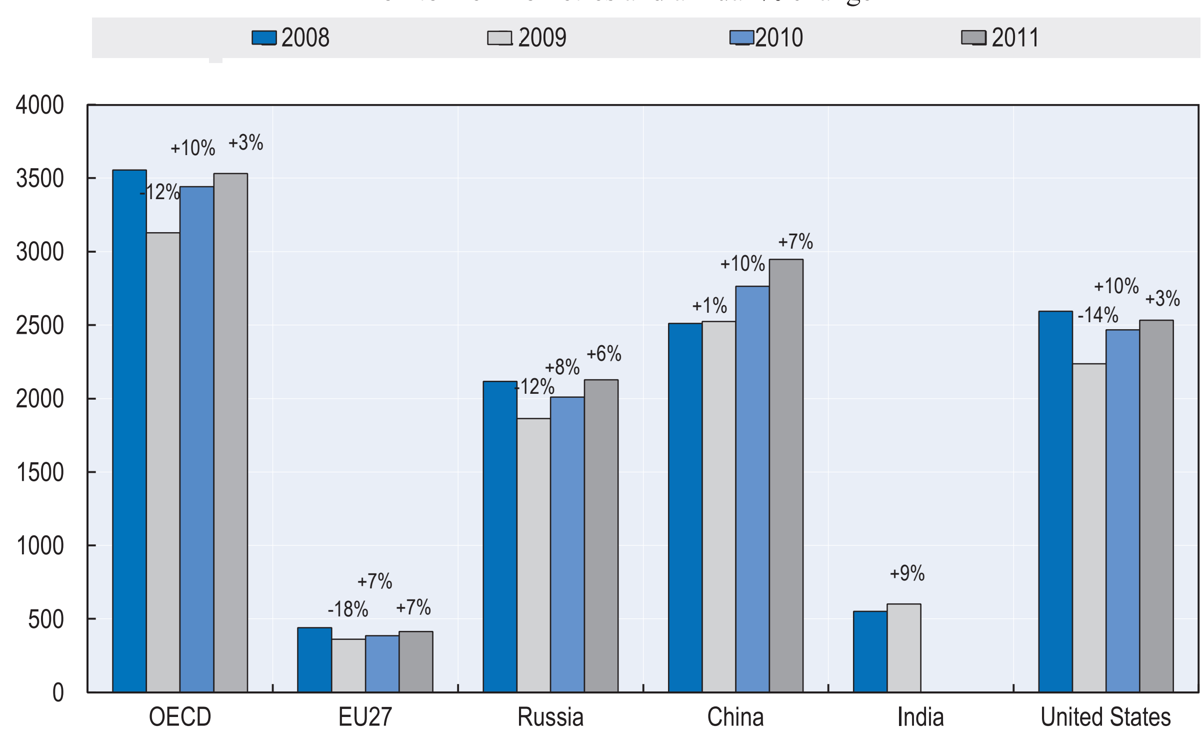
Rail and road freight volumes

Rail freight transport in the OECD countries was severely hit by the global economic crisis in 2009 (-12% compared with 2008), see Figure 1.10. Rail tonne-kilometres increased 10% in 2010 and 3% in 2011, reaching pre-crisis levels. After the initial shock in 2008 (-18%) in the European Union, the rail freight volume has increased 7% annually to slightly over 400 billion tonne-kilometres in 2011. This is still 6% below the level in 2008. In the United States, rail freight volumes increased by 10% and 3% respectively in 2010 and 2011, nearly reaching the 2008 level. In the Russian Federation, tonne-kilometres exceeded the 2008 after 6% increase in 2011. In China, rail freight growth continued in 2011, with the volume increasing by 7%. The United States, Russia and China account for nearly 80% of total estimated global rail freight.

Preliminary data for rail freight in the United States and Europe, based on our quarterly statistics, indicate a stagnation in Europe and freight volume growth turning negative in the United States. In the Russian Federation, rail freight growth has slowed down to 4% in 2012.

Figure 1.10. **Rail freight**

Billion tonne-kilometres and annual % change



Note: 2010 and 2011 data for India are not available. Data for Italy estimated for 2011.

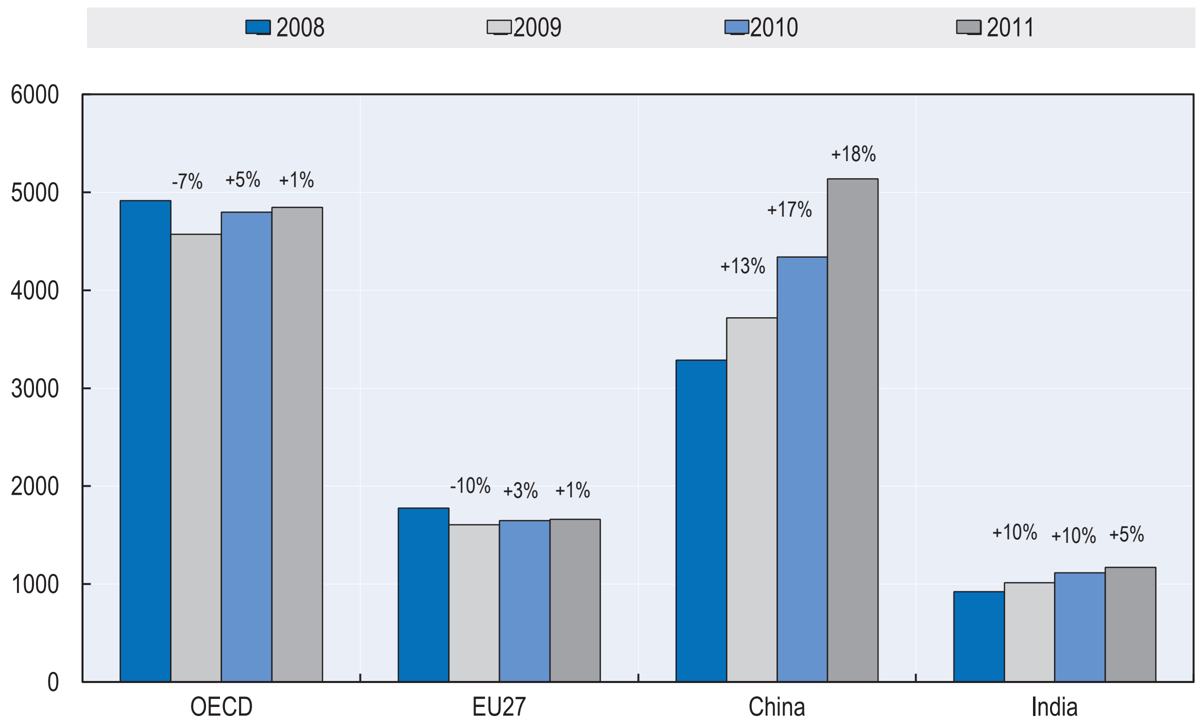
StatLink http://dx.doi.org/10.1787/888932943989

Road freight transport suffered in 2009. The decline in activity, measured in tonne-kilometres, was 7% in the OECD and 10% in the European Union in 2009. Data for 2010 show an overall increase but volumes remain below their 2008 levels. The increase in tonne-kilometres was 4% in the EU in 2010. In 2011, the growth in tonne-kilometres has slowed down both in the OECD and EU countries, increasing by only 1%. Our preliminary estimate for the EU area in 2012, covering 75% of the total road tonne-kilometres, indicates a decline of around 4% for road freight in the European Union.

Road freight activity in emerging economies, especially China and India, continued to increase throughout the period. Tonne-kilometres grew by 13% to 18% per year in China in the period 2008-2011. In India, road freight increased by 10% in 2009 and 2010 while growth slowed down in 2011 to 5%.

Figure 1.11. **Road freight**

Billion tonne-kilometres and annual % change

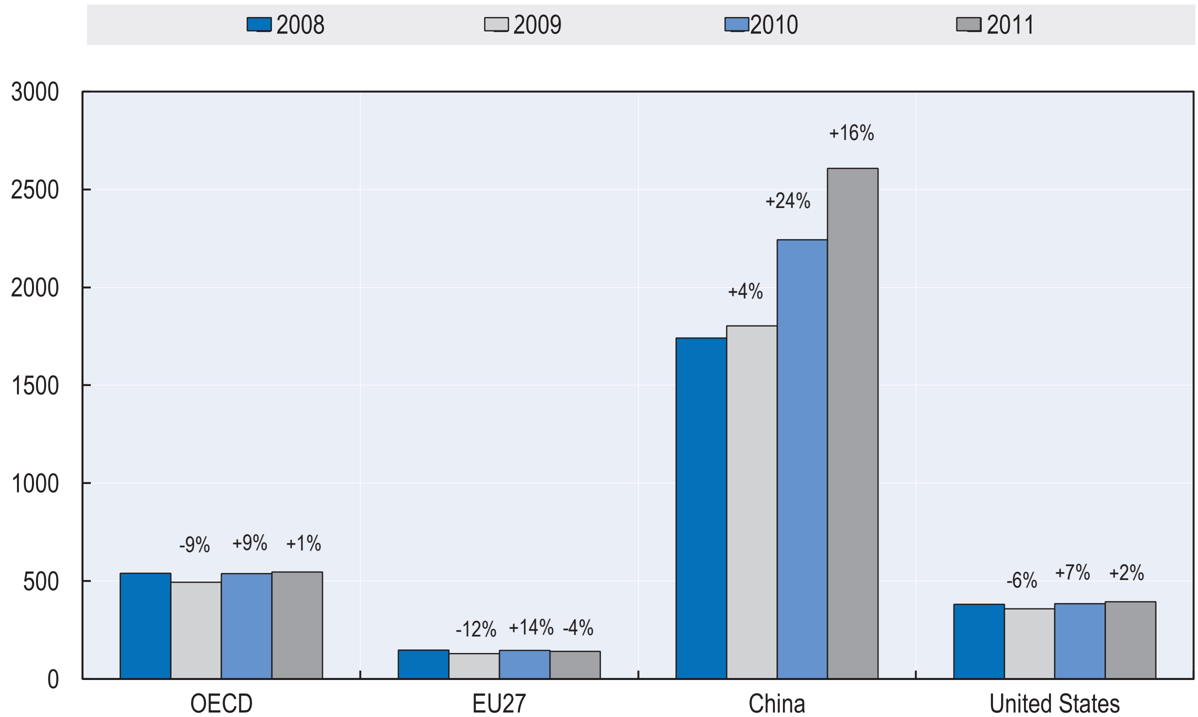


Note: Data for Canada, Greece, Italy, United Kingdom and United States estimated for 2011. Data for Malta not available.

StatLink http://dx.doi.org/10.1787/888932944008

Data on freight transport by inland waterways shows a rapid recovery in tonne-kilometres in the OECD and the EU in 2010 after the decline in 2009. The growth in volume slowed down in the OECD in 2011 (+1%) and turned negative in the European Union (-4%). The economic crisis had an impact also on inland waterway freight in China where tonne-kilometres grew only by 4% in 2009. In 2010 and 2011 inland waterway freight volumes have grown rapidly in China, by 24% and 16% respectively.

Figure 1.12. **Inland waterways freight**
Billion tonne-kilometres and annual % change



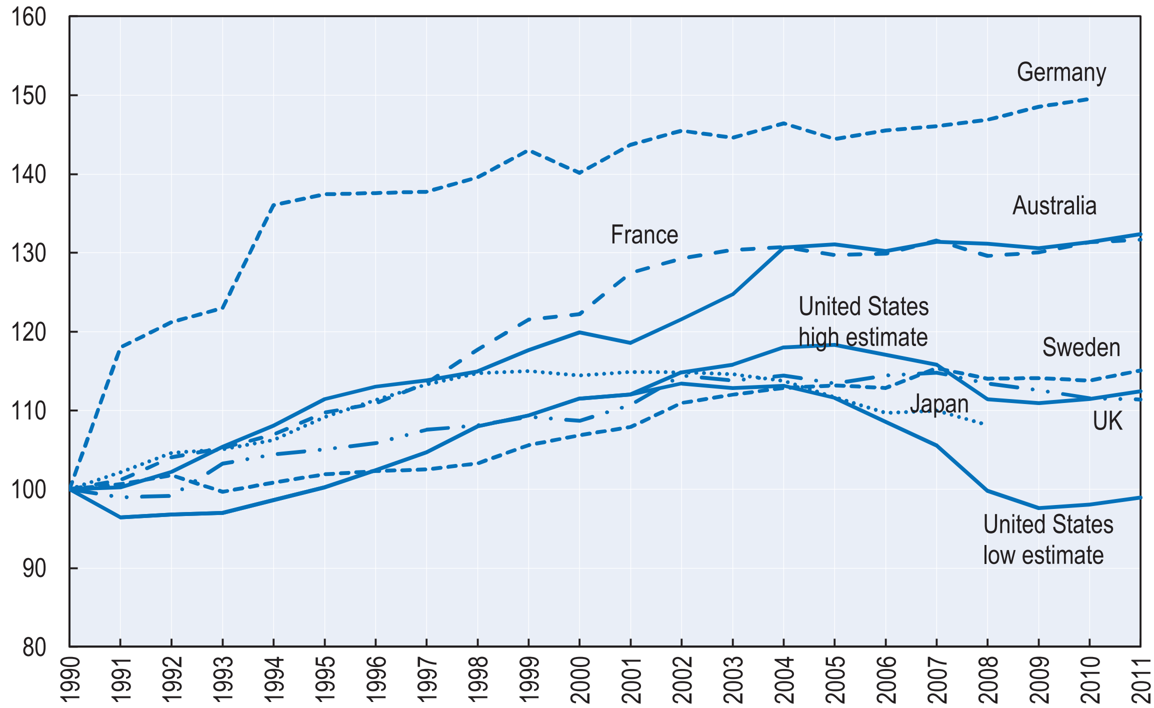
Note: Data for Switzerland estimated for 2011.

StatLink http://dx.doi.org/10.1787/888932944027

Car use in high income economies

Over the past 10 to 15 years, the growth of passenger vehicle travel volumes has decelerated in several high-income economies and in some growth has stopped or turned negative.[6] Figure 1.13 shows an index of passenger-kilometre volumes by car (and by light trucks and/or vans where relevant) in a selection of high-income economies from 1990 through 2011. The slowdown in growth is clear in Germany. In France, car use is virtually unchanged since 2003. In Japan, car use has been declining since 1999. In the United Kingdom growth is negative since 2007 and it had slowed down considerably since 2003. The United States displays a decline since around 2005 or even earlier.[7] Where available, data for 2011, however, appear to suggest an increase in growth rates.

Figure 1.13. **Passenger-kilometres by private car**
1990=100



Note: The Federal Highway Administration estimate of vehicle occupancy in the United States has been revised for 2009 based on the 2009 National Household Travel Survey (NHTS), resulting in a lower occupancy rate than previously. High estimate applies the vehicle occupancy based on 2001 NHTS while low estimate is based on a gradual decline from 2001 rate to 2009 rate.

StatLink http://dx.doi.org/10.1787/888932944046

The economic recession and relatively high fuel prices explain part of the decline in the growth of travel but not all of it. Slowing population growth, population ageing and increasing urbanisation contribute to the change in passenger vehicle use in several countries. There is evidence that car use growth has been reduced through policy interventions, particularly in urban areas and sometimes at the national level.

Research also reveals remarkable changes in the intensity of car use within some socio-demographic subgroups. Notably, car use per capita among young adults (men in particular) has declined in several countries in recent years. It is as yet not entirely clear why this decline occurs, with competing – or complementary – potential explanations relating to attitudinal and lifestyle changes (e.g. starting a family at later age), to unfavourable economic conditions for increasing numbers of young adults (e.g. rising inequality and higher unemployment) and to increased availability of options other than car use to participate in activities (e.g. more ubiquitous public transport, internet shopping and socialising).

Mobility choices, including car ownership and use, appear to be changing but it is not entirely clear why and explanations sometimes are place-specific. As a consequence, confidence in projections of mobility and car use volumes is undermined and simple, reduced form approaches based mainly on GDP and population further lose their appeal. Rising uncertainty over mobility choices is exacerbated by rising uncertainty over the future development of factors like household income. The rising uncertainty in forward looking analysis needs to be acknowledged and if some policies are more robust to uncertainty than others, such policies become relatively more appealing.

One emerging insight is that transport users are becoming more diverse, both in terms of preferences for lifestyles and mobility and in terms of budgets. Some groups choose less car-oriented lifestyles and the increased availability of other transport modes and online alternatives makes it easier for them to do so. However, in many (but not all[8]) cases such choices require a relatively high level of affluence, for example because of relatively high costs of living in urban centres and of choosing high speed rail and air travel as substitutes for long-distance road travel. Other groups appear to adapt mobility patterns out of necessity. Rising inequality and unfavourable economic conditions, including low wages and high unemployment, restrain budgets for increasing numbers of households. Rising costs of getting a driving license and of car insurance exacerbate these constraints, perhaps most for young adults. The affordability of mobility is a rising concern.

Aggregate car use is the result of location and travel choices made by a diverse set of potential car users. These choices depend on preferences, incomes, and prices of various transport options and alternatives to travel. Preferences are subject to change, and there are signs that car use is less of a priority in groups preferring urban lifestyles and more reliant on online networks. Income growth is now less self-evident with rising inequality and weaker growth prospects in many OECD economies. Prices are partly determined in markets and partly depend on transport policies broadly defined, where the latter now often are less favourable to car use than before. Together with ageing and saturation of access to cars, these changes contribute to slower growth of car use. They also reflect increasing heterogeneity among potential car users. Whereas car ownership and use was a common aspiration for most, and an aspiration that was satisfied for increasingly many, it has become a somewhat less universal goal, and perhaps one that is more difficult to reach for some.

Aggregate car travel is a variable of some policy interest, as it is roughly indicative of a country's resource needs for car transport (including road and parking infrastructure, energy, etc.), of environmental and climate change impacts, and of the sector's tax revenue generating capacity. Aggregate travel is particularly relevant for gauging investment needs when transport and economic growth are high and networks are under development, as it provides an indication of overall resource needs. In more mature economies, decisions on where and how to invest in infrastructure are driven less by overall growth than by specific needs in the network. It is, for example, anything but obvious that slower growth in aggregate car use changes the case for relieving current bottlenecks.

Goodwin (2012) argues that the broad class of 'smart' and less car-oriented mobility policies fares better than standard policies that can be characterised as accommodating towards car usage aspirations. At any rate, the need to select policies that consider overall benefits ('balanced mobility policies') rather than focussing on direct user benefits is strengthened by the rise in uncertainty over the development of car use. Appraisal, in the form of comprehensive cost-benefit analysis of policy strategies rather than just projects, is instrumental to such a policy approach. Of course, the case for such policies is not contingent on any particular pattern of development of car use, but on the need to align individual travel aspirations and choices with their social costs and benefits. This does not mean that the observed changes are irrelevant to the debate. First, to the extent that user preferences diverge less from what is socially beneficial, as is the case according to some readings of the observed change in aggregate car travel, implementing balanced mobility policies will meet with less resistance. Second, there are several indications that, apart from a possible change in preferences, behavioural change now is easier given the changing nature of travel (a larger share of non-work trips, for which own- and cross-price elasticities may be larger) and the increased availability of alternatives (more public transport, more cheap air travel, more online activities, etc.).[9] Such changes may translate into more flexibility in travel choices, so that higher prices for car travel result in larger declines of that travel. This suggests that pricing reforms (more efficient road, parking, fuel and insurance pricing, and less favourable company car policies) can be more effective at reducing vehicle travel and encouraging use of alternative modes, and road tolls will generate less revenue than assumed in many travel models.

Revenues needed for maintaining the integrity and quality of current road networks, let alone of upgrading them, do not diminish in proportion to slower growth of network usage. If transport infrastructure is to be funded from user charges, slower or zero traffic growth will need to be accompanied by increasing charges (especially if user charges are mainly fuel taxes and fuel economy improves, as is clear from the current experience in the United States). If funding is from general revenue, transport tax revenues will grow more slowly or stagnate, unless rates are raised and/or new taxes introduced. In either case, the possibility of prolonged slow growth of car use volumes adds to the already considerable set of arguments for reforming the funding basis for transport infrastructure.

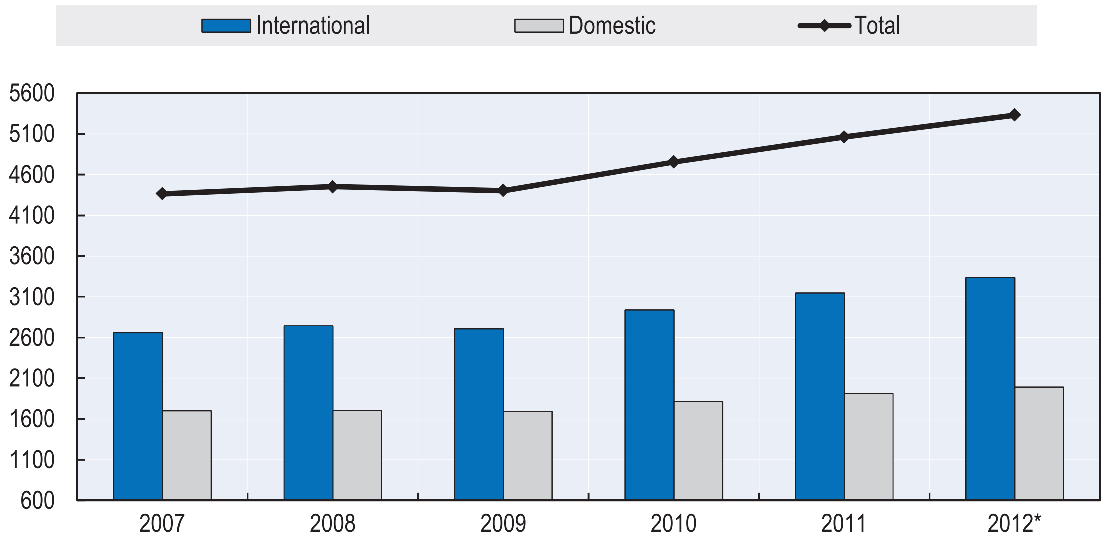
In developing economies, the rule of thumb that mobility and in particular car use will develop in line with GDP as long as policies do provide strong steering in the opposite direction, remains broadly applicable. Furthermore, strong natural population growth and rural migration to cities where motorisation is often twice that of rural areas due to higher incomes will induce pressure towards higher motorisation. Possibly, attitudinal changes related to availability of online activities could curb growth at an earlier stage than in high income economies, and faster urbanisation leading to congestion can reduce growth in car use. However, this curbing effect will not necessarily materialise in the absence of policies that disincentivise car use. Balanced mobility policies conceivably could induce levelling off of car use at lower per capita car use volumes than are observed in currently high income economies. Providing public transport is not enough for this – car use itself needs to be regulated through appropriate prices, and land-use policy. And even when car use is inconvenient because of high congestion and high purchase prices, the preference for personal mobility may lead users to turn to two-wheelers (motorcycles, in particular), as currently is the case in Asian and Latin American cities.

Air, rail and bus passenger transport

Air passenger-kilometres fell by 1.1% in 2009 as a consequence of the economic crisis. Despite the volcanic ash crises that substantially disrupted air passenger traffic in the first half of 2010, total passenger air transport has recorded a new high each year since recovery started in 2010. Passenger-kilometres increased by 8% in 2010, reaching 4 754 billion revenue passenger-kilometres (RPK) or 2.6 billion passengers. In 2011, RPKs grew by 6.5% while the estimate for 2012 puts growth at 5.3%, reaching 5 330 billion passenger-kilometres or 2.85 billion passengers.

Domestic passenger-km traffic markets grew by 4% in 2012. China, the second largest domestic passenger air transport market, recorded the strongest growth. Traffic expanded by 9.5% reaching 85.8 billion passenger-kilometres in 2012. Domestic air travel in Brazil grew by 8.6%. The United States, with over 900 billion passenger-kilometres, remains the world’s largest domestic air travel market albeit passenger-kilometres increased only by 0.8%.

Figure 1.14. **World total air passenger traffic – international and domestic**
Billion passenger-kilometres



Source: Based on IATA Annual Review 2013 and ICAO Annual Report of the Council 2011. Data for 2012 a preliminary estimate.

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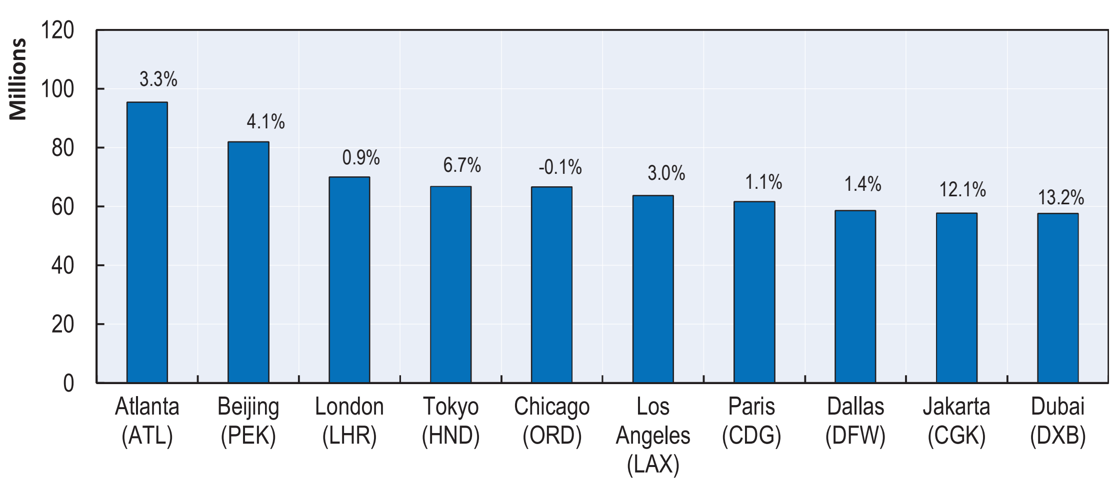
Total international passenger traffic increased by 6% in 2012. Middle Eastern carriers recorded the strongest international passenger-kilometre growth in 2012 (15.4%), followed by Latin America (8.4%) and Africa (7.5%), according to the International Air Transport Association's (IATA) preliminary release. In terms of number of passengers, Airport Council International's (ACI) preliminary data also show the highest growth for Middle East airports (12%). The number of passengers in Asia Pacific and European airports increased by 5%, while in North America growth was just over 1%.

Figure 1.15. **Top 10 busiest airports in 2012**
Number of passengers and % change over previous year



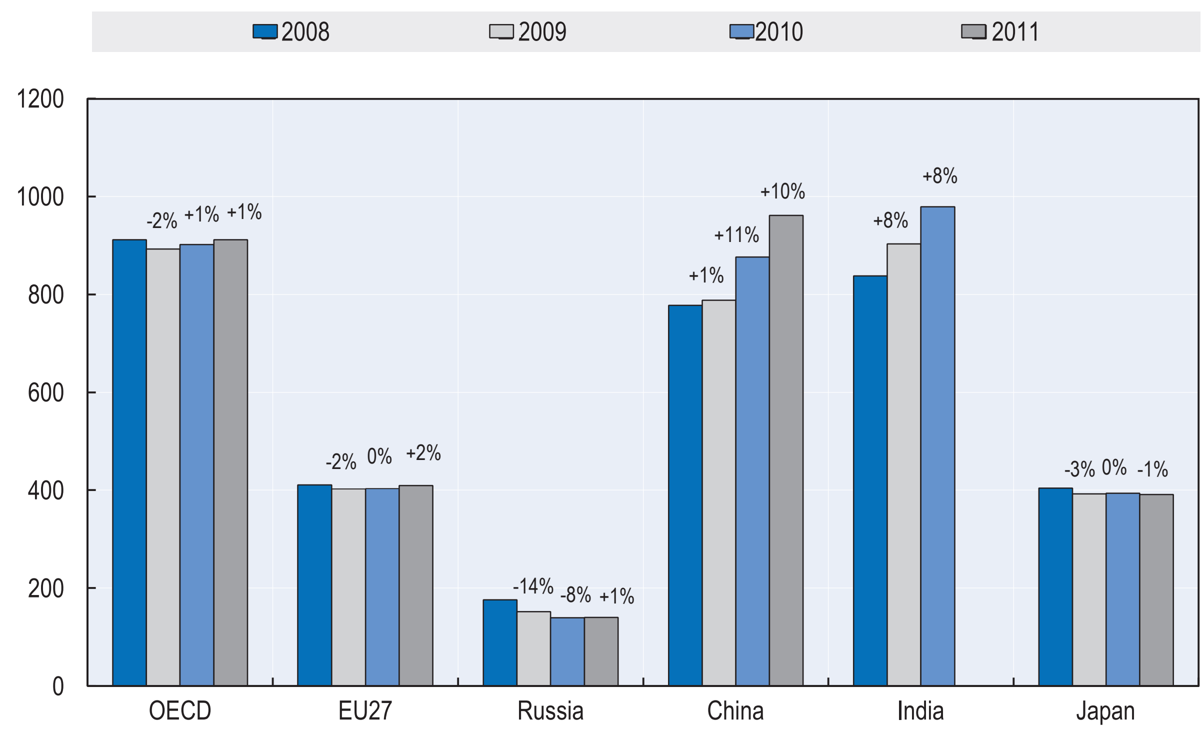
Source: Airport Council International Media Release

StatLink http://dx.doi.org/10.1787/888932944084

The economic crisis had a relatively small impact on *rail passenger transport*. Rail passenger-kilometres fell around 2% in the OECD countries in 2009 after which the volume recovered back to the pre-crisis levels by 2011. In the European Union, passenger-kilometres stagnated in 2010 after falling 2% in 2009. In 2011, rail passenger-kilometres increased again by 2%, reaching the pre-crisis levels. There are marked differences between individual countries. Preliminary data from our quarterly database show that the overall passenger rail traffic for the EU area has remained stable in 2012 at near pre-crisis levels, measured in passenger-kilometres.

Outside Europe, available rail passenger-kilometres data for Russia and Japan show close to zero growth in 2011. Rail passenger-kilometres continue to show strong growth in China and India with 10% and 8% increase respectively in 2011 compared with 2010. To put these figures into perspective, the annual growth of passenger-kilometres in these two countries equals to 40% of the total rail passenger transport in the EU in 2011. India and China further account for nearly 70% of the estimated global rail passenger transport.

Figure 1.16. **Rail passenger traffic**
Billion passenger-kilometres and annual % change

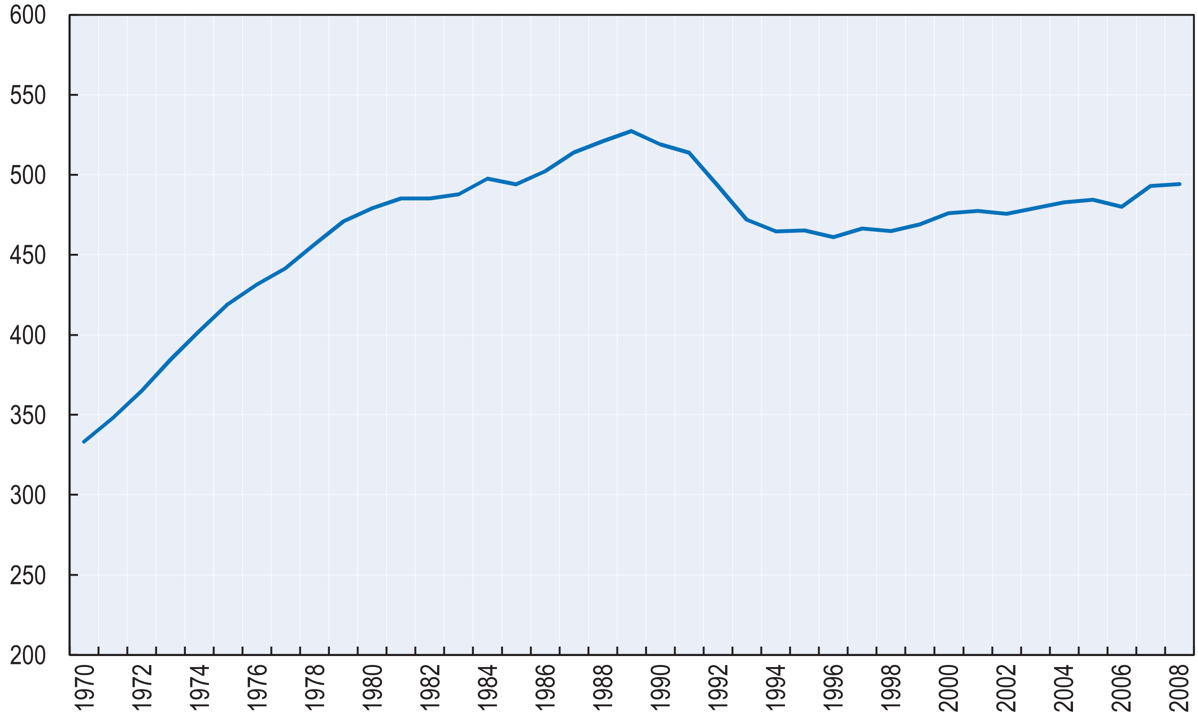


Note: 2011 data for India are not available. Japan 2011 estimate based on ITF quarterly statistics.

StatLink http://dx.doi.org/10.1787/888932944103

Data on buses and coaches are less detailed. In the European Union, *bus passenger transport* experienced high growth rates in the 1970s and the 1980s. Recent data suggest a mix of trends in the EU countries. In 2011, bus transport grew in France (2.4%), Italy (1.0%), Latvia (0.3%), Lithuania (2.2%), Norway (4.8) and Spain (9.5%); while it declined in Bulgaria (-1.2%), Croatia (-4.2%), Denmark (-1.2%), Poland (-4.4%), Romania (-1.5%) and the United Kingdom (-4.4%). Outside Europe, passenger-kilometres grew in Australia (2.3%), Mexico (3.3%) and the United States (0.1%) and fell in the Russian Federation (-1.5%).

Figure 1.17. **Passenger transport by bus in the EU**
Billion passenger-kilometres



Note: European Union excludes Ireland, Luxembourg and Malta.

StatLink http://dx.doi.org/10.1787/888932944122

NOTES

1. Figures in this paragraph are from *World Bank Global Economic Prospects June 2013*, *Table 1*.

2. Financial Times, 10 July 2013 – http://www.ft.com/intl/cms/s/0/ab4a801c-e8a0-11e2-aead-00144feabdc0.html#axzz2YcmhyDda).

3. Financial Times, 28 July 2013 - http://www.ft.com/intl/cms/s/0/2f018d1c-f475-11e2-a62e-00144feabdc0.html#axzz2bGZUSD00.

4. However, in the highest income economies there are signs that at least some forms of mobility, particularly car use, are now growing less quickly than GDP, whereas the connection between growth and freight transport remains tight. Recent evolutions of and potential impacts for future car use in high income economics are discussed separately in chapter Car use in high-income economies.

5. See http://krugman.blogs.nytimes.com/2013/07/03/unprecedented-globalization/.

6. For a more elaborate discussion, see http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP201309.pdf.

7. Two lines are shown for the United States, with the upper one assuming car occupancy rates remain at the level measured in 2001, and the lower one assuming they decline as of 2001 to the level observed in the most recent household travel survey. The true path likely is in between those two bounds.

8. For example, incomes in many U.S. city cores are relatively low, and more generally the sum of commuting and housing costs in urban centres may not differ strongly from that in suburbs.

9. Elasticities are not constant over time, although data limitations often lead to time-independent estimates. Whereas some studies have found a declining elasticity of mileage with respect to the fuel price, more recent evidence suggests a renewed increase.

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CHAPTER 2. TRANSPORT DEMAND IN THE LONG RUN

This chapter presents an overview of long-run scenarios, up to 2050, on the development of global passenger transport and freight volumes. The transport scenarios are translated into CO_2 emission scenarios by applying different transport technology paths. The chapter also introduces a Latin America urban transport case study that explores specific characteristics of mobility development in developing countries. The urban model analyses the impact of land use, infrastructure and fuel pricing policy on the development of urban mobility in Latin America, improving the evidence base for scenario analysis. Finally, the chapter presents regional implications of different development paths for passenger and freight transport and CO_2 emissions.

Overview of global scenarios to 2050

The International Transport Forum (ITF) *Transport Outlook* presents long run scenarios, up to 2050, on the development of global passenger mobility and freight volumes. Scenarios on passenger mobility are constructed using ITF modelling tools, which are fully revised compared to earlier editions of the *ITF Transport Outlook*. The tools are fully compatible with the International Energy Agency's Mobility Model (MoMo), version 2013, and partly draw from its database. Freight transport volume projections are based on IEA MoMo. A detailed description of different scenarios can be found in the Reader's Guide.

Population and Gross Domestic Product (GDP) scenarios are a key driver of the passenger and freight transport scenarios, particularly given the long run and aggregate modelling approach adopted. The 2013 *ITF Transport Outlook* uses new GDP scenarios, developed by ITF. These too are MoMo-compatible. We discuss the main features of these projections below.

GDP volumes in the *ITF Transport Outlook* are noted in constant 2007 US dollars expressed in purchasing power parity (PPP) terms. This allows for accurate comparison of actual production volumes between countries based on differences in real costs and controlling for inflation. More specifically, using PPP equalised currencies better illustrates the differences in the real value of developed and developing country economies since it corrects for the generally lower price of non-tradable goods in developing countries.

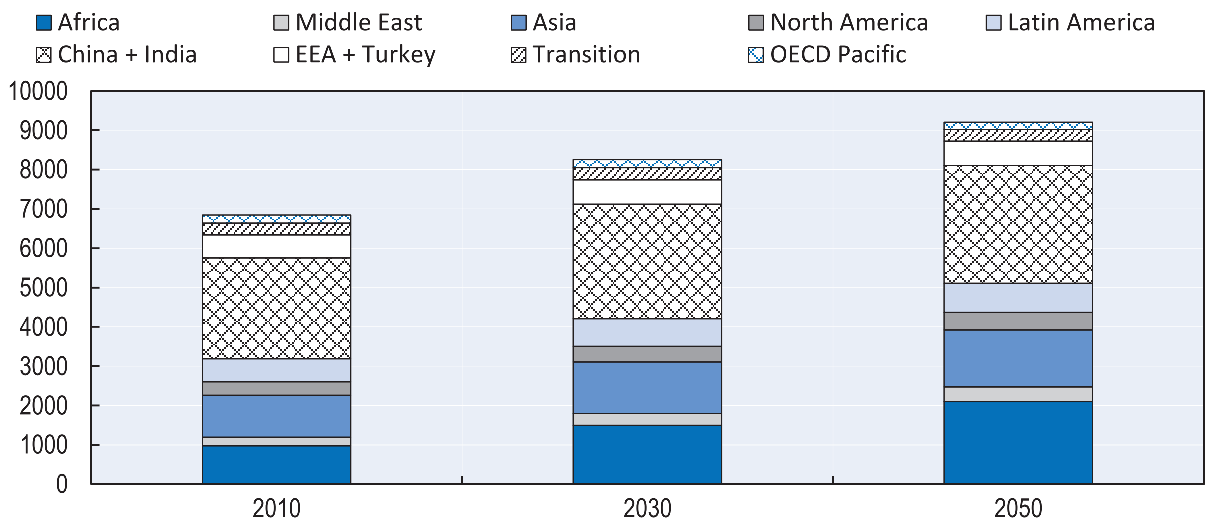
We present the world economy over the period 2010–2050 using two different regional aggregations. In order to illustrate the dimensions of the scenarios we arrange countries by development status and relative size in the global economy (OECD, emerging economies and the rest of the world) and into nine geographical groupings (Africa, Asia, China + India, EEA + Turkey, Latin America, Middle East, North America, OECD Pacific, and the Transition Economies).

The transport scenarios are translated into CO_2 emission scenarios by applying transport technology paths. The technology assumptions and emission calculations are taken from the International Energy Agency's MoMo model and the World Energy Outlook. The scenario used is the New Policies Scenario, which corresponds to a context in which broad policy commitments and plans that have been announced by countries are implemented. Under this scenario fuel economy standards are tightened and there is progressive, moderate uptake of advanced vehicle technologies (IEA, 2013 and Dulac, 2013). The result is a slow but sustained decrease in fuel intensity of travel and carbon intensity of fuel for all vehicles. Such a decrease is in general higher within the OECD region.

Global demographic scenario

Population projections are taken from the UN World Population Prospects, 2012 Revision, medium variant. Urban population projections come from the UN World Urbanization Prospects, 2011 Revision, medium variant. According to these, the world population is expected to grow to about 9 billion people in 2050, from 6.8 billion in 2010, see Figure 2.1. Population growth is strongest in Africa, the Middle East and Asia. It is weakest in the European Economic Area (EEA) and Turkey, the transition economies and the OECD Pacific.

Figure 2.1. **Population by region, 2010, 2030 and 2050**
Millions



Source: Based on UN World Population Prospects (2012 Revision). Data are ranked by declining growth rates from bottom to top.

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Growth rates are lower on average in OECD countries, resulting in ageing populations given the migration scenarios assumed by the United Nation's (UN) Moderate population scenario. Some non-OECD economies, including transition economies and China, also experience rapid ageing by 2050. Table 2.1 displays the share in total population of people aged 65 years or more, by region.

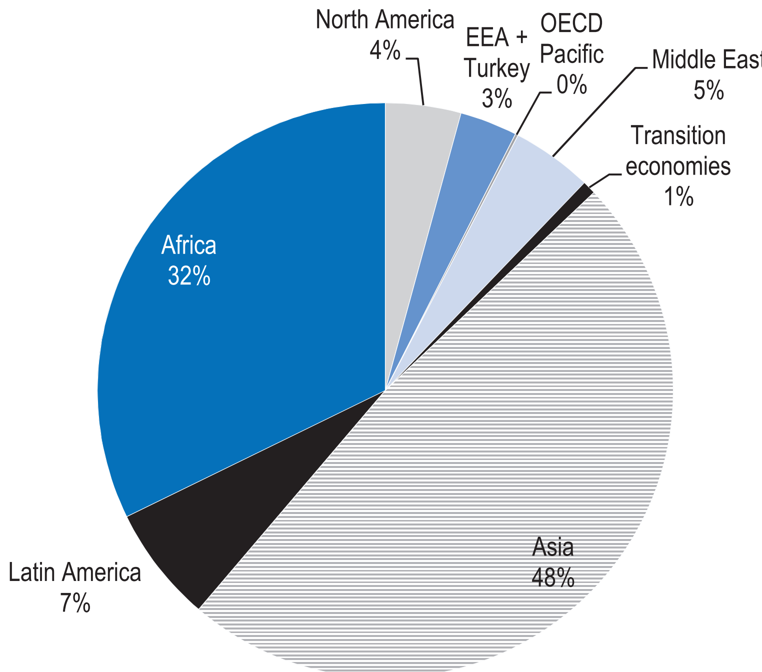
Table 2.1. **Share of total population aged 65 years and over, by region**
Lowest to highest share

	2010	2030	2050
Africa	3.5	4.5	6.5
Middle East	4.1	6.9	13.9
Asia	5.4	9.4	15.6
China + India	6.6	12.2	18.7
Latin America	6.8	12.1	19.1
Transition	11.4	16.4	20.4
North America	13.2	20.2	21.6
EEA+Turkey	16.0	21.9	26.9
OECD Pacific	18.7	26.8	32.5

Source: Based on UN World Population Prospects (2012 Revision).

Between 2010 and 2050, the share of urban population in total world population will grow from 50% to 70%. Under the UN scenario, most of this rural-urban shift will take place in the developing world: of the almost 2.7 billion *additional* urban dwellers, 92% will live in developing countries (Figure 2.2).

Figure 2.2. **Share of world urban population growth by region of the world (2010-2050)**



Source: Based on UN Urbanization Prospects (2011 Revision).

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Global GDP scenarios

The GDP scenarios are the result of assumptions about institutional developments within and between countries and the extent of technological diffusion. Technological diffusion is the major driver of long-term growth including in countries undergoing one-off readjustment, once a balance in capital stock has been attained. The length and extent of transition to a balanced global economy will impact global production and transport volumes as well as the geographic distribution of transport activity.

Global economic growth since the financial crisis has been slow, and uncertainty about medium term developments is high. The long run GDP scenarios chosen for the *ITF Transport Outlook* are at the lower end of the spectrum of available growth projections. They reflect the consequences of a deep shift in the world economy which is yet to be completed.

On the basis of standard growth theory a slowdown of world growth is to be expected but a more drastic deceleration of growth could unfold if the transition is not managed successfully. While this is not necessarily the most likely scenario given past strong growth in economies such as China and India, in times of uncertainty such an outcome is worth considering. An unsuccessful transition from investment led (and debt-financed) growth in the developing world to more consumer driven growth could suppress growth prospects also in other regions of the world.

Growth rates correlate strongly with initial per capita income levels and low income countries generally grow faster as they catch up with more developed countries. Initially, capital stocks of countries are low. As these rise more productive capacity is released as the economy moves to an industrial and service sector base. During rebalancing more capital is accrued to workers with more productive labour and higher wages result. At this stage decreasing returns to capital set in, which generally increases the reliance of further economic growth on the productivity of labour. Demographics can impose limits to growth as populations age and population growth slows or even declines. Often high growth regions enjoy a demographic dividend, in which a young population enjoys labour productivity improvements which quickly translate into wider economic growth.

A commonly accepted way to improving economic productivity is better regulation of both domestic and international product and service markets, promoting competition and rapid diffusion of technologies. The long-term growth path of countries thus depends on the extent to which these drivers are supported (Johansson et al. 2013). The transition that characterises a large part of the global economy is not only one of rebalancing but coincides with increasing unbundling of production geographically (with increases in the distance component per unit of value-added).

Growth prior to the economic crisis coincided with an unprecedented boom in international trade and transport. Whereas (investment fuelled) economic growth was a cause of higher trade, it has also been supported by the lowering of effective transport and communication costs and closer co-operation between national economies. In the future a further unbundling of global production chains is likely to involve more industrial sectors and more country pairs. Transport systems will remain central to economic growth processes. If growth becomes less dominated by investment, the role of lower trade costs in terms of communication, travel and freight transport will come increasingly to the fore.

The modelling exercise which underlies the *ITF Transport Outlook* scenarios views economic growth and population dynamics as exogenous. Assumptions about transport are however implicitly included in the GDP scenarios. Both GDP scenarios and baseline assumptions on population dynamics and urbanisation imply continuous and rapid increases in the demand for transport. This also means that if projections of yet higher output are to materialise infrastructure will be strained.

> "…the entire trend in transport infrastructure will have to be revised upwards, rather than being based on extrapolation of the past."
>
> Amartya Sen in his 2013 International Transport Forum Summit keynote (Sen, 2013)

Two GDP scenarios are used: *a baseline scenario* and a *low growth scenario*. In the baseline, interpreted as the more likely scenario, world GDP grows by 3.2% per year on average between 2010 and 2050 (in PPP terms, 2007 US dollars). In the low growth scenario, average annual growth is 2.4%. World GDP grows by a factor of 3.6 in the former, and 2.6 in the latter. Details on the GDP scenarios are provided later in this chapter, here we summarise key features.

World average per capita income grows from 10 thousand USD (in 2007 USD at PPP) to 20 thousand USD in the low scenario and 28 thousand USD in the high scenario by 2050. This means that a larger share of the world population will be enjoying middle income status.

In the baseline scenario, world GDP growth declines from around 3.5% per year in the near term (a level in line with those observed in the recent past) and declines gradually to reach around 2.7% as of 2040. The higher growth is the result of rising capital stocks and increasing labour productivity in emerging economies. As these economies mature and capital stocks balance, growth is mainly driven by diffusion of technology. Frontier countries, defined as a group of high-tech OECD economies, are the source for innovation and technology improvements which diffuse through the world economy through knowledge sharing and trade in machinery and other inputs.

The low growth scenario illustrates the downside risk associated with the transition in emerging economies from export- and investment- (and debt-) financed growth to one led by consumer demand. The result is slower growth in the emerging economies which reverberates throughout the world economy.

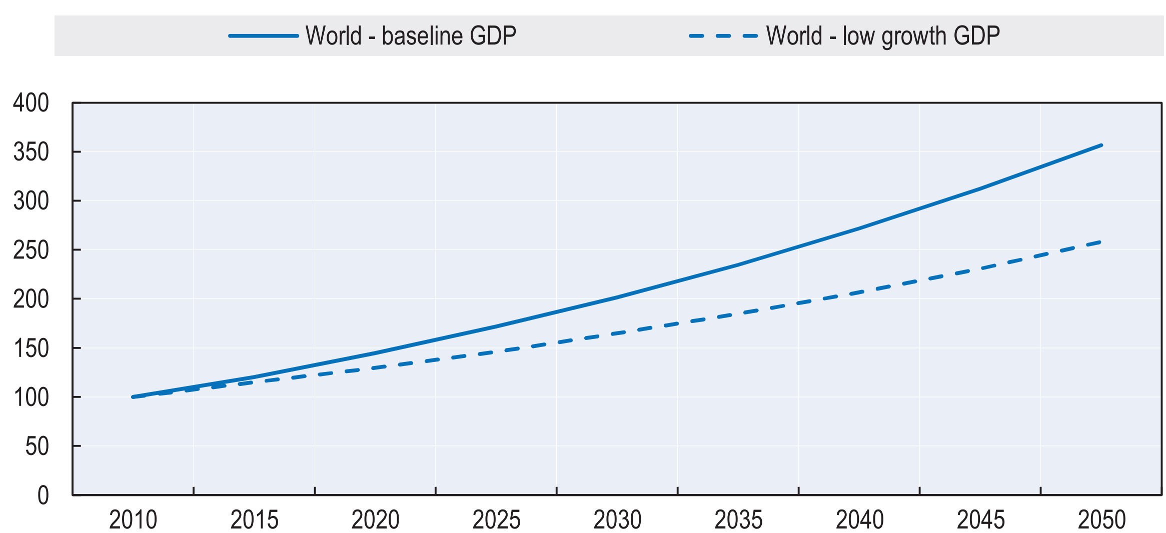
Figure 2.3 shows the evolution of world GDP in the baseline and low growth scenario. It illustrates the (sizeable) difference between world output growth between the scenarios. Figure 2.4 presents a breakdown for three regions: the OECD, the emerging economies, and the rest of the world. It illustrates that the lower growth is to occur mainly in the emerging economies. Figure 2.5 displays the evolution of the shares of world GDP generated in the same three regions.

The low growth scenario reflects what may happen when misgivings about growth potential and conversion of growth models as they have appeared recently in the public debate actually materialise and persist. We do not take it to be the most likely outcome, but rather treat it as a lower bound. Growth performance in the vicinity of the baseline is seen as more probable.

The baseline scenario of GDP growth in the 2013 *ITF Transport Outlook* is similar in terms of 2050 results to that of the 2012 edition (which already considered a permanent impact of the financial crisis rather than a bounce-back to pre-crisis growth paths), whereas the low scenario is considerably more pessimistic for non-OECD regions (see Figure 2.6). The low growth scenario in 2012 reflected a slower than expected return to pre-crisis growth patterns, whereas the 2013 low growth scenario captures prolonged slower growth due to difficulties with moving to a less export- and investment oriented growth approach in emerging economies.

In both growth scenarios, faster growth outside the OECD results in a rapid shift of economic mass and an increase in the share of world GDP produced outside of the OECD (see Figure 2.5). This increase is considerably slower in the low GDP scenario, however. In the baseline, OECD and emerging economies produce equal shares of world GDP by 2030; OECD and non-OECD economies as a whole produce equal output shares by 2020. With low growth, OECD and non-OECD outputs will level only by 2050. Note that the relative impact of the low growth scenario is larger for non-OECD economies. This slow growth has direct effects on the development of transport volumes.

Figure 2.3. **World GDP volumes**
2010=100



Source: Based on OECD (2012), Conference Board (2012) and IMF (2013).

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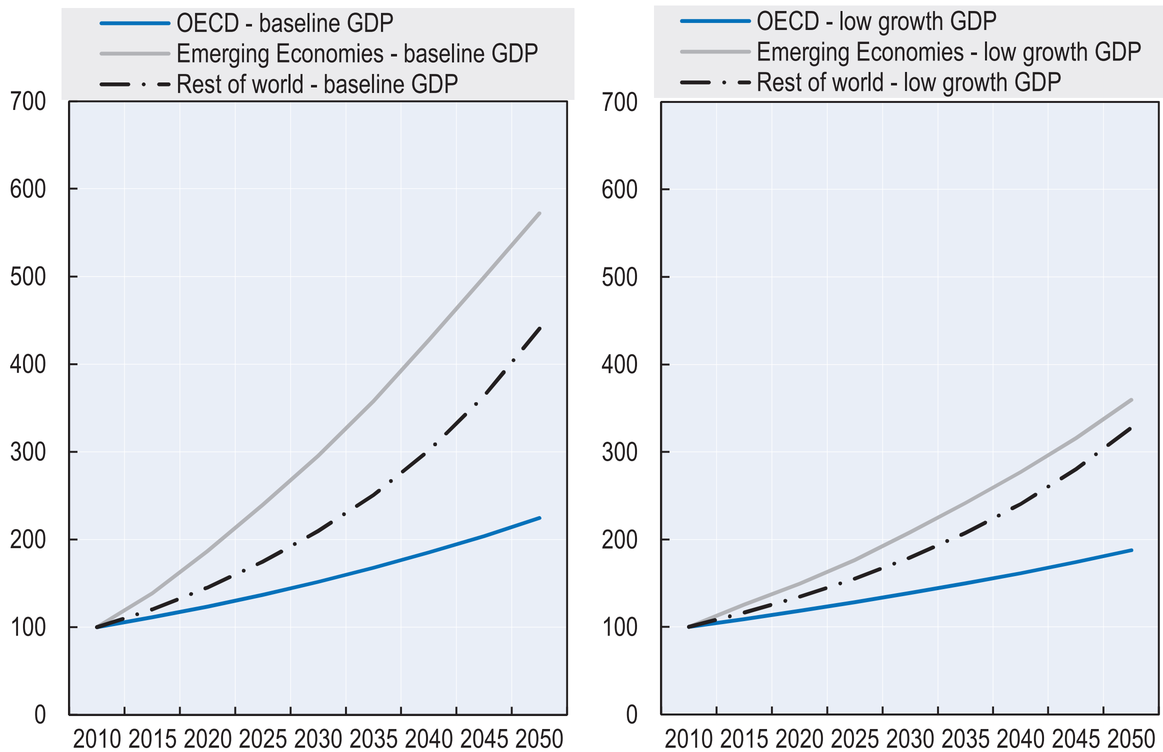
Figure 2.4. **GDP Volumes in OECD, the emerging economies and the rest of world**
2010=100



Source: Based on OECD (2012), Conference Board (2012) and IMF (2013).

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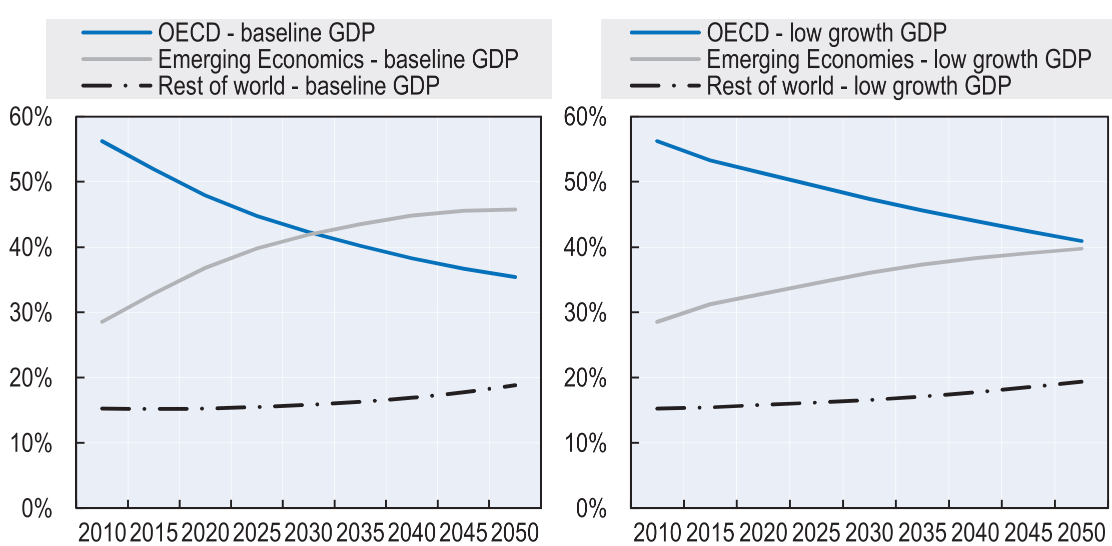
Figure 2.5. **Share of world GDP volumes generated in OECD, the emerging economies and rest of world**

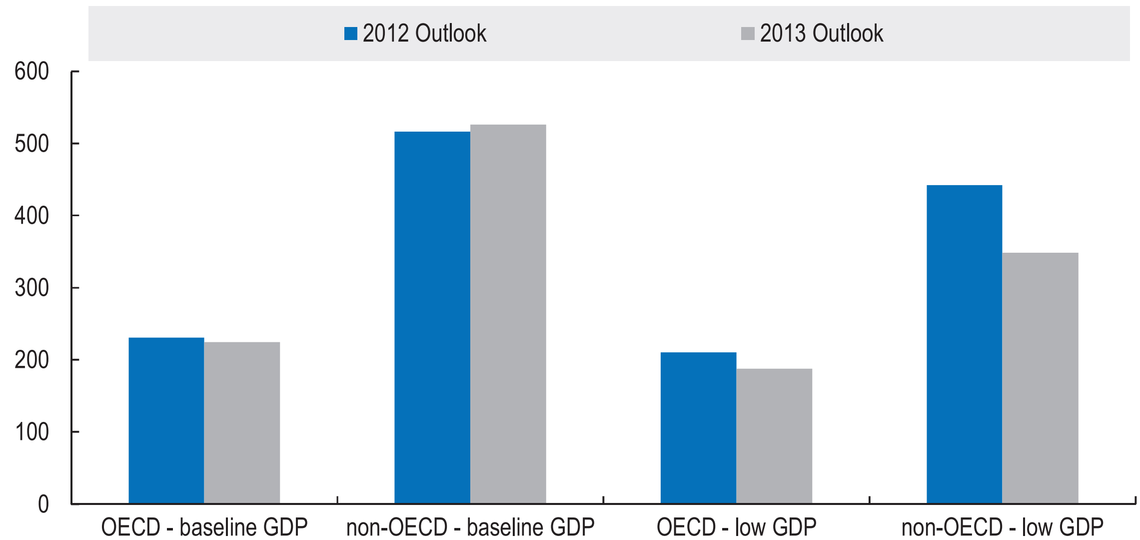
Percentage



Source: Based on OECD (2012), Conference Board (2012) and IMF (2013).

StatLink http://dx.doi.org/10.1787/888932944217

Figure 2.6. **World GDP in 2050, baseline and low GDP growth scenarios**
2010=100



Source: Based on OECD Economic Outlook (2012), IEA MoMo, Conference Board (2012), IMF (2012) and IMF (2013).

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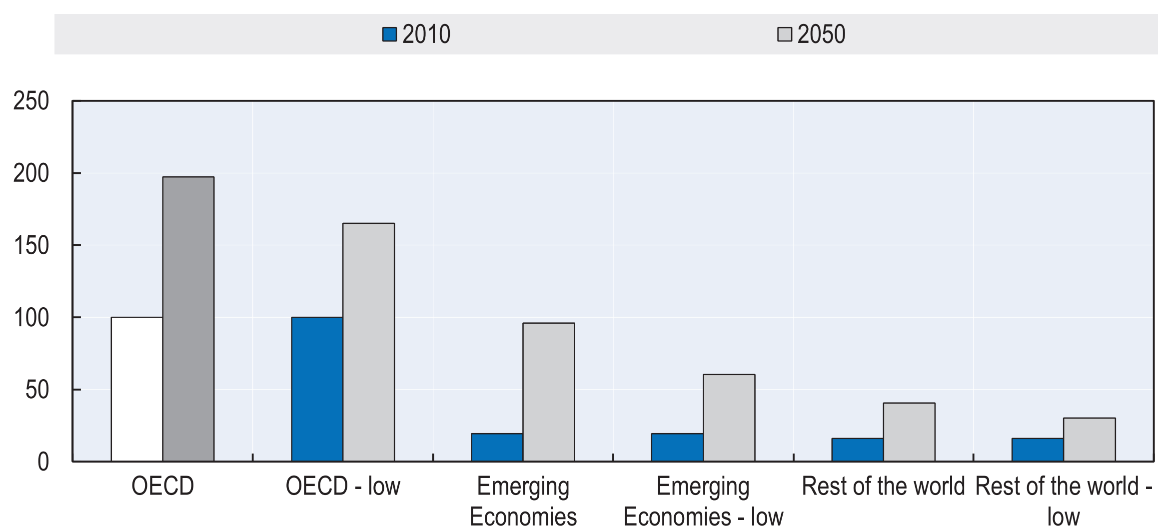
Figure 2.7. **Per capita GDP in OECD, the emerging economies and the rest of the world, baseline and low growth**
OECD 2010=100



Source: Based on OECD (2012), Conference Board (2012) and IMF (2013).

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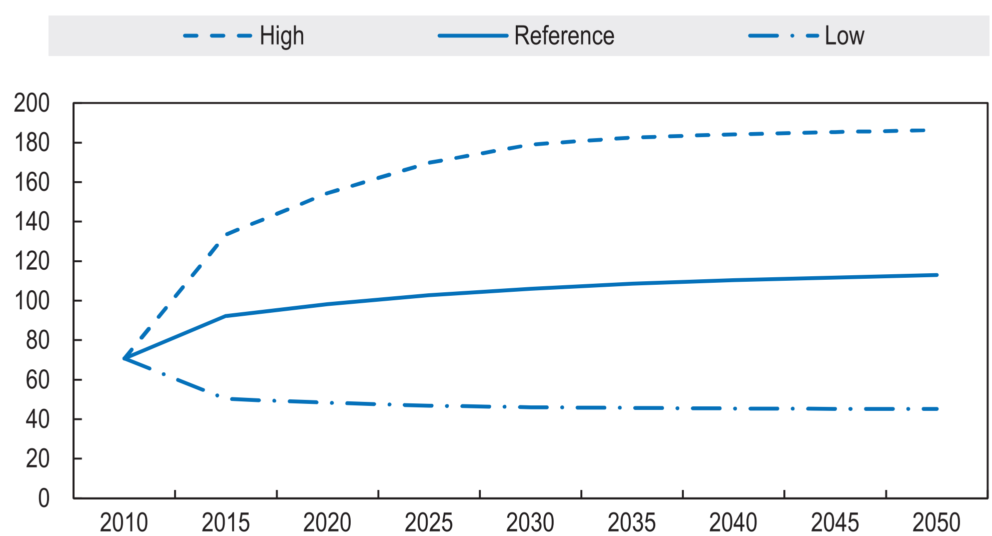
The combined population and GDP scenarios imply global convergence of GDP per capita (see Figure 2.7). Convergence is slower in the low growth scenario, but the dispersion between countries of per capita GDP declines in both scenarios. Per capita GDP in the emerging economies approaches levels currently observed in the OECD by 2050, meaning that transport demand and modal composition may approach current OECD levels, at least if policies allow similar demand-driven development of mobility.

With low GDP growth, per capita GDP remains well below current OECD levels in the emerging economies and *a fortiori* in other non-OECD economies.

Box 2.1. **Oil price scenarios**

We constructed 3 oil price scenarios based on work by the International Energy Agency (IEA) and United States Energy Information Administration (EIA). In particular, our reference price scenario corresponds to the New Policy Scenario of the IEA World Energy Outlook 2012 (IEA, 2013) and is also the reference case scenario used in the Mobility Model of the IEA. The high and low scenarios are based on the continuation to 2050 of trends presented in the 2011 International Energy Outlook of the EIA. As such, they represent strong deviations from the reference case. In the reference case the oil price reaches 113 real USD per barrel by 2050, which is approximately 60% above price levels in 2010, and lies at around 100 real USD in 2020. In the high scenario the oil price reaches 186 real USD per barrel in 2050 (160 real USD in 2020) and in the low scenario it drops to approximately 42 real USD per barrel by 2020 and stays at that level through 2050. It should be noted that oil prices have been characterised by instability over the last 40 years and that this is likely to continue to be a feature of prices to 2050. The lower scenario relates to long-run elasticities of supply and demand and the potential for new and unconventional sources of oil, oil substitution and energy efficiency to influence prices. The upper scenario relates to short-run elasticities of supply and demand in the presence of market power and political constraints on supply (ITF 2008).

Figure 2.8. **World oil price: high, reference and low scenarios**
Real 2005 USD



Source: Based on International Energy Agency and United States Energy Information Administration data.

StatLink http://dx.doi.org/10.1787/888932944274

Connections between population, urbanisation, GDP and transport

Population growth generates rising mobility needs. Population and urbanisation trends indicate that rising mobility demand will be concentrated in urban agglomerations and in particular in those of the developing world.

Growth in per-capita income levels also generates transport demand and has in particular a positive effect on the ownership of private vehicles. This in turn tends to increase reliance on private vehicles to meet growing mobility demand. The elasticity of private ownership with respect to per capita GDP follows an S-shaped curve (see Figure 2.17), with ownership rising slowly with income at first, accelerating as income rises through medium levels and slowing again as incomes reach high levels.

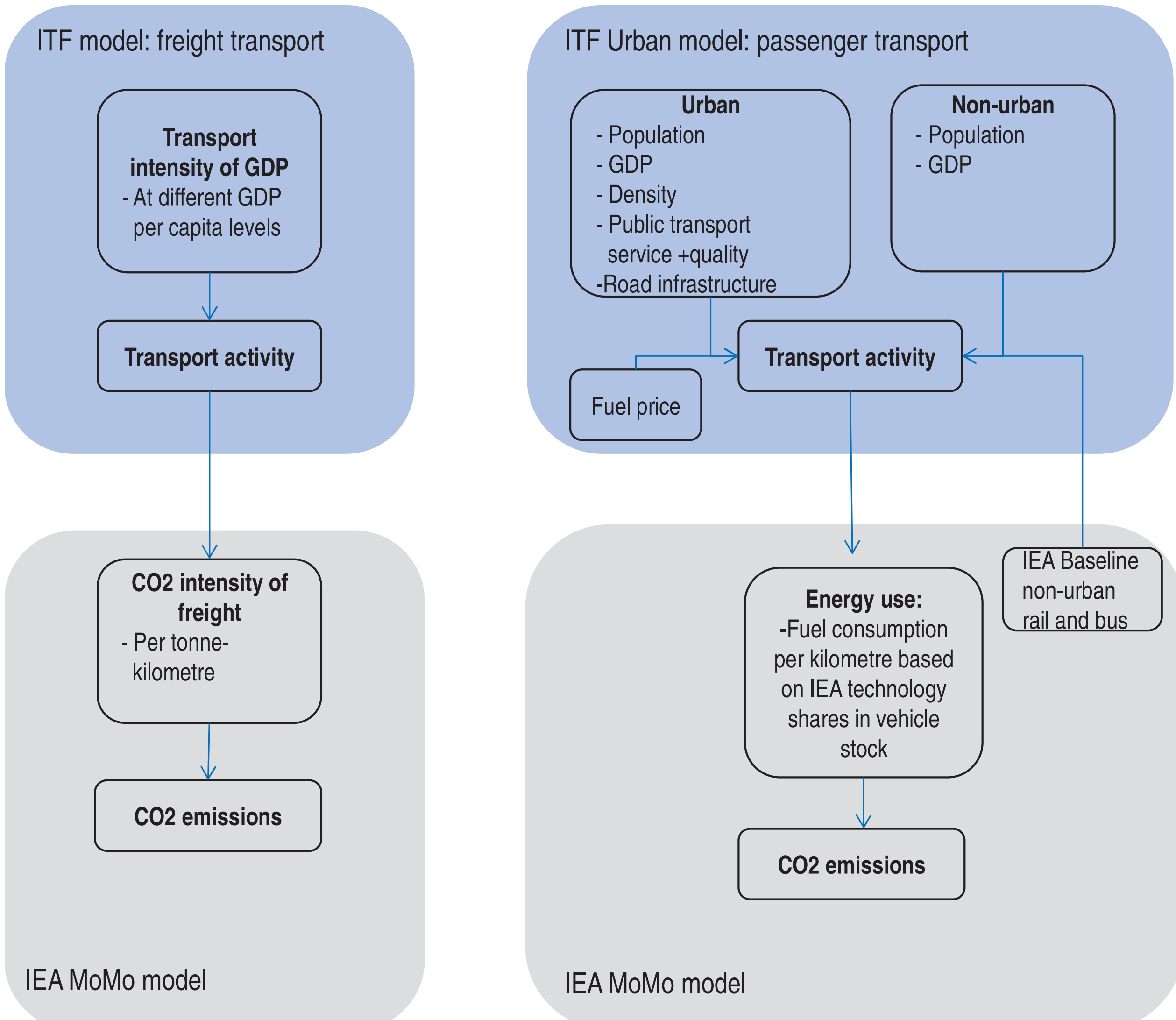
High concentration of population allows urban agglomerations to offer transport alternatives to private vehicles. Providing public transport services tends to slow down the increase in car ownership and use as incomes grow. Cities hence have the potential to embark on less private ownership-oriented pathway and rely more on other modes to meet growing mobility demands.

Global passenger trends will be increasingly defined by the modal distribution in urban areas, particularly in developing countries. As discussed in detail below, urban form and infrastructure expansion will play an important role in determining the relative share of competing modes in meeting rising passenger transport demand in urban centres. Fuel prices will also influence the volumes and modal shares of passenger transport. These have an effect in both urban and rural areas, although their effect is intensified at the urban level due to the higher number of transport alternatives.

Freight traditionally correlates strongly with GDP especially during early stages of economic development, and we assume a weaker relation as GDP rises. The surface freight transport scenarios show changes in total regional surface freight volumes (measured in tonne-kilometres) following either a unitary relationship to high and low GDP scenarios or a slowing relationship between surface freight and baseline GDP growth. The latter is more likely during a dematerialisation of the economy as incomes increase.

The connection between trade volumes and GDP in our scenarios is largely implicit. Higher GDP is associated with more trade. In the 15 years before the crisis of 2008, trade grew very quickly, with growth strongly concentrated in a small number of trade routes between North America, Western Europe and Asia, and with particularly strong growth in exports of electronics from China and in raw materials trade. Future trade growth is likely to be less concentrated on these routes and less skewed towards these commodity types. Unbundling of production along value chains may also drive trade growth and contribute to output growth, if supply chain resilience is maintained and trade costs kept low and predictably stable.

Figure 2.9. **Schematic description of the model**



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Global transport and CO_2-emission scenarios to 2050

Passenger transport volumes and CO_2-emissions

Figure 2.10 summarises growth in vehicle-kilometres for passenger traffic between 2010 and 2050 for the OECD, non-OECD economies and the world as a whole, using both the baseline and low growth scenarios for GDP. Figure 2.11 shows the corresponding levels of CO_2-emissions on the basis of the IEA's business-as-usual (New Policies) scenario for the development of vehicle technology.

The figure shows the range of outcomes from the alternative transport scenarios modelled. The lowest passenger travel (vehicle-kilometres) growth scenario assumes high fuel prices and urban transport development that is transit-oriented with slow expansion of road infrastructure. The highest growth occurs when fuel prices are low and urban transport development is private-vehicle oriented, with strong expansion of road infrastructure. The central scenario assumes reference fuel prices while public transport supply and road infrastructure grow in pace with population growth, resulting in stable levels of infrastructure per capita. Detail on the different scenarios is found in the discussion of urban transport scenarios below.

Figure 2.10. **Vehicle-kilometres for passenger transport, 2050**
2010=100

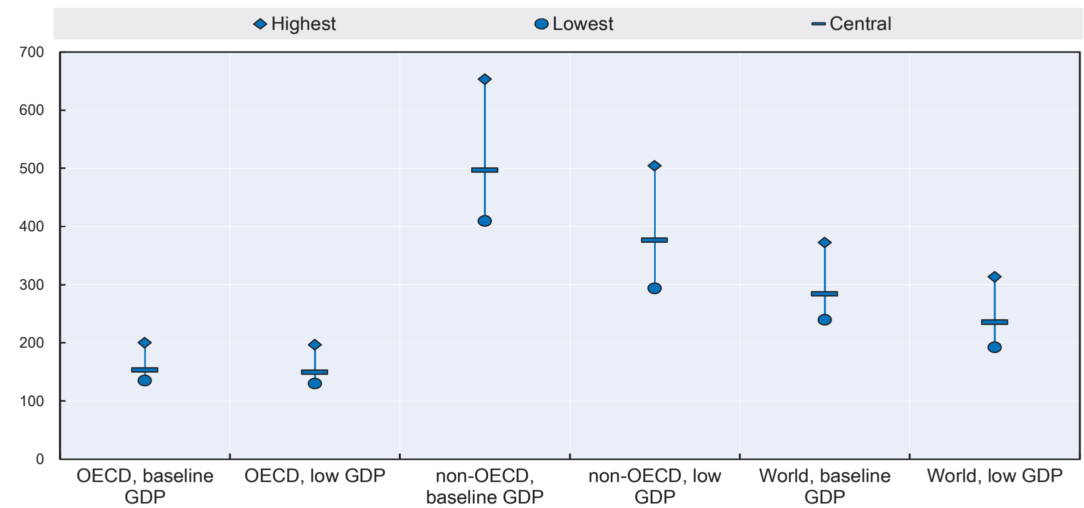

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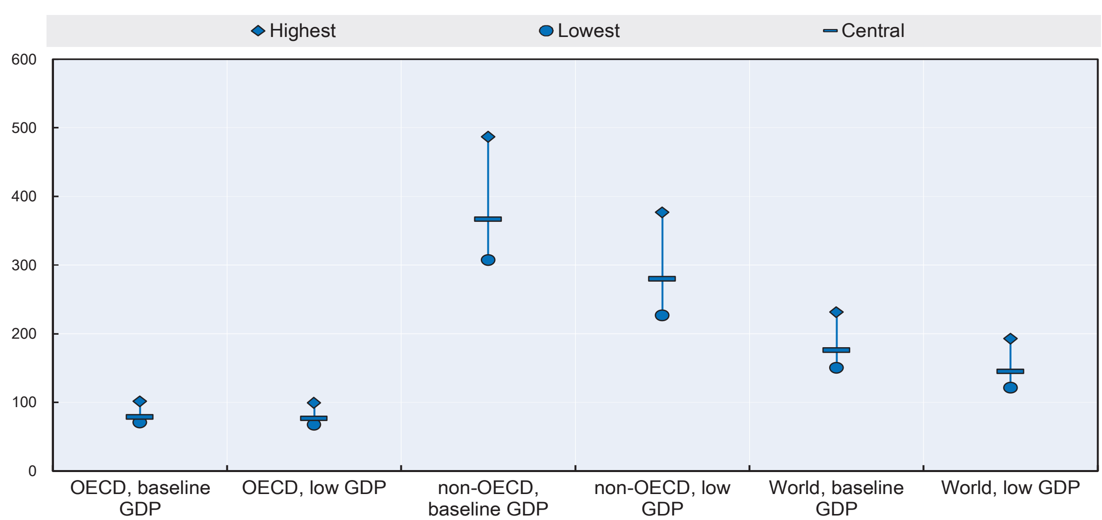
Figure 2.11. **CO_2-emissions from passenger transport, 2050**
2010=100



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Depending on the evolution of GDP, fuel prices and urban transport development, global vehicle-kilometres for passenger transport are set to grow by a factor of 1.9 to 3.7 from 2010 through 2050. In the central scenario the growth factor is 2.4 for low GDP and 2.9 for baseline GDP.

Growth is much larger outside the OECD region than within it. This is because both GDP grows faster and because transport demand increases more strongly with GDP outside of the OECD.

Baseline and low GDP scenarios produce similar outcomes for the OECD, with around 55% growth of vehicle-kilometre volumes between 2010 and 2050. This similarity occurs because the difference between the GDP projections is small for the OECD and the elasticity of vehicle-kilometres with respect to GDP is low.

Outside of the OECD, larger differences between the low and baseline projections of GDP and a higher elasticity of vehicle-kilometres with respect to GDP lead to much bigger differences in the passenger transport volume projections: for baseline GDP the central scenario results in five-fold growth of vehicle-kilometres, whereas for low GDP the growth factor is 3.8. Combining baseline GDP growth with low fuel prices, low public transport expansion, and car-accommodating urban transport policies would lead to vehicle-kilometre volumes increasing 6.5 times. The same economic growth under a context of high oil prices, transit-oriented policies and low road infrastructure expansion would result in a growth of vehicle-kilometres of 4.1 times over 2010 levels.

Applying the IEA-MoMo New Policy Scenario for the evolution of vehicle technology to these transport volumes leads to increases of CO_2 emissions for passenger transport from 20% in the lowest scenario with low GDP growth to 130% in the highest scenario with baseline GDP growth. The central scenario results in 50% emissions growth for the low GDP and 80% for the baseline GDP. The global results reflect declining emissions in the OECD (by about 20% in the central scenario), and rising emissions outside of it, by 190% under low GDP growth and 280% under baseline GDP growth in the central scenario.

Comparing CO_2 and vehicle-kilometre growth, it is clear that emissions grow more slowly than transport volumes. In the OECD, vehicle-kilometres grow and emissions decline. Outside the OECD, emissions grow only three-quarters as much as vehicle-kilometres. The declining CO_2-intensity of vehicle-kilometre volumes is to a very large extent the consequence of technological change. Changes in modal split, measured in vehicle-kilometres, and changing weights of regions within the broad OECD and non-OECD categories are of minor importance. This holds for all scenarios.

Surface freight transport volumes and CO_2-emissions

Figures 2.12 and 2.13 show the growth of total surface freight volumes (including light commercial vehicles) and the emissions thereof for the OECD and non-OECD economies, and the world, between 2010 and 2050. The scenarios presented correspond to a high, central or low correlation with GDP and the baseline and low GDP growth scenarios discussed in more detail in Appendix 1. The CO_2 emissions per unit of transport volume are based on IEA New Policy Scenario developments in vehicle technology.

In the high freight scenario surface freight develops in line with GDP – assuming a unitary relationship. In the low scenario, there is decoupling from GDP growth which can occur with a dematerialisation of GDP. The central scenario differs for the OECD and non-OECD economies and rests on the assumption that the transport intensity of GDP decreases with rising per capita income levels. More details of the scenarios are given below in Section discussing regional implications of different development paths at the end of this chapter. Lower vehicle technology improvements also lead to stronger growth in emissions from freight transport in all regions.

Surface freight growth ranges from 42% to 124% of 2010 levels in the OECD and between 100% and 430% in the non-OECD economies. CO_2emissions decrease by up to 4% in the OECD under a scenario of slow economic development and decoupling scenario, but increase up to 50% assuming stronger growth and a one to one relationship between GDP and freight transport. In the Non-OECD economies, emissions rise much more strongly, between 100% and 460%.

The modal share of rail transport in surface transport (road and rail) is assumed to increase slightly from 42% to 46% in the OECD but decrease from 58% to 46% in the non-OECD economies. Currently some non-OECD economies exhibit very high rail market shares. For non-bulk commodities the share is likely to decrease due to strongly increasing demand for more flexible road transport. In many places the commodity mix carried will primarily allow producers to pay the relatively higher per unit shipping costs by truck and increase the demand for reliability and timely delivery.

Baseline GDP growth and a strong stake of transport in growth can lead to global surface freight volumes increasing by up to 4 times between 2010 and 2050 and corresponding CO_2 emissions to increase 3.3 times. Under a low growth scenario, combined with the possibility of a declining intensity of freight transport in economic growth, global surface freight could be only 1.7 times higher in 2050 than 2010 with corresponding growth in emissions a factor of 1.4 times.

Figure 2.12. **Tonne-kilometres for surface freight transport, 2050**
2010=100

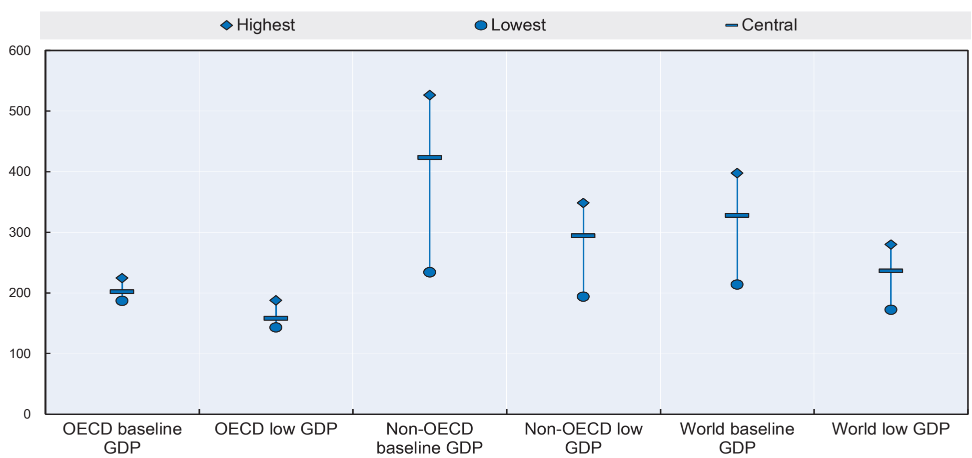

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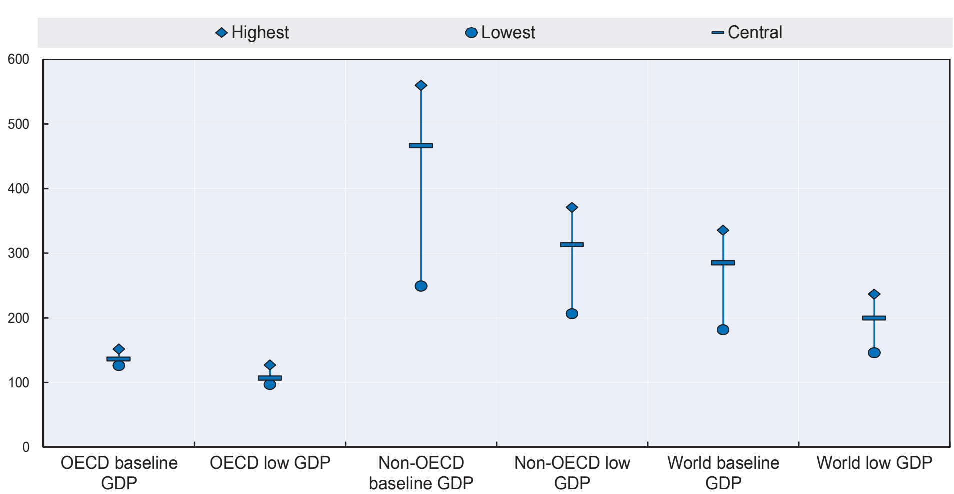
Figure 2.13. **CO_2-emissions from surface freight transport, 2050**
2010=100



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Total CO_2-emissions from passenger and freight transport

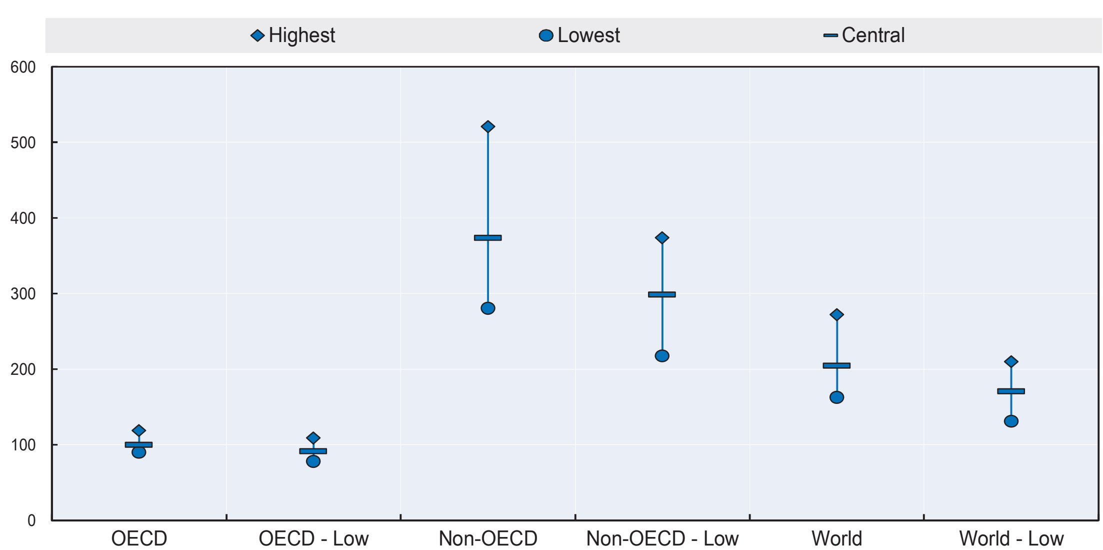
Overall transport volumes and CO_2 emissions from both passenger and freight transport will increase strongly between 2010 and 2050. This growth is much more pronounced in the non-OECD economies since this is where most economic growth will occur and transport correlates strongly with economic growth. Factors that impede or facilitate economic growth and the relationship with transport are captured by our choice of GDP scenarios and high, low and central transport scenarios.

CO_2 emissions will grow more slowly than transport volumes in part due to policies to improve fuel economy. These are generally more powerful than modal shift policies. In developing countries the impact of fuel economy improvement will be less marked. Improving fuel economy has the added benefit of containing the cost of mobility in times of high oil prices.

Globally, and for all scenarios considered, CO_2 emissions from freight and passenger transport are to rise between 30% and 170%. In the Non-OECD economies this range is considerably higher and lies between 120% and 420%. In the OECD we can expect a decrease of 20% in the lowest case and an increase of 20% in the highest case over the period 2010 – 2050.

The scenarios highlight the rising share of surface freight transport emissions in total surface transport emissions, particularly in the OECD. In 2010 emissions from surface freight are 35% of the total emissions in the OECD (Figure 2.14) and 46% in the non-OECD economies. By 2050 these figures change to between 40% and 49% in the OECD and 41% to 50% in the non-OECD economies, depending on the scenario. Exploiting cheap abatement options in the surface freight sector therefore can be expected to have large payoffs.

Figure 2.14. **CO_2 emissions from surface freight transport and passenger transport, 2050**
2010=100



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Urban transport scenarios for a middle-income region: Case study of Latin America

Increasing urbanisation with the proportion of the world population living in cities rising from 50% to 70% between 2010 and 2050, is a phenomenon mainly driven by the developing world.

A rising share of urban dwellers and faster growth in urban areas leads to strong concentration of GDP in cities. 74% of global growth between 2010 and 2025 is expected to occur in urban agglomerations in developing countries (McKinsey Global Institute, 2012).

As a consequence, global mobility trends will be increasingly defined by urban mobility outcomes, particularly in developing countries. Urban mobility policy will therefore be increasingly influential on the achievement of national and global sustainability goals.

Due to higher density of demand the scope for relying on public transport to meet mobility needs is broader in cities than elsewhere. Higher congestion levels also reduce the benefits of using private transport compared to situations where its use is less constrained by capacity limits. Urbanisation hence can result in a lower share of cars in meeting transport demand even if urban incomes are higher. However, realising this potential requires supporting policy, and this is reflected in the scenarios.

Incomes in cities in the developing world will remain below those in developed economies – reducing poverty will remain a challenge – but increasing demand will put pressure on infrastructure provision. The impact of infrastructure provision on transport volumes has to be factored into the outlook.

Urban centres in the developed world show differences in the relative importance of transport modes to meet their mobility demand. This is because of differences in geography and historical context but also because of diverging policies. Analysis of past experience informs scenarios on possible futures for mobility in cities experiencing rapid economic expansion.

Important differences between transport trends in developed and developing cities have already begun to make themselves evident. The Latin American urban transport case study explores specific characteristics of mobility development in developing countries with the objective of improving the evidence base for scenario analysis. It analyses the impact of land use, infrastructure and fuel pricing policy on the development of urban mobility.

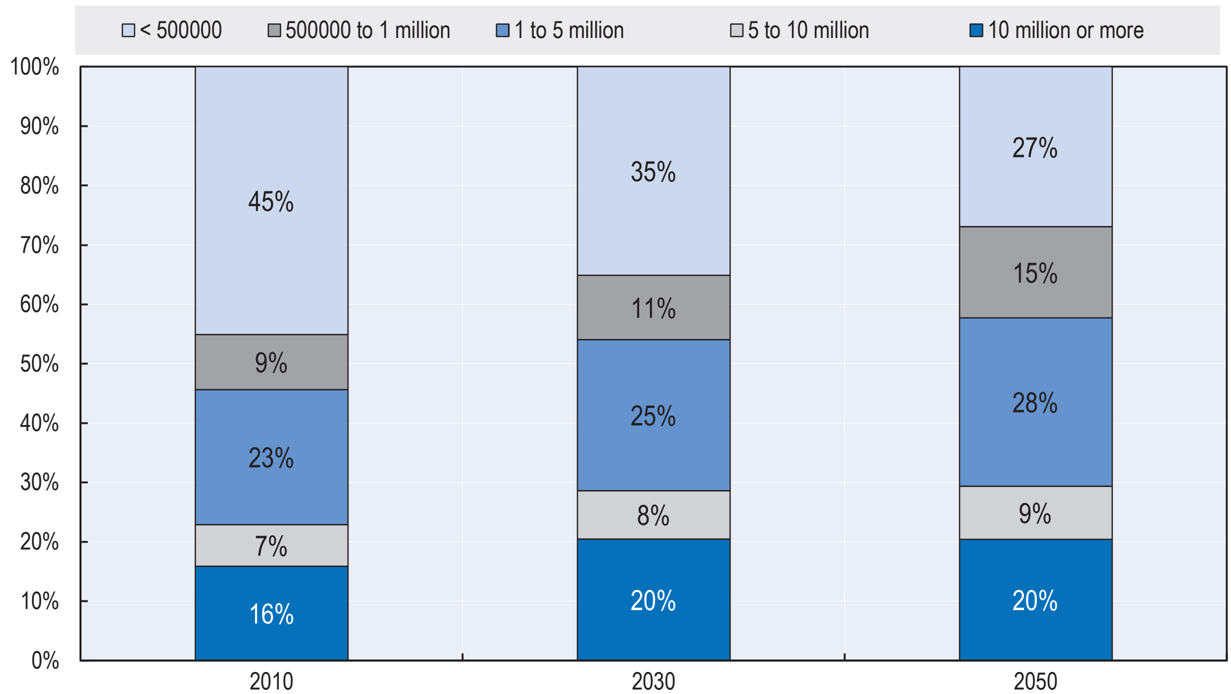
Underlying scenarios for Latin America

Demographic and GDP scenarios

Latin America is a highly urbanised region. Its concentration of population in urban centres (80%) is comparable with that in the United States and higher than in Europe. The rural-urban shift that took place over recent decades was particularly rapid. The urban population increased from 40% to 70% over the 1950-1990 period (United Nations, 2012b). The process was characterised by strong concentration of population and economic activity in capital cities. These and some additional urban centres have become central economic entities, with more than 5 million inhabitants, and often going over 20 million population. As in many other regions, urban centres have grown beyond administrative boundaries, and this has resulted in major challenges in terms of planning, service delivery, and infrastructure expansion.

From 2010 to 2050 rural-urban migration is expected to decrease but the urbanisation rate will continue to rise, to reach 90% by 2050. Many small cities will consolidate into medium ones, and some of the medium cities of today will become large and even megacities of above 10 million population (see Figure 2.15).

Figure 2.15. **Evolution of urban population in Latin America by size of urban agglomeration**



Source: Based on the UN World Urbanization Prospects, 2011 Revision.

StatLink http://dx.doi.org/10.1787/888932944407

Urban areas are the engines of economic performance in Latin America. Urban centres with populations of 500 000 or more make up 60% of total regional GDP; urban agglomerations with more than 200 000 inhabitants account for two-thirds of it. The four megacities with populations of 10 000 000 or more alone account for 14% of regional population and 23% of the region's GDP. In general, personal incomes in cities in the region increased three-fold between 1970-2010 (United Nations, 2012b).

Despite this overall improvement, cities have gone through stages of slow and even negative growth, suggesting severe challenges to generating sustained growth. Accelerated environmental deterioration and the high shares of the population with limited access to services and opportunities in Latin American cities highlight a lack of capacity for translating economic growth into environmental and social sustainability.

The way in which the many growing cities of the region develop in the coming decades will be of particular importance to the future of the region. It will determine the extent to which its countries will benefit from the high proportion of working-age population and prepare forageing of the population.[1]

Urban planning policies can make a significant difference in how well cities meet rising mobility demands driven by the expansion and rising incomes. In order to contribute to long-term growth, mobility policy will need to assure that such demands are met while minimising the environmental burden and in a way that fosters social inclusion.

The transport projections for the case study are based on an urban transport model for Latin America, developed by the International Transport Forum. The model simulates transport volumes, modal shares, and transport-related CO_2 emissions for the 2010-2050 period. The unit of analysis is the average urban agglomeration in each of the United Nations categories for urban agglomerations[2], and each country. The main model features and assumptions are discussed next.

Box 2.2. **Urban transport model for Latin America**

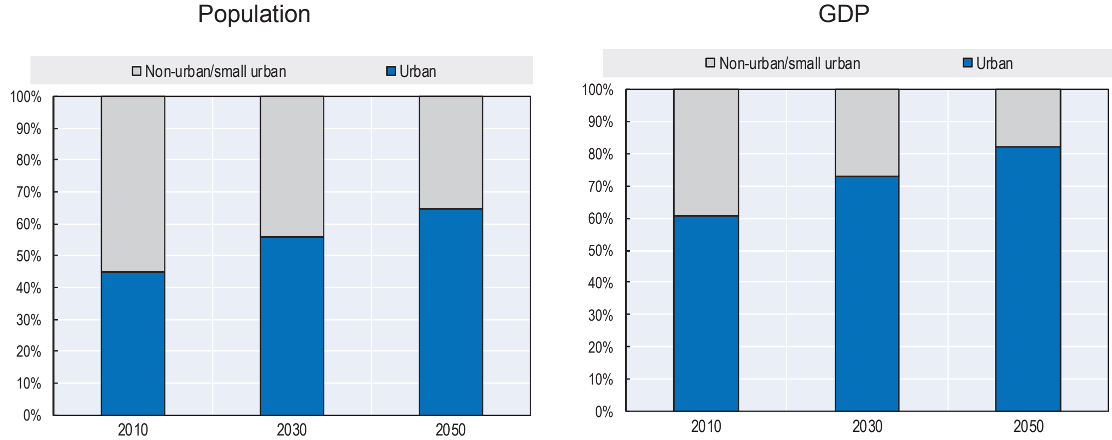
The model simulates the urban context of the average agglomeration in each category and country, in terms of economic growth, land use, fuel prices and infrastructure, under different scenarios. The UN projects the number of agglomerations in each category up to 2050.[3] Mobility levels and the share of each mode in delivering them are derived according to the simulated urban context. The model uses various assumptions on load factors, fuel economy and CO_2 emission factors from the MoMo mobility model of the *International Energy Agency*. Economic analysis and modeling by type of agglomeration is based on data from MGI cityscope provided by the *McKinsey Global Institute*. Relations between urban variables and mobility were estimated using data from the Urban Mobility Observatory created by the *Development Bank for Latin America-CAF*. This database contains information for fifteen Latin American cities for 2007: Buenos Aires, Bogotá, Caracas, Mexico City, Guadalajara, León, Lima, Sao Paolo, Rio de Janeiro, Curitiba, Porto Alegre, Belo Horizonte, Montevideo, Santiago, San José.

Between 2010 and 2050, the urban population in agglomerations with 500 thousand population or more is expected to grow by 80%. For economic growth, two alternative scenarios are used, corresponding to the *Baseline* and *Low growth* scenarios described above. This results in annual growth rates for GDP and GDP/capita in the region of 3.4% and 2.8% in the baseline, and 2.5% and 2% in the low growth scenario.

To account for differences in urban and non-urban growth rates, the model calculates the evolution of GDP and GDP/capita by category of urban agglomeration while retaining consistency with the economic growth scenario on the country level. This is done using the estimated relation between the concentration of population and the concentration of GDP in urban agglomerations. The relation is S-shaped[4] to allow for the general observation that when urban agglomerations are relatively small the elasticity between wealth and population concentration is lower, then rises as agglomerations grow, and when agglomerations get very big the marginal benefit of increasing the concentration of population begins to decrease.

Data to estimate the relation for the different countries was taken from the McKinsey City Scope Database, which contains 2010 population and GDP observations for 51 agglomerations in the region and a 2025 forecast for these same cities. Using these data for projections up to 2050 implies the assumption that countries maintain the same relation between population concentration and growth for 2025 through 2050 as between 2010 and 2025. Results show that by 2050 urban centres with more than 500 thousand inhabitants in the Latin American region will concentrate 65% of total population and 82% of GDP in Latin America, see Figure 2.16.

Figure 2.16. **Percentage of Latin American population and GDP in urban agglomerations of 500 000 inhabitants and above**



Source: Based on McKinsey Global Institute Cityscope 2.0 database

StatLink http://dx.doi.org/10.1787/888932944426

In the baseline economic growth scenario, urban GDP in 2050 grows by a factor of 5 while non-urban GDP is 70% higher than in 2010. In the low growth scenario, urban GDP grows by a factor of 3.5 and non-urban GDP increases by 16%. In terms of personal incomes, the baseline economic growth scenario results urban personal incomes growing by a factor of 2.8 and non-urban per capita GDP by a factor of 2.1. Under low growth urban and non-urban incomes would rise by a factor of 1.9 and 1.4 respectively.

Land use scenarios

The land use scenarios capture different evolutions of urban density. They are constructed as follows. First, country pathways of urban agglomeration population growth and urban surface expansion were calculated for the countries of the region[5]. Next, using projections of average population size by country and category and the calculated relation between population growth and surface expansion, the model calculates urban surface per country and urban category type. Finally, the model calculates the density of the average urban agglomeration for every country and category by dividing the population over the calculated surface. From the available countries, Argentina was found to have the highest surface expansion in its urban agglomerations relative to population growth; Colombia was found to have the lowest ratio. Based on these findings, three land use scenarios where created in the context of this analysis:

- *Baseline:* from 2010 through 2050 period, urban agglomerations in all countries grow in surface, relative to population expansion, following their own past population growth-surface expansion path. By the end of the period this results in an urban density of the average[6] urban agglomeration that is 13% higher than in 2010.

- *High sprawl:* from 2010 through 2050, urban agglomerations grow in surface, relative to population expansion, following the Argentinean population growth-surface expansion path. In this scenario by 2050 the average urban agglomeration in the region has an urban density that is 30% below that of 2010.

- *Low sprawl:* from 2010 through 2050, urban agglomerations grow in surface, relative to population expansion, following the Colombian population growth-surface expansion path. By 2050 this results in an increase by 30% of the urban density of the average Latin American urban agglomeration.

In the model, urban density is linked to mobility through two mechanisms. The first is through public transport and road infrastructure provision. These relations are estimated based on the Urban Mobility Observatory data and explained below. Second, urban density correlates positively with public transport ridership. This relationship is examined in the analysis of the Land Transport Authority (LTA) Academy, which finds an increasing elasticity of ridership to density as urban density rises (Ely, 2012). These elasticities are used in our model.

Public transport service scenarios

We simulate public transport provision for each urban agglomeration category and country. There is a positive relation between urban density and public transport supply, measured as vehicle-km per capita (based on CAF, 2010). Thus, each of the land-use scenarios described above is associated with a different level of public transport provision. **Three public transport quantity scenarios** are used in this analysis.

Baseline: Public transport expands according to the baseline evolution of urban density of each country. By 2050, total vehicle-kilometres of public transport service in the region are 1.9 those in 2010, and in per capita terms remain stable.

High public transport: In this scenario, the increase of public transport service provision depends not only on the relation with urban density but is intensified by a policy shift towards public transit expansion. In this case, expansion of service is set to be 50% higher than urban population growth in each country.[7] Total vehicle kilometres offered in public transport modes grow by a factor of 2.8.

Low public transport: Supply of public transport service develops in this case according to the *High sprawl* evolution of density in cities. As a result total vehicle-kilometres increase by only 20% during the 2010-2050 period. This corresponds to a 30% decrease in per capita service.

Data from the Urban Mobility Observatory reveal a positive relation between income and the proportion of public transport services delivered in rapid transit modes (rail or BRT trunk corridors[8]). This relation was used as an upper bound on how income growth translates into better quality public transport service in the region. The lower bound is the share of rapid kilometres in the preceding period. The model assigns increasing weights to the high bound share over time, reaching the share of rapid kilometres established in the chosen scenario by 2050.

Two public transport quality scenarios are explored. Since public transport quality is dependent on economic growth in our model, each scenario results in a different share of rapid kilometres. In the *baseline transport scenario*, kilometres of rapid public transport supply are 10% of the total offer in 2050 under baseline economic assumptions. Under lower growth, the share reaches 7.6% in 2050. In the *high quality* scenario, by 2050 rapid kilometers account for 15% of public transport service under *baseline* GDP growth. Under low GDP growth scenario, rapid kilometres account for 10.8% of public transport services.

Road infrastructure scenarios

Road infrastructure per capita is simulated by urban agglomeration category and country based on the negative relation between urban density and this variable (based on CAF, 2010). As in the case of public transport service, the relation between density and road expansion means that the different land-use scenarios lead to different outcomes for road infrastructure. The three scenarios used in this analysis are:

Baseline: Road infrastructure per capita expands at the rate that corresponds to the urban density evolution under *baseline* sprawl. Total kilometres of urban roads grow by a factor of 1.7. Road infrastructure per capita remains almost constant during the period.

High roads: Kilometres of urban roads per capita develop according to the scenario where road expansion is intensified. Road expansion is calculated to grow 50% more than urban population growth in every country. By the end of the period, this results in total vehicle-kms of road infrastructure in the region that are 2.6 times those of 2010. The growth factor in per capita terms is 1.46 compared to 2010.

Low roads: In this scenario, urban road infrastructure per capita grows following the *Low sprawl* evolution of urban density. Total urban road kilometres increase by a factor of 1.5, while per capita infrastructure decreases by 20% by 2050.

Table 2.2 summarises values of the context variables discussed above for the different scenarios in index form. It also recalls assumptions on technology and oil prices.

Table 2.2. **Latin American urban context under different scenarios**

				2010	**2030**	**2050**
Population				100	147	181
GDP		Baseline		100	234	507
		Low growth		100	194	349
GDP/capita		Baseline		100	159	281
		Low growth		100	132	193
Land use	Urban Density of Average urban agglomeration	Baseline		100	106	113
		High sprawl		100	75	70
		Low sprawl		100	117	130
Public transport service	Total vehicle -kms of service	Baseline		100	149	190
		High public transport		100	167	281
		Low public transport		100	106	121
	Per capita kms of service	Baseline		100	103	104
		High public transport		100	114	155
		Low public transport		100	73	67
	Share of rapid kms (quality)	Baseline	Baseline growth	4.4%	5.0%	10.0%
			Low growth	4.4%	4.6%	7.6%
		High quality expansion	Baseline growth	4.4%	6.4%	15.0%
			Low growth	4.4%	5.6%	10.8%
Road infrastructure	Total kms of road	Baseline		100	144	171
		High roads		100	162	263
		Low roads		100	130	149
	Per capita kms of road	Baseline		100	98	95
		High roads		100	110	146
		Low roads		100	89	83
Oil prices		Baseline		100	150	160
		High oil prices		100	253	264
		Low oil prices		100	65	64

Connection between underlying scenarios and transport

Ownership levels for light-duty vehicles and motorcycle ownership are calculated by urban agglomeration and country using quasi-logistic S-curves (figure 2.17). These were estimated on Urban

Mobility Observatory data and historical data on country ownership levels for the 15 cities included in the database. Explanatory variables are personal income, quantity[9] and quality of public transport, fuel prices, and road intensity.[10]

The form of the model implies that fuel prices will have an effect on the threshold of income at which growth in vehicle ownership speeds up. For both motorcycles and Passenger Light Duty Vehicles (PLDV), the negative sign of the corresponding coefficient means that the higher the fuel price, the higher the income threshold at which ownership growth accelerates. Even for urban agglomerations that present ownership levels that are above take-off, modifying fuel prices throughout the period shifts downwards the 2010-2050 path of ownership.

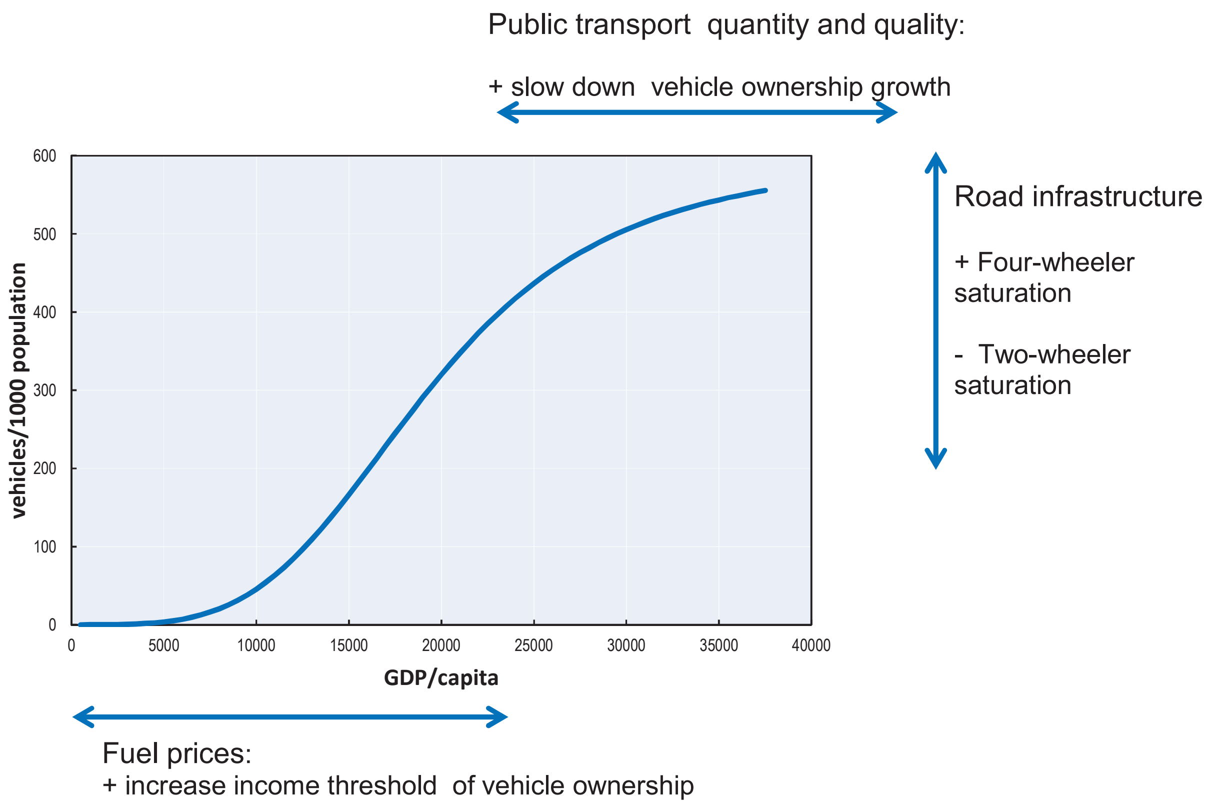
For both types of private vehicles, higher levels and quality of public transport tend to slow-down the growth of ownership.

Road provision has opposite effects on car and motorcycle ownership and data suggests that higher road provision will tend to increase the saturation levels for cars and decrease those of motorcycles. Figure 2.17 summarises impacts of different scnearios on urban vehicle ownership.

Vehicle-kilometres driven by private modes are calculated using a -0.25 elasticity of usage with respect to fuel prices, with initial levels of use matched to the IEA MoMo model for each country. Passenger-kilometres, fuel consumption and CO_2 emissions are based on IEA MoMo assumptions.

Public transport ridership depends on urban density and its correlation with the share of public transport in overall passenger mobility and on income and fuel price elasticities. As we are not aware of any study that has calculated these elasticities for Latin America, international parameters from urban studies are applied. The fuel price elasticities used are 0.15 for buses and 0.27 for rail and Bus Rapid Transit (BRT). The income elasticity is only used for buses and is set at -0.62 (Litman, 2004). Reduction in private passenger-kilometres due to improved public transport service quality is allocated to public transport modes.

Figure 2.17. **Impact of different scenarios on urban vehicle ownership**



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Urban mobility and CO_2-emission scenarios for Latin America

Isolating the effects of different urban scenarios

This section discusses scenarios where only one parameter changes. The next section examines four scenarios combining urban policies and exogenous variables to reflect a diverse range of strategies for urban mobility in Latin America. Anticipating the results, it is worth noting that strong changes in mobility outcomes only result when several transport and planning policies are combined. The baseline, business as usual, scenario serves as the benchmark and is discussed first

In the *baseline* scenario all variables develop according to their business as usual trend (see Table 2.2). Under these assumptions and with baseline GDP growth, mobility in urban Latin America grows rapidly and by 2050 is 3.7 times as large as in 2010 (Figure 2.19). The share of public transport in urban mobility falls by more than half by 2050. Four-wheeler and two-wheeler shares rise by 16% and 8% respectively (Figure 2.18). Passenger transport related CO_2 emissions are, by 2050, 3.2 times the 2010 levels. On average, CO_2 emissions rise by a rate of 0.88% for every 1% rise in mobility (Figure 2.19).

The *baseline* with l*ow* economic growth leads to a rise in mobility by a factor 3.2 between 2010 and 2050. The slower rise in personal incomes delays the rise of private vehicle ownership and therefore the shift away from public modes. Nonetheless, four-wheeler and two-wheeler shares grow by 12% and 5% respectively, and the public transport share in mobility still drops significantly to 28%. C02 emissions in 2050 are 2.6 times as high as in 2010 levels. The lower share of private vehicles translates into a rise in emissions at an average rate of 0.83% per every 1% rise in mobility.

Different patterns of *urban sprawl*, here modelled through different population density scenarios, do not affect total mobility levels by much, but outcomes do differ in terms of modal split and CO_2 emission growth. More sprawl intensifies road provision and discourages public transport service. Higher levels of sprawl accelerate ownership of private modes by making public modes less available and competitive. They also generate lower ridership of existing public transit service. By intensifying road infrastructure, sprawl speeds up car ownership as costs of congestion are delayed. With high urban sprawl public modes represent 13% of total urban passenger-kilometres in 2050, against 25% with low urban sprawl. In terms of CO_2 emissions, the result is growth by a factor 3.6 with high sprawl and 3.1 with low sprawl – for similar total mobility levels. Sprawl increases CO_2 emissions 13% relative to baseline outcomes. High density land use development reduces CO_2 emissions 3% (figure 2.20).

Low *oil prices* (which here translates into low fuel and usage costs) increase ownership and, more strongly, use of private modes. Conversely, high fuel prices or vehicle usage costs are a relatively powerful tool for reducing use of private vehicles. However, isolated pricing policies tend to reduce negative impacts of transport at the expense of reducing mobility, because more expensive private transport without expanded availability of public transport confronts growing proportions of the population with restricted mobility options. With high and low fuel prices CO_2 emissions grow to 3.8 and 2.9 times their 2010 levels respectively. This is equivalent to a 9% decrease and a 19% decrease over the baseline respectively. Mobility would grow by factors of 4.2 and 3.4 respectively by 2050, and the share of public transport would be 17% and 24% respectively.

The level and quality of public transport and of road infrastructure affects the share of public transport as well as the relative use of four-wheelers and two-wheelers. The following combinations illustrate the effects:

- *High public transport* and *High road* provision*:* expansion of public transport service is 50% higher than urban population growth; by 2050 the proportion of service offered in rapid modes is 15% of total public transport service; road provision also is 50% above urban population growth.
- *High public transport* and *Low road* provision*:* same as previous for public transport; road expansion lags behind population growth as it would in case of low sprawl development (but sprawl itself is modelled following baseline trends).
- *Low public transport* and *High road* provision: expansion of public transport service lags behind population growth in a similar magnitude as in the high sprawl scenario; by 2050 the proportion of service offered in rapid modes is maintained at 10% of total public transport service; road provision expands at 50% above urban population growth.
- *Low public transport* and *Low road* provision: same as previous for public transport; road expansion lags behind population growth as it would in case of low sprawl development.

The first of these four scenarios leads to the strongest urban mobility growth, by a factor of 4 between 2010 and 2050. Public transport mobility grows significantly, and private mobility is strongly dominated by four-wheel vehicles. The lower bound in terms of mobility is found in the fourth scenario, where mobility grows by a factor 3.6 from 2010 through 2050. This is below business as usual growth and is mainly due to low growth in public transport mobility and the higher share of two-wheelers in private mobility.

High public transport with *Low road* infrastructure and *Low public transport* with *High road* infrastructure scenarios produce mobility levels just above *Baseline* levels (3.8 times the 2010 level). The scenario with *Low public transport* and *High road* provision generate slightly higher mobility throughout but the gap between the two scenarios closes towards the end of the period (Figure 2.19).

Scenarios where more and better public transport is provided result in a higher share of public transport use and in this way reduce transport-related CO_2 emissions compared to *Baseline* levels. Public transport mobility shares by 2050 are 38% and 41% in the high public transport with high and low road provision cases respectively. CO_2 emissions in 2050 in the two cases are 3 and 2.7 times the 2010 levels (7% and 17% less than baseline CO_2 emissions). In contrast, the low public transport expansion case results in a share of public transport by 2050 of 14% and 15% in its high and low road expansion variants. CO_2 emissions are 3.7 and 3.3 times as high as in 2010 respectively, both above *Baseline* levels (16% and 3% respectively).

Figure 2.18. **Transport modal shares when varying elements of the urban context**

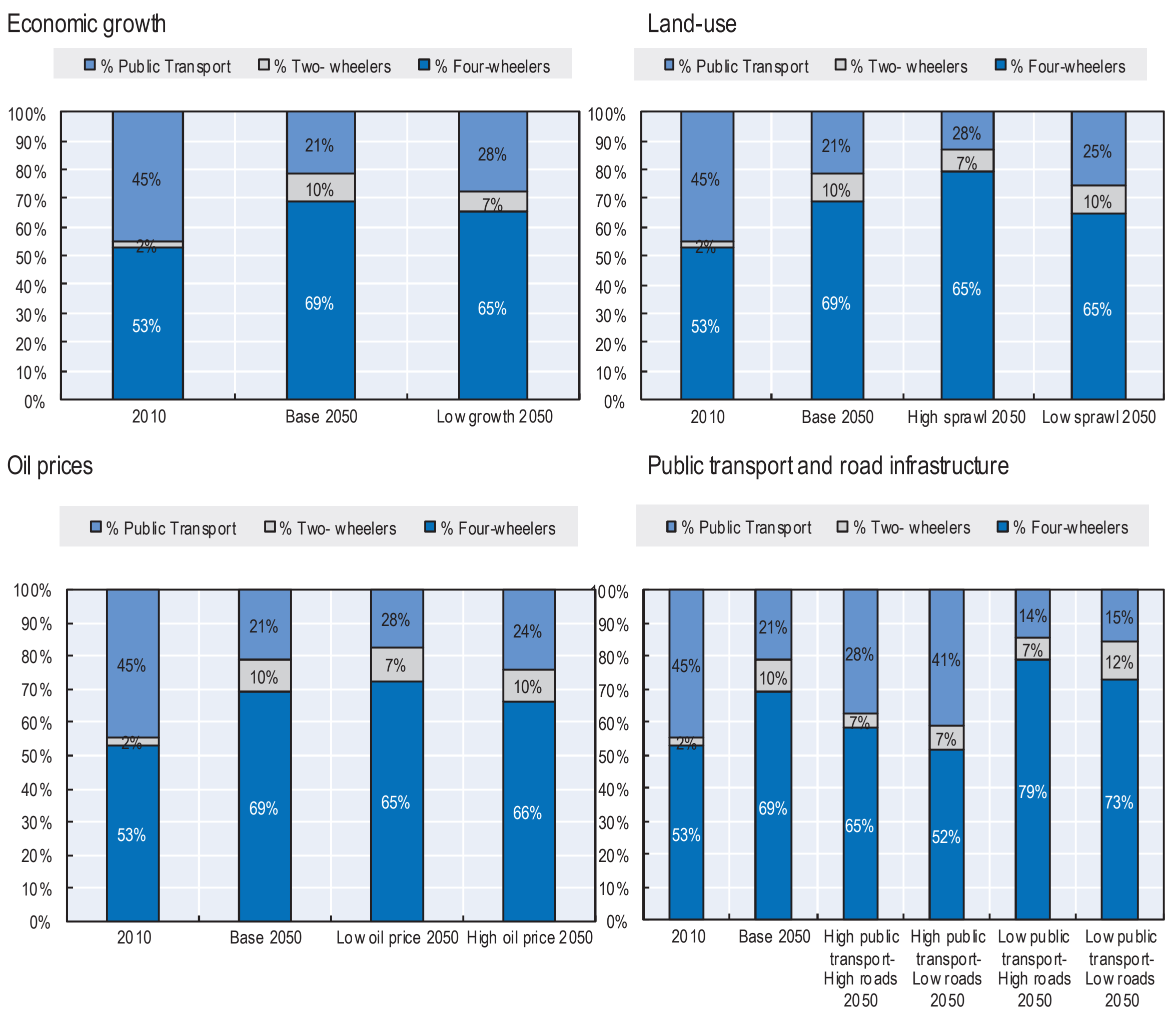

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Figure 2.19. **Urban mobility and CO_2 emissions when varying elements of the urban context**

2010=100

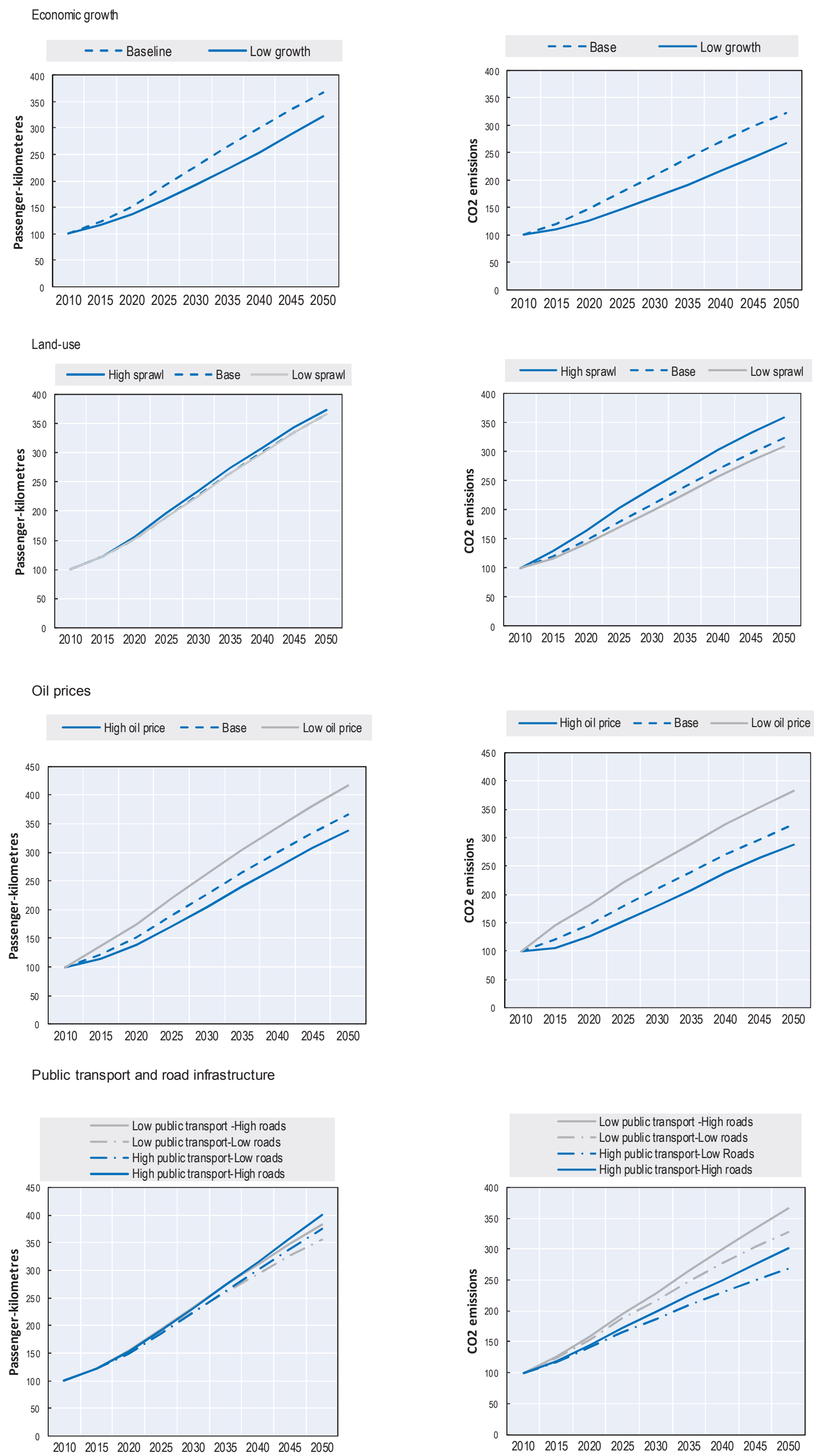

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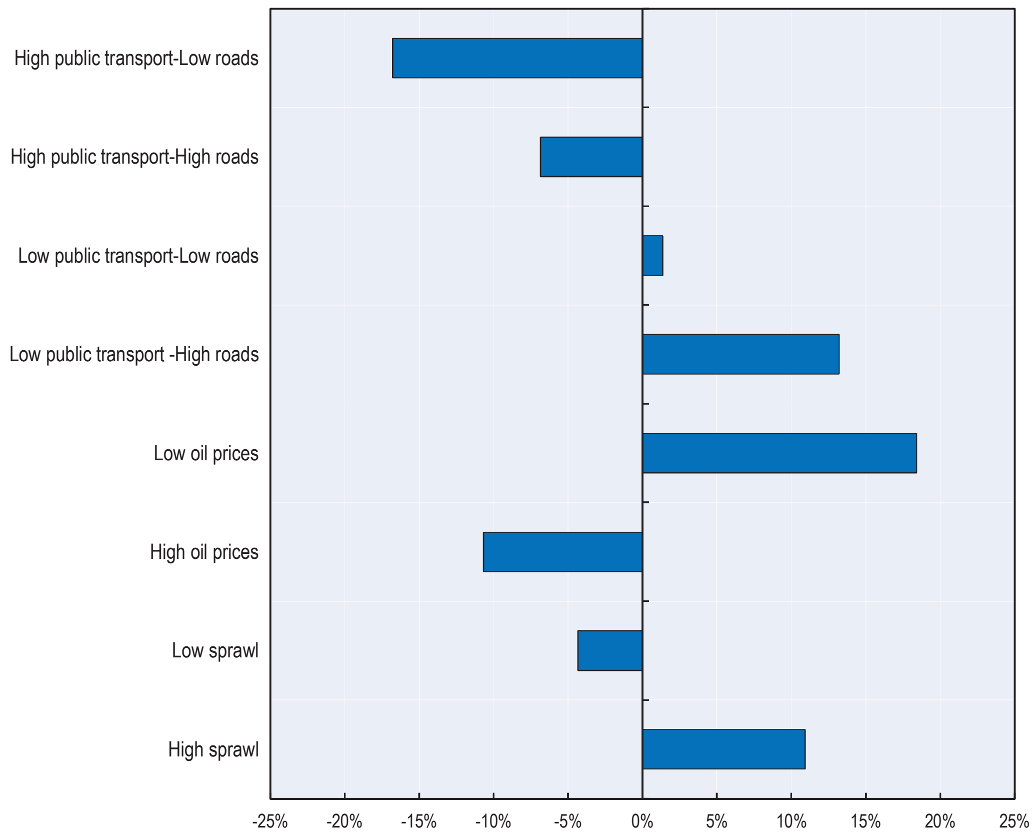
Figure 2.20. **Changes in CO_2 emissions relative to the baseline**



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Summary of different urban policy pathways

This section considers combinations of changes in context variables. It is these combinations that are relevant to the development of urban and total mobility in Latin America. With the aim of exploring the scope of the possible differences two main settings have been considered. Under *Private transport-oriented* urbanisation**,** urban agglomerations grow following the *High sprawl* scenario. Public transport service evolves according to the resulting sprawl and therefore follows the *Low public transport* path. Quality of the public transport offer increases at its *Baseline* rate. Finally, fuel prices develop under the *Low oil price* case. Under *Public transport-oriented* urbanisation, urban agglomerations grow following the *Low sprawl* scenario. Public transport expands at a faster rate than population, and its quality increases significantly. These trends correspond to the *High public transport* and *High quality* configurations. Fuel prices follow the *High oil price* path. Combining these basic urbanisation paths with the *High* and *Low road* infrastructure scenarios creates four variants.

Private transport-oriented mobility urbanisation with *High road* infrastructure expansion,

Private transport-oriented mobility urbanisation with *Low road* infrastructure expanion,

Public transport-oriented mobility urbanisation with *High road* infrastructure expansion,

Public transport-oriented mobility urbanisation with *Low road* infrastructure expansion.

In *Private transport-oriented* scenarios urbanisation fosters private mobility and results in higher levels of mobility (Figure 2.22). Mobility levels are 4.3 and 4 times the 2010 level respectively. A significant proportion of the mobility difference with public transport oriented urbanisation is generated by diverging fuel prices, as can be inferred from considering *Private transport-oriented* mobility urbanisation with *High road* infrastructure expansion, under *baseline* oil prices. This generates mobility that is 3.8 times as high as in 2010 instead of 4.3 times as high.

While *Public transport-oriented* urbanisation scenarios result in lower mobility throughout the period, the gap with mobility levels under *Private transport-oriented* urbanisation scenarios tends to close as time progresses. This is because by the end of the period the expansion of public transport service and the progressive penetration of high quality modes begin to offset restrictions in private mobility caused by the high costs of fuel assumed in these scenarios. Lower sprawl also promotes the reduction of the gap by fostering higher ridership of public transport.

Modal splits differ strongly between the two types of urbanisation scenarios (Figure 2.21). In *Private transport-oriented* urbanisation, public modes would have an 11% and 12% share in 2050 while 4 and 2-wheeler vehicles shares rise strongly. With *Low road* infrastructure motorcycles reach the same proportion of total passenger-kilometres as public transport in 2050. With *High road* infrastructure, the rise of 2-wheeler use is smaller but their share still increases, to 7% in 2050. Contrastingly, *Public transport-oriented* urbanisations scenarios allow to maintain current private/public mobility shares while urban mobility grows. In both scenarios, motorcycles still increase their share but at a lower rate. In the *Low road* expansion case their increased participation accompanies a decrease in the share of 4-wheeler vehicles.

Not surprisingly, *Private transport-oriented* urbanisation scenarios result in higher than *baseline* growth of CO_2 emissions, 4.3 (34%) and 3.8 times (19%) 2010 levels respectively. The scenarios result in higher mobility than the Baseline case and they increase the carbon intensity of the additional mobility. In both scenarios, growth in CO_2 emissions is just as fast as mobility growth whereas in the *Baseline* case CO_2 emissions grow at 0.88% for every 1% increase in mobility. *Public transport-oriented* settings generate lower than *Baseline* growth in CO_2 emissions, 2.6 and 2.4 times that in 2010 (19% and 25% below baseline respectively). In both scenarios, mobility now is less carbon-intensive than in the *Baseline* scenario: CO_2 emissions grow by 0.7% for every 1% growth in mobility.

The IEA’s 450 technology scenario[11] assumes significant fuel efficiency improvements for gasoline vehicles. It also includes higher penetration of alternative technologies (electric vehicles, plug in hybrids, etc.) which by 2050 make up about 40% of the world light-duty vehicle fleet. For two-wheelers, the electric share is even higher. Buses also become more fuel efficient. This scenario is more likely in the case where oil prices are high, making alternative technology adoption more cost-effective.

Other things equal, a shift to cleaner, more fuel efficient vehicle technologies would result in slightly greater use of private vehicles, as technology driven increases in car purchase prices are outweighed in the model by lower costs of using vehicles (per kilometre) than under the Baseline. Under the IEA’s 450 technology scenario for vehicle fleet improvement, lower CO_2 emission pathways can be achieved at higher urban mobility levels under the public transport-oriented scenario. CO_2 emissions grow on average by only 0.4% for every 1% increase in mobility.

Figure 2.23 summarises effects of different urban pathways on CO_2 emissions relative to the baseline.

Figure 2.21. **Urban modal shares under alternative urban settings**

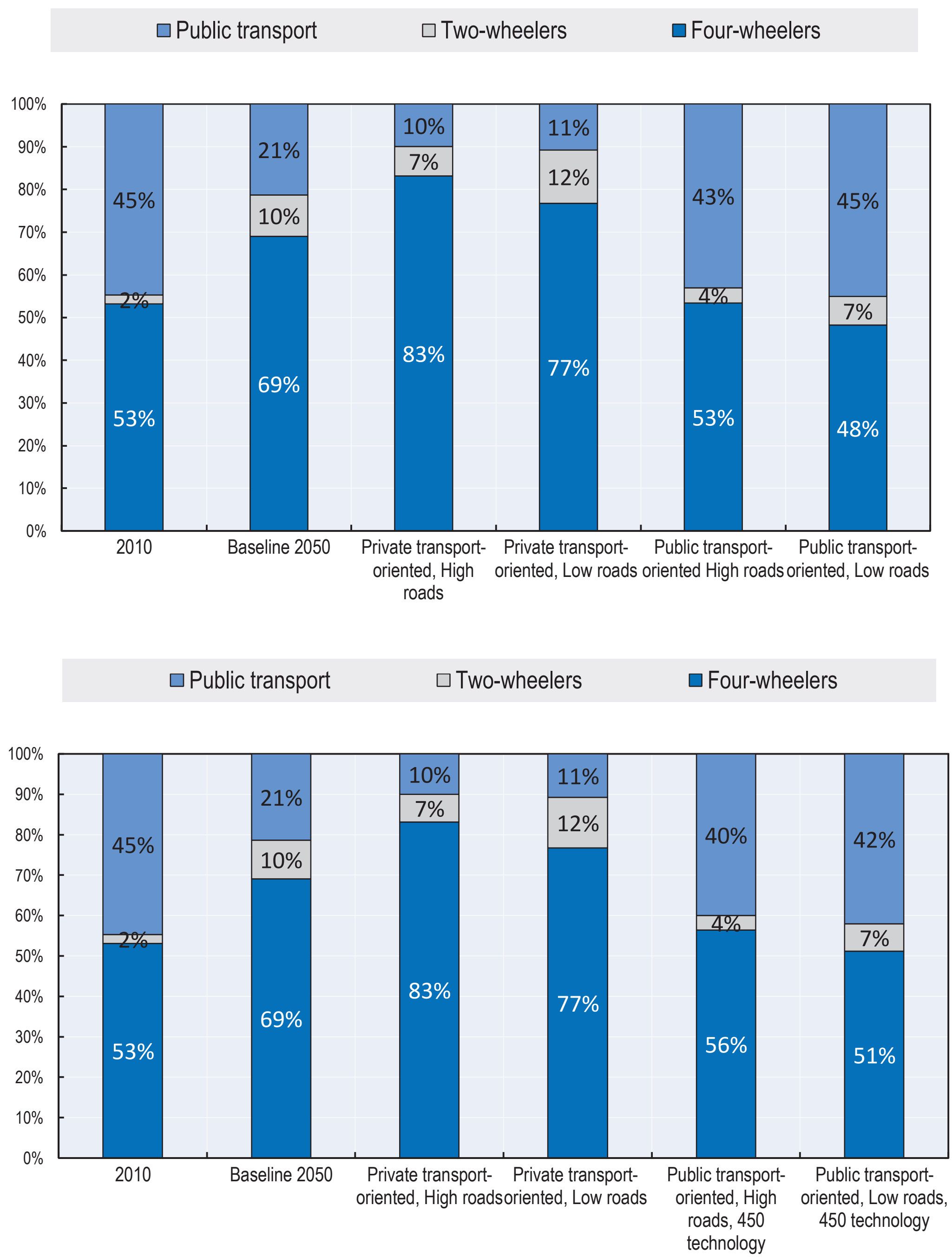

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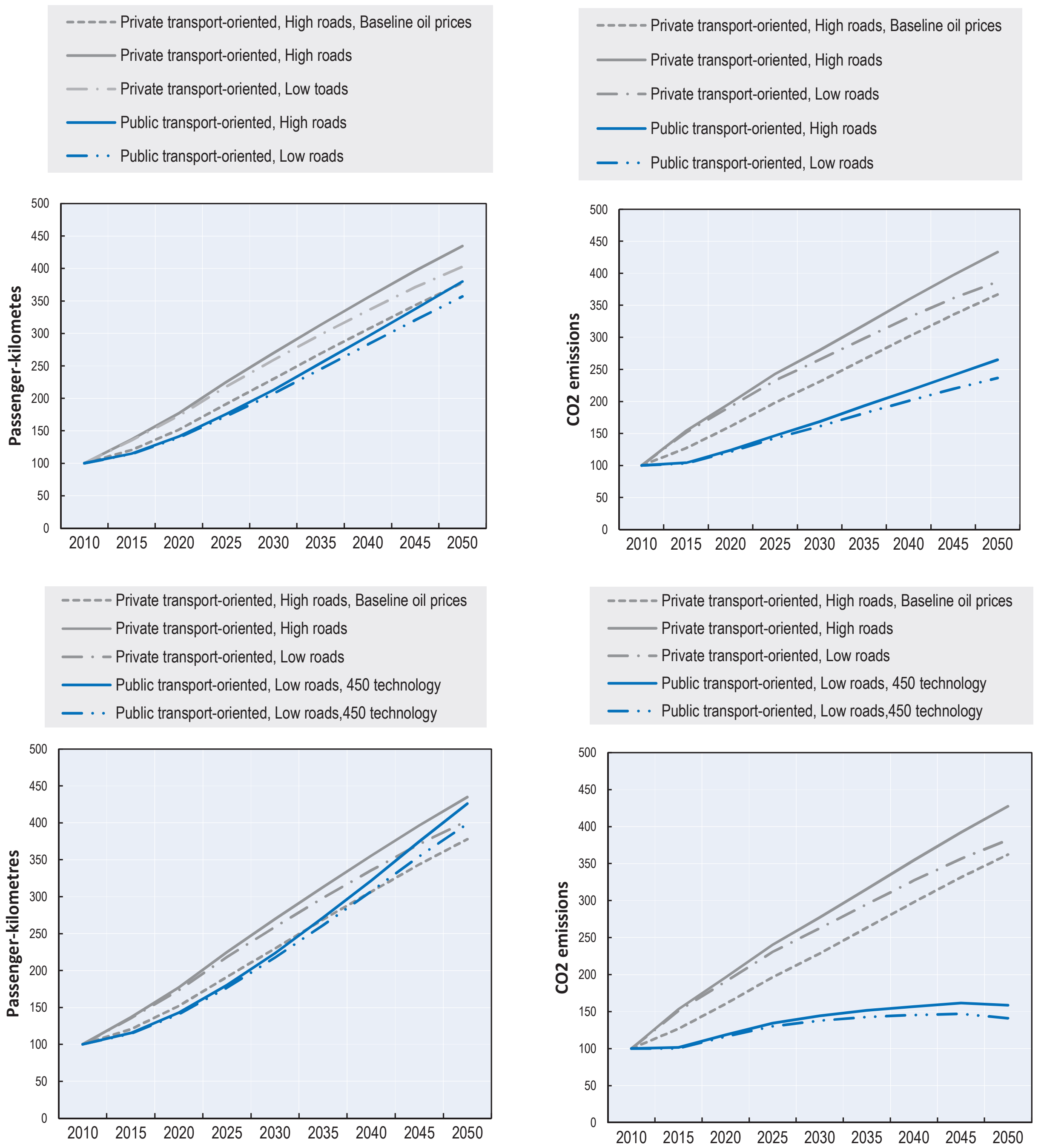
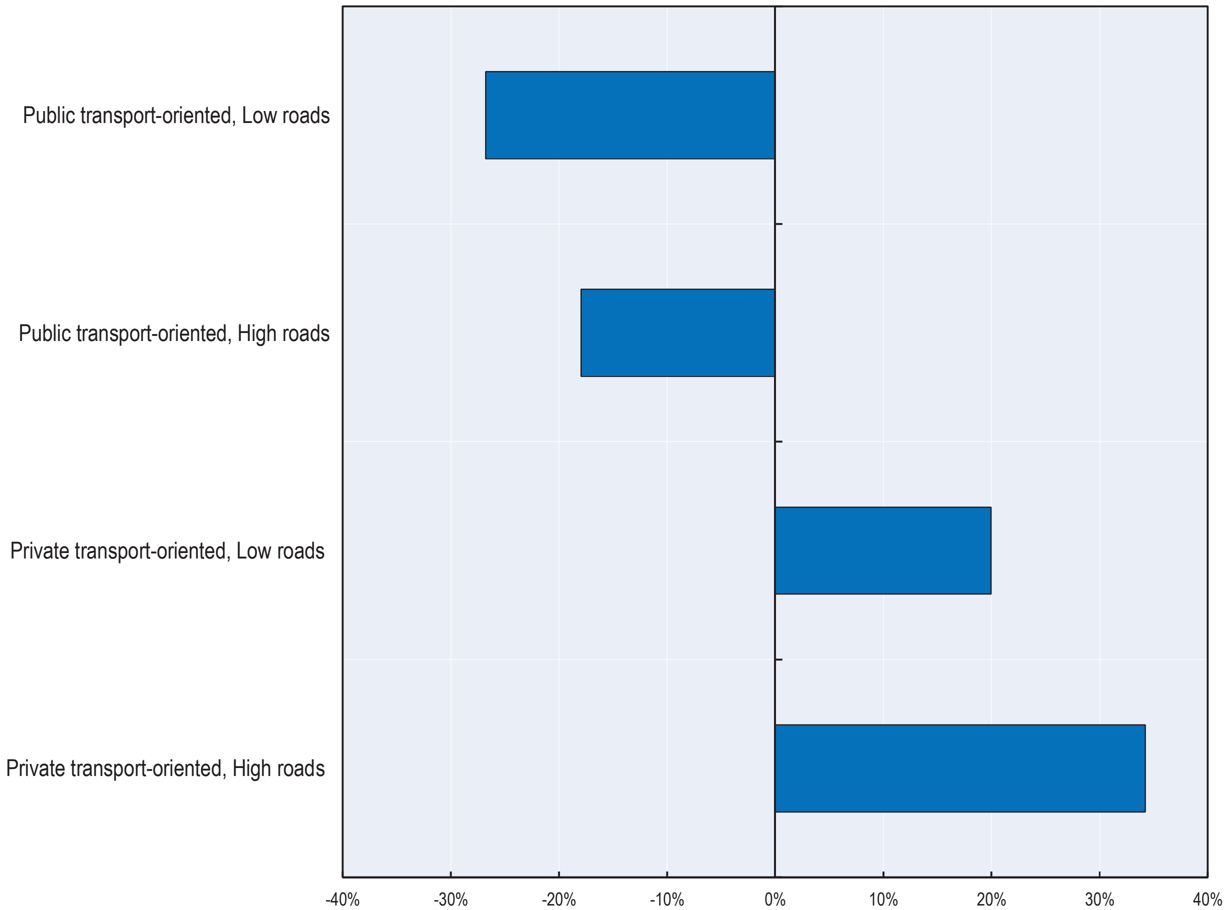
Figure 2.22. **Urban mobility and CO_2 emissions**
Alternative urban pathways, 2010=100



StatLink http://dx.doi.org/10.1787/888932944540

Figure 2.23. **Impact of different urban pathways on CO_2 emissions relative to the baseline**



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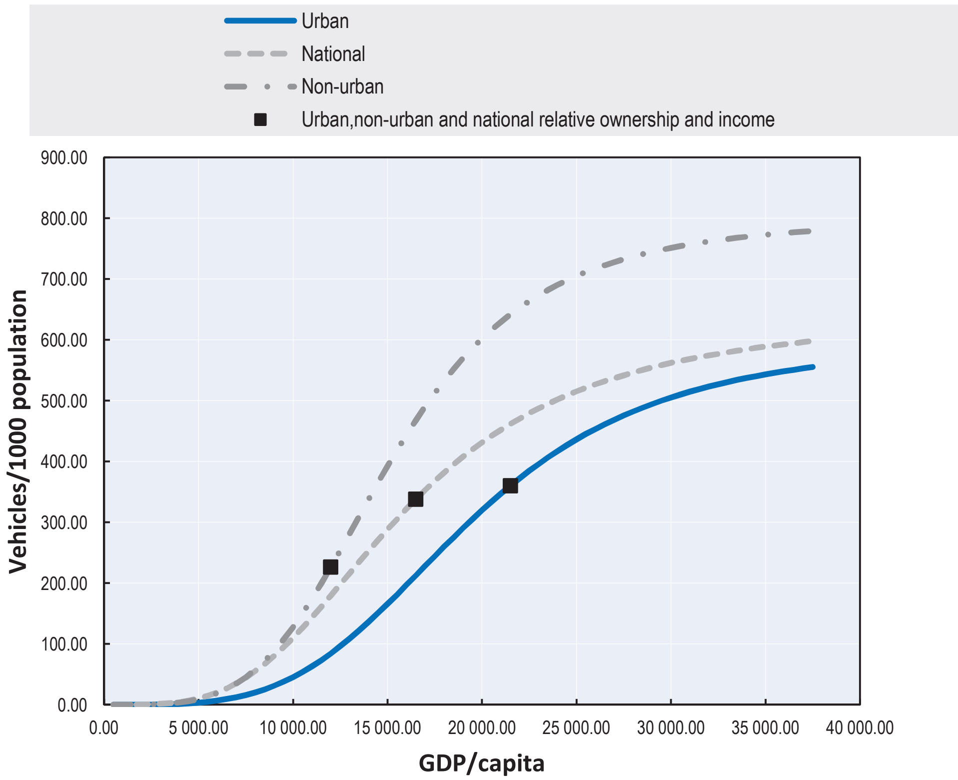
The results of the different urban policy scenarios have large effects on the overall transport outcomes for Latin America. In the model, national ownership rates are the average of urban and non-urban levels weighted by population shares in each sector (see Figure 2.24). Due to the concentration of income in urban areas and elevated levels of urbanisation the urban income-ownership pathways will account for much of the difference in national and regional fleet composition and travel patterns and related externalities.

Figure 2.24. **Relationship between urban, non-urban and national vehicle ownership**



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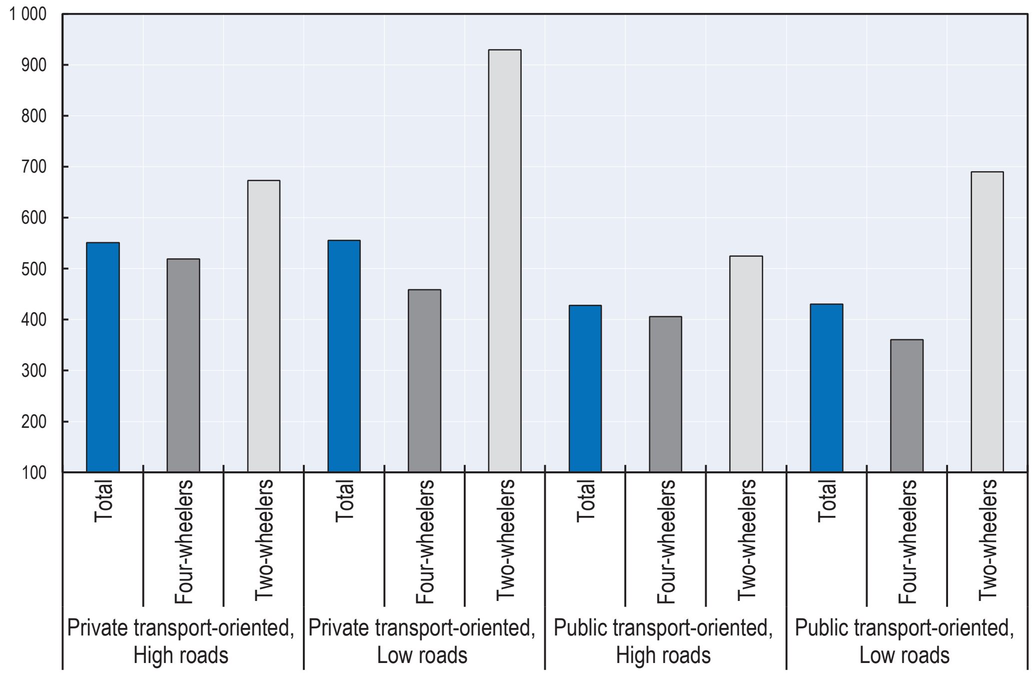
Under the urban policy scenarios the total private vehicle fleet in Latin America would grow 5.5 times in scenarios where urban policies foster private mobility and 4.3 times in the case where they foster more public transport modes (Figure 2.25). Private mobility oriented urban contexts where road infrastructure expansion is slow will speed up already high growth of two-wheeler ownership while lowering to some extent the future growth of 4-wheeler vehicles. In urban contexts that foster public mode use, high fuel prices and better public transport supply, would result in a lower growth for both four and two-wheelers.[12]

Figure 2.25. **Latin American private fleet growth, 2050**
Different urban pathways scenarios, 2010=100



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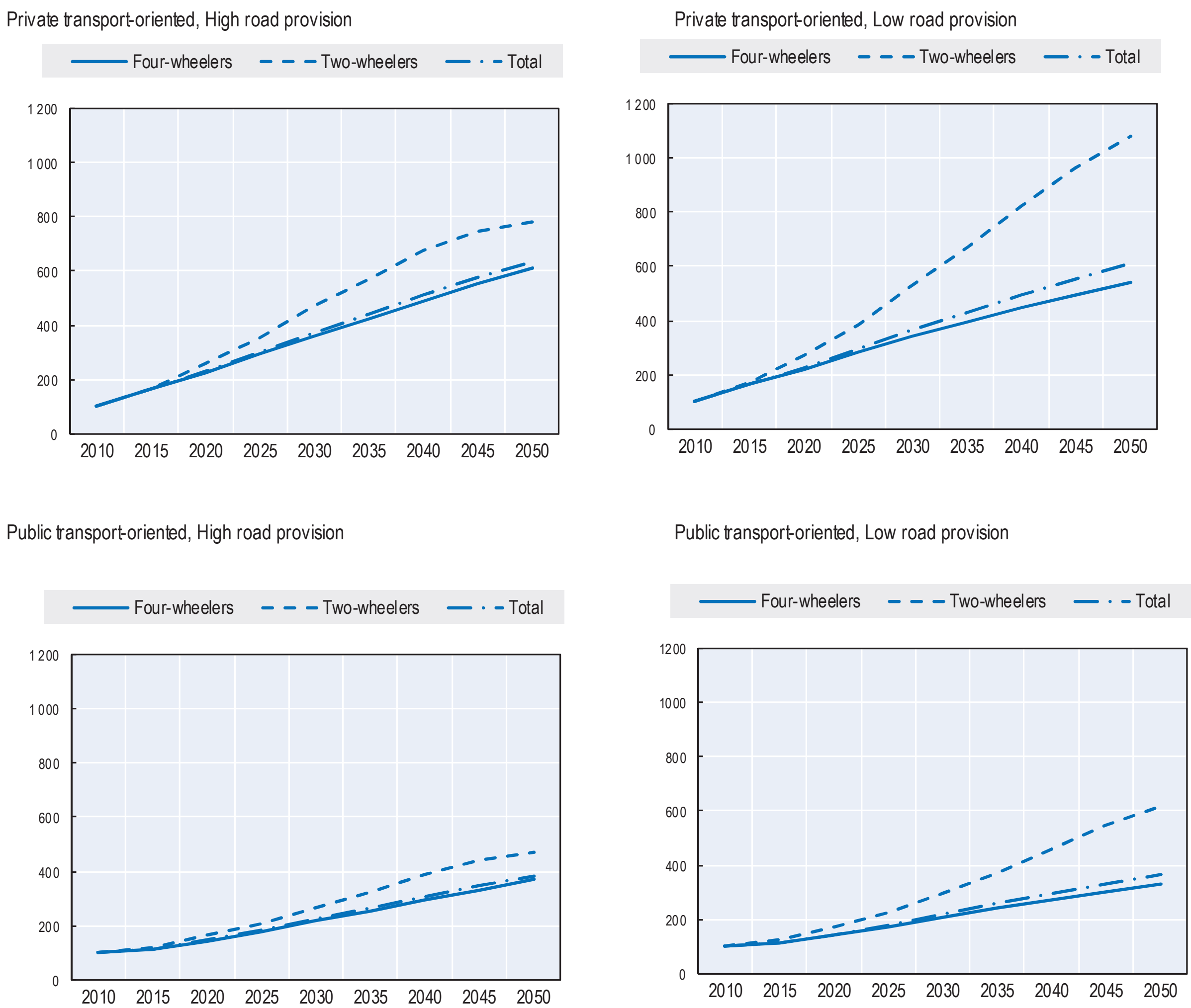
The evolution of private vehicle-kilometres under the different scenarios mirrors that of the fleet, but differences are magnified by the effect of variations in fuel prices on vehicle use (Figure 2.26). Both two-wheeler and four-wheeler travel will rise significantly faster under scenarios where urbanisation fosters private mobility. Scenarios where road infrastructure expansion in cities is fast will tend to see higher growth in kilometres travelled by four-wheelers. For two-wheelers, growth show signs of slow-down earlier in these scenarios.

Figure 2.26. **Total private vehicle-kilometres in Latin America under different urban settings**
2010=100



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Regional development paths and their implications for transport

Regional GDP scenarios

Table 2.3 shows the relative changes in GDP, population, GDP/capita and oil prices for the nine geographical regions relative to the base year 2010. For GDP and GDP/capita baseline and low growth scenarios are shown and for the oil price a reference and high and low scenario.

Table 2.3. **GDP, GDP per capita, population and oil price by region**
2010=100

Growth scenarios

GDP		2010	2030		2050	
			Baseline	Low growth	Baseline	Low growth
	Africa	100	211	184	467	351
	Asia	100	243	193	563	373
	China + India	100	345	227	669	404
	EEA + Turkey	100	143	134	204	177
	Latin America	100	195	168	375	273
	Middle East	100	197	172	379	298
	North America	100	162	149	246	209
	OECD Pacific	100	138	123	193	152
	Transition	100	161	153	250	215
	World	100	202	165	357	258
GDP per capita	Africa	100	139	121	219	165
	Asia	100	195	155	405	268
	China + India	100	303	200	575	347
	EEA + Turkey	100	136	127	194	168
	Latin America	100	165	142	300	219
	Middle East	100	142	124	221	174
	North America	100	139	128	190	161
	OECD Pacific	100	137	122	201	159
	Transition	100	160	152	257	222
	World	100	168	137	267	193

Population and oil prices

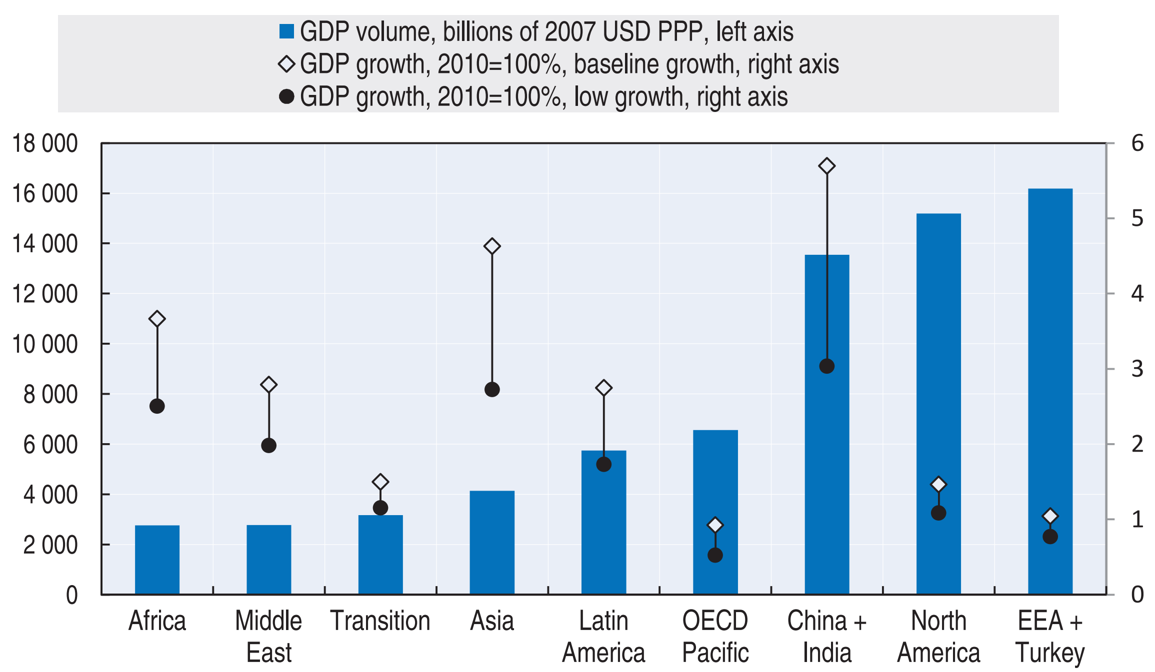
Population		2010	2030	2050
	Africa	100	152	213
	Asia	100	125	139
	China + India	100	114	116
	EEA + Turkey	100	105	105
	Latin America	100	118	125
	Middle East	100	139	171
	North America	100	117	130
	OECD Pacific	100	101	96
	Transition	100	100	97
	World	100	120	134
Oil prices	World, high	100	253	264
	World, baseline	100	150	160
	World, low	100	65	64

Source: Based on IEA (2013), United Nations (2012a), OECD (2012), Conference Board (2012) and IMF (2013).

Over the period 2010 to 2050 average annual growth of world GDP is 3.2% in the baseline scenario and 2.4% in the low growth scenario. This means global real GDP measured in PPP terms will increase by a factor of 2.6 to 3.6 by 2050, and is set to slow down from growth averaging 3.5% – 4% during the last decade, in both scenarios.

In the baseline growth scenario the world GDP growth rate is sustained in the near term (at 3.5% per year) and slows gradually during rebalancing, finally reaching 2.7% annual growth after 2040. In the low growth scenario the slowdown is much more abrupt (there is a "hard-landing") in the medium to near term with the average growth rates down from 3.5% - 4% and levelling off to between 2.3% and 2.5% per annum in the following periods. Despite our relatively low projections world output is set to double by 2030 or 2040, depending on the scenario. The loss of momentum during the aftermath of the financial crisis amounted to loss of economic output equivalent to about 5 years (ITF, 2012). Globally the economic centre of gravity will shift further east and further south, and demand patterns will change greatly as a much larger population base enters income ranges between 15 and 30 thousand USD at 2007 PPP.

Figure 2.27. **GDP volume, 2010 and growth to 2050, by region: baseline and low growth scenarios**



Source: Based on OECD (2012), Conference Board (2012) and IMF (2013).

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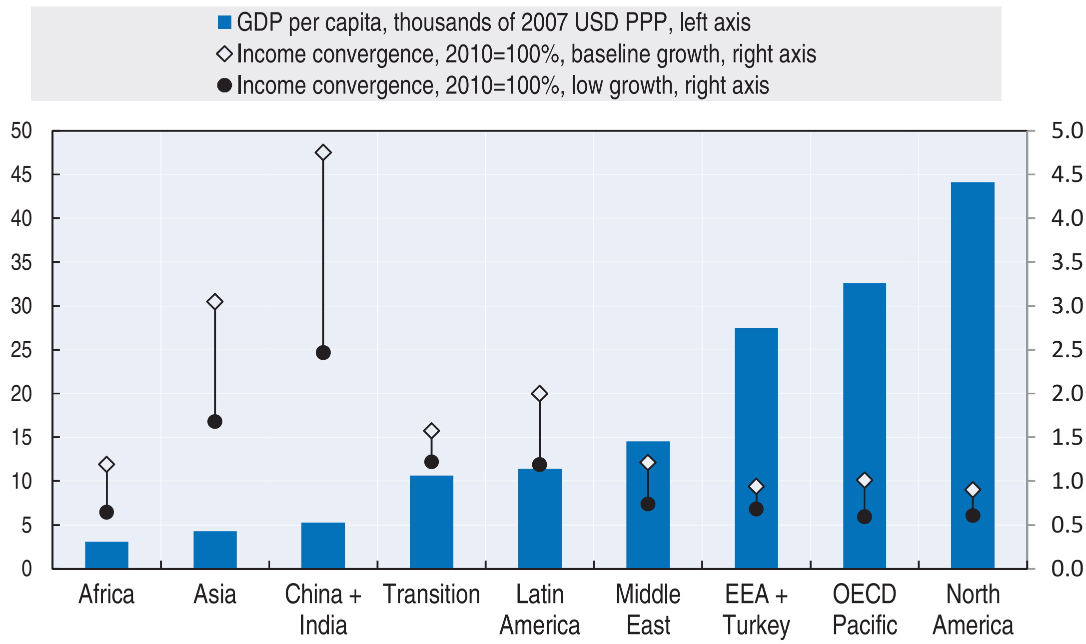
Figure 2.28. **GDP per capita, 2010 and income convergence between 2010 – 2050 by region: baseline and low growth scenarios**



Source: Based on OECD (2012), Conference Board (2012) and IMF (2013).

StatLink http://dx.doi.org/10.1787/888932944654

Income convergence is particularly strong in the lesser developed regions of non-OECD Asia including China and India, and Latin America. Asia and in particular China and India can be identified as the pivotal regions in the world economy. They are already producing output at levels similar to North America and EEA + Turkey but still show much larger growth potential. Per capita incomes are set to grow by 250% to 480% in China + India which means overall economic output could be up to 580% higher in the baseline scenario. In comparison, the economic output of North America and EEA + Turkey is only set to grow by 80% - 120% over 2010 levels.

The middle income regions of Latin America, the Middle East and the Transition economies show more moderate growth prospects but already enjoy higher levels of development.

In general natural resource rich economies will enjoy continued strong demand for their exports. In Latin America the development of a stronger industrial base will also contribute to growth. In the Transition economies this effect is more subdued. Per capita income growth over 2010 levels ranges from 110% –200% in Latin America and in the Transition economies between 120% – 150%. Economic output is to approximately double in the Eastern European and Central Asian transition economies but grows by 180% – 260% in Latin America, which in the medium term also benefits from positive demographic developments.

Efforts at increasing connectivity to major markets are underway in most regions. Transport infrastructure investment is increasing port catchment areas and extending the economic reach of the hinterland in both Europe and Asia. For example, the Iron Silk Road may allow countries to latch on to trade flows between Asia and Europe which benefit from reduced shipping times compared to maritime routes. This may help foster industrial and consumer bases in both regions. The Middle East, also at cross-roads of major trading regions and benefitting from natural resource endowments, will see economic output grow 200% – 280% over 2010 levels and per capita income by 65% – 120%.

Africa and Asia, excluding China + India, are the regions with the largest growth potential. Africa shows increasing realisation of this potential towards the end of the projected time period with average per capita income growth rates up to 2.3% during the period 2030 – 2050 up from 1.5% to 1.8% in earlier periods. Output volumes grow by 4.1% in later periods. Growth is already strong in some of the region's countries, but connectivity in general is still poor and some regions land-locked.

In South and South-East Asia production growth is strong with GDP volumes set to increase by 270% – 460% over 2010 levels. Per capita income levels increase by 170% – 300%. Growth is stronger from the onset, especially in some of the more dynamic ASEAN countries. This region depends on China due to geographic proximity and inclusion in regional value chains.

The OECD Pacific region is assumed to experience growth in line with current development levels, ranging from 60% – 101% growth per capita income and 50% – 90% growth in GDP. The largest economy in the region, Japan, faces increasing demographic pressures as population growth is to slow considerably. Australia can rely on export of raw materials, although previously strong exports to China slow in the low GDP growth scenario. Overall, the region is dependent on trade and on developments in the East and South-East Asian region as well as in North America.

Table 2.4. **Real GDP, average annual growth rates, baseline and low growth scenarios**

	2010-2020		2020-2030		2030-2050	
	Baseline	Low growth	Baseline	Low growth	Baseline	Low growth
Africa	3.8%	3.1%	3.8%	3.1%	4.1%	3.3%
Asia	4.7%	3.4%	4.4%	3.3%	4.3%	3.3%
China + India	7.6%	4.6%	5.1%	3.7%	3.4%	2.9%
EEA + Turkey	1.8%	1.5%	1.8%	1.4%	1.8%	1.4%
Latin America	3.4%	2.7%	3.4%	2.5%	3.3%	2.5%
Middle East	3.6%	3.0%	3.4%	2.5%	3.3%	2.8%
North America	2.5%	2.0%	2.4%	2.0%	2.1%	1.7%
OECD Pacific	1.5%	1.1%	1.7%	1.0%	1.7%	1.1%
Transition	2.5%	2.3%	2.3%	1.9%	2.2%	1.7%
World	3.8%	2.6%	3.4%	2.4%	2.9%	2.3%

Source: Based on OECD (2012), Conference Board (2012) and IMF (2013).

Table 2.5. **GDP/capita, average annual growth rates, baseline and low growth scenarios**

	2010-2020		2020-2030		2030-2050	
	Baseline	Low growth	Baseline	Low growth	Baseline	Low growth
Africa	1.5%	0.9%	1.8%	1.1%	2.3%	1.5%
Asia	3.4%	2.1%	3.4%	2.3%	3.7%	2.8%
China + India	6.8%	3.8%	4.6%	3.2%	3.2%	2.8%
EEA + Turkey	1.5%	1.2%	1.6%	1.2%	1.8%	1.4%
Latin America	2.4%	1.7%	2.6%	1.8%	3.0%	2.2%
Middle East	1.7%	1.1%	1.9%	1.1%	2.2%	1.7%
North America	1.7%	1.2%	1.7%	1.3%	1.6%	1.2%
OECD Pacific	1.4%	0.9%	1.8%	1.1%	1.9%	1.3%
Transition	2.4%	2.2%	2.4%	2.0%	2.4%	1.9%
World	2.7%	1.6%	2.5%	1.6%	2.4%	1.7%

Source: Based on OECD (2012) , Conference Board (2012) and IMF (2013).

Passenger transport projections

This section applies insights from the Latin America case study to global surface passenger transport projections. It builds on Dargay, Gately and Sommer`s framework for world car ownership projections. Their most recent work includes urbanisation as a variable that reduces the saturation levels of private vehicle ownership on the country level. Applying their framework under our GDP growth scenarios for the Latin American region results in levels of ownership obtained using the Latin American urban model discussed in the previous section, under our *Baseline* with *High Road* infrastructure expansion.

Box 2.3. **Dargay, Gately and Sommer's framework for world car ownership projections**

The framework develops a model for vehicle ownership simulations into the future. It is estimated on the basis of pooled time-series (1960-2002) and cross-section data for 45 countries that include 75% of the world's population. The main driver for vehicle ownership is GDP/capita. The framework explicitly models the vehicle saturation level as a function of observable country characteristics: urbanisation and population density.

Source: Dargay et al. (2007).

The four summary urban scenarios developed for Latin America above were applied to other regions of the world on the assumption that the Dargay, Gately and Sommer results reflect a business as usual scenario with high road infrastructure investment for all countries, as this is most similar to the data on which the model is estimated. Income-ownership pathways were shifted from the average using coefficients calculated in the Latin American case study for every element of the urban context,[13] weighted by the share of urban population in each of the countries. In this way, the methodology produces national scenarios that account for differences in levels of urbanisation. Ownership is also made dependent on the segment of the income-ownership pathway countries fall on. Countries at income levels where the income elasticity of ownership is low will, for example, have lower overall changes.

In the case of two-wheelers, there are no world ownership projections as far as we know. For countries and regions where specific research has been conducted, we used the findings to calculate business as usual income-ownership pathways.[14] This is the case for India, China, and the ASEAN and Other Developing Asia (ODA) regions (Tuan, 2011; Asian Development Bank, 2006; Argonne National Library, 2006). For other MoMo regions we took Baseline trends provided in the MoMo model to calculate the functions to be shifted. The procedure by which such functions where shifted to calculate income-ownership pathways under the different policy scenarios is similar to that used for four-wheel vehicles and accounts for regional differences in the same way.

Bus and rail world scenarios were built using the MoMo baseline for non-urban bus and rail simulations. In the case of urban bus vehicle kilometres, starting points were taken from MoMo. Urban rail vehicle kilometres for 2010 were estimated by ITF using data for urban rail track infrastructure from the International Association of Public Transport (UITP) and the vehicle-kms/infrastructure ratios calculated from the UITP's Millennium Database. Total public transport service in each scenario was assumed to expand at the same rate relative to urban population as in the Latin American case study in each of the scenarios. The percentage of rapid kilometres was assumed to grow at the same rate, relative to per capita income growth of each region than in the Latin American case study.

The different urban transport policy packages result in significant differences in the growth of the world's private vehicle fleet. The highest case results from a context where urban transport in the existing and new urban centres develops according to the *Private transport-oriented, High roads* policy package. The lowest case corresponds to a scenario where this development occurs under the conditions of the *Public transport-oriented, Low roads scenario*. Overall, urbanisation under these two pathways accounts for a difference of 500 million private vehicles by 2050 in the *Baseline* GDP case, and 600 million in the case of *Low* economic growth case (see Figure 2.29).

The effects of alternative urban transport policy on future private vehicle fleet growth vary by region. They depend on income and current location on the "S-curve" describing the development of motorisation as well as the present level of urbanisation and speed of future urbanisation. Another important factor is the level of market development for different types of private vehicle rates (four and two-wheelers). Description of past trends for two-wheelers is based on Montezuma (2012). Figures 2.30 and 2.31 show the 2010 four-wheeler and two-wheeler ownership by world region and expected 2010-2050 growth for these vehicles under the four different urban policy setting scenarios (with Baseline GDP growth).

Higher-income regions (North America, EEA+Turkey, OECD Pacific) have already gone through the accelerated motorisation phase in the past and today show a low and decreasing elasticity of private vehicle ownership with respect to income. Motorisation in these regions was predominantly in the form of four-wheelers, in particular in North America. In the EEA+ Turkey region, the spread of two-wheelers was more significant in countries such as Italy, Spain, Germany and France. However, decreasing prices of less expensive cars slowed down the demand and the production boom of the 1960's, reducing their role in the motorisation process of the region. During the 1980's these vehicles gained some market share but ownership rates remain very low compared to four-wheelers. In the OECD Pacific region, motorcycle ownership is highest in Japan, which during the 1970's became the main manufacturer of these vehicles. Ownership of two-wheelers grew rapidly during the 1960's and also during the 1980's reaching levels well beyond those of European countries. However, two-wheeler ownership slowed down soon after four-wheeler ownership began to accelerate and has even showed decreasing trends, suggesting that two-wheeler's were significant only as a short-term stage of motorisation in this country. In Korea two-wheeler motorisation followed the same pattern but slowed down at lower levels of ownership than in Japan.

The low elasticity between income and private vehicle ownership plus the modest economic growth expected during the period, suggest low growth in the private vehicle fleet of high income regions in the years to come. Since urbanisation rates in these regions are high, diverging urban transport policy has appreciable effects, even when income elasticities are low. The highest differences are generated by higher road infrastructure expansion in urban centres which raise saturation levels for four-wheelers and therefore shift a significant part of the growth towards these vehicles. Overall higher private fleet growth is generated by these scenarios. Differences in public transport and fuel prices have a limited effect because of the small income elasticities in late motorisation stages. Nonetheless, these elements could explain to a great extent the inter-regional difference in the ownership levels at which elasticities began to decrease and therefore, different present private ownership levels between them.

Middle-income regions (Transition Economies, Middle East, Latin America) are still on an upward motorisation path, showing high elasticities of income to private vehicle ownership. The Middle East and Latin America show significantly higher elasticities than the Transition economies. Up to the present, motorisation in these regions has been mainly through the increase in four-wheelers while two-wheelers remain marginal vehicles used for specific purposes. Nonetheless, more recent trends suggest that two-wheelers will become important actors in the future stages of motorisation in the Middle East and Latin America. Various factors have played a role in this trend. Among them, the globalisation of production of two-wheelers which has allowed the introduction of low-price models into these markets. In the Latin American region, Brazil, Colombia and Argentina have now developed their own motorcycle production industry which has further reduced costs and increased supply. Besides low purchase costs, inexistent and lax regulation also account for low costs of ownership and use of these vehicles. Response of demand to decreasing prices of two-wheelers has been very high, even when incomes and motorisation in these regions are in middle stages. This is due to a great extent to deficient quality and insufficient supply of public transport in urban centres and to income inequalities that concentrate four-wheeler motorisation in a small part of the population (with multiple vehicles per household). In this way, two-wheel vehicles have become available as first stage motorisation vehicles for public transport captive users. Severe congestion problems have also increased competitiveness of such vehicles in the urban agglomerations of these regions.

Relatively high income elasticities of private vehicle ownership and personal income growth rates expected during the 2010-2050 period translate into elevated growth in the private vehicle fleet of middle income regions. Growth in the Transition region remains more four-wheeler oriented while the Middle East and Latin American regions show a significant shift to two-wheeler private mobility, and account for a large part of the overall growth of these vehicles. As in the case of higher income regions, greater than baseline urban road expansion generates a shift in the growth of the private vehicle fleet towards PLDVs. However, because ownership of private vehicles is still far from saturation levels, lower urban road expansion also generates significant differences, shifting private ownership growth towards two-wheelers. Scenarios where there are lower fuel prices and lower expansion of public transport result in higher private vehicle growth while those with high fuel prices and significant expansion in public transport slow-down the translation of increasing incomes into private vehicle fleet growth. Effects in public transport development and pricing scenarios have a larger impact in the development of two-wheelers in the Middle East and Latin America regions. Global effects of urban policy changes modelled are emphasised in the three regions since urbanisation rates are already high and continue to rise. This is more so in Latin America which is and will continue to be the most urbanised region among the three.

Lower-income regions (Africa, Asia, China and India) are at an early stage of overall motorisation but some of the countries present already high income elasticities of private motorisation. Many others are at income levels at which elasticity is still low. In the Asia region as well as in China and India two-wheeler motorisation began to grow at low per capita income levels, as in the case of Japan and Korea. Early introduction of two-wheelers into these markets was possible as many mass produce these vehicles (Malaysia, Indonesia, Thailand and later on China and India). In various countries, especially in the ASEAN region, motorcycle ownership has grown to very high levels (Chinese Taipei for example has passed 600 vehicles per 1000 population, see Montezuma, 2012). Recently, growth in four-wheelers has overtaken two-wheelers in the countries experiencing the highest economic growth in the region, which suggests a shift away from the two-wheeler dominated motorisation. Differences between four-wheeler and two-wheeler fleet growth will be especially pronounced in China and India as higher incomes accelerate the shift. In the case of Africa, vehicle ownership of both types of vehicles is still low. Two-wheeler development at early stages of the motorisation process has been less significant than in the Asian region. Nonetheless, there is significant presence of two-wheelers in the region which suggests that these will also play an important role in the overall motorisation process.

As a group, countries in these regions present the highest income elasticities to vehicle ownership and have the highest economic growth throughout the studied period. Because of this it is in these regions that the highest growth in private vehicle fleets occurs. In Asia, growth in four-wheelers is high and accounts for the largest part of the overall four-wheeler growth. Because of the high income elasticity, urban policy alternative scenarios have a greater effect in the increase of these vehicles. Higher urban road provision generates an even higher growth in four-wheelers and accelerates the slow-down in two-wheeler ownership. Higher development and better quality public transport, accompanied with higher fuel prices generates smaller growth in private vehicles and especially in four-wheelers. In Africa, both types of vehicles present relatively high growth and two-wheelers increase their share of the fleet. Better and higher public transport translate into lower overall private vehicle motorisation. The impact of alternative urban transport policies grows as countries become more urban. This will be especially the case after 2050, when urbanisation rates catch up with those corresponding to the middle and higher-income regions.

Figure 2.29. **World private vehicle fleet, 2050**
Different urban policy pathways and alternative economic growth scenarios, million units

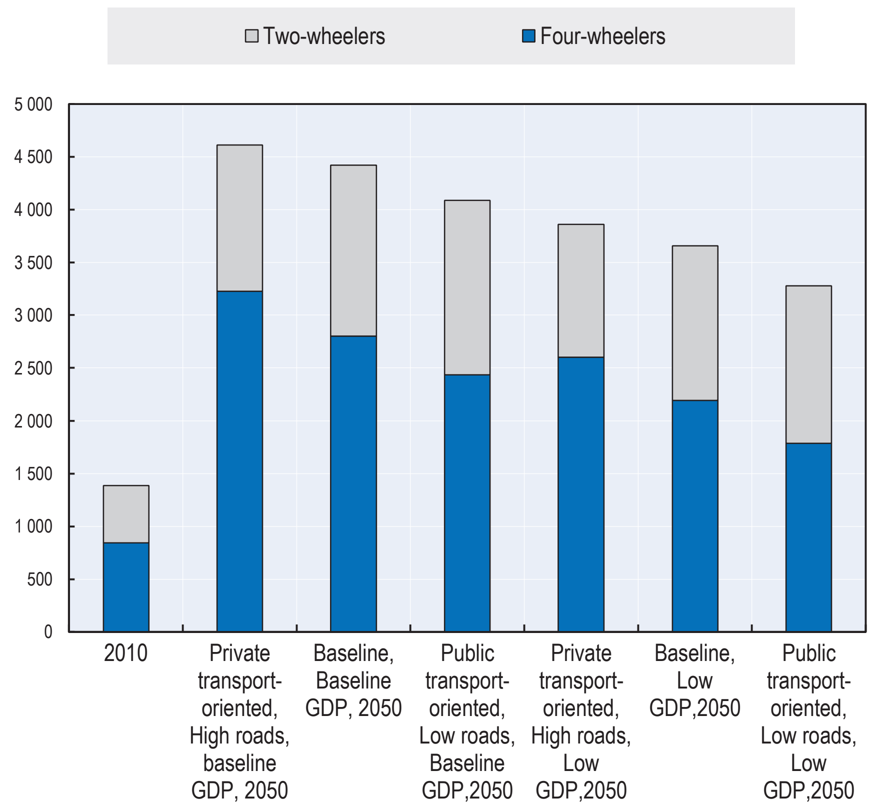


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Figure 2.30. **Four-wheeler ownership and growth by region**
Alternative policy pathways, baseline GDP

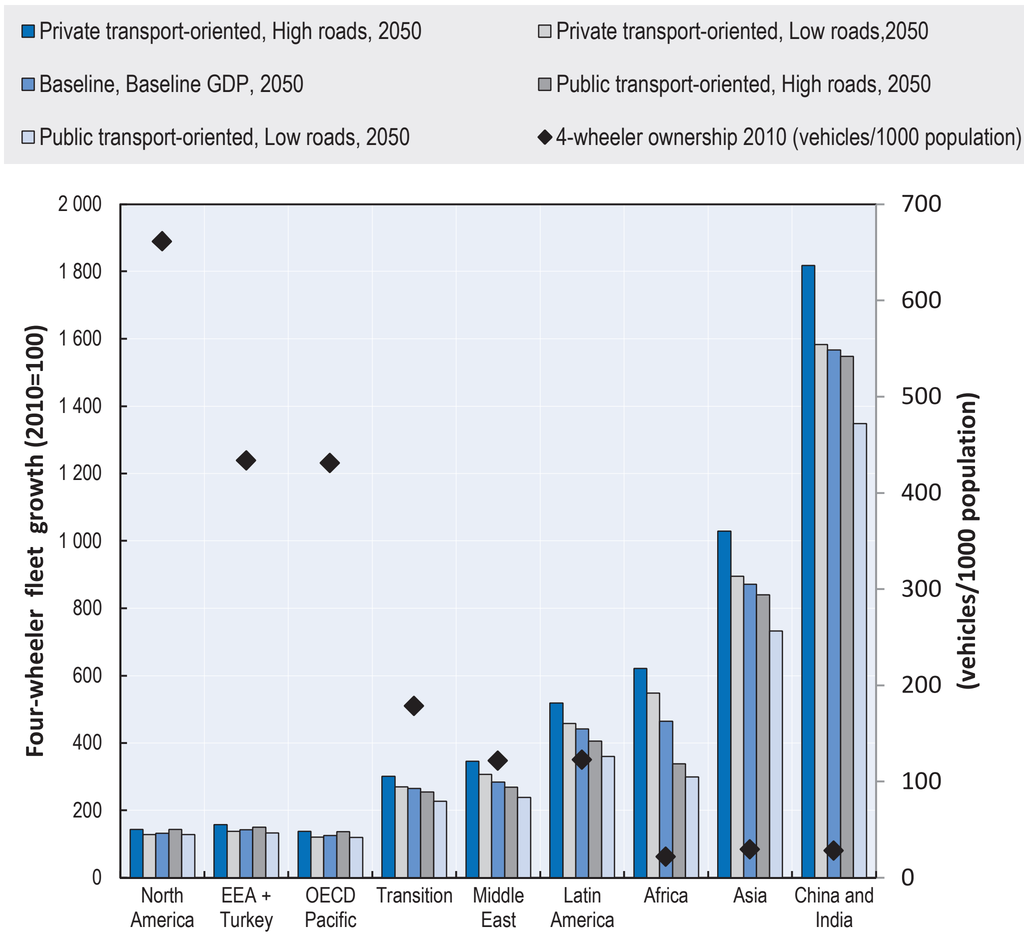

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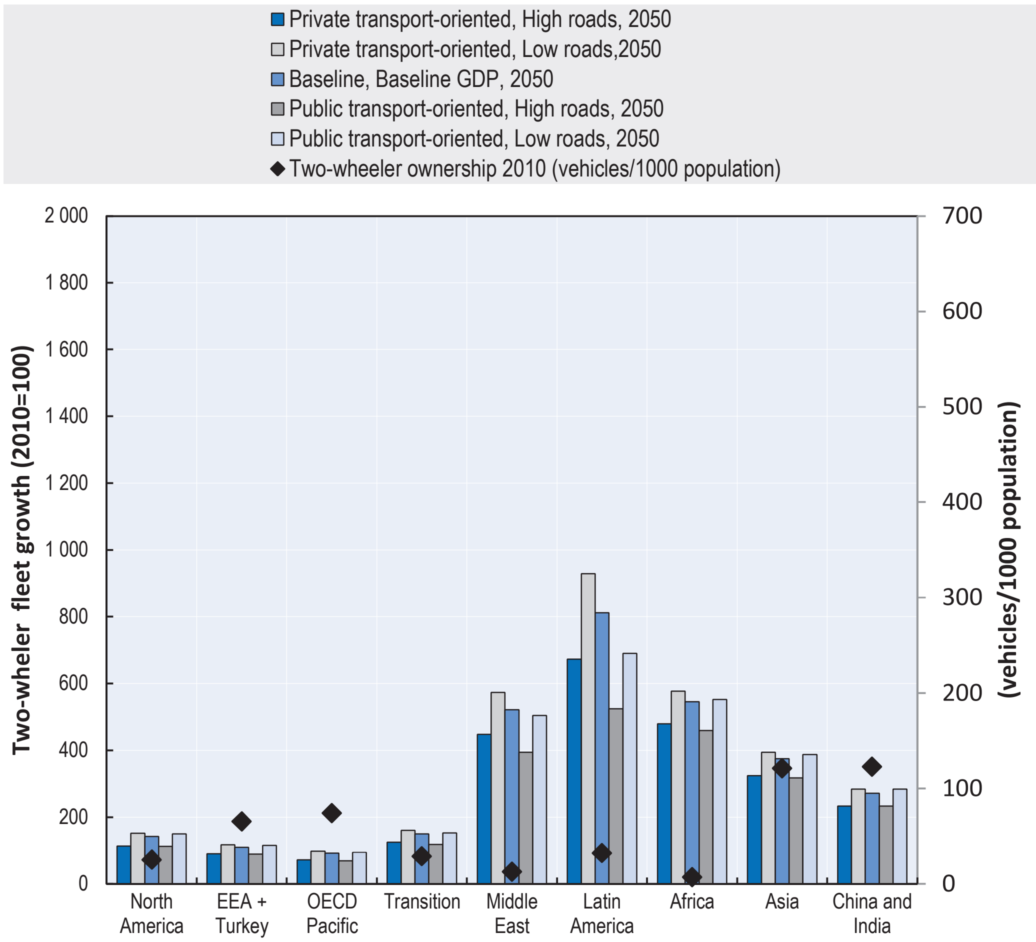
Figure 2.31. **Two-wheeler ownership and growth by region**
Alternative policy pathways, Baseline GDP



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Fleet differences between scenarios are magnified when translated into travel by the effect of different fuel prices. Figure 2.32 shows the total vehicle travel growth under the scenarios by region of the world, modelled under baseline growth assumptions. The figure illustrates *Lowest* and *Highest* scenarios presented in the beginning of this chapter (the *Private transport-oriented*, *High roads* and *Public transport-oriented, Low roads* scenarios respectively) together with the *Central baseline* scenario. The *Lowest* bound is also presented under low economic growth. In this way, the difference between the *Highest* and *Lowest with low GDP* scenario reflects the whole range of variance modelled, taking into account both economic and alternative urban policy scenarios. The effects of urban transport policy can be seen by comparing the *Highest*, *Central*, and *Lowest* scenario. The magnitude of economic growth uncertainty is shown by the difference between the *Lowest* and *Lowest with low GDP* scenario. Figure 2.33 shows the same information but in terms of CO_2 emission growth.

Overall, significantly higher rates of vehicle travel will happen outside the OECD, since it is in these regions where income elasticity of ownership will continue to be high, and where higher economic growth prospects are expected. It is therefore within these regions that diverging urban policies will have a largest effect on the private vehicle ownership pathways and on future growth of CO_2 emissions.

Figure 2.32. **Vehicle-kilometre growth for passenger transport by region, 2050**
Different urban pathways and alternative economic scenarios, 2010=100

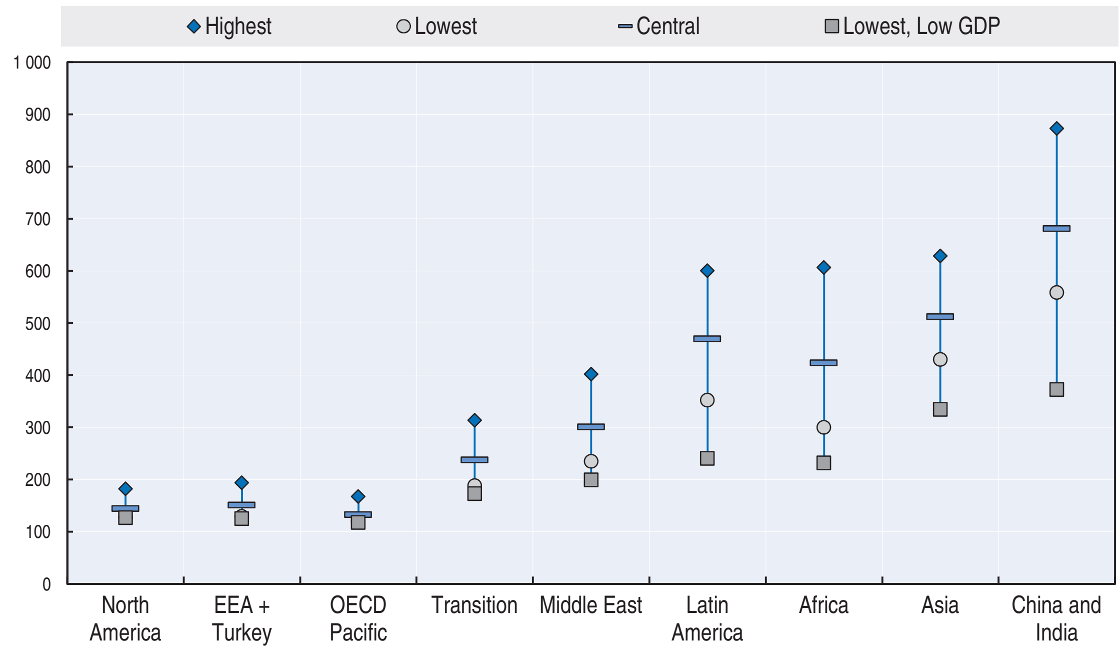

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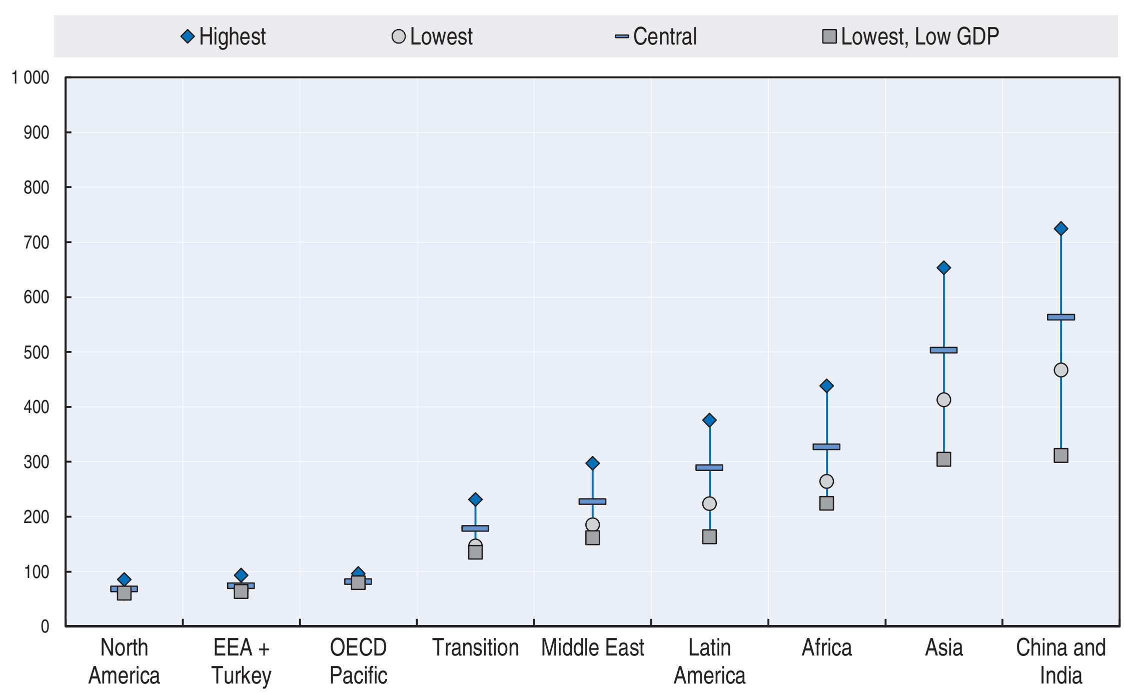
Figure 2.33. **CO_2 emission growth for passenger transport by region, 2050**
Different urban pathways and alternative economic scenarios, 2010=100



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Freight transport projections

Underlying the surface freight scenarios presented in figures 2.34 – 2.35 are assumptions on the correlation of tonne-kilometres transported to overall economic production, and on changes in the volume of economic production itself. There is a strong (unitary) correlation between GDP and tonne-kilometres transported or that the transport intensity of the economy weakens. We examine the effects of these on global transport volumes and emissions by geographical regions.

A reduction in the transport intensity of GDP can result from a dematerialisation of production. Growing service sector shares in advanced economies or increasing production and trade of lighter weight goods like electronic devices reduces actual tonnages shipped. These same traits have accompanied globalisation of the economy, with higher value-goods able to be shipped over longer distances and larger and more global service sectors facilitating de-localised production across the globe. At the same time unbundling can incur transaction costs and economies of scope may work to keep production tasks together (Lanz et al, 2012).

The range of outcomes in terms of tonne-kilometres of surface freight transported in our scenarios is large, especially outside the OECD, and reflects mainly uncertainty over future growth paths.

To construct a central case we pooled historical data from the World Bank World Development Indicators on surface freight volumes, GDP volumes at PPP and per capita incomes at PPP and covering the period 1990–2010. This allows us to cover a broader set of countries than using other datasets, which is important as it contains more observations on different levels of per capita incomes. We use this dataset to estimate the transport intensity of GDP for different per capita income levels[15], by grouping countries into 3 broad income categories: low, middle and high.[16] We find that at the lowest income levels overall GDP correlates over-proportionally (coefficient of 1.13) with surface freight tonne-kilometres and that this relation successively decreases as per capita incomes grow. It is reduced to 0.78 for the high income countries and lies at just below parity (0.96) in the middle income bracket. In the unitary GDP correlation scenario we assume that each additional unit of GDP translates into one additional unit of transport throughout the projected time period and for all regions. For surface freight this can be considered an upper bound. Together with baseline GDP growth, this forms our high scenario. In the decoupling scenario lower correlations are assumed throughout. On average they imply a correlation ranging between 0.65 and 0.85 for the OECD and non-OECD economies, which is slowly decreasing over time. These follow the transport intensity of GDP used in the IEA’s New Policy Scenario. Applied to our low growth GDP scenario this forms our lowest case.

The range of results shown by region illustrate the highest scenario in which there is baseline GDP growth and a unitary correlation with transport, all the way down to the lowest scenario where there is strong decoupling and lower GDP growth. As central cases, and to illustrate the importance of economic production in determining freight transport, we apply the central case transport intensities to baseline and low GDP growth. For regions in which there is a large shift to middle income brackets in both scenarios, this means that surface freight demand will be towards the low scenario, especially for the low central case.

In the high-income countries of EEA + Turkey, North America and the OECD Pacific we see the lowest average economic growth and corresponding growth in tonne-kilometres which are in some cases negative. All countries in these regions are affected more strongly by decoupling than other parts of the world in the central case. This is also the case in the low GDP scenario, since the correlation with GDP remains the same. In the OECD Pacific region surface freight remains important as a link to outside economies especially for land-mass countries as well as providing the capacity for domestic production. Naturally, due to a smaller range of outcomes in growth, the range of outcomes in terms of tonne-km is tighter as well.

In the middle-income countries of Latin America, the Middle East and the Transition Economies tonne-kilometres also see moderate growth. Parts of these regions enter high income ranges by 2050, meaning that in our central scenario surface freight tonne-km begin to decouple from growth more strongly. All three regions rely strongly on trade in raw materials, but much of these materials leave via sea routes, except on the large land-mass countries of Central Asia and Eastern Europe. Future freight transport demand will depend to some extent on the development path chosen, with the existence of a strong service based economy alongside raw materials industries (the Australian case) or a more diversified economic structure including a manufacturing base (more similar to China or United States) having strong influences on freight transport demand, also in terms of mode choice. In part this will also depend on efforts of regional integration which determine the size of effective domestic markets and the possibilities for stronger industrial and consumer bases.

Low-income countries in the regions of Africa, Asia and China + India see stronger growth of GDP meaning that a large share of the population sees middle-income levels throughout the projected time period. On average (including South Africa in the Africa aggregate) all regions are in the middle income bracket between 2010 and 2050. In China growth is considerably stronger until later in the projected time period and it surpasses 17 thousand 2007 USD at PPP by 2025.

The downward risk of GDP growth in parts of these regions is also high in our scenarios which lead to a broad range of outcomes in terms of tonne-kilometres by 2050. Due to stronger per capita income growth in China, the central scenarios show larger reductions in tonne-km there in 2050 than Africa or other developing Asia compared to the baseline scenario. In our central scenario and assuming slower GDP growth, tonne-km are to grow approximately 3 times in all three regions.

Overall, we see that low income regions are particularly susceptible to changes in future growth paths and that outcomes in the freight transport sector vary strongly with them.

Figure 2.34. **Surface freight tonne-kilometres by region, 2050**
2010=100

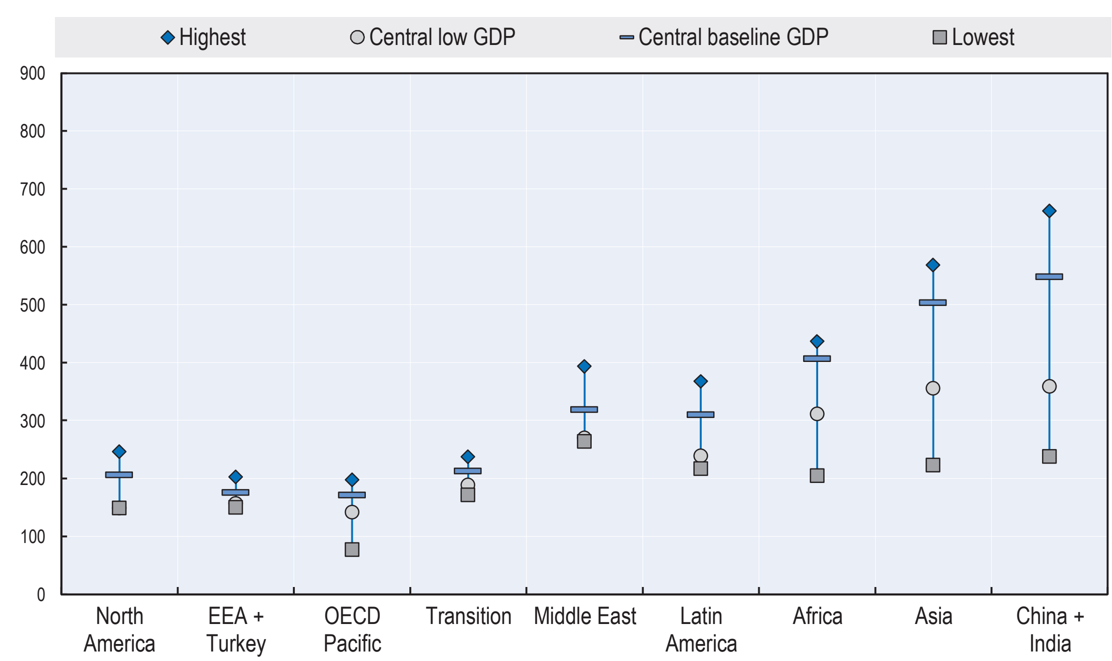

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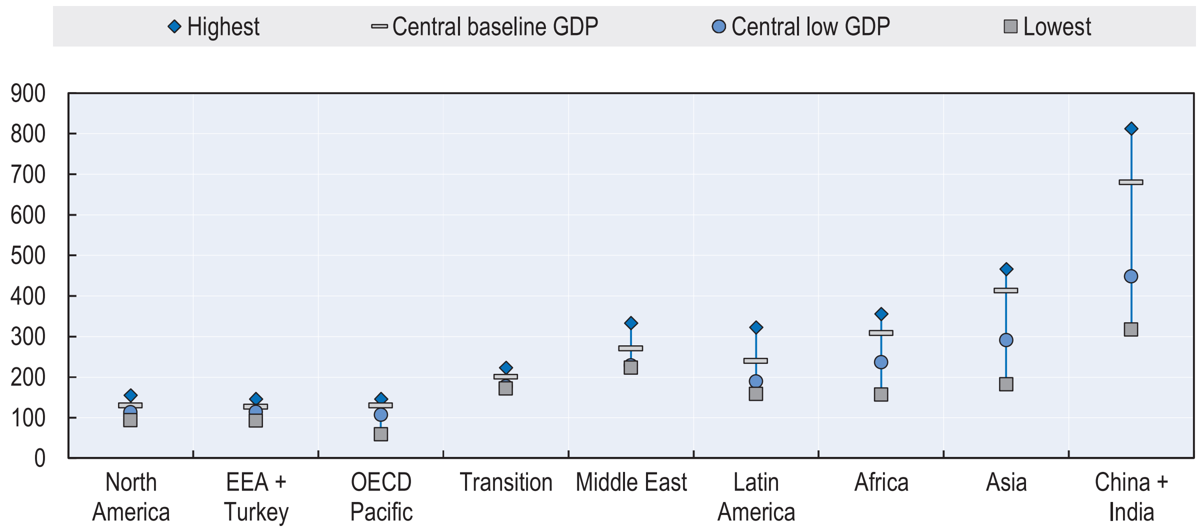
Figure 2.35. **CO_2 emissions from surface freight by region, 2050**

2010=100



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NOTES

1. Latin America's working-age population is projected to expand continuously until it peaks in the 2040s.

2. 500 thousand–1 million population; 1–5 million population, 5–10 million population, and >10 million population.

3. 5-year cohorts.

4. The functional form of the S-curve used is that of a quasi-logistic function with saturation of 1 (100%): $GDP\ concentration = 1/(1+\exp(-x1) * population\ concentration^{-x2})$.

5. This exercise was based on information from "Demographia", adjusted with information from the Urban Mobility Observatory (CAF, 2010). The values used for surface are those reported as urban surface of the metropolitan region. Paths were established for those countries where enough information was available: Argentina, Brazil, Colombia, Mexico, Chile, and Peru. Other countries where assumed to follow the path to which the few urban centres available seem to be closer to, or the path calculated when using all available information for the region.

6. Simple average across city types.

7. Initial weights of each country`s public transport service explain the fact that although per capita levels by country are set to be 1.5 times their 2010 levels, this does not translate into a 1.5 per capita growth for the whole region.

8. Several additional sources to build assumptions on kms in BRT segregated corridors where used: Global BRT Data, available at: http://www.brtdata.org/; SIBRT Technical Data sheets, available at: www.sibrtonline.org/en; "Lessons learned from major bus improvements in Latin America and Asia"World Resources Institute-EMBARQ, 2010; "Bus Rapid Transit Planning Guide"Institute for Transportation and Development Policy, 2007.

9. In per capita terms.

10. The general form for both light-duty vehicle and motorcycle ownership is the following:
$$ownership = Saturation/(1+\exp(-1*x1)*\left(\frac{GDP}{population}\right)^{-x2} * fuel\ prices^{-x3})$$
where $= S1 + s2 * roadprovision$; $x1 = vkms\ public\ transport\ service + x1a * share\ of\ service\ by\ rapid\ modes$; Variables $x1a$ and $x2$ where allowed to adjust according to the category of urban agglomeration.

11. A scenario presented in the *World Energy Outlook* that sets out an energy pathway consistent with the goal of limiting the global increase in temperature to 2°C by limiting concentration of greenhouse gases in the atmosphere to around 450 parts per million of CO_2, www.iea.org.

12. Non-urban ownership rates were calculated using non-urban GDP/capita calculated by the Latin American urban transport model included in MoMo.

13. Changes in oil and technology scenarios were calculated running a regression for a coefficient that weighted by the urban share in Latin American countries would shift the Dargay income-ownership pathway in the same magnitude than the baseline with high infrastructure in the Latin American module. Such a coefficient shifts the income-ownership pathway by modifying the α term of the Gompertz function used by Dargay and Gately.Public transport scenarios were simulated in a similar way. However, the calculated coefficient modifies the β term of the Gompertz function. Finally, for road infrastructure scenarios the sole Dargay urbanisation coefficient was used in the case of the high road expansion scenario. As this coefficient already multiplies

urbanisation rates, what was calculated is the magnitude by which such a coefficient would be higher in a low infrastructure expansion case.

14. Quasi-logistic functional forms were utilised based on Button et al. (1993).

15 This is done with the regression $\log(\text{surface tkm}) = \text{constant} + \log(\text{GDP}) + \text{Dinc} * \log(\text{GDP})$, where Dinc is a dummy variable equal to one according to the per capita income groupings. The lowest income group is the control group. The coefficient on GDP thus captures the relation effect on surface freight tonne-km for the low income category and is reduced by the coefficient on the interaction variable for other income groupings.

16 Per capita income ranges between 0 and 3 thousand GDP at 2005 USD PPP in the low, between 3 and 17 thousand in the middle and anything above 17 thousand in the high. These brackets do not correspond with commonly used World Bank groupings, and should be viewed in terms of a ranking rather than a definition of income status.

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CHAPTER 3. TRANSPORT FOR GROWTH

This chapter discusses how to improve transport's contribution to economic growth with the focus on advanced economies. It reviews evidence on the contribution that investment in transport infrastructure can make to productivity and output growth. The chapter provides evidence of current transport infrastructure spending levels. Finally, it gives policy guidance on how to strengthening appraisal for goal-oriented spending decisions, taking into account also wider economic benefits.

How much does investment in transport infrastructure contribute to growth?

Transport contributes to economic growth and to welfare by facilitating access to labour and output markets and to welfare-enhancing activities in general. There is ample evidence that transport activity rises with economic development, and that this is both because transport enables development and development leads to more demand for movement of people and goods. Global economic development is supported by fast, smooth and cheap transport as it facilitates reaping gains from specialisation and from economies of scale while maintaining good connections with markets.

With lacklustre growth in advanced economies in particular, the question arises if transport policy could enhance the sector's contribution to growth while containing the negative side effects on the environment and ensuring sustainable development over the long run. Without aiming for a comprehensive treatment of the issue, this section discusses some ideas on how to improve transport's contribution to growth, with a focus on advanced economies.

Within a short run perspective, discussions on transport for growth are part of the broader discussion on the desirability of stimulus programmes and what concrete form they should take. Opinions on the effectiveness of stimulus policies differ. If austerity is seen as the opposite of expansionary macroeconomic policy, then the emerging view appears to be that the merits of austerity have been overstated[1], and that there is a good case for expansionary spending, in particular on items that strengthen economies' long-run productive capacity. The point was made with some force by Amartya Sen in his keynote speech at the International Transport Forum (ITF) Summit in May 2013:

> "Many countries in the world still need more institutional reform (there has been some reform in Europe, but much more needs to be done), but they do not need any more austerity – in fact the opposite. In thinking about spending and investment on transport infrastructure, it is important to see clearly that an expansion in that field does not make reform any more difficult, while helping to stimulate the economy in a powerful way, if the process is well chosen. That is the context in which, I would argue, the challenges of transport spending and funding have to be viewed today, especially in Europe." (Sen, 2013).

But what exactly is the potential contribution that investment in transport infrastructure can make to productivity and output growth? Attempts have been made to measure this contribution empirically, with at first sight somewhat underwhelming results. Early findings of large growth effects from spending on public infrastructure, e.g. in the seminal study by Aschauer (Aschauer, 1989), were put into question when more sophisticated econometric work produced a wide range of results, including findings of no growth effects at all. For example, a recent International Monetary Fund (IMF) study (Acosta-Ormaechea and Morozumi, 2013) finds that reallocation spending to transport and telecommunications infrastructure has no significant impact on output, in a study for 14 low-, 16 medium-, and 24 high-income countries from 1970 through 2010. This is in contrast to quite strong output effects from more spending on education. Similar results on growth effects from infrastructure spending have been found in some earlier studies using aggregate data, so it is not a foregone conclusion that such spending increases growth.

Deeper insight in the distribution of growth impacts of transport infrastructure is provided by Melo et al. (2013), who carried out a meta-analysis of 563 estimates of the output elasticity of investments in transport infrastructure. The studies included in the meta-analysis estimate a production function, where output depends on inputs including labour, capital and transport infrastructure investment. The average estimated output elasticity of transport infrastructure investment is 0.06, meaning that a 10% increase in infrastructure investment raises output by 0.6%. The median elasticity is much lower at 0.016, suggesting that the average is affected by a small number of high elasticity estimates. Furthermore, the standard deviation of the mean is 0.288, indicating a very broad range of estimates and suggesting that the finding of a positive average output elasticity may not be very meaningful in itself. Interestingly, Melo et al. find larger output effects from investment in roads than from investments in railways and airports. The effects are also larger for output from manufacturing than from the economy as a whole. The range of effects found within these subgroups remains large, however. The overall conclusion is that output effects from infrastructure investment are highly context-specific, and not every investment should be expected to engender strong output growth.

One possible explanation for the absence of robust findings on growth effects from transport spending in aggregate data is that the growth effects are too diffuse over time and space to be traceable in such data. Alternatively, it may be the case that in fact there is no strong effect on average, and this could occur because not all spending decisions are made solely with growth objectives in mind – instead distributional or broad accessibility concerns can underlie spending decisions – or are poorly made in the sense of not adequately allocating resources in line with stated policy objectives.

In this context, a study by Duranton and Turner (2012) on the effects of interstate highway provision on employment growth in US cities' is noteworthy. Through careful econometric analysis, the authors find that raising the stock of a city's highways by 10% increases employment by around 1.5% over 20 years. Obtaining this result requires controlling (through the use of instrumental variables) for the way decisions on infrastructure are made; for if no such controls are used the (wrongly) measured employment effect is much *smaller*. This means that the decision process appears to favour investment in areas with lower growth potential, so that the employment effects of such investment are smaller than they could have been under different project selection approaches. Furthermore, the results also suggest (albeit with a lower degree of confidence than applies to the estimation results) that building more highways by the same process and at the same rate as in the period 1983 – 2003 is not worth the cost, so is not a good investment.

The upshot of these empirical results is not that productivity-improving transport investments no longer exist in advanced economies, but that prevailing project selection mechanisms do not guarantee, or perhaps do not envisage, putting investment funds to their best possible productive use. This may be the result of an explicit and legitimate policy choice, if objectives other than productivity and growth carry weight in the decision process. A less benign explanation is that project selection is subject to political economy pressures that reduce the overall social returns from infrastructure investment and from transport policy in general. It is also sometimes argued that investment decisions are too strongly centred on supply of general purpose infrastructure, in the assumption that usage will be forthcoming if general economic conditions are favourable. In reality, large infrastructure users (e.g. major companies) can have substantial bargaining power over what infrastructure they require before they make location decisions, and by leveraging this power they influence the ultimate economic returns from infrastructure investment (Ansar, 2013).

Chapter 4 discusses how current transport funding approaches sometimes amplify the risk of sub-optimal funding decisions. Below we discuss what broad indications exist on funding levels and needs, and on the role of appraisal in making good investment decisions.

Spending on transport infrastructure

Table 3.1 shows what share of Gross Domestic Product (GDP) countries devoted to overall investment, to infrastructure investment and to transport infrastructure investment in 1980 and 2008. Total investment is between a quarter and a fifth of GDP, and is on the rise in emerging economies while it declines in developed economies. These opposite movements make sense given the differences in levels of economic development, but at the same time there is rising concern about too much investment in at least some emerging economies (with China the best known example) and too strong a consumption-orientation in developed economies (with the United States as one example among others, particularly in the decade leading up to the crisis of 2008).

The pattern of infrastructure and transport infrastructure spending is similar to that of total investment, with declining shares of GDP in developed economies and rising shares in emerging economies.

Figure 3.1 shows how much ITF countries spend on road transport infrastructure as a share of GDP in relation to their per capita GDP. ITF countries include advanced as well as emerging economies, and the differences between both are as clear as in Table 3.1, although there is considerable heterogeneity within the group of emerging economies. In emerging economies, investment in transport and other infrastructure contributes to economic development by establishing connectivity, i.e. expanding the reach of transport networks, and by improving quality, i.e. faster and more reliable connections. Infrastructure spending has also been used as a macroeconomic policy lever to support demand, with the inherent risk that social returns in the long run are limited or even negative (i.e. overinvestment). As mentioned in chapter 1, growth in China emphasises investment as a domestic source of growth. Over-reliance on investment leads to unbalanced growth and implies a risk of overinvestment. Chapter 4 discusses high-speed rail development as an example of likely overinvestment.

In advanced economies, the share of transport investment in GDP is lower than in emerging economies and it is lower in 2008 than in 1980 (see ITF, 2013). More generally, Figure 3.1 strongly suggests a negative correlation between per capita income and the share of GDP spent on road investments. For the highest income countries, investment in inland transport infrastructure (which is broader than just road investment shown in Figure 3.1), the average GDP share is roughly constant at 1% since the 1980s. It is sometimes argued that this particular GDP share has become a *de facto* political benchmark in Western European countries in the 1980s (Short and Kopp, 2005). There is of course no guarantee that this leads to adequate budgets and even less to appropriate spending decisions. To the contrary, such a benchmark suggests budgeting through maintaining a status quo rather than allocating available resources on the basis of needs in transport and in other sectors.

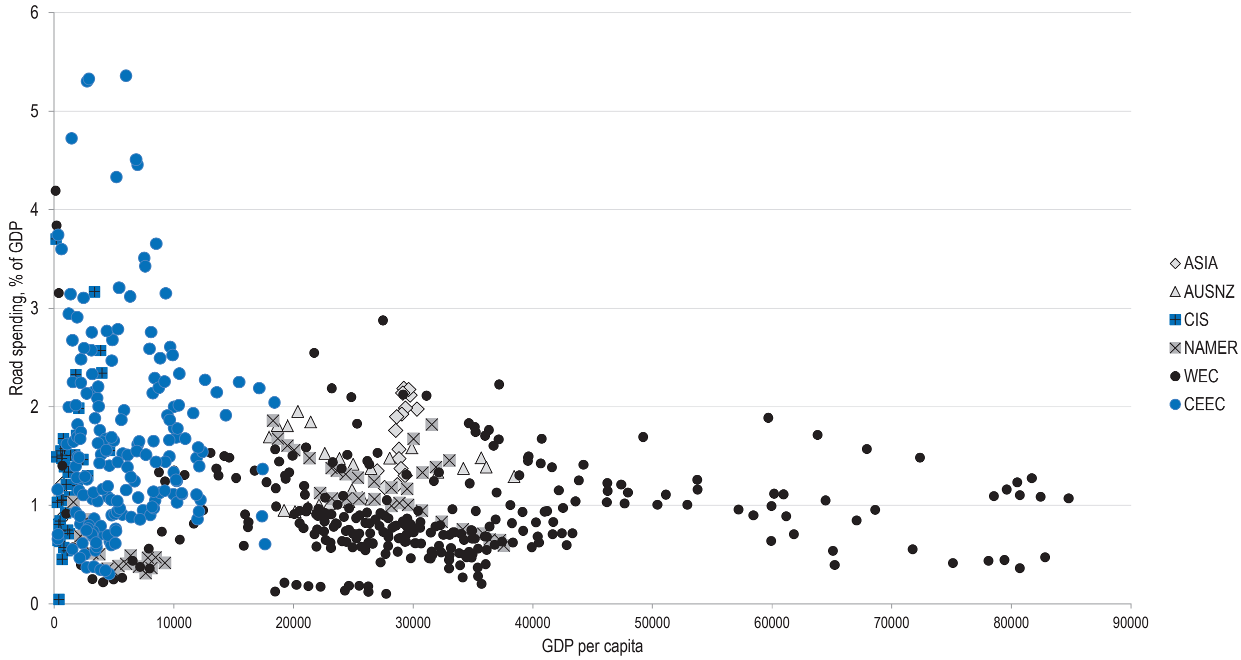
Table 3.1**. Transport infrastructure, infrastructure, and total investment spending**

Percentage of GDP, developed and emerging economies

		1980	2008
Developed economies	Transport infrastructure	1.5	1.3
	Infrastructure	3.6	2.8
	Total investment	24.3	20.9
Emerging economies	Transport infrastructure	1.9	3.1
	Infrastructure	3.5	5.7
	Total investment	Approx. 20	Approx. 25

Source: McKinsey Global Institute, 2010, Farewell to cheap capital?, p.15, 26, 27.

Figure 3.1. **Road infrastructure spending**
Percentage of GDP, constant 2005 euros



StatLink http://dx.doi.org/10.1787/888932944806

Note: WECs include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey and the United Kingdom. CEECs include Albania, Bulgaria, Croatia, Czech Republic, Estonia, FYROM, Hungary, Latvia, Lithuania, Montenegro, Poland, Romania, Serbia, Slovakia and Slovenia. CISs include Azerbaijan, Gerogia and Moldova. North America includes Canada, Mexico and the United States. Australasia includes Australia and New Zealand. Data for Japan exclude private investment.

The question of whether current spending is ‘enough’ is not easily answered. The empirical evidence reviewed earlier in this section appears to suggest no shortage of spending on new infrastructure, as growth effects are small on average and vary widely. Furthermore, one of the most solid and most often repeated insights from transport economics is that prevailing pricing structures in transport almost everywhere lead to inefficient use of infrastructure. Reducing such inefficiencies would mean that more social value can be obtained from better use of existing infrastructure – better pricing is a much cheaper way of getting larger social returns from transport infrastructure than expanding the infrastructure itself. However, the empirical evidence is (naturally) based on past expenditures and does not cover all expenditure types or not in sufficient detail to draw conclusions about the desirability of particular investment options. While better pricing is a ‘no brainer’ policy recommendation, it does not follow that the case for more or better infrastructure evaporates completely.

Are there reasons to think that future needs in high income economies might differ from past needs, or that reorientation of infrastructure spending might produce larger payoffs than those seen in the past? The relative decline of infrastructure investment spending over time in advanced economies may well have been justified as connectivity and quality of networks increased and the marginal benefits of additional investment declined. However, maintaining or improving the quality of infrastructure to meet higher expectations is likely to require increased spending on maintenance and upgrading as networks age.

There is widespread concern that maintenance spending has been lower than ideal, so that future costs to maintain network integrity can turn out to be high. It is difficult to give this concern a strong empirical basis as consistent data on the performance of transport networks are not available (see ITF, 2013 for some suggestive evidence on the strong dependence of maintenance outlays on macroeconomic conditions). Political economy arguments do go in the same direction, however, as they point to a political preference for building new infrastructure, and a strong sensitivity of maintenance spending on business and budget cycles.

Since delaying maintenance increases future costs more than it saves on current costs, such dependence tends to drive up life cycle costs of infrastructure. As a consequence, future infrastructure spending in high income economies likely requires a stronger emphasis on maintenance than seen in the past, and total spending needs may increase. For new infrastructure, careful evaluation of benefits and costs of potential investment, embedded in a coherent strategic view of what transport is for and how goals are to be achieved, is required. This is discussed under the next subtitle.

Strengthening appraisal for goal-oriented spending decisions

If transport policy makers are to make credible claims on resources to ensure the sector can make its full contribution to overall welfare, it is imperative to assess as well as possible what the social returns of various ways of deploying the budget are likely to be. In many countries, such systematic assessment takes the form of cost-benefit analysis (CBA).

The prominence of CBA for evaluating transport sector projects in the countries that use it systematically means that the sector has a clear idea of how much value for money it generates, and this can strengthen its case in arguing for budgets. It is, for example, plausible that this helped limit the impact on the transport sector of the significant overall public spending cuts that took place in the UK in the Autumn of 2010 (ITF, 2010). The relevance of appraisal to funding was highlighted at the ITF Summit in 2013 by Alberto González of CINTRA, when he stated that "Most [PPP] projects in [financial] trouble turn out not to address a real need for mobility and are based on poor cost-benefit assessment".

Appraisal-informed project selection strengthens the legitimacy of spending decisions over the long term. At the same time, the practice of appraisal needs to meet decision makers' needs, and these evolve over time. In order to live up to its potential, continual improvements to project appraisal must be made. Below we briefly discuss some points of debate on this issue.

Evaluate strategies, not just projects

With increasing awareness of the contribution of mobility to welfare, but also of the considerable costs and potential threats to sustainability, transport policy needs a clear sense of purpose and the best possible guidance on how to attain strategic objectives. Careful assessment can support the development and execution of this strategy by determining what pathways offer best value for money. As remarked Sir Peter Hendy at the ITF Summit in 2013, when commenting on the challenges facing transport policy in London: "Settling the funding sources is important, but what we have benefitted from most, is having a long-term plan."

CBA has been developed as a method for project appraisal, i.e. for assessing the impact that a project is likely to have on social welfare. Such evaluation implies comparison to other projects and to a do-nothing-scenario. Projects are broadly defined as discrete changes to the prevailing situation. CBA can be used for the appraisal of technical variants of a project, e.g. comparing different alignments for a planned bypass of a congested transport link. It can also be used for assessing clusters of projects, e.g. the construction of rail networks, for programming and hierarchising a set of independent projects, either for the same mode or for different modes under a given budget allocation, and for strategic policy choices, e.g. in the context of decarbonisation or broader sustainability policy, or for deciding the relative shares of the public budget to allocate to transport versus other sectors.

The level of detail and the emphasis of the modelling work needs to be adapted to the particular context of the appraisal. For example, when comparing two bypasses, the focus will be on calculating time savings through a transport network model and on construction costs and environmental and safety impacts. But where, for example, decarbonisation is concerned, broad trade-offs between environmental concerns, public finance, and the pros and cons of various types of spatial development patterns need to be addressed. When appraisal moves into the planning and policy arena, narrow time, cost and safety concerns will no longer suffice to obtain a good appraisal; instead, more attention will need to go to the impacts on spatial distribution of activities, on macro-economic impacts and on the definition of the transport problem itself.

In order to maximise its potential value for strategic policy orientations, CBA needs to be sufficiently broad. Excluding impacts on the grounds they are poorly understood becomes problematic when these impacts are essential to the project. The better approach is to account explicitly for uncertainty. This imposes rigour on how trade-offs between various objectives are handled. It also highlights the need for more research to improve knowledge of the impacts of investments in relation to strategic objectives.

CBA is evolving, with a gradual expansion of the scope of the analysis. Coupled with the use of transparent summary tables to present results alongside distributional effects and other indicators critical to political priorities, CBA is well suited to addressing changing strategic policy priorities and emerging demands for project programming.

Policy alternatives are not limited to building new infrastructure

Project appraisal, and particularly cost-benefit analysis, has often been used to compare several ways of solving a capacity problem in transport networks. This boils down to comparing the various impacts of technical alternatives, which have in common that they are infrastructure investments. However, there is generally no reason to restrict the set of policy alternatives to physical investments in infrastructure. Pricing of road use or of parking, for example, has the potential to improve network use at lower costs, and should be considered as routinely as building new capacity. Similarly, upgrading available capacity can be a valid alternative to expanding it.

Considering a sufficiently broad set of alternative policy approaches is particularly important as appraisal moves from narrow project selection to broader support of strategic choices, both because the set of potential instruments becomes broader and because the potential costs of choosing suboptimal policy approaches rises.

Consider a sufficiently wide range of benefits

The apparatus of CBA is designed to estimate costs and benefits as well as possible, in order to make statements on net benefits (“value for money”) with a reasonable degree of confidence. The core methodological approach of CBA for transport infrastructure is to measure benefits through the willingness of users to pay for the transport benefits, i.e. the “direct benefits” of the infrastructure.

The approach of working with direct benefits to users can be seen as one rooted in practicality. A transport infrastructure project will affect travel times and more generally the benefits of travel that accrue directly to users. Traffic models help analysts form a picture of what these direct effects will look like. The direct benefits from improved travel conditions include travel time, but also increased reliability of travel time and the benefits of more convenient and more comfortable travel. Recognising these various dimensions of direct benefits is important as they relate not just to travel speed and therefore avoid a bias towards faster modes of travel.

Measuring user benefits is far easier than tracing the ultimate incidence of project impacts throughout the economy, and therefore provides a practical avenue to producing robust results relatively quickly. Practicality, however, comes at a cost in terms of scope and policy relevance. Relevance becomes a problem when policy makers are less interested in total benefits than in distributional impacts, whether by income group or spatially. The scope issue arises because direct user benefits represent total benefits only under restricted conditions, and in recent years some productivity effects (particularly from agglomeration) have been shown to be additional to the ones captured in direct benefit-based assessment.

The influential Eddington study (Eddington, 2006) argues there is sufficient empirical evidence that agglomeration economies are important for some, typically large, projects and that they should be included in appraisal of these types of project especially when investments significantly alter access to places of work. The case for including such benefits in routine appraisal is weaker, as it is not yet possible to transfer this evidence to the context of a typical, smaller, transport infrastructure project. The conclusion is that using rules of thumb to account for agglomeration benefits in CBA is not best practice. Investigating the existence and size of agglomeration benefits makes sense for large and very costly projects but the evidence suggests it would be misguided to treat agglomeration as a general boost to the benefits of transport infrastructure investment, representable by some kind of average mark-up over direct user benefits.

Even if CBA produces a good approximation to total costs and benefits, this knowledge provides little information on how cost and benefits are ultimately distributed in the economy (incidence). This is a problem because incidence is relevant to decision making. In order to determine the full distributional impact of transport projects, it is not enough to establish the direct impact of the project on different user groups, because direct impacts can differ strongly from the ultimate impact after all channels of transfers (and wider impacts) have played out. Tracing the ultimate incidence of project impacts requires a model of the economy that distinguishes at least the main groups that could be affected by that project, for example a spatial general equilibrium model that distinguishes between various types of households and the effects on various locations. Operational models to accomplish this are not yet routinely available and customised applications are expensive and time-consuming. The consequence is that attempts to describe the likely ultimate incidence of the impacts of transport projects are relatively rare and cannot up to now aspire to a high degree of accuracy.

Insight into the distributional effects of transport policy in general is of clear interest, given the importance of distributional outcomes in determining the welfare derived from aggregate production. It does not follow, however, that transport policy always needs to be modified in order to obtain preferred distributional results. Often there will be better instruments to attain desired equity objectives, e.g. social security systems and tax systems.[2] It is plausible nevertheless that in some situations transport policy itself plays a role in distributional policy, e.g. by providing access to labour markets. Careful consideration of alternatives, e.g. promoting geographical household mobility, is needed to evaluate the relative appeal of several access-related policy options. In any case, there is no justification for using transport policy as a distributional instrument by default.

Systematic appraisal provides decision makers with coherent information on core costs and benefits from a set of policy options, which can be defined at the strategic level or at the operational project level. The method clearly has merit, and its limits are equally clear. Good appraisal facilitates access to funding for worthwhile projects, and can help bring innovations to funding mechanisms. For example, the Special Business Rate that helps fund the Crossrail project in London was partly made acceptable by the appraisal, which showed clear benefits for the business community in particular.

Appraisal provides information that can help create acceptance of infrastructure investments, but acceptance nevertheless remains a major challenge. Socially worthwhile projects for which funds are available can be, and often are, resisted by stakeholders faced with negative impacts. Policy makers sometimes see such action as the main hurdle to effective decision making, as testified by the following comment from the German Minister of Transport, Dr Peter Ramsauer, at the ITF Summit in 2013: "The main problem for advancing with needed investments is not funding but public acceptance."

NOTES

1. See for example questions regarding the size of the output gap in European economies. If the output gap is larger than thought, the case for austerity to address structural sources of excessive government spending weakens. (http://online.wsj.com/article/SB10001424127887323899704578585661751307472.html)

2. See OECD (2006) for an in-depth discussion.

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CHAPTER 4. FUNDING AND FINANCING TRANSPORT

This chapter reviews future funding needs to maintain the performance of the transport infrastructure. The chapter then investigates what funding frameworks are needed to ensure adequate funding levels and cost-effective spending decisions. It addresses the question of funding and financing mechanisms and highlights the need for committing to reliable funding flows for transport infrastructure, including private sector finance. Finally, the chapter summarises the role and scope for public-private partnerships in delivering future transport infrastructure

Future funding needs

Chapter 3 provided indicators of the level of transport infrastructure spending, showing how the share of country Gross Domestic Product (GDP) devoted to infrastructure first rises as economic development takes off and then declines as per capita GDP grows. Further evidence is provided in a study for 152 countries from 1950 through 1995 (Canning, 1998), which shows that the elasticity of road length with respect to GDP rises from zero to one as middle income levels are reached. This pattern accords with common sense, as investment needs are high as long as basic networks are not in place and connectivity is poor, and needs for network expansion decline when connectivity is already high. Having established a high degree of connectivity and accessibility can be seen as a defining feature of an advanced economy.

While it is plausible that a smaller share of GDP is sufficient to meet transport investment needs at higher levels of economic development, it does not follow that current levels of spending are appropriate in higher income economies. As mentioned in chapter 3, there is widespread concern in advanced economies that maintenance spending has been lower than it should be, so that future costs to maintain network integrity can turn out to be high. Furthermore, networks do not only need to be maintained, they also need to be improved to meet rising expectations for quality of service, and they need selective extension to cut congestion or meet rising levels of demand. There are strong indications that current investment efforts in advanced economies are insufficient to ensure maintenance, upgrading and selective extensions.

In Germany, for example, the report of the Daehre Commission (Daehre, 2012) notes that road infrastructure investments in the country have declined from 1% of GDP to around 0.7% in recent years. Gross expenditures have declined by 24% in real terms over the past 20 years. Over the same period, passenger traffic increased by a quarter and freight traffic by a factor three. Quality indicators show a marked decline. Under current funding arrangements, available resources fall short by EUR 3.3bn of spending needs for maintenance, upgrading and extensions. Adding these resources would increase the budget by a bit less than 50%.

The situation in the United States is broadly similar. Evidence suggests that alarmism over ‘crumbling infrastructure’ and an ‘infrastructure crisis’ are overblown. Systematic tracking of highway performance over time up to 2008 shows that the overall condition of the state-owned highway system ‘has never been better [than in 2008]’ (Hartgen et al., 2010). However, the authors are careful to add that performance differs among states, with larger and more urbanised states evolving less favourably than smaller and more rural states. Furthermore, some performance indicators are positively affected by the decline in travel observed in recent years (less congestion, less road wear, fewer fatalities).

It is more than doubtful, however, that infrastructure performance in the United States can be maintained in the future with current expenditure levels. To the contrary, long-time observer Ken Orski wrote in July 2013 that:

> “No one disputes the infrastructure advocates’ claim that some of America’s transportation facilities are reaching the limit of their useful life and need reconstruction. Nor does anyone disagree about the need to expand infrastructure to meet the needs of a growing population.” (Orski, 2013b)

The US Department of Transport calculated that, up to 2028, keeping spending on all roads constant in real terms at 2008 levels would fall short of investment needed to maintain current conditions and performance by 10%, whereas real investment spending would need to rise by nearly 90% if all cost-beneficial improvements were to be implemented (U.S.DoT – FHWA – FTA, 2012). Although there is in general no reason to think that all cost-beneficial projects ever could or should be carried out, the overall conclusion remains that parts of the interstate highway system are reaching the end of their design life, so reconstruction and upgrading needs will rise. Furthermore, improvements are needed to deal with congestion, population growth, rising service level expectations, and broad objectives of growth and competitiveness. The case for increasing infrastructure spending is much less in maintaining what exists than in building for future prosperity.

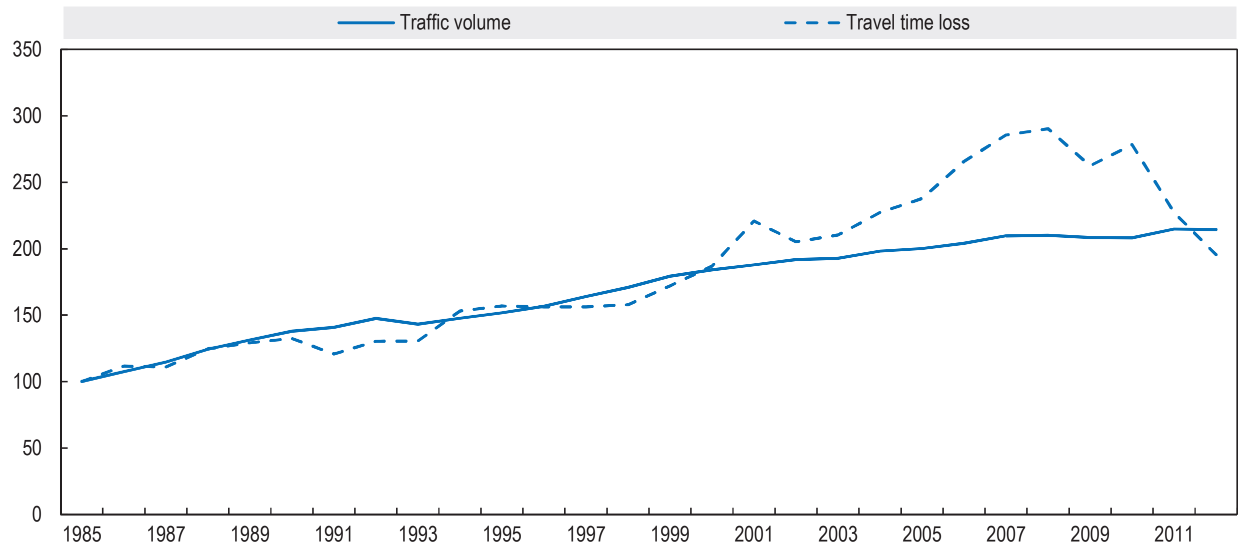
The need for increased infrastructure spending is also apparent from long term transport infrastructure supply projections. Constructing such projections is fraught with difficulties, given the fairly weak empirical understanding of the links between economic development, traffic growth and infrastructure provision in the past, and given problems with transferability of past patterns to future development in other regions of the world. However, pragmatic approaches do help gauge the size of the infrastructure challenge the world is facing over the coming decades. For example, recent work by the International Energy Agency (IEA) suggests that the global supply of paved lane-kilometres will be 1.55 times as high in 2050 as it was in 2010 (Dulac, 2013). This estimate is derived from the IEA's traffic scenarios for 2050, which appear fairly conservative in general. Furthermore, the projections allow for a strong increase in vehicle travel per lane-kilometre of road in China and in India. With the same demand projection and a more limited increase of this ratio, considerably higher projections would result. For these reasons, the strong increase projected by the IEA therefore probably is not in the high range of reasonable results.

Infrastructure investment needs can also be derived from economic growth projections instead of transport volume projections. McKinsey (2010) notes a strong correlation between overall investment rates and rates of output growth. From 1970 to 2002, gradually slower growth in developed economies translated into lower investment rates (down to approximately 22% of world GDP in the early 2000s from around 25% in the early 1970s). Rapid growth in emerging economies has led to a renewed rise in the investment rate, and further increases are expected. The exact size of the increase in the investment rate depends on growth rates. In McKinsey's central scenario, the global investment rate would increase to over 25% by 2030. This central scenario may look somewhat optimistic at present, but the general expectation remains that of solid growth in emerging economies. Furthermore, investment needs would be particularly strong for infrastructure and real estate. Infrastructure investment could take twice the share of global output in 2030, compared to 2008.

To summarise, studies based on a variety of methods and of differing scope suggest that investment needs in transport infrastructure are set to rise over the coming decades. In advanced economies, this is mostly because existing assets are in need of overhaul to maintain integrity and require upgrading and selective extension to ensure adequate quality of service. Not meeting these investment needs can lead to declining quality, and can limit the productive potential of the assets.

As discussed in chapter 3, careful assessment of investment options is needed to get good results. In places where basic networks are in place and demand no longer grows as strongly, the desired outcomes from investment do not correlate as strongly with volumes anymore as in earlier stages of network development. For example, Dutch studies indicate that travel time losses are increasingly disconnected from the overall traffic load on the principal road network (see Figure 4.1), so that deciding on network capacity on the basis of volumes alone is not appropriate. Furthermore, standard supply indicators, including available infrastructure and aggregate use, are increasingly less informative of policy objectives, which relate to overall transport costs and environmental impacts (Kennisinstituut voor Mobiliteitsbeleid, 2011). Measuring transport network performance in appropriate dimensions is the first prerequisite for developing effective and goal-oriented transport policy.

Figure 4.1. **Traffic volume and travel time loss, Netherlands**
1985 = 100



Source: Kennisinstituut voor Mobiliteitsbeleid, 2011, Verklaring reistijdverlies en betrouwbaarheid op hoofdwegen 2000 – 2010, Ministerie van Infrastructuur en Milieu, p.29.

StatLink http://dx.doi.org/10.1787/888932944825

In emerging economies, the main driver of investment is the interaction between growth and infrastructure provision. The challenge here is to fund the needed investments but also to ensure they contribute to balanced development of mobility. The IEA notes that more public transport-oriented mobility growth is both more balanced and reduces infrastructure needs considerably. There are at present few signs that mobility growth is along such a more balanced path, however. Fast motorisation leads to strong congestion and air pollution in cities throughout the developing world, and policy responses tend more towards infrastructure provision than to demand management, as has been the case earlier in advanced economies (with similar but perhaps less extreme results).

Another example, the development of high speed passenger rail networks in China also shows signs of unbalanced development. Usage remains below expectations as conventional rail fares are considerably lower and the disadvantage of lower speed can sometimes be avoided by opting for overnight travel. As a consequence not as much capacity is freed up for freight trains as hoped for, despite tight capacity constraints for such traffic (gross tonne-kilometre per kilometre of track is higher in China than anywhere else). Design choices prevent usage of the high speed network for regular passenger or freight trains. The result is a very costly investment, responsible for an expected 8 to 9% of Chinese GDP by 2015, with lower than expected social benefits and a difficult financial future (see Wu and Rong, 2013; Zhao and Zhao, 2013).

Future funding frameworks

Legitimising spending efforts

From Section 1 we retain that global needs for investment in transport infrastructure are set to rise, both in absolute terms and as a share of GDP. The increase is concentrated in the emerging economies, but at least some developed economies will need to step up efforts in order to maintain network integrity or improve its quality. Transport policies can reduce investment needs to some extent but cannot avoid rising infrastructure needs. This section investigates what funding frameworks are needed to ensure adequate funding levels and cost-effective spending decisions.

In advanced economies, changing the long run trend towards declining infrastructure investment shares in GDP requires raising public awareness of the social returns from infrastructure, and from investment in general, because more public investment implies reduced public consumption where total budgets are not expected to grow. Specifically for transport, the sector's image as mainly a source of negative impacts (e.g. pollution, congestion, climate change, reduced liveability) needs turning around. Increased awareness of the societal benefits from transport is a prerequisite for boosting the legitimacy of more investment and spending. This does not mean ignoring the negative side effects from transport, as has perhaps been the case too often in earlier eras of elevated investment. Instead, balanced and transparent transport policies are needed to improve social acceptance.

Balanced policies should be embedded in a long run strategic vision for the sector that is realistic (i.e. there is sufficient confidence that it is feasible) and trades off costs and benefits. Such a vision helps create a clear and legitimised mandate and a concrete guideline for spending on transport investment and operations. Commitment to objectives is the key prerequisite for establishing reliable funding flows. Given the nature of transport technology, such commitment spans several political cycles, meaning that it cannot always be integrated with standard budgetary processes.

Public acceptance of, and willingness to contribute to, infrastructure spending also may require adapting funding methods to changing spending needs. In advanced economies, spending needs shift from construction to maintenance and upgrading of networks already in place, and to selective expansion of capacity. The funding for such expansion can be tied to the local projects themselves, rather than be channelled through the funding arrangements put in place for the construction of the basic networks. For example, and as in fact is happening in the United States, States can take the lead in funding projects through mechanisms adapted to local circumstances, rather than continuing to rely on the ailing Highway Trust Fund (see Orski, 2013a).

Sources of funding

Funding refers to the primary sources of revenue that ultimately cover costs. Financing refers to tools used to adapt the availability of funding flows over time to expenditure needs or to manage borrowing costs. Funding for transport can come from three sources: general tax revenue, charging infrastructure users (direct beneficiaries), or charging indirect beneficiaries (e.g. property owners, developers, or businesses benefitting from transport infrastructure).

Choosing between the sources of funding is a pragmatic matter, with funding at least economic cost as a guiding principle. Social acceptance and political feasibility also require that funding mechanisms are perceived as fair, although fairness is perhaps more strongly related to overall societal outcomes than to narrow, sector-specific funding arrangements.

Transport economics has long argued that user charges should reflect marginal social costs of infrastructure use in order to obtain efficient use of the infrastructure. Where marginal costs are low, for example on rural roads where there is no congestion and health costs from vehicle emissions are lower, the revenues from such user charges are usually not sufficient to cover infrastructure costs. Funding from tax revenue then is indicated in principle, although the economic costs of raising general tax revenue should be compared to those of levying user charges. With transport demand fairly inelastic and the marginal costs of raising general tax revenue quite high, the case for some reliance on user charges in excess of marginal costs merits careful consideration. Where marginal costs of infrastructure use are high, for example in densely populated and congested areas, the revenues from efficient user charges may well be in excess of infrastructure costs. In short, the case for increased reliance on user charges compared to current practice in most countries is strong, as:

- User charges are particularly appealing where they can contribute to transport demand management. Congestion charges can be deployed more widely than is currently the case and can generate considerable amounts of revenue.
- Distance-based charges can also be justified as (a) they help cover infrastructure and environmental costs and (b) transport demand on the network level is sufficiently inelastic that economic costs of raising revenue may not be much different from the cost of raising general tax revenue.
- Fuel economy improvements and CO_2-reduction efforts shrink fuel consumption as a tax base unless transport demand grows strongly. Crist and Van Dender (2011), suggest that the fuel tax base in countries like France, Germany and the United States could be one third less in 2050 than it is today; if technology shifts away from fossil fuels more quickly than expected, the fuel tax base could shrink by half. This erosion of the tax base necessitates a shift to other sources of transport funding. In the medium to long run, revenue-raising in transport needs to shift from fossil fuels to transport energy in general or to transport use, whichever is least costly to collect.

Although policy makers have been reluctant to rely more strongly on user charges, there are strong signs that this is changing, with charges on driving introduced or in preparation in several countries. There are some caveats however:

- First, the costs of collecting charges based on network use are relatively high compared to fuel taxes (which are also user charges). As a rule of thumb, collection costs are currently not suppressible below 10% of revenue raised (ITF, 2010).
- Second, fuel taxes for road transport currently are high in many countries (but not all). Often, road transport energy is taxed more highly than energy use in other sectors, see table 4.2. Such higher taxes could be justified if the fuel taxes are used to internalise external costs (arguably higher than in other sectors, particularly if congestion costs and accident costs are considered[1)]. But if distance-based charges are introduced, they would take over that function for the major external costs including congestion. Raising charges on road transport activity, through driving-related charges rather than road transport energy, perhaps is better seen as a shift than as an increase in the overall tax burden.
- Third, as indicated earlier, the potential of covering infrastructure and operational costs through user charges at reasonable economic cost depends on the density of demand and differs among transport modes in accordance with their cost structures.

Table 4.2. **Tax rates on CO_2 and energy use by sector, OECD average**

	Oil products (Euros per tonne CO_2, 2012)	**All fuels** (Euros per tonne CO_2, 2012)	**Energy use** (Percentage)
Transport	164	161	27
Heating and process use	24	12	37
Electricity	11	13	36
All use	110	52	100

Source: OECD Centre for Tax Policy, Taxing Energy Use, 2013, p.33.

Relating to the last caveat, public transport in particular is likely to remain more dependent on funds not generated within the sector. This dependence becomes more problematic when funds are scarcer. Cost coverage can rise when services are high quality and fares commensurate or value capture applied more systematically. This strategy aligns well with efforts to balance mobility better but may clash with broad accessibility (equity) considerations. Clarity about business models and overall equity objectives can improve the cost-efficiency and the marketability of collective transport. Under current governance arrangements, goals set for public transport market shares and volumes risk creating an unacceptable burden on public budgets.

Public transport at present often does not cover its costs, and frequently not even its operating costs. For example, a benchmarking study of 27 metro systems from 1994 to 2010 (Anderson et al., 2012) reveals that on average 9% of operating costs are covered by subsidies, with operating costs including service operations, maintenance, and administration. There is huge variation in subsidy rates, with fare revenue between 1/3 and 1.8 times as large as operating cost. Cost coverage is particularly low in European and to some extent North American metros, due to relatively lower fares, costlier labour, and lower population and employment density.

The cost structure, with marginal costs sometimes below average costs, the presence of externalities, and pricing of substitute modes can justify subsidies. Affordability of public transport to lower incomes is also a potential justification for subsidisation. Subsidies may sometimes be justified in principle but entail practical problems. One such problem is that subsidies are not always put to their intended use but accrue to input factors and lead to high costs (e.g. relatively high wages, poor cost control and overinvestment). Another problem is that dependence on subsidies can reduce stability, as they are subject to political approval, and hinder implementation of long-run strategies. Governance structures need to be designed to limit these problems.

Non-fare revenue is possible and, as just argued, it is needed under many pricing policies. The challenge is to make non-fare revenue (at least) as reliable as fare revenue. Reliability is poor with pay-as-you-go-style public subsidies. Sales taxes, hypothecated revenue from gas taxes and congestion charges etc. do better. Transport authorities can also subsidise fares rather than operations through operating contracts.

Allowing fares to rise is another way to reduce reliance on public subsidies, in particular when combined with improved quality of service. In a sample of bus operations in 103 French agglomerations (all outside Ile-de-France) between 1995 and 2005, bus-km grew by 0.67% per year, revenues per trip fell by 0.60% per year, revenues per km fell by 0.70% per year, the number of trips increased by 0.60% per year, and occupancy rates fell by 0.11% per year (but not in the largest agglomerations). These trends continued through 2010. The ratio of revenue to expenditures fell from 45% in 2005 to 35% in 2010. The strategy to attract more users was to keep fares low, but the result is reduced cost coverage. In Germany, by contrast, the ratio of revenue to expenditure rose from 55% in 1990 to 75% in 2010. This is partly the result of cost cutting, but also of better service and higher fares, e.g. in Berlin (Faivre-d'Arcier and Brun, 2012).

Above all, designing effective governance requires clarity about the objectives of public transport. Public transport is sometimes expected to contribute to more sustainable or better balanced mobility by offering competitive levels of service with cars, to be affordable to all but the very lowest incomes, and to reduce its dependence on public money. These objectives cannot be attained simultaneously. Attaining two out of three may be possible if pricing of car use allows and/or if durable commitment to them exists.

Committing funds and financing

Future transport funding will draw from the three funding sources mentioned, but charges on direct and indirect beneficiaries should become a bigger part of the mix. Funding and financing mechanisms should also evolve to ensure a better match with the cost structure that characterises transport infrastructure.

Transport infrastructure assets are long-lived and maintenance-intensive. Life-cycle asset management at lowest cost requires reliable funding flows that enable financing spending needs over the long run. This reliability and long-run perspective often is lacking in current funding practices which rely on pay-as-you-go solutions from general budgets (which effectively means there is no financing, so no attempt to match spending needs with availability of funding except through the general budget). These methods create risks for insufficient maintenance and stop-and-go funding, and weak connections between allocated funds and expected benefits in general. This is because pay-as-you-go funding puts heavy focus on annual public budgets. Political negotiations could lead to instability over time, a problem that in practice appears to be mitigated by preserving the status quo (with budgets relatively constant as share of GDP, see chapter 3). Achieving stability this way is vulnerable to political rather than benefit-based allocations of funds within the transport envelope (poor choice of projects, insufficient attention for maintenance).

As discussed in chapter 3, appraisal can reduce the risk of poor allocation of funds, and can assist transport decision-makers in budget negotiations as it reveals value for money. Despite differing underlying ideas in US and Europe (with a user charges mind-set dominant in the United States, and a general tax revenue approach in many European countries), the resulting funding structure at present is not very different, with annual or multi-annual budgets decided through political negotiation and funds obtained from a mix of fuel tax revenue and general tax revenue (although there is no explicit dedication of fuel tax revenue in Europe, in contrast to the United States), and funds channelled to projects on the basis of political choices informed by appraisal to varying extents.

Transport infrastructure is lumpy, meaning that permanent adaptation of capacity to demand is not possible. Investment decisions hence require careful evaluation of likely needs and the various options of addressing them. Such evaluation requires a framework view of what transport infrastructure and services are for. Project evaluation should be embedded in the strategic plan, and provisions for funding should align with the plan in order to limit exposure to shorter run budgetary cycles.

Hypothecation of revenue flows for funding transport infrastructure helps ensure reliability of flows over the long run, and is in that sense desirable. It does not follow that only user charges can be hypothecated or that all revenues collected from a particular facility or mode should be hypothecated to that facility or mode. Instead, funding needs can and do differ from revenue-generating capacity, and decisions on how much to hypothecate and from what sources should be based on needs.

Transport infrastructure funds with a clear and expiring mandate and with explicitly defined revenue-raising mechanisms may provide a reasonable compromise between accountability (the mandate is politically defined) and long-run reliability (the fund is at arm’s length from the politics of the day). Examples of such funds are found in Australia, Austria and Switzerland, among others. Alternatively, transport networks can be managed as regulated utilities, with similar appeal to funds in terms of balancing accountability and long-run management in line with asset requirements. The rate of return will then need to be managed and investment incentives and quality of service maintained a regulatory task that is known to pose considerable difficulty.

Committing to reliable funding flows for transport infrastructure renders possible efficient financing of infrastructure, including private sector finance. Transparent and committable funding arrangements are a prerequisite for creating markets for infrastructure finance products. Private sector involvement can extend beyond finance, for example to public-private partnership initiatives (PPPs). The potential for PPPs exists particularly in projects where cost savings seem possible through innovation in project design and through cost-effective construction and maintenance practices. PPPs are discussed in some detail in the next section.

Public-private partnerships

PPPs concede construction, operation and finance of a public project under a single contract. Governments' interest in PPPs arises for several reasons. First, when constraints on spending from general tax revenue are tight and social acceptance of tolling on publicly provided infrastructure is low, private finance can help maintain or accelerate investment momentum. Limits on public spending can arise because of policies to curb deficits. Public accounting rules sometimes treat PPPs differently from public procurement, so that PPPs do not contribute to recorded public commitments even if in fact these commitments may be the same as under public procurement. Turning to PPPs on such grounds risks being entirely counterproductive, as liabilities are real but less visible. A better approach would be to treat investment spending differently from other public spending by not subjecting it to the same spending constraints. The choice for a PPP or any other procurement method then can be made on more relevant characteristics relating to efficiency.

With tighter public budgets in the aftermath of the financial crisis, public interest in maintaining financing capacity and obtaining efficiency gains through PPPs has increased. However, the financial crisis also led to bank recapitalisation, so that less short-term capital is available and the share of PPPs in project finance has declined in recent years. In addition, as long as PPPs do not offer real cost savings or do not allow introducing new funding instruments (most notably user charges), they offer no solution for tighter public budgets except optical ones.

In terms of efficiency, PPPs have a number of potential advantages over public procurement. As discussed before, public funding is subject to fluctuations in economic and political cycles, and this tends to result in stop-and-go funding, with for example short run incentives to cut maintenance even if this raises life cycle project costs. PPPs allow insulating projects from such cyclicality by bundling maintenance with construction and stipulating conditions on the quality of service to be delivered. This improves the ability to minimise costs over the lifecycle of an infrastructure project. PPPs also have the potential to reduce the risk of cost overruns, as the bundling of construction contracts in a single company can be expected to improve coordination through expert project management. Furthermore, PPPs can produce major cost savings, particularly when contracts specify outputs (services with quality requirements) instead of detailing inputs, so that project (re-)design is allowed for. For example, the private partner redesigned an expressway in Dallas, Texas, reducing costs by 30% for similar service levels.

The choice of funding sources for PPP projects is in essence the same as for public procurement, i.e. funds can come from tax revenue or from charges on direct or indirect beneficiaries. Remuneration for the private partner can come in the form of availability payments from government or through a flow of toll payments from users. The methods appeal to different types of investors as the risk profiles differ. Toll-based PPPs attract equity from project development or operating companies as well as specialised investment banks and pension funds. Availability payments are more attractive to investment banks and specialised infrastructure funds. They often involve only 'pinpoint equity' of less than 1% of total funds. Hybrid remuneration forms are possible of course, for example with minimum revenue guarantees under toll structures, in which case the latter effectively become availability payment-based schemes. Availability payments defer public spending up to project completion rather than tapping into new sources of funding.

PPPs are subject to various types of risk. The planning and design phase involves expenditure with no guaranteed return. Construction costs are difficult to predict precisely, and coordination risk occurs as the cooperation between the various partners is difficult to organise. The biggest problems are associated with demand and revenue risk. Revenue risk is relatively low for infrastructure for which there are few or no substitutes, within a busy network, e.g. major bridges or tunnels. Demand is also known with reasonable confidence when tolled links are expanded, or when infrastructure is added in already tolled networks. Revenue risk is higher where new types of service are involved, e.g. high speed rail, or where alternatives exist, or where demand is not very high to begin with. Revenue risks also rise as the time horizon within which payoffs are expected to occur is longer. The lower the revenue risk, the more amenable a PPP is to equity investment and remuneration through tolling.

The financing costs for a PPP are likely higher than for public procurement. Public borrowing is usually cheaper than private borrowing, and bank loans to PPPs need to be covered by (costly) insurance and hedging instruments (whereas taxpayers bear project risk in case there is a government guarantee). In addition, equity finance requires higher returns than loans. PPPs also carry substantial transaction costs. For example, the legal and consulting fees for the £22 billion investment in London metro lines amounted to £500 million, or 2.3% of the total budget. There is no evidence that these fees decline as more experience is gained with PPPs.

The full financing costs of PPPs include the costs of refinancing for distressed projects, which can be high. Renegotiation is not exceptional. In the United Kingdom, to date about 40% by value of transport sector PPPs have been renegotiated. The most common cause of renegotiation is that demand forecasts turn out to have been over-optimistic, and there is evidence that forecasts are biased upwards for strategic reasons including boosting the probability of winning project bids. Therefore, aside from revenue guarantees, the potential costs of renegotiation need to be recognised as a public liability. Systematic ex-post evaluation of PPP projects is a prerequisite for creating the ability to gauge expected costs of renegotiation.

The fiscal sustainability of PPPs needs to be strengthened. Government's expertise on PPP contracting in general and on demand and revenue forecasting in particular is sometimes weak. In addition, accounting and budgeting rules for PPPs can be improved. Financial flows associated with PPPs could be treated on-balance sheet in public accounts, and data on PPP spending could be included in public expenditure publications. Projections of PPP spending can be included in treasury debt analysis. The liabilities accumulated through PPPs can be limited by specifying a fixed PPP budget. Such a limit will shift the emphasis in using PPP structures to project selection, instead of seeking finance for particular projects. These measures are implemented to varying degrees already. For example, in the UK the most recent private finance initiative (PFI-2) is subject to a public budget limit; in India, PPPs require budget approval by parliament in the same way as public procurement.

PPP projects are often refinanced once construction is completed, with short-term loans paid off by issuing bonds. It is at this stage that pension funds and other long term investors usually invest in PPPs, as they are averse to the risks associated with the early stages of the PPP financing cycle. PPP structures focus on the procurement of particular projects. A different approach is to attract private capital from institutional investors (e.g. pension funds, infrastructure investment funds) in infrastructure finance more generally.

Establishing a framework conducive to financing by institutional investors is not straightforward, however, requiring long term relationships of trust between developers, fund managers and pension funds, among others, and requiring a steady pipeline of projects to make acquisition of expertise in the evaluation of infrastructure risk viable. The relative dearth of such expertise with institutional investors is an important factor in explaining the limited investment from these sources in transport infrastructure. It can be noted that turning to availability payments, where demand risk is retained by government, can improve the attractiveness of transport assets to institutional investors. However, if the goal is to broaden the funding base for transport by increased reliance on user charges, the government will have to make this case instead of tying their introduction to private tolling.

Regulated utility models offer an alternative to PPPs for private investment in transport infrastructure. They have the advantage of providing greater flexibility to adapt to changes in external circumstances whilst providing a long-term commitment that investors will recover their sunk costs. The regulator sets rates of return, usually indexed to inflation, and monitors quality standards. Periodic review of rates of return is usual with utility type regulation, providing a useful degree of flexibility in adjusting to external conditions that is lacking in PPP contracts. Investment in regulated utilities listed on the stock exchange is accessible to a broader range of investors than PPPs. Many European airports' and Great Britain's rail infrastructure is financed this way, with investment remunerated at a rate of return set by an independent regulator. Road networks could be financed this way as could packages of projects that create sufficient scale to merit the costs of establishing a regulator, and providing that effective regulatory structures can be implemented.

Sovereign wealth funds prefer investment in government-guaranteed infrastructure project bonds, or bonds in PPP projects issued on completion of construction and secured by toll revenues or availability payments. This is known as securitisation and is perhaps the main route to broadening the range of investors in PPPs over the full project cycle. At the same time the proportion of loans to a PPP that can be sold on in this way may be subject to a maximum limit (for example 70% in Chile) in order to preserve the link between construction and operation of the facility and the incentives for long run efficiency that result.

Once it is accepted that the share of PPPs in overall transport infrastructure investment will be limited it becomes clear that projects for PPPs should be selected according to the maximum efficiency gains that can be expected to be delivered. This prioritises projects susceptible to achieving major cost savings from redesign or modification of construction techniques. It also requires governments to remove the strings of detailed project specification for suitable projects.

NOTES

1. Whether fuel taxes are in line with external costs is debatable. Research for the United States indicates fuel taxes are too low (Parry and Small, 2005), whereas for the UK they are too high or just about right (comparing the findings of Parry and Small, 2005 and Newbery, 2008).

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STATISTICAL ANNEX

Rail freight transport

Million tonne-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	32	26	36	53	52	46	66	..
Armenia	678	654	668	771	705 e	718	..	..
Australia	167 970	182 980	189 040	204 986	203 460	237 163	258 624	264 469 e
Austria	17 931	17 064	20 980 |	21 371	21 915	17 767	19 833	20 345
Azerbaijan	7 536	9 628	11 059	10 375	10 021	7 592	8 250	7 845
Belarus	40 331	43 559	45 723	47 933	48 994	42 274	46 224	..
Belgium	7 691	8 042	8 587	8 148	8 469	5 947	6 264 e	6 698 e
Bosnia-Herzegovina	363	379	372	1 088	1 242	992	877	1 018
Bulgaria	5 211	5 163	5 396	5 241	4 693	3 145	3 064	3 291
Canada	230 996	240 993	241 556	245 534	236 842	216 287	240 292	238 522
China	1 928 880	2 072 600	2 195 441	2 379 700	2 510 628	2 523 917	2 764 413	2 946 579
Croatia	2 493	2 835	3 305	3 574	3 312	2 641	2 618	2 438
Czech Republic	15 092	14 866	15 779	16 304	15 437	12 791	13 770	14 316
Denmark	2 147	1 967	1 885	1 776	1 863	1 696	2 238	2 613
Estonia	10 488	10 639	10 418	8 430	5 943	5 934	6 638	6 261 e
Finland	10 105	9 706	11 060	10 434	10 777	8 872	9 750	9 395
France	45 035	39 659	41 179 |	42 612	40 436	32 129	29 965	34 202
FYROM[1]	426	530	614	778	743	497	525	479
Georgia	4 855	6 145	7 393	6 927	6 515	5 417	6 228	6 055
Germany	86 409	95 421	107 008	114 615	115 652	95 834	107 317	113 317
Greece	592	613	662	835	786	537	601	352
Hungary	8 749	9 090	10 167	10 137	9 874	7 673	8 809	9 118
Iceland	x	x	x	x	x	x	x	x
India	411 300	441 800	483 400	521 370	551 450	600 548	..	..
Ireland	399	303	207	129	103	79	92	105
Italy	23 271	22 199	22 907	23 289	21 981	15 224 |	13 405	12 961
Japan	22 476	22 813	23 192	23 334	22 256	20 562	20 398	19 417 e
Korea	10 641	10 108	10 554	10 927	11 566	9 273	9 452	9 997
Latvia	18 618	19 779	16 831	18 313	19 581	18 725	17 179	21 410
Liechtenstein	x	x	x	x	x	x	x	x
Lithuania	11 637	12 457	12 896	14 373	14 748	11 888	13 431	15 088
Luxembourg	559	392	441	287	280	200	309 e	270 e
Malta	x	x	x	x	x	x	x	x
Mexico	54 387	72 185 |	73 726	77 169	74 582	69 185	78 771	79 729
Moldova, Republic of	2 968	2 980	3 656	3 092	2 873	1 058	959	1 196
Montenegro, Republic of	93	133	182	185	184	101	151	136
Netherlands	5 831	5 914	6 289	7 216	6 984	5 578	5 925	6 378
New Zealand	3 904	4 322	4 312	4 329	4 556	3 962	3 919	4 178
Norway	2 017	2 208	2 374	2 454	2 597	2 572	2 348	2 416
Poland	52 316	49 972	53 623	54 253	52 043	43 446	48 707	53 746
Portugal	2 282	2 422	2 529	2 586	2 549	2 174	2 313	2 322
Romania	18 426	16 582	15 791	15 757	15 236	11 088	12 375	14 719
Russian Federation	1 801 601	1 858 093	1 950 830	2 090 337	2 116 240	1 865 305	2 011 308	2 127 835
Serbia, Republic of	3 164	3 482	4 232	4 551	4 339	2 967	3 522	3 611
Slovak Republic	9 702	9 463	9 988	9 647	9 299	6 964	8 105	7 960
Slovenia	3 149	3 245	3 373	3 603	3 520	2 668	3 421	3 752
Spain	12 018	11 641	11 599	11 124	10 287	7 391	7 872	8 018
Sweden	20 856	21 675	22 271	23 250	22 924	20 389	23 464	22 705
Switzerland	11 489	11 677	12 466	11 952	12 265	10 565	11 074	11 526
Turkey	9 417	9 152	9 676	9 921	10 739	10 326	11 462	11 677
Ukraine	233 987	223 980	240 810	262 504	257 007	196 188	218 091	..
United Kingdom	20 137	21 427	21 919	21 265	21 077	19 171	18 576	20 974
United States	2 427 346	2 476 733	2 586 920	2 656 613 |	2 594 716	2 236 989	2 468 818	2 524 666

.. Not available; | Break in series; e Estimated value; x Not applicable

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Road freight transport

Million tonne-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	2 798	3 210	3 306	3 584	4 098	4 445	4 626	..
Armenia	210	231	432	710 e	1 034 e	..	..	..
Australia	156 977	166 459	173 343	182 243	190 779	190 839	195 309	200 132
Austria	39 186	37 043	39 186	37 400	34 312	29 075	28 658	28 542
Azerbaijan	7 278	7 870	8 568	9 492	10 317	11 021	11 728	12 776
Belarus	13 969	15 045	15 779	19 200	22 767	..	..	..
Belgium	47 878	43 846	43 017	42 085	38 356	36 174	35 001	33 107
Bosnia-Herzegovina	..	..	..	1 648	1 873	1 711	..	1 718
Bulgaria	11 961	14 371	13 765	14 624	15 321	17 741	19 454	21 212
Canada	122 700	131 500	130 600	130 600	129 380	118 903	138 721	..
China	784 090	869 320	975 425	1 135 469	3 286 819	3 718 882	4 338 967	5 137 474
Croatia	9 547	10 243	11 095	11 429	11 042	9 429	8 780	8 927
Czech Republic	46 010	43 447	50 369	48 141	50 877	44 954	51 833	54 830
Denmark	10 539	11 058	11 494	11 800	10 718	10 002	10 573	12 025
Estonia	6 837	7 641	8 857	10 660	8 279	6 290	5 986	6 567 e
Finland	32 291	31 855	29 741	29 818	31 035	27 657	30 337	26 917
France	197 412	193 153 |	198 829	207 025	195 515	166 052	174 409	177 993
FYROM[1]	5 341	5 576 |	8 299	5 938	3 978	4 035	4 235	5 381
Georgia	570	578	586	594	600	611	620	628
Germany	303 744	310 114	330 008	343 439	341 550	307 575	313 097	323 848
Greece	15 473 e	15 861 e	16 510 e	17 359 e	16 960 e	16 940 e	20 146 e	..
Hungary	20 598	25 137	30 495	35 804	35 744	35 373	33 720	34 529
Iceland	699 e	741 e	786 e	825 e	805 e	813 e	806 e	777 e
India	646 000	658 900	766 200	852 000	920 000	1 013 000	1 115 000	1 170 000
Ireland	17 289	18 152	17 686	19 146	17 290	12 068	10 924	9 941
Italy	158 184	171 554	155 426	152 398	165 385	156 341	149 258	..
Japan	327 632	334 979	346 534	354 800	346 420	332 961	317 999 e	245 912 e
Korea	101 057	100 869	109 008	105 222	101 437	99 089	102 808	104 477 e
Latvia	7 309	8 547	10 937	13 142	12 344	8 115	10 590	12 131
Liechtenstein	..	390	340	340	330	264	305	312
Lithuania	12 279	15 908	18 135	20 278	20 419	17 757	19 398	21 512
Luxembourg	9 954 e	8 915 e	8 879 e	9 222 e	9 566 e	8 401 e	8 658 e	8 838 e
Malta	..	..	..	..	..	..	..	..
Mexico	199 800	204 217	209 392	222 391	227 290	211 600	220 285 |	226 900
Moldova, Republic of	2 161 |	2 405	2 567	2 743	2 966	2 714	3 233	3 597
Montenegro, Republic of	65	61	73	92	137	179	167	102
Netherlands	34 346	34 003	33 417	32 867	34 344	33 642	36 113	35 829
New Zealand	16 610	16 838	16 963	17 633	17 915	16 509	17 477	18 110
Norway	14 966	15 875	15 862	16 244	17 564	16 109	17 176	16 965
Poland	110 481 |	119 740	136 490	159 527	174 223	191 484	214 204	218 888
Portugal	17 445	17 425	17 591	18 374	16 768	13 969	12 554	12 838
Romania	37 220	51 532	57 278	59 517	56 377	34 265	25 883	26 347
Russian Federation	182 141	193 597	198 766	205 849	216 276	180 136	199 341	222 823
Serbia, Republic of	277	680	798	1 161	1 112	1 185	1 689	1 907
Slovak Republic	18 517	22 550	22 114	27 050	29 094	27 484	27 411	29 045
Slovenia	2 267 |	2 361	2 279	2 572	2 635	2 276	2 289	2 176
Spain	220 815	233 219	241 758	258 869	242 978	211 891	210 064	206 840
Sweden	32 670	34 682	35 455	36 376	37 933	32 118	32 738	33 417
Switzerland	15 379	15 754	16 330	16 993	17 262	16 924	17 058	17 510
Turkey	156 853	166 831	177 399	181 330	181 935	176 455	190 365	203 072
Ukraine	7 981	9 180	11 337	14 284	18 168 e	..	..	..
United Kingdom	162 018	165 468	169 182	175 851	166 183	147 358	155 050 e	..
United States	1 871 060	1 885 576	1 885 180	1 982 956 |	2 024 019	1 874 894	..	..

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Inland waterway freight transport

Million tonne-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	x	x	x	x	x	x	x	x
Armenia	x	x	x	x	x	x	x	x
Australia	x	x	x	x	x	x	x	x
Austria	2 809	2 760	2 419	2 597	2 359	2 003	2 375	2 123
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	182	90	109	93	132	..	..	..
Belgium	8 459	8 719	8 973	9 006	8 746	7 086	8 210	9 251 e
Bosnia-Herzegovina	x	x	x	x	x	x	x	x
Bulgaria	1 326 |	1 532	1 429	1 711	1 936	1 794	1 813	1 422
Canada	20 300	21 400	24 800	22 900	22 800	21 059	23 934	25 000
China	917 370	1 112 030	1 290 845	1 559 895	1 741 170	1 803 267	2 242 853	2 606 884
Croatia	179	119	117	109	843	727	941	692
Czech Republic	409	779	767	898	863	641	679	695
Denmark	x	x	x	x	x	x	x	x
Estonia	0	0	0	0	0	0	0	0
Finland	118	75	66	101	80	61	76	90
France	8 420	8 905	9 005	8 830	8 557	8 410	9 115	8 704
FYROM[1]	x	x	x	x	x	x	x	x
Georgia	x	x	x	x	x	x	x	x
Germany	63 667	64 096	63 975	64 716	64 061	55 497	62 278	55 027
Greece	x	x	x	x	x	x	x	x
Hungary	1 904	2 110	1 913	2 212	2 250	1 831	2 393	1 840
Iceland	x	x	x	x	x	x	x	x
India	..	2 347	2 857	2 806	2 950	3 710	4 030	..
Ireland	x	x	x	x	x	x	x	x
Italy	110	89	76	93	64	76	135	144 e
Japan	x	x	x	x	x	x	x	x
Korea	x	x	x	x	x	x	x	x
Latvia	0	0	0	0	0	0	0	0
Liechtenstein	x	x	x	x	x	x	x	x
Lithuania	1	1	2	11	13	4	4	4
Luxembourg	364	337	376	345	366	279	359	305 e
Malta	x	x	x	x	x	x	x	x
Mexico	x	x	x	x	x	x	x	x
Moldova, Republic of	0	0	1	1	1	1	0	1
Montenegro, Republic of	x	x	x	x	x	x	x	x
Netherlands	43 563	43 066	43 577	45 037	44 446	35 638	40 286	46 316
New Zealand	x	x	x	x	x	x	x	x
Norway	x	x	x	x	x	x	x	x
Poland	1 067	1 277	1 237	1 338	1 274	1 020	1 030	909
Portugal	..	..	..	..	..	..	..	..
Romania	6 956 |	8 438	8 158	8 195	8 687	11 765 |	14 317	11 409
Russian Federation	92 474	87 173	86 727	86 027	63 705	52 686	53 955	59 144
Serbia, Republic of	1 115	1 622	1 640	1 584	1 369	1 114	875	963
Slovak Republic	721	680	936	1 004 |	1 101	899	1 189	931
Slovenia	x	x	x	x	x	x	x	x
Spain	x	x	x	x	x	x	x	x
Sweden	x	x	x	x	x	x	x	x
Switzerland	124 e	124 e	125 e	128 e	128 e	..	..	..
Turkey	x	x	x	x	x	x	x	x
Ukraine	5 605	6 315	6 307	5 670	5 670 e	..	..	..
United Kingdom	150	170	160	140	160	133	105	144 e
United States	414 722	400 568	408 468	396 554	380 994	357 685	384 326	393 013

.. Not available; | Break in series; e Estimated value; x Not applicable

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Oil pipeline transport

Million tonne-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	8	7	6	6	4	6	2	..
Armenia	1 264	1 581	1 597	1 958	1 958 e	..	..	..
Australia	x	x	x	x	x	x	x	x
Austria	7 571	7 780	7 656	7 226	7 521	7 304	7 000	7 228
Azerbaijan	1 696	1 539	15 679	52 305	62 434	73 195	72 931	65 850
Belarus	x	x	x	x	x	x	x	x
Belgium	1 533	1 517	1 572	1 494 e	1 450 e	..	..	..
Bosnia-Herzegovina	x	x	x	x	x	x	x	x
Bulgaria	274	352	357	420	420	436	415	481
Canada	123 500	114 000	123 900	124 500	124 000	123 200	122 659	134 845
China	81 500	108 800	155 117	186 589	194 403	202 242	219 719	288 544
Croatia	1 841	1 774	1 533	1 781	1 677	1 797	1 703	1 477
Czech Republic	1 902	2 259	2 291	2 079	2 315	2 156	2 191	1 954
Denmark	5 254	5 125	4 872	4 627	4 209	3 895	3 547	3 265
Estonia	x	x	x	x	x	x	x	x
Finland	x	x	x	x	x	x	x	x
France	20 559	20 856	22 200	21 141	20 918	19 481	17 607	17 207
FYROM[1]	..	149	170	164	164	144	123	98
Georgia	2 368	2 590	2 590 e	2 590 e	2 590 e	..	..	..
Germany	16 236	16 741	15 844	15 824	15 670	15 950	16 259	15 623
Greece	x	x	x	x	x	x	x	x
Hungary	5 410	5 591	5 779	5 723	5 637	5 262	5 623	5 581
Iceland	x	x	x	x	x	x	x	x
India	301 348	334 335	448 764	551 824	632 681	1 026 019	1 254 425	1 359 129
Ireland	x	x	x	x	x	x	x	x
Italy	10 699	11 423	11 447	11 388	11 266	10 497	10 400	9 952
Japan	x	x	x	x	x	x	x	x
Korea	x	x	x	x	x	x	x	x
Latvia	3 252	3 380	3 630 |	2 711	2 097	1 573	2 350	2 439
Liechtenstein	x	x	x	x	x	x	x	x
Lithuania	4 287	4 406	2 670	1 032	527	410	579	591
Luxembourg	x	x	x	x	x	x	x	x
Malta	x	x	x	x	x	x	x	x
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	x	x	x	x	x	x	x	x
Montenegro, Republic of	x	x	x	x	x	x	x	x
Netherlands	6 090	5 939	5 828	5 583	5 967	5 622	5 647	5 502
New Zealand	x	x	x	x	x	x	x	x
Norway	4 721	4 590	4 529	4 192	3 827	3 854	3 440	3 065
Poland	24 806	25 388	25 588	23 513	21 247	22 908	24 157	22 794
Portugal	x	x	x	x	x	x	x	x
Romania	1 898	2 210	2 027	1 849	1 720	1 243	996	879
Russian Federation	1 116 210	1 156 298	1 153 823	1 140 894	1 112 852	1 122 802	1 122 964	1 120 140
Serbia, Republic of	472	458	470	452	462	402	381	311
Slovak Republic	..	..	..	..	..	..	..	..
Slovenia	x	x	x	x	x	x	x	x
Spain	8 279	9 228	9 224	8 936	9 141	8 232	8 182	8 601
Sweden	x	x	x	x	x	x	x	x
Switzerland	238	226	256	217	248	233	218	203
Turkey	11 927	5 736	5 841	12 894 |	36 402	45 111	39 636	44 690
Ukraine	37 410	32 106	29 599	36 249	35 372 e	..	..	..
United Kingdom	10 657	10 777	10 800	10 229	10 180	10 185	10 165	..
United States	875 399	886 933	848 682	814 226	884 305	829 848	..	..

.. Not available; | Break in series; e Estimated value; x Not applicable

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Total inland freight transport

Million tonne-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	2 838	3 243	3 348	3 643	4 154	4 497	4 694	..
Armenia	2 152	2 466	2 697	3 439 e	3 697 e	..	..	..
Australia	324 947	349 439	362 383	387 229	394 239	428 002	453 933	464 601 e
Austria	67 497	64 647	70 241 |	68 594	66 107	56 149	57 866	58 238
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	54 482	58 694	61 611	67 226	71 893	..	..	..
Belgium	65 561	62 124	62 149	60 733 e	57 021 e	..	..	..
Bosnia-Herzegovina	..	..	..	2 736	3 115	2 703	..	2 736
Bulgaria	18 772 |	21 418	20 947	21 996	22 370	23 116	24 746	26 406
Canada	497 496	507 893	520 856	523 534	513 022	479 449	525 606	..
China	3 711 840	4 162 750	4 616 828	5 261 653	7 733 020	8 248 308	9 565 952	10 979 481
Croatia	14 060	14 971	16 050	16 893	16 874	14 594	14 042	13 534
Czech Republic	63 413	61 351	69 206	67 422	69 492	60 542	68 473	71 795
Denmark	17 940	18 150	18 251	18 203	16 790	15 593	16 358	17 903
Estonia	17 325	18 280	19 275	19 090	14 222	12 224	12 624	12 828 e
Finland	42 514	41 636	40 867	40 353	41 892	36 590	40 163	36 402
France	271 426	262 573 |	271 213 |	279 608	265 426	226 072	231 096	238 106
FYROM[1]	..	6 255 |	9 083	6 880	4 885	4 676	4 883	5 958
Georgia	7 793	9 313	10 569 e	10 111 e	9 705 e	..	..	..
Germany	470 056	486 372	516 835	538 594	536 933	474 856	498 951	507 815
Greece	16 065 e	16 474 e	17 172 e	18 194 e	17 746 e	17 477 e	20 747 e	..
Hungary	36 661	41 928	48 354	53 876	53 505	50 139	50 545	51 068
Iceland	699 e	741 e	786 e	825 e	805 e	813 e	806 e	777 e
India	..	1 437 382	1 701 221	1 928 000	2 107 081	2 643 277	..	..
Ireland	17 688	18 455	17 893	19 275	17 393	12 147	11 016	10 046
Italy	192 264	205 265	189 856	187 168	198 696	182 138 |	173 198	..
Japan	350 108	357 792	369 726	378 134	368 676	353 523	338 397 e	265 329 e
Korea	111 698	110 977	119 562	116 149	113 003	108 362	112 260	114 474 e
Latvia	29 179	31 706	31 398 |	34 166	34 022	28 413	30 119	35 980
Liechtenstein	..	390	340	340	330	264	305	312
Lithuania	28 204	32 772	33 703	35 694	35 707	30 059	33 412	37 195
Luxembourg	10 877 e	9 644 e	9 696 e	9 854 e	10 212 e	8 880 e	9 326 e	9 413 e
Malta	..	..	..	..	..	..	..	..
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	5 129 |	5 385	6 224	5 836	5 840	3 773	4 192	4 794
Montenegro, Republic of	158	194	255	277	321	280	318	238
Netherlands	89 830	88 922	89 111	90 703	91 741	80 480	87 971	94 025
New Zealand	20 514	21 160	21 275	21 962	22 471	20 471	21 396	22 288
Norway	21 704	22 673	22 765	22 890	23 988	22 535	22 964	22 446
Poland	188 670 |	196 377	216 938	238 631	248 787	258 858	288 098	296 337
Portugal	..	..	..	..	..	..	..	..
Romania	64 500 |	78 762	83 254	85 318	82 020	58 361 |	53 571	53 354
Russian Federation	3 192 426	3 295 161	3 390 146	3 523 107	3 509 073	3 220 929	3 387 568	3 529 942
Serbia, Republic of	5 028	6 242	7 140	7 748	7 282	5 668	6 467	6 792
Slovak Republic	..	..	..	..	..	..	..	..
Slovenia	5 416 |	5 606	5 652	6 175	6 155	4 944	5 710	5 928
Spain	241 112	254 088	262 581	278 929	262 406	227 514	226 118	223 459
Sweden	53 526	56 357	57 726	59 626	60 857	52 507	56 202	56 122
Switzerland	27 230 e	27 781 e	29 177 e	29 290 e	29 903 e	..	..	..
Turkey	178 197	181 719	192 916	204 145 |	229 076	231 892	241 463	259 439
Ukraine	284 983	271 581	288 053	318 707	316 217 e	..	..	..
United Kingdom	192 962	197 842	202 061	207 485	197 600	176 847	183 896 e	..
United States	5 588 527	5 649 810	5 729 250	5 850 349 |	5 884 034	5 299 416	..	..
European Union (EU27)	**2 215 518**	**2 285 720**	**2 370 429**	**2 456 580**	**2 423 974**	**2 159 157**	**2 245 173**	**2 272 987**
OECD	**9 181 923**	**9 336 076**	**9 553 773**	**9 797 020**	**9 812 198**	**8 976 927**	**9 533 089**	**9 676 063**

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

Area totals include only those countries shown in the table.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Coastal shipping
National transport

Million tonne-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	..	..	..	..	..	..	..	..
Armenia	x	x	x	x	x	x	x	x
Australia	117 114	114 098	122 260	126 046	125 511	107 607	114 767	110 945
Austria	x	x	x	x	x	x	x	x
Azerbaijan	6 771	7 521	8 043	5 989	6 076	6 173	4 859	5 186
Belarus	x	x	x	x	x	x	x	..
Belgium	..	..	..	..	..	..	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	..	..	..	..	..	..	..
Canada	25 329	24 450	24 881	29 388	27 852	23 452	23 905	..
China	..	..	..	..	..	..	..	..
Croatia	283	256	237	289	248	214	210	217
Czech Republic	x	x	x	x	x	x	x	x
Denmark	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..
Finland	2 524	2 180	2 679	2 892	2 937	2 513	3 621	3 966
France	..	..	..	..	..	..	..	..
FYROM[1]	x	x	x	x	x	x	x	x
Georgia	..	..	..	..	..	..	..	..
Germany	..	..	..	..	..	..	..	..
Greece	..	..	..	..	..	..	..	..
Hungary	x	x	x	x	x	x	x	x
Iceland	118	145	114	105	48	57	47	..
India	..	..	..	..	..	..	..	..
Ireland	1 305	1 870	1 950	1 925	1 923	1 957	1 738	2 085
Italy	38 804	46 839	46 594	52 211	47 017	49 173	48 844	..
Japan	218 833	211 576	207 849	202 962	187 859	167 135	..	..
Korea	25 840	26 590	26 478	27 998	29 590	25 249	23 281	27 220
Latvia	..	..	..	..	..	..	..	..
Liechtenstein	x	x	x	x	x	x	x	x
Lithuania	..	..	..	..	..	..	..	..
Luxembourg	x	x	x	x	x	x	x	x
Malta	..	..	..	..	..	..	..	..
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	x	x	x	x	x	x	x	x
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	..	..	..	..	..	..	..	..
New Zealand	..	..	..	..	..	..	..	..
Norway	25 997	23 890	24 342	23 690	22 860	22 512	19 077	20 100
Poland	..	..	..	..	..	..	..	..
Portugal	..	..	..	..	..	..	..	..
Romania	..	..	..	..	..	..	..	..
Russian Federation	6 270	6 544	7 591	11 702 |	12 450	12 042 |	12 640	13 239
Serbia, Republic of	..	..	..	..	..	..	..	..
Slovak Republic	x	x	x	x	x	x	x	x
Slovenia	..	..	..	..	..	..	..	..
Spain	48 117	48 178	47 383	49 446	45 396	40 040	41 666	42 115
Sweden	7 154	8 000	7 192	7 866	8 255	6 504	7 851	7 508
Switzerland	x	x	x	x	x	x	x	x
Turkey	7 419	6 480	7 084	9 571	11 114	11 397	12 569	15 961
Ukraine	486	533	474	770	..	..	..	..
United Kingdom	58 300	59 700	50 600	49 500	48 400	47 600	40 800	..
United States	408 584	384 650	331 640	332 950	303 495	286 578	280 822	263 105

.. Not available; | Break in series; x Not applicable

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Rail container transport

Twenty-foot equivalent unit (TEU)

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	..	..	..	..	..	..	..	..
Armenia	..	..	..	..	..	..	..	..
Australia	..	..	..	290 264	325 528	363 294	334 127	354 409
Austria	..	..	1 104 894	1 356 087	1 358 667	1 104 894	1 310 989	1 356 994
Azerbaijan	15 324	17 750	16 431	13 226	13 553	13 851	13 582	16 797
Belarus	..	..	..	..	..	..	..	..
Belgium	898 213	932 315	816 649	911 512	864 031	749 417	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	29 383	34 030	72 390 |	75 527	102 211	109 818	57 297	51 387
Canada	..	..	..	..	3 205 834	2 952 584	3 235 761	3 315 391
China	..	..	..	..	..	..	..	..
Croatia	47 271	54 300	59 226	91 234	96 577	64 786	69 583	44 214
Czech Republic	517 095	596 505	673 864	868 326	997 974	876 747	1 051 439	1 111 464
Denmark	195 543	178 279	252 483	218 047 |	210 925	161 827	197 945	198 763
Estonia	8 451	11 068	16 170	16 309	21 190	17 355	22 484	..
Finland	262 061	224 227	127 520	118 818	133 644	89 318	70 204	60 174
France	..	..	..	..	..	..	..	..
FYROM[1]	..	..	..	..	..	..	..	..
Georgia	20 089	19 156	34 525	35 872	40 117	30 727	45 923	43 856
Germany	3 915 508	4 212 328	4 833 220	5 603 297	6 023 299	5 078 291	5 614 553	5 921 037
Greece	23 679	42 298	55 781	107 038 |	88 473	56 550	51 009	65 175
Hungary	389 522	467 366	469 928	439 827	447 944	452 273	568 685	520 752
Iceland	x	x	x	x	x	x	x	x
India	..	..	..	..	..	..	..	..
Ireland	71 678	16 964	7 404	3 312	4 896	4 340	13 472	14 280
Italy	1 425 231	1 368 591	1 400 489	1 381 261	1 291 673	864 525	649 259	563 196
Japan	..	..	..	..	..	..	..	..
Korea	..	..	..	..	..	..	..	..
Latvia	23 484	25 199	32 657	55 334	52 759	71 142	98 223	101 099
Liechtenstein	x	x	x	x	x	x	x	x
Lithuania	30 770	40 065	58 444	95 214	101 711	70 247	78 188	102 297
Luxembourg	132 014	161 512	217 148	29 945	26 967	33 892	..	..
Malta	x	x	x	x	x	x	x	x
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	5 797	3 195	3 426	3 313	3 525	1 922	1 914	1 774
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	631 808	700 083	681 993	968 534	1 077 777	1 026 295	921 108	939 808
New Zealand	..	..	..	..	..	..	..	..
Norway	..	..	..	..	552 003	519 954	493 386	..
Poland	281 616	307 611	409 933	547 461	706 804	426 619	569 759	783 338
Portugal	67 920	52 710	67 154	82 043	82 664	88 032	171 146	185 456
Romania	186 826	217 318	249 461	190 240	230 829	145 065	196 328	125 372
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	..	..	..	..	..	..	..	..
Slovak Republic	120 421	158 863	165 816	263 369	374 672	314 700	449 429	713 921 |
Slovenia	107 469	123 982	148 512	206 225	256 449	222 740	325 556	385 194
Spain	..	..	..	..	..	..	..	..
Sweden	276 753	317 079	336 766	384 609	416 973	533 876	536 934	486 271
Switzerland	..	..	..	..	..	..	..	..
Turkey	21 270	21 220	193 424	220 657	319 583	439 936	451 710	586 468
Ukraine	53 848	55 228	92 609	116 521	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available; | Break in series; x Not applicable

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Maritime container transport

Twenty-foot equivalent unit (TEU)

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	8 292	15 286	21 879	33 127	46 798	68 622	71 614	..
Armenia	x	x	x	x	x	x	x	x
Australia	4 859 118	5 171 367	5 311 094	5 828 947	6 312 647	6 102 990	6 329 135	6 788 836
Austria	x	x	x	x	x	x	x	x
Azerbaijan	307	910	834	1 209	3 025	3 768	13 306	9 712
Belarus	x	x	x	x	x	x	x	x
Belgium	7 241 354	7 872 963	8 424 693	9 841 397	10 478 990	9 185 866	10 431 840	10 253 280
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	106 731	110 420	120 471	131 570	200 863	168 339	170 835	179 181
Canada	3 691 783	3 813 942	3 990 469	4 235 611	4 447 910	3 924 200	4 519 600	..
China	..	..	..	..	..	..	..	..
Croatia	76 105 |	94 095	114 301	182 606	210 729	151 926	144 649	154 451
Czech Republic	x	x	x	x	x	x	x	x
Denmark	538 000	614 000	684 000	790 000	747 000	637 000	734 000	782 000
Estonia	141 157	128 634	153 004	182 328	182 065	131 278	152 060	..
Finland	1 129 199	1 300 236	1 393 690	1 554 176	1 594 686	1 104 755	1 219 575	1 398 630
France	6 565 499	3 578 578	3 648 069	4 234 692	3 906 791	3 684 842	3 870 943	3 814 869
FYROM[1]	x	x	x	x	x	x	x	x
Georgia	80 009	105 946	129 100	184 792	253 811	181 613	226 115	299 461
Germany	10 822 400	12 100 830	13 801 570	15 257 000	15 667 000	11 915 000	13 096 000	15 271 000
Greece	1 877 389	1 760 437	1 796 409	1 873 219	1 036 980	1 025 729	1 187 487	2 054 064
Hungary	x	x	x	x	x	x	x	x
Iceland	..	..	..	..	..	..	..	..
India	4 235 000	4 613 000	5 537 000	6 704 000	6 578 000	6 863 000	7 561 000	7 778 000
Ireland	924 845	993 625	1 100 320	1 173 301	1 043 809	823 218	772 548	744 056
Italy	7 952 570	7 769 604	7 842 333	8 483 074	7 896 531	6 605 651	8 644 600	..
Japan	17 837 550	18 847 700	20 047 680	20 821 900	20 705 860	18 015 530	20 533 730	21 135 700
Korea	14 523 138	15 216 460	15 964 896	17 543 923	17 926 748	16 341 378	19 368 960	21 610 502
Latvia	117 873	122 321	149 930	175 616	167 491	145 415	208 508	246 590
Liechtenstein	x	x	x	x	x	x	x	x
Lithuania	174 242	214 322	231 603	321 432	373 263	247 995	295 226	382 185
Luxembourg	x	x	x	x	x	x	x	x
Malta	1 508 781	1 318 261	..	..	..	..	..	..
Mexico	1 903 845	2 133 476	2 676 774	3 062 442	3 316 087	2 884 487	3 691 374 |	4 223 631
Moldova, Republic of	x	x	x	x	x	x	x	x
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	8 384 123	9 378 669	10 103 160	11 301 690	11 206 050	9 955 769	11 242 400	..
New Zealand	..	..	..	..	..	..	..	..
Norway	543 695	560 348	599 270	635 863	624 762	585 647	656 244	691 172
Poland	347 812	396 537	455 829	576 336	635 387	660 594	1 041 690	1 330 746
Portugal	1 164 826	1 191 308	1 313 909	1 439 111	1 548 000	1 508 678	1 675 572	1 791 644
Romania	213 192	475 960	670 690	948 100	1 405 333	607 483	548 094	653 306
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	..	..	..	..	..	..	..	..
Slovak Republic	x	x	x	x	x	x	x	x
Slovenia	153 347	179 745	218 970	305 648	353 880	343 165	476 731	589 314
Spain	9 968 913	11 034 160	11 969 810	13 187 300	13 314 320	11 719 130	12 505 800	13 849 940
Sweden	853 048	925 235	995 644	1 087 072	1 081 549	996 444	1 071 238	1 165 087
Switzerland	x	x	x	x	x	x	x	x
Turkey	2 937 567 |	3 137 787 |	3 673 132 |	4 461 841 |	5 091 621	4 404 442	5 743 455	6 523 506
Ukraine	411 987	..	..	532 766	..	..	..	..
United Kingdom	8 023 000	7 788 000	8 029 000	8 903 000	8 764 000	7 415 000	8 254 000	8 176 000
United States	23 850 520	26 092 400	27 631 490	29 020 340	28 308 780	24 989 110	..	..

.. Not available; | Break in series; x Not applicable

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/95cd.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Passenger transport by rail

Million passenger-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	89	73	80	51	41	32	19	..
Armenia	30	27	28	24	24 e	..	..	..
Australia	12 046	12 020	12 522	13 246	14 241	15 086	15 890	16 390
Austria	8 295	8 470	9 296		9 580	10 837	10 653	10 306	10 876
Azerbaijan	789	878	964	1 108	1 049	1 024	917	660
Belarus	13 893	10 351	9 968	9 366	8 188	7 401	7 578	..
Belgium	8 676	9 150	9 607	9 932	10 406	10 427	10 403	..
Bosnia-Herzegovina	34	34	36	61	78	61	59	100
Bulgaria	2 404	2 389	2 422	2 424	2 335	2 144	2 100	2 068
Canada	1 413	1 478	1 450	1 453	1 574	1 413	1 404	1 373
China	571 220	606 196	662 212	721 631	777 860	787 889	876 218	961 229
Croatia	1 213	1 266	1 362	1 611	1 810	1 835	1 742	1 486
Czech Republic	6 590	6 667	6 922	6 900	6 803	6 503	6 591	6 714
Denmark	6 074	6 136	6 274	6 353	6 475	6 367	6 577	6 889
Estonia	193	248	257	274	274	249	247	243 e
Finland	3 352	3 478	3 540	3 778	4 052	3 876	3 959	3 882
France	74 100	76 200	79 300	81 600	86 600	85 900	85 900	89 000
FYROM[1]	94	94	105	109	148	154	155	145
Georgia	614	713	808	773	674	626	654	641
Germany	72 565	74 946	78 764	79 098	82 428	81 206	83 033	84 979
Greece	1 669	1 854	1 811	1 930	1 657	1 414	1 337	958
Hungary	10 544	9 880	9 584	8 752	8 293	8 073	7 692	7 806
Iceland	x	x	x	x	x	x	x	x
India	575 700	615 600	694 800	769 960	838 030	903 460	979 000	..
Ireland	1 582	1 781	1 872	2 007	1 976	1 683	1 678	1 638
Italy	49 254	50 088	50 185	49 780	49 524	48 124	47 172	..
Japan	385 163	391 215	395 547	405 612	404 394	392 114	393 540	390 973 e
Korea	52 749	54 641	56 067	55 762	56 799	55 489	58 381	63 044
Latvia	811	894	992	983	951	756	749	741
Liechtenstein	x	x	x	x	x	x	x	x
Lithuania	443	428	431	409	398	357	373	389
Luxembourg	266	272	298	316	345	333	347	349
Malta	x	x	x	x	x	x	x	x
Mexico	74	73	76	84	178		449	908		891
Moldova, Republic of	346	355	471	468	486	423	399	399
Montenegro, Republic of	130	123	132	110	125	99	91	65
Netherlands	14 079	14 730	15 889	15 546	15 313	15 400	15 400	..
New Zealand	..	..	..	..	..	..	..	..
Norway	3 092	3 203	3 300	3 445	3 631	3 601	3 683	3 644
Poland	18 626	17 884	18 240	19 524	20 195	18 637	17 921	18 177
Portugal	3 633	3 753	3 876	3 987	4 213	4 152	4 111	4 143
Romania	8 638	7 985	8 092	7 476	6 958	6 128	5 438	5 073
Russian Federation	164 272	172 217	177 838	174 085	175 872	151 466	138 885	139 742
Serbia, Republic of	821	713	684	687	583	522	522	541
Slovak Republic	2 228	2 182	2 213	2 165	2 296	2 264	2 309	2 431
Slovenia	764	777	793	812	834	840	813	773
Spain	20 386	21 624	22 105	21 857	23 969	23 137	22 456	22 795
Sweden	8 658	8 936	9 617	10 261	11 146	11 321	11 219	11 434
Switzerland	14 914	16 144	16 578	17 434	17 776	18 571	19 177	19 471
Turkey	5 163	5 036	5 277	5 553	5 097	5 374	5 491	5 882
Ukraine	51 726	52 655	53 230	53 089	53 056	48 327	50 240	..
United Kingdom	41 689	42 677	45 214	48 281	50 626	50 439	53 320	56 059
United States	8 869	8 660	8 706	9 309	9 943	9 518	10 332	10 570

.. Not available; | Break in series; e Estimated value; x Not applicable

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/c74a.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Passenger transport by private car

Million passenger-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	6 340	6 645	6 870	6 377	5 647	6 068	5 535	..
Armenia	1 974	2 131	2 344	2 426 e	2 426 e	2 741	2 356	..
Australia	262 755	263 508	261 844	264 189	263 683	262 526	264 130	266 180
Austria	..	..	..	..	..	..	..	..
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	..	..	..	..	..	..	..	..
Belgium	109 690	109 420	109 920	112 080	110 390	111 470	112 640	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	..	..	..	..	..	..	..
Canada	468 000	494 000	493 000	488 000	477 000	493 000	..	..
China	874 840	929 208	1 013 085	1 150 677	1 247 611	1 351 144	1 502 081	1 676 025
Croatia	..	..	..	..	..	..	..	..
Czech Republic	67 570	68 640	69 630	71 540	72 380	72 290	63 570 |	65 490
Denmark	58 152	58 348	59 137	60 958	61 009	60 455	59 613	60 676
Estonia	..	..	..	..	..	..	..	..
Finland	60 940	61 910	62 455	63 785	63 400	64 330	64 745	65 490
France	807 000	800 800	801 700	812 000	800 000	802 900	810 800	812 700
FYROM[1]	..	..	..	..	..	..	..	..
Georgia	..	..	..	..	..	..	..	..
Germany	868 700	856 900	863 300	866 500	871 300	881 100	887 000	..
Greece	36 403 e	36 258 e	36 240 e	36 324 e	35 895 e	..	..	..
Hungary	49 121	49 403	52 315	53 946	54 005	54 396	52 595	52 251
Iceland	4 301	4 558	4 833	5 077	4 948	5 002	4 958	4 776
India	..	..	..	..	..	..	..	..
Ireland	..	..	..	..	..	..	..	..
Italy	716 060	677 014	676 255	677 056	676 359	719 912	698 390	665 818
Japan	864 412	848 739	833 863	835 980	822 076	..	..	..
Korea	163 532	142 566	145 210	145 916	210 886	216 378	264 281	248 111
Latvia	..	..	..	..	..	..	..	..
Liechtenstein	..	..	..	..	..	..	..	..
Lithuania	25 799	34 793	39 472	39 119	37 991	36 055	32 569	29 908
Luxembourg	..	..	..	..	..	..	..	..
Malta	..	..	..	..	..	..	..	..
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	..	..	..	..	..	..	..	..
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	151 500	148 800	148 000	150 500	147 044 e	..	135 100 |	140 100
New Zealand	..	..	..	..	..	..	..	..
Norway	52 606	52 400	53 302	54 866	55 956	56 536	57 037	58 029
Poland	181 500	197 300	219 240	239 260	273 503	285 028	297 904	313 209
Portugal	87 036 e	86 688 e	86 645 e	86 844 e	85 819 e	..	..	..
Romania	..	..	..	..	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	..	..	..	..	..	..	..	..
Slovak Republic	24 332	25 824	25 920	25 994	26 395	26 420	26 879	26 887
Slovenia	22 042 |	22 509	23 006	24 355	24 878	25 775	25 636	..
Spain	330 192	337 797	340 937	343 293	342 611	350 401	341 629	334 021
Sweden	107 100	107 400	107 100	109 500	108 200	108 300	108 000	109 200
Switzerland	77 740	77 844	78 394	79 261	80 689	82 459	83 775	84 889
Turkey	..	..	..	..	..	..	..	..
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	673 000	667 000	673 000	675 000	667 000	662 000	656 000	655 000
United States	4 332 420	4 344 110	4 298 629	5 351 032 |	5 147 478	4 507 134 |	4 529 563	4 569 061

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/c74a.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Passenger transport by bus and coach

Million passenger-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	141	280	480	663	790	1 302	2 370	..
Armenia	92 e	92 e	92 e	95 e	95 e	..	..	..
Australia	18 433	18 474	18 918	19 104	19 428	19 845	20 270	20 740
Austria	..	..	..	..	..	..	..	..
Azerbaijan	10 279	10 892	11 786	12 893	14 041	15 291	16 633	18 264
Belarus	9 382	9 231	9 343	9 353	8 220	..	..	..
Belgium	17 110	17 540	18 070	18 730	18 350	18 670	17 260	..
Bosnia-Herzegovina	..	..	..	2 038	2 113	1 951	..	1 454
Bulgaria	11 093	11 355	11 136	11 272	11 398	9 288	9 187	9 077
Canada	20 368	18 736	17 103	15 471	15 471 e	..	..	..
China	..	..	..	..	..	..	..	..
Croatia	3 390	3 403	3 537	3 808	4 093	3 438	3 284	3 145
Czech Republic	8 516	8 608	9 501	9 519	9 369	9 494	10 816 |	9 267
Denmark	7 300	7 169	7 054	6 857	6 782	6 781	6 884	6 804
Estonia	2 714	2 938	3 112	2 909	2 676	2 336	2 241	..
Finland	7 605	7 540	7 540	7 540	7 540	7 540	7 540	7 540
France	42 400	42 500	43 300	45 300	48 400	48 800	49 900	51 100
FYROM[1]	1 110	1 087	1 016	1 027	1 239	1 213	1 441	1 640
Georgia	..	..	..	..	..	..	..	..
Germany	67 806 |	67 063	66 184	65 387	63 592	62 401	62 975	..
Greece	6 193 e	6 226 e	6 069 e	6 253 e	6 287 e	..	..	..
Hungary	18 408	17 235	17 315	16 501	16 979	16 081	16 250	16 259
Iceland	554	587	622	653	637	644	638	615
India	..	..	..	..	..	..	..	..
Ireland	..	..	..	..	..	..	..	..
Italy	99 760	100 954	103 049	102 657	102 438	101 706	102 225	103 238
Japan	83 151	84 266	84 075	83 082	83 831	..	..	..
Korea	26 651 |	58 213	59 129	59 242	96 614	94 409	114 582	115 207
Latvia	2 655	2 891	2 800	2 644	2 517	1 929	1 975	1 981
Liechtenstein	..	..	..	..	..	..	..	..
Lithuania	3 140	3 267	3 283	3 170	2 952	2 382	2 348	2 400
Luxembourg	..	..	..	..	..	..	..	..
Malta	..	..	..	..	..	..	..	..
Mexico	410 000	422 915	436 999	449 917	463 865	436 900	452 033 |	465 600
Moldova, Republic of	1 949	2 059	2 206	2 475	2 599	2 300	2 417	2 685
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	15 949 e	16 034 e	15 630 e	16 105 e	16 192 e	..	..	..
New Zealand	..	..	..	..	..	..	..	..
Norway	5 967	5 939	5 894	6 077	6 147	6 208	6 318	6 622
Poland	30 118	29 314	28 148	27 359	26 791	24 386	21 600	20 651
Portugal	10 773 e	10 830 e	10 557 e	10 878 e	10 937 e	..	..	..
Romania	9 438	11 812	11 735	12 156	13 881 |	12 805	11 955	11 773
Russian Federation	168 289	141 903	135 590	149 542	151 774	141 191	140 333	138 284
Serbia, Republic of	3 676	4 820	5 480	4 456	4 719	4 582	4 653	4 652
Slovak Republic	7 882	7 740	7 816	7 737	6 567	4 673	4 509	4 681
Slovenia	3 218 |	3 062	3 133	3 235	3 146	3 196	3 183	..
Spain	53 458	53 176	49 369	59 163	60 864	57 043	50 902	55 742
Sweden	8 900	8 800	8 700	8 800	8 500	8 500	8 600	8 700
Switzerland	5 058	5 312	5 602	5 673	5 344	5 435	5 522	5 624
Turkey	..	..	..	..	..	..	..	..
Ukraine	46 841	51 820	53 343	55 446	55 446 e	..	..	..
United Kingdom	45 000	45 000	43 000	45 000	44 000	45 000	45 000	43 000
United States	232 048	238 170	231 449	495 280	505 782	490 873	469 790	470 237

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/c74a.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Total passenger transport by road

Million passenger-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	6 481	6 925	7 350	7 040	6 437	7 370	7 905	..
Armenia	2 066 e	2 223 e	2 436 e	2 521 e	2 521 e	..	..	..
Australia	281 188	281 982	280 762	283 293	283 111	282 371	284 400	286 920
Austria	..	..	..	..	..	..	..	..
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	..	..	..	..	..	..	..	..
Belgium	126 800	126 960	127 990	130 810	128 740	130 140	129 900	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	..	..	..	..	..	..	..
Canada	488 368	512 736	510 103	503 471	492 471 e	..	..	..
China	..	..	..	..	..	..	..	..
Croatia	..	..	..	..	..	..	..	..
Czech Republic	76 086	77 248	79 131	81 059	81 749	81 784	74 386 |	74 757
Denmark	65 452	65 517	66 191	67 815	67 791	67 236	66 497	67 480
Estonia	..	..	..	..	..	..	..	..
Finland	68 545	69 450	69 995	71 325	70 940	71 870	72 285	73 030
France	849 400	843 300	845 000	857 300	848 400	851 700	860 700	863 800
FYROM[1]	..	..	..	..	..	..	..	..
Georgia	5 200	5 252	5 269	5 416	5 568	5 724	5 885	6 049
Germany	936 506 |	923 963	929 484	931 887	934 892	943 501	949 975	..
Greece	42 596 e	42 484 e	42 309 e	42 577 e	42 182 e	..	..	..
Hungary	67 529	66 638	69 630	70 447	70 984	70 477	68 845	68 510
Iceland	4 855	5 145	5 455	5 730	5 585	5 646	5 596	5 391
India	3 469 000	4 252 000	4 546 000	4 860 000	5 196 000	5 197 000	5 556 000	5 969 000
Ireland	..	..	..	..	..	..	..	..
Italy	815 820	777 968	779 304	779 713	778 797	821 618	800 615	769 056
Japan	947 563	933 005	917 938	919 062	905 907	..	..	..
Korea	190 183 |	200 779	204 339	205 158	307 500	310 787	378 863	363 318
Latvia	..	..	..	..	..	..	..	..
Liechtenstein	..	..	..	..	..	..	..	..
Lithuania	28 939	38 060	42 755	42 289	40 943	38 437	34 917	32 308
Luxembourg	..	..	..	..	..	..	..	..
Malta	..	..	..	..	..	..	..	..
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	..	..	..	..	..	..	..	..
Montenegro, Republic of	101	85	115	141	123	102	81	80
Netherlands	167 449 e	164 834 e	163 630 e	166 605 e	163 236 e	..	..	..
New Zealand	..	..	..	..	..	..	..	..
Norway	58 573	58 339	59 196	60 943	62 103	62 744	63 355	64 651
Poland	211 618	226 614	247 388	266 619	300 294	309 414	319 504	333 860
Portugal	97 809 e	97 518 e	97 202 e	97 722 e	96 756 e	..	..	..
Romania	..	..	..	..	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	..	..	..	..	..	..	..	..
Slovak Republic	32 214	33 564	33 736	33 731	32 962	31 093	31 388	31 568
Slovenia	25 260 |	25 571	26 139	27 590	28 024	28 971	28 819	..
Spain	383 650	390 973	390 306	402 456	403 475	407 444	392 531	389 763
Sweden	116 000	116 200	115 800	118 300	116 700	116 800	116 600	117 900
Switzerland	82 798	83 156	83 996	84 934	86 033	87 894	89 297	90 513
Turkey	174 312	182 152	187 593	209 115	206 098	212 464	226 913	242 265
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	718 000	712 000	716 000	720 000	711 000	707 000	701 000	698 000
United States	4 564 468	4 582 280	4 530 078	5 846 312 |	5 653 260	4 998 007 |	4 999 353	5 039 298

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/c74a.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Total inland passenger transport

Million passenger-kilometres

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	6 570	6 998	7 430	7 091	6 478	7 402	7 924	..
Armenia	2 096 e	2 250 e	2 464 e	2 545 e	2 545 e	2 741	2 356	..
Australia	293 234	294 002	293 284	296 539	297 352	297 457	300 290	303 310
Austria	8 295	8 470	9 296 |	9 580	10 837	10 653	10 306	10 876
Azerbaijan	11 068	11 770	12 750	14 001	15 090	16 315	17 550	18 924
Belarus	23 275	19 582	19 311	18 719	16 408	7 401	7 578	..
Belgium	135 476	136 110	137 597	140 742	139 146	140 567	140 303	..
Bosnia-Herzegovina	34	34	36	2 099	2 191	2 012	59	1 554
Bulgaria	13 497	13 744	13 558	13 696	13 733	11 432	11 287	11 145
Canada	489 781	514 214	511 553	504 924	494 045 e	494 413	..	..
China	1 446 060	1 535 404	1 675 297	1 872 308	2 025 471	2 139 033	2 378 299	2 637 254
Croatia	4 603	4 669	4 899	5 419	5 903	5 273	5 026	4 631
Czech Republic	82 676	83 915	86 053	87 959	88 552	88 287	80 977 |	81 471
Denmark	71 526	71 653	72 465	74 168	74 266	73 603	73 074	74 369
Estonia	2 907	3 186	3 369	3 183	2 950	2 585	2 488	..
Finland	71 897	72 928	73 535	75 103	74 992	75 746	76 244	76 912
France	923 500	919 500	924 300	938 900	935 000	937 600	946 600	952 800
FYROM[1]	1 204	1 181	1 121	1 136	1 387	1 367	1 596	1 785
Georgia	5 814	5 965	6 077	6 189	6 242	6 350	6 539	6 690
Germany	1 009 071 |	998 909	1 008 248	1 010 985	1 017 320	1 024 707	1 033 008	..
Greece	44 265 e	44 338 e	44 120 e	44 507 e	43 839 e	..	..	..
Hungary	78 073	76 518	79 214	79 199	79 277	78 550	76 537	76 316
Iceland	4 855	5 145	5 455	5 730	5 585	5 646	5 596	5 391
India	4 044 700	4 867 600	5 240 800	5 629 960	6 034 030	6 100 460	6 535 000	..
Ireland	1 582	1 781	1 872	2 007	1 976	1 683	1 678	1 638
Italy	865 074	828 056	829 489	829 493	828 321	869 742	847 787	769 056
Japan	1 333 039	1 324 220	1 313 558	1 324 606	1 310 492	..	..	..
Korea	242 932 |	255 420	260 406	260 920	364 299	366 276	437 244	..
Latvia	3 466	3 785	3 792	3 627	3 468	2 685	2 724	2 722
Liechtenstein	..	..	..	..	..	..	..	..
Lithuania	29 382	38 488	43 186	42 698	41 341	38 794	35 290	32 697
Luxembourg	266	272	298	316	345	333	347	349
Malta	..	..	..	..	..	..	..	..
Mexico	410 074	422 988	437 075	450 001	464 043 |	437 349	452 941 |	466 491
Moldova, Republic of	2 295	2 414	2 677	2 943	3 085	2 723	2 816	3 084
Montenegro, Republic of	231	208	247	251	248	201	172	145
Netherlands	181 528 e	179 564 e	179 519 e	182 151 e	178 549 e	..	150 500 |	140 100
New Zealand	..	..	..	..	..	..	..	..
Norway	61 665	61 542	62 496	64 388	65 734	66 345	67 038	68 295
Poland	230 244	244 498	265 628	286 143	320 489	328 051	337 425	352 037
Portugal	101 442 e	101 271 e	101 078 e	101 709 e	100 969 e	..	..	..
Romania	18 076	19 797	19 827	19 632	20 839 |	18 933	17 393	16 846
Russian Federation	332 561	314 120	313 428	323 627	327 646	292 657	279 218	278 026
Serbia, Republic of	4 497	5 533	6 164	5 143	5 302	5 104	5 175	5 193
Slovak Republic	34 442	35 746	35 949	35 896	35 258	33 357	33 697	33 999
Slovenia	26 024 |	26 348	26 932	28 402	28 858	29 811	29 632	..
Spain	404 036	412 597	412 411	424 313	427 444	430 581	414 987	412 558
Sweden	124 658	125 136	125 417	128 561	127 846	128 121	127 819	129 334
Switzerland	100 820	102 878	104 068	105 596	106 670	108 886	110 245	..
Turkey	179 475	187 188	192 870	214 668	211 195	217 838	232 404	248 147
Ukraine	98 567	104 475	106 573	108 535	108 502 e	..	..	..
United Kingdom	759 689	754 677	761 214	768 281	761 626	757 439	754 320	754 059
United States	4 573 337	4 590 940	4 538 784	5 855 621 |	5 663 203	5 007 525 |	5 009 557	..
European Union (EU27)	**5 225 695**	**5 205 956**	**5 263 266**	**5 336 670**	**5 363 144**	**..**	**..**	**..**
OECD	**12 845 883**	**12 884 010**	**12 897 553**	**14 334 591**	**14 260 478**	**..**	**..**	**..**

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/c74a.

Area totals include only those countries shown in the table.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Road traffic injury accidents

Number of accidents

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	801	850	1 015	1 254	1 208	1 465	1 564	..
Armenia	1 164	1 312	1 574	1 943	2 202	2 002	..	..
Australia	..	..	..	..	..	..	..	..
Austria	42 657	40 896	39 884	41 096	39 173	37 925	35 348	35 129
Azerbaijan	2 388	3 179	3 197	3 104	2 970	2 792	2 721	2 890
Belarus	7 218	7 717	8 283	7 501	7 238	6 739	..	..
Belgium	48 670	49 307	49 171	49 794	48 827	47 798	45 918	47 924
Bosnia-Herzegovina	36 367	35 233	36 090	39 899	40 859	40 237	..	37 928
Bulgaria	7 612	8 224	8 222	8 010	8 045	7 068	6 609	6 639
Canada	147 648	148 154	145 130	141 094	129 816	123 524	122 820	..
China	517 889	450 254	378 781	327 209	265 204	238 351	219 521	210 812
Croatia	17 140	15 679	16 706	18 029	16 283	15 730	13 272	13 228
Czech Republic	26 516	25 239	22 115	23 060	22 481	21 706	19 676	20 487
Denmark	6 209	5 412	5 403	5 549	5 020	4 174	3 498	3 525
Estonia	2 244	2 341	2 585	2 450	1 869	1 505	1 346	..
Finland	6 767	7 022	6 740	6 657	6 881	6 414	6 072	6 408
France	85 390	84 525	80 309	81 272	74 487	72 315	67 288	65 024
FYROM[1]	1 987	2 821	3 313	4 037	4 403	4 353	4 223	4 462
Georgia	2 936	3 870	4 795	4 946	6 015	5 482	5 099	4 486
Germany	339 310	336 619	327 984	335 845	320 614	310 806	288 297	306 266
Greece	15 547	16 914	16 019	15 092	15 083	14 914	14 146	13 717
Hungary	20 957	20 777	20 977	20 635	19 174	17 864	16 308	15 827
Iceland	810	687	915	1 147	1 085	893	876	837
India	429 910	439 255	460 920	479 216	484 704	486 384	499 628	497 686
Ireland	5 781	6 533	6 018	5 158	5 580	6 615	5 780	..
Italy	243 490	240 011	238 124	230 871	218 963	215 405	211 404	205 000
Japan	952 191	933 828	886 864	832 454	766 147	736 688	725 733	..
Korea	220 755	214 171	213 745	211 662	215 822	231 990	226 878	221 711
Latvia	5 081	4 466	4 302	4 781	4 196	3 160	3 193	3 386
Liechtenstein	512	435	448	420	402	358	366	327
Lithuania	6 357	6 772	6 588	6 448	4 796	3 805	3 530	3 266
Luxembourg	716	777	805	954	927	869	787	..
Malta	1 194	1 156	1 218	953	876	1 010	..	..
Mexico	30 665	29 444	29 030	30 551	30 379	29 596	..	..
Moldova, Republic of	2 447	2 289	2 298	2 437	2 869	2 729	2 921	2 825
Montenegro, Republic of	..	6 192	7 185	8 882	10 170	10 112	9 138	8 519
Netherlands	9 013	8 929	8 717	9 228	8 897	6 927	3 853 e	..
New Zealand	10 367	10 808	11 293	12 042	11 647	11 125	10 886	9 804
Norway	8 425	8 078	7 925	8 182	7 726	6 922	6 434	6 079
Poland	51 069	48 100	46 876	49 536	49 054	44 196	38 832	40 065
Portugal	38 930	37 066	35 680	35 311	33 613	35 484	35 426	32 541
Romania	6 860	7 226	21 904 |	24 662	29 861	28 612	25 996	26 648
Russian Federation	208 558	223 342	229 140	233 809	218 322	203 603	199 431	199 868
Serbia, Republic of	13 373	12 752	13 912	16 585	16 651	15 807	14 179	14 119
Slovak Republic	8 443	7 903	7 988	8 500	8 343	6 465	6 570	5 775
Slovenia	12 721	10 309	11 223	11 414	8 938	8 589	7 560	7 218
Spain	94 009	91 187	99 797	100 508	93 161	88 251	85 503	83 027
Sweden	18 029	18 094	18 213	18 548	18 462	17 858	16 500	16 119
Switzerland	22 891	21 706	21 491	21 911	20 736	20 506	19 609	18 990
Turkey	537 352	620 789	728 755	825 561	950 120	1 053 346	1 106 201	1 228 928
Ukraine	45 592	46 485	49 491	63 554	51 279	37 049 e	..	..
United Kingdom	213 043	203 682	204 363	188 105	176 814	169 805	160 080	156 068
United States	1 900 000	1 855 000	1 785 000	1 748 000	1 664 000	1 548 000	1 572 000	..

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/82be.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Road traffic injuries

Number

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	795	872	1 065	1 344	1 251	1 455	1 716	..
Armenia	1 492	1 774	2 089	2 720	3 145 e	2 804 e	..	..
Australia	28 782	29 850	31 204	32 777	32 543	..	..	.. e
Austria	55 857	53 234	51 930	53 211	50 521	49 158	45 858	45 025
Azerbaijan	2 766	3 668	3 606	3 432	3 232	3 044	2 871	3 031
Belarus	7 522	8 047	8 832	8 037 e	7 494 e	7 283 e	..	..
Belgium	62 992	65 342	65 297	65 850	64 437	62 720	60 362	62 802
Bosnia-Herzegovina	..	..	9 994	11 890	11 884	11 052	..	9 683
Bulgaria	9 308	10 112	10 215	9 827	9 952	8 674	8 078	8 301
Canada	206 229	204 764	199 994	192 744	176 455	170 425	169 508	.. e
China	480 864	469 911	431 139	380 442	304 919	275 125	254 074	237 421
Croatia	24 271	21 773	23 136	25 092	22 395	21 923	18 333	18 065
Czech Republic	34 254	32 211	28 114	29 243	28 501	27 244	24 384	25 550
Denmark	7 546	6 588	6 515	6 656	5 923	4 947	4 153	4 039
Estonia	2 875	3 027	3 508	3 271	2 398	1 931	1 719	..
Finland	8 791	8 983	8 580	8 446	8 513	8 057	7 673	7 931
France	108 366	108 076	102 125	103 201	93 798	90 934	84 461	81 251
FYROM[1]	2 922	4 176	4 936	6 133	6 724	6 731	6 195	6 853
Georgia	4 069	5 546	7 084	7 349	9 063	8 261	7 560	6 112
Germany	440 126	433 443	422 337	431 419	409 047	397 671	371 170	392 365
Greece	20 179	22 048	20 675	18 886	19 010	18 463	18 882	16 707
Hungary	28 054	27 505	27 977	27 452	25 369	23 274	20 917	20 172
Iceland	1 156	1 013	1 327	1 658	1 573	1 282	1 253	1 205
India	..	465 282	496 481	513 340	523 193	515 458	527 512	511 412
Ireland	7 867	9 318	8 575	7 806	7 921	9 742	8 270	.. e
Italy	349 301	340 676	338 624	330 981	315 470	307 258	302 735	292 000
Japan	1 181 986	1 155 573	1 097 279	1 033 550	944 636	909 257	894 278	.. e
Korea	346 987	342 233	340 229	335 906	338 962	361 875	352 458	341 391
Latvia	6 416	5 600	5 404	6 088	5 408	3 930	4 023	4 224
Liechtenstein	122	107	..	..	108	110	..	103
Lithuania	7 862	8 466	8 252	8 043	5 818	4 426	4 230	3 919
Luxembourg	990	1 054	1 089	1 326	1 239	1 156	1 059	.. e
Malta	1 181	1 190	1 207	1 195	1 104	1 048	..	..
Mexico	31 274	32 268	33 168	33 580	32 769	31 659	..	..
Moldova, Republic of	2 888	2 770	2 807	2 984	3 494	2 801	3 735	3 543
Montenegro, Republic of	..	1 942	2 257	2 796	2 473	2 478	2 099	2 075
Netherlands	9 487	9 401	9 051	9 683	8 750 e	6 956 e	3 651 e	..
New Zealand	13 890	14 451	15 174	16 013	15 174	14 540	14 031	12 574
Norway	12 121	11 214	11 126	12 082	10 868	9 844	9 130	8 363
Poland	64 661	61 191	59 123	63 224	62 097	56 046	48 952	49 501
Portugal	51 850	49 096	47 018	46 198	43 824	46 414	46 365	41 960
Romania	5 594	5 868	26 124 |	29 604	36 931	35 523	32 414	33 491
Russian Federation	251 386	274 864	285 362	292 206	270 883 |	255 484	250 635	251 848
Serbia, Republic of	17 557	16 872	18 405	22 201	22 275	21 512	19 326	19 312
Slovak Republic	11 190	10 490	10 692	11 310	11 040	8 534	8 150	7 057
Slovenia	18 723	14 314	16 075	16 037	12 409	12 114	10 316	9 673
Spain	138 383	133 394	143 450	142 521	130 947	124 966	120 345	115 627
Sweden	26 582	26 459	26 636	26 749	26 248	25 281	23 305	22 360
Switzerland	28 746	26 754	26 718	27 132	25 556	25 130	24 237	23 242
Turkey	136 437	154 086	169 080	189 057	184 468	201 380	211 496	238 074
Ukraine	53 636	55 999	60 018	78 528	63 254	45 894 e	..	..
United Kingdom	286 979	275 840	264 288	254 157	237 811	229 576	215 700	210 750
United States	2 788 164	2 698 557	2 532 292	2 490 941	2 345 739	2 217 192	2 239 115	2 216 633

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/82be.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Road traffic fatalities

Number

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	315	308	277	384	303	378	353	..
Armenia	259	310	332	371	407	325	..	..
Australia	1 583	1 627	1 599	1 603	1 437	1 489	1 367	1 275 e
Austria	878	768	730	691	679	633	552	523
Azerbaijan	811	1 065	1 027	1 107	1 052	930	925	1 016
Belarus	1 688	1 673	1 726	1 518	1 564	1 322	..	..
Belgium	1 163	1 089	1 069	1 067	944	943	841	858
Bosnia-Herzegovina	437	384	403	430	434	382	..	356
Bulgaria	943	957	1 043	1 006	1 061	901	776	657
Canada	2 731	2 898	2 884	2 761	2 419	2 207	2 186	2 025 e
China	107 077	98 738	89 455	81 649	73 484	67 759	65 225	62 387
Croatia	608	597	614	619	664	548	426	418
Czech Republic	1 382	1 286	1 063	1 222	1 076	901	802	773
Denmark	369	331	306	406	406	303	255	220
Estonia	170	170	204	196	132	100	78	101 e
Finland	375	379	336	380	344	279	272	292
France	5 593	5 318	4 709	4 620	4 275	4 273	3 992	3 963
FYROM[1]	155	143	140	173	162	160	162	172
Georgia	637	581	675	737	867	738	685	526
Germany	5 842	5 361	5 091	4 949	4 477	4 152	3 648	4 009
Greece	1 670	1 658	1 657	1 578	1 553	1 453	1 265	1 093
Hungary	1 296	1 278	1 303	1 232	996	822	740	638
Iceland	23	19	31	15	12	17	8	12
India	92 618	94 968	105 749	114 444	119 860	125 660	134 513	142 485
Ireland	374	396	365	338	279	238	212	186 e
Italy	6 122	5 818	5 669	5 131	4 731	4 237	4 090	3 800
Japan	8 492	7 931	7 272	6 639	6 023	5 772	5 745	5 507 e
Korea	6 563	6 376	6 327	6 166	5 870	5 838	5 505	5 229
Latvia	516	442	407	419	316	254	218	179
Liechtenstein	1	2	..	..	1	1	..	2
Lithuania	752	773	760	740	499	370	299	296
Luxembourg	50	47	43	46	35	48	32	33 e
Malta	13	17	11	12	15	21	15	21 e
Mexico	4 603	4 710	4 908	5 398	5 379	4 870	..	..
Moldova, Republic of	405	391	382	464	500	487	452	433
Montenegro, Republic of	..	95	85	122	112	100	95	58
Netherlands	881	817	811	791	750	720	640	661
New Zealand	435	405	393	421	366	385	375	284
Norway	257	224	242	233	255	212	208	168
Poland	5 712	5 444	5 243	5 583	5 437	4 572	3 907	4 189
Portugal	1 294	1 247	969	974	885	840	937	891
Romania	2 418	2 641	2 587	2 800	3 065	2 797	2 377	2 018
Russian Federation	34 506	33 957	32 724	33 308	29 936 |	27 659	26 567	27 953
Serbia, Republic of	953	841	900	962	897	808	656	728
Slovak Republic	608	600	608	661	606	384	353	325
Slovenia	274	258	262	293	214	171	138	141
Spain	4 741	3 857	4 104	3 823	3 100	2 714	2 478	2 060
Sweden	480	440	445	471	397	358	266	319
Switzerland	510	409	370	384	357	349	327	320
Turkey	4 427	4 505	4 633	5 007	4 236	4 324	4 045	3 835
Ukraine	6 966	7 229	7 592	9 574	7 718	5 348	..	..
United Kingdom	3 368	3 336	3 298	3 059	2 645	2 337	1 905	1 960
United States	42 836	43 443	42 708	41 059	37 261	33 808	32 885	32 367
European Union (EU27)	**47 892**	**45 325**	**43 707**	**43 107**	**39 581**	**35 369**	**31 514**	**30 624**
OECD	**115 102**	**112 445**	**109 652**	**107 197**	**97 576**	**89 749**	**..**	**..**

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/82be.

Area totals include only those countries shown in the table.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Road traffic casualties (injuries plus fatalities)

Number

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	1 110	1 180	1 342	1 728	1 554	1 833	2 069	..
Armenia	1 751	2 084	2 421	3 091	3 552 e	3 129 e	..	..
Australia	30 365	31 477	32 803	34 380	33 980	..	..	..
Austria	56 735	54 002	52 660	53 902	51 200	49 791	46 410	45 548
Azerbaijan	3 577	4 733	4 633	4 539	4 284	3 974	3 796	4 047
Belarus	9 210	9 720	10 558	9 555 e	9 058 e	8 605 e	..	..
Belgium	64 155	66 431	66 366	66 917	65 381	63 663	61 203	63 660
Bosnia-Herzegovina	..	..	10 397	12 320	12 318	11 434	..	10 039
Bulgaria	10 251	11 069	11 258	10 833	11 013	9 575	8 854	8 958
Canada	208 960	207 662	202 878	195 505	178 874	172 632	171 694	..
China	587 941	568 649	520 594	462 091	378 403	342 884	319 299	299 808
Croatia	24 879	22 370	23 750	25 711	23 059	22 471	18 759	18 483
Czech Republic	35 636	33 497	29 177	30 465	29 577	28 145	25 186	26 323
Denmark	7 915	6 919	6 821	7 062	6 329	5 250	4 408	4 259
Estonia	3 045	3 197	3 712	3 467	2 530	2 031	1 797	..
Finland	9 166	9 362	8 916	8 826	8 857	8 336	7 945	8 223
France	113 959	113 394	106 834	107 821	98 073	95 207	88 453	85 214
FYROM[1]	3 077	4 319	5 076	6 306	6 886	6 891	6 357	7 025
Georgia	4 706	6 127	7 759	8 086	9 930	8 999	8 245	6 638
Germany	445 968	438 804	427 428	436 368	413 524	401 823	374 818	396 374
Greece	21 849	23 706	22 332	20 464	20 563	19 916	20 147	17 800
Hungary	29 350	28 783	29 280	28 684	26 365	24 096	21 657	20 810
Iceland	1 179	1 032	1 358	1 673	1 585	1 299	1 261	1 217
India	..	560 250	602 230	627 784	643 053	641 118	662 025	653 897
Ireland	8 241	9 714	8 940	8 144	8 200	9 980	8 482	..
Italy	355 423	346 494	344 293	336 112	320 201	311 495	306 825	295 800
Japan	1 190 478	1 163 504	1 104 551	1 040 189	950 659	915 029	900 023	..
Korea	353 550	348 609	346 556	342 072	344 832	367 713	357 963	346 620
Latvia	6 932	6 042	5 811	6 507	5 724	4 184	4 241	4 403
Liechtenstein	123	109	97	116	109	111	114	105
Lithuania	8 614	9 239	9 012	8 783	6 317	4 796	4 529	4 215
Luxembourg	1 040	1 101	1 132	1 372	1 274	1 204	1 091	..
Malta	1 194	1 207	1 218	1 207	1 119	1 069	..	..
Mexico	35 877	36 978	38 076	38 978	38 148	36 529	..	..
Moldova, Republic of	3 293	3 161	3 189	3 448	3 994	3 288	4 187	3 976
Montenegro, Republic of	..	2 037	2 342	2 918	2 585	2 578	2 194	2 133
Netherlands	10 368	10 218	9 862	10 474	9 500 e	7 676 e	4 291 e	..
New Zealand	14 325	14 856	15 567	16 434	15 540	14 925	14 406	12 858
Norway	12 378	11 438	11 368	12 315	11 123	10 056	9 338	8 531
Poland	70 373	66 635	64 366	68 807	67 534	60 618	52 859	53 690
Portugal	53 144	50 343	47 987	47 172	44 709	47 254	47 302	42 851
Romania	8 012	8 509	28 711 |	32 404	39 996	38 320	34 791	35 509
Russian Federation	285 892	308 821	318 086	325 514	300 819	283 143	277 202	279 801
Serbia, Republic of	18 510	17 713	19 305	23 163	23 172	22 320	19 982	20 040
Slovak Republic	11 798	11 090	11 300	11 971	11 646	8 918	8 503	7 382
Slovenia	18 997	14 572	16 337	16 330	12 623	12 285	10 454	9 814
Spain	143 124	137 251	147 554	146 344	134 047	127 680	122 823	117 687
Sweden	27 062	26 899	27 081	27 220	26 645	25 639	23 571	22 679
Switzerland	29 256	27 163	27 088	27 516	25 913	25 479	24 564	23 562
Turkey	140 864	158 591	173 713	194 064	188 704	205 704	215 541	241 909
Ukraine	60 602	63 228	67 610	88 102	70 972	51 242 e	..	..
United Kingdom	290 347	279 176	267 586	257 216	240 456	231 913	217 605	212 710
United States	2 831 000	2 742 000	2 575 000	2 532 000	2 383 000	2 251 000	2 272 000	2 249 000

.. Not available; | Break in series; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/82be.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Investment in rail transport infrastructure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	2.1	2.3	1.2	0.6	1.4	0.1	0.3	0.9
Armenia	..	..	..	..	..	..	..	..
Australia	1 105.8	1 492.5	1 251.7	1 962.0	1 727.2	2 285.0	3 611.5	5 492.2
Austria	1 334.7	1 330.1	1 489.1	1 505.2	1 683.3	2 061.5	1 936.0	2 143.1
Azerbaijan	7.0	19.1	11.8	3.7	11.1	2.4	3.2	2.8
Belarus	..	..	..	..	..	..	..	..
Belgium	976.4	915.8	1 011.6	1 009.2	1 222.6	1 222.6	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	31.2	45.5	39.4	44.5	71.6	49.6	129.9	90.0
Canada	356.5	572.5	598.5	646.1	617.0	493.4	698.8	841.5
China	..	..	..	..	..	..	..	..
Croatia	128.2	93.8	121.5	92.3	125.7	98.2	83.4	80.5
Czech Republic	411.5	484.6	464.8	612.2	1 216.7	740.3	563.7	447.3
Denmark	341.5	240.9	178.2	232.1	373.0	356.7	396.4	863.0
Estonia	20.0	20.0	21.0	30.3	22.7	37.5	35.1	94.0
Finland	328.3	281.2	234.0	211.0	327.0	361.0	288.0	355.0
France	3 680.5	4 117.8	4 214.1	4 505.0	5 119.4	5 046.9	4 914.8	5 148.2
FYROM[1]	0.1	1.4	1.1	0.7	1.6	3.6	2.3	0.5
Georgia	11.1	14.2	61.9	212.0	48.2	80.3	77.5	249.2
Germany	6 404.0	3 411.0	3 971.0	3 836.0	3 816.0	3 412.0	3 807.0	3 920.0
Greece	1 786.0	278.0	239.0	253.0	..	..	..	..
Hungary	154.5	170.7	91.4	376.4	297.7	317.4	275.2	..
Iceland	..x	..x	..x	..x	..x	..x	..x	..x
India	1 504.0	1 425.2	1 328.4	1 437.1	1 500.7	2 514.7	2 994.2	3 079.9
Ireland	184.0	184.0	172.0	244.0	..	..	..	..
Italy	8 809.0	10 174.8	8 969.7	7 701.9	7 109.0	5 687.0	4 773.0	..
Japan	6 217.3	6 057.1	6 735.6	6 882.6	7 367.1	9 601.9	11 308.3	10 197.7
Korea	29.8	38.5	38.4	37.3	..	..	..	..
Latvia	33.1	40.2	33.0	37.1	61.2	63.8	77.6	53.8
Liechtenstein	..x	..x	..x	..x	..x	..x	..x	..x
Lithuania	70.4	68.1	50.4	75.9	85.4	67.2	107.2	116.1
Luxembourg	106.9	126.5	103.9	138.5	149.7	172.3	156.5	150.4
Malta	..x	..x	..x	..x	..x	..x	..x	..x
Mexico	192.0	222.7	370.5	562.7	497.9	437.9	434.9	649.2
Moldova, Republic of	5.6	9.4	6.4	10.5	24.5	8.4	7.2	7.4
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	1 051.2	1 100.5	702.8	845.2	820.1	778.2	1 096.6	1 135.6
New Zealand	..	..	..	..	..	..	..	..
Norway	221.9	193.4	258.1	310.0	286.4	358.2	479.3	527.6 e
Poland	220.2	236.1	353.2	646.7	904.3	650.2	690.2	924.9
Portugal	484.0	415.0	307.0	329.0	392.0	360.0	403.0	333.0
Romania	57.8	109.1	101.8	310.9	316.4	177.4	168.8	161.4
Russian Federation	3 647.6	4 021.1	4 167.6	5 435.8	9 506.7	6 574.6	9 065.8	9 860.5
Serbia, Republic of	4.4	4.4	3.9	2.2	2.4	5.7	12.2	7.0
Slovak Republic	90.6	159.9	225.5	287.3	214.6	175.3	273.4	293.0
Slovenia	58.9	42.4	12.8	53.5	128.7	100.1	131.0	105.7
Spain	4 368.4	5 764.1	6 335.9	8 345.0	8 981.0	9 780.0	8 255.0	7 581.0
Sweden	942.6	1 124.2	1 061.0	1 253.5	1 319.4	1 318.6	1 433.6	1 400.3
Switzerland	2 116.2	2 191.4	2 351.1	2 329.0	2 621.7	2 888.1	3 036.3	3 413.9
Turkey	222.1	226.3	450.8	498.6	671.8	756.3	1 493.3	1 470.1
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	5 450.1	5 757.5	7 940.4	7 733.5	7 562.5	6 341.9	6 387.3	6 651.7
United States	..	..	..	..	..	..	..	..

.. Not available; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Investment in road transport infrastructure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	91.1	68.1	175.2	253.3	499.6	486.9	241.9	210.2
Armenia	..	..	..	..	..	..	..	..
Australia	5 194.1	6 736.2	6 972.9	8 025.4	9 263.1	9 196.1	11 200.3	13 792.2
Austria	719.7	687.0	802.0	869.9	874.5	665.0	390.0	303.0
Azerbaijan	48.1	82.4	260.0	374.0	1 327.5	1 271.7	1 545.3	1 561.7
Belarus	..	..	..	..	..	..	..	..
Belgium	1 431.7	1 561.8	1 508.4	1 281.1	1 431.9	1 431.9	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	272.2	166.2	134.0	168.7	101.2	281.2	344.1
Canada	4 173.9	5 496.8	6 780.2	7 810.3	8 751.4	10 891.5	15 394.5	15 060.7
China	..	..	..	..	..	..	..	..
Croatia	876.7	750.3	875.0	1 066.0	1 101.3	909.3	515.3	465.7
Czech Republic	1 030.6	1 415.4	1 491.0	1 492.8	2 041.0	1 984.6	1 721.2	1 294.5
Denmark	727.8	927.7	1 190.8	1 028.9	935.6	713.8	936.6	..
Estonia	56.0	102.0	130.0	126.0	142.0	119.0	137.0	158.0
Finland	599.4	594.8	650.0	802.0	973.0	921.8	890.0	932.0
France	11 271.3	11 354.7	12 099.2	12 489.1	12 623.4	12 648.1	11 942.4	11 875.7
FYROM[1]	27.9	23.1	23.3	39.0	45.0	42.6	31.7	38.2
Georgia	40.0	62.5	90.9	122.2	124.3	218.8	232.4	215.7
Germany	10 710.0	10 200.0	10 730.0	10 845.0	11 410.0	12 160.0	11 710.0	11 610.0
Greece	1 507.0	1 592.0	1 845.0	1 946.0	..	..	..	..
Hungary	1 426.9	1 703.6	583.8	645.9	976.3	1 564.3	840.7	..
Iceland	142.8	151.5	210.6	186.5	241.6	121.4	79.5	38.7
India	2 331.8	3 831.5	4 606.1	5 403.2	5 816.7	6 235.5	..	..
Ireland	1 190.0	1 153.0	1 495.0	1 425.0	1 319.0	1 173.0	841.0	463.0
Italy	7 571.7	9 168.6	14 279.9	13 663.5	13 051.0	5 641.0	3 389.0	..
Japan	43 290.3	40 103.4	36 584.8	31 560.4	31 861.2	37 206.8	35 774.0	..
Korea	56.7	60.2	61.4	57.8	19.3	..	..	..
Latvia	63.1	160.9	181.0	241.4	264.7	134.6	139.7	223.7
Liechtenstein	26.2	27.3	..	..	..	..	..	..
Lithuania	136.7	165.4	242.4	311.9	437.3	448.0	422.3	343.5
Luxembourg	135.2	127.7	175.9	157.4	137.8	148.5	182.6	220.2
Malta	10.1	8.2	..	..	..	..	..	..
Mexico	1 998.9	2 853.8	2 542.0	2 164.2	2 544.8	3 022.7	3 938.4	3 911.5
Moldova, Republic of	4.0	2.4	6.5	27.7	26.0	13.4	13.8	..
Montenegro, Republic of	3.9	3.1	37.2	50.8	10.9	23.2	17.8	14.8
Netherlands	2 333.9	1 635.8	1 654.0	1 680.0	2 194.3	2 362.6	2 299.7	2 287.4
New Zealand	269.4	347.3	395.8	487.3	511.6	579.1	731.7	839.9
Norway	1 138.3	1 462.6	1 473.8	1 718.4	1 984.9	2 395.7	2 621.7	2 724.4 e
Poland	1 236.9	1 874.7	2 604.8	3 443.5	4 508.4	5 340.4	6 510.1	8 319.4
Portugal	1 932.9	2 111.8	1 940.3	1 453.0	1 366.3	951.4	1 510.5	..
Romania	1 095.3	1 331.4	1 949.9	2 806.0	3 891.3	3 105.0	2 850.1	3 283.2
Russian Federation	3 182.0	3 790.2	4 872.4	7 299.1	9 899.0	6 240.3	6 209.9	8 413.8
Serbia, Republic of	184.8	174.0	351.4	406.0	378.6	251.5	228.8	339.0
Slovak Republic	240.0	360.2	411.0	520.0	566.7	661.6	342.1	432.0
Slovenia	496.3	450.1	573.2	666.5	694.4	406.2	220.8	128.4
Spain	7 244.5	8 580.0	8 411.0	8 077.0	8 522.0	8 588.0	7 818.0	5 911.0
Sweden	1 443.2	1 297.6	1 407.1	1 423.0	1 604.3	1 573.7	1 653.0	1 871.0
Switzerland	2 729.6	2 766.3	2 710.9	2 674.3	2 839.9	2 996.7	3 388.4	..
Turkey	633.9	920.6	1 966.9	1 947.2	2 233.4	2 918.0	5 419.5	5 180.5
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	4 949.2	5 631.8	6 341.5	6 202.0	6 042.9	6 583.2	6 472.4	5 146.9
United States	48 958.9	52 889.6	58 537.8	54 359.7	53 576.3	56 710.6	59 892.9	55 531.6

.. Not available; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Investment in inland waterway transport infrastructure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.1
Armenia	..	..	..	..	..	..	..	..
Australia	..x	..x	..x	..x	..x	..x	..x	..x
Austria	11.6	6.5	6.6	3.8	2.5	5.0	11.3	8.1 e
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	..	..	..	..	..	..	..	..
Belgium	153.4	156.4	161.8	178.4	188.4	188.4	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	25.6	85.4	196.9	405.5	0.0	0.0	0.0	0.0
Canada	..	..	..	..	..	..	..	..
China	..	..	..	..	..	..	..	..
Croatia	3.3	1.9	1.2	2.0	1.9	3.5	2.6	3.5
Czech Republic	11.5	10.2	18.6	14.0	21.5	58.8	57.9	22.3
Denmark	..x	..x	..x	..x	..x	..x	..x	..x
Estonia	..x	..x	..x	..x	..x	..x	..x	..x
Finland	3.9	0.9	2.0	5.4	2.1	2.1	2.0	1.0
France	109.1	107.7	162.0	167.6	140.7	182.2	188.2	197.3
FYROM[1]	..x	..x	..x	..x	..x	..x	..x	..x
Georgia	..x	..x	..x	..x	..x	..x	..x	..x
Germany	790.0	790.0	800.0	820.0	905.0	1 180.0	1 100.0	1 040.0
Greece	..x	..x	..x	..x	..x	..x	..x	..x
Hungary	0.8	1.6	3.9	4.1	0.4	3.1	0.7	..
Iceland	..x	..x	..x	..x	..x	..x	..x	..x
India	..	..	..	..	..	..	..	..
Ireland	..x	..x	..x	..x	..x	..x	..x	..x
Italy	50.8	53.0	55.5	29.1	34.0	27.0	42.0	..
Japan	..x	..x	..x	..x	..x	..x	..x	..x
Korea	..x	..x	..x	..x	..x	..x	..x	..x
Latvia	..x	..x	..x	..x	..x	..x	..x	..x
Liechtenstein	..x	..x	..x	..x	..x	..x	..x	..x
Lithuania	0.0	0.3	1.7	3.5	3.8	0.6	0.9	2.3
Luxembourg	1.3	0.3	0.7	0.2	0.5	0.3	1.0	1.3
Malta	..x	..x	..x	..x	..x	..x	..x	..x
Mexico	..x	..x	..x	..x	..x	..x	..x	..x
Moldova, Republic of	..	..	..	..	..	..	..	..
Montenegro, Republic of	..x	..x	..x	..x	..x	..x	..x	..x
Netherlands	486.2	284.5	311.7	263.4	269.6	361.0	251.6	263.2
New Zealand	..x	..x	..x	..x	..x	..x	..x	..x
Norway	..x	..x	..x	..x	..x	..x	..x	..x
Poland	14.1	7.0	6.7	12.7	20.8	25.2	24.8	29.1
Portugal	7.9	19.8	13.0	10.0	7.0	4.8	1.0	0.8
Romania	190.6	139.7	213.0	358.9	490.1	536.1	423.3	519.0
Russian Federation	140.5	72.8	51.4	57.7	102.0	58.8	68.3	301.4
Serbia, Republic of	18.7	14.7	29.5	23.6	36.3	19.3	21.1	25.8
Slovak Republic	1.2	0.9	1.3	0.4	0.9	1.5	2.9	1.0
Slovenia	..x	..x	..x	..x	..x	..x	..x	..x
Spain	..x	..x	..x	..x	..x	..x	..x	..x
Sweden	..x	..x	..x	..x	..x	..x	..x	..x
Switzerland	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkey	..x	..x	..x	..x	..x	..x	..x	..x
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Total investment in inland transport infrastructure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.1
Armenia	..	..	..	..	..	..	..	..
Australia	..x	..x	..x	..x	..x	..x	..x	..x
Austria	11.6	6.5	6.6	3.8	2.5	5.0	11.3	8.1 e
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	..	..	..	..	..	..	..	..
Belgium	153.4	156.4	161.8	178.4	188.4	188.4	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	25.6	85.4	196.9	405.5	0.0	0.0	0.0	0.0
Canada	..	..	..	..	..	..	..	..
China	..	..	..	..	..	..	..	..
Croatia	3.3	1.9	1.2	2.0	1.9	3.5	2.6	3.5
Czech Republic	11.5	10.2	18.6	14.0	21.5	58.8	57.9	22.3
Denmark	..x	..x	..x	..x	..x	..x	..x	..x
Estonia	..x	..x	..x	..x	..x	..x	..x	..x
Finland	3.9	0.9	2.0	5.4	2.1	2.1	2.0	1.0
France	109.1	107.7	162.0	167.6	140.7	182.2	188.2	197.3
FYROM[1]	..x	..x	..x	..x	..x	..x	..x	..x
Georgia	..x	..x	..x	..x	..x	..x	..x	..x
Germany	790.0	790.0	800.0	820.0	905.0	1 180.0	1 100.0	1 040.0
Greece	..x	..x	..x	..x	..x	..x	..x	..x
Hungary	0.8	1.6	3.9	4.1	0.4	3.1	0.7	..
Iceland	..x	..x	..x	..x	..x	..x	..x	..x
India	..	..	..	..	..	..	..	..
Ireland	..x	..x	..x	..x	..x	..x	..x	..x
Italy	50.8	53.0	55.5	29.1	34.0	27.0	42.0	..
Japan	..x	..x	..x	..x	..x	..x	..x	..x
Korea	..x	..x	..x	..x	..x	..x	..x	..x
Latvia	..x	..x	..x	..x	..x	..x	..x	..x
Liechtenstein	..x	..x	..x	..x	..x	..x	..x	..x
Lithuania	0.0	0.3	1.7	3.5	3.8	0.6	0.9	2.3
Luxembourg	1.3	0.3	0.7	0.2	0.5	0.3	1.0	1.3
Malta	..x	..x	..x	..x	..x	..x	..x	..x
Mexico	..x	..x	..x	..x	..x	..x	..x	..x
Moldova, Republic of	..	..	..	..	..	..	..	..
Montenegro, Republic of	..x	..x	..x	..x	..x	..x	..x	..x
Netherlands	486.2	284.5	311.7	263.4	269.6	361.0	251.6	263.2
New Zealand	..x	..x	..x	..x	..x	..x	..x	..x
Norway	..x	..x	..x	..x	..x	..x	..x	..x
Poland	14.1	7.0	6.7	12.7	20.8	25.2	24.8	29.1
Portugal	7.9	19.8	13.0	10.0	7.0	4.8	1.0	0.8
Romania	190.6	139.7	213.0	358.9	490.1	536.1	423.3	519.0
Russian Federation	140.5	72.8	51.4	57.7	102.0	58.8	68.3	301.4
Serbia, Republic of	18.7	14.7	29.5	23.6	36.3	19.3	21.1	25.8
Slovak Republic	1.2	0.9	1.3	0.4	0.9	1.5	2.9	1.0
Slovenia	..x	..x	..x	..x	..x	..x	..x	..x
Spain	..x	..x	..x	..x	..x	..x	..x	..x
Sweden	..x	..x	..x	..x	..x	..x	..x	..x
Switzerland	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkey	..x	..x	..x	..x	..x	..x	..x	..x
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Investment in sea port infrastructure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	7.9	10.7	6.0	1.0	3.1	2.8	3.9	9.9
Armenia	..	..	..	..	..	..	..	..
Australia	418.9	576.9	700.8	701.9	1 056.9	1 170.6	1 765.2	3 256.3
Austria	..x	..x	..x	..x	..x	..x	..x	..x
Azerbaijan	..	..	..	..	..	..	..	59.0
Belarus	..x	..x	..x	..x	..x	..x	..x	..x
Belgium	260.3	184.4	158.6	202.5	219.2	219.2	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	1.0	4.7	8.3	46.0	6.9	8.2	5.1	4.6
Canada	119.0	108.2	160.1	175.3	183.6	298.9	319.6	249.4
China	..	..	..	..	..	..	..	..
Croatia	9.3	16.6	13.5	17.4	51.9	76.7	51.4	62.6
Czech Republic	..x	..x	..x	..x	..x	..x	..x	..x
Denmark	101.7	67.5	104.6	67.1	70.7	66.2	49.4	..
Estonia	66.0	24.0	31.0	56.5	40.8	74.9	38.6	18.5
Finland	118.3	135.7	195.1	221.0	238.0	100.1	69.0	76.0
France	377.5	282.6	261.3	226.0	410.0	394.2	228.9	218.0
FYROM[1]	..x	..x	..x	..x	..x	..x	..x	..x
Georgia	..	..	..	..	29.7	23.6	24.0	13.4
Germany	430.0	570.0	580.0	640.0	630.0	685.0	965.0	925.0
Greece	86.0	61.0	75.0	60.0	..	..	..	..
Hungary	..x	..x	..x	..x	..x	..x	..x	..x
Iceland	34.4	22.8	34.3	36.7	23.2	20.0	14.5	16.9
India	17.4	28.5	56.2	65.6	55.1	65.4	73.9	97.8
Ireland	..	..	..	..	..	..	..	..
Italy	2 447.4	2 062.3	848.3	1 179.1	940.0	1 278.0	1 345.0	..
Japan	3 600.6	3 207.6	2 800.5	2 505.5	2 848.7	4 655.6	2 168.9	2 423.2
Korea	15.5	20.8	23.7	23.5	1.9	..	..	..
Latvia	97.7	61.8	90.5	148.6	261.8	..	..	..
Liechtenstein	..x	..x	..x	..x	..x	..x	..x	..x
Lithuania	16.2	29.8	29.5	25.8	42.3	15.6	20.6	27.2
Luxembourg	..x	..x	..x	..x	..x	..x	..x	..x
Malta	..	..	..	..	..	..	..	..
Mexico	527.3	565.4	512.7	437.6	578.8	383.1	486.7	542.2
Moldova, Republic of	..x	..x	..x	..x	..x	..x	..x	..x
Montenegro, Republic of	0.2	1.4	0.6	2.1	2.6	1.7	2.6	2.5
Netherlands	..	..	..	..	..	..	..	..
New Zealand	..	..	..	..	..	..	..	..
Norway	72.3	99.6	73.0	123.4	8.6	81.0	19.0	..
Poland	13.7	9.4	13.9	17.4	29.6	4.2	27.0	63.6
Portugal	84.0	44.0	114.0	157.0	128.0	100.0	112.0	83.0
Romania	..	..	..	..	..	..	..	..
Russian Federation	300.2	278.6	235.9	197.3	413.3	182.6	115.3	326.3
Serbia, Republic of	..x	..x	..x	..x	..x	..x	..x	..x
Slovak Republic	..x	..x	..x	..x	..x	..x	..x	..x
Slovenia	4.2	1.6	2.9	6.5	10.0	53.7	12.7	5.9
Spain	1 942.3	2 257.8	2 431.8	2 573.3	2 871.0	2 507.7	2 247.0	1 902.0
Sweden	76.4	37.2	42.7	80.6	60.3	72.4	107.4	..
Switzerland	..x	..x	..x	..x	..x	..x	..x	..x
Turkey	6.8	10.1	13.7	22.8	30.2	20.2	16.0	34.0
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	297.6	336.4	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Investment in airport infrastructure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	6.4	6.6	1.4	1.8	0.1	0.0	0.0	0.0
Armenia	..	..	..	..	..	..	..	..
Australia	..	..	..	..	..	..	..	..
Austria	240.1	361.5	217.1	187.2	305.6	221.1	174.4	..
Azerbaijan	9.4	100.2	96.0	70.6	82.5	28.5	201.0	164.2
Belarus	..	..	..	..	..	..	..	..
Belgium	46.6	67.6	88.0	134.5	115.5	115.5	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	3.4	1.9	2.4	2.4	3.6	1.0	1.5	1.5
Canada	777.1	785.9	828.8	741.0	810.4	731.2	607.9	612.9
China	..	..	..	..	..	..	..	..
Croatia	11.9	19.1	24.3	19.9	20.6	27.9	28.1	18.6
Czech Republic	150.5	236.7	71.0	76.9	324.7	92.2	81.5	40.0
Denmark	26.6	35.0	37.1	64.2	20.1	92.3	..	..
Estonia	6.3	4.3	9.9	30.7	55.7	18.9	2.9	6.0
Finland	48.2	48.2	60.0	74.0	108.0	76.2	45.0	44.0
France	837.6	860.2	978.0	1 052.4	819.6	738.8	776.5	998.7
FYROM[1]	0.1	0.2	2.0	0.3	1.5	0.0	0.1	101.6
Georgia	..	..	..	27.4	0.1	0.1	0.2	0.9
Germany	540.0	700.0	720.0	1 620.0	1 140.0	1 510.0	1 480.0	1 815.0
Greece	94.0	68.0	52.0	34.0	..	..	..	..
Hungary	20.4	115.1	9.2	2.5	..	10.7	50.3	..
Iceland	2.8	7.3	5.0	5.0	11.6	5.3	1.9	1.7
India	4.1	63.4	3.9	17.0	21.5	132.6	213.0	212.9
Ireland	80.0	105.0	147.0	271.0	403.0	509.0	243.0	83.0
Italy	307.0	806.2	234.2	123.5	126.0	117.0	634.0	..
Japan	2 027.3	2 154.5	2 547.8	2 277.9	2 265.2	2 537.8	2 361.6	1 326.8
Korea	2.5	3.2	3.3	2.6	0.9	..	..	..
Latvia	4.5	17.2	20.1	17.1	18.5	2.8	2.8	5.7
Liechtenstein	..x	..x	..x	..x	..x	..x	..x	..x
Lithuania	2.9	4.3	18.2	53.3	11.3	28.7	8.1	14.6
Luxembourg	23.5	26.3	70.6	64.2	46.6	18.8	6.7	12.5
Malta	..	..	..	..	..	..	..	..
Mexico	167.2	602.2	344.9	191.3	325.7	179.1	270.8	226.0
Moldova, Republic of	1.1	1.2	1.7	3.7	11.8	3.6	0.0	1.8
Montenegro, Republic of	3.6	3.0	0.6	3.9	0.4	1.6	28.4	3.8
Netherlands	..	..	..	..	..	..	..	..
New Zealand	..	..	..	..	..	..	..	..
Norway	103.8	21.4	153.9	237.5	205.3	251.4	203.1	..
Poland	48.8	131.0	133.0	84.8	79.4	63.3	131.9	205.6
Portugal	170.0	133.8	102.6	82.0	134.8	151.4	126.9	102.0
Romania	2.2	1.9	15.0	42.0	9.2	6.1	0.9	2.1
Russian Federation	683.8	268.2	397.7	435.5	441.4	268.6	470.7	434.5
Serbia, Republic of	0.8	0.1	0.7	0.0	0.1	1.2	0.7	0.3
Slovak Republic	11.4	32.2	13.5	16.1	29.6	56.4	70.1	33.0
Slovenia	3.2	1.3	11.0	23.8	5.1	13.3	7.3	2.9
Spain	2 020.2	1 512.4	1 828.8	2 163.8	2 132.2	1 773.0	1 744.0	1 235.0
Sweden	80.6	84.6	87.7	117.6	107.9	86.9	78.8	126.4
Switzerland	158.7	104.0	..	..	..	168.9	210.8	327.0
Turkey	92.8	217.7	631.7	175.0	138.3	569.0	520.1	426.1
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	2 202.7	2 601.6	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Rail infrastructure maintenance expenditure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	..	..	..	..	..	..	..	..
Armenia	..	..	..	..	..	..	..	..
Australia	..	..	..	..	..	..	..	..
Austria	341.0	302.0	362.0	325.0	355.5	347.6	344.2	450.6
Azerbaijan	12.0	5.9	8.5	12.1	20.7	29.6	22.2	18.9
Belarus	..	..	..	..	..	..	..	..
Belgium	..	..	..	..	..	..	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	5.6	30.7	29.1	30.2	57.8	38.3	35.8	32.7
Canada	..	..	..	..	..	..	..	..
China	..	..	..	..	..	..	..	..
Croatia	113.4	106.6	107.7	112.2	105.8	76.4	89.9	86.8
Czech Republic	212.9	235.9	255.9	252.6	353.1	372.0	359.4	364.9
Denmark	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..
Finland	155.4	156.2	156.0	167.0	180.0	195.8	195.0	197.0
France	3 591.7	3 567.9	3 225.0	3 376.5	3 672.0	3 730.0	3 770.0	3 804.0
FYROM[1]	10.7	9.5	10.4	0.4	5.0	2.6	2.2	1.9
Georgia	90.7	100.9	94.4	133.3	132.9	131.9	138.0	22.9
Germany	..	..	..	..	..	..	..	..
Greece	..	..	..	..	..	..	..	..
Hungary	211.2	234.0	1 237.4	1 287.8	457.2	398.2	..	..
Iceland	..x	..x	..x	..x	..x	..x	..x	..x
India	7 774.4	8 814.3	8 850.7	9 706.5	11 395.8	12 444.4	14 916.4	..
Ireland	121.0	127.0	135.0	144.0	..	..	..	..
Italy	7 807.3	8 919.0	9 492.0	8 282.0	8 036.0	7 832.0	7 829.0	..
Japan	..	..	..	..	..	..	..	..
Korea	1.0	8.0	9.1	14.7	..	..	..	..
Latvia	55.6	60.3	70.4	88.6	125.2	136.0	104.4	110.4
Liechtenstein	..x	..x	..x	..x	..x	..x	..x	..x
Lithuania	95.6	105.4	105.4	114.7	165.7	132.4	142.8	151.2
Luxembourg	114.9	112.2	127.4	108.3	115.0	125.5	120.0	124.4
Malta	..x	..x	..x	..x	..x	..x	..x	..x
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	..	..	..	..	..	..	..	..
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	1 037.0	1 117.7	1 547.4	1 367.4	1 174.5	1 410.3	1 690.0	1 797.9
New Zealand	..	..	..	..	..	..	..	..
Norway	353.0	359.9	403.9	421.7	447.2	534.1	676.2	728.6
Poland	76.9	82.3	66.7	100.4	35.6	157.1	212.8	238.6
Portugal	91.0	100.0	115.0	122.0	122.0	127.0	135.0	..
Romania	20.2	57.7	38.3	96.2	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	22.1	22.4	18.1	20.2	20.9	15.8	13.5	17.4
Slovak Republic	9.1	9.6	9.7	15.1	14.0	15.0	12.4	6.0
Slovenia	3.0	7.5	8.3	8.1	9.4	0.7	1.0	7.5
Spain	..	..	..	..	..	..	..	..
Sweden	467.3	490.3	509.4	540.0	598.3	589.9	723.9	701.3
Switzerland	862.2	683.3	701.9	847.4	475.0	534.4	587.6	670.9
Turkey	136.9	164.1	180.3	191.5	206.5	177.5	222.9	194.6
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Road infrastructure maintenance expenditure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	6.8	7.1	5.7	6.0	8.1	8.7	6.9	7.7
Armenia	..	..	..	..	..	..	..	..
Australia	2 623.9	2 893.1	2 239.2	2 720.2	3 237.4	3 192.0	4 471.5	..
Austria	457.8	443.3	495.0	485.9	467.4	516.2	558.8	494.3
Azerbaijan	34.7	32.8	54.6	31.3	34.7	24.7	23.4	26.5
Belarus	..	..	..	..	..	..	..	..
Belgium	490.5	469.7	492.3	458.0	499.1	522.9	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	..	107.9	215.3	203.0	69.0	99.7	70.6
Canada	5 402.5	5 245.7	5 413.0	6 879.5	6 947.6	6 551.4	8 702.7	5 816.4
China	..	..	..	..	..	..	..	..
Croatia	243.8	242.3	154.5	158.1	168.3	143.9	194.9	212.1
Czech Republic	296.4	350.5	544.1	589.4	611.0	578.1	670.5	570.3
Denmark	736.7	767.3	705.3	728.5	715.7	866.3	1 058.0	..
Estonia	22.5	25.1	27.9	32.3	37.7	39.1	37.8	38.6
Finland	587.2	599.7	612.0	611.0	673.0	684.0	667.0	658.0
France	239.4	2 189.2 |	2 235.4	2 294.0	2 285.9	2 601.0	2 431.0	2 746.0
FYROM[1]	6.7	6.3	3.7	13.6	13.5	12.2	15.6	14.7
Georgia	6.3	6.2	9.8	11.1	11.6	11.1	9.3	13.4
Germany	..	..	..	..	..	..	..	..
Greece	..	..	..	..	..	..	..	..
Hungary	254.5	283.5	1 255.7	1 367.0	443.5	453.7	..	..
Iceland	26.5	33.6	32.3	35.5	52.1	30.1	28.9	29.0
India	2 379.3	3 773.6	5 155.8	5 381.7	5 296.1	6 254.6	9 311.9	8 830.5
Ireland	51.0	53.0	54.0	50.0	55.0	45.0	42.0	35.0
Italy	11 241.2	12 549.0	13 452.0	9 764.0	10 756.0	6 008.0	6 437.0	..
Japan	14 630.2	14 029.9	11 773.0	11 372.9	10 875.4	13 528.9	13 965.9	..
Korea	11.5	13.5	17.9	15.3	..	..	..	..
Latvia	70.7	80.4	129.3	211.4	224.8	133.2	119.9	126.0
Liechtenstein	4.1	4.1	..	..	..	..	..	..
Lithuania	121.9	125.1	161.0	124.8	133.5	124.8	160.2	152.9
Luxembourg	32.0	34.9	24.2	23.1	26.8	29.6	33.8	36.2
Malta	2.3	3.0	..	..	..	..	..	..
Mexico	376.7	478.3	471.5	464.6	690.3	671.8	802.1	820.6
Moldova, Republic of	10.1	8.4	11.0	11.3	18.1	17.3	37.0	675.9
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	610.8	725.2	1 039.9	1 090.9	1 230.5	827.2	1 209.4	323.0
New Zealand	481.8	570.1	542.9	616.2	579.3	607.2	719.8	787.0
Norway	906.2	992.8	1 053.6	1 109.0	1 149.2	1 222.6	1 499.0	1 669.8
Poland	1 055.3	1 263.5	1 670.0	1 515.2	2 005.6	2 341.0	2 636.5	2 678.3
Portugal	233.0	176.9	202.7	192.2	140.9	124.0	102.0	..
Romania	379.4	425.6	1 040.6	1 336.6	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	183.8	259.4	259.7	300.4	331.0	258.9	229.0	205.4
Slovak Republic	82.1	100.3	130.5	155.6	161.4	192.4	174.7	160.0
Slovenia	76.5	99.2	139.8	138.6	147.8	151.0	137.2	121.8
Spain	..	..	..	..	..	..	..	..
Sweden	758.4	787.5	809.3	836.3	858.6	786.8	982.8	925.2
Switzerland	1 476.2	1 520.4	1 534.1	1 409.9	1 610.8	1 817.2	2 035.8	..
Turkey	71.1	88.7	156.9	278.0	308.8	410.5	360.1	673.7
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	5 450.1	5 662.5	5 857.4	5 639.3	5 057.1	4 409.0	3 989.3	3 719.3
United States	21 037.1	23 568.8	25 004.0	22 513.0	22 642.1	23 087.9	..	..

.. Not available; | Break in series

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Inland waterway infrastructure maintenance expenditure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	..	..	..	..	..	..	..	..
Armenia	..	..	..	..	..	..	..	..
Australia	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Austria	..	..	..	..	..	..	..	..
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	..	..	..	..	..	..	..	..
Belgium	61.0	66.0	67.1	76.0	87.0	131.0	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	292.8	507.2	619.2	787.9	1.5	1.0	1.0	1.5
Canada	..	..	..	..	..	..	..	..
China	..	..	..	..	..	..	..	..
Croatia	4.4	3.8	1.2	1.9	2.6	1.2	0.7	0.8
Czech Republic	10.5	2.2	1.0	2.9	1.9	1.8	1.5	1.8
Denmark	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Estonia	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Finland	14.3	15.3	14.9	15.8	17.0	26.1	17.0	14.0
France	43.3	55.0	60.9	58.2	60.0	61.3	60.5	61.5
FYROM[1]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Georgia	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Germany	..	..	..	..	..	..	..	..
Greece	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Hungary	1.0	1.3	24.5	33.1	1.6	0.9	..	..
Iceland	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
India	..	..	..	..	..	..	..	..
Ireland	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Italy	120.9	481.0	498.0	98.0	83.0	82.0	81.0	..
Japan	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Korea	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Latvia	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Liechtenstein	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Lithuania	1.4	1.7	2.0	2.3	2.6	1.4	1.2	1.2
Luxembourg	0.9	0.5	0.7	0.5	0.4	0.2	0.3	0.2
Malta	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Mexico	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Moldova, Republic of	0.0	0.0	0.0	0.0	3.8	0.6	0.0	..
Montenegro, Republic of	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Netherlands	288.8	603.5	377.1	492.4	583.3	693.4	543.9	343.2
New Zealand	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Norway	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Poland	8.6	14.4	7.7	2.1	2.3	3.0	7.8	16.5
Portugal	..	..	..	..	..	..	..	..
Romania	7.7	6.1	17.4	28.5	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	6.1	6.0	7.2	11.3	13.5	10.5	13.2	23.0
Slovak Republic	1.5	2.1	0.8	1.1	3.7	2.3	2.1	2.0
Slovenia	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Spain	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Sweden	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Switzerland	..	..	..	..	..	..	..	..
Turkey	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Sea port infrastructure maintenance expenditure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	..	..	..	..	..	..	..	..
Armenia	..	..	..	..	..	..	..	..
Australia	..	..	..	..	..	..	..	..
Austria	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Azerbaijan	..	..	..	..	..	..	..	..
Belarus	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Belgium	130.0	130.0	130.0	130.0	130.0	135.0	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	1.0	4.7	0.0	27.3	0.0	4.6	1.0	0.5
Canada	72.9	92.5	110.0	114.4	128.4	138.3	150.6	26.1
China	..	..	..	..	..	..	..	..
Croatia	5.5	3.8	4.8	7.8	5.4	3.7	2.7	3.4
Czech Republic	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Denmark	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..
Finland	87.9	92.9	88.1	89.3	82.0	107.2	106.0	134.0
France	50.4	49.9	50.1	44.0	48.0	47.8	52.5	53.0
FYROM[1]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Georgia	..	..	..	..	0.1	0.0	0.6	1.8
Germany	..	..	..	..	..	..	..	..
Greece	..	..	..	..	..	..	..	..
Hungary	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Iceland	..	..	..	..	..	..	..	..
India	105.1	115.7	135.2	170.7	157.6	131.6	193.8	167.8
Ireland	..	..	..	..	..	..	..	..
Italy	1 243.9	3 074.0	2 469.0	1 394.0	1 163.0	1 287.0	1 098.0	..
Japan	..	..	..	..	..	..	..	..
Korea	2.2	2.7	2.9	2.7	..	..	..	..
Latvia	7.5	28.7	34.5	54.3	58.3	..	..	..
Liechtenstein	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Lithuania	3.2	5.2	2.9	3.8	6.1	2.0	7.0	2.3
Luxembourg	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Malta	..	..	..	..	..	..	..	..
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	..	..	..	..	..	..	..	..
New Zealand	..	..	..	..	..	..	..	..
Norway	..	..	..	..	..	..	..	..
Poland	5.1	8.9	2.8	5.6	6.3	9.7	9.5	15.3
Portugal	2.0	2.0	1.2	0.7	0.6	1.3	1.3	4.3
Romania	..	..	..	..	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Slovak Republic	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Slovenia	1.4	1.3	2.3	1.4	1.2	2.1	1.9	2.6
Spain	..	..	..	..	..	..	..	..
Sweden	12.4	12.6	21.4	27.8	0.9	22.8	27.5	..
Switzerland	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]	..[x]
Turkey	..	..	..	..	..	..	..	..
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Airport infrastructure maintenance expenditure

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	..	..	..	..	..	..	..	..
Armenia	..	..	..	..	..	..	..	..
Australia	..	..	..	..	..	..	..	..
Austria	..	..	..	..	..	..	..	..
Azerbaijan	7.1	43.8	10.7	10.2	7.4	10.6	3.7	6.9
Belarus	..	..	..	..	..	..	..	..
Belgium	..	..	..	..	..	..	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	3.4	1.9	2.4	2.4	0.0	1.0	1.5	1.5
Canada	490.8	548.3	603.2	629.9	630.3	600.0	707.1	699.1
China	..	..	..	..	..	..	..	..
Croatia	0.7	0.7	1.6	1.9	1.8	3.4	2.3	3.5
Czech Republic	13.7	14.5	8.2	13.0	12.3	12.5	13.8	7.0
Denmark	..	..	..	..	..	..	..	..
Estonia	..	..	..	..	..	..	..	..
Finland	181.3	180.7	203.0	218.0	232.0	230.1	240.0	267.0
France	..	..	..	..	..	..	..	..
FYROM[1]	..	..	..	..	..	..	..	..
Georgia	0.0	0.0	0.2	0.1	1.5	0.3	0.3	0.4
Germany	..	..	..	..	..	..	..	..
Greece	..	..	..	..	..	..	..	..
Hungary	..	..	646.0	658.9	..	..	..	..
Iceland	..	..	..	..	..	..	..	..
India	64.3	76.9	85.0	210.7	116.6	167.5	230.5	166.9
Ireland	30.0	33.0	35.0	37.0	37.0	33.0	34.0	29.0
Italy	189.5	178.0	197.0	113.0	98.0	100.0	102.0	..
Japan	..	..	..	..	..	..	..	..
Korea	0.1	0.2	0.3	0.3	..	..	..	..
Latvia	..	..	..	..	..	..	..	..
Liechtenstein	..x	..x	..x	..x	..x	..x	..x	..x
Lithuania	2.6	2.9	3.5	3.8	12.5	1.7	1.2	1.3
Luxembourg	3.4	3.5	4.2	5.6	3.5	4.8	7.5	7.0
Malta	..	..	..	..	..	..	..	..
Mexico	..	..	..	..	..	..	..	..
Moldova, Republic of	..	..	..	..	..	..	..	..
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	..	..	..	..	..	..	..	..
New Zealand	..	..	..	..	..	..	..	..
Norway	..	..	..	..	..	..	..	..
Poland	1.3	2.0	4.1	5.6	19.9	4.4	5.0	20.6
Portugal	4.3	4.4	4.7	5.0	17.9	13.7	9.0	15.8
Romania	1.2	0.0	1.0	1.8	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Slovak Republic	1.8	2.0	1.4	1.6	2.5	2.7	4.6	2.0
Slovenia	..	..	..	..	..	..	..	..
Spain	..	..	..	..	..	..	..	..
Sweden	36.9	34.3	35.9	32.3	33.6	30.9	26.4	17.3
Switzerland	..	..	..	..	..	..	..	..
Turkey	10.7	2.7	1.9	1.9	3.0	4.5	6.7	2.4
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..

.. Not available

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

x) Not applicable

Source: ITF Transport statistics

Total spending on road infrastructure investment and maintenance

Million euros

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	97.9	75.2	180.9	259.3	507.6	495.7	248.8	217.9
Armenia	..	..	..	..	..	..	..	..
Australia	7 818.0	9 629.3	9 212.1	10 745.6	12 500.5	12 388.0	15 671.8	..
Austria	1 177.5	1 130.3	1 297.0	1 355.8	1 341.9	1 181.2	948.8	797.3
Azerbaijan	82.8	115.2	314.5	405.3	1 362.2	1 296.4	1 568.6	1 588.2
Belarus	..	..	..	..	..	..	..	..
Belgium	1 922.2	2 031.5	2 000.7	1 739.1	1 931.0	1 954.8	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	..	274.1	349.2	371.7	170.3	380.9	414.7
Canada	9 576.5	10 742.5	12 193.3	14 689.8	15 699.0	17 442.9	24 097.1	20 877.1
China	..	..	..	..	..	..	..	..
Croatia	1 120.5	992.6	1 029.5	1 224.1	1 269.7	1 053.1	710.2	677.8
Czech Republic	1 327.0	1 765.9	2 035.1	2 082.1	2 652.1	2 562.7	2 391.7	1 864.8
Denmark	1 464.5	1 695.0	1 896.1	1 757.4	1 651.3	1 580.1	1 994.5	..
Estonia	78.5	127.1	157.9	158.3	179.7	158.1	174.8	196.6
Finland	1 186.6	1 194.5	1 262.0	1 413.0	1 646.0	1 605.8	1 557.0	1 590.0
France	11 510.7	13 543.8	14 334.6	14 783.1	14 909.4	15 249.1	14 373.4	14 621.7
FYROM[1]	34.6	29.5	26.9	52.6	58.4	54.8	47.4	52.9
Georgia	46.3	68.7	100.8	133.3	136.0	229.9	241.8	229.0
Germany	..	..	..	..	..	..	..	..
Greece	..	..	..	..	..	..	..	..
Hungary	1 681.4	1 987.1	1 839.5	2 012.9	1 419.8	2 017.9	..	..
Iceland	169.3	185.1	242.9	222.0	293.7	151.6	108.4	67.7
India	4 711.2	7 605.2	9 761.9	10 784.8	11 112.8	12 490.1	..	..
Ireland	1 241.0	1 206.0	1 549.0	1 475.0	1 374.0	1 218.0	883.0	498.0
Italy	18 812.9	21 717.6	27 731.9	23 427.5	23 807.0	11 649.0	9 826.0	..
Japan	57 920.6	54 133.2	48 357.9	42 933.3	42 736.6	50 735.8	49 739.9	..
Korea	68.2	73.7	79.3	73.1	..	..	..	..
Latvia	133.8	241.3	310.3	452.8	489.5	267.8	259.6	349.7
Liechtenstein	30.3	31.4	..	..	..	..	..	..
Lithuania	258.6	290.5	403.4	436.7	570.8	572.9	582.4	496.4
Luxembourg	167.3	162.6	200.1	180.5	164.5	178.1	216.4	256.4
Malta	12.4	11.3	..	..	..	..	..	..
Mexico	2 375.6	3 332.0	3 013.5	2 628.8	3 235.1	3 694.5	4 740.5	4 732.2
Moldova, Republic of	14.1	10.8	17.5	39.0	44.1	30.7	50.8	..
Montenegro, Republic of	..	..	..	..	..	..	..	..
Netherlands	2 944.7	2 361.0	2 693.9	2 770.9	3 424.8	3 189.8	3 509.1	2 610.4
New Zealand	751.2	917.4	938.6	1 103.5	1 090.8	1 186.3	1 451.5	1 626.9
Norway	2 044.5	2 455.4	2 527.4	2 827.4	3 134.0	3 618.3	4 120.7	4 394.3 e
Poland	2 292.1	3 138.2	4 274.8	4 958.6	6 514.1	7 681.4	9 146.6	10 997.7
Portugal	2 165.9	2 288.7	2 142.9	1 645.2	1 507.2	1 075.4	1 612.5	..
Romania	1 474.7	1 757.0	2 990.5	4 142.7	..	..	..	..
Russian Federation	..	..	..	..	..	..	..	..
Serbia, Republic of	368.5	433.3	611.1	706.4	709.6	510.4	457.8	544.4
Slovak Republic	322.1	460.5	541.4	675.6	728.0	854.0	516.8	592.0
Slovenia	572.9	549.3	713.1	805.1	842.2	557.2	358.1	250.2
Spain	..	..	..	..	..	..	..	..
Sweden	2 201.6	2 085.2	2 216.5	2 259.3	2 463.0	2 360.5	2 635.8	2 796.2
Switzerland	4 205.9	4 286.6	4 245.0	4 084.1	4 450.7	4 813.9	5 424.2	..
Turkey	705.0	1 009.3	2 123.8	2 225.3	2 542.2	3 328.6	5 779.6	5 854.2
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	10 399.3	11 294.2	12 198.9	11 841.3	11 100.1	10 992.3	10 461.6	8 866.2
United States	69 996.1	76 458.5	83 541.7	76 872.7	76 218.4	79 798.5	..	..

.. Not available; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

Total inland transport infrastruture investment as a percentage of GDP

Percentage

	2004	2005	2006	2007	2008	2009	2010	2011
Albania	1.6	1.1	2.5	3.2	5.7	5.6	2.7	2.3
Armenia	..	..	..	..	..	..	..	..
Australia	1.2	1.3	1.3	1.4	1.5	1.6	1.5	1.8
Austria	0.9	0.8	0.9	0.9	0.9	1.0	0.8	0.8 e
Azerbaijan	0.8	1.0	1.6	1.6	4.0	4.0	3.9	3.4
Belarus	..	..	..	..	..	..	..	..
Belgium	0.9	0.9	0.8	0.7	0.8	0.8	..	..
Bosnia-Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	1.7	1.5	1.9	0.7	0.4	1.1	1.1
Canada	0.6	0.7	0.7	0.8	0.9	1.2	1.4	1.3
China	..	..	..	..	..	..	..	..
Croatia	3.1	2.3	2.5	2.7	2.6	2.3	1.3	1.2
Czech Republic	1.6	1.8	1.7	1.6	2.1	2.0	1.6	1.1
Denmark	0.5	0.6	0.6	0.6	0.6	0.5	0.6	..
Estonia	0.8	1.1	1.1	1.0	1.0	1.1	1.2	1.6
Finland	0.6	0.6	0.5	0.6	0.7	0.7	0.7	0.7
France	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
FYROM[1]	0.6	0.5	0.5	0.7	0.7	0.7	0.5	0.5
Georgia	1.2	1.5	2.5	4.5	2.0	3.9	3.5	4.5
Germany	0.8	0.6	0.7	0.6	0.7	0.7	0.7	0.6
Greece	1.8	1.0	1.0	1.0	..	..	..	..
Hungary	1.9	2.1	0.8	1.0	1.2	2.1	1.2	..
Iceland	1.3	1.2	1.6	1.3	2.1	1.4	0.8	0.4
India	0.7	0.8	0.8	0.8	0.8	0.9	0.2	0.2
Ireland	0.9	0.8	0.9	0.9	..	..	..	..
Italy	1.2	1.4	1.6	1.4	1.3	0.7	0.5	..
Japan	1.3	1.3	1.2	1.2	1.2	1.3	1.1	..
Korea	0.0	0.0	0.0	0.0	0.0	..	..	..
Latvia	0.9	1.6	1.3	1.3	1.4	1.1	1.2	1.4
Liechtenstein	0.9	0.9	..	..	..	..	..	..
Lithuania	1.1	1.1	1.2	1.4	1.6	1.9	1.9	1.5
Luxembourg	0.9	0.8	0.8	0.8	0.7	0.9	0.8	0.9
Malta	0.1	0.1	..	..	..	..	..	..
Mexico	0.4	0.5	0.4	0.4	0.4	0.5	0.6	0.5
Moldova, Republic of	0.5	0.5	0.5	1.2	1.2	0.6	0.5	0.1
Montenegro, Republic of	0.2	0.2	1.7	1.9	0.4	0.8	0.6	0.5
Netherlands	0.8	0.6	0.5	0.5	0.6	0.6	0.6	0.6
New Zealand	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.7
Norway	0.6	0.7	0.6	0.7	0.7	1.0	1.0	0.9 e
Poland	0.7	0.9	1.1	1.3	1.5	1.9	2.0	2.5
Portugal	1.6	1.7	1.4	1.1	1.0	0.8	1.1	..
Romania	2.2	2.0	2.3	2.8	3.4	3.2	2.8	2.9
Russian Federation	1.5	1.3	1.2	1.3	1.7	1.5	1.4	1.4
Serbia, Republic of	1.1	1.0	1.7	1.5	1.3	1.0	0.9	1.2
Slovak Republic	0.7	1.1	1.2	1.3	1.2	1.3	0.9	1.1
Slovenia	2.0	1.7	1.9	2.1	2.2	1.4	1.0	0.6
Spain	1.4	1.6	1.5	1.6	1.6	1.8	1.5	1.3
Sweden	0.8	0.8	0.8	0.8	0.9	1.0	0.9	0.8
Switzerland	1.6	1.6	1.6	1.5	1.5	1.6	1.5	..
Turkey	0.3	0.3	0.6	0.5	0.6	0.8	1.3	1.2
Ukraine	..	..	..	..	..	..	..	..
United Kingdom	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.7
United States	..	..	..	..	..	..	..	..

.. Not available; e Estimated value

Note: Detailed metadata at: http://metalinks.oecd.org/transport/20131030/5354.

1. FYROM: the Former Yugoslav Republic of Macedonia

Source: ITF Transport statistics

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