OECD Economic Surveys
CHINA

MARCH 2013



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OECD Economic Surveys: China 2013



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Please cite this publication as:
OECD (2013), *OECD Economic Surveys: China 2013*, OECD Publishing.
http://dx.doi.org/10.1787/eco_surveys-chn-2013-en

ISBN 978-92-64-18259-2 (print)
ISBN 978-92-64-18260-8 (PDF)

Series: OECD Economic Surveys
ISSN 0376-6438 (print)
ISSN 1609-7513 (online)

OECD Economic Surveys: China
ISSN 2072-5035 (print)
ISSN 2072-5027 (online)

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This Survey *was prepared in the Economics Department, with Richard Herd as the main author under the supervision of Vincent Koen. The other contributors were Sam Hill and Xiao Wang. Research assistance was provided by Thomas Chalaux, and secretarial assistance by Nadine Dufour and Pascal Halim.*

The Survey *was discussed at a special seminar of the Economic and Development Review Committee on 10 January 2013, with participation of representatives of the Chinese government.*

The Survey *is published on the responsibility of the Secretary-General of the OECD.*

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BASIC STATISTICS OF CHINA

2011 unless noted otherwise[1]

LAND AND PEOPLE

Population (million)	1 347	[1 223]	Population density per km²	139.8	(34.3)
Under 15 (%)	16.5	(18.4)	Agricultural land (% of total, 2009)	56.2	(35.8)
Over 65 (%)	9.1	(14.9)	Agricultural land (m^2 per capita, 2009)	3 938	(9 972)
Foreign-born (%, 2010)	0.1	(9.3)	Life expectancy (years, 2010)	74.8	(79.7)
Latest 5-year average growth (%)	0.5	(0.5)	Males	72.4	(76.9)
Urbanisation rate	51.3	(79.4)	Females	77.7	(82.5)

ECONOMY

GDP, current prices (USD trillion)	7.3	[42.8]	Value added shares (%)		
GDP, current prices (CNY trillion)	47.2	[276.7]	Agriculture	10.0	(1.4)
Latest 5-year average annual real growth (%)	10.5	(0.8)	Industry, including construction and mining	46.6	(24.4)
GDP per capita, PPP (USD thousands)	8.5	(35.4)	Services	43.3	(74.4)

GENERAL GOVERNMENT

Expenditure (% of GDP, 2009)	26.6	(44.9)	Gross financial debt (% of GDP, 2009)	18.2	(98.9)
Revenue (% of GDP, 2009)	26.0	(36.8)	Net financial assets (% of GDP, 2009)	4.4	(-60.2)

EXTERNAL ACCOUNTS

Exchange rate (per USD)	6.465	n.a.	Structure of exports (% of GDP)		
PPP exchange rate (per international USD)	4.156	n.a.	Food and raw materials	0.9	(1.7)
Exports of goods and services (% of GDP)	28.6	(31.2)	Energy	0.4	(2.0)
Imports of goods and services (% of GDP)	26.0	(32.0)	Manufactures	22.4	(17.8)
Investment income (% of GDP)	-0.3	(-0.7)	Services	2.5	(6.4)
Current account balance (% of GDP)	2.8	(-0.6)	Structure of imports (% of GDP)		
Net international investment (% of GDP, 2010)	23.7	(-6.5)	Food and raw materials	3.2	(1.8)
Net international investment (USD trillion, 2010)	1.7	[-2.6]	Energy	3.8	(4.5)
Foreign exchange reserves (USD trillion)	3.2	[3.1]	Manufactures	14.0	(17.2)
Foreign exchange reserves (% GDP)	43.8	(6.8)	Services	3.3	(5.4)

LABOUR MARKET, SKILLS AND INNOVATION[2]

Employment rate, age 15-64 (%, 2005)	64.3	(64.8)	Unemployment rate (%)	6.6	(7.9)
Males (2005)	73.0	(73.0)	Youth (%, 2010)	11.9	(16.2)
Females (2005)	55.7	(56.8)	Long-term unemployed (%, 2010)	4.2	(3.9)
Working hours per year (2009)	2 209	(1 776)	Tertiary education rate age 25-64 (%, 2010)	10.1	(30.0)
Gross domestic expenditure on R&D (% of GDP)	1.8	(2.4)	Patents (resident, per million persons)	219	(701)

ENVIRONMENT

Total primary energy supply (toe/person, 2010)	1.8	(4.3)	Freshwater water use (m^3/person, 2009)	3 938	(8 512)
Renewables (%, 2010)	11.6	(8.2)	Freshwater use by agriculture (%, 2011)	61.6	(44.9)
Particulate matter (urban, PM10, $\mu g/m^3$, 2008)	91.0	(22.0)	Freshwater use by domestic users (%, 2011)	12.7	(15.8)
CO_2 emissions from fuel (tonnes/person, 2010)	5.7	(10.1)	Fertiliser consumption (kg per ha arable land, 2010)	463.0	(105.0)

SOCIETY AND WELL-BEING

Public social spending (% of GDP)	9.6	(28.3)	Murder rate (2010, male victim, per 100 000 persons)	1.4	(6.3)
Health care	3.4	(7.9)	Lifetime risk of maternal death (%)	0.06	(0.03)
Pensions (excluding government sector)	2.8	(7.3)	Children per woman	1.6	(1.8)
Education	3.1	(5.9)	Divorce rate (number per 1 000 people per year)	1.9	(1.7)
Other	0.3	(7.2)	Corruption perception index (100 = not corrupt)	39	(70)
Life satisfaction (1 = most satisfied ranking)	92	(29)	Personal happiness yesterday (1 = happiest ranking)	15	(49)
Gender gap (composite indicator, 1 = equality)	0.69	(0.71)	Net official development assistance (% of GNI)	0.03	(0.4)

Better Life Index: *www.oecdbetterlifeindex.org*

1. The numbers in (parentheses) refer to the OECD weighted average or total [square brackets]. OECD average refers to 2011 except for value-added shares (2008) and public spending (2009).
2. Labour market and skills data for urban areas in the case of China, nationwide for OECD countries.

Executive summary

Main findings

Macroeconomic developments and prospects

China's economy expanded rapidly in recent years despite a dire international context, though it slowed in 2011-12. Rebalancing has made headway: externally, the current account surplus has fallen sharply, from over 10% of GDP in 2007 to under 3%; domestically, growth has lately been pulled more by consumption than by investment. With the slowdown, inflation has been brought under control. More recently, activity has regained momentum, helped by policy easing and a pick-up in infrastructure spending, but the global economic context remains fragile. If needed, there is room for further cautious monetary and fiscal stimulus. In a longer-run perspective, China has now overtaken the euro area and is on course to become the world's largest economy around 2016, after allowing for price differences. Living standards will continue to improve fast provided reforms are implemented, most of which feature in the 12th Five-Year Plan (2011-15) and in the conclusions of the November 2012 18th CCP Congress.

Selected reform areas

Financial sector reform. Gradually, market-based financial instruments and interest rates are playing a greater role, the renminbi is being used more across borders and the restrictions on capital inflows and outflows are being eased. Continued progress in this direction will support growth.

Competition and innovation. Competition is generally intensifying, boosting productivity, but state ownership needs to be reduced in some sectors, reform needs to be started in others, and the state should pull out of non-core sectors. Publicly-funded R&D should focus more on fundamental research. The intellectual property rights of innovators, domestic and foreign, should be strengthened further.

Inclusive urbanisation. Close to a quarter of the population now lives in cities where income per capita is as high as in some OECD countries. Migration from the countryside to cities, and out of agriculture into higher-productivity industry and services, will continue to fuel growth but also brings many challenges. In particular, sufficient land must be made available for the expansion of larger and more productive cities and to meet the demand for more living space. This will help avoid renewed overheating in the real estate sector and improve wellbeing. Farmers need to be given the same property rights as urban dwellers and allowed to develop, or sell for development, the land for which they have user rights. Internal migrants need to be given the same access to public services as registered urban residents. This is notably the case for education, all the way from primary school to university, and for health care.

Relations between levels of government. Providing adequate basic public services across the country is essential to improve wellbeing nationwide. This calls for a greater portion of transfers to provinces, prefectures or counties to go to lower-income areas.

Greening growth. Cities need to become greener, as does the countryside. Some forms of pollution are declining but air and water quality are often poor, imposing sizeable costs. Going forward a broad policy mix is needed to help meet environmental goals in a cost effective manner, including well implemented market-based approaches and better enforcement of existing regulations. To further encourage progress in the efficient use of energy, taxation of diesel and gasoline ought to be raised, while the price of electricity, coal, gas and water needs to better reflect costs. Large ongoing investment in renewable energy should be better harnessed. Continuing to move towards pollution taxes and carbon pricing is also key. So is further lifting standards for motor vehicle emissions and fuel quality. Progress in improving enforcement and information dissemination needs to be built on while targets should be set for a broader range of environmental objectives.

Key policy recommendations

Macrostructural policies

- Monetary policy can remain relatively accommodative in the near term but should be forward-looking and guard against inflation risks further out.
- Implement and closely monitor the effectiveness of the measures taken to deal with the off-budget liabilities of local government financing platforms and to prevent their further build-up.
- Substantially raise the annual quotas for new building land in areas where the cost of apartments is high, in order to guard against renewed pressure on property prices.

Financial sector reform

- Strengthen the rules on maturity mismatch and risk diversification for wealth management products.
- Continue to move to market-determined interest rates by progressively widening the allowable margin around the regulated rate.
- Align the regulation of bond markets for maturities of over five years with the practices of the market for shorter maturities.
- Progressively increase the quota for inward investment in equities and long-dated bonds.
- Allow greater use of offshore *renminbi* deposits in mainland China.
- Allow for greater exchange rate flexibility.

Competition and innovation

- Clarify rules concerning the opening up of new sectors to private investment, including of foreign provenance. Strengthen the business operating environment by reducing the time taken to register a new business. Avoid promoting "national champions" in new strategic sectors.
- Improve effectiveness of R&D spending by increasing the resources available to the agencies dispensing government funding and rebalance outlays towards fundamental research.
- Strengthen enforcement of intellectual property rights by raising awareness of laws and increasing penalties for infringements to ensure adequate protection to domestic and foreign innovators.

Inclusive urbanisation

- Allow migrants to enroll in high schools and take university entrance exams in their place of residence. Abolish local quotas for entrance to university.
- Disconnect the provision of local public services from local registration.
- Change the use-rights of agricultural land to the same length as in urban areas.
- Subject to zoning and planning requirements, ease the limits on the use of agricultural land for development and housing, and allow farmers to sell land to developers directly and to consolidate agricultural land parcels in order to raise productivity.

Intergovernmental fiscal relations

- Raise the share of general intergovernmental transfers and improve the design of earmarked ones.
- Where major cities cover a relatively small geographical area, expand their boundaries to absorb surrounding counties in order to create authorities covering a metropolitan region.
- Switch from taxing land transactions to taxing land possession, while keeping the overall property tax burden broadly unchanged.

Greening growth

- Encourage energy conservation by raising excise duties on gasoline and fully deregulating prices. Move to full market-based pricing for natural gas and coal. Deregulate electricity prices, beginning in the generation sector, and avoid preferential electricity pricing for selected industrial users.
- Raise piped water prices to end-users to better reflect scarcity and encourage conservation.
- Increase levies and pollution taxes. Effectively implement CO_2 pilot emissions trading schemes. Move towards national carbon pricing, preferably via a carbon tax, depending on experiences with the pilot schemes. Further lift standards for motor vehicle emissions as well as fuel quality.
- Establish targets for a broader range of environmental objectives and step up enforcement efforts, including by holding local governments accountable.
- Improve national data collection and dissemination for all major pollutants including CO_2 and other greenhouse gases.

Assessment and recommendations

China has weathered the global economic and financial crisis of the past five years better than virtually any OECD country and than many other emerging economies. It is well placed to enjoy a fourth decade of rapid catch-up and improving living standards, notwithstanding various risks: in the near term, global economic conditions might be less supportive than projected; there are also concerns about property prices and excessive off-balance sheet financing by the banking system and local governments; and over the longer run, inequalities and ageing are sources of tension. However, China can avoid the "middle-income trap" provided reforms are continued or stepped up. Encouragingly, in November 2012, the 18th Congress of the Chinese Communist Party called for further reforms in a number of areas, most of which are touched upon in this *Survey* (Annex 1).

The Chinese economy slowed down markedly over the past two years, with spillovers on the rest of the world, but rebalancing has made headway and a gradual reacceleration is in train. To sustain vigorous and socially inclusive growth over the longer run, renewed reform momentum is required with respect to financial sector liberalisation; open competition in markets for goods and services; education, research and innovation – all areas highlighted in the 12th Five-Year Plan (2011-15). After taking stock of progress on these fronts, this *Economic Survey* examines three closely interlinked sets of issues: urbanisation, relations between central and local governments and the environment.

Continued rapid growth will require further large-scale urbanisation. The *Survey* looks at how cities have developed over the past decade using fresh 2010 census data and documents the sizeable productivity gains associated with urbanisation. Problems have arisen, however, from the legal system governing the use of land, which need to be overcome to provide more land for growing cities and greater living space to households. Wellbeing will also improve, as will social inclusion, as internal migrants are granted better access to social services.

Local governments are responsible for providing nearly all public services, but have limited ability to raise income according to their needs. Transfers to lower levels of government need to be reformed to bring about a more equitable distribution of public services across the country.

As incomes have risen, the government has been paying far more attention to the environmental stress accompanying rapid economic expansion. However, major challenges remain, not least reducing air and water pollution. Environmental performance can further improve at limited if any cost to the economy through well implemented marked-based reforms complemented by stronger standards.

China continues to advance

The global economic and financial crisis that erupted in 2007 hit Chinese exports but swift policy action mitigated the impact on the economy, as described in the previous *OECD Economic Survey of China* (OECD, 2010). As a result, year-average growth remained above 9% in 2008, 2009 and 2010, only fractionally below the performance of the previous, high-growth, decade and in stark contrast to the OECD area (Figure 1). However, in the face of overheating symptoms and sectoral imbalances, corrective action was undertaken in 2011, contributing to a slowdown that was amplified by a weakening and uncertain international environment, so much so that policy reversed gears around mid-2012. Growth troughed at 7.8% in 2012 and is set to regain momentum in 2013-14 (Table 1).

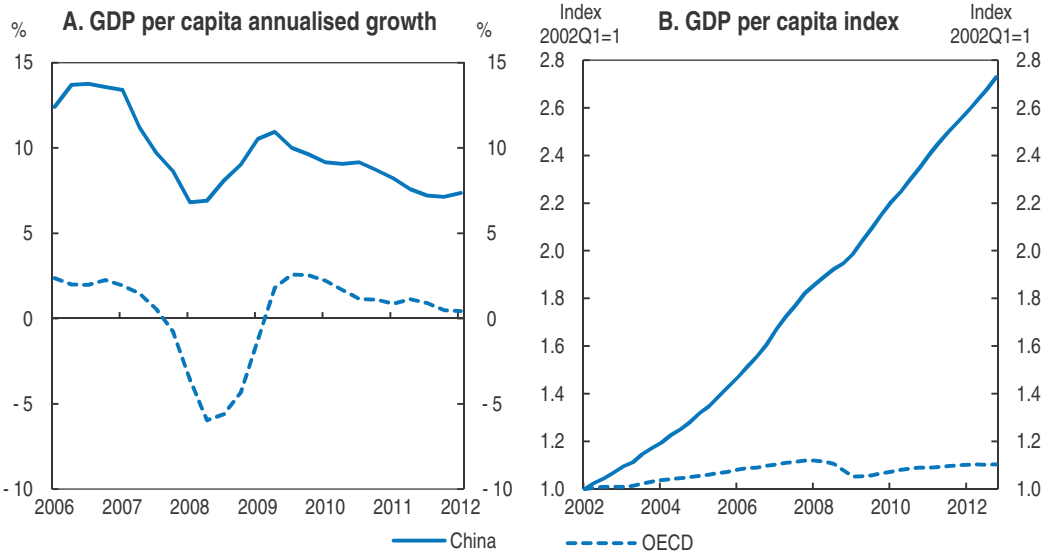
Table 1. **Macroeconomic developments and prospects**

	2007	2008	2009	2010	2011	2012	2013	2014
	% change							
Real GDP	14.2	9.6	9.2	10.4	9.3	7.8	8.5	8.9
Consumption (households and government)	10.8	8.4	9.2	9.0	10.5	8.2	8.5	8.7
Investment (fixed capital and inventories)	14.3	10.6	18.9	11.8	9.6	8.3	8.5	8.9
Total domestic demand	12.3	9.4	13.6	10.3	10.1	8.2	9.0	9.8
Exports	19.8	8.5	-10.2	27.6	8.1	5.1	9.4	10.9
Imports	13.7	4.0	4.5	20.6	8.8	6.3	10.4	11.5
	Percentage point contributions to changes in GDP							
Consumption (households and government)	5.6	4.2	4.6	4.5	5.2	4.1	4.3	4.5
Investment	6.0	4.5	8.1	5.5	4.5	3.9	4.0	4.1
Foreign trade (including statistical discrepancy)	2.6	0.9	-3.5	0.4	-0.4	-0.2	0.2	0.4
of which								
Foreign trade[1]	3.6	2.3	-5.7	3.6	0.4	0.0	0.4	0.6
Statistical discrepancy[2]	-1.0	-1.4	2.2	-3.2	-0.8	-0.2	-0.2	-0.2
	% change							
GDP deflator	7.5	8.0	-0.8	6.6	7.8	1.9	2.5	2.7
Consumer price index	4.8	5.9	-0.7	3.2	5.5	2.6	2.7	2.9
Terms of trade	-1.0	-5.3	8.7	-9.6	-3.4	3.0	-0.1	-1.0
	% of GDP							
Fiscal balance[3]	2.0	0.9	-1.1	-0.7	0.1	-0.4	-1.0	-0.7
Current account balance	10.1	9.3	4.9	4.0	2.8	2.6	2.3	2.0
	% change							
Memorandum item: House prices[4]	25.0	22.5	2.8	40.0	15.6	-0.6		

1. Estimated using price indices for the export and import of goods.
2. Estimated as a residual.
3. Sum of the balance of the national government and the social security system.
4. Price index for the second-hand market, covering four of the five largest cities in 2007-08 and ten of the largest 13 thereafter. Average prices have been weighted by the estimated value of the housing stock in each city.

Source: National Bureau of Statistics, *OECD Economic Outlook Database*, OECD estimates for house prices based on data from SouFun Holdings, *http://fdc.soufun.com/index/ErShouFangIndex.aspx*.

Figure 1. **China sails through the crisis**



Note: OECD real GDP has been aggregated using 2005 purchasing power parities.
Source: CEIC; *OECD Analytical Database*; *OECD Economic Outlook Database*.

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Policy stimulus gave rise to imbalances

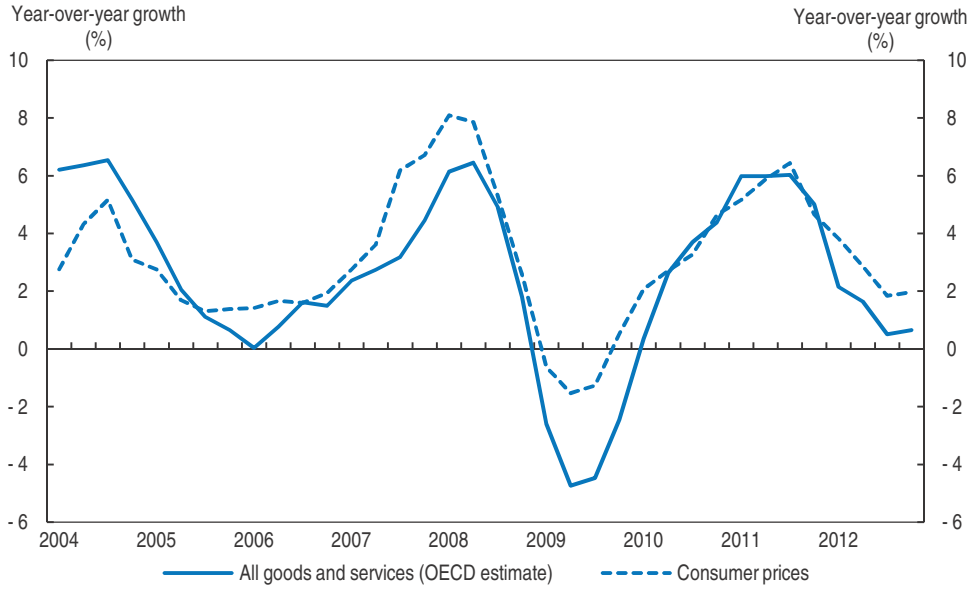
The massive stimulus programme launched in late 2008 was based essentially on infrastructure investment and mostly financed by the banking system. The money supply jumped by 30% in the course of 2009 – an increase equivalent to over 40% of GDP, far larger than needed to fund the extra public outlays. The extra credit fed through quickly into the property market. Sales of new units in urban areas and housing completions soared. By May 2010, the price of existing houses was up by 48% over a year earlier.

With aggregate demand exceeding the ability of the economy to supply sufficient goods and services, year-over-year inflation rose to as much as 6.6% by mid-2011 (Figure 2). The increase in overall prices was exacerbated by a weather-induced spike in food prices.

The stimulus did not push the headline fiscal balance deep into the red (Table 1) and indeed on a national accounts basis the government remained in surplus (Table 2). Although public spending was ramped up, these two budgets had been in significant surplus and the bulk of the stimulus package was in fact financed off-budget. Moreover, much of the on-budget stimulus expenditure was of a one-off nature (*e.g.* subsidies for certain household goods). However, headline budget data vastly understate actual general government borrowing (Box 1). Taking into account various off-budget forms of debt, total public debt stood at 57% of GDP at the end of 2010.

The severe inflationary imbalances that had thus emerged by late 2010 prompted the government to take action. Monetary policy was tightened. From October 2010, regulated deposit interest rates were raised in steps from 2¼ to 3½ per cent, with a similar hike in lending rates. Reserve ratios were also increased though to some extent this was to offset the impact of the central bank's foreign exchange purchases. Liquidity was restricted, pushing up market interest rates. In addition, credit conditions were tightened in the real estate market: people already owning one property were required to make larger down-payments. Together with restrictions on lending to property developers, this led property sales to fall by 8% during 2011, and housing prices to decline in 2012.

Figure 2. **Inflation**



Note: Prices of all goods and service refers to the geometrically weighted average of the official indices for consumer prices, fixed asset investment prices and the unit value for export prices. The weights correspond to the share of consumption, capital formation and exports in total nominal demand in 2005. This index is designed to reflect as closely as possible all components of total demand.
Source: CEIC and OECD calculations.

StatLink http://dx.doi.org/10.1787/888932787106

Table 2. **General government revenue and expenditure**

In per cent of GDP

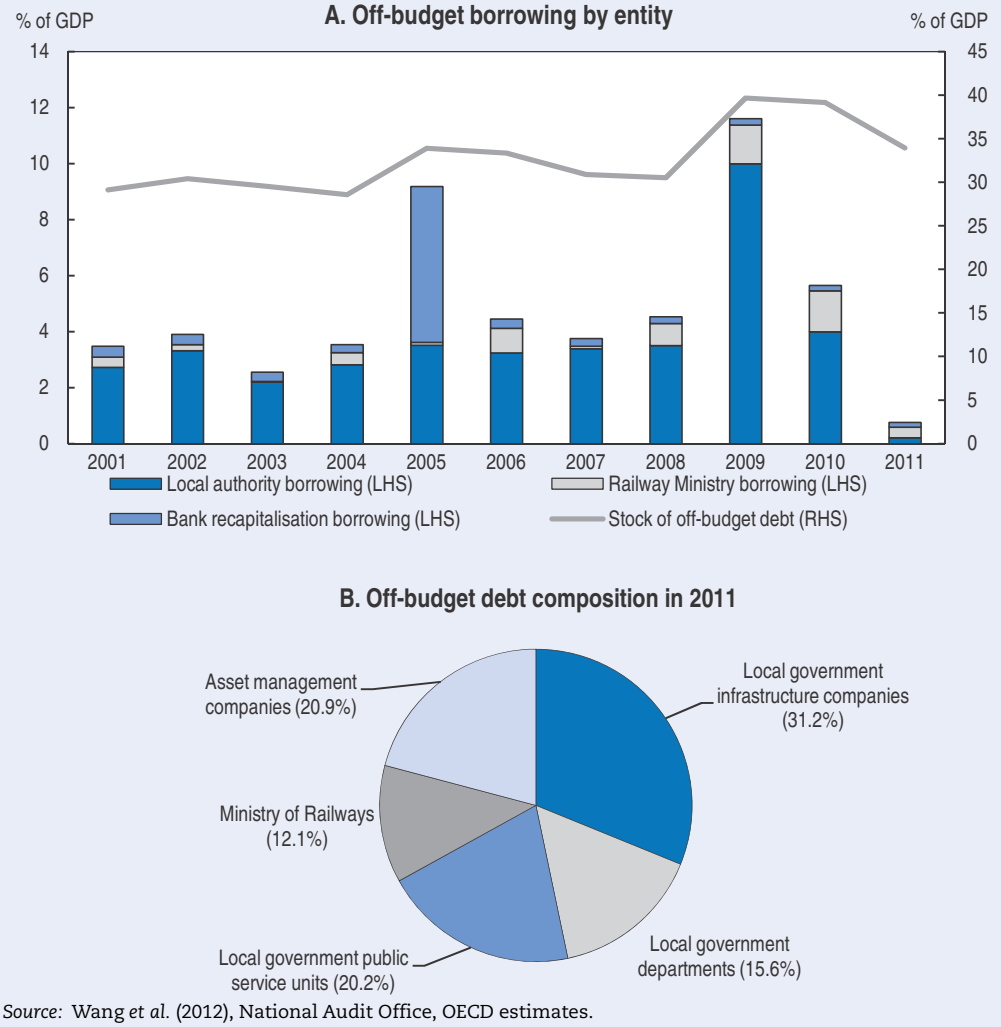
	2007	2008	2009	2010	2011
Indirect taxes	13.1	12.4	12.2	13.0	13.3
Direct taxes	8.6	9.1	9.3	9.1	9.9
Other revenue	2.0	2.5	2.2	2.3	2.4
Net property income	0.3	0.5	0.6	0.6	0.6
Total current income	24.0	24.6	24.4	25.1	26.2
Consumption	14.0	13.8	13.9	13.9	14.3
Social expenditure	4.3	4.8	5.5	5.6	5.8
Total current expenditure	18.2	18.6	19.4	19.5	20.1
Saving	5.8	6.0	5.0	5.5	6.1
Land use rights (net)	2.5	1.4	2.2	2.2	2.2
Capital outlays	5.1	5.6	6.6	6.6	6.7
Financial balance	**3.2**	**1.8**	**0.6**	**1.2**	**1.5**
of which:					
National government	0.6	-0.4	-2.3	-1.7	-1.1
Social security	1.1	1.2	1.1	1.0	1.3
Fiscal balance	2.0	0.9	-1.1	-0.7	0.1
Other	1.5	1.0	1.8	1.9	1.4
Memorandum items:					
Stock of bank deposits	19.2	18.1	22.6	24.1	23.3
Stock of government debt	19.8	17.1	18.2	17.9	16.5
Bank deposits less debt	-0.6	1.1	4.5	6.2	6.8

Note: The fiscal balance consolidates central and local governments plus the social security fund.
Source: National Bureau of Statistics Flow of Funds Account, Ministry of Finance, Ministry of Human Resources and Social Security, data for 2010 and 2011 are estimates.

Box 1. **Off-budget borrowing**

Published data until 2010 showed no local authority borrowing as they are not legally allowed to do so but most of the infrastructure projects in the stimulus package have been undertaken by companies owned by local government and financed by borrowing by these companies. Likewise, the debt run up by a number of local government agencies (known as public service units and which run hospitals, schools and universities) is not included in the official data. Nonetheless, the local governments effectively stand behind the bulk of the debt incurred by these various entities, directly or through guarantees. Off-budget borrowing of this sort jumped to 10% of GDP in 2009-10 (Figure 3), pushing up total local authority debt to 26% of GDP. This debt has been financed mainly through commercial banks, but also by the China Development Bank. The banking regulator has estimated that the future cash flow of infrastructure companies responsible for one-quarter of outstanding debt may be insufficient to cover their debt service payments.

Figure 3. **Off-budget borrowing by entity and the stock of off-budget debt**



Source: Wang *et al.* (2012), National Audit Office, OECD estimates.

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Box 1. **Off-budget borrowing** *(cont.)*

Substantial further debt was accumulated off-budget by entities backed by the central government. The Ministry of Railways has issued debt to finance high-speed trains outside the normal government budget. The rail network has been making losses which would impair its borrowing ability were it not for its quasi-governmental status. Furthermore, the government still has an implicit liability to pay off the debt given by asset management companies to banks in exchange for bad loans in past bank recapitalisations. The banking system holds this debt on its balance sheet and interest payments on the outstanding capital have been added to debt as the asset management companies do not have sufficient income to pay the interest. In all, the total amount of off-budget debt approached 40% of GDP in 2009-10, reflecting recurrent recourse to non-transparent finance.

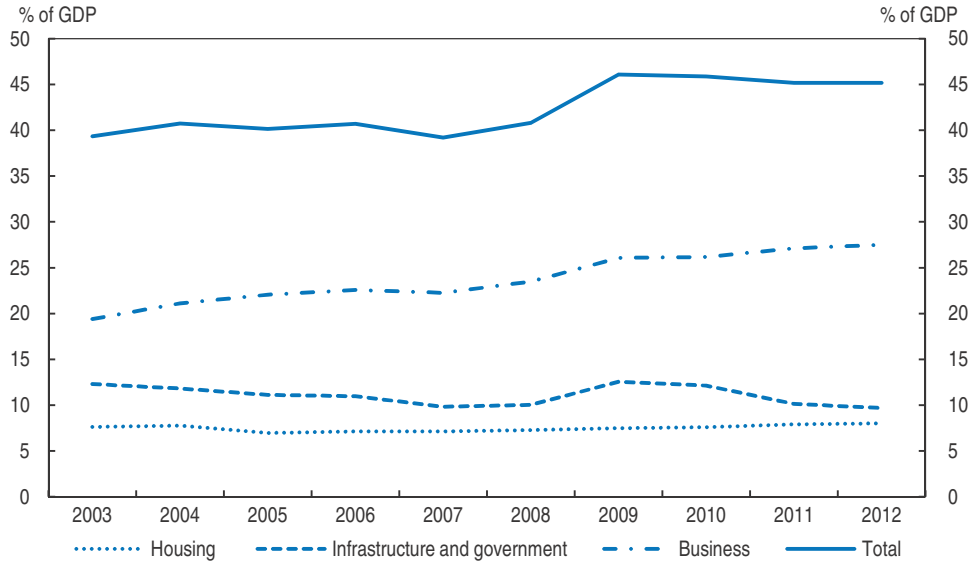
The government has a two-pronged strategy to address the problem of local authority platform borrowing. Firstly, it is putting in place a monitoring system to reconcile government accounts and those of local platforms, so that going forward their borrowing can be accurately and rapidly assessed. In February 2013, the government also re-iterated the ban on local governments giving guarantees to their platforms and the ban on transferring social assets (hospitals, schools and offices) to platforms to serve as security for loans. These bans had been introduced in the summer of 2010.

The second prong is to establish a resolution programme for existing loans whose maturity or solvability raises problems. In 2010, 52% of platform debt was to mature before 2013, well before most of the infrastructure projects being financed would start to yield paybacks. This debt has been refinanced since. Some projects, however, won't provide any material cash return, as with many infrastructure projects in the OECD area. If the shortfall is small, local governments may be required to pay subsidies to the platforms so that they can meet their interest bills. If the problem is more severe, local authorities will have to transfer assets (such as land-use rights or shares in quoted local state-owned enterprises) to cover financing expenses. Overall, clear data on the finances of every local government platform needs to be published together with resolution plans, if necessary.

On the fiscal side new borrowing by off-budget local authority companies was prohibited. As a result, overall, infrastructure investment dropped by two percentage points of GDP in 2011, with particularly large falls in rail expenditure (Figure 4). On-budget fiscal policy was also tightened somewhat and the headline budget balance moved back into surplus in 2011 (Table 1).

Even so, social expenditure continued to increase sharply (Figure 5). National government expenditure on health, social security, employment and other social services rose by over 24% per year on average between 2008 and 2012. This reflected the rolling-out of the new medical insurance schemes designed to give at least a low level of coverage to all citizens, the progressive introduction of the rural pension system, a major push to have employers respect the law concerning the enrolment of their staff in the social security system and greater spending on the programme for public rental housing (see the chapters on health, pensions and employment in the 2010 *OECD Economic Survey of China*). In the four years to 2011, the share of health spending covered by households fell from 40% to 35%, while the coverage of the rural medical insurance system rose to over 97%. As far as rural pensions are concerned, 60% of counties had implemented a scheme by 2011. While benefits tend to remain modest, the increase in social spending has helped reduce inequality in recent years (Box 2). A 19% increase of such overlays is planned for 2013.

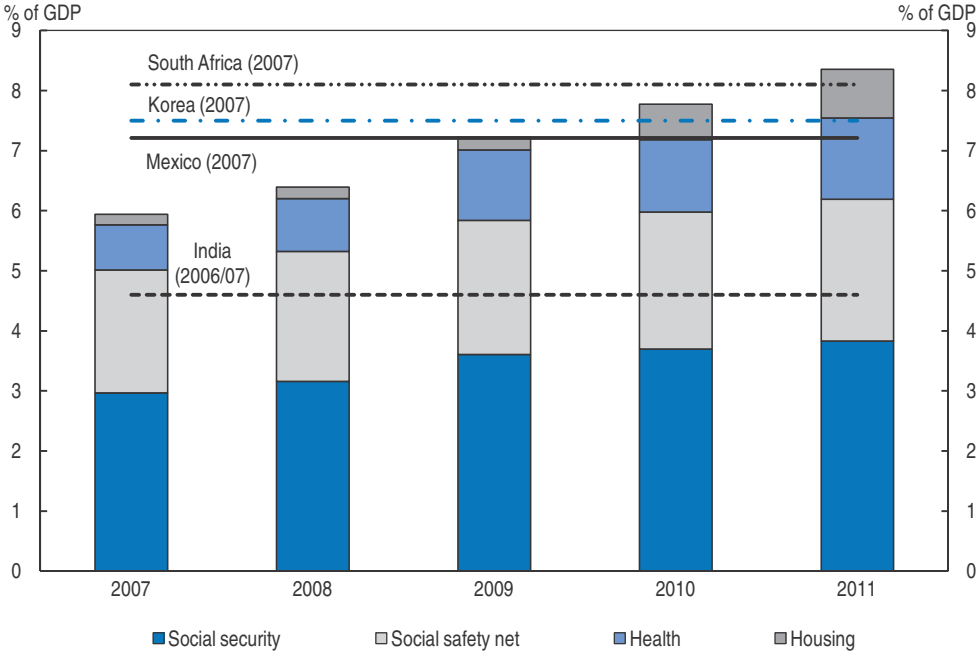
Figure 4. **Infrastructure and other investment**



Source: CEIC and OECD estimates.

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Figure 5. **Social spending by the national government has grown sharply**



Source: CEIC and *OECD Social Expenditure Database*.

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The export sector has been under strain but rebalancing has made headway

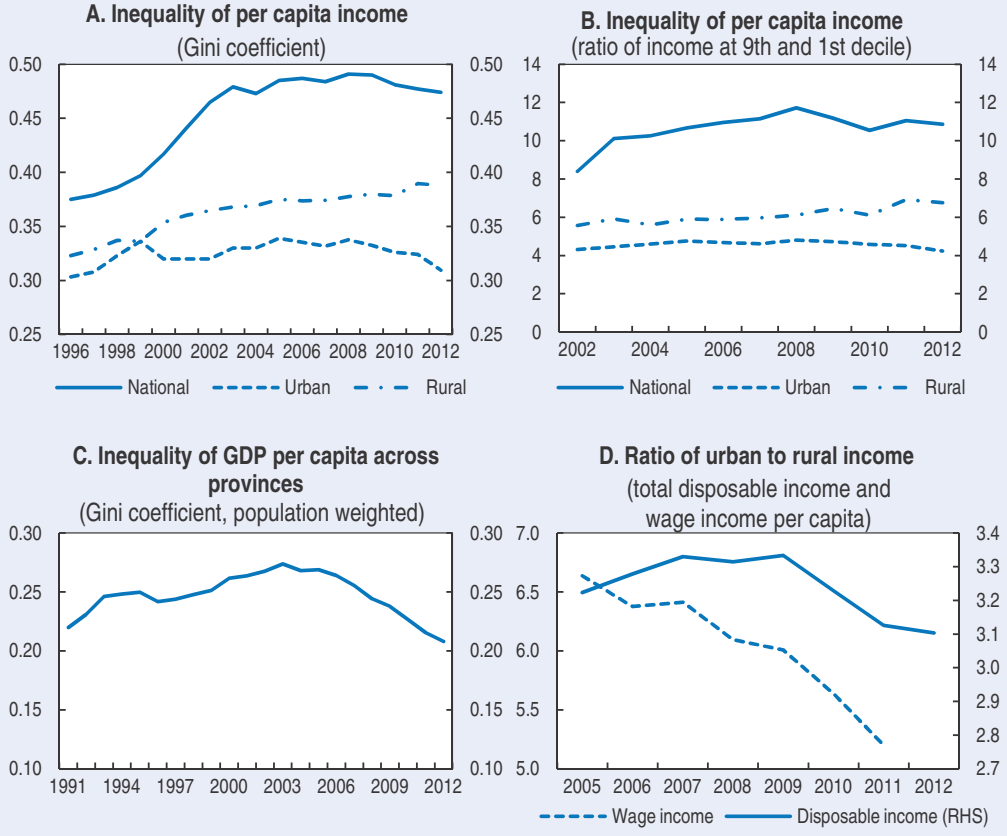
In the seven years following its 2001 entry into the World Trade Organisation, China's share in the world market increased by almost one percentage point per year, approaching 10% by 2008. While export growth rebounded after the financial crisis, the pace of market share gains fell markedly (Figure 7). Combined with sluggish world market growth, this

Box 2. **Inequality is high but declining**

Inequality is high in China but stopped rising a few years ago, as noted in the chapter on inequality in the 2010 *OECD Economic Survey of China*. In January 2013, the National Bureau of Statistics released a measure of national inequality in per capita incomes for the first time in a decade, in the form of the Gini coefficient. This showed that national inequality peaked in 2008 and has been declining slightly since. Several factors come into play. In urban areas, inequality has trended down for some years, perhaps reflecting faster growth in wages and larger reimbursements for health care at the lower end of the spectrum. In rural areas, migration has widened the gap between families where nobody has migrated and those with migrants, pushing up inequality. Overall, the gap between incomes at the first and ninth decile has started to decline. The gap between rural and urban incomes has also declined as migrants transfer income to the countryside. At the national level, this movement brings more people towards the middle of the income distribution and so lowers inequality.

Regional inequality has also been declining markedly in recent years. Growth and productivity in the poorer parts of the country have been catching up. The number of youth newly migrating to coastal areas has declined, which has pushed up wages there and encouraged industries to locate in cheaper inland areas. Overall, by 2011, regional inequality had fallen back to the level of the early 1990s.

Figure 6. **Most indicators of inequality have declined somewhat in recent years**



Source: National Bureau of Statistics; OECD estimates.

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Box 2. **Inequality is high but declining** *(cont.)*

In February 2013, the State Council issued a set of guidelines prepared by the National Development and Reform Commission, the Ministry of Finance and the Ministry of Human Resources and Social Security to encourage ministries and local governments to take measures to further reduce the level of inequality and boost consumption. The government aims to raise the share of primary income going to households in three ways: *i)* it will continue with financial sector reform, deregulating interest rates and encouraging the formation of mutual funds invested in short-term assets and longer-term debt; *ii)* it will aim to raise the proportion of the profits of central government-owned enterprises that is paid to the government by five percentage points, an increase of around 0.15% of GDP, with part of this money financing higher social benefits; *iii)* the government intends to raise the minimum wage to 40% of the average wage in most of the country by 2015, though this will have a limited impact on wages and employment as the estimated average minimum wage was already 37% of average earnings in 2011.

Furthermore, the guidelines stipulate that social spending should rise to 38% of government outlays by 2015 from 36% in 2011, with an emphasis on lower-income regions via intergovernmental transfers. One target is to reduce out-of-pocket health care expenses to 25% of the total, down from 34% in 2011. Total social spending is expected to thus be raised by 0.6% of GDP, financed partly by higher SOE dividend payments to the government, partly via higher taxes on luxury goods and partly by reducing the number of government employees. The guidelines call for pushing ahead with property taxation, which could help reduce inequality, depending on the specific design of such a tax, and better tax collection from high-earners, which would be redistributive.

The government intends to introduce a national residence card based on where a person actually lives. The card will give its holder the same rights where she or he lives as those accruing to the holder of a local urban (non-agricultural) *hukou*. At the same time the government intends to improve the compensation for farmers whose land is expropriated. A recent policy document from the Party rather than the government has also stated that there is a need to improve the security of farmers by extending leases and by constructing a complete register of all property rights. Besides, the government hopes to boost the income of farmers through higher agricultural subsidies, and is to promote rural co-operatives with a view to reap economies of scale.

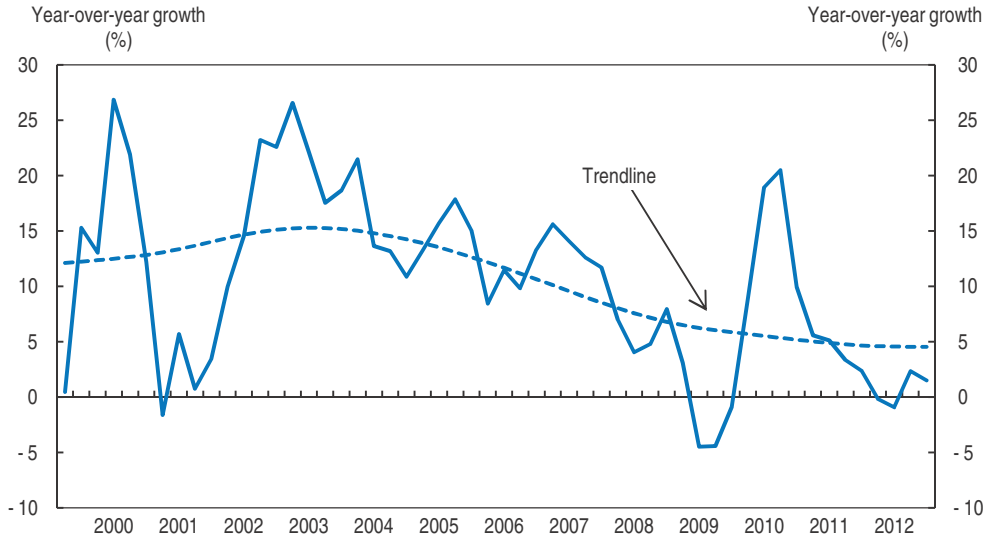
Many of these policies fit with the recommendations in this *Survey* but in a number of areas the key will be effective implementation at a local level, especially in the big cities and in the areas around the expanding cities. The central government has been advocating policies to reduce the discrimination faced by migrants for the past decade but so far progress has been limited.

The February 2013 guidelines do not address the need for greater competition in the industries dominated by centrally-owned state-owned enterprises. Intensified competition would likely reduce the monopolistic profits that are shared between companies and their employees (whose wages far exceed market clearing levels – in 2010, the average annual wage in central government enterprises was almost three times the average in the domestic private sector). The guidelines do, however, suggest that the pay of chief executives should be limited and bonuses partly deferred.

brought the trend increase in the economy's export dependence to a standstill. Indeed, exports have failed to grow as rapidly as GDP since 2006 with the result that the exports-to-GDP ratio has fallen by over 11 percentage points between 2006 and 2012. Recent data for the

Figure 7. **China's market share is no longer expanding as rapidly**

Growth in Chinese exports less growth in world markets



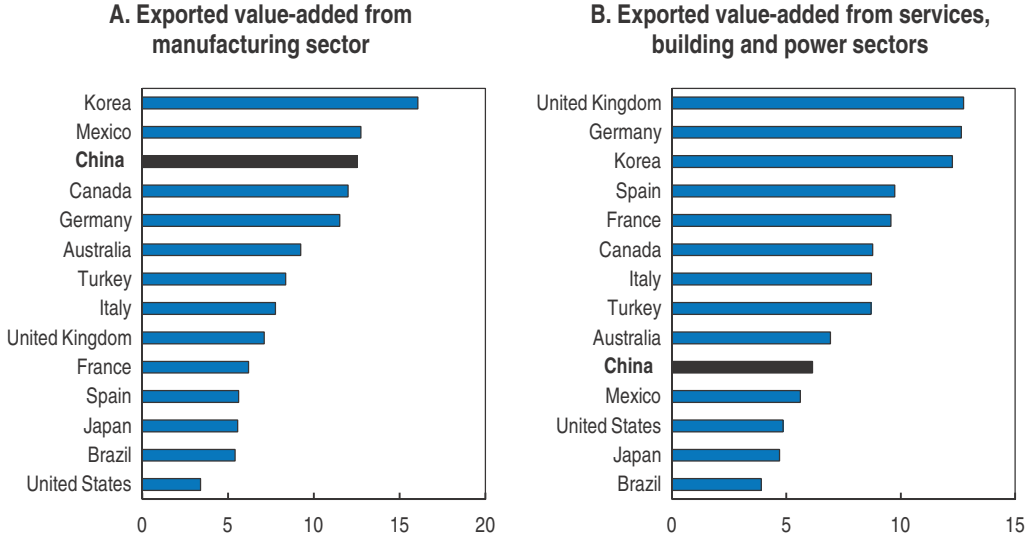
Note: The trend has been estimated using a Hodrick-Prescott filter.
Source: OECD Economic Outlook Database.

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share of total value-added generated by the export sector of the economy are not available, but in 2009, the share of economy-wide value-added exported by the manufacturing sector was amongst the highest in the world – on a par with that in Canada and Mexico but slightly below that in Korea (Figure 8, Panel A). However, the service sector in China generates a relatively low level of exported value added (Figure 8, Panel B), so that the overall dependence of the economy on exports was similar to the average of other large economies.

Figure 8. **Exports of manufactured and service value added relative to GDP**

In per cent of GDP in 2009



Source: OECD-WTO Database on trade in value added.

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The slowing in export market share gains has been one of the factors behind the rebalancing of the economy in the four years to 2011. Since 2007, the erosion of the share of household income in GDP has ceased and household investment in housing has risen (Table 3). At the same time, increased social spending has helped reduce the government financial surplus. However, these two developments account for only one-third of the domestic counterpart to the decline in the current account surplus. The main counterpart was higher investment in infrastructure and business ventures.

Table 3. **Sectoral financial balances**

Per cent of GDP

	2002	2007	2009	2011
Households	11.4	14.8	14.6	14.3
General government[1]	-4.7	3.2	0.6	1.5
Enterprises	-3.4	-5.6	-10.3	-11.2
Sum of domestic sectors	3.3	12.4	4.9	4.6
Statistical discrepancy	0.8	2.2	0.0	1.8
Foreign balance	2.4	10.1	4.9	2.8

1. Infrastructure investment by local government-owned enterprises is included in the enterprise sector.

Source: CEIC (2002-09); 2011 OECD estimate based on partial data.

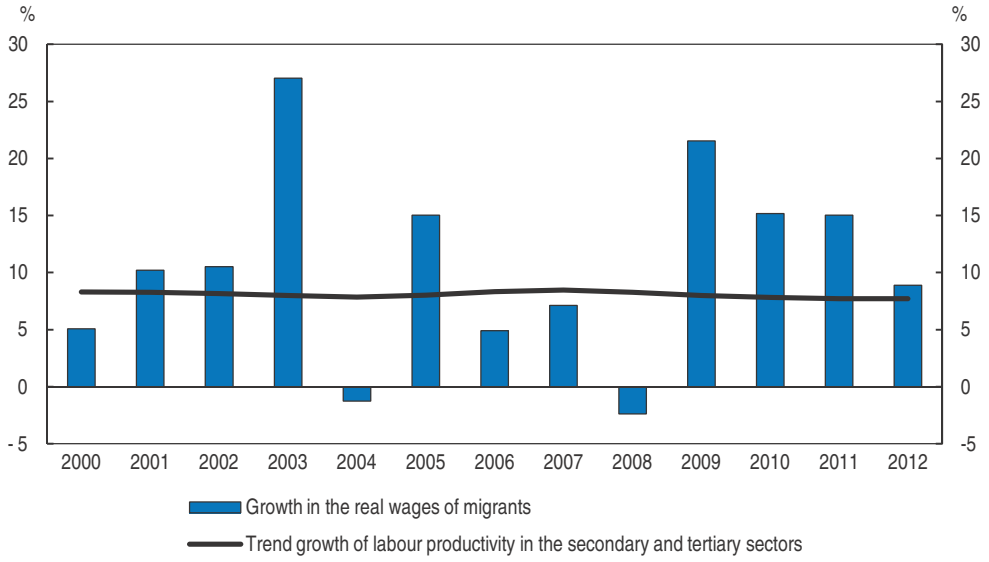
The inflexion in export performance also stems from a change in labour market conditions. Demand for labour in manufacturing and services has been strong over the past decade, and the share of the total rural labour force working away from their birthplace has increased accordingly. The pull intensified in recent years, and by 2011 this share approached 40%, with domestic migrants representing nearly half of non-agricultural employment. Demographic trends are reducing the number of people likely to migrate: most migrants are aged between 20 and 35, and the size of the cohort turning 20 in a given year is set to fall from 25 million in 2010 to 15 million by 2020. In addition, the new generation of migrant workers is better educated. Both factors tend to push up the growth of migrant workers' wages, which a decade ago were rising less than productivity in industry but have far outpaced it in recent years (Figure 9).

The export sector is extremely concentrated in China's coastal areas. Just 20 of the over 330 prefectures, accounting for only 13% of China's total population, produced three-quarters of total exports in 2010. Enterprises in these areas rely heavily on workers who moved to these cities from other parts of the country and so the rapid rise in real wages has weighed on profit margins and slowed export growth. Indeed, growth in the top 20 exporting prefectures was nearly four percentage points lower in 2008-11 compared to their average growth rate in the seven years after WTO entry, with particularly sharp falls in 2011.

The economy slowed down but a recovery is under way

With such strong headwinds, GDP growth fell to 7.8% by 2012 and the economy is now running below potential. The sharp deceleration has facilitated disinflation: by the fourth quarter of 2012, annual consumer price inflation had fallen to 2%. Employment has continued to rise but unemployment in urban areas, which was already high in 2011 at around 6½ per cent (as measured by the national labour force survey), has risen further

Figure 9. **Migrants' wages have increased briskly in recent years**



Note: Migrants' wages have been deflated by the urban consumer price index. The data for 2012 refer to the first three quarters.
Source: National Bureau of Statistics.

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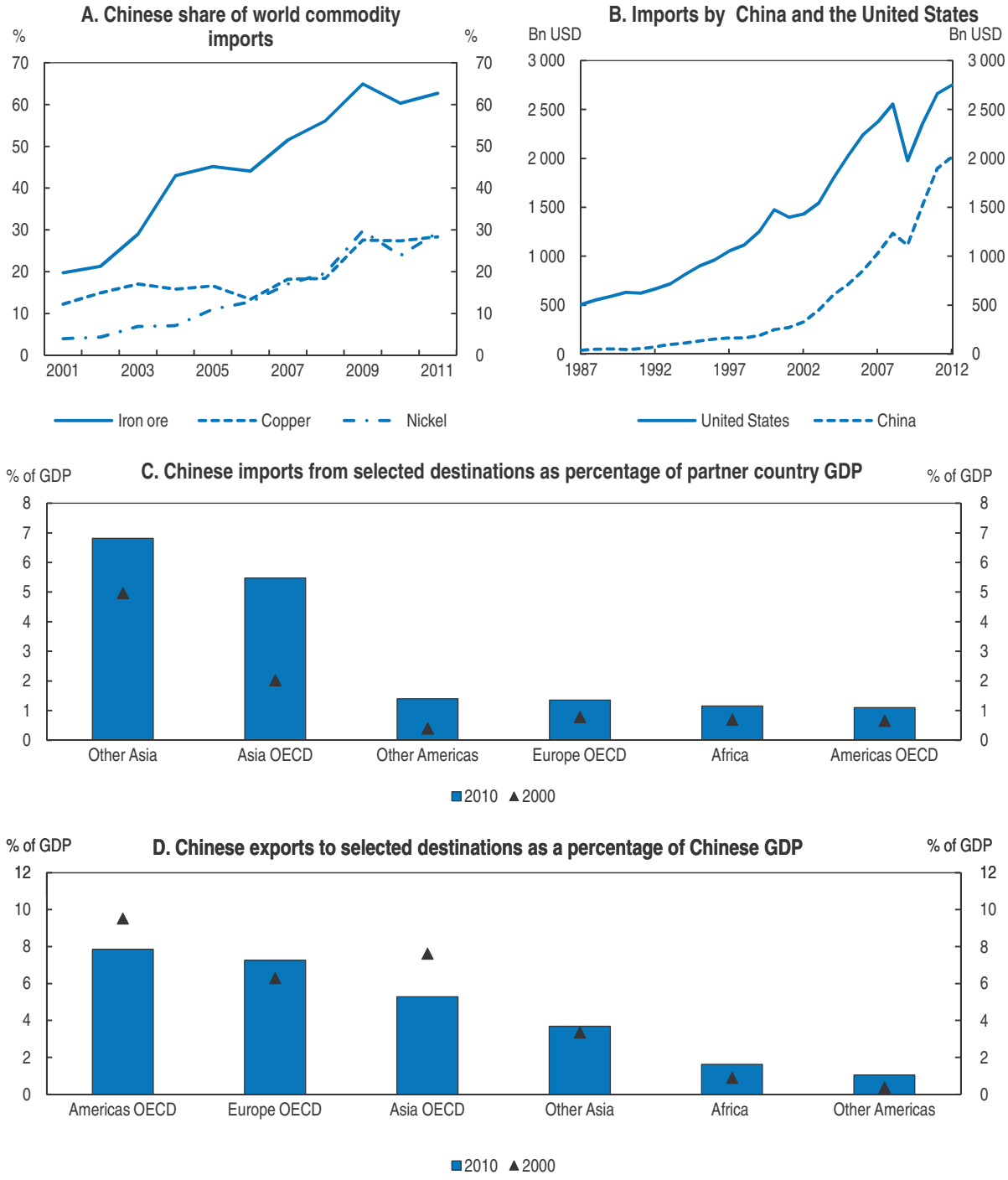
in 2012, to around 7%. Youth unemployment is up sharply, notably due to the mismatch between the type of jobs offered to new graduates and their expectations. The jump in the numbers of new university and college graduates in the past five years is depressing the starting salaries they are being offered, which according to employment agencies are now approaching the pay levels of far less educated migrant workers. The wage gap between college and university graduates and technical school graduates showed some signs of peaking as early as 2008, after a steady increase in the previous decade as market forces were allowed to operate in the labour market (Meng *et al.*, 2012).

The slowdown in activity has also had major international spillover effects on countries such as Australia, Indonesia and Brazil by pressing down the demand and price of raw materials, since for many of them China accounts for a large and growing share of world demand (Figure 10). By 2010, exports to China represented 3% of world GDP outside China, up from 1% a decade earlier. The linkages are strongest in Asia, where exports to China are equivalent to around 5% of GDP, with Korea at 11%, Malaysia at 10%, and Thailand and Vietnam both at 7%.

Growing trade integration has increased the exposure of its trading partners to changes in demand in China. The import content of consumption is relatively low, implying that changes in consumption do not spill over much across borders. A change in investment, though, has a greater impact on the rest of the world: a 1% decline in fixed capital formation (equivalent to a 0.34% decline in total demand in China) is estimated to lower GDP in some G20 countries – notably Japan and Germany – by over 0.1% (Ahuja and Nabar, 2012). Growing trade integration is also contributing to the renminbi's increasing role as an anchor currency in Asia, discussed below (Subramanian and Kessler, 2012).

In the face of a pronounced slowdown, the authorities began to ease the macroeconomic policy stance from around mid-2012. The policy interest rate was cut in July, and the central government has been encouraging the frontloading of infrastructure

Figure 10. **China's growing importance to other economies**



Note: Americas OECD covers Canada, Chile, Mexico and the United States. Asia OECD covers Australia, Japan, Korea and New Zealand.
Source: *United Nations Comtrade Database*, Datastream.

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spending. National government expenditure has been rising fast lately, far outpacing nominal GDP, leading to a slight deficit in 2012. This is justified in the current context but would push government expenditure above the levels seen in countries at a similar level of economic development if continued for much longer.

Against this backdrop, growth is projected to pick up. The underlying increase in the demand for housing is beginning to show through again, now that the impact of restricting purchases of second or third properties has been fully felt. Moreover, banks have been asked to lower interest rates for first-time buyers and outlays under the government's social housing programme have been growing. So far the increase in property demand has not jeopardised the government's aim of stabilising housing prices. The pick-up in business investment also seems likely to continue as profitability is restored, market interest rates fall and credit availability improves. However, by past standards, export growth is set to remain subdued. As a result the upswing may be relatively sluggish compared with China's earlier experience, with growth not exceeding 9% during the next two years. Inflation seems likely to ease back further given persistent excess capacity. There is some uncertainty about the extent of slack in the economy and the pace at which the economy can grow. The rapid increase in the capital stock since 2009 has lowered total factor productivity gains as a larger-than-normal share of investment was in low-yielding infrastructure, but this may be a transient effect.

A risk to the outlook, on the domestic side, is that inflation, including for property prices, would shoot up in response to rising demand. This is especially of concern if the estimate of potential growth underpinning the OECD projection were too high. Signs of renewed overheating would warrant a tightening of the monetary stance. That said, the risk of another property price upsurge would be best warded off by relaxing the restrictions on land supply in the areas where demand is strong (see below). On the external side, a prominent risk stems from worse-than-expected developments abroad, notably in the euro area, which is one of China's key trading partners. In this case, the appropriate response would be to lower interest rates.

Box 3. **Main macrostructural policy recommendations**

- Monetary policy can remain relatively accommodative in the near term but should be forward-looking and guard against inflation risks further out.
- Implement and closely monitor the effectiveness of the measures taken to deal with the off-budget liabilities of local government financing platforms and to prevent their further build-up.
- Substantially raise the annual quotas for new building land in areas where the cost of apartments is high, in order to guard against renewed pressure on property prices.

China's high growth can be sustained over the medium term

China's growth performance since the sharp acceleration in the early 1980s has been exceptional and has propelled it to become the world's second-largest economy. While trend growth is bound to slow gradually over time, China's rapid catch-up can continue during the coming decade if the reforms discussed below are implemented. Indeed, the Chinese economy is on course to become as large as that of the United States around 2016, when allowance is made for differences in price levels between the two countries by using purchasing power parity (PPP) rather than market exchange rates. However, China's income per head will be only one-quarter that of the United States in 2016. Even so, by 2020, China may have become a moderately prosperous society and a high-income country on the World Bank definition (around USD 12 500 in 2011 prices). For growth to be

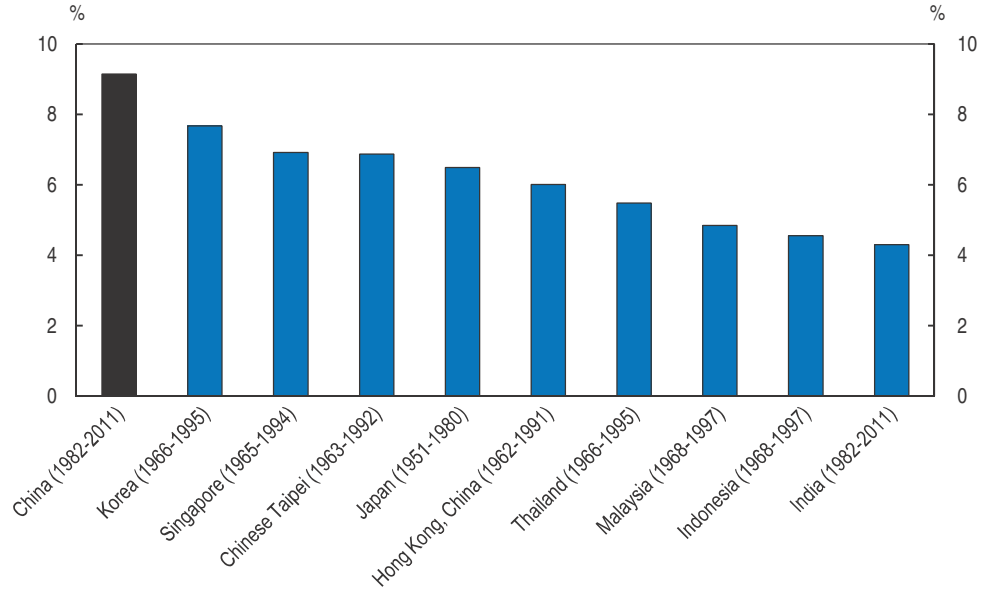
sustainable and to contribute as much as possible to citizens' wellbeing, however, it needs to become more inclusive and greener, as discussed below.

China's achievements have been underpinned by vigorous growth outside agriculture

The Chinese economy has expanded at an average annual rate of around 10% over the past three decades, even faster than other high-performing, rapidly-industrialising Asian economies during their long growth spells (Figure 11). This has delivered major improvements in living standards. Based on the World Bank's classification, China recently graduated from lower to upper middle-income status. By 2012, GDP per capita, on a PPP basis, likely exceeded USD 9 000. A growing emphasis on improving access to health and education as well as high investment in infrastructure have helped spread the benefits of growth nationally including in rural areas, where incomes have enjoyed consistently strong gains.

Figure 11. **High-growth spells compared**

Average annual GDP growth per capita during fastest 30-year period



Source: Maddison (2003), *The World Economy: Historical Statistics*; CEIC; *OECD Analytical Database*.

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High GDP growth has been underpinned by a rapid and sustained expansion in industry and services, where high profits are largely reinvested. In contrast, excess labour remains in agriculture, which still employs 35% of the labour force, and where the marginal product of an extra household member is virtually nil. In the decade to 2011, non-agricultural growth averaged just under 11%. This performance was mainly driven by ever-more rapid capital accumulation (Table 4) – though there is considerable uncertainty about exact magnitudes in the absence of official capital stock data. The quality of investment appears quite good insofar as marginal returns to capital are quite high. There is also evidence that investment is allocated to areas where profits are highest, at least in industry, where the growth of the capital stock correlates well with the rate of return in previous years (Simons, 2013). The only exception is in electricity generation where the capital stock has continued to grow despite poor returns, presumably as producers expected regulated prices to be raised eventually.

Table 4. **Growth accounting**[1]

Average annual rate of change, in per cent

	1996-2001	2001-06	2006-11
Actual growth			
Capital	10.5	12.9	13.9
Labour	1.3	3.4	2.8
Output	8.9	10.9	10.7
Contribution to growth			
Capital	5.3	6.5	6.9
Labour	0.6	1.7	1.4
Productivity	3.0	2.8	2.3
Share of growth			
Capital	59.0	59.1	65.0
Labour	7.2	15.3	13.1
Productivity	33.8	25.5	21.8

1. For output outside agriculture and housing (as the output of the housing sector is poorly measured in Chinese national accounts), figures are calculated from log differences multiplied by 100.

Source: OECD calculation.

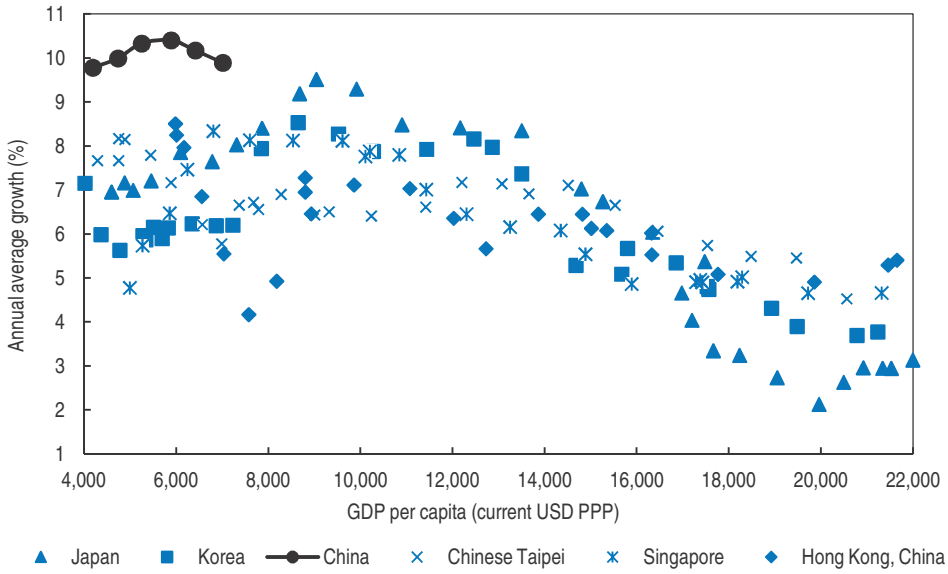
Employment growth picked up in the early 2000s with the large influx of labour from the countryside, though it subsequently slowed a bit. The contribution of total factor productivity gains to overall growth has steadily declined over the past three five-year periods. In the second half of the past decade, this may partly reflect the spurt in infrastructure spending in 2009-10. Such outlays generally only generate paybacks over the longer term or are in areas where not all of the benefits show up in GDP – as is the case for toll-free roads or loss-making high-speed trains.

The economy will gradually slow but high growth can be maintained for some time

As China reduces the gap in GDP per capita with the leading OECD economies, opportunities for technological catch-up and returns from capital deepening are set to diminish, damping longer-term growth (Eichengreen *et al.*, 2012). The progression from middle to high income – based on the World Bank's typology – is not assured (Felipe *et al.*, 2012; Berg *et al.*, 2012). However, one-quarter of the current OECD membership, including the Czech Republic, Korea and Poland, have made that transition, as have Chinese Taipei; Hong Kong, China; Singapore and Macao, China.

In many ways China's economic progress has mirrored the earlier take-offs of Chinese Taipei, Korea and Japan, or the city-size economies of Hong Kong, China and Singapore. In each of these, rapid catch-up was driven by strong investment in physical and human capital, a dynamic and competitive export sector and a commitment to sound policy including prudent macroeconomic management. High growth was maintained for many years and only began to slow much at relatively high income levels (Figure 12). There is significant scope for further catch-up in China. China has a strong record with respect to several of the key factors for sustaining growth and is well positioned to emulate the record of earlier stellar Asian performers. Recent OECD simulations suggest that China could maintain high, though gradually easing, growth during the current decade, averaging 8% in per capita terms (OECD, 2012d).

Figure 12. **Growth pathways in selected East Asian economies**



Note: Growth rates calculated as ten-year moving averages of annual observations. Each point for a country advances the ten-year moving average of the growth rate by one year. The starting points for the ten-year averages are as follows: Japan (1951), Korea (1970), China, (1999), Chinese Taipei (1967), Singapore (1961), Hong Kong, China (1961). The income level for each point is the income level at the mid-point of the moving average.
Source: Penn World Tables and OECD calculations.

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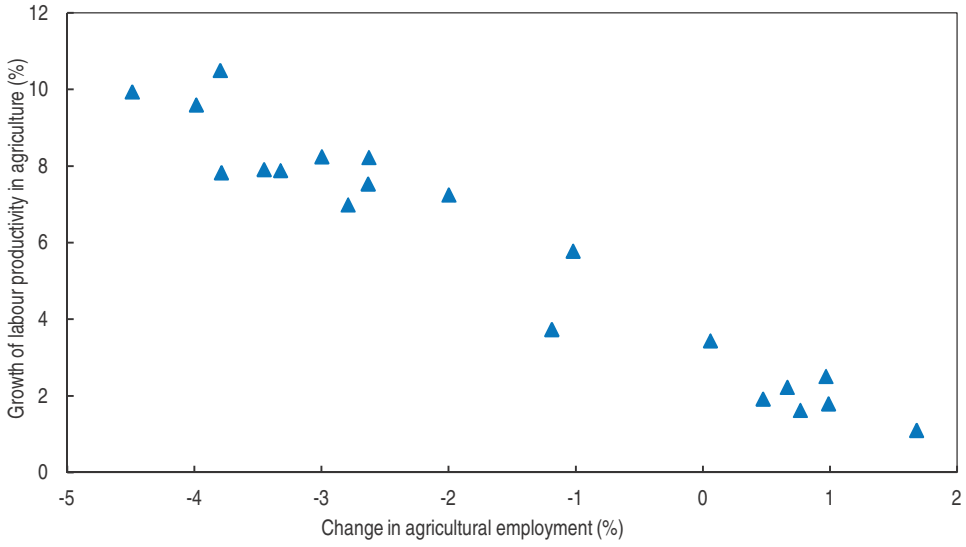
Continued migration of labour from agriculture will support productivity growth

Over the medium term, demographics will switch from supporting growth to acting as a drag, as the working age population starts to decline and the population ages. Over the past three decades declining fertility and slower population growth supported high economic growth as the dependency ratio fell and the saving rate rose. The fertility rate, at around 1.5, is now well below the replacement rate, and is even lower in the most economically advanced parts of the country reflecting stricter enforcement of family planning policy in urban areas. Like in other industrialising countries, the fertility rate in the countryside is likely to fall due to rising incomes and labour force participation, higher education levels and increasing opportunity costs of child rearing. A marked fall in the proportion of women amongst younger cohorts in the next decade will also depress fertility and population growth. Over the longer term, the preference for male babies may fall as the education level of women increases and as the change in policy that allows a second child when the first one is a girl, starts to take effect. The share of the population aged 20 to 64 in the total population is expected to peak soon and the elderly dependency ratio will continue to rise, exerting downward pressure on saving rates (if the elderly in China behave as elsewhere in the world).

With slowing productivity, an already high investment rate and an ageing society, continued rapid growth in manufacturing and services will require further transfer of labour from the agricultural sector. Agricultural employment has been falling for a decade at an average rate of 3.5% annually, with massive migration from the countryside to cities. This fall in employment has not been accompanied by any fall in agricultural output, on the contrary (Figure 13). Continuing migration of workers out of agriculture will help boost farming profitability, leading to further gains from more mechanisation. In addition, some

Figure 13. **In agriculture, employment has declined and productivity has risen**

Annual observations, 1991-2011



Note: The agricultural sector is defined here as including forestry and fishing.
Source: CEIC.

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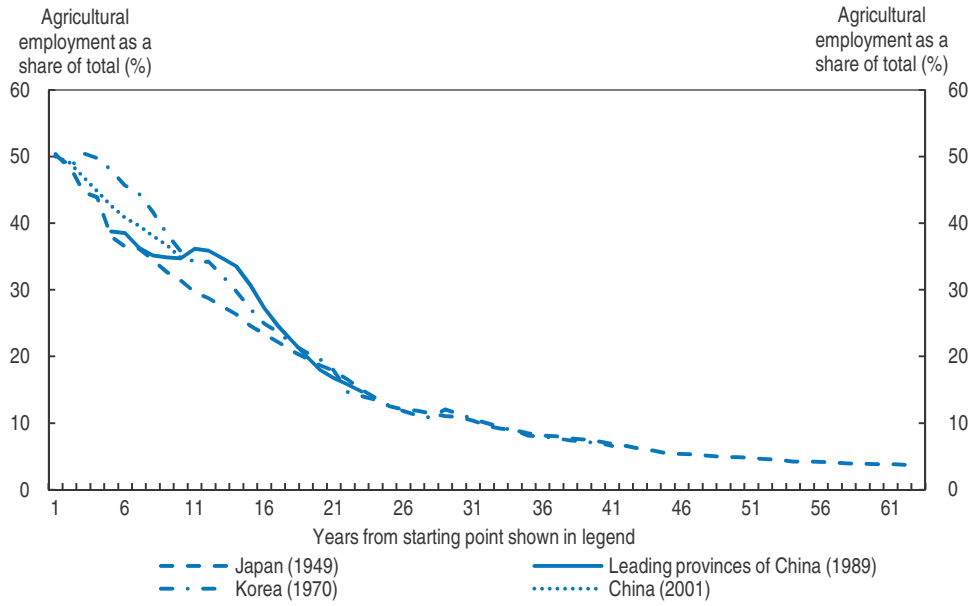
consolidation of farms into bigger units may occur provided that the laws governing the ownership of rural land-use rights are changed to allow the sale of use-rights and favour the rental market for agricultural land.

Further large economy-wide productivity gains are in store as urbanisation and the migration of labour from agriculture to higher value-added manufacturing and services proceed. One scenario would be for employment in agriculture to continue to fall at the same pace as during the five years to 2011. This would reduce the share of the labour force in agriculture to 12.5% by 2025, down from over half of total employment a decade ago. Such a massive reallocation of labour was in fact experienced in Korea during its period of rapid industrialisation from 1970 to 1990, and earlier on in Japan (Figure 14). It has also already been witnessed in China's five most advanced provinces over the past two decades. In this scenario, the non-agricultural labour force would continue to grow at close to 2% a year, a solid, if slower, pace than in the recent past.

Further capital accumulation, as well as more education and innovation, will also support growth

Growth will also continue to be underpinned by capital deepening. The investment share is already high (Figure 15, Panel A). Indeed, on some estimates it may far exceed warranted levels (Lee *et al.*, 2012). Given also that domestic saving rates will probably ease back as the population ages, the investment rate seems unlikely to rise further. However, capital per head in China remains well below levels in advanced economies, though above those in some other large emerging economies (Figure 15, Panel B). In key infrastructure segments capacity lags behind. By the late 2000s the total length of paved roads in China was around half that in the United States, despite a comparable land area and a population more than four times larger. The total length of the railway network in China is even further behind, at around one third of the United States. Accordingly, returns to infrastructure investment may still be high. Despite strong investment in the property

Figure 14. **Fall in agricultural employment in East Asian countries and regions**



Note: The agricultural sector is defined here as including forestry and fishing.
Source: CEIC, *Korean Statistical Yearbook*, *Japan Statistical Yearbook*.

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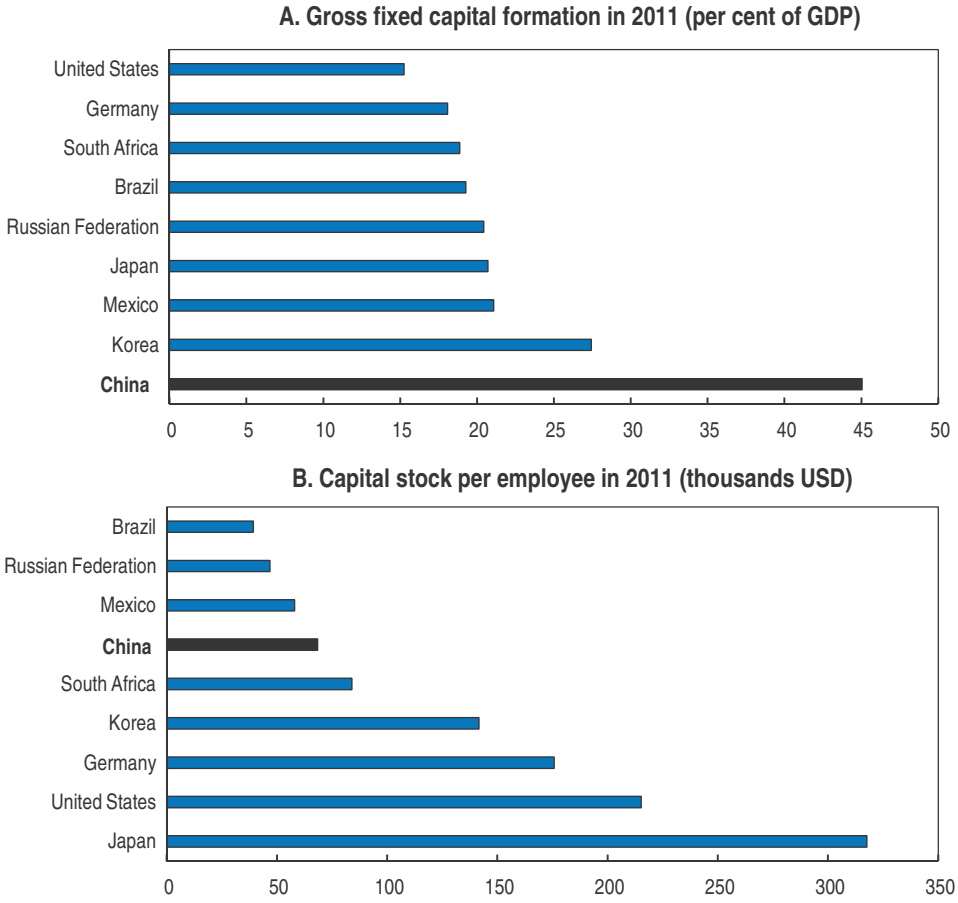
sector, per capita residential living space is still just only 20 m^2 (and lower on an internationally comparable basis), while large sections of the rural and urban populations live in sub-standard buildings. In sum, large unmet demand in a number of areas will require continued strong investment.

Notwithstanding a very high investment rate, profitability outside agriculture and housing has remained elevated by international standards: the estimated gross rate of return averaged 19% between 1992 and 2009 and the net rate of return 15%. This is probably a lower bound insofar as the capital stock includes assets in the government sector on which it makes no profit. The rate of return has been quite stable over time, though it has fallen in periods of slower growth. Other estimates confirm that the rate of return has been and remains high (Bai *et al.*, 2006; Sun *et al.*, 2011).

Housing and infrastructure investment seem likely to remain high for some time but the outlook for business investment depends on how profitability evolves. As noted, the labour supplied to the business sector is set to slow over the next decade, reducing profitability. In addition, overall productivity growth may well slacken as GDP per capita grows, as has happened in other fast-growing economies. Against this backdrop, the nominal capital-output ratio may stabilise by around 2020 (OECD, 2012d). This would imply a fall in the investment share. With employment stabilising and the growth of both productivity and capital per worker slowing, per capita GDP growth could slacken to under 7% by 2020.

However, other scenarios are possible. A much greater increase in the capital stock might be required to reduce the rate of return on capital to levels found in developed countries. This would be especially the case in the non-state sector of the economy, where rates of return are higher. Employment in the business sector might expand faster than suggested by overall demographic considerations. In such a scenario investment would be higher and growth stronger. Indeed, the superior performance of the Chinese economy

Figure 15. **Investment is high but the capital stock per employee is still low in China**



Note: The capital stock has been converted to constant 2005 international dollars using PPP for gross fixed capital formation.

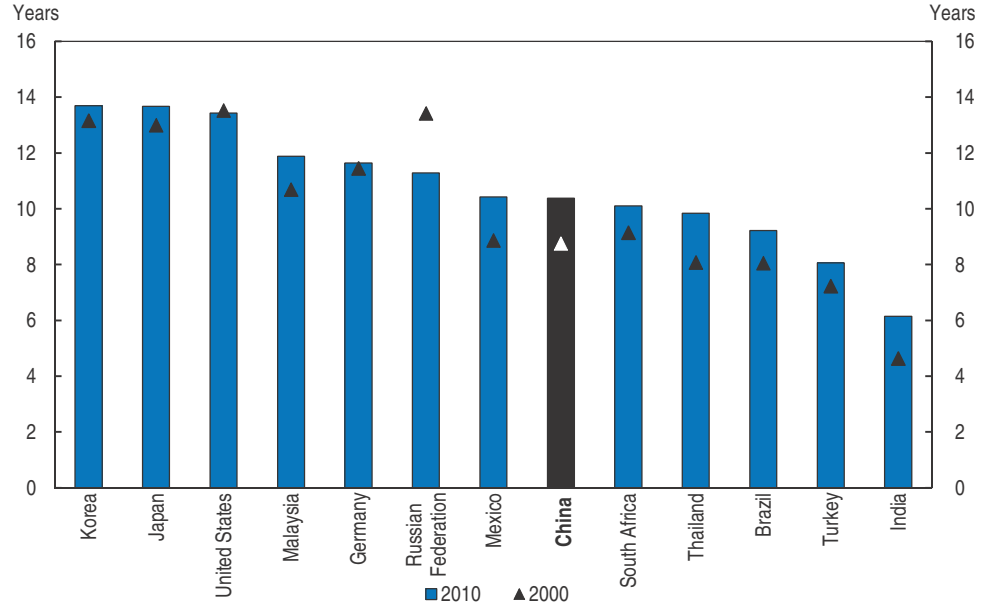
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compared with other East Asian economies when the latter were at a similar stage of development (Figure 12), suggests this could be the case.

Educational attainment continues to progress rapidly and average education levels across the population are now comparable to other upper-middle-income countries (Figure 16). Growth will be driven by further increases in educational attainment. Education up to the junior high school level, which involves nine years of schooling, is compulsory and since the late 2000s has been free of charge. This has helped ensure that the completion rate for this type of schooling is now reaching universal levels and is pushing up participation at higher levels of education. Upper secondary school completions rates are on the rise and the number of students enrolled in higher education institutions almost tripled through the 2000s. The government plans to ensure that all children receive 12 years of education by 2020. Over time, this rising participation in higher education of younger cohorts will ensure that average education levels amongst Chinese workers will increase and the gap with advanced economies narrow further. Moreover, on some measures, the quality of higher education is improving: 26 Chinese universities now rank in the top 500 worldwide when judged by faculty performance (Shanghai Jiao Tong University, 2012).

Figure 16. **Human capital is catching up**

Average years of education for the age group 25-29



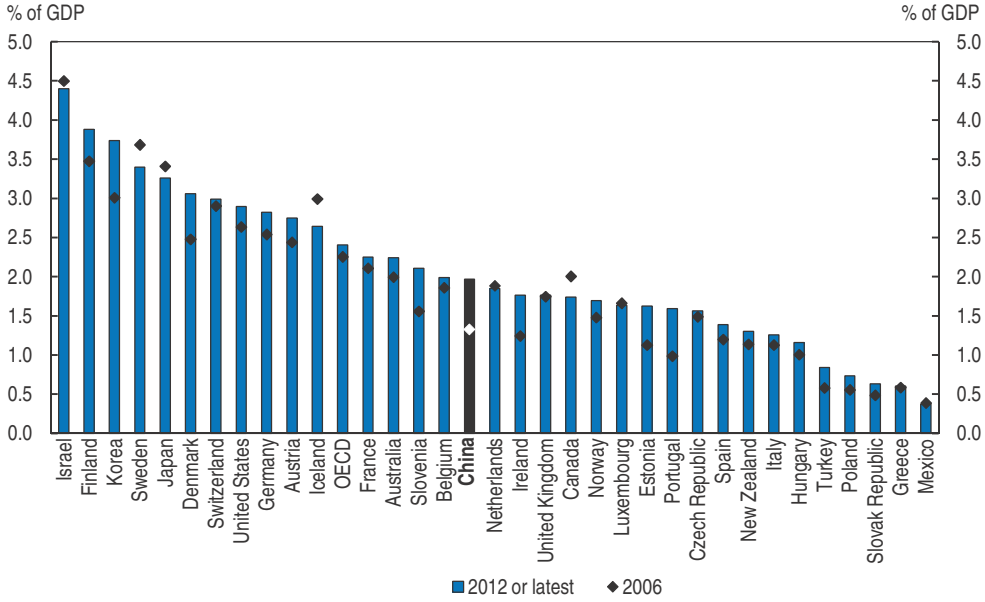
Source: Barro and Lee (2011).

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Innovation capacity is also expanding strongly. Research and development (R&D) spending more than doubled in the second half of the 2000s and reached almost 2% of GDP by 2012 (Figure 17). The Medium and Long-Term National Plan for Science and Technology aims to lift it to 2.5% of GDP by 2020. In absolute, PPP, terms Chinese expenditures are

Figure 17. **Spending on research and development**

In per cent of GDP[1]



1. Data for China refer to 2012, for Canada to 2011 and for other countries data refer to 2010.

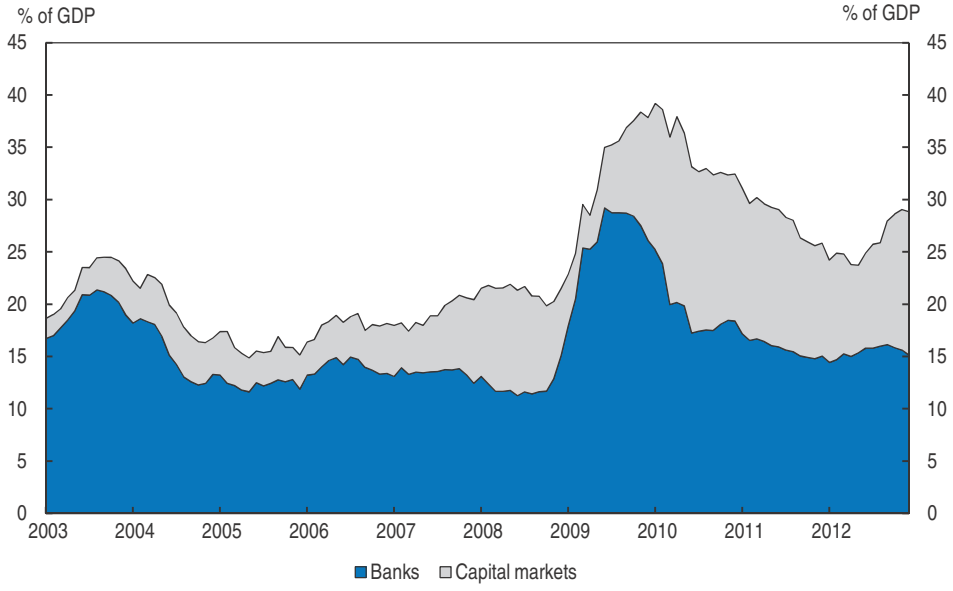
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second only to the United States, while China is home to one of the largest R&D workforces. The business sector has always accounted for the largest share of R&D spending in China, though this reflects the key function played by state-owned enterprises (SOEs), with barely over a third of the spending by large and medium enterprises undertaken by private mainland firms or non-mainland or joint venture companies.

Further financial sector reforms are underway

With high investment underpinning rapid growth and a large share of investment undertaken by SOEs, a financial system that allocates capital efficiently is essential. The role of capital markets in the financing of the business sector has increased over the past decade, as underlined in the chapter on financial reforms in the 2010 *OECD Economic Survey of China*. After a pause during the initial phases of the global financial crisis, the share of capital markets in total financing flows rose anew and by late 2012 it exceeded 40%, double the share in the five years before the start of reform in 2007 (Figure 18).

Figure 18. **Composition of financing flows**



Note: The total financing flows from capital markets is the sum of the change in entrusted loans, trust loans, bankers' acceptances, notes, bonds and equities. The flow from banks is the sum of the changes in domestic and foreign currency lending. The sum of flows from banks and capital markets is called "total social financing".
Source: CEIC.

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Banks remain the key element in the Chinese financial system and have to conform to the new Basel III capital requirements by end-2018. The ratios are one percentage point higher for the systemically important banks, whose identity, however, has not been revealed so far. The major banks' capital ratios were already above the 2018 targets in September 2012. Moreover, as from 2013, the regulator will allow them to calculate risk weights internally, which may lift their capital ratios by one percentage point. However, stress-testing of the major banks points to vulnerabilities, with a medium-scale shock leaving half of them with a capital adequacy ratio below 12% (People's Bank of China, 2012).

Many new instruments have been developed. The short-term commercial paper market and the market for notes (bonds) with maturities of less than five years have taken off. The market for shorter-term securities is regulated and supervised by the central bank (People's Bank of China – PBoC), in contrast to the longer-term enterprise bond market supervised by the National Development and Reform Commission. In both markets, access is restricted to state-controlled firms with A or above credit ratings. The securities regulator (CSRC) has now opened a third channel for the development of bond markets by allowing the Shenzhen and Shanghai stock markets to list bonds from small or lower-rated companies. While the stock of bonds is still dominated by issuers linked to the central government, the stock of bonds issued by local government companies has grown rapidly, as has the stock of medium-term notes. The bond market is now the world's third largest but, in relation to GDP, it is much smaller than markets in most OECD countries.

Banks themselves have developed new products that offer savers higher rates of return by giving them access to capital markets. Notably, bank loans have been effectively securitised through a system known as "loan designation": investors specify the type of industry exposure they wish and set a required rate of interest and the banks then create a matching portfolio of loans. Other channels have included the use of trust banks in which the trust purchases securities for the investor. A number of products allow investors to obtain a return higher than the regulated deposit rate or firms to borrow below the regulated rate. These instruments were particularly popular in 2010-11 when tighter monetary policy drove market interest rates well above benchmark rates. The popularity of these products led to some attempts to discourage their use, as the regulatory authorities feared that the stability of banks would be undermined by off-balance-sheet lending. This issue remains a concern as many of these instruments (known collectively as wealth management products) display a mismatch between the maturity of their liabilities to the public and their assets. In addition, in some cases the assets consist of loans to just a few companies. Rules on maturity mismatch and risk diversification need to be strengthened for these products. The process of liberalisation continued in 2012, with the PBoC granting banks greater leeway in interest rate setting by allowing their loan and deposit rates to differ more substantially from the regulated rates. This was in part to avoid clients with the best risk-profile raising money from the market rather than banks, at the expense of the quality of banks' portfolios.

The government has launched pilots in the city of Wenzhou and the province of Guangdong to ease the provision of finance for small and medium-sized enterprises and formalise local non-bank credit channels. Existing informal lenders can acquire formal status if they do not lend more than three times their own equity, do not charge more than four times the PBoC benchmark rate and do not take deposits from the public. So far, the lending is short-term and tends to be secured with a mortgage on residential property belonging to the borrower. These non-bank lenders could eventually become village-level banks.

On the external side, controls on capital movements are being eased. Restrictions on the use of the renminbi by foreigners and by Chinese companies abroad have been relaxed. In 2009, companies in selected geographic areas in China were allowed to use the renminbi in trade-related transactions in Hong Kong, China. This led to the development of an offshore market for renminbi bank deposits in Hong Kong. The range of companies allowed to operate in this market was gradually widened. In early 2012, all restrictions on domestic companies using the market were removed and later in the year all restrictions on the opening of renminbi deposit accounts that applied to non-residents were abolished. As a

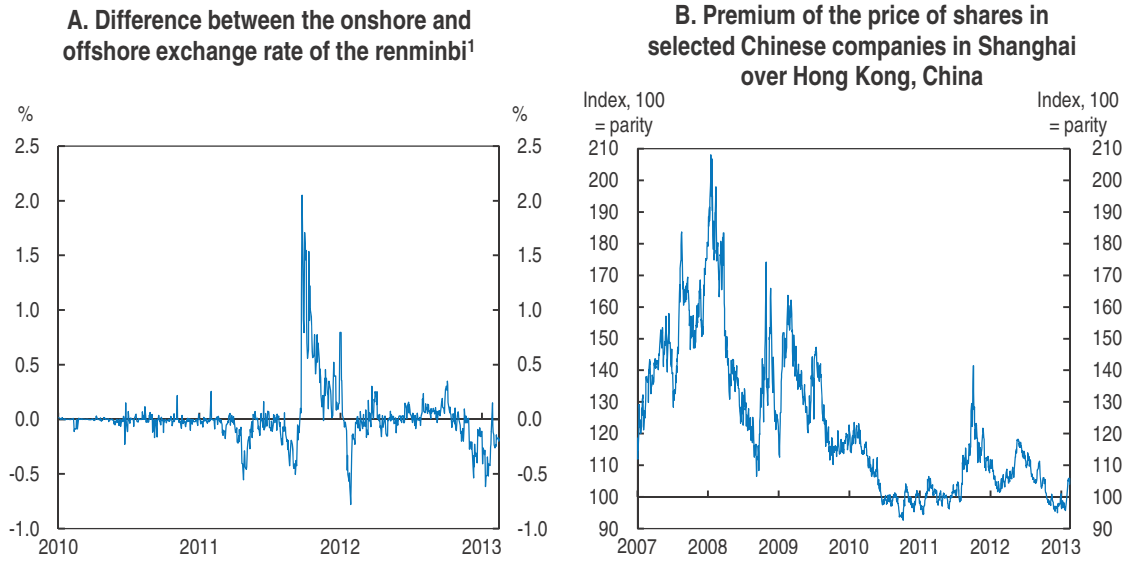
result, the proportion of Chinese current account transactions settled in renminbi rose sharply, to 9.5% in the first three quarters of 2012. Nonetheless, the renminbi is still only the 17th currency in terms of the total value of cross-border transactions, representing only 0.5% of the value of all transactions through SWIFT.

Transactions in renminbi have also been facilitated by the creation of the China International Payments system, which links directly with SWIFT, the worldwide interbank transmission system. Two additional small offshore markets have sprung up, in London and Singapore. Around three-quarters of international payments in renminbi transit through Hong Kong, with the remainder paid directly to mainland Chinese banks (SWIFT, 2012). While these changes have generated a liquid offshore market for the renminbi, banks are still restricted in their ability to lend money back into mainland China. Indeed, bank renminbi holdings in excess of lending to non-Chinese clients must be deposited at the Bank of China which in turn deposits the money at the PBoC. Japan's 1980s experience when it tried to increase the settlement of its trade in yen suggests that allowing increased reflows of offshore deposits will be crucial to foster the international use of the renminbi.

Restrictions on capital account transactions have begun to be loosened. The quota for investment in the Chinese stock and interbank bond markets has been raised to USD 80 billion, though it had not been allocated to individual qualified institutional investors by late 2012. In addition, the Hong Kong subsidiaries of qualified Chinese asset managers can apply for permission to use a quota of offshore renminbi for investment in mainland equity and bond markets, up to CNY 200 billion (around USD 30 billion). In combination, these two schemes represent 4.5% of the current value of negotiable shares on the Shanghai and Shenzhen stock markets. The major channel for foreign investment in the Chinese market is the Hong Kong stock market, where the value of mainland shares is equivalent to almost one-third of the market capitalisation of the Shanghai and Shenzhen stock markets. It is now possible to finance direct investment in China with an offshore renminbi loan. The amount of capital inflow allowed is still small relative to the size of domestic markets. Foreign investors can also invest in the very small issuances that have been made offshore. Greater opening of the longer-term bond and equity markets could help achieve the government objective of liberalising capital transactions, with limited risk of outflows. In addition, the authorities have greatly reduced the controls over domestic companies wishing to invest abroad and outflows of direct investment have surged.

Two indicators point to a considerable amount of *de facto* capital account convertibility. As liquidity in the offshore renminbi market has increased, the difference between the exchange rate for offshore and onshore renminbi against the US dollar is generally very low (Figure 19, Panel A). Another indicator is the difference in price of Chinese company shares quoted both in domestic markets and in Hong Kong. While in mid-2009, prices for the same share were 30% higher in Shanghai than in Hong Kong, this difference has now almost vanished (Figure 19, Panel B). However, *de jure* non-convertibility is still evident when markets are under stress: in September 2011, when perceived risks in Europe worsened, investors liquidated positions in the offshore renminbi market, providing an arbitrage opportunity for mainland borrowers which the authorities blocked, thereby creating a differential between the domestic and offshore markets that spread to the equity market (Cockerell and Shoory, 2012).

Figure 19. **Evidence of *de facto* capital account convertibility**



1. The offshore market for the renminbi has existed since 2010. Prior to that date, an offshore futures market for the renminbi existed, but transactions could not be settled in renminbi. Any difference in value of the contract was settled in dollars.

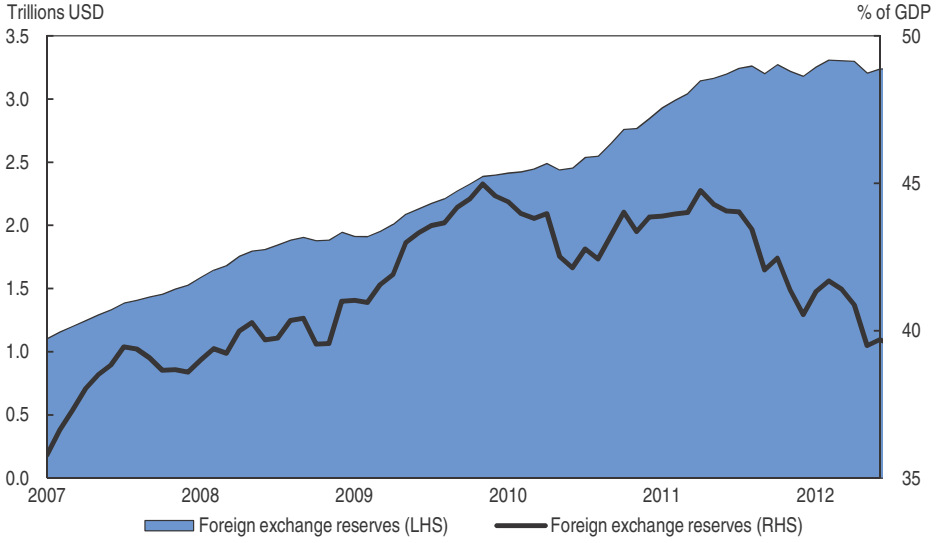
Source: Datastream.

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With the decline in the current account surplus and the growth of direct investment outflows, conditions in the foreign exchange market have changed markedly. In April 2012, the PBoC announced that the intra-day range for the movement of the exchange rate against the dollar had been widened to ±1% around the initial fixing price announced by the PBoC at the opening of the trading session. This signalled a move towards a more market-determined exchange rate regime. In the process, the accumulation of foreign exchange reserves essentially came to a halt in 2012, with the value of reserves ceasing to grow somewhat earlier due to valuation changes (Figure 20). Since then, their level has

Figure 20. **Official foreign exchange reserves**

Excludes holdings of gold



Source: CEIC.

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hovered around USD 3.1 trillion, by far the highest worldwide in absolute terms but only the 17th highest relative to GDP at the end of 2011.

Overall, China has continued to move towards a more market-based system despite a turbulent international financial environment. The official objective is to further enhance the role of the market in channelling financial resources to the economy. The government expects that bond and equity financing will represent 15% of total financing flows ("total social financing") by 2015, against 11% in 2011. Banks are to receive further degrees of freedom in interest rate setting. In a change of policy the government will actively encourage financial institutions covering more than one activity, subject to firms having clear strategies and effective risk control systems. Financial sector regulation is to be eased further, notably as regards capital account transactions. However, a careful sequencing of reforms is necessary. Domestic reform of the banking system should come first with deregulation of bank deposits and lending rates. Only when this has been achieved should the capital account be fully liberalised in order to avoid the creation of arbitrage opportunities. Greater exchange rate flexibility is envisaged, though without any specific targets. The presumption that such flexibility would result in a marked appreciation of the currency has withered, as foreign exchange markets are now closer to balance. Greater flexibility would enhance the effectiveness of monetary policy. Other key goals include establishing a deposit insurance system and creating a mechanism for resolving failed financial institutions. Last but not least, co-ordination between the financial regulators is to be improved.

Box 4. **Main recommendations on financial sector reform**

- Strengthen the rules on maturity mismatch and risk diversification for wealth management products.
- Continue to move to market-determined interest rates by progressively widening the allowable margin around the regulated rate.
- Align the regulation of bond markets for maturities of over five years with the practices of the market for shorter maturities.
- Progressively increase the quota for inward investment in equities and long-dated bonds.
- Allow greater use of offshore renminbi deposits in mainland China.
- Allow for greater exchange rate flexibility.

Strengthening innovation and competition is essential for sustaining growth

Market competition and innovation capacity are essential for lifting productivity and therefore for long-run economic performance and wellbeing. Competition helps promote efficient resource allocation and spurs firms to engage in costly R&D. Innovation can boost productivity through the accumulation of intangible assets: knowledge-based capital accounts for a rising share of business investment in China, as it does in a number of OECD countries (Hulten and Hao, 2012; OECD, 2012a). As the economy matures and opportunities for technological catch-up diminish the importance of innovation capacity will rise.

Competition and innovation, including greener modes of production and consumption, may also aid economic rebalancing (OECD, 2011b). Green innovations have already supported environmental improvements in China, notably through the rapid expansion of renewable energy. There remains tremendous scope for further gains. While

multinational corporations continue to play a key role in the development of leading export sectors and facilitating the diffusion of advanced technology from abroad, Chinese policy is increasingly focussed on promoting indigenous innovation capability and lessening the reliance on foreign technology.

Liberalisation has enhanced competition

A long-standing commitment to liberalisation has allowed market forces to play a primary role in allocating resources in the Chinese economy for some time, as documented in the chapter on product market regulation in the 2010 *OECD Economic Survey of China*. Prices for most goods are market determined, with direct price regulation and price guidance now limited to some forms of energy, water and a very small proportion of retail goods. A modern competition policy framework has been established, underpinned by the 2008 Anti-Monopoly Law (AML) and more recent complementary regulations. This provides enforcement authorities with a comprehensive legal basis for addressing anticompetitive agreements, abuse of market dominance, anticompetitive mergers and administrative monopolies. Trade barriers are generally low and the dispersion of tariffs moderate. Empirical evidence shows that trade liberalisation and other reforms aimed at enhancing competition, including product market liberalisation, have boosted productivity in China (Bas and Causa, 2013; Zheng and Ward, 2011).

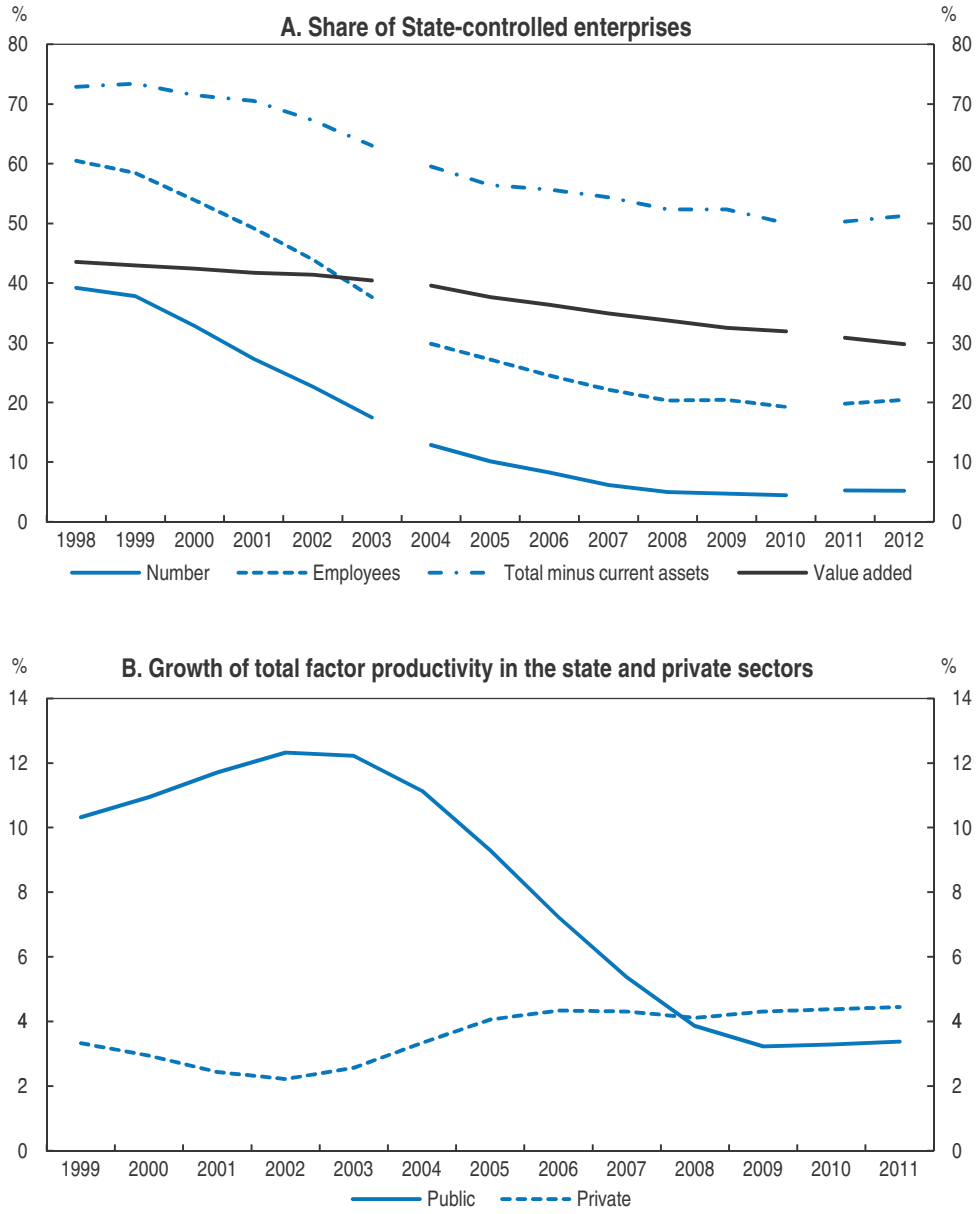
However, economic liberalisation has lost momentum in the past four years. The reduction in the size of the state-owned sector came to an end in 2008. Since then, employment in state-controlled enterprises has stabilised as has the number of enterprises (Figure 21, Panel A). Even so, the value-added of private sector enterprises has continued to grow more rapidly than that of state-controlled firms. By mid-2012, the stock of their assets was on a par with that of the state sector, while they accounted for 80% of industrial employment. SOEs still account for a larger share of value-added than of employment, reflecting much higher capital per employee.

Back in 2000, total factor productivity was six times lower in SOEs than in the private sector (OECD, 2010a). SOE restructuring a decade ago helped boost efficiency, as did privatisation. Private sector productivity accelerated around 2003 as foreign firms entered the market, and even as the pace of restructuring in state-controlled firms slackened. The slowdown in total factor productivity outside agriculture in the five years to 2011 can be ascribed, in part, to the interruption of SOE restructuring.

Progress with liberalisation has generally been sluggish in other areas, including banking where the four very large state-owned commercial banks accounted for around half of all banking assets in 2011 (CBRC, 2012). The state also retains control over the second-tier banks and other lending institutions and foreign ownership is restricted.

The 12th Five-Year Plan foresees a growing role for the private sector, including via the promotion of private investment in sectors hitherto dominated by SOEs. Sector-specific guidelines calling for an opening to private capital were issued in 2010 and 2012 covering energy, finance, telecommunications, transport and others areas. While lifting restrictions, the guidelines lack detail on what forms of investment will be permitted and whether any other limitations might apply. These new arrangements need clarification and more generally further steps are called for to improve the business environment. In the World Bank's latest survey of 185 economies, China ranked 91st for ease of doing business, ahead

Figure 21. **A comparison of the state and private industrial sector**



Note: There are two discontinuities in the data series. The 2004 Economic Census brought to light a large number of hitherto unrecorded private sector companies. In 2011, the reporting threshold for industrial companies was raised from a turnover of CNY 0.5 million to CNY 2.0 million. These discontinuities have been controlled for in Figure 21, Panel B. The year-to-year growth in total factor productivity has been smoothed using a Hodrick-Prescott filter.
Source: OECD estimates based on data from CEIC on the main economic indicators of industrial enterprises.

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of some other large emerging economies but far behind most OECD economies (World Bank, 2012). Reducing the time to register a new business is one area needing attention.

In order to stimulate private investment the authorities will need to proactively address any anticompetitive behaviour and strengthen institutional capacity to ensure effective enforcement. The effectiveness of the AML in promoting competition in China depends on how it is applied in practice. The authorities have begun to scrutinise mergers under the new framework and action has been taken against price collusion and other anti-competitive behaviour at the local level (Fels, 2012).

The 12th Five-Year Plan also identifies a number of strategic emerging industries which the government is actively promoting with a view to increasing their share in the economy to 8% by 2015. In the process, the government needs to avoid promoting "national champions" and instead focus on removing impediments to investment. Undue industrial policy activism would stifle competition and work against other government objectives, including promoting the role of private enterprise.

Furthermore, renewed action is needed in the state-controlled sector. Local governments still own scores of loss-making industrial companies that need to be rationalised. In addition, more SOEs need to be run as corporations and listed on stock markets, which will boost their productivity, as shown in the chapter on product market regulation and competition of the 2010 OECD *Economic Survey of China*. This holds in particular for railways, postal services, water and sanitation enterprises. As well, a vast number of semi-commercial activities are still part of ministries – especially in publishing, culture and sport. Over 20 000 SOEs are operating restaurants, hotels, wholesaling and retail stores, which could also be privatised.

As importantly, the corporate governance of the major central enterprises needs to be improved. A key challenge remains co-ordinating the multiple roles played by state entities – as shareholders, regulators and managers (OECD, 2011a). In particular, the opaque holding companies sitting between the listed SOEs and the government should become more transparent. Their listed assets should be split out from the holding company, which is generally the major shareholder of the listed company. Already in 2008, nearly 67% of the assets of centrally-owned SOEs were listed and they accounted for almost 90% of the after-tax profits of this sector. If the government became the direct shareholder of these listed companies (as is already the case with several major banks) then it would receive their dividends directly and transparency would be improved. The holding companies would then need to be restructured and their remaining assets eventually listed. While the overall corporate governance of the state-owned sector needs improvement, especially for the holding companies at the top the pyramid of SOEs, a few quoted SOEs have made considerable progress, with five of China's largest SOEs quoted in Hong Kong being rated as amongst ten companies with the best governance when judged by their compliance with the OECD *Code of Corporate Governance* (Hong Kong Institute of Directors and Baptist University of Hong Kong, 2012).

Expanding research and development

Strong R&D growth has led the number of patents granted to domestic inventors in China to more than triple between 2006 and 2011. Likewise, the number of scientific papers published by Chinese residents in domestic and international journals has soared in recent years. Even so, China still lags well behind OECD countries on innovation. One international benchmark is the number of patents registered simultaneously in the United States, Europe and Japan: China accounted for less than 2% of the global total in 2010. Within China, foreign companies are typically granted the type of patents associated with significant innovations while Chinese firms most often receive patents for incremental advances.

With innovation output continuing to lag the input of resources, further reforms are needed. Ensuring that funding is allocated efficiently and transparently is essential. Public funding allocation has not always followed best practice and has been skewed to favour particular initiatives or outcomes (Shi and Rao, 2010). As well, a balance must be struck between funding for fundamental research and supporting strategic initiatives: compared

with OECD countries public R&D funding in China is heavily oriented towards applied research, suggesting that some rebalancing is needed towards cutting-edge research, as underlined in the latest OECD *Science, Technology and Industry Outlook* (OECD, 2012b).

Experience in OECD countries also highlights the importance of sound framework conditions for creating the right incentives and a supportive environment for innovation (OECD, 2010b). This includes a system of intellectual property rights (IPR) that balances the need to provide sufficient financial reward and protection for costly investments with the need to make new technology accessible to firms. China established an IPR framework consistent with international norms in tandem with WTO membership and the signing of the international agreement on Trade-Related Aspects of Intellectual Property Rights in 2001. Since then several amendments, most recently in 2009, have brought the framework into closer alignment with those operating in many OECD countries. While efforts to strengthen enforcement have also been stepped up, concerns remain over infringement, including software piracy and the production of counterfeit goods (Kassner, 2012). In recent surveys, foreign investors in China continued to voice concerns over IPR enforcement (AmCham China, 2012; European Chamber, 2012).

Nevertheless, there are indications that when aggrieved firms seek legal recourse over possible IPR violations, matters are often dealt with adequately. Responses from one survey of foreign businesses showed almost two-thirds of those who had taken action against infringements were satisfied with the level of co-operation with local officials and courts (AmCham China, 2012). An analysis of trademark infringement cases dealt with by courts in the coastal province of Zhejiang showed that rulings overwhelmingly favoured foreign firms (Snyder, 2012). Both foreign and domestic firms are making increased use of legal avenues to address infringement concerns. Indeed, it would appear that as domestic innovation capacity expands, local inventors and owners of intellectual property, particularly in high-technology sectors such as software, are seeking stronger legal protection (Suttmeier and Yao, 2011). Going forward, IPR enforcement should be further strengthened by raising awareness of laws and ensuring adequate penalties for infringements. Such moves will help promote the diffusion of foreign technology, through the continued presence of multinational corporations, and achieve the policy objective of creating a world-class domestic innovation capability.

Strengthening other framework conditions including governance, competition and access to finance, will also support innovation goals. Access to finance is especially a problem for SMEs (OECD, 2010a). Firm-level analysis from emerging economies underscores the importance of framework issues such as access to finance and competition in determining the pace of innovation (Ayyagari *et al*., 2011). Indeed, in a survey of SME managers in China that examined the key institutional barriers to innovation, the top two responses related to problems in accessing finance and unfair competition (Zhu *et al*., 2011). This holds back the ability of small firms to innovate and commercialise their new technologies. Recently, though, access to finance has been improving, with a rapid increase in bank lending to small and micro enterprises.

Box 5. **Main recommendations to strengthen competition and innovation**

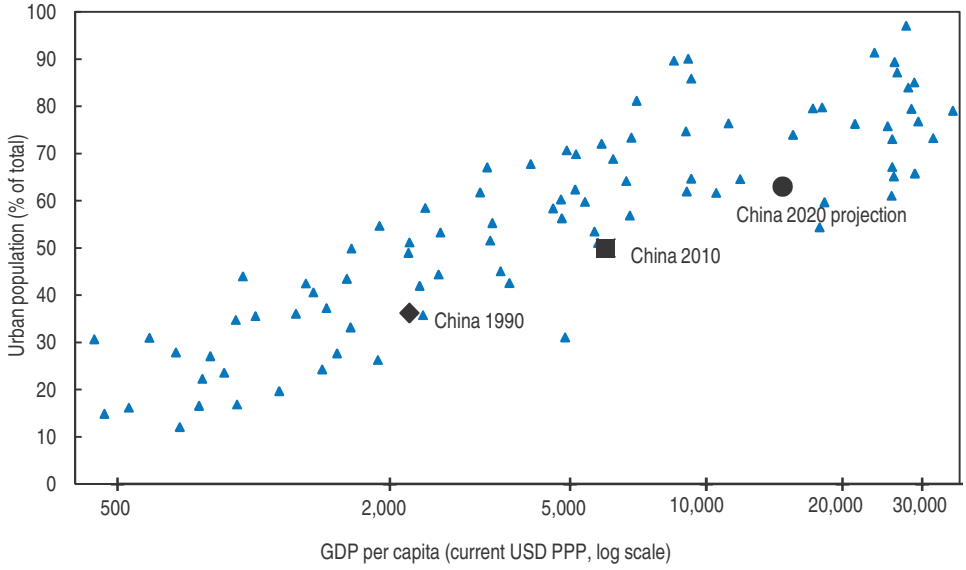
- Clarify rules concerning the opening up of new sectors to private investment, including of foreign provenance. Strengthen the business operating environment by reducing the time taken to register a new business. Avoid promoting "national champions" in new strategic sectors.
- Improve effectiveness of R&D spending by increasing the resources available to the agencies dispensing government funding and rebalance outlays towards fundamental research.
- Strengthen enforcement of intellectual property rights by raising awareness of laws and increasing penalties for infringements to ensure adequate protection to domestic and foreign innovators.

Further reforms for inclusive urbanisation

China's urbanisation was long held back by severe restrictions on land and internal migration but took off in earnest in the 1990s, as they were gradually relaxed. As a result, the urbanisation rate, which stood at 17% when economic opening up was initiated in 1978, reached 52.6% by 2012, and is expected to continue to increase. Even so, the urbanisation rate is on course to remain below the level associated internationally with China's per capita income (Figure 22). Moreover, the share of the population living in very large cities has risen considerably but is still low compared with other countries, as policymakers have traditionally favoured smaller cities.

Figure 22. **Urbanisation and level of income worldwide**

All countries with populations over 15 million



Source: World Development Indicators (IBRD); National Bureau of Statistics; National Population and Family Planning Commission (2011).

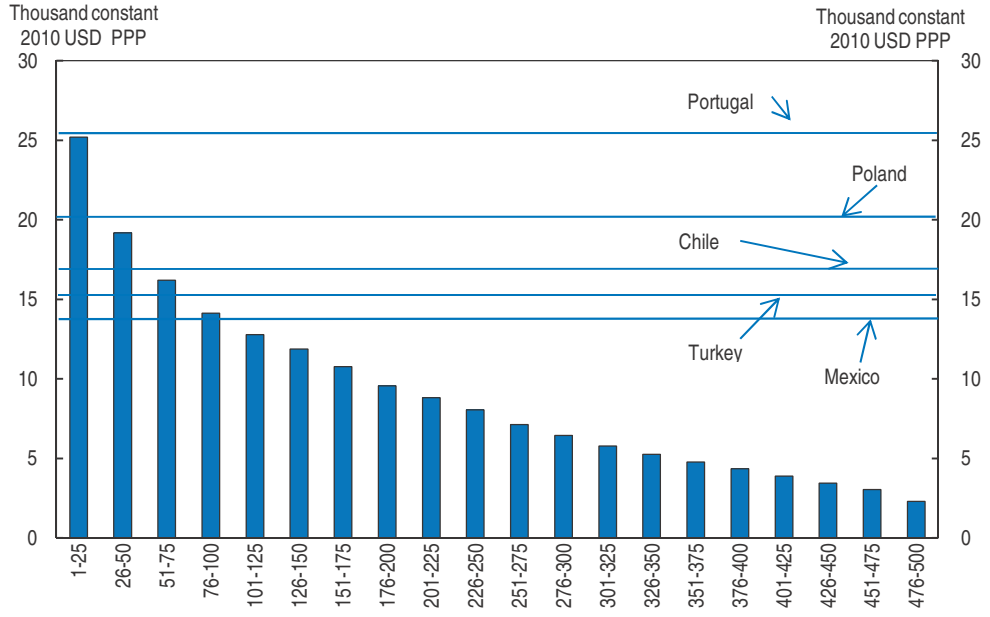
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Urbanisation has been and will remain a powerful driver of growth and social change. Cities have expanded mainly via migration away from rural areas. Labour has thus been reallocated out of agriculture into higher-productivity sectors, and the concentration in urban

areas has allowed the reaping of agglomeration benefits. In the process, living standards have improved rapidly: close to one quarter of China's population now lives in areas where income per head is at least as high as in Chile, Mexico or Turkey (Figure 23); and in China's richest 25 metropolitan areas (as defined in Herd *et al.*, 2013) GDP per capita is on average equivalent, in PPP terms, to Portugal's. Productivity tends to be higher in the large metropolitan areas, even though efficiency gains diminish beyond a certain size. At the same time, the departure of unproductive workers, plus remittances from migrants, have lifted per capita income in rural areas enough for the rural-urban income gap to have narrowed over the past decade (Box 2).

Figure 23. **The largest 500 Chinese metropolitan areas by GDP per capita: international comparison**

GDP per capita by groups of 25 cities in 2010, using the PPP exchange rate of the World Bank



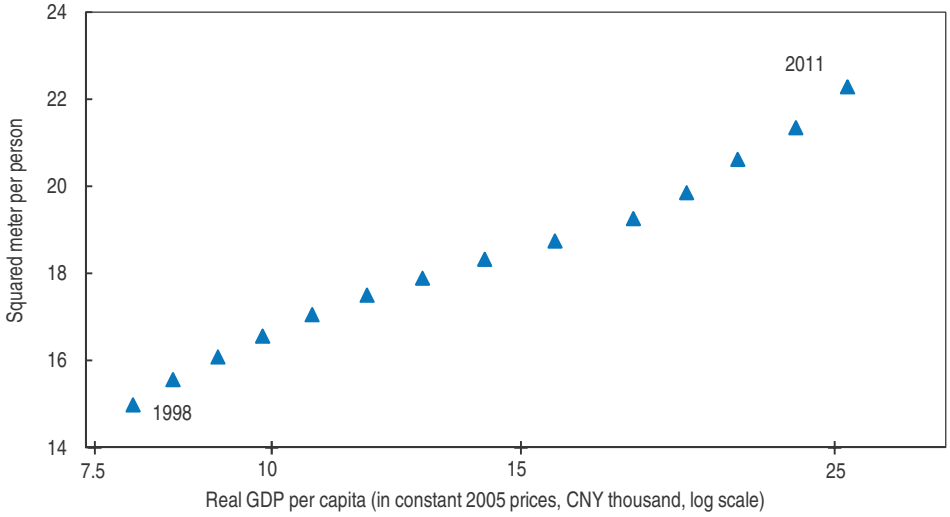
Source: CEIC, National Bureau of Statistics*: City Statistical Yearbook;* Communiqués on 6th Census issued by local national Bureau of Statistics offices; *World Development Indicators* and OECD calculations.

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While urbanisation brings considerable benefits, it also entails costs. One relates to congestion: the development of public transport infrastructure, while impressive, has not kept up with urbanisation. Cities also regroup numerous industries and generate more trips than rural areas, with deleterious effects on air quality. However, larger cities need not be more polluted than smaller ones. In fact, compact cities can help reduce automobile dependence and allow for more efficient energy generation and use, while carbon pricing, congestion charges and regulation can help address environmental concerns (see below).

Demand for living space has increased in lockstep with GDP per capita (Figure 24), though less than in other East Asian countries (Berkelmans and Wang, 2012), likely reflecting the exceptional scale of migration towards cities in China and migrants' lower demand for floor space. Concomitantly, population density has declined in a number of major urban areas – often from extremely high levels. Housing investment took off in the early 1990s, as land-use rights became marketable (Figure 25). The sale of these rights by specialised agencies set up by the local authorities amounted to over 7% of GDP in 2010, but

Figure 24. **Living space and GDP per capita**

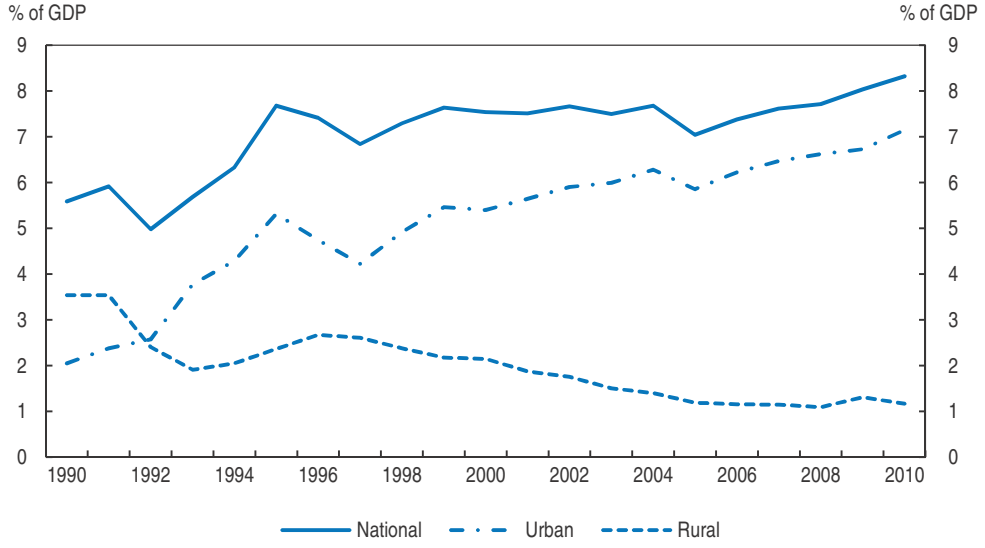


Source: CEIC, National Bureau of Statistics; OECD calculations.

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Figure 25. **Housing investment**

Excluding land, in % of GDP



Source: Herd *et al.* (2013).

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only half of this represented revenue for the local authorities in 2009 (Table 5). The use of the other half often remains opaque. In particular, compensation payments for expropriated land are shown in official statistics as being far higher than the amounts received by farmers. By 2012, gross revenue from sale of use-rights had fallen to 5½ per cent of GDP. The property developers purchasing the land-use rights have to comply with a myriad of administrative procedures in order to start construction. At the same time, illegal construction on collectively-owned rural land has taken place on a large scale, leading in some cases to expropriation and demolition.

The total number of rural migrants living in urban areas is estimated at around 275 million in 2010, *i.e.* one fifth of China's total population. The vast majority of them have

Table 5. **Revenue and expenditure across levels of government**

Excludes social security and local government financing platforms

	National consolidated	Central	Sub-national levels				
			Consolidated total	Province	Prefecture	County/ District	Township
	% of national GDP						
Own revenue	27.6	11.4	16.3	3.6	6.1	5.4	1.2
Tax revenue	17.5	9.8	7.7	1.8	2.5	2.4	1.0
Gross land lease revenue	4.4	0.1	4.3	0.4	2.1	1.7	0.1
Other revenue	5.8	1.5	4.3	1.3	1.4	1.4	0.2
Own expenditure	29.4	5.3	24.1	5.1	7.4	10.3	1.3
Land compensation and improvement[1]	2.3	0.0	2.3	0.1	1.1	1.0	0.1
Balance on own account	-1.8	6.1	-7.8	-1.5	-1.3	-4.9	-0.1
Transfers from higher levels of government		0.0	8.4	8.4	6.1	5.5	0.0
Transfers to lower levels of government[2]		8.4		7.2	4.4	0.0	0.0
Net received transfers		-8.4	8.4	1.2	1.7	5.5	0.0
Balance of above = net acquisition of financial assets	-1.8	-2.3	0.5	-0.3	0.3	0.6	-0.1
Use of cash balances (negative means an increase)	-0.8	0.3	-1.1	0.0	-0.5	-0.7	0.1
Net borrowing[3]	2.6	2.0	0.6	0.3	0.2	0.1	0.0
			Net received transfers as percentage % of own expenditure				
Transfer dependency			34.8	23.4	22.5	53.7	n.a.

n.a. Data not available.

1. This line measures the costs that local authorities incur before land rights are sold. The costs are *i)* the compensation paid to farmers and home-owners when land is acquired for development; and *ii)* the expenses incurred by local governments when they improve the land by installing roads and utilities on a site before it is sold. The values for individual levels of sub-national government are based on the average proportions for all levels of sub-national government.
2. Transfers to prefectures exclude those prefectures whose provinces make transfers directly to counties and districts.
3. The central government borrows on behalf of provincial governments which then lend to lower levels of government.

Source: OECD calculations based on Ministry of Finance (2010), *Finance Yearbook 2009;* Ministry of Finance (2011a), *2009 Fiscal Statistics of Prefectures, Cities and Counties;* Ministry of Finance (2011b), *Local Fiscal Statistical Yearbook*, 2009.

no official registration (*hukou*) in their place of residence. Therefore, they do not enjoy the same social entitlements as local *hukou* holders, nor do their families, even if the rules governing migrants' access to schools, health care and pensions have begun to be relaxed in recent years in a number of cities. In Shanghai, for example, some 70% of migrant children now receive free compulsory education in state schools. However, progress has been more modest regarding access to senior secondary school and university, where registration remains a barrier, *de facto* if not *de jure*. Here, Fujian province stands out, as it has announced it would allow all migrant high-school students to take the university entrance exam there. As regards health insurance, it is also very difficult for migrant families to cover their children, whose health is markedly worse. Furthermore, taking advantage of the affordable housing programme is reserved to *hukou* holders.

Against this backdrop, the central government has pushed for *hukou* reform, and in particular for allowing the conversion of registration from one locality to another and from agricultural to non-agricultural. The modalities of *hukou* reform vary enormously across cities, but overall the uptake seems to be rather limited, owing to the associated conditions. As a result few of the more than 250 million who have migrated to cities have been able to change their registration status from their place of origin to their new residence. Many would anyhow choose not to do so because a change involves sacrificing

potentially valuable land and given that they move to another place if favourable opportunities arise. Overall, the *hukou* reforms introduced to date are attractive mainly for highly-educated individuals moving from one city to another and who intend to stay for a long time in their new place of residence. Thus, the best way forward would be to further delink the eligibility for urban public services from the *hukou* status, for example by granting resident migrants a residence permit with the same rights as those of local urban *hukou* holders. The cost of such a policy is declining as access to education is broadening rapidly. Suzhou prefecture introduced such permits in 2011, of which more than 6 million had been issued by mid-2012.

Continued urbanisation is hampered by the rigid central planning rules governing the conversion of designated cropland into construction land, which partly reflect misguided concerns about food security (Herd *et al.*, 2013). This is likely to put considerable pressure on land prices in the coming years and to encourage illegal construction. A major change in land ownership rules in rural areas is needed to allow famers and their collectives to obtain land-use rights enabling them to change the use of their land to construction. Market-based reforms need to be complemented by strong standards and sound urban planning (OECD, 2012c). The sale of land use-rights for development under this new regime would result in a capital gain for the farmer. For real estate transactions, the current capital gains tax rate varies according to the scale of the gain. In the case of a farmer selling land for residential development, the farmer would be liable to a 60% tax on the total price, given that the use-right was obtained without payment. The revenue from this tax should accrue to the local government.

Box 6. **Main recommendations to foster inclusive urbanisation**

- Allow migrants to enrol in high schools and take university entrance examinations in their place of residence. Abolish local quotas for entrance to university.
- Disconnect the provision of local public services from local registration.
- Change the use-rights of agricultural land to the same length as in urban areas.
- Subject to zoning and planning requirements, ease the limits on the use of agricultural land for development and housing, and allow farmers to sell land to developers directly and to consolidate agricultural land parcels in order to raise productivity.

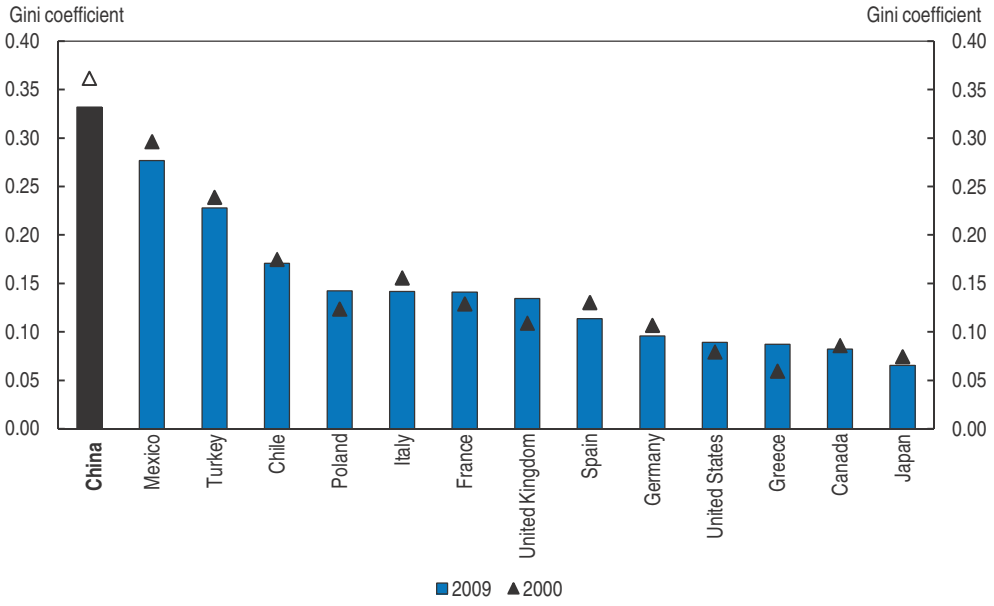
Reforming sub-national finance to promote geographical equity and facilitate urbanisation

Disparities across Chinese regions started to increase in the early 1990s. While this trend ceased around the mid-2000s and disparities may have declined somewhat since, as documented in the chapter on inequality in the 2010 *OECD Economic Survey of China*, they remain more pronounced than in many OECD countries (Figure 26). Reorientation of infrastructure investment towards the less prosperous regions – notably under the aegis of the Western Development Programme – has contributed to reducing regional inequality. And as noted above, urbanisation has helped narrow the rural-urban income gap.

To mitigate the effects of regional disparities, national policy has focused increasingly in recent years on public service equalisation (State Council, 2012). A very high proportion of public services are provided by sub-national governments. The total tax revenues of

Figure 26. **Regional disparity in China and in OECD countries**

Gini coefficient of regional GDP per capita in 2009 or nearby year



Note: Gini coefficients range from 0 (full equality) to 1 (maximum inequality). The definition of regions varies across countries to avoid that their population size be overly dissimilar. For China, the regional unit is the prefecture. For the United States, states are the units. In Europe, level-2 regions in the Nomenclature of Territorial Units for Statistics have been used. Elsewhere, the unit is the highest sub-national territorial unit, *e.g.* province or state. Data for China, United States and Korea refer to 2010. For Greece and Turkey data refer to 2008. Gini coefficients have only be calculated for countries where there are at least 10 regions.

Source: OECD Regional Statistics; National Bureau of Statistics.

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provinces are generally a fairly similar proportion of local GDP. Consequently, given the disparities in GDP across provinces equalisation of services will require a sizeable increase in transfer payments to lower-income areas. In addition, continued rapid urbanisation requires major local investment in infrastructure. Social spending is also likely to increase over time and much of this type of outlays is made at the local level. In all, the need for fiscal transfers may well increase in the future.

More specifically, there are four sub-national tiers: province, prefecture, county/district and township. The level of nominal decentralisation is exceptionally high relative to OECD countries and is meant to ensure that local service needs are met efficiently. However, local governments have almost no freedom to change either the rates or the tax base of those revenue sources allocated to them. In addition the major lines of local expenditure decisions are transmitted to local governments that are effectively agents acting on behalf of the central government (Wang and Herd, 2013). There are also overlapping responsibilities between different levels of government. Sub-national governments have very limited local tax bases and no freedom to vary tax rates, but receive a fixed proportion of a number of national taxes, amounting to 15% of local government revenue in 2011. They also get part of the revenue from the sale of land-use rights. Even so, sub-national governments require transfers from the central government to balance their budgets as they are not generally allowed to borrow. The reliance on transfers is particularly marked at the level of the rural counties and county cities (Table 5).

The transfers from the central government are governed by the rules set out at the time of the 1994 fiscal reform. The transfer system has three parts:

- general transfers, which aim to lessen fiscal disparities and which can be used freely (47% of total transfers in 2012);
- earmarked transfers, which can be used only for specified goals such as to subsidise local projects in certain areas subject to matching outlays by the local government (42% of total transfers);
- compensation transfers to provinces that lost revenue as a result of the 1994 reform, which have still not been completely phased out (11% of total transfers).

Transfers have grown rapidly since 1994, from 4.7% of GDP in 1995 to 8.7% by 2012. Within the total, the share of compensation payments has declined substantially, as intended at the inception of the system.

The transfers only partly alleviate fiscal disparities: there is substantial equalisation across provinces but disparities within provinces remain high. County-level governments are particularly dependent on transfers and many have inadequate revenue to meet central government mandates, even after significant transfers (Shen *et al.*, 2012). The degree of fiscal equalisation within a province does not appear to be linked to the income level of the province but to local policies. For instance, amongst high-income provinces, Zhejiang achieves a much higher level of equalisation than Guangdong whilst amongst lower-income provinces equalisation is much higher in Guizhou than in Liaoning.

The share of transfers whose use is unrestricted stands at 58%, well within the (very wide) ranges observed across OECD countries. General transfers are designed to lessen differences in per capita public spending across the country. Compensation transfers tend to go to the richest provinces. Earmarked transfers, in contrast, are less redistributive and include over 100 different types all of which are allocated on an *ad hoc* or negotiated basis, thus undermining transparency relative to a rule-based system. However, going further and reducing earmarked transfers may be difficult, as the central government wishes to ensure that its priorities are followed. Efforts are therefore required to improve the effectiveness of earmarked transfers and ensure that they do not work against equalisation. This could involve, for example, grouping different earmarked project grants together into a block general purpose grant allocated to a particular type of social service.

To date, the need for transfers has been assessed mostly based on registered rather than actual population in a province. This has in fact increased the extent of fiscal equalisation as actual population is generally lower than registered population in low-income provinces, given that migrants remain registered in their home province regardless of where they live. The government is set to henceforth include 15% of the difference between actual and registered population in the formula for determining transfers (Ministry of Finance, 2012). This will partly take into account the cost of migrants to a province. However, as a rule it will also reduce the extent of equalisation. As compensation payments generally accrue to high-income provinces, the adverse impact on lower-income provinces of the change in population base could be offset by reducing compensation payments more rapidly.

The reform of the tax system in 1994 left some local governments with inadequate revenue to meet their expenditure needs. The gap has been met by a rapid increase of transfers from the central government. This necessarily involves central or provincial governments taking decisions about spending at lower levels of government. If the objective

is to devolve expenditure decisions as much as possible, the 1994 rules about the share of each national tax attributed to local government need to be revisited. In particular, the share of value-added tax that is attributed to county and district level governments needs to be raised substantially. The generalisation of the VAT on services to replace the business tax (which cannot be reclaimed as an input tax) would provide an opportunity to make this change. The formula for tax sharing will have to be altered because the business tax is an almost entirely local tax while three-quarters of VAT accrues to the central government.

The introduction of a property tax has been under consideration since 2003 as a means of improving local tax revenue. However, the government owns all land in China. Insofar as a property tax reduces the value of land-use rights, governments face a conflict: introducing a generalised property tax would reduce the income that they derive from sales of land-use rights. There are already a range of taxes on property in China which bring in about 1.7% of GDP, similar to what is raised through property taxation in the OECD area. However, in China two-thirds of the taxes are based on transactions and so limit the fluidity of the property market.

The balance of forces in favour of property taxation will gradually increase as China becomes more urbanised. Land sales will become a much less important source of revenue and the balance would change even more if rural residents were given the same property rights as urban residents and were able to benefit from the increase in value of land when it changes use from agricultural to residential use (see above). Over the longer term, property taxation would represent a stable source of revenue – albeit one that would mainly accrue to the governments of richer areas.

Pilot schemes have been launched in Chongqing and Shanghai in 2011 to tax the possession of a second residential property. In Shanghai, it only applies to newly acquired second properties and only to properties of over 180 m^2 for a family of three. The tax rate is only 0.28% per annum for property worth less than twice the local average price. Moreover, if newly married children are using the second property, no tax is payable. The yield from the tax in both Shanghai and Chongqing will be very low.

Finally, progress with the ongoing reform efforts to reduce the number of levels of government has been slow. These efforts need to be stepped up, while taking into account metropolitan development. The current reform aims to put in place direct transfer programmes from province to county, bypassing the prefecture government. The objective is to reduce the administrative hierarchy and better support local rural development (Ministry of Finance, 2009). Removing the responsibility of counties from the prefecture government, which is normally based in the prefecture's large city, would allow that level of government to be transformed into an entity that focused entirely on an urban metropolitan area. In some cases, mergers between city and immediately surrounding counties should be envisaged on the lines of what has already occurred in a number of areas.

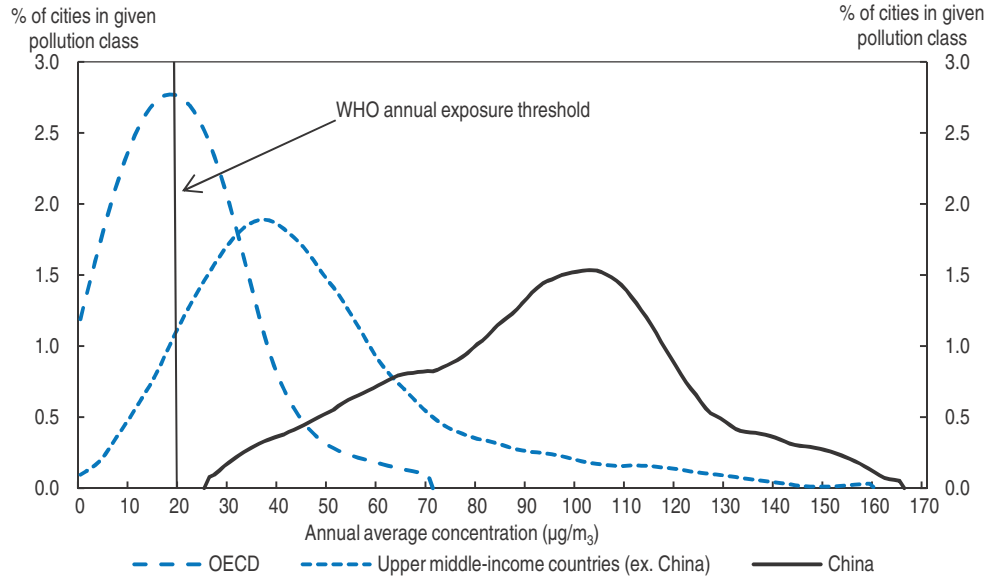
Box 7. **Main recommendations on intergovernmental fiscal relations**

- Raise the share of general intergovernmental transfers and improve the design of earmarked ones.
- Where major cities cover a relatively small geographical area, expand their boundaries to absorb surrounding counties in order to create authorities covering a metropolitan region.
- Switch from taxing land transactions to taxing land possession, while keeping the overall property tax burden broadly unchanged.

Greening the economy will require concerted efforts

One of the overarching policy priorities in China is to shift towards more environmentally friendly modes of consumption and production. This requires wide-ranging reforms. The 11th Five-Year Plan ensured progress in curbing some types of pollution and improving water and energy efficiency. However, large sections of the freshwater system continue to suffer from severe pollution, creating problems in some coastal areas. Air quality is poor due to high concentrations of small particles (Figures 27 and 28). Moreover, recent air pollution episodes, notably in Beijing, saw concentrations many times in excess of the WHO limit, rivalling the infamous London smog of 1952. Given the tendency for many types of pollution to spill across national boundaries, tackling environmental issues also has important global ramifications. This is especially true in the case of climate change as China is the largest emitter of greenhouse gases which continue to rise rapidly. The challenge ahead is to further decouple pollution and other forms of environmental degradation from economic growth.

Figure 27. **Percentage of cities with a given ambient concentration of particulate matter**

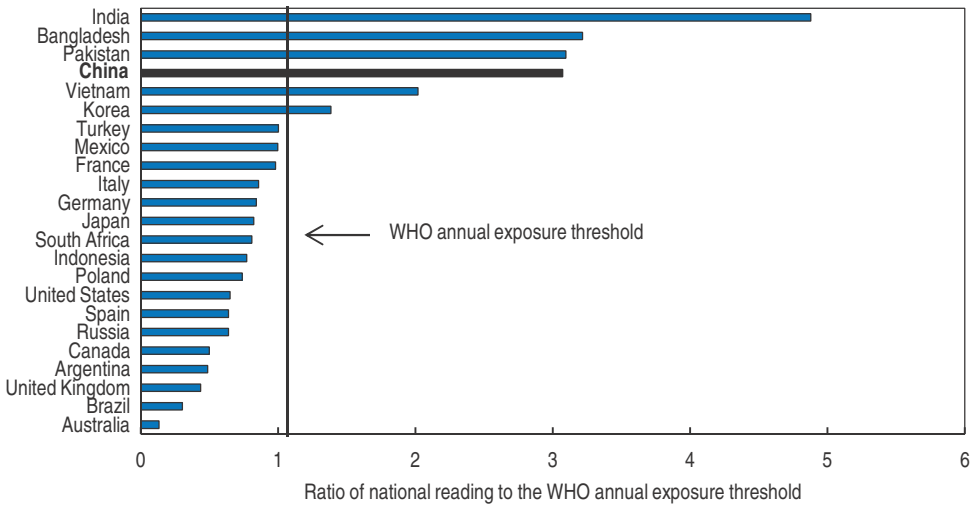


Note: 2010 or most recent observation.
Source: CEIC, OECD and NBS-MEP (2011).

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Figure 28. **Outdoor air pollution from small diameter particulates**

Satellite estimates of PM 2.5 concentrations, annual population-weighted averages
Expressed as a ratio to the WHO annual exposure threshold



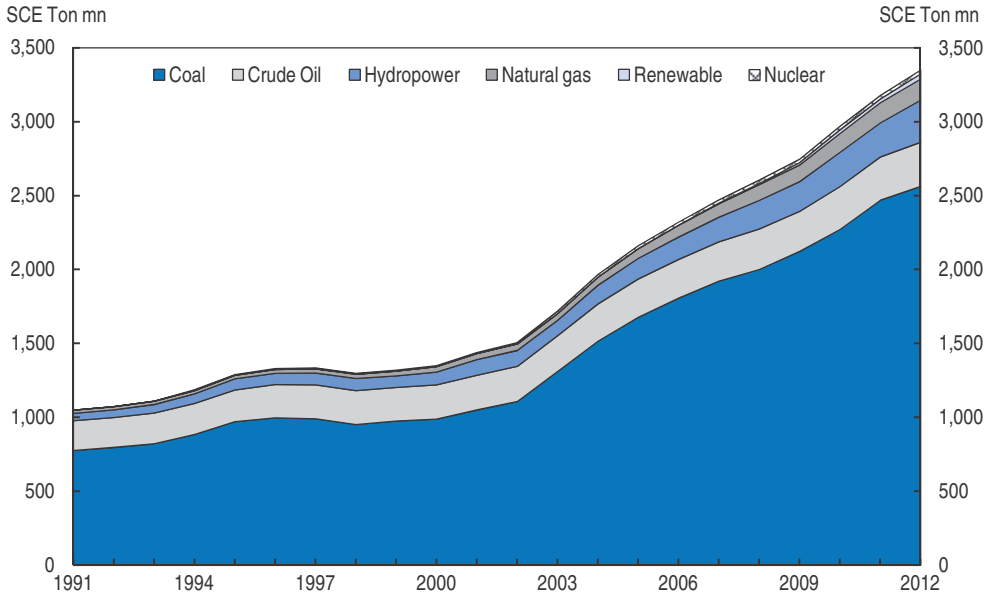
Source: Environmental Performance Index (2012), concentrations have been estimated using satellite remote sensing data.

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China's environmental challenges reflect rapid economic growth as well as underlying industrial and energy structures. Significant progress has been made in improving energy efficiency but it is still relatively poor. Energy demand is also rising rapidly and China recently passed the United States as the largest energy consumer, even though its energy use in per-capita terms remains relatively low. China relies heavily on fossil fuels for its energy needs, especially coal, reflecting large endowments (Figure 29). Coal is used for the bulk of electricity generation and central heating as well as directly by heavy industry, and is a major source of air pollution. The supply of cleaner forms of energy has expanded at impressive speed with China quickly becoming a world leader in both renewable energy capacity and manufacturing (Pew, 2012). The share of cleaner energy is set to rise further over the medium term but will remain relatively small. Water pollution originates from a diverse range of point and non-point sources, notably households and agriculture. Water quality problems are compounded by water scarcity in some parts of the country, which is putting pressure on resources including groundwater.

Environmental degradation has significant costs which justify a continued strong policy response. Exposure to polluted air and water as well as other contaminants can damage health while climate change can entail costs through adverse weather developments and other channels. Broader costs from pollution include damage to property and resource depletion. Quantification is difficult but several recent estimates suggest that these costs are large in China (Ebenstein, 2012; Matus *et al.*, 2012; World Bank-DRC, 2012), with increases in inequality as the poor and vulnerable often suffer disproportionately from environmental degradation. The government has invested heavily to increase access to improved drinking water but many, especially in rural areas, remain exposed to water pollution related health threats. Addressing environmental problems is likely to deliver particularly large co-benefits given that in many cases high pollution emissions originate from the same sources.

Figure 29. **Primary energy production in China**



Source: National Bureau of Statistics.

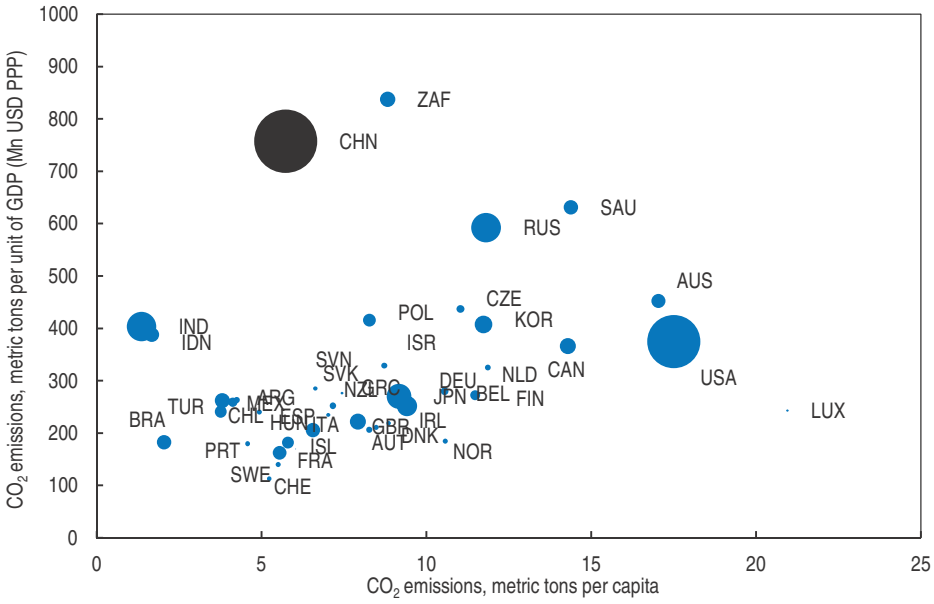
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Major efforts have also been made to address desertification stemming in part from excessive conversion of poor quality grasslands into cultivated land. Such conversion is now being rolled back with land being turned into forests. Ambitious forestation projects have been launched. While they have not always been completely successful, with examples of new forests dying quickly or failing to mature, the area of desert appears to be receding. Moreover the number of sand storms appears to be declining, though their intensity may be rising.

The government has accorded the environment a high priority in the 12th Five-Year Plan and aims to build on its recent successes. The range of pollutants the government is targeting to reduce in absolute terms has widened. For the first time, a target to reduce the amount of carbon dioxide (CO_2) emitted per unit of output has been specified, which represents an interim step towards a 2020 goal. This should help bring emission intensity, which is high in China, down towards the levels seen in most other countries while allowing per capita emissions, which are low, to increase (Figure 30). Targets are also set for energy and water efficiency as well as forest coverage. To achieve these goals a number of the strategies adopted so far will be extended and in some cases broadened. Spending on water treatment and other environmental infrastructure by governments at all levels, as well as private enterprise, is set to increase further. Efforts to reduce air pollution from thermal power generators by retrofitting equipment to remove sulphur dioxide (SO_2) and nitrogen oxides will continue and standards for new facilities are being lifted to OECD levels. There will also be a continued push to close heavily polluting, outdated industrial and power generation capacity.

Beyond these initiatives, achieving the government's objectives in a more cost-effective manner calls for the focus to shift towards a greater reliance on well implemented market-based reforms. While often successful in improving the environment, many command-and-control approaches adopted thus far have had undesirable consequences, including costly

Figure 30. **Emissions of carbon dioxide and emission intensity**[1]



1. The size of each circle is proportional to the carbon dioxide emissions of the country.
Source: IEA.

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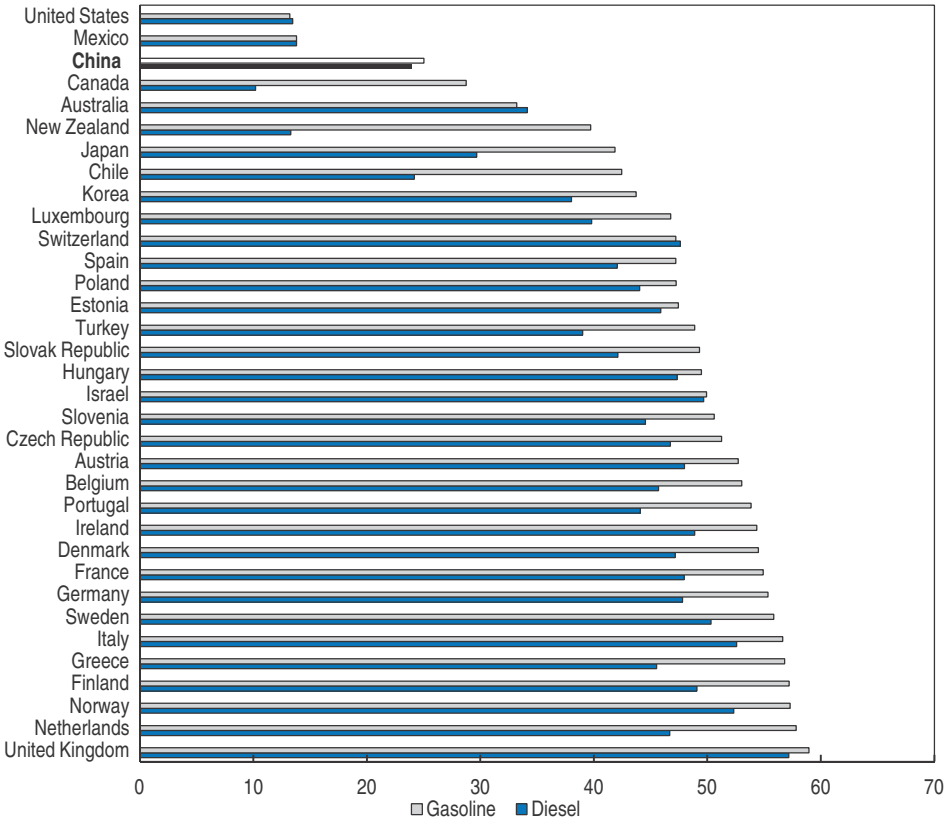
power shortages. The closure of further industrial capacity through administrative means is also likely to be costly given the resources required to identify facilities and implement changes. The limits of end-of-pipe measures are also being reached in some areas. Notably, the installation of desulphurisation equipment in coal combustors is reaching saturation point amongst large facilities and may be unviable in smaller ones (Wang, Lei *et al.*, 2012). As manufacturing emits more pollution than services, market-based approaches that enforce the polluter-pays-principle will also support the broader government objective of increasing the proportion of output produced by the service sector.

Notable progress has been made in liberalising some energy prices, which supports energy efficiency targets and ensures energy subsidies are low by international comparison. The regulations governing gasoline and diesel prices have been changed so that domestic prices reflect prevailing average international oil prices over the previous month, so providing better signals to end users. Nevertheless, the government still intervenes to smooth adjustment and the current regulations leave the possibility for the government to cap prices if oil prices spike. To ensure timely pass-through the government should move to full deregulation but first needs to improve competition in distribution. Prices also remain relatively low by international standards so there is scope to increase excise rates to bring them closer towards the OECD average (Figure 31). Significant steps have also been taken towards liberalising coal prices but suppliers are still required to sell some coal to power companies below market price. Less progress has been made with natural gas, where the price of domestically produced gas is held down by the government. For both coal and natural gas the government should move to a system of market-based pricing.

Electricity prices for power generators and end-users remain tightly regulated and have barely moved in the past few years despite rising generation costs, reducing the profits of the power generators and threatening future investment. The government needs

Figure 31. **Tax share of retail diesel and gasoline prices**

In per cent, second quarter 2012



Source: IEA.

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to change its formula for regulating the price received by generators from the two state-owned grids so that prices properly reflect input costs, notably that of coal. This would put the regulation of electricity prices on a par with petroleum prices and would restore the financial health of the generators. The government should then implement its plan to experiment with separating distribution companies from the State Grid companies in certain areas. If these experiments are successful in improving efficiency, they should be generalised. Once distribution and transmission have been separated, then a market-based system of energy pricing could be tested in order to promote competition and clear the way for the introduction of carbon pricing. At the same time the authorities need to avoid providing special pricing arrangements to support industrial policy objectives.

Reforms to water prices would also help meet water conservation targets as well as broader environmental objectives. Though prices for households have risen they remain low compared with other countries and could be raised somewhat. Distributional concerns could then be addressed by providing direct assistance to poorer households. In rural areas some progress has been made in encouraging the development of local water markets. However, these are sometimes hindered by government intervention. Providing farmers with clearer water usage rights and allowing for water trading can provide effective incentives for farmers as well as a supplementary income source. Progress in this area is especially important given the large share of national water resources that are used in agriculture.

China has a long history of applying pollution levies as well as experimenting with emissions trading schemes (ETS), especially for SO_2. Pollution and carbon pricing in particular are also envisaged in the 12th Five-Year Plan (Information Office of the State Council, 2011). Such approaches can offer significant advantages and are becoming more popular in OECD countries, particularly to help meet climate change related objectives. Thus far the experience in China has been mixed, with many schemes failing to achieve desired goals. In many cases failures can be linked to poor implementation which has led to weak incentives to curb pollution. Pollution levies have sometimes been set too low and have been plagued by problems with collection and poor enforcement. Trading schemes have suffered from a weak institutional basis, inadequate scale and inappropriate government interventions. Central and sub-national governments are establishing pilot CO_2 ETS in several Chinese cities and provinces. To be effective, these schemes need to set clear emissions caps on a rolling basis, have a well defined (and ideally broad) coverage, strong monitoring, reporting and verification systems and effective sanctions for firms exceeding their permit allocation.

Going forward more emphasis is needed on better implementation of pollution pricing. Pollution price signals should be strengthened by increasing levies and pollution taxes. Applicable rates also need to be adjusted to ensure adequate incentives for pollution mitigation in line with policy objectives, including indexation so that their effectiveness is not eroded over time. National carbon pricing should form the cornerstone of government efforts to reduce carbon intensity. In principle this could be achieved either through a trading scheme or a carbon tax. However, given mixed experiences with pollution trading schemes in China as well as in a number of OECD countries, and their additional administrative complexity, a national carbon tax is likely to offer some practical advantages. Irrespective of the approach taken, a key associated implementation challenge will be ensuring that electricity prices reflect higher costs due to the introduction of carbon pricing.

Market-based reforms need to be complemented by strong standards and sound planning, particularly with respect to cities. International evidence underscores the many environmental and other advantages of well planned compact cities, notably greater energy efficiency and lower pollution from transport (OECD, 2012c). As noted, population density is high in Chinese cities and as they continue to grow ensuring land is used efficiently and investment in public transport is adequate will be key. This will help control motor vehicle use, which is rising quickly. A number of cities have taken measures to discourage motor vehicle ownership and exhaust emissions standards have been raised. However, the effectiveness of emissions standards depends on fuel quality standards which are continuing to lag in most parts of the country. Success in reducing air pollution, especially NO_X emissions, will require a more concerted effort to raise national standards in this area. Further promoting recent initiatives to improve energy standards for buildings and consumer goods would also help meet energy efficiency targets.

More generally, efforts need to be redoubled to strengthen environmental regulation and enforcement. In recent years the framework for environmental policy and protection in China has continued to evolve (McElwee, 2011). In 2008, the government established the Ministry of Environmental Protection with broad responsibilities for formulating environmental policies, thereby upgrading environmental matters to ministerial level. However, enforcement primarily remains the domain of local environmental protection bureaus controlled by local governments which at times face conflicting incentives. Strong central government oversight has been essential for progress in key areas and a continued

effort is needed going forward. Some steps to strengthen penalties, including higher fines, have also been taken and raising them in the future will be important for ensuring they provide an adequate disincentive. One specific area where the government is seeking to bolster regulation is nuclear energy safety. A recent safety audit found that most facilities met domestic and international safety standards (Zhou, 2012). However, the sector is expanding at a rapid pace and it is vital that regulatory capacity is increased in tandem.

Better monitoring and information dissemination can support stronger enforcement. In the late 2000s, a national pollution census was undertaken which provided policymakers and other stakeholders important insights on environmental challenges. More recently, efforts have been stepped up to track industrial air pollutants more closely, including SO_2 and mercury, while monitoring of fine particulate matter, which is especially damaging to human health, is being rolled out across the country. Awareness and interest in environmental issues has increased and information dissemination is improving. Changes are also being made to the way environmental information is disseminated, including through devices such as the official Air Pollution Index. However, further steps should be undertaken to broaden the coverage of pollutants reported on a regular basis, including CO_2 and other GHG emissions. Going forward this would help the government to establish targets for a broader range of environmental objectives.

Box 8. **Main recommendations to improve the environment**

- Encourage energy conservation by raising excise duties on gasoline and fully deregulating prices. Move to full market-based pricing for natural gas and coal. Deregulate electricity prices, beginning in the generation sector, and avoid preferential electricity pricing for selected industrial users.
- Raise piped water prices to end-users to better reflect scarcity and encourage conservation.
- Increase levies, moving them towards a system of pollution taxes. Effectively implement CO_2 pilot emissions trading schemes. Move towards national carbon pricing, preferably via a carbon tax, depending on experiences with the pilot schemes. Further lift standards for motor vehicle emissions as well as fuel quality.
- Establish targets for a broader range of environmental objectives and step up enforcement efforts, including by holding local governments accountable.
- Improve national data collection and dissemination of all major pollutants including CO_2 and other greenhouse gases.

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ANNEX 1

OECD key recommendations on structural policies and selected aspects of the President's report to the 18th Party Congress held in November 2012

OECD key recommendations	Orientations in the Report to the 18th Party Congress
Financial sector reform	
Continue to move to market-determined interest rates by progressively widening the allowable margin around the regulated rate. Align the regulation of bond markets for maturities of over five years with the practices of the market for shorter maturities.	Take steady steps to make interest rates more market-based. Accelerate the development of a diversified capital market.
Progressively increase the quota for inward investment in equities and long-dated bonds. Allow greater use of offshore renminbi deposits in mainland China. Allow for greater exchange rate flexibility.	Promote the RMB's convertibility under capital accounts in due course. Take steady steps to make the RMB exchange rate more market-based.
Competition and innovation	
Clarify rules concerning the opening up of new sectors to private investment. Strengthen the business operating environment by reducing the time taken to register a new business. Avoid promoting "national champions" in new strategic sectors.	Strike a balance between the role of the government and that of the market. Follow more closely the rules of the market.Support and guide the development of the non-public sector, and ensure that economic entities under all forms of ownership have equal access to factors of production in accordance with the law, compete on a level playing field and are protected by the law as equals.
Improve effectiveness of R&D spending by increasing the resources available to the agencies dispensing government funding and rebalance outlays towards fundamental research.	Strengthen basic research, research in frontier technologies, and public benefit-oriented research and development.
Strengthen IPR enforcement by raising awareness of laws and increasing penalties for infringements to ensure adequate protection to domestic and foreign innovators.	Implement the strategy concerning intellectual property rights and strengthen their protection.
Inclusive urbanisation	
Allow migrants to enrol in high schools in their place of residence and university entrance examinations to be taken in the place of residence. Abolish local quotas for entrance to university.	Ensure that children of rural migrant workers in cities have equal access to education.
Disconnect the provision of local public services from local registration.	Accelerate reform of the household registration system, in an orderly way, so that all permanent urban residents have access to basic urban public services.
Equalise the use-rights of agricultural and urban land by extending rural leases.	Protect and improve farmers' rights to farm the land and houses they have contracted to use.
Subject to zoning and planning requirements, ease the limits on the use of agricultural land for development, and allow farmers to sell land to developers directly and to consolidate agricultural land parcels in order to raise productivity.	Improve the farmers' share in the proceeds from rural collective operations and ensure that the quality of urbanisation improves markedly.

OECD key recommendations	Orientations in the Report to the 18th Party Congress
Intergovernmental fiscal relations	
Raise the share of general intergovernmental transfers and improve the design of earmarked ones.	Ensure that the central and local governments have sufficient financial resources to exercise their respective powers and fulfil their respective responsibilities. Improve the public finance system to ensure equal access to basic public services.
Where major cities cover a relatively small geographical area, expand their boundaries to absorb surrounding counties in order to create authorities covering a metropolitan region.	Improve the geographical and administrative structure of local government by experimenting with provinces controlling counties and county-level cities. Reform town and township administrations.
Switch from taxing land transactions to taxing land possession, while keeping the overall property tax burden broadly unchanged.	Accelerate the reform of the taxation systems.
Environment	
Improve incentives for energy conservation by raising excise duties on gasoline and fully deregulating prices. Move to full market-based pricing for natural gas and coal. Deregulate electricity prices, beginning in the generation sector, and avoid preferential electricity pricing for selected industrial users. Raise piped water prices to end-users to better reflect scarcity and encourage conservation.	Reform of prices, taxes and fees paid for resource products. Establish a system for paying for resource consumption and ecological damage – a system that responds to market supply and demand and resource scarcity.
Strengthen pollution price signals by increasing levies and pollution taxes. Ensure effective implementation of CO_2 pilot emissions trading schemes. Move towards national carbon pricing, preferably by implementing a carbon tax, depending on experiences with the pilot schemes. Further lift standards for motor vehicle emissions as well as fuel quality.	Carry out trials for trading energy savings, carbon emission rights, pollution discharge rights and water rights. Accelerate the reform of the fiscal and taxation systems.
Establish targets for a broader range of environmental objectives and hold local governments accountable. Improve national data collection and dissemination of all major pollutants including CO_2 and other greenhouse gases.	Strengthen environmental monitoring and improve accountability for ecological and environmental protection and the system of compensation for environmental damage.

Chapter 1

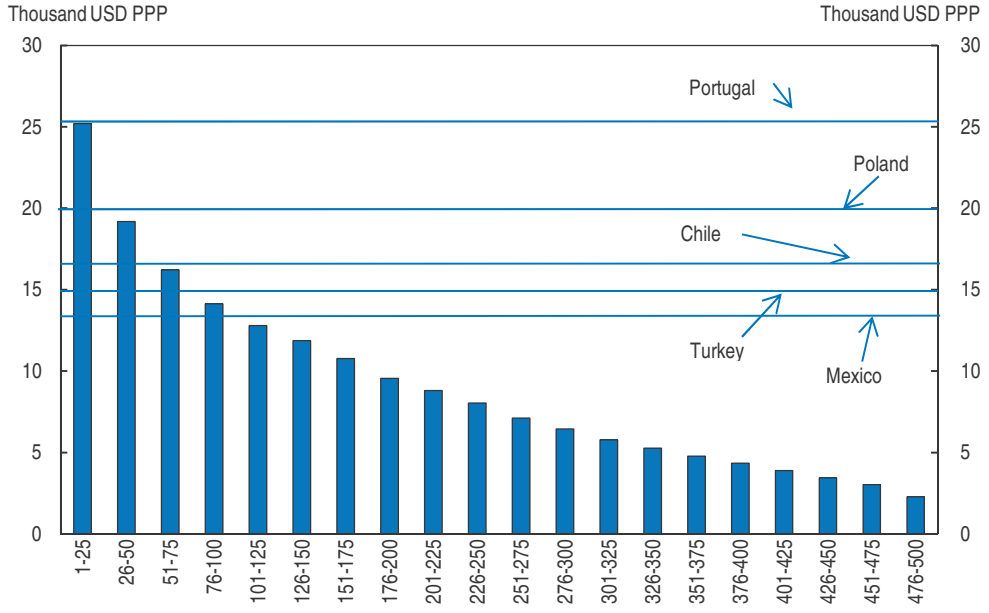
Urbanisation, growth and social inclusion

Urbanisation in China has long been held back by various restrictions on land and internal migration but has taken off since the 1990s, as these impediments started to be gradually relaxed. People have moved in large numbers to richer cities, where productivity is higher and has increased further thanks to agglomeration effects. In the process, the rural-urban income differential has narrowed. Urbanisation also entails costs, however, notably in the form of congestion, all the more so as public transport provision has not kept up. Demand for living space is set to continue to increase as living standards improve, putting pressure on land prices. This can be offset by relaxing the very stringent restrictions on the use of agricultural land for building. For migrants to better integrate in the cities where they work, their access and that of their families to education, health and other social services must continue to improve, in particular via further changes to the registration system, coupled with more market-based rules on land ownership and use.

Urbanisation has come a long way in China over the past two decades. Over half of the population is now officially classified as urban and just under one-quarter of the Chinese population, amounting to 310 million people, now live in metropolitan areas with income per head matching that in the three lowest-income OECD countries: Chile, Mexico and Turkey (Figure 1.1). After a historical overview of the urbanisation process, this chapter discusses the associated benefits and costs (the environmental challenges stemming from the rapid expansion of cities are also discussed in Chapter 2). It then examines the drivers of urbanisation – notably rural-urban migration – and the role played by government in the process. Going forward, both land rights and migrants' access to public services in cities are key for inclusive urbanisation.

Figure 1.1. **The largest 500 Chinese metropolitan areas by GDP per capita: international comparison**

GDP per capita by groups of 25 metropolitan areas in 2010, using the PPP exchange rate of the World Bank



Source: CEIC, National Bureau of Statistics, *City Statistical Yearbook*; Communiqués on 6th Census issued by local offices of the National Bureau of Statistics; World Development Indicators. The methodology for selecting and defining metropolitan areas is explained below.

StatLink *To download the data corresponding to this graph, refer to Figure 23.*

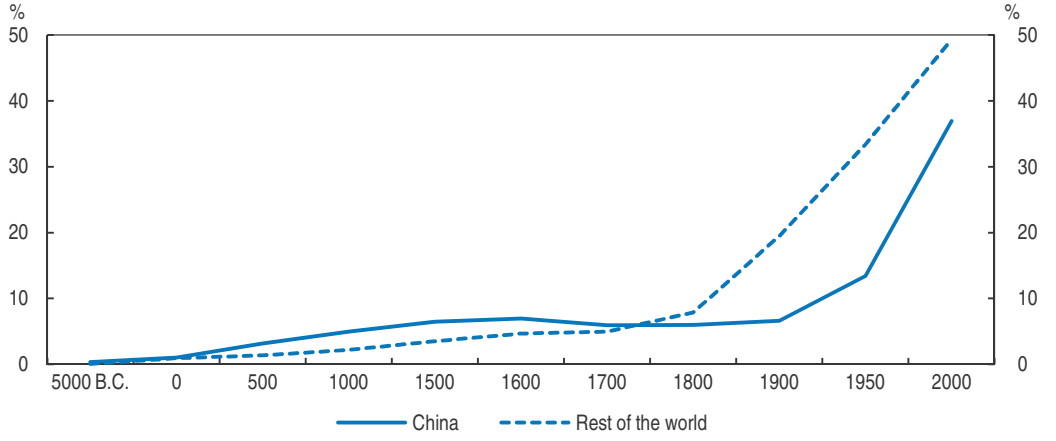
Urbanisation in China: a long history

The first cities in China appear to have emerged after those in Mesopotamia, Egypt and India, probably because irrigation came later in China. By 1400BC the first major city of China (Anyang) developed with an area of around 3 km^2, substantially less than Babylon's. In contrast to Western cities, China's were part of a structured network of walled cities that controlled the neighbouring countryside (Trewartha, 1952). Chinese cities continued to

grow under the Chou dynasty, with Chang'an (Xi'an) reaching a population of 146 000 by 195 BC. They more than doubled in size in the next two centuries.

Under the Chi'in and Han dynasties, cities prospered and a two-level administrative structure was put in place with 36 provinces and 320 prefectures. After being destroyed, the city of Chang'an was rebuilt and became one of the largest cities in the world, along Babylon and Baghdad, with a population of over one million by around 700 – a size only reached by London in 1801 and Paris in 1850. Under the Ming and Qing dynasties, there were 13 cities with over 500 000 inhabitants (Chang, 1963). As a result, China's share of the world's overall urban population far exceeded its share of the total population up to the beginning of the industrial revolution in Europe (Figure 1.2). Even so, China largely remained a rural society with towns fulfilling a predominantly administrative and trading function. The urbanisation rate peaked around 1 600 and then slowly declined as the country remained inwardly-oriented economically and suffered from invasions. By the early 1900s, the urbanisation rate was barely above the rate achieved four centuries earlier.

Figure 1.2. **Urbanisation rates in China and the rest of the world**



Source: Goldewijk *et al.* (2010).

StatLink http://dx.doi.org/10.1787/888932787676

Urbanisation progressed slowly during the following 50 years. A number of major coastal cities emerged as foreign trade grew through the enforced opening of a number of cities with foreign concessions. Towns such as Shanghai, Tianjin and Guangzhou grew to over a million inhabitants. This process was interrupted by war and revolution, so that by 1949, at 12%, the urbanisation rate in China was only around one-third that in the rest of the world.

Government policies held back urbanisation until the 1990s

In the early years of the new China that emerged in the late 1940s, rehabilitation, the first five-year plans and the initial period of the Great Leap Forward brought the urbanisation rate up to close to 20% by 1960. However, the agricultural sector was unable to respond efficiently to the outflow of labour as it was still organised on a collective basis and grain supply fell. The government sent people back to the countryside to boost food production and by 1963 the urbanisation rate had dropped to 17%.

Government policies during this period left a long-standing mark on urban planning in China. The famines of the early 1960s reinforced the idea that national security requires

a stable source of domestically-produced food, especially grains. An extremely restrictive household registration system (*hukou*) limited household mobility until the late 1980s.

The economic opening-up that started in 1978 saw a marked acceleration in urbanisation. Restrictions on population mobility were eased and many people were allowed to return to urban areas. In 1984, people with an agricultural *hukou* were allowed to move to cities as long as they could provide themselves with food and lodging. In addition, in small towns and county cities, pilot programmes were introduced to reduce differences between urban and rural *hukou* holders. Finally, a new temporary residence permit was introduced for people who moved outside their registered location. The entrepreneurial spirit generated by the liberalisation of farming helped create a large number of small enterprises drawing local people into towns and smaller cities, which were also favoured by the policy of industrialisation without urbanisation. The overall result was that during the 1980s and 1990s smaller cities grew faster than large cities (Fan, 1999; Anderson and Ge, 2005).

The faster development of smaller cities was in fact an explicit policy objective. In 1979, the Chinese Communist Party decided that the country should develop its small towns and gradually equip them with modern industry so that they could transform the countryside. The growth of large cities was to be constrained by building satellite cities around them. Twenty years later this policy was still in place, with the Communist Party stating that the government should avoid the "blind" flow of labour to large and even medium-sized cities, and calling for measures to promote the development of small towns.

The fast development of small cities came in a period when the price of land was effectively set to zero. All land in the administrative area of urban district governments belonged to the state. Urban land was given to state-owned enterprises (SOEs) which developed in accordance with the priorities of the government bureaux which managed them. This led to an irrational use of land in cities. For example, in 1990 in Shanghai over one-quarter of land in the central districts was under industrial use, which included housing for the workers in those firms. Experiments in selling land-use rights started in Shanghai and Shenzhen during the 1980s but it was not until 1990 that the State Council disseminated the *Provisional Regulations on the Granting and Transferring of Land-Use Rights for State-Owned Land in Cities and Towns*. This document introduced the concept of time-limited land-use rights (similar to land leases) that were transferable but did not confer ownership of the land itself. The law was implemented at the local level and most projects involved commercial developments.

But land and migration policies changed markedly…

While the legal framework had changed, progress in introducing a market in land was limited during the 1990s. Most local governments saw land as a means of housing new industrial enterprises. New development meant higher tax revenues, part of which could be kept by the local government. This resulted in competition between areas which meant that most land for industrial use was assigned without any payment. The transformation of the land market only occurred once the housing market had been reformed.

Reform of the housing market took over a decade. A 1988 government document called for privatisation of housing, but few SOEs responded and this stymied the reform as most urban workers were housed by their employer at the time. In 1994, a State Council *Decision on Deepening Housing Reform* created two types of new housing construction: economic housing and commodity housing, with the former being reserved for low and middle-income

families. At the same time a housing saving system was introduced. The reform did not deliver the desired results (Deng *et al*., 2009): development companies started but most new housing was sold to SOEs that in turn sold the flats to employees at a large discount.

The nature of the urbanisation process changed in 1998, however, when the State Council issued its *Decision on Further Deepening the Reform of the Urban Housing System and Accelerating Housing Construction*. This document broke the link between the enterprise and housing for its employees. SOEs were forbidden to buy new housing and had to sell their existing stock to the occupants, opening the way for commercial development of housing that responded to market requirements.

While the above reforms set the scene for market-oriented development, the *Land Administration Act* that came into effect in 1999 has constrained the urbanisation process. It provides that land should be split into three categories: *i)* basic agricultural land, which cannot be rezoned into building land without permission from the State Council; *ii)* remaining agricultural land (20% of total agricultural land), which can be rezoned only if other land is brought under cultivation, and subject to permission from the State Council if the rezoning covers more than 35 hectares; *iii)* land which was designated for development prior to the passage of the law.

Migration laws and regulations were liberalised after land and housing markets. In the 1990s, the policy focus was still on preventing the rural labour force from moving to large cities, as spelled out in a notice from the State Council and other Ministries on *Further Improving the Control of the Outflow of Migrant Workers*. It was not until 2002 that policy started to change with measures to cancel fees for migrant workers and improve training.

… allowing rapid urbanisation and city expansion

Between 1978 and 2011, the urban population has grown by a factor of four. Before the late 1970s, the urban population was growing by less than 5 million people per year. By the decade that ended in 2010, it was expanding by 20 million per year. As a result the proportion of people living in urban areas rose from 17% to almost 53% between 1978 and 2011.

Not all people who live in urban areas live in cities, yet cities rather than urbanisation are key to growth. Cities provide large labour markets where specialist occupations can thrive, facilitate the exchange of information and allow to cluster activities. In addition, cities offer diverse cultural and entertainment possibilities that are only viable in large economic catchment areas. For this reason, the development of cities seems more important than urbanisation itself. A dispersed set of villages each with a population density of more than a set level might be considered as urban but would not constitute a city where agglomeration economies can be reaped.

In China, the word city is used to describe an administrative area that might not, outside of China, be seen as city. A city can cover an area that is physically huge and contains both a large urban core and a vast rural hinterland (*e.g.* Chongqing). Within that hinterland, there can be areas that are also known as cities but which differ little from neighbouring areas which are not called cities. By the administrative definition there are over 600 cities in China, ranging in status from directly-controlled municipalities to provincial capitals with a direct link to the central government, prefectural-level cities and finally relatively small county cities. This classification takes little account of urbanisation factors but generates a hierarchy of areas, each with less administrative power. In order to exclude areas that are actually more rural than urban, the new analysis presented below rests on the notion of

metropolitan areas, identified using two criteria: an overall population greater than 300 000 and a population density exceeding 500 people per square kilometre at the lowest administrative level, which is that of a county (Herd *et al.*, forthcoming). On this basis, there were 515 metropolitan areas in 2010 (Table 1.1). These generate the bulk of valued-added in China: indeed, just 200 of them accounted for slightly over half of GDP in 2010.

Table 1.1. **Administrative structures identified as metropolitan areas**[1]

Type	2000	2010	2000	2010	2010		
	Number		Population (millions)		% of national population	% of national GDP	Density (people per km^2)
Directly-controlled municipalities[2]	4	4	39.0	58.6	4.4	10.7	2 317
Specially designated cities and provincial capitals	25	26	74.2	102.8	7.7	16.0	2 222
Specially designated cities which are not provincial capitals	5	5	16.8	22.5	1.7	5.3	2 421
Prefectural cities	143	157	151.8	180.9	13.5	20.7	1 205
County cities	111	112	92.2	99.1	7.4	11.0	762
Counties	226	211	170.0	149.7	11.2	7.6	656
Total	**514**	**515**	**543.9**	**613.5**	**45.8**	**71.2**	**1 041**

1. The definition of a metropolitan area excludes the population of those urban districts which had a population density of less than 500 people per km^2 in 2010.
2. In the Chongqing Municipality, only the population of the urban districts of Chongqing city has been included.

Source: Census communiqués and National Bureau of Statistics.

People have moved to higher-income cities

Higher-income cities have been acting as magnets for migrants from rural areas. Across the metropolitan areas considered here, a level of GDP per capita 10% above the average in 2000 has been associated with a 1.5% increase in population through 2010. In 2000, the largest cities already tended to have the highest incomes and so they have tended to see their population grow fastest (Figure 1.3). Indeed, just 5% of cities which had the largest population in 2000 accounted for over 60% of the absolute increase in the population of all the selected metropolitan areas (Figure 1.4), despite policy efforts to constrain the growth of large and super-large cities. At the same time, policies to favour the growth of small and medium-sized cities have indeed spurred the growth of cities of below one million inhabitants. In contrast, nearly one third of the selected metropolitan areas saw their population shrink in the decade ending in 2010. Moreover, a further 145 experienced net outward migration, even though their population did not fall.

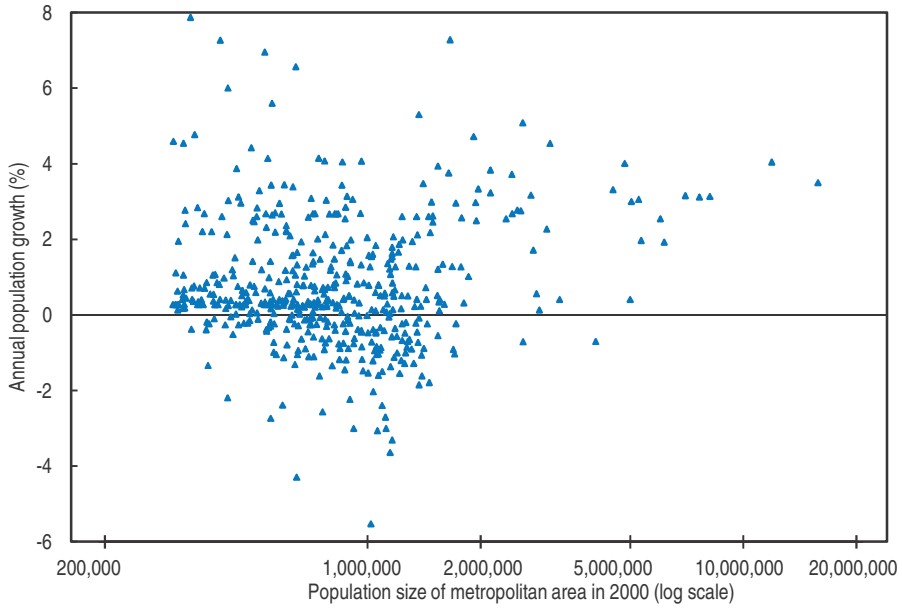
But the urbanisation rate and size of cities remain relatively low

With larger cities expanding faster than smaller cities the size distribution of Chinese cities has moved closer to that seen in the rest of the world (Table 1.2). The share of the population living in cities of over 8 million inhabitants has almost tripled but, reflecting constraints on the growth of very large cities, still remains well below the proportion of the population living is such large cities in the rest of the world.

Despite the rapid growth of cities, the urbanisation rate in China is still somewhat below the level that might be expected on the basis of its per capita income (Figure 1.5). Indeed, the gap has barely changed in the past decade. The question remains whether urbanisation is a driver of income growth or whether higher incomes result in people wanting to move to

Figure 1.3. **Metropolitan areas: annual population growth and initial size**

2000 to 2010

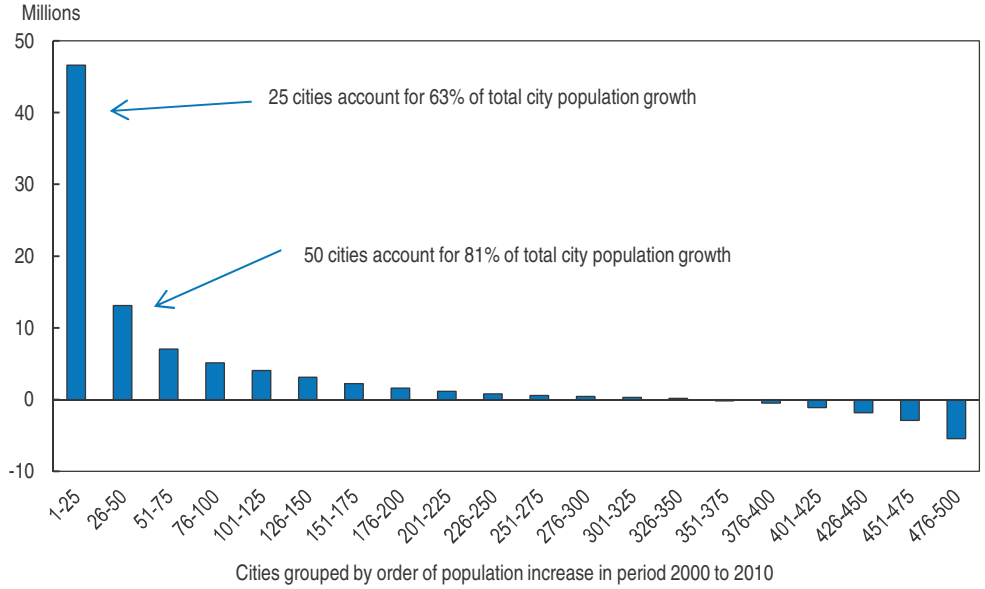


Source: National Bureau of Statistics: Statistical communiqués on the census issued by prefectural NBS offices.

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Figure 1.4. **The concentration of population increase across metropolitan areas**

Increase from 2000 to 2010



Note: Of the 515 identified metropolitan areas, the 15 with the smallest population have been excluded for presentational purposes.

Source: OECD calculations using 2010 Census data.

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cities, or whether it reflects the decline of the agricultural sector as a country develops. While estimating the agglomeration economies due to urbanisation is difficult, there is a robust consensus that such economies are substantial (Glaeser and Gottlieb, 2009).

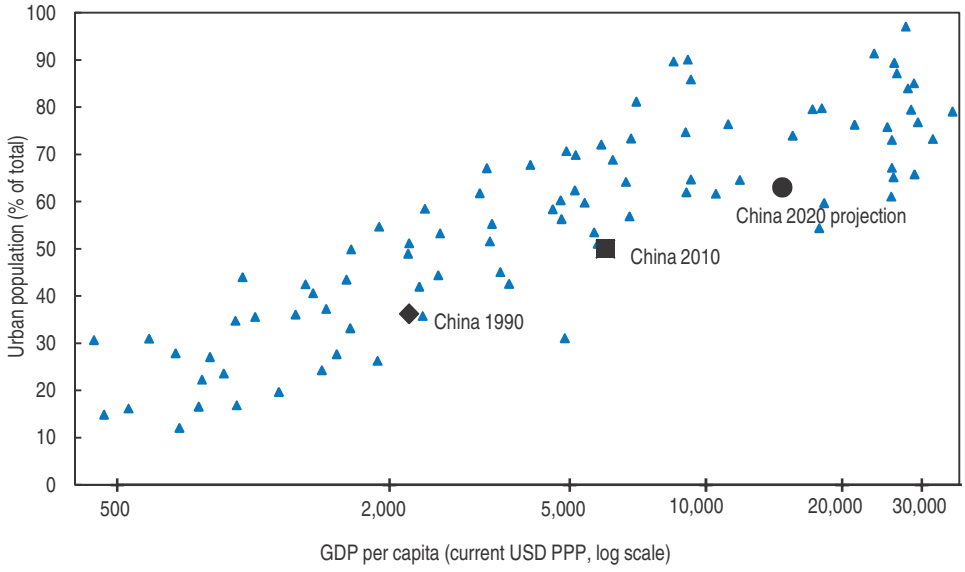
Table 1.2. **City size distribution: China and the rest of the world**

City size	2010		2000	
	China	World ex. China	China	World ex. China
	As share of total population			
Over 2 million	16.9	19.4	11.8	11.6
Over 8 million	5.9	9.6	2.1	5.7
	Number of cities per billion population			
Over 2 million	33.6	23.0	26.6	29.1
Over 8 million	4.5	5.6	1.6	4.4

Source: China 2010, 2000: National Bureau of Statistics Census communiqués and Census tabulations; World ex. China 2010: Demographia (2012), 2000: Henderson and Wang (2004).

Figure 1.5. **Urbanisation and level of income worldwide**

All countries with populations over 15 million



Source: World Development Indicators (IBRD) and National Bureau of Statistics.

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Urbanisation has brought considerable benefits

Productivity and living standards are higher in large metropolitan areas

Agglomeration economies allow larger cities to be more productive, and explain that growth tends to be concentrated geographically. While urbanisation is thus a powerful engine of growth, it also brings other welfare gains, including by improving the variety of available goods and services for consumers (Glaeser, 2011). Moreover, agglomeration benefits obtain even when individual metropolitan areas are not completely contiguous. To wit, GDP per capita is very high in several urban corridors or clusters of cities, such as the two corridors running north-west and south-east of Shanghai. In all, there may be between 28 and 53 such areas across China (Kamal-Chaoui *et al.*, 2009).

As with the increase in population, the creation of value-added is concentrated across cities. Indeed, 40% of the GDP produced in the 515 metropolitan areas stemmed from the top 25 ones in 2010, where on average GDP per capita, at purchasing power parity, is equivalent to Portugal's (Figure 1.1). The following 75 metropolitan areas produced a further 30%. The concentration of GDP is more extreme than that of population because the larger cities also display higher productivity. As with population, the extent of the concentration of GDP has increased somewhat since 2000. Even allowing for the differences in prices between urban and rural areas, the higher income levels in cities translate into higher living standards.

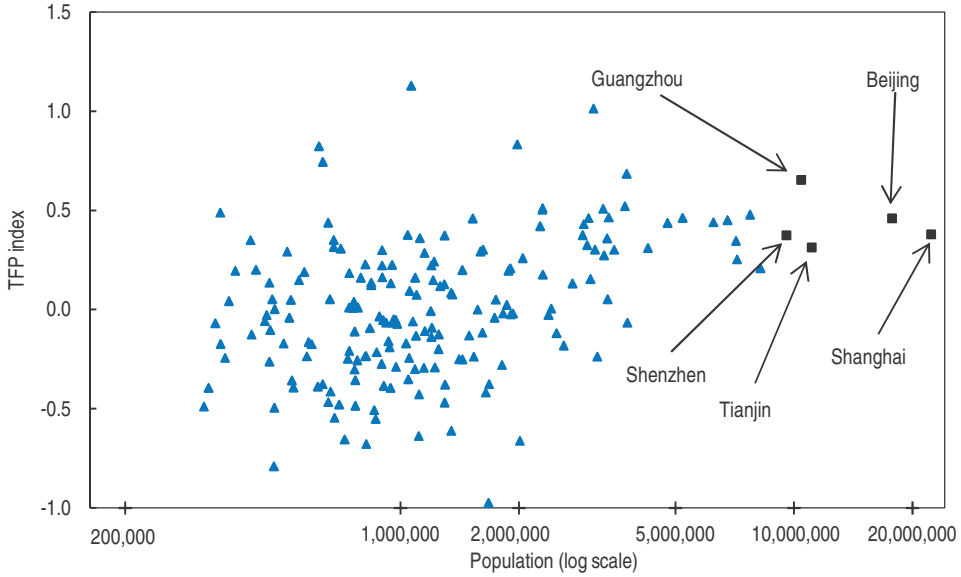
City size is a major determinant of income per capita, even if a simple correlation between the two can be misleading. Many factors influence city competitiveness (OECD, 2006): cities that were initially more productive thanks to a favourable physical location or political supremacy, for example, may have accumulated more capital; better educated people may have moved to larger cities, raising productivity. Focusing on size, two approaches have been used in the literature on Chinese cities: one used size as an input to explain the productivity of a city (Wang and Xia, 1999), the other tried to allow for increased commuting times in bigger cities (Au and Henderson, 2006). These two approaches gave very different results. Wang and Xia found that productivity gains outweighed external costs (as measured by government expenditure) until cities reached a size of 10 million people. Au and Henderson found that net of external costs associated with city size the productivity of cities peaked at a size of around 1 million. They concluded that most cities were undersized but a few were oversized, even in 1999. However, both studies used registered rather than actual city population, thereby overstating the extent of agglomeration economies since migrants are predominately in large, high-income cities.

Even so, the relationship between city size and productivity (proxied by GDP per capita) is fairly robust in China. In the largest ten (2%) metropolitan areas, GDP per capita is nearly 60% higher than in the bottom 2%. One major factor that can explain the differences in productivity across cities is the amount of capital available per person. The total capital stock in each of the chosen metropolitan areas cannot be measured. However, for the major areas the total fixed assets of industrial enterprises is available and can serve to proxy the total capital stock in a city. Using the actual population, as given by the 2010 census (rather than the registered population), as a proxy for employment, a simple Cobb-Douglas production function can be estimated and yields a capital share in income of 0.47. This estimate is in line with the results of macroeconomic production functions and with income shares, as well as with the estimates in the two above studies.

Once the inputs of capital and labour are accounted for, there remain significant differences in productivity across cities that are correlated with city size (Figure 1.6): there is a clear positive relationship between the productivity that is unexplained by a standard Cobb-Douglas production function approach and population size. There are diminishing returns to scale, however: the gain in efficiency from moving from a population of 400 000 to a population of 500 000 is much greater than the gain from moving from 20 million to 25 million.

It might be that as cities increase in size, efficiency stabilises or even starts to fall. In order to assess whether this might be the case in China, the average efficiency gain as size increases for cities with a population between 300 000 and 9 million has been used to estimate the average efficiency level in the five largest cities in China (Beijing, Guangzhou, Shanghai, Shenzhen and Tianjin). Actual efficiency levels in the mega-cities turn out to be in

Figure 1.6. **Total factor productivity and city size**[1]



1. The vertical axis of this chart shows the residual from an estimated Cobb-Douglas production function where the labour and capital coefficients have been constrained to add to unity. Employment has been proxied by population and capital by industrial sector fixed assets. The equation has been estimated over 180 metropolitan areas for which a full dataset was available in 2010.

Source: OECD calculations.

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line with this relationship, except for Shanghai, the largest metropolitan area, where it is lower. This need not be related to size, however. Other factors affect the efficiency of a city, such as the business environment and economic model pursued by the local government.

Across OECD countries, the relationship between city size and productivity is much looser. There is some evidence that productivity levels rise with size up to a population level of 6 million, especially when a city has more than one-fifth of the total population in a country (OECD, 2006) and then starts to decline (Herd *et al.*, forthcoming). However, the relationship is extremely weak and barely statistically significant. One reason for the differences in the productivity relationship between cities in China and those in the OECD area may lie in the non-market barriers to city expansion in China both in the labour market and in the land market where administrative hurdles have, in the past, tried to restrict migration so preventing wage equalisation across the country and even within provinces (OECD, 2010a).

Such evidence as is available from outside China points to economies of scale in administration costs. In 635 Japanese cities, the cost per capita of providing public services was shown to decline with size (Nakamura and Tahira, 2008). When looked at by cost centres for a sub-sample of around 130 cities, increasing returns to scale were most noticeable in areas involving infrastructure but could also be important in the provision of some social services (Table 1.3).

Table 1.3. **Elasticity of public expenditure per capita with respect to population size**

Prefecture	Sanitation	Civil engineering	Education
Hyogo	-0.101	-0.189	-0.117
Osaka	-0.573	-0.531	-0.598

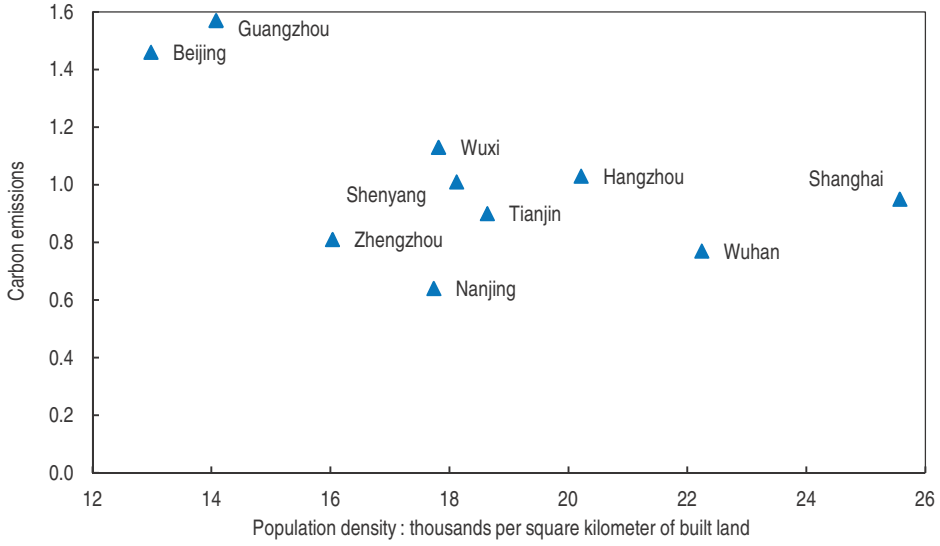
Source: Nakamura and Tahira (2008).

Compact cities are energy efficient but industrial parks have proliferated

Cities in China tend to be compact and compactness can contribute to urban sustainability in many, mutually reinforcing ways (OECD, 2010b). The dense and proximate development patterns of compact cities reduce the intra-urban travel distances, result in a lower level of automobile dependence and offer the possibility of more district-wide energy utilisation and local energy generation (Matsumoto and Sanchez-Serra, 2012). Several studies in OECD countries have shown that it is the density rather than the overall size of a city that is important in reducing carbon dioxide emissions and this also appears to be the case in China, where cities are far denser than in the OECD area (Figure 1.7).

Figure 1.7. **Carbon emissions from ground transport per capita and population density**

Emissions measured as tons of CO_2 per person



Source: Wang *et al.* (2012).

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However, while cities are relatively compact, standalone industrial and mining sites have proliferated. During the initial stages of China's economic take-off, national development zones were a key source of growth. Following their success, most local authorities, down to the county level, created similar zones or industrial parks. By 2003, there were nearly 7 000 zones covering an area nearly 30% greater than the then built-up area of the country. Even though the government closed many of the undeveloped zones, standalone industrial and mining sites still cover vast areas, using up more land than cities and designated towns (Zhang, 2011; He *et al.*, 2012). The central government is concerned that frantic industrial land development by local government may lower the efficiency of land use and give rise to excessive demand for transport.

Mitigating the costs associated with urbanisation

While urbanisation brings a number of benefits, it also has costs, especially beyond a certain size. One relates to congestion, which can be alleviated through congestion charging (see Chapter 2) and by developing the transport network and providing adequate public transport infrastructure. Cities also regroup many industries and generate more

trips than rural areas, so generating an increase in emissions of pollutants. However, the evidence from Europe is that the external costs of emissions do not rise in line with city size. As a result, the per capita external cost of pollution tends to fall with increases in city size beyond a relatively low threshold (Holland and Watkiss, 2004). Moreover, if appropriate pollution taxation is introduced, the externalities can be internalised and reduced, making the city more attractive (Henderson, 1974).

Public transport provision has fallen behind urbanisation

Public transport policy began to change a few years ago. In 2006, the NDRC, Ministry of Finance, Ministry of Construction and Ministry of Labour jointly spelled out guidelines to cities on the *Economic Policy for Priority Development of Urban Public Transport*. In 2007, the State Council made increasing public transport use a key element of its Comprehensive Energy Reduction Work Programme. However, at city level, there is often no integrated structure for achieving this goal: responsibilities are spread over many departments (Pan, 2011).

The 12th Five Year Sub-Plan for Transport calls for the orderly construction of light rails, subways, tramcars, and so forth, and for urban rail transit networks based on differentiated targets reflecting size and characteristics. Cities with a population of over 10 million should gradually enhance their existing urban rail transit network, cities over 3 million should establish a framework for an urban rail transit network, and cities over 1 million should construct large-capacity ground public transport systems as needed. The government has an objective of raising the market share of public transport to 40% by 2015.

A considerable deficit in provision needs to be overcome. In the ten largest cities, the average rail density per square kilometre is only one quarter that in major urban areas outside of mainland China and the density per million people is only one fifth (Table 1.4). In these ten areas, bringing rail density up to world averages would require constructing 5 000 kilometres of track. The new metro system in Hangzhou is expected to cost CNY 0.9 billion per km (USD 140 million), far less than new subways systems in Europe. Even so, the cost of bringing the ten major Chinese cities up to the world level of provision, given their population in 2010, would amount to CNY 4.5 trillion (11% of 2010 GDP).

With around 20 million people migrating to urban areas each year, the target for public transport will need to be raised. If the experience of the past ten years were repeated, just over half of the increase in urban population would take place in the 50 cities with a population currently at or close to 2 million. The density in the smallest quarter of these cities (in terms of population per square kilometre of built area) may not be high enough to justify metros as it is well below the 15 000 threshold considered necessary for a subway system. Even so the built area of the largest three-quarters of these cities is likely to expand at least in proportion to population, creating the need for around another 1 500 km of urban railways. Starting with the stimulus plan of 2008 and continuing with the announcement of projects authorised under 12th Plan, the government has given the green light for the construction and extension of subways in 33 cities, which will bring the total number of cities with subways to 35 (Table 1.5). The effort is being undertaken at a time when the level of economic development in major cities is in line with that in the United Kingdom and France when their subway lines were largely completed. In the following five years, construction is projected to continue apace and by 2030 the total length of all networks may approach 11 000 km. The eventual expected availability and density of the networks varies considerably across cities. A number of smaller ones have objectives in terms of availability

Table 1.4. **Rail transport systems in large metropolitan areas**

As of 2012

	Length of transport system			Demographic indicators			Transport indicators	
	Commuter rail	Subway	Total	Population	Area	Density	Availability	Density
	Kilometres			Million	Km^2	People/ km^2	Km/ million people	Metres/ km^2
Outside mainland China								
Hong Kong, China	0	174	174	7	275	25 455	25	633
London	1 912	436	2 348	12	4 144	2 951	192	567
Osaka-Kobe-Kyoto	1 095	234	1 329	15	2 719	5 608	87	489
Paris	1 012	213	1 225	10	2 745	3 515	127	446
Seoul/Incheon	249	701	950	23	2 163	10 402	42	439
Tokyo-Yokohama	1 779	360	2 139	31	5 258	5 934	69	407
Singapore	0	147	147	5	466	10 944	29	314
Nagoya	528	89	617	8	2 823	2 851	77	219
New York	979	456	1 435	20	11 137	1 823	71	129
Taipei	0	110	110	8	1 140	7 281	13	96
Mainland China								
Shanghai	56	312	368	22.3	2 825	5 776	16.5	130.3
Guangzhou	0	232	232	10.4	1 953	5 263	22.3	118.8
Tianjin	0	131	131	11.1	1 400	5 166	11.8	93.6
Shenzhen	0	178	178	9.6	2 505	6 579	18.5	71.1
Beijing	86	372	458	17.7	7 537	4 804	25.9	60.8
Fosham	0	20	20	6.8	333	20 420	2.9	60.1
Wuhan	0	56	56	7.7	1 024	7 520	7.2	54.7
Chongqing City	0	87	87	7.5	1 774	7 979	11.6	49.0
Nanjing	0	87	87	7.2	2 741	4 758	12.1	31.7
Dalian	0	63	63	3.4	3 068	7 930	18.5	20.5

and density that are well above those found in bigger cities. There may thus be a degree of over-investment in subway networks in smaller cities.

As cities become larger, the strategy may need to change from building subway systems to building commuter rail systems that have less frequent stations and hence achieve faster journey times from the more distant parts of cities. In Beijing, a commuter rail system is being developed. It is not managed by the urban transport system but by a subsidiary of the Ministry of Railways. By 2020, it is expected to be of a similar size to the current metro network.

A newer development has been the growth of bus rapid transport (BRT) systems but this has not been sufficient to improve the overall availability of buses. Eleven cities now have BRT, with dedicated lanes for buses on existing highways or in some cases on newly-built roads. The total length of these systems is around 650 km. BRT is not widespread yet: one third of the Chinese network is in a single city, Guangzhou, where the 22 km dedicated route carries slightly over 800 000 passengers per day and has quickly paid back its investment. This passenger flow is greater than that on all but two metro lines in China and equivalent to 40% of the entire number of bus riders in New York City (Hughes and Zhu, 2011). This experience replicates success in other cities where BRT delivers high passenger flows at relatively low cost (Suzuki *et al.*, 2011). However, local governments have not invested sufficiently in this form of public transport. The overall number of buses grew by 5.4% per year between 2000 and 2010, barely faster than the growth of built land in

Table 1.5. **Existing and planned subways in China**

	Population of urban districts 2010	Area	Length of subway and commuter rail network as of 2012	Length of projects under construction	Planned over the longer haul	Eventual target 2020 or 2030	Eventual availability of network	Eventual density of network
	Million	Km^2	Km	Km	Km	Km	Km per million people	Metres per km^2
Fosham	6.8	333	20	139	107	266	39.1	799
Wuhan	7.7	1 024	56	63	411	530	68.8	518
Zhengzhou	4.3	455	0	53	149	202	47.0	444
Guangzhou	10.4	1 953	232	318	291	841	80.9	431
Fuzhou	2.9	556	0	55	129	184	63.4	331
Shanghai	22.3	2 825	368	202	307	877	39.3	310
Taiyuan	3.4	839	0	49	187	236	69.4	281
Dongguan	8.2	1 088	0	37	227	264	32.2	243
Shenyang	5.2	1 353	50	94	182	326	62.7	241
Nanjing	7.2	2 741	87	58	455	600	83.3	219
Tianjin	11.1	1 400	131	90	81	302	27.2	216
Ningbo	3.5	478	0	21	80	101	28.9	211
Xi'an	6.5	2 868	21	75	501	597	91.8	208
Shenzhen	9.6	2 505	178	159	126	463	48.2	185
Nanning	2.3	1 014	0	32	146	178	77.4	176
Chongqing	7.5	1 774	87	128	86	301	40.1	170
Wuxi	3.0	1 460	0	58	188	246	82.0	168
Beijing	17.7	7 537	458	28	650	1 136	64.2	151
Harbin	4.8	1 142	0	17	145	162	33.8	142
Hangzhou	6.2	2 465	0	49	230	279	45.0	113
Qingdao	3.7	2 081	0	54	177	231	62.4	111
Nanchang	2.3	1 622	0	50	118	168	73.0	104
Guiyang	2.3	2 129	0	55	142	197	85.7	93
Dalian	3.4	3 068	63	150	49	262	77.1	85
Suzhou	1.6	1 669	25	22	94	141	88.1	84
Wenzhou	3	2 908	0	51	184	235	78.3	81
Changchun	2.9	3 547	51	43	163	257	88.6	72
Kunming	3.3	2 612	18	83	86	187	56.7	72
Lanzhou	2.5	2 922	0	27	180	207	82.8	71
Hefei	3.4	4 727	0	56	266	322	94.7	68
Shijiazhuang	2.7	1 188	0	35	24	59	21.9	50
Xiamen	2.3	5 155	0	31	215	246	107.0	48
Chengdu	7.1	5 473	40	67	143	250	35.2	46
Changsha	3.1	2 560	0	46	60	106	34.2	41
Changzhou	3.3	7 128	0	54	75	129	39.1	18
Total	**197.5**	**84 599**	**1 885**	**2 549**	**6 654**	**11 088**	**56.1**	**131**

metropolitan areas. By contrast the road area grew by 8.4% annually and the number of privately owned cars at an annual rate of 25%.

While there are no statistics on average daily commuting times in all Chinese cities, in Beijing and Shanghai, they are 79 and 69 minutes respectively (Zhaopin *et al.*, 2012), well above the OECD average of just under 40 minutes and higher than in Korea, the OECD country where commuting takes up most time (OECD, 2011). The development of high-volume urban transport systems has not kept pace with city growth. Use of effective pricing can reduce the extent of congestion to an efficient level.

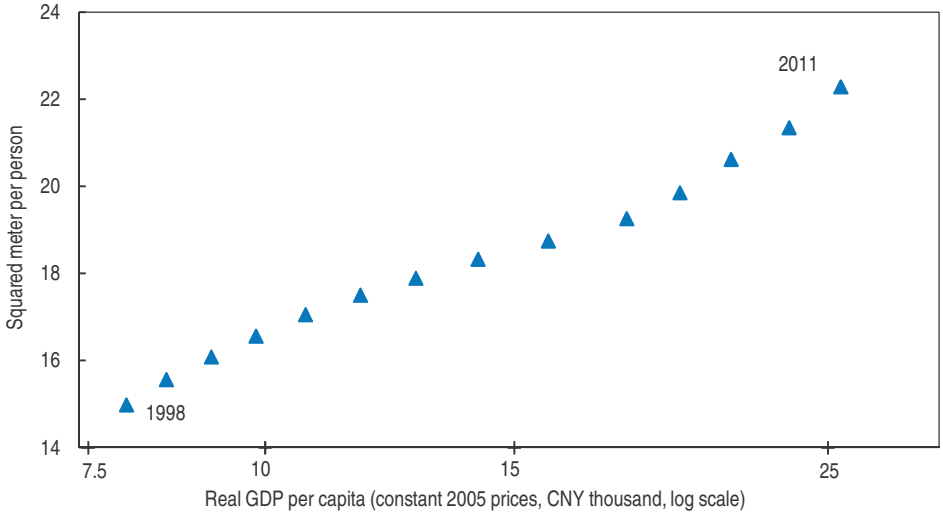
Housing and land

Demand for living space has been rising

Since the liberalisation of the housing market the average floor space occupied by an individual has steadily increased, helped by a decline in average household size. It is difficult to be precise about the extent of the improvement. Survey data are available but in urban areas they exclude migrants, whose housing demand is much lower *(e.g.,* in Beijing, their average floor space is just 8.2 m^2, against 27 m^2 for official residents, according to Zheng *et al.*, 2009). It is possible to estimate the total floor area of housing from new construction data but these suffer from another defect. The official data only counts housing on state land and not that on collective land within cities. Such housing is always considered by the government as rural even if it is quite clearly urban in the normal meaning of the word. This anomaly stems from the legal distinction between rural and urban land. The former is owned by the village council on a collective basis whereas in the historic urban area, land is owned by the state. As cities have expanded the urban areas have surrounded rural areas. A significant proportion of what by appearance and location is urban land is officially classified as rural land. In many major cities, developed collectively-owned land is equivalent to one-third of the area of developed state-owned land.

Given the conflicting definitions of urban and rural in different official statistics, the most effective way to assess the increase in overall living space is to use a national average. Based on initial average living space data for 1978 (when this distinction was of little importance due to the smaller size of cities and the near absence of migration), and the subsequent construction of new property and demolition of existing buildings, the average living space gross floor area available to an individual has increased from around 7.5 m^2 to around 22 m^2 in 2011, very much in line with the growth of real incomes (Figure 1.8).

Figure 1.8. **The relationship between living space and GDP per capita**



Source: CEIC, NBS and OECD calculations.

StatLink *To download the data corresponding to this graph, refer to Figure 24.*

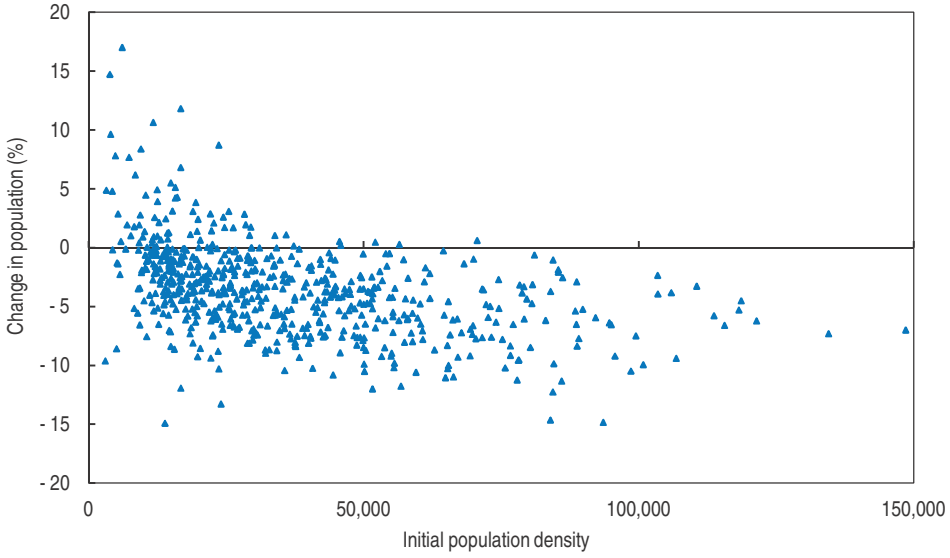
Demand for housing space has, however, increased less than in other East Asian countries: in China, a one percentage point increase in income has been associated with an increase of living space of 0.06 m^2, compared with a gain of 0.13 to 0.25 m^2 in a cross-

country panel (Berkelmans and Wang, 2012). This is probably related to the scale of internal migration in China. As the income of migrants rises, their incremental demand for housing is extremely low (less than one quarter of the increase registered for official urban residents). Even so, with rapid per capita income growth since the liberalisation of the housing market in 1998, per capita absolute housing demand has risen by 0.5 m^2 per year, equivalent to a demand increase of 2¾ per cent annually.

And people prefer lower-density living

The fall in population density has been concentrated in the metropolitan areas with the highest initial population densities: where population density was initially low (below 10 000 people per km^2), it has in fact often increased (Figure 1.9). This is in line with studies showing that higher wage levels are associated with lower densities and with studies of local housing prices showing that high plot ratios for apartment developments lower housing prices.

Figure 1.9. **Change in population density and initial density**



Source: National Bureau of Statistics census communiqués.

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Densities are likely to continue to decline in a number of major urban areas for many decades. In the Pearl River Delta area, for example, the city of Dongguan has an average population density of 89 000 per km^2, while in certain areas of Shenzhen population densities are over 200 000 per km^2 of residential land (Wang, Wang and Wu, 2009). Such high densities are unusual in developed countries and in China are a reflection of the small amount of space demanded by migrants and historical acceptance of dense living conditions.

The extent of new and existing transport infrastructure has also been a key factor in lowering the very high densities formerly seen in Chinese city centres. In cities with one radial railroad line, 14% of central city output moves to the outskirts. Road networks have an even more pronounced impact on the location of people. Each ring road in Chinese cities results in a marked drop in the share of the city centre population in the prefecture and in an outward movement of industrial population (Baum-Snow *et al.*, 2012). The latter tends

to reduce the cost of central accommodation and so allows a greater influx of migrants. Indeed, the provision of a peripheral ring road to each prefectural city without such infrastructure in 2010 would likely raise the urban population by 50 million people (Baum-Snow and Turner, 2012). Moreover, the outward movement of production generated by rail networks benefits neighbouring rural areas, as documented in other studies of Chinese counties (Banerjee *et al.*, 2012).

Population growth has added to the demand for extra housing

The growth in the population of cities has added to the demand for extra living space generated by higher incomes. Overall, population density has fallen (Table 1.6). However, this mostly reflects greater floor space per person, since building density has remained relatively stable. In the 515 metropolitan areas, almost 52% of the increase in the built area between 2000 and 2010 has been the result of an expansion in the average living space, while population increase has accounted for 44%. In county-level cities, population growth has not been a significant driver of demand for land, which has rather resulted from a decline in the building density and an increase in average floor space per person. The extent of land used for construction has been a major source of concern to the authorities in China. Yet, between 2000 and 2010, the overall increase in the use of land for construction in the 515 metropolitan areas has been just 1% of total arable land, bringing the total built-up area of theses region to just one fortieth of total arable land, with the average diameter of the built-up area of these metropolitan areas rising from 9 km to 12 km.

Table 1.6. **Population and building densities for metropolitan areas**

	All metropolitan areas				
	Annual average growth rate 2000-10				
	All densities	Higher densities			Lower densities
	Type of administrative city				
	All	All	Above county level	County level	Other cities
Population	1.5	2.1	2.4	0.7	0.3
Floor space per person	2.8	2.8	2.8	2.8	2.8
Total demand for floor space	4.3	4.9	5.2	5.0	3.1
Total built area	5.1	5.1	5.4	6.5	3.9
Building density	-0.8	-0.2	-0.2	-1.5	-0.8
Population density	-3.4	-3.3	-2.8	-5.5	-3.5
Memorandum items:					
Built-up land as share of cultivated land (%)	3.1	2.4	2.1	0.3	0.8
Number of areas	631	305	192	113	326
Share of total population (%)	100	67.2	51.8	15.4	32.8

Source: *City Statistical Yearbook*, Statistical communiqués for census results of individual cities.

Urbanisation and the demand for more space has pushed up housing investment

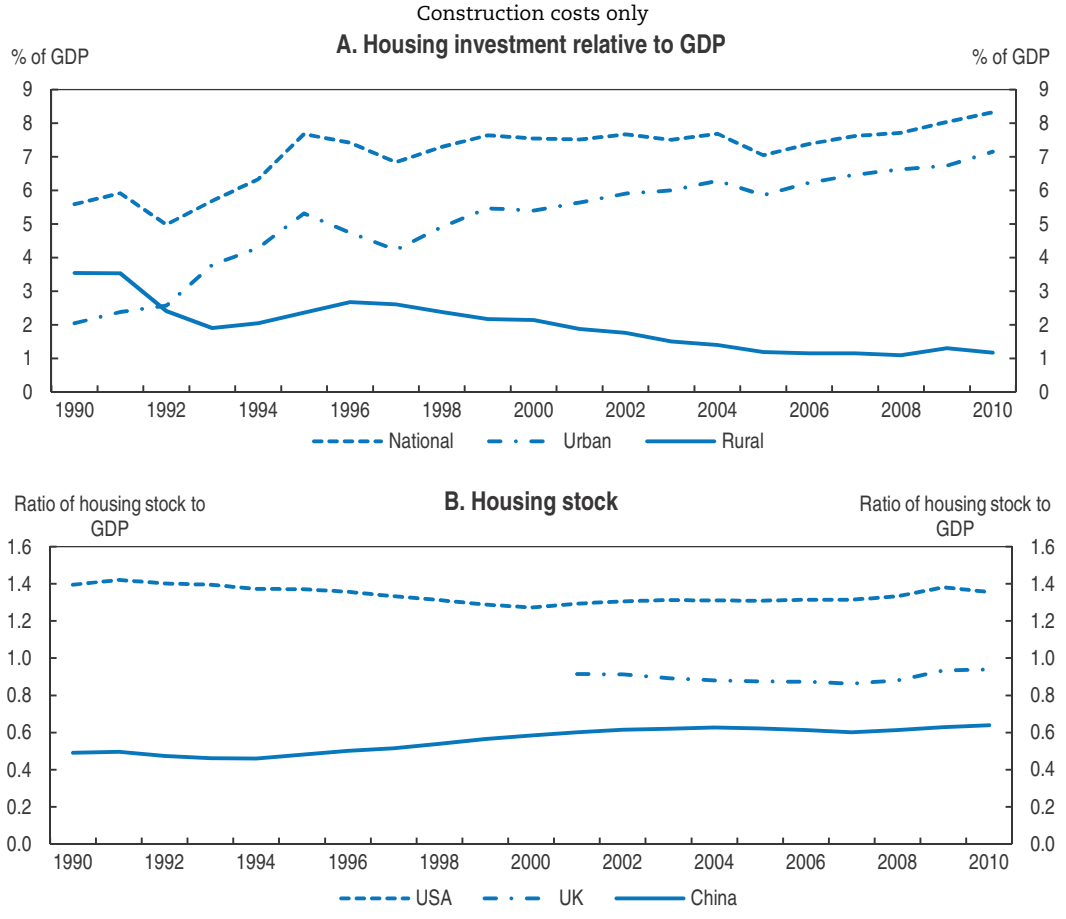
Massive urbanisation has necessitated a marked increase in the resources devoted to housing. In the first 30 years of the new China housing was not seen as a priority. Indeed, it was not until 1981 that the average living space for urban dwellers recovered its level of the early 1950s. By then the average per capita living space was still only 4 m^2 per capita, equivalent to around 8 m^2 of gross floor area per person (Annex 1 in Herd *et al.* [forthcoming] discusses various measures of living space). After 1980, urban housing was given more emphasis but investment remained low, at around 2% of GDP. In rural areas, however, the

liberalisation of agriculture and the migration to small towns and cities gave rise to a boom in rural housing that ended in the mid-1990s as migration to small towns fell back.

The urban housing market began to expand in the second half of the 1990s as land-use rights became marketable. Property developers entered the market, but initially few individuals bought their own apartment. Rather, housing units were still purchased by SOEs and allocated to their employees. But with the liberalisation of the housing market in the late 1990s investment in housing surged. Moreover, the nature of the market changed, with real estate developers selling apartments to individuals. Rural investment also grew rapidly. Two trends underpinned this boom: first, many rural areas were effectively engulfed by urban areas; secondly, migrant workers invested in a house in their village of origin.

Overall, the coincident boom in urban and rural housing pushed up investment in housing. There are no official data for residential fixed capital formation or for the housing capital stock. However, both series can be estimated from other official data sources (Herd *et al.*, forthcoming), which suggest that residential gross fixed capital formation rose to over 8% of GDP by 2010 (Figure 1.10, Panel A). The share of investment in GDP is considerably higher than that seen in OECD member economies, but with high capital consumption and rapid GDP growth the value of the housing (excluding land-use rights in China and land elsewhere) remains low in relation to developed economies and has been

Figure 1.10. **Residential investment and housing stock**



Source: Herd *et al.* (forthcoming).

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quite stable despite high net investment (Figure 1.10, Panel B). However, the estimates of gross fixed capital formation exclude the cost of transforming raw land, be it farmland or land that already has structures on it. This investment is undertaken by the government and included in the sale price of land (see below). A further factor causing the level of investment to be understated is that most Chinese apartments are sold either as shells or in a semi-finished state with the fitting-out spending borne by the acquirer.

The role of government in urban development

While the housing sector has become almost completely market oriented, local government still plays a key role in urban development. Land in urban areas is owned by the state, which can either sell land-use rights or allocate them to third parties, or transfer them to companies wholly owned by the local government in exchange for equity in these companies. Once the market in land-use rights was established, local governments quickly realised that the powers given to them under the Land Management Act meant that they could control the supply of development land in their administrative area. This markedly changed the institutional structure from that which prevailed in the first decade of urbanisation in the 1990s, when there was a significant black market in the land occupied by SOEs which sold their use rights even though there was no legal basis for the transaction.

Local authorities were quick to establish a series of agencies known as land banks. These were not established as companies but as public service units (PSU – a form of government agency). In 1998, there were just 49 such units. Five years later, 1 600 of the 2 300 administrative units in the country had established such land banks (Yang *et al.*, 2005). The focus of these agencies is generally land rather than city development. They acquire greenfield sites from village collectives and purchase existing structures for redevelopment in cities. Once either the land or the use-right has been acquired and the previous land users compensated, the PSU clears the land and installs basic urban infrastructure such as drainage, roads and utilities. Only then can a real estate promoter purchase the land-use right. Since 2007, land-use rights have to be sold by public auction or tender with the government setting a minimum reserve price. The local government prefers to sell large development plots. In 2006, in Beijing, the average size of a lot was 55 000 m^2, about the size of four city blocks in a North American city. With a plot ratio of 2.5 and an apartment size of 120 m^2, the average sales revenue from such a plot would be USD 450 million with slightly more than 1 000 units sold. Consequently, well capitalised firms dominated the property development market. The large size of plots is surprising in that, in Beijing, the larger the plot size the lower the land price (Bao *et al.*, 2008). This could occur because there are fixed costs of dealing with permits. It could also reflect problems in the design of auctions for the sale of land-use rights. Some auctions are designed as two-stage processes and often in the second stage there is only one bidder, resulting in a lower price than in traditional English-style auctions. There is evidence that officials choose to place the larger and most attractive plots into two-stage auctions, so raising the likelihood of corruption (Cai *et al.*, 2009).

Property developers have to comply with myriad of administrative procedures in order to start construction of commercial or residential projects (Box 1.1). In total, 33 procedures have to be followed, a number that is only exceeded in the Russian Federation. Overall, local experts estimate that the full procedure takes 311 days, in contrast to 26 days in Singapore and the United States; 30 days in Korea and 67 days in Hong Kong, China. Of 190 territories worldwide, only 15% take longer than China to complete formalities (World Bank, 2012).

Box 1.1. **Regulatory requirements for new construction**

- Submit application to obtain approval of the project proposal from the District Development and Reform Commission.
- Request and obtain the approval of request of construction project planning and design from the competent Department of Urban Planning.
- Request and obtain the approval of planning and design project for construction and the notification of the review of the design plan from the Urban Plan Department.
- Request and obtain the Planning Permit of Using Land for Construction Purposes from the Urban Planning Administration Bureau.
- Request and obtain the land using permit for construction from the State Land, Resources, and Housing Agency.
- Request and obtain an environmental evaluation.
- Request and obtain construction project planning permit.
- Request and obtain certificate of safety operation on construction project at the Safety and Quality Supervision Office of the Municipal Construction Commission.
- Request and obtain evidence of capital from bank.
- Hire an authorised supervision agency.
- Register construction drawings at the People's Civil Defence office.
- Review of construction drawings by the City Appearance and Environmental Sanitation Administration Bureau.
- Review of construction drawings by the Fire Protection Bureau.
- Review of construction drawings by the Traffic Police District Level Team.
- Obtain a letter of notice after review of building drawings by a building drawing examiner authorised by the Construction Project Document Review Centre.
- Register for direct contracting of construction with the District Tendering Office.
- Have the building contractor and supervisor seal the application form.
- Pay the fees for funds of concrete and energy-saving wall materials with the Office of Building Materials of the Municipal Construction Commission.
- Request and obtain building permit after having obtained all previous permits.
- Receive on-site inspection by the Construction Commission.
- Receive "Four-Party" Inspection from the site inspector, the designer, the builder and the supervisor.
- Request and receive inspection of the completed construction from the planning department.
- Request and receive fire department inspection upon building completion.
- Request opinion on whether construction project is lightning-proof.
- Request and obtain certificate of the completed construction from the fire department.
- Request and receive inspection of the completed construction from the environmental protection department.
- Request and receive inspection on construction completion and inspection from the Municipal Construction Committee.
- Request and obtain certificate of completion and certificate of final inspection from the Municipal Construction Commission.
- Register building with Real Estate Registry.

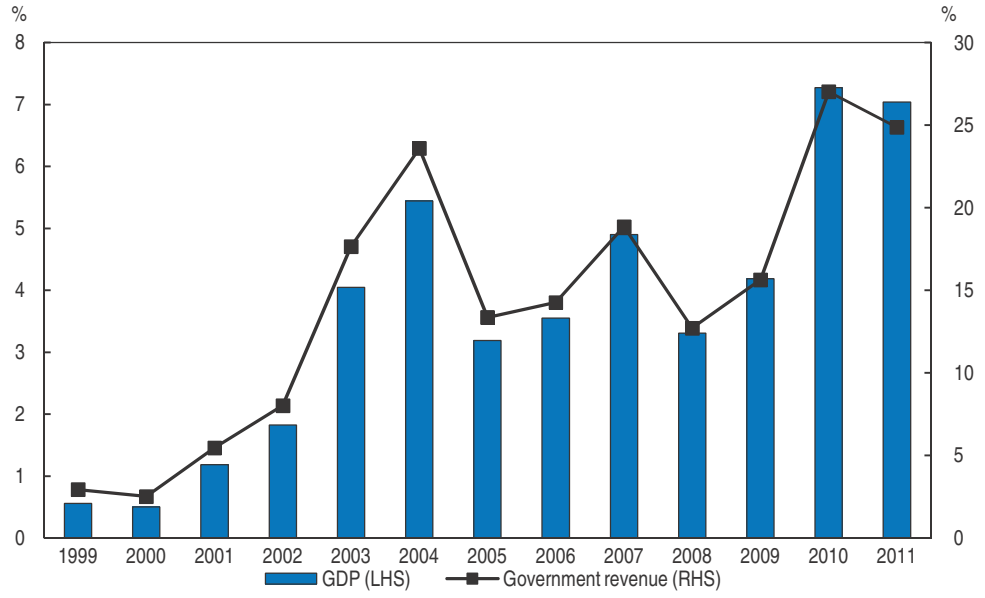
Source: World Bank (2012).

Land sales as a source of revenue

During the period of strongly rising house prices from 2008 to 2010, the gross revenue flowing to local governments from the sale of land-use rights increased rapidly but it is difficult to trace the exact use of the money. Total revenue from the sale of land-use rights peaked at 7.3% of GDP in 2010 (Figure 1.11). The allocation of this money is far from transparent. In 2011, according to the Ministry of Finance (2012), nearly four-fifths of the gross revenue of local government from land sales was spent either on compensation to previous owners/users or on redevelopment costs. The redevelopment work probably includes the standard public facilities on the land, such as schools, clinics and the like, the size of which is set down by law. A further 8% of total revenues were earmarked for specific purposes by legislation – notably for creating new farmland. The surplus available for spending by the local authorities amounted to 18% of the gross revenue from sales (1.3% of GDP) and represented 6.4% of total local government expenditure.

Figure 1.11. **Gross revenue from sale of land-use rights**

As percentage of GDP and of national tax and social security revenues



Source: Wu (2012).

StatLink http://dx.doi.org/10.1787/888932787828

Where do the compensation funds go?

The amount allocated for compensation and redevelopment, however, seems on the high side. No detail was given of who received this compensation, nor of the cost of land improvement, nor of the split between greenfield acquisitions and redevelopment. An example from the suburbs of Beijing shows that the compensation for the acquisition of collective agricultural land is less than one-tenth of the money raised from land-use rights. The compensation for collective land expropriation is, at the maximum, around 130 times the gross annual yield of the land. In the outer Beijing area, this formula gave compensation that at most amounted to around CNY 119 per m^2 in 2011 (Wu, 2012). The price of the developed land, when auctioned, amounted to CNY 4 600 per m^2, so in this case compensation amounted to 2.6% of the value of the land-use right. This is broadly

consistent with an estimate covering 17 provinces which showed that the amount going to farmers was 2.2% of the money received by the government after it improved the land and sold it for commercial use (Landesa and Renmin University, 2012), even though official data showed that half of the proceeds of land sales were paid as compensation.

The impact of the very strict restrictions on the conversion of agricultural land to building land can be seen when comparing the edges of Beijing with Greater London, where prices are equivalent to CNY 5 700 per m^2 (Valuation Office Agency, 2011). Indeed, in rapidly growing areas in the London metropolitan area, the land zoned for residential use is worth 800 times neighbouring agricultural land and 600 times the value of the land before necessary infrastructure has been constructed. Compensation adequacy has to be judged against the current ownership status of the land. Farmers only own a 30-year use-right to cultivate the land and so legally cannot benefit from any change of use. However, they are clearly aware of the value of their land in alternative use and in a number of cities have taken illegal steps to attempt to secure the development value of the land for themselves (see below). In any case, such high differentials highlight the opportunity costs of not exploiting the land in its highest value use.

Urban planning

Local governments also influence urban development through the urban planning process. They must create 20-year master plans for the development of their areas and have them approved by the superior administrative authority. These master plans are essentially very broad-brush descriptions of how an area might develop, setting out objectives for transport, economic development and integration with the environment. A common problem faced by the designers of the master plan is that their planning cycle is far behind the speed of development of the local economy. This can be seen in the successive master plans for Beijing (Yang and Zhou, 2007) and Hangzhou (Wei, 2005), where targets for urban populations one decade in the future were exceeded within a few years. This problem is even apparent in the national 12th Five-Year Plan, where the government set a target for an increase in the urbanisation rate of 0.8 percentage points per year, to reach 51.5% by 2015. By 2012, almost halfway through the plan period, the urbanisation rate had reached 52.6% with the expansion rate since 2010 being nearly 60% faster than envisaged under the Plan.

These master plans, however, do not regulate the use of individual pieces of land. That is decided at the lower level of the plot plan and often in isolation from other plots or after negotiation with developers (Bertaud, 2007). Thus within a city there is often no systematic consideration of how dense development should be in different parts of the city, in contrast to the approach in New York or Hong Kong where plot ratios are determined as a function of the attractiveness of the land with building density rising as the distance to the centre of the city diminishes.

Development of collectively-owned land

While the planning procedure for state-owned land in metropolitan areas is complicated, procedures for developing collective land are much simpler and have enabled villagers to capture a significant part of development rent. Collectively-owned land is split into three parts: residential, reserved and agricultural. For residential land, each household of the collective is allowed one plot of land of between 150 and 250 m^2, depending on the region, to construct their own house. In practice, when the village collective is close to a

densely populated area, or surrounded by such an area, the villagers have often become property developers. This is also common when the agricultural land of a village has been expropriated leaving just the collective owning the residential land. In some areas, to avoid dissent amongst the villagers, the urban authority has compensated the village with a certain proportion of the expropriated land – up to 12% in a number of fast-expanding southern cities (Hsing, 2010). In these areas village collective land was transferred to a company owned either by the collective or by the villagers. The company then develops the land and pays dividends to the owners. In other cases, the individual villagers develop their own site usually ignoring limitations on property height. In the absence of the usual planning regulations, users of land are often affected by externalities generated by neighbouring sites (Zhu and Hu, 2009).

Despite the illegality of the construction on rural land, this development has provided much of the rental housing for migrants and a low-cost ownership route for many residents with a local urban *hukou*. In Beijing, new, but illegal, property development (known as *xiangchanquan* housing), built by township governments on collective land classed as agricultural, accounted for 18% of all new property developments on the market in 2006 (Hsing, 2010). Generally, these properties sell for less than half the price of an equivalent property on state land, even though the two are often indistinguishable from developments on state land (Cao, 2007). The lower price reflects the legal risk attached to owning the property (Ye and Wu, 2010). Purchasers are willing to take the risk, despite the regular warnings from the authorities on the need for buyers to ensure that they have legal title to property, especially where the development is relatively large.

Indeed, little is done to enforce such warnings nationwide, though the risk for residents varies across areas. Demolition and confiscation are common in Beijing and Shanghai, but less so in Chengdu and Chongqing. Nanjing recently granted full property rights to one community after it dealt with the proper land transfer procedures (Chen, 2012). It is not clear that there is a legal deterrent as the urban authority has no jurisdiction in collectively-owned areas. In fact, in 2004 the Shanghai Higher People's Court ruled that while it was illegal for such housing units to be transferred to people with no residence rights in the community, if the property had actually been transferred to them and they were living there, then the status quo should be respected.

The risk of expropriation is greater for older property as some cities have a policy of acquiring older properties to redevelop the site. As a result, in central areas housing units on collective land have a much shorter life than similar housing on state land. One study found that village property was demolished after 12.7 years, ten years before property on nearby state land (Nie, 2012). Many southern cities have issued redevelopment plans for urban villages. These plans have often not been put into practice, however, as, with population densities of 200 000 per km^2, the only politically feasible solution is to negotiate with the village property company rather than expropriate. In such cases, the existing value of the site has been found to be sufficiently high that redevelopment is not financially viable. Overall, new property development on collective land has accounted for 8% of urban development between 1995 and 2010 (Wu, 2012). Since most of this property is rented by migrants and other new entrants to the labour market, who accept space one third that of official residents, the share of the population in major cities housed, illegally, on collective land is probably as high as 25%, rising to 70% in parts of Guangdong province.

The development of collective land by farmers, while providing housing for migrants, does have drawbacks. According to law, the zoning and urban planning of village collective land is the responsibility of the township government which governs the villages. However, the villages have the right to convert agricultural land to non-agricultural use as long as it is for their own use. Thus there is a legal ambiguity in how land can be developed. Village collectives resist the application of zoning by the township government and development often follows a haphazard pattern decided by competition between villages to develop land before it is expropriated (Zhu, 2012). This usually results in a lack of public facilities but has the advantage of providing lower-cost housing. Proximity to village land can also lower the value of nearby urban land and housing. Thus there is a need for a solution which provides for more of an overall development plan for village property while maintaining the right of villages to develop land.

One method that allows a degree of control over development has been the formation of village co-operatives which then decide a development plan and deal with nearby urban governments and real-estate developers. This allows village collectives to keep a much higher proportion of the increase in value flowing from redevelopment. Experiments along these lines in the Beijing area have considerably calmed disputes about land (Po, 2011).

Reforms are under way to improve the position of farmers whose land-use right is expropriated. In late 2012, the State Council authorised the Shenzhen government to pay farmers half of the increase in value of the land when it is converted to non-agricultural use. Furthermore, a national plan was announced in early 2013 to create a complete property register of all rural land in order secure property rights of farmers and give them legal proof for compensation in cases of land transfers. The law is to be changed to give a greater share to farmers of the appreciation in land values following expropriation. However, rural land on which construction has been authorised will not be allowed to be freely bought and sold. Furthermore, the current 30-year term of rural use-rights may be extended.

Migration and urban growth

Migrants have been essential to urban growth

Migration has driven around 70% of the growth in the urban population (Table 1.7) over the 40 years to 2010 but is difficult to measure accurately. Without migration the population of cities would barely have increased due to the one-child family planning policy, which has limited the natural growth of the urban population to around 0.6% per year. There are two types of migration in China: official and unofficial. In the former people change both their place of residence and the place in which they are enrolled for the household registration system. In the other type of migration, people change their residence but are not allowed by the government to change the locality where they are enrolled. Different agencies publish different data for the total number of unofficial migrants. The census estimated the unofficial migrant population to be 261 million in 2010 but does not include local migration. This number, though, includes migrants from one urban area to another. In 2005, such migrants were about half of the total number of migrants (OECD, 2010a). Such migration does not change the overall urban population. There is also an annual survey of the number of rural migrants who hold an agricultural *hukou*. It distinguishes both local and longer-distance migration but the figures have only recently been placed in the public domain. Overall, this survey suggests that the number of long-distance migrants and their non-working family members was 185 million in 2010, broadly consistent with the number shown in the census. In addition, there were nearly 90 million local migrants, bringing the total number of rural migrants to 275 million in 2010.

Table 1.7. **Sources of growth of the urban population**

	1970-80	1980-90	1990-2000	2000-10	1970-2010
	Average annual change per period, millions				Total change
Change in urban population	4.7	11.1	15.7	20.7	521.4
of which:					
1) Natural increase of registered population	1.3	1.5	1.8	2.1	66.4
2) Migration	2.9	9.5	9.2	15.8	374.0
Official migration from rural to urban areas	2.0	1.8	3.0	3.0	98.0
Unofficial migration	0.9	7.7	6.2	12.8	276.0
Local	0.6	4.5	2.4	1.4	89.0
Longer distance	0.0	2.1	3.0	10.0	151.0
Families of migrant workers	0.0	0.9	0.7	1.5	31.0
Less urban-rural and rural-rural migration	0.3	0.2	0.1	-0.1	5.0
3) Areas that became urban (residual)	0.6	0.1	4.7	2.8	8.1
	Share of increase in population				
Natural growth	26.8	13.4	11.4	10.2	12.7
Migration	61.4	85.9	58.6	76.5	71.7
Expansion of urban area	11.7	0.7	30.0	13.3	15.5

Source: Unofficial migrants: Private communication from Lu Feng, as presented in Lu (2011) citing *China Agricultural Yearbook 2010*, Urban population: *China Statistical Yearbook*.

The drivers of urban population growth have varied with the regulations governing population movement. Before the first liberalisation in the early 1980s, only official migration was allowed. In the early 1980s, migrants had to provide food from the countryside for themselves if they moved to an urban area: they were not eligible for the food rations allocated to local residents. As a result, nearly three-quarters of migration was to local towns where it was possible for migrants to assure their own food supply. The only urban areas exempted from this rule were those designated as Special Economic Zones, which were experimenting with more liberal economic regulations. It was not until the decade ending in 2010 that large-scale migration across administrative borders occurred following liberalisation of regulations: local migration dropped sharply and longer-distance migration surged. There has also been a substantial flow of official migrants, which has been relatively stable, though in recent years a number of cities have tried to attract skilled or wealthy migrants using point-based *hukous*. Hardly any rural migrants have been able to benefit from this policy change.

Migration was temporarily held back by the financial crisis that erupted in August 2007 (Table 1.8). The number of areas that previously absorbed large number of migrants (such as the Pearl River Delta) fell. The stock of within-township migrants even declined in 2009, suggesting that longer-distance migrants may be more reluctant to move back to their farms than shorter-distance migrants when the demand for labour falls. In 2010-11, the flow of migrants quickly picked up as the economy improved, moving above the ten-year average, especially for local migrants.

Urban growth has helped narrow rural-urban income differentials

As noted, population has moved to higher-income urban areas, which have gained further from agglomeration economies as their size has expanded. In the process, per capita income levels in the poorer areas have also risen as workers leave small farms with little if any reduction in output. There are also spillovers from the higher level of activity in

Table 1.8. **Recent developments in rural migration**

	2000	2008	2009	2010	2011
	Millions				
Stock of people having migrated outside their registered township	94.5	169.0	175.0	184.1	191.4
Workers	78.5	140.4	145.3	153.4	158.6
Family	n.a	28.6	29.7	30.7	32.8
Total stock of workers who have migrated	149.7	225.4	229.8	242.2	252.8
Total stock of people who have migrated	n.a	254.0	259.4	272.9	285.6
	%				
As % of total non-farm employment	41.5	49.4	49.0	50.3	51.2
Total migrants as % of urban population	20.6	27.1	27.1	27.5	27.7
	Millions per year				
Flow of migrants (net)	n.a.	11.0	5.4	13.5	12.6
Inside township	n.a.	1.4	-0.6	4.4	5.3
Outside township	n.a.	9.6	6.0	9.1	7.4

Source: National Bureau of Statistics (2012), *China's Migrant Workers Survey and Monitoring Report*, Beijing, April (in Chinese).

the rich areas, on top of migrants' remittances to relatives in the rural areas. As incomes rise, property prices increase in the rich areas and land-intensive and transport-intensive activities will tend to move to outlying areas. To some extent urban districts in China have attempted to internalise this movement by expanding their boundaries well into the countryside. Nonetheless, in the past decade the countryside around big cities has benefited from all of these changes. A further factor has allowed incomes in rural areas to benefit from urbanisation, namely the extensive investments undertaken in rail and road infrastructure. In the case of rail, this has taken the form of markedly increasing the footprint of the network by creating new radial lines from the main prefectural cities – a development that has still to be completed fully in the south-west of the country. In addition the provincial and prefectural road network has been improved. Railway communication has made it easier for manufacturing to relocate and better highways have reduced public transport times for migrants living in cities relatively near to their homes.

These changes have helped reduce income differentials between cities and the countryside, as measured by GDP per capita (Table 1.9) and have improved the living standards of families one of whose members has migrated (De Brauw and Giles, 2012). Moreover, the GDP per capita differentials are probably lower than the official estimate of urban-rural income differentials (Box 1.2).

Table 1.9. **GDP per capita in cities and the countryside**

For the 160 prefectures with a dense core city with a population of over 30 000
GDP per capita in urban districts/GDP per capita in selected areas

	2000	2010	2000	2010
	Weighted average		Unweighted average	
Ratio of urban districts to:				
All counties in same prefecture	2.9	2.4	4.3	2.3
All less dense counties in same prefecture	3.1	2.7	2.5	2.4
All more dense counties in same prefecture	2.7	2.2	2.7	2.3

Source: OECD estimates.

Box 1.2. **The urban-rural income differential in China appears to be overstated**

The urban and rural surveys of household income are probably overstating the ratio of urban to rural income, possibly by as much as over 40% (Xu and Gao, 2012). The deficiencies in the household surveys are known to the National Bureau of Statistics, which is to launch a new national household survey in 2013.

The problems with the existing surveys stem from the rapid change in the labour market and the consequent migration of people from the countryside to the city. Given that migrants in China, as in many developing countries, keep close links with their family in their birth place, it can be difficult to allocate the income and consumption of a migrant worker.

The protocol for the surveys indicates that when migrants working in an urban area are an economically inseparable part of a rural household, their income should be counted as part of that household's income. In practice, this means that the income of a household where both spouse and children live in an urban area should be counted in the urban household survey, while other migrants should be included in the rural household survey.

However, a survey in two provinces (Zhejiang and Shaanxi) indicates complete migrant families represented around 30% of urban households in Zhejiang and 7% in Shaanxi, while nationwide they accounted for less than 1% of households in the urban household survey. So there are many missing households in the urban survey and this group is not counted in the rural household survey either.

For the rural household survey there is also another measurement problem linked to migrants. Rural households are supposed to report the complete income of urban migrants where a spouse or children still live in the rural area. In addition all unmarried adult children who are urban migrants should be counted in the rural survey. In reality, according to interviews with a sample of people included in the rural survey, rural households only report the income that the migrant sends back to the household. Detailed interviews showed that the remitted share of income for migrants where there was a spouse or child in the rural household was 70%, but only 40% for unmarried children. This latter group represented the largest group of migrants whose income should have been fully counted in the rural survey, accounting 80% of the total in Zhejiang and 40% in Shaanxi. Insofar as the two provinces under consideration are representative of nationwide patterns, this information on its own would suggest that the urban-rural income differential was 2.2 in 2009 and not 3.1 as shown in the official data. However, to the extent that underreporting of income is more of a problem for urban than for rural households, especially at the higher income levels, the overstatement of the urban-rural gap would be less pronounced (Wang and Woo, 2010).

Providing public services to the families of migrants in cities

The scale of the problem

Most of the migrants to major cities do not bring their families with them. Data from earlier censuses suggest that there were 11 million migrant children of compulsory education age in 2000 living without one of more of their parents, while in 2005 around 32 million children of the same age range were in the same position. If the number of such children has risen in proportion to the number of migrants, then by 2010 there would have been about 36 million left-behind children. In addition, the 2010 Census suggests that there were another 23 million children who had migrated with their parents, a total of 59 million children with migrant parents representing about one-third of the total number of children

in primary and junior high school. There may have been a more-than-proportionate rise in the number of migrant children in cities (and hence less left at home), as in Beijing the number of school-age migrant children quadrupled between 2000 and 2008 to reach 400 000 (Rozelle *et al.*, 2009). The type of education that these children receive will have a considerable impact on their ability to progress socially and economically.

Progress in providing compulsory education

The provision of free compulsory education to migrant children has much improved over the past decade. The main concerns now are about quality and the scale of payment made by local authorities to the private schools educating many migrant children. Since 2003, the central government has actively encouraged local authorities to ensure that migrant children receive education in their place of residence at least to the age of 15, when compulsory education finishes. It appears that nearly all migrant children now receive compulsory education at primary school level. At junior high school level, drop-out rates seem to have increased but the overall participation in nine-year education appears to be well over 90%. As far as the left-behind children are concerned, they are educated in state schools in their place of residence. According to official figures 79% of migrant children are now educated in state schools, but it is not clear whether this covers all the children of migrants or just those who accompanied their parents.

The situation varies considerably across regions (Table 1.10) and from city to city. In Shanghai, all migrant schools in the centre of the city have been closed and children transferred to state schools. Further out of the city, children attend migrant schools funded by different levels of local government (Chen and Feng, 2012). Overall, 70% of migrant children attend state schools in Shanghai. However, the participation rate of migrant children in elite primary schools is probably lower as entry to these schools is dominated by parents in professional occupations and officials (Wu, 2009). These schools, formerly known as "key schools", received extra funding, better teachers and were expected to guide other schools. The system of key primary schools has been abolished in Shanghai and elsewhere (OECD, 2010c) but the best quality primary schools actually continue to set entrance examinations (Yiwen, 2012).

Table 1.10. **Type of school attended by migrant children**

Region	Type of school (% of all migrant children)		
	Key schools	Public schools	Private schools
East	6.3	70.3	23.5
Middle	6.9	63.6	29.5
West	12.9	84.5	2.6

Source: Li (2008).

In Shenzhen and Beijing, however, the situation is reversed and only 30% of migrant children attend state schools. In Shenzhen, the amount the local government spends per child on migrant schools is less than in state schools, implying much larger class sizes and less qualified teachers. In Beijing, policies towards migrants vary. Many migrant schools there are located on collectively-owned land. When either the urban district government expropriates the land, or the village collective redevelops it, migrant schools in that area are closed. Thirty such schools were demolished in 2012 in the Chaoyang, Shijingshan, Changping, Daxing, and Fengtai districts of Beijing (areas where migrants were 44% of the total population in 2010) with

no provision for transferring the children to state schools (Beijing News, 2011). As a result, many children had to return to live with their grandparents (Li, 2012).

But quality differences remain

A major concern endures as to the quality of education. The results of migrant children, even when they attend state schools, appear to be worse than those of local children. The district education authorities do not administer standardised tests to children in migrant schools as they are considered outside the system. A private survey by Shanghai University of Finance and Economics has undertaken such tests across a sample of nine-year olds (Chen and Feng, 2012). The results show that the teachers in state schools are much better qualified than those in migrant schools. The performance of migrant children in migrant schools for Chinese tests is almost one standard error lower than for local children in state schools (Table 1.11). For mathematics, the score is 1¼ standard deviations lower. In PISA test terms, this would put migrant schools in Shanghai on a par with the average results of schools in Chile, Mexico and Turkey. Once control variables were allowed for, the performance gap narrowed but was still significant. Similar results have been found for Beijing (Lai *et al.*, 2012), where the performance of children at migrant schools, allowing for the impact of control variables, was even slightly worse than the performance of children in rural schools.

Table 1.11. **Migrant and state schools in Shanghai compared**

	Public schools		Migrant schools
Background of teachers			
Teaching experience (years)			
Less than 3 years	4		23
3 to 10 years	11		49
More than 10 years	85		28
Teachers' education			
High school and below	6		25
Associate degree	36		59
Bachelor's degree and above	58		16
Monthly salary			
Below CNY 3 000	1		81
CNY 3 000 to CNY 5 000	28		19
Above CNY 5000	71		0
	Local children	Migrant children	Migrant children
Test results			
Chinese	69.1	66.4	55.8
Mathematics	65.3	62.3	46.3

Source: Chen and Feng (2012).

High school education: Under the same blue sky?

Access to senior secondary school has improved much less than access to compulsory education. To attend high school it is necessary to take an entrance examination and this must be taken in the locality of registration rather than the locality of residence. In

Shanghai, migrant children can only attend vocational high schools. The Shanghai Education Committee justifies local high schools' refusal to admit the children of migrant workers on the grounds that "if we were to open the door to them, it would be difficult to shut it in the future; local education resources should not be freely allocated to immigrant children" (Ren, 2012). As a result, few migrant children attend general high schools and those who do return to their registration locality find it hard to adapt and often fail to complete the course (Ming, forthcoming).

Migrant parents, and all low-income households, urban and rural, face a major financial barrier to send their children to senior secondary schools. Fees are high. In Shaanxi for instance, a three-year course costs the equivalent of 89% of the average annual net income of a rural household (Liu *et al.*, 2009) – three times higher relative to income than in Indonesia and 60% higher than in Mexico. These fee levels affect rural high school attendance (which is most probably only half that of urban registered children) and tend to lower performance in junior high school. Fees may also represent a barrier to achieving the government's target of raising the enrolment rate for senior high school to 90% by 2020. Low educational achievement will undermine the employment prospects of future migrants, all the more so as China progressively becomes a more capital/innovation driven economy.

The need to return to the place of registration is compounded by the regulation that only allows a university entrance examination to be sat in the place of registration rather than the place of residence. In 2012, the Ministry of Education issued a new regulation encouraging provincial governments to allow pupils who are not registered locally to take the examination in the place of residence provided that the parent of the student has a stable job and pays social security contributions. However, the employers of most migrants do not enrol their employees in the social security programme, despite the provisions of the Labour law. Moreover, the Minister of Education has stated that local authorities can adapt the rules to take into account local conditions. This is meant to avoid people moving to a province with better quality universities (such as Beijing or Shanghai) to take the university entrance there so as to benefit from the fact that the acceptance mark for local universities is lower for locally registered students than for those with out-of-town residence. Fujian province, however, has announced that it will allow all migrant children who have been at junior or senior high school to take the entrance exam in Fujian. The Education Commission of this province sees this relaxation of rules as a way to attract more migrant workers to their province given current shortages of migrant labour.

For university entrance, the discrimination against students with registration outside the local district is severe. For example, in the past five years, 97% of the country's poorest counties sent no students to Beijing's prestigious Tsinghua University. In 2011, Peking University enrolled a third of its students from Beijing but less than one student in every 10 000 came from Henan, Shandong or Hubei. In Shanghai, students with a local *hukou* are 53 times more likely than the national average to get a place at the city's prestigious Fudan University. The same entrance marks need to be applied to all pupils from across the country.

Access to health care for the families of migrants

Apart from the persisting problems in education, migrant families also are unable to join the local health insurance scheme for children. Health insurance for employees is provided by the government if the employer joins the social security system, but many do not as penalties for non-compliance are low (OECD, 2010a). Moreover, the scheme covers

only employees, not their children. To fill this gap a contributory (but subsidised) scheme has been introduced. But households registered outside the locality cannot join the local scheme and must join the scheme where they are registered, often with lower benefits which cannot be drawn outside the local area. The result is that the health of migrant children is markedly worse than that of local children (Table 1.12). It is not clear though whether these illness rates are better or worse than those in rural areas.

Table 1.12. **Death rate of children under five in Guangdong province**

Classification	Infant		1-4 years old		Ratio of migrant to local deaths
	Migrant	Local	Migrant	Local	
	Deaths per 100 000				
Malnutrition	10.4	0.0	5.2	0.0	
Traffic accident	5.2	0.0	41.7	2.9	16.3
Diarrhoea	36.5	2.9	18.2	1.4	12.7
Diseases of the digestive system	39.1	4.3	18.2	1.4	10.0
Septicaemia	26.1	1.4	13.0	4.3	6.8
Injury and poisoning	59.9	16.7	125.1	11.5	6.6
Infectious and parasitic diseases	31.3	2.9	15.6	4.3	6.5
Meningitis	10.4	4.3	13.0	0.0	5.4
Maternal factor in child birth	783.7	148.8			5.3
Diseases of the respiratory system	93.8	44.6	18.2	15.8	1.9
Diseases of the circulatory system	13.0	10.1	10.4	4.3	1.6
Congenital malformations	130.3	90.6	2.6	10.1	1.3
Neoplasm	13.0	4.3	2.6	14.4	0.8
All above	1 263.1	330.9	289.2	70.5	3.9

Source: Li *et al.* (2006) quoted in Chan (2009).

Furthermore, migrants generally cannot take advantage of the affordable housing programme. As a rule, only local registered people are allowed to purchase housing at a 30-40% discount through the economical housing programme, while the public rental programme is often unattractive given the rental levels and the poor locations where the property is built. There are also a number of administrative documents that require local registration: a driver's licence for example or a ticket in the lottery for car licence plates in Beijing.

Financing of improved benefits

The financing of compulsory education is shared between national governments and (in cities) the district-level government. On average, the national government pays for just over half of the cost of this level of education, but the share varies across regions (see Wang and Herd, 2013). While most transfer payments from central to local government are made in proportion to the registered population, the grant for compulsory education is made in proportion to the number of children at both state schools and schools for migrants. As more migrants settle in cities, the cost of education increases by the amount that wages of teachers in destination areas exceed wages in source areas. Moreover, there may be some need to build new schools.

Turning to pension benefits, if employers were forced to enrol all migrant workers in pension schemes, costs would rise due to the redistributive character of the employee pension system. Over the lifetime of a migrant, the extra cost is estimated at CNY 80 000 per person (Development Research Centre, 2011). Depending on the rate of discount that is used in the

calculation this is equivalent to an extra public expenditure of around 1% of GDP per year. Half of this cost represents extra pension expenditure that would occur some 40 years into the future. Since 2009, the pension system for migrant workers has been reformed. The employers' contribution has been reduced to 12% from 20% for this type of worker. At the same time, a portability provision has been introduced for people who move form province to province.

Reform of the *hukou* system

The objectives of the government in increasing urbanisation are to boost incomes, create domestic demand, rebalance the economy and create a stable urban society. To achieve these goals, *hukou* reform has been seen as a necessary step. *Hukou* reform is a complex issue, as registration status determines not only the rights of a person in their new urban location but also their rights in the place of origin. At present changing *hukou* status from agricultural to non-agricultural involves surrendering land-use rights in the place of origin and also may result in the loss of permission to have a second child. Thus the issues are far wider than giving rural migrants access to certain public services in urban areas. Full *hukou* reform would require changing the rules governing land-use ownership rights in the countryside and family planning regulations, as well as rights in urban areas. In response to central government pressure, most provinces now have regulations in place that allow people to transfer their household registration from one locality to another and from agricultural to non-agricultural status.

The changes that local governments have put in place set a high hurdle that migrants have to cross. By now, most provinces have begun to allow people without local registration to obtain registration or to merge local rural and urban registrations, but these changes have had limited effects. More than half of the provinces have merged their local rural and urban *hukous*, but not generally on a province-wide basis. Such changes have little impact on migrants as they come from outside local areas. In addition, most cities have reformed the rules for migrants to obtain a local *hukou*. In most provinces the scale of the reforms varies with city size (Table 1.13). For small and medium-sized cities, the qualifications to change residence status focus on employment stability and having appropriate housing (Table 1.14). In large cities the most common requirement is for a university education, though poorer provinces only insist on the person having at least a vocational high school certificate (Table 1.15). In addition, many provinces have a residence or tax payment requirement. As a result, in most of the attractive areas, reforms have had little impact. Even in smaller cities it can be difficult for migrants to meet the conditions as the employers of migrants often avoid affiliating their employees to social security systems and so paying taxation.

A number of provinces and cities introduced reforms in 2010. Chengdu and Chongqing reformed the *hukou* system as it applied to locals but not to migrants, while Guangdong established a new system for migrants. In both cases, the objective was to abolish the difference between the local agricultural and non-agricultural *hukou*. In Chongqing, the local government aimed to change the status of 3 million people by 2012 and 10 million by 2020. The first stage was to abolish the distinction between rural and non-agricultural *hukous* in each locality. Then people would be allowed to change their place of registration to a city area if they met a similar group of criteria as used in many other provinces (stable employment, owning an apartment). In both Chongqing and Chengdu, part of the system was based on exchanging rural land rights for urban status. In the case of Chongqing, the idea was to free up land near cities and then replace the agricultural land so lost by offering rural people an urban *hukou* exchange for their residential land. Their house would be demolished and the

Table 1.13. **Extent of *hukou* reform by province**

	Year of the most recent reform	Scope of application for *hukou* by size of locality	Unified registration between local urban and local rural *hukou*	Type of province
Anhui	2001	Large, medium, small (town)	No	Central
Beijing	2002	Small (town)	No	Municipality
Chongqing	2003	Large, medium, small (town)	Yes	Municipality
Fujian	2001	Large, medium, small (town)	Yes	Eastern
Gansu	2003	Large, medium, small (town)	No	Western
Guangdong	2001	Large, medium, small (town)	Yes	Eastern
Guizhou	1998	Small (town)	No	Western
Hebei	2003	Large, medium, small (town)	Yes	Eastern
Heilongjiang	2008	Medium city	Yes	Central
Henna	2003	Large, medium, small (town)	Yes	Central
Hubei	2003	Large, medium, small (town)	Yes	Central
Hunan	2003	Large, medium, small (town)	Yes	Central
Inner Mongolia	2000	Small (town)	No	Western
Jiangsu	2002	Large, medium, small (town)	Yes	Eastern
Jiangxi	2002	Large, medium, small (town)	No	Central
Jilin	2001	Large, medium, small (town)	No	Central
Liaoning	2002	Large, medium, small (town)	No	Eastern
Ningxia	1998	Small (town)	No	Western
Shandong	2004	Large, medium, small (town)	Yes	Eastern
Shanghai	2009	Large	No	Municipality
Shaanxi	2005	Large, medium, small (town)	Yes	Western
Shanxi	2007	Small (town)	Yes	Central
Sichuan	2002	Medium and small	Yes	Western
Tibet	2001	Large, medium, small (town)	No	Western
Xinjiang	1998	Small (town)	No	Western
Yunnan	2008	Large, medium, small (town)	Yes	Western
Zhejiang	2002	Large, medium, small (town)	Yes	Eastern

Source: Du (2011).

land turned back into agricultural land. In this way, the Chongqing government would be able to extend its urban land without breaking the limit on conversion of agricultural land to urban land. This part of the reforms has now been stopped as the State Council issued a decision that land rights can no longer be exchanged for an urban *hukou*. The rules for granting a non-agricultural *hukou* in Guangdong are based on a points system that favours highly qualified people who are unlikely to be rural migrants (Table 1.16).

Rural migrants are increasingly likely to want to remain in cities but few appear motivated to convert their rural *hukou* to an urban *hukou*. One well-known example of the low perceived value of urban *hukou* in smaller cities is that of Shijiazhuan (capital of Heibi province): in 2001, the local government announced major changes to the *hukou* system which, it stated, would mean that any person who had worked there for two years would be eligible for a local *hukou*. However, of the 300 000 eligible persons, only 75 000 changed their registration status (Zhan, 2011). An official survey found that almost three quarters of younger migrants had no desire to do so, though this proportion was lower in bigger cities (National Bureau of Statistics, 2011). This is perhaps because giving up a rural *hukou* often involves losing a land right. Migration was still seen as a circular process in which people stay in the city for a period and then return nearer to their home. However, very few

Table 1.14. **Small and medium-sized cities: criteria for obtaining local urban *hukou***

	Stable source of income	Residence	Years of residence
Municipalities			
Chongqing	Any employment	Ownership/Employer	n.a.
Beijing	Any employment	Not dormitory	Not specified
Shanghai	Above average	Not specified	7
Eastern provinces			
Hebei	Any employment	Not dormitory	No limit
Liaoning	Any employment	Any form	Not specified
Jiangsu	Any employment	Any form	2
Zhejiang	Any employment	Any form	Not specified
Fujian	Any employment	Any form	Not specified
Shandong	Not specified	Any form	Not specified
Guangdong	Any employment	Any form	Not specified
Central provinces			
Shanxi	Any employment	Ownership	Not specified
Jilin	Any employment	Not dormitory	Not specified
Heilongjiang	Contract or business owner	Not dormitory	4
Anhui	Any employment	Not dormitory	3
Jiangxi	Any employment	Any form	Not specified
Henan	Contract or business owner	Ownership/Employer	Not specified
Hunan	Any employment	Any form	Not specified
Hubei	Any employment	Any form	Not specified
Western provinces			
Inner Mongolia	Any employment	Any form	Not specified
Sichuan	Any employment	Ownership/Employer	Not specified
Guizhou	Any employment	Any form	4
Yunnan	Any employment	Ownership/Employer	Not specified
Tibet	Any employment	Any form	No requirement
Shaanxi	Not specified	Any form	Not specified
Gansu	Any employment	Any form	Not specified
Ningxia	Any employment	Any form	2
Xinjiang	Contract or business owner	Any form	2

Source: Du (2011).

migrants wish to return to be farmers; most want to move to move to a county seat or a town near to their village (Zhu and Chen, 2010).

Even if the perceived value of sacrificing land holdings were not high, the requirements for obtaining a local *hukou* under the reforms that have been introduced would be difficult for a migrant to satisfy. The criteria to be met in order to obtain a new *hukou* pertain to education, wealth, stable employment and payment of taxes. There is no data on the number of people nationwide who have successfully made changes by fulfilling these criteria. Anecdotal evidence suggests that in the main, those who have changed are well educated and well off and often have a non-agricultural *hukou* from another city.

Migration has been seen more as way to maximise household income and lower risk than as a permanent decision. Moreover, settling in a city seems to be driven more by identity than by legal status (Zheng *et al.*, 2009). Changing *hukou* status is not the key as to whether a person stays in a city or not. Rather the attributes of the person (education and willingness to invest in training) determine the length of time a person stays in a city. The attitude of the new generation of migrants, born between 1980 and 1990, is changing. They have a much weaker attachment to the land. Their physiology, lifestyle and behaviour have

Table 1.15. **Large cities: criteria for obtaining a local urban *hukou***

	Purchase of housing	Private investment	Tax payment to local government	Education level
Anhui	Minimum area	Not specified	Not specified	College
Beijing	Not specified	Not specified	Not specified	Not specified
Chongqing	Minimum area	Not specified	Not specified	College
Fujian	No minimum	Decided by cities	Not specified	College
Gansu	No minimum	Not specified	Not specified	Vocational high school
Guangdong	Decided by cities	Decided by cities	Not specified	College
Guizhou	No minimum	Not specified	Not specified	Not specified
Hebei	No minimum	Not specified	Not specified	College
Heilongjiang	Not specified	Not specified	Not specified	Not specified
Henan	No minimum	Not specified	Not specified	Vocational high school
Hubei	No minimum	Not specified	Size required	College
Hunan	No minimum	Not specified	Not specified	Not specified
Inner Mongolia	Not specified	Not specified	Not specified	Not specified
Jiangsu	No minimum	Not specified	Not specified	College
Jiangxi	No minimum	Decided by cities	Decided by cities	Vocational high school
Jilin	No minimum	Not specified	Not specified	College
Liaoning	No minimum	Not specified	Not specified	College
Ningxia	No minimum	Not specified	Not specified	Not specified
Shandong	No minimum	Investment required	Amount and years required	College
Shanghai	Not specified	Not specified	Amount and years required	College
Shaanxi	Minimum area	Not specified	Not specified	Vocational high school
Shanxi	Minimum area	Not specified	30 000 yuan	College
Sichuan	No minimum	Not specified	Not specified	Vocational high school
Tibet	No minimum	100 000 yuan	Not specified	Vocational high school
Xinjiang	No minimum	Not specified	Not specified	Not specified
Yunnan	No minimum	Not specified	Not specified	Not specified
Zhejiang	No minimum	Decided by cities	Decided by cities	Decided by cities

Source: Du (2011).

Table 1.16. **The point system for acquiring an urban *hukou* in Guangdong**

Number of points required	
Guangzhou	65
Rest of the province	60
Points awarded	
University graduate	80
Junior high school	5
High school	20
One year social security contributions	5
Charitable contribution per thousand yuan	2
Blood donation	2
Voluntary youth service (per 50 hours)	2 points
County-level honorary title	10
Prefectural-level honorary title	60
Junior professional employment	10
Mid-level worker	30
Senior worker	50
Technician	60

Source: Guangdong Provincial Government (2010).

become urbanised, and their employment is no longer an additional income for the families but their lifetime career. They do not know how to farm nor do they want to (China Development Reform Foundation, 2013).

What reform path for hukou*?*

A fundamental difficulty with *hukou* reform is the right to both rural agricultural and residential land given by a rural *hukou*. This right is seen by most migrants as a valuable hedge against the uncertainty associated with earning labour income in cities. Moreover, most migrants still do not seek to settle permanently in one area: if job prospects change, they are prepared to move elsewhere. At the moment, even if the new generation of migrants (born in the 1980s) express a greater desire to stay in cities, most still envisage eventual return, if only on retirement. In this context, the *hukou* reforms introduced so far are mainly designed for highly-educated people moving from one city to another. The appropriate way forward would be to reduce the value of the urban *hukou* by disconnecting the eligibility for urban public services from the *hukou* status. For example the local authority could grant a residence permit giving the same rights to all people who have lived in an area for six months as to those holding a local urban *hukou*. The cost of such a policy to local authorities is rapidly declining as education is now provided for nearly all migrant children.

In 2011, the prefecture of Suzhou, one of the areas with the highest GDP per capita in the country, initiated a new residence permit policy along these lines. It announced that residence permits would replace temporary residence permits for migrant workers. Any migrant worker aged above 16, with a place to live and a stable living condition, can apply for a residence permit free of charge. The residence permit gives the same rights to migrants as permanent residents. These rights include health care for dependents on payment of a premium, education, employment, driving license application, employment security, transportation discounts, access to low-rent housing and other public services. By mid-2012, the prefecture had distributed 6.1 million residence permits by July 2012. As a result, the new residence permit policy now covers almost the entire migrant population.

Reform of the *hukou* system is a necessary step in the creation of an inclusive urban society. The most pressing aspect of reform is to allow all residents in urban areas equal access to local services. Such a reform can be achieved without a full reform of all of the laws that are linked to *hukou* status. The reforms undertaken in Suzhou appear to be a promising route as they enable urban rights to be equalised without the need to change the rights of the migrants in rural areas which will require significant administrative and legal action.

Will migration and urbanisation boost domestic demand and rebalance the economy?

There is international evidence to suggest that urbanisation by itself results in a rebalancing of the economy, through a decrease of household or national saving (Loayza *et al.*, 2000; Hung and Qian, 2010). Usually it is hypothesised that this is because urban income is more secure than rural income and so urban residents save less for precautionary reasons. The magnitude of the impact is small and uncertain. If the urbanisation rate were to rise from 50% to 65% (as is plausible for China over the next one or two decades), then the national saving rate might be expected to drop by only 0.8 percentage points from its 2010 level of over 50%. Moreover, panel regressions fail to explain a high proportion of the Chinese saving rate (Hung and Qian, 2010).

One reason for the failure of panel regressions to explain the level of urban saving may be that the employment situation of migrant workers is not very stable and their social

benefits are low relative to urban residents. In the Chinese context, it is possible that at least until a large portion of the migrant population has decided that it is preferable to remain in the city, the saving rate may rise as urbanisation proceeds. Household surveys show the saving rate of migrant households to be extremely high – well above that of local residents and above that of rural households. A number of studies have found that migrants save more than urban households. Chen *et al*. (2012) found the level of consumption of migrant families was 37% lower than for local households. In Guangdong, one study found a saving rate of 60% (Huang, 2010). Amongst migrants living in urban villages in Beijing, the saving rate was estimated at 47% (Zheng *et al*., 2009).

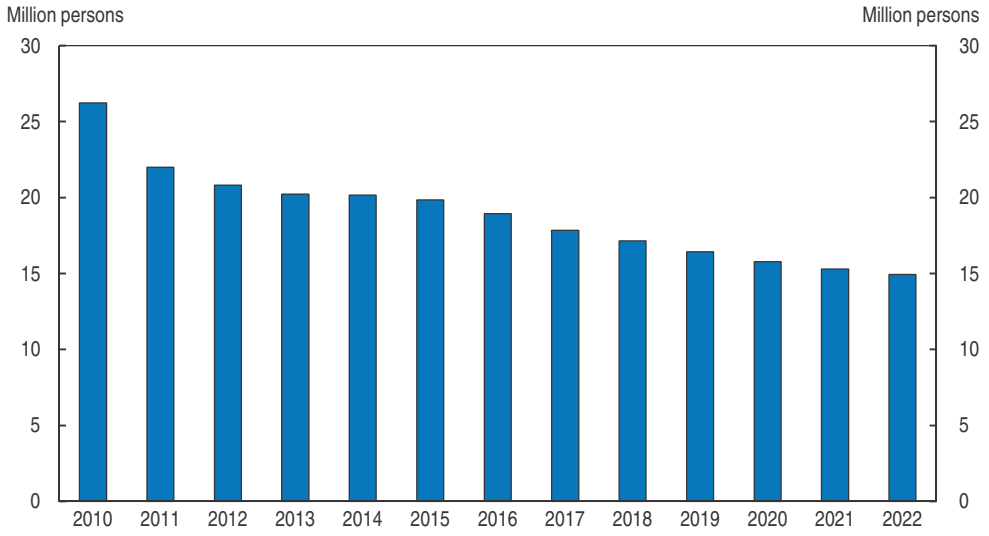
It is difficult to rationalise such high saving rates in terms of high levels of insecurity or poor social services – the counter-factual is that the migrant remains in the countryside where health and social security benefits are even worse and saving rates lower. The high saving rate may partly reflect transfers to families remaining in the countryside. However, Brugiavini *et al.* (2013) find that even in migrant households with two people present (and hence reduced need for transfers to the countryside) the saving rate is still higher than for urban households. They attribute this to habit persistence on the part of those who move from lower-income areas and suggest that this differential will disappear if migrants stay in cities. As well, self-selection may be one reason why migrants save: they have decided to seek higher incomes at considerable risk. In any case, although each individual has limited consumption ability and does not consume much, the sheer number of rural migrant workers, and of their family members, represents an enormous potential for consumption expansion (China Development Reform Foundation, 2013).

Migrants' high saving rate may decline as they become more settled and as their incomes rise. Since 2009, there has been a turnaround: until then, the wages of migrants had been constantly declining relative to the wages of local workers; since 2009, they have been rising faster, reflecting the marked demographic change that has started to occur in the number of 20-year olds (Figure 1.12). Besides, migrants' consumption pattern is different: young migrants spend much more on housing and clothing than local residents (Figure 1.13). The money spent on housing though generally flows back to local "farmers" who are generally the landlords.

Constraints on further urbanisation

Government regulations concerning the conversion of agricultural land to construction land are very strict. The 1994 Basic Farmland Protection Regulation requires the designation of farmland protection districts at the township level and prohibits any conversion of land in those districts to other uses. It also requires that a quota of farmland preservation be determined first and then allocated to lower-level governments in the five-level administrative chain (state, province, city, county and township). The 1999 New Land Administration Law intends to protect agricultural land and co-ordinate the planning and development of urban land. It stipulates that the government should strictly implement overall plans and annual plans for land utilisation and take measures to ensure that the total amount of cultivated land within their administrative areas is not reduced. Moreover designated basic farmland shall not be less than 80% of total cultivated land. The designation of basic farmland is based primarily on soil productivity rather than location. Because existing urban development has occurred near historically high-productivity areas, that land is likely to be designated as basic farmland whereas land farther away is not. Such

Figure 1.12. **Cohorts of 20-year olds**

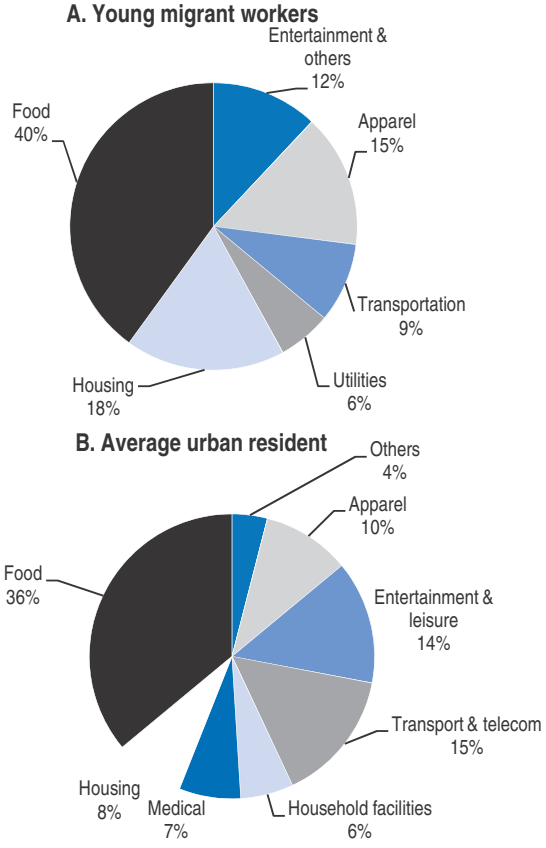


Source: US Bureau of the Census (2011).

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Figure 1.13. **Consumption patterns of migrants and registered residents**

In 2010



Source: National Population and Family Planning Commission (2011).

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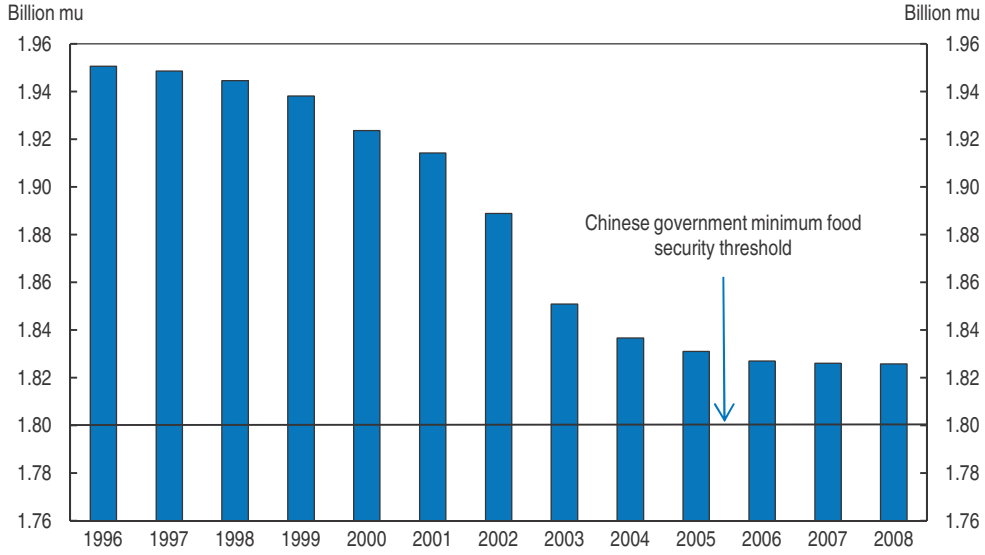
restrictions impose a high economic cost and, as shown above, force farmers to develop land within existing townships, creating a leapfrogging development pattern (Ding, 2004).

Conversion of designated cropland into construction land is very difficult. It is only possible for key projects such as energy, transportation, irrigation and military infrastructure and then with the approval of the State Council. Other forms of land can be designated for future construction only through a provincial master land-use plan established once per decade and approved by the State Council. Provinces are allocated conversion quotas based on existing land-use shares. After the provincial land conversion quota has been established, the provincial government reserves some land for itself and then allocates the remainder to prefectural-level cities. First, it allocates conversion quotas for key transportation, irrigation, water-conservancy and energy generation projects. Secondly, the quotas for land to be used for normal transportation, irrigation, water conservancy and rural residential purposes are distributed to each city using the existing share of each land category in the prefecture as a weight. Finally, construction land conversion quotas for urban development are allocated to each city based on weights taking into account the existing land urban land area, the GDP of the city in secondary and tertiary sectors and the predicted city-level land needs (Wang, Tao and Tong, 2009). Each prefecture allocates conversion rights to lower levels of government. The national government also sets an annual land-use conversion quota and the amount used under this quota has to ensure that the designated agricultural land targets are not breached. As the master plan covers a whole decade, the government also sets a limit on the conversion that is possible within the plan period. Finally, a quota has been established for the creation of new agricultural land and this is also distributed down from the province to the prefecture. Such a method for the conversion of land is arbitrary and takes no account of economic factors. A much more market-based system is needed. The province of Zhejiang has introduced a market in conversion quotas so that the areas with surplus quotas can sell them to deficit areas, but this is only a second-best procedure.

The fundamental reason given for the quotas (national security) is mistaken. The government is concerned that, if the country were to face a military blockade or subject to an export embargo (as was the case for the Soviet Union in 1980), there would be food shortages. Such concern is largely unjustified. Food supply is surprisingly elastic even in the short term. Crops can be changed and land brought back into cultivation within one year, and less where two crops are possible. The experience of Britain between 1939 and 1945 bears this out (Herd *et al*., forthcoming). The authorities are also concerned that a continuing increase in Chinese food imports over the medium term would drive up world prices which would weigh on consumers given the still high share of food in household spending.

The future growth of urban areas is likely to put further pressure on this central-planning method of allocating land for new construction. Agricultural land has dropped substantially in the past decade. By 2008 (the last year for which data is available), agricultural land had fallen to within 1.1% of the government limit (Figure 1.14). Between 2010 and 2020, the urban population is likely to increase by over 200 million, if the recent pace of city growth continues with the urbanisation rate rising to above 60% (United Nations, 2012). In addition, rising disposable will result in households demanding more living space. It is unlikely that migrant workers will be content to live in an area of 8 m^2 per person if they choose to settle in urban areas. If the current average population density in built areas (of just under 10 000 per km^2) is maintained, average living space increases as in the past decade and the plot ratio remains constant, then the demand for building land will soon exceed the available supply, putting upward pressure on prices (Figure 1.15).

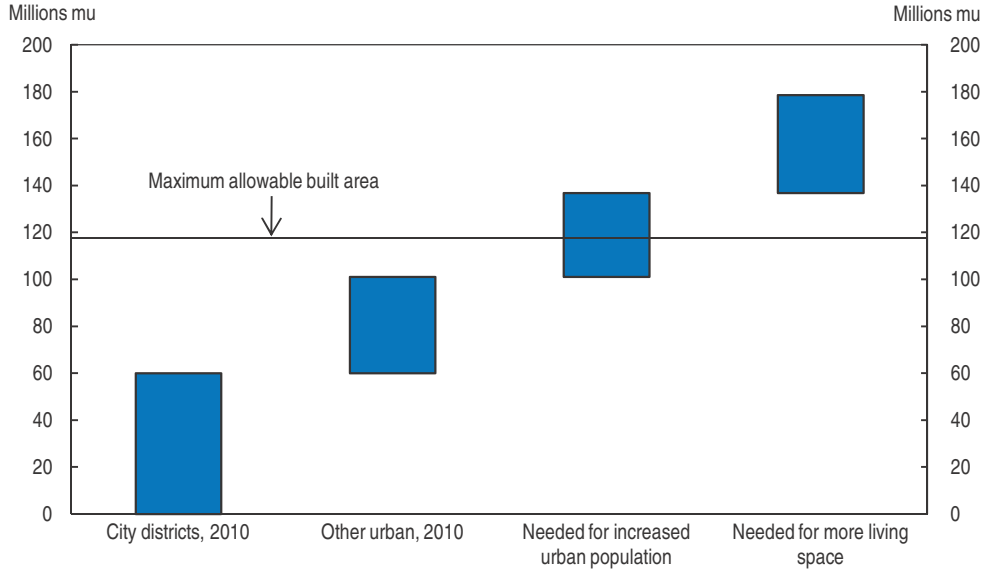
Figure 1.14. **Agricultural land use and the government limit**



Source: Ministry of Land and Resources.

StatLink http://dx.doi.org/10.1787/888932787885

Figure 1.15. **Projected increase in built area from 2010 to 2020**



Source: OECD projections.

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Pressure on land prices in the past decade has led local authorities to take land illegally and then to central government attempts to restrict such land grabs. Moreover, at the local level there has been pressure from farmers for greater, market-based compensation. Farmers are aware that in many areas village collectives have been able to keep a far greater share of the increase in value of land when it switched from agricultural to construction use. The response of the central government has been to centralise the land conversion process by establishing quotas that cascade down through the administrative hierarchy. In an economy that is now market-based in most areas, allocating building land by administrative *fiat* is an anomaly. Moreover, rural land remains

essentially a non-marketable asset. A major change in land ownership rules in rural areas is needed to allow famers and their collectives to obtain land-use rights enabling them to change the use of their land to construction. Subjecting sales of land for building to value-added tax would give local authorities a substantial income to replace the profit currently made on land development. Finally, decentralisation of the agricultural protection quotas is needed, as it is very unlikely that central government can judge the needs of each province and similarly that the provinces can judge the needs of each city. Governments might still need to be active in redevelopment, but a freer market in land would ensure a closer matching of supply and demand. In addition, replacing land development profits by a value-added tax on development gains and perhaps a property tax would bring greater transparency to local government finances.

Conclusions

Over the past decade, as labour mobility increased and the housing market opened up to private capital, China has undergone the world's most massive and rapid urbanisation. Population and value-added have risen most in very large cities, but not at the expense of rural areas, where productivity has risen with outmigration. More than 300 million people now live in cities were GDP per capita is on a par with incomes in some OECD member countries. However, the growth of cities has not been without problems. The inherited institutional structure means that as a rule, migrants cannot access all public services in the city where they live. Remaining artificial barriers between migrants and the local population need to be progressively reduced by delinking rights to access public services from the *hukou* system. This system is fundamental to the migrant's continued ownership of the use-right to land in the countryside. As cities expanded, the value of rural land has increased. Village collectives need to become full owners of their land with restrictions on development removed, so that villagers can sell or develop their land subject to the levy of an appropriate tax. A structured vision for city development is still needed, but the monopoly of land development by the government should be ended. In a number of instances, exclusive reliance on government planning has held back the pace of development, pushed up land prices and created large amounts of illegal construction. Equally, the centralised system of land development quotas needs to be ended. Urbanisation can also generate externalities such as congestion and pollution. As the next chapter shows, these problems are not necessarily linked to city size, but can be dealt with by appropriate policies that internalise externalities and so enable cities to develop more efficiently.

Box 1.3. **Main policy recommendations on urbanisation**

Urban planning and transport

- Government policy towards city size should be neutral. Policies that favour small and medium-sized cities should be ended as should those that restrict the growth of large cities.
- The annual quota for the conversion of agricultural land should be abandoned as should the national floor on agricultural land. They should be replaced by a locally-determined master plan that takes into account the need to lower housing prices at the fringes of larger cities.
- In large cities, subway systems are generally still undersized, requiring further investment. In smaller cities, more emphasis should be given to Bus Rapid Transit systems.

Box 1.3. **Main policy recommendations on urbanisation** *(cont.)*

Land use

- Plot ratios in urban master plans should take into account public transport availability and the nearness of public facilities, and the district plans should follow master plans more closely.
- The size of residential development sites should be lowered to increase value and allow more competition amongst developers.
- A much higher proportion of the development value of agricultural land should accrue to farmers. Greater legal certainty should be given to the property development undertaken on collectively-owned "village" land located in urban or peri-urban areas. The use of a company structure could help achieve this objective.
- The expenditures funded by land sales should be made more transparent, both as far as the cost of redevelopment is concerned and with respect to the final destination of compensation payments.
- The land-use rights of farmers should be extended to allow – subject to zoning and planning requirements – the sale, renting and mortgaging of their rights which should be extended to 70 years in order to allow the development of larger farms.

Public service provision to migrants

- Disconnect the provision of local services from the possession of a local *hukou*.
- Increase the subsidies to private schools that provide education to migrant children. Allow migrants to enroll in high schools in their place of residence instead of their place of registration.
- Allow the university entrance examination to be taken in the place of residence.
- Abolish local quotas for entrance to university.

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Chapter 2

Reforms for a cleaner, healthier environment

China's exceptional economic expansion has led to rising energy demand and pollution as well as other environmental pressures. Strong efforts by the government have moderated emissions of some types of air and water pollution from high levels but others, including greenhouse gas emissions, continue to rise. Poor air and water quality threaten human health, create other costs and reduce well-being. The 12th Five Year Plan aims at further reducing pollution and at other environmental improvements. To achieve these goals in a cost-effective manner wide-ranging reforms are needed. Reliance on command-and-control measures ought to make way gradually for well-implemented market-based approaches. Energy and water pricing need to be reformed to provide stronger incentives for end-users. So does pollution pricing. A carbon tax should be given serious consideration, especially if pilot carbon emissions trading schemes turn out to be difficult to implement. As well, stronger standards are needed, including for motor vehicles and fuels. Efforts to enhance environmental enforcement, particularly at the local level, will also be key to further progress.

As a rapidly growing middle-income country China faces a number of environmental challenges. Addressing these is an increasing priority for the government and under the auspices of targets laid out in the 11th Five Year Plan (FYP) some notable improvements have been achieved. Nevertheless, air and water pollution remains high. Water pollution is also exacerbated by water scarcity while a dependence on fossil fuels and rising energy demand poses a major challenge to controlling air pollution. These pressures impose significant health and other costs and reduce well-being. Often the poor suffer disproportionately and so environmental problems work against efforts by the government to reduce inequality. Environmental developments in China also have significant global repercussions, not least with respect to climate change. Looking ahead, the government has set itself renewed environmental targets in the 12th FYP and this chapter examines how these and related goals can be achieved in a cost-effective manner. Section one provides an overview of environmental trends and challenges, analyses their costs and recent policy responses. Section two examines market-based reforms to encourage energy and water conservation as well as how pollution pricing can be used more effectively. The complementary role of stronger standards and better enforcement are discussed in section three while section four concludes.

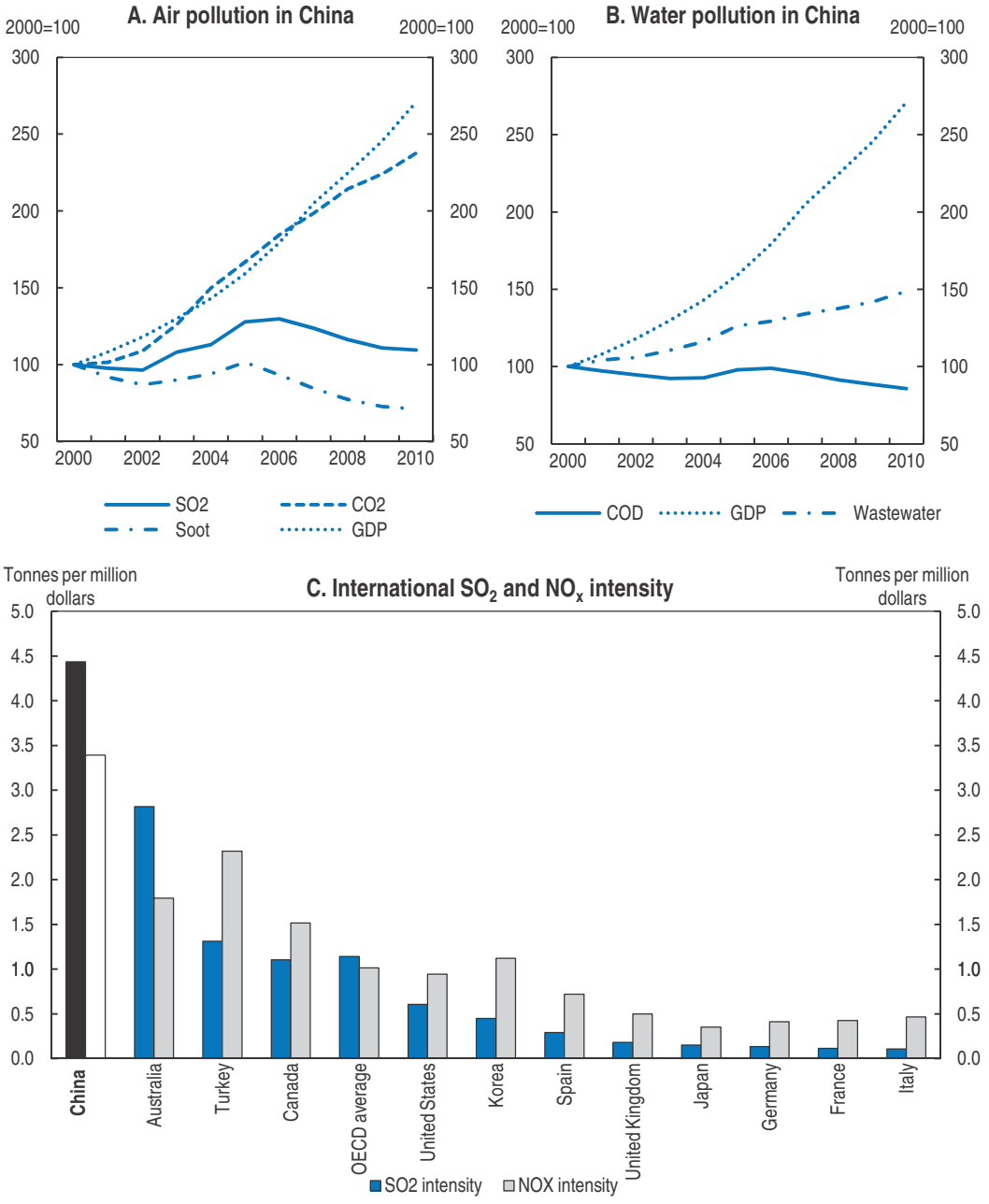
Progress is being made but wide-ranging environmental challenges remain

Pollution emissions remain high

Against the backdrop of sustained high economic growth and rising living standards China has made progress in curbing some forms of pollution and achieved other environmental improvements. Progress was especially notable during the 11th FYP period (2006-10). Emissions of sulphur dioxide (SO_2), an important primary air pollutant, were decoupled from economic growth in the early 2000s and later declined in absolute terms (Figure 2.1, Panel A). Discharge of various types of water pollution also fell (Figure 2.1, Panel B). Total annual discharges of chemical oxygen demand (COD), which reflects the presence of organic and inorganic pollutants, were around 14% lower in 2010 compared with a decade earlier, while discharges of ammonia nitrogen also declined. However, emissions of other pollutants continue to rise and overall pollution levels remain high. China is the single largest emitter of SO_2, exceeding the combined emissions of the United States and the European Union. Chinese emissions of nitrous oxides (NO_X), another important primary air pollutant, have continued to climb in recent years and exceed US emissions by a considerable margin. Although per capita emissions of SO_2 and NO_X are lower, emissions relative to GDP, an indicator of environmental efficiency, are high compared with large and medium-sized OECD countries (Figure 2.1, Panel C).

Emissions of SO_2 and NO_X contribute to secondary pollutants, including ground-level ozone and particulate matter, while nitrogen compounds from NO_X contribute to eutrophication in waterways and the broader ecosystem. Together they cause acid rain, which affects aquatic life and damages crops and other vegetation as well as materials

Figure 2.1. **Air and water pollution emissions and intensity**



Note: Wastewater and COD includes industrial and household sources. Pollution intensity refers to 2010 or most recent observation.
Source: CEIC, OECD and NBS-MEP (2011).

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including building exteriors. Though the incidence of acid rain in China has declined somewhat in recent years, it remains a serious concern. In 2011 the government estimated that over 10% of China's landmass was affected, including farmlands and densely populated areas along the Yangtze River and in the South-East (MEP, 2012). In addition, almost half of a sample of 468 monitored cities was reported to have experienced frequent bouts of acid rain. Official data on emissions of other important primary air pollutants such as carbon

monoxide (CO), volatile organic compounds (VOCs), a precursor of ground level ozone, and black carbon, a form of particulate matter, is scarce. However, independent studies relying on inventory methods to estimate emissions using fuel consumption and other data indicate emissions of these pollutants are also high by international standards. An estimate of total VOC emissions by Cao *et al.* (2011) compares unfavourably with many large OECD countries while on their estimates CO emissions far exceed those in the United States.

Chinese emissions of black carbon, which is the result of incomplete combustion of fossil fuels, rose rapidly in the five years to 2009 (Qin and Xie, 2012). They are far greater than slightly more dated estimates for the United States (EPA, 2012). Recent scientific evidence suggests that the role of black carbon in global warming is much greater than was thought a few years ago, when it was found to have a warming effect of 0.44 W/m^2 (IPCC, 2007). A recent large study concluded that the impact was 0.61 W/m^2 (UNEP and WMO, 2012). Even more recently, a large study from the International Global Atmospheric Chemistry Project suggested that it may be as high as 1.1 W/m^2, making it the second largest source of global warming (Bond *et al.*, 2013). However, mitigation strategies need to be designed carefully to allow for feedback effects from pollutants emitted at the same time as black carbon which may act as cooling agents (such as SO_2).

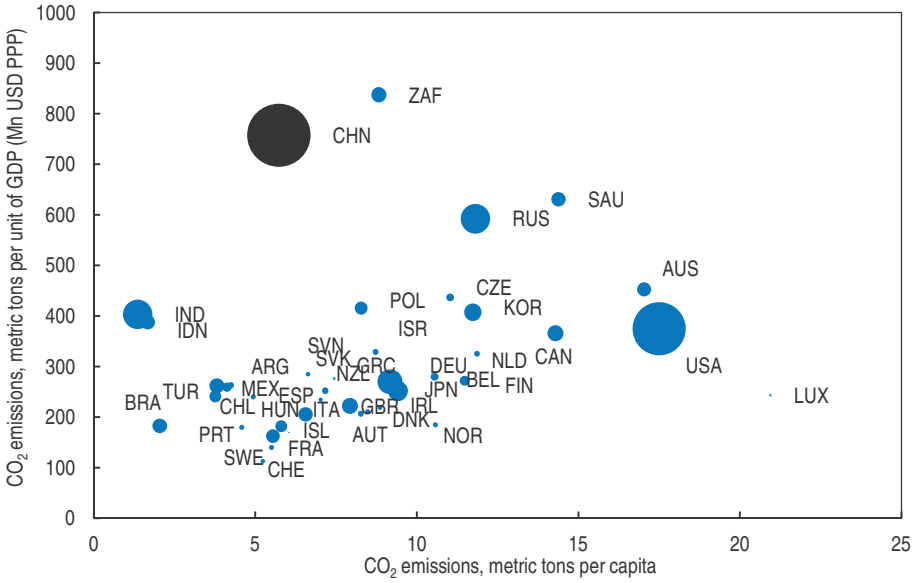
In China, black carbon is predominately emitted in rural areas. Low-efficiency stoves and open fires are the main source. Small-scale rural industries also cause such pollution, while agriculture has become a major source as the increasing cost of labour has resulted in a surge of stubble burning (Cao *et al.*, 2006). Finally, the growing stock of poor-quality diesel engines has boosted emissions as well. Programmes to replace inefficient coal stoves and fires or to use alternative fuels, together with better control of emissions from diesel engines would help, as there are few offsets to warming from this source. Reducing black carbon particles, which can penetrate deep into the lungs, would help human health even though they may not be a direct health threat given that they operate as a carrier of a wide variety of chemicals of varying toxicity to sensitive targets in the human body (WHO, 2012).

China was the largest emitter of greenhouse gases (GHG) by 2005 and of energy-related carbon dioxide (CO_2) by 2007 (IEA, 2012a). Though Chinese emissions of CO_2, the largest component of global GHG, have decoupled from GDP growth in recent years, they have continued to rise fast and reached almost 7 billion tonnes, around one quarter of the global total, in 2009 (Figure 2.2). Historically, GHG emissions from China were much lower than those of the advanced economies so that China's contribution to atmospheric concentrations today is smaller than that of many advanced economies. In addition, as many emissions are generated during the process of producing goods which are exported, consumption-based measures of CO_2 emissions for China are significantly lower than production-based estimates (while the reverse is true for many OECD countries) (Nakano *et al.*, 2009). China's per-capita emissions also continue to trail OECD countries but emissions intensity is well above OECD levels (Figure 2.2).

As a consequence, air quality in Chinese cities, as well as many regions, is often poor. Across a number of major cities concentrations of air pollutants most closely monitored by the authorities – including NO_X and large particulate matter (PM10), which is particularly harmful to human health – are high. In 2010, in 31 major Chinese cities including Beijing, other provincial-level cities and provincial capitals, the ambient concentration of PM10 averaged around 95 $\mu g/m^3$, slightly lower than in 2005 but still well above the World Health Organisation (WHO) guideline limit of 20 $\mu g/m^3$. It also exceeds the WHO interim target

Figure 2.2. **Carbon dioxide emissions and emissions intensity**

In 2010



Note: The size of circles indicates the volume of CO_2 emissions.
Source: IEA.

StatLink *To download the data corresponding to this graph, refer to Figure 30.*

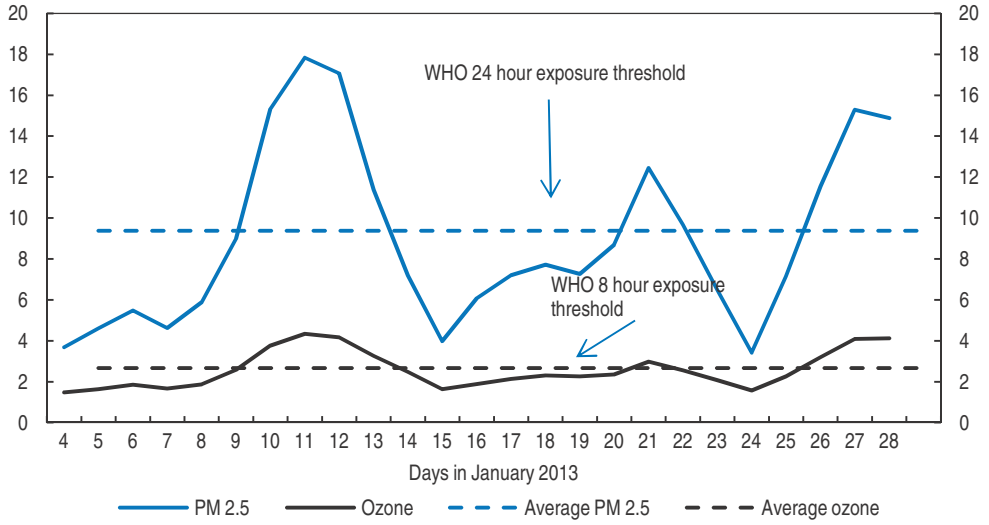
level 1 of 70 µg/m^3, a level associated with an approximately 15% higher long-term mortality risk relative to the guidelines level. Average NO_X concentrations are also high in Chinese cities, at around the WHO guideline limits of 40 µg/m^3, averaged over one year. Moreover, as noted above, NO_X emissions have risen in recent years and this is reflected in the air quality of cities where average NO_X concentrations rose over 5% between 2005 and 2010.

Air quality varies across cities and pollution levels are often highest in inland locations. In Beijing, over the whole winter of 2007/08, NO_X pollution averaged seven times the WHO hourly guidelines, with mobile sources accounting for almost two-thirds thereof. Pollution levels exhibited a saw-tooth pattern with peaks corresponding to periods when winds were from the south or south-east east pushing pollution towards the mountains to the north and north-west of the city, so preventing it from being blown away (Lin *et al.*, 2011). A severe air pollution peak occurred in January 2013, when the 24-hour PM 2.5 concentration level averaged nine times the WHO safe exposure level and ozone levels also far exceeded WHO limits (Figure 2.3). Such high levels of pollution are equivalent to those that occurred in the London smog of 1952, which caused an estimated 12 000 premature deaths (Bell and Davis, 2001).

While the January 2013 pollution peak was very evident, the average level of pollution by PM 2.5 particles is very high both in Beijing and across the country. According to estimates by satellite imagery, the annual average level of PM 2.5 pollution in China has been three times the WHO's average safe level (Columbia Earth Institute *et al.*, 2012). The level of pollution in Beijing is slightly below the population weighted average for the country as a whole (Table 2.1). There are nine provinces which have worse air quality on average, though pollution peaks may not be so severe as in Beijing as peaks tend to correspond to a combination of adverse meteorological conditions and the particular physical surroundings of an area. Despite an average growth rate of 10.6% per year, the level of PM 2.5 pollution did not rise in the period 2001 to 2010. In a few provinces (Jiangsu

Figure 2.3. **Pollution levels in Beijing relative to WHO limits, January 2013**

PM 2.5 measured as a 24 hour average, ozone measured as an 8 hour average



Note: The data come from one monitoring station in central Beijing; however, the Vice-Minister of Environmental Protection has stated that the figures from this station are roughly representative of the whole of Beijing (Wu, 2012a).
Source: Twitter.com/BeijingAir.

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and Inner Mongolia) pollution rose but in some others it fell. To reduce the annual average particle pollution to the WHO's safe level in one decade would take an annual reduction of almost 11% per year. In urban areas, ground monitoring stations showed that average pollution levels were almost double the countrywide average revealed by satellite monitoring, at 5.8 times the WHO norm (Wu, 2012b).

Table 2.1. **Particulate pollution in Chinese provinces**

Ambient concentration of small diameter particles (2.5) relative to the WHO annual norm

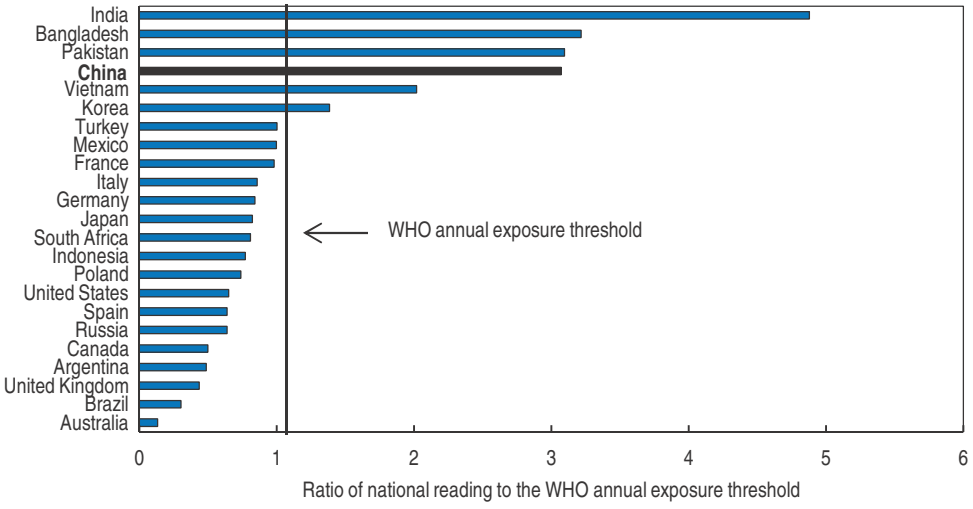
	Pollution ratio	Trend		Pollution ratio	Trend
	Relative to WHO level	Annual average change 2005 to 2010 (%)		Relative to WHO level	Annual average change 2005 to 2010 (%)
Shandong	5.0	..	Shanxi	2.4	-1.6
Henan	4.3	..	Guangdong	2.5	-5.3
Hebei	4.0	..	Guizhou	2.0	-5.3
Jiangsu	4.5	1.6	Zhejiang	2.2	..
Anhui	3.8	0.1	Fujian	1.5	-2.5
Hubei	3.8	..	Liaoning	1.8	..
Sichuan	4.1	..	Gansu	1.7	..
Guangxi	3.6	-3.3	Xingjian	1.8	..
Tianjin	3.0	..	Ningxia	1.4	..
Beijing	2.8	..	Jilin	1.5	..
Jiangxi	2.7	-3.6	Qinghai	1.4	..
Hunan	3.1	..	Inner Mongolia	1.1	3.6
Shanghai	2.4	..	Tibet	0.9	..
Yunnan	2.7	..	Heilongjiang	0.9	..
Shaanxi	2.7	..	Hainan	0.3	..

Source: Hsu (2012).

Urban air quality in China also compares poorly internationally, with concentrations of PM 2.5 invariably higher than those in OECD and other upper middle-income countries (Figure 2.4). There are, nonetheless, a few countries where pollution is higher than in China, notably in South Asia. In India, for example, the annual PM 2.5 pollution level in three major cities (Delhi, Kolkata and Mumbai) is estimated to be between 8 and 15 times the WHO annual limit (Dey *et al.*, 2012).

Figure 2.4. **Outdoor air pollution from small diameter particulates**

Satellite estimates of PM 2.5 concentrations, annual population-weighted averages
Expressed as a ratio to the WHO annual exposure threshold



Source: Environmental Performance Index (2012).

StatLink *To download the data corresponding to this graph, refer to Figure 28.*

In 2012, the government announced plans to expand the coverage of air pollutants monitored and to include PM 2.5. The government plans to monitor air quality standards in all prefecture-level cities by 2015 and cover the whole country by 2016. The government has also issued new standards for air pollution including limits for small diameter particles that it expects to lower PM 2.5 concentrations by at least 5% in 13 major areas covering 117 cities. To achieve these objectives, the Beijing city government had pledged to remove by administrative action 400 000 heavily polluting vehicles during its 2011-15 Five Year Plan. Following the pollution peak, the city government announced that by the end of 2013 it would have removed 700 000 polluting vehicles from the roads since 2011 (about 14% of the stock of cars in the city), though many would have been scrapped due to normal depreciation. It also aims to reduce the use of coal for domestic heating and shut about 450 heavily polluting factories. It expects these measures to decrease concentrations of major pollutants by 2% in 2013.

While water quality has improved somewhat in recent years, reflecting declining pollution discharges, China's rivers and lakes continue to suffer from widespread and often severe pollution. As in other countries, China uses a grading system for monitoring and reporting the quality of freshwater across the country, with grade I water the highest quality and grade V-plus the worst. Water meeting at least grade II is deemed useable for drinking and water quality grade IV or worse inappropriate for contact with human skin. On this grading system, in 2011, out of 469 monitored sections of China's key national river

basins, just fewer than 40% were assessed as grade IV or worse, down from 54% in 2006. The situation remains especially serious for major rivers in the north of the country which pass through large cities, including the Huaihe and Liaohe, where well over half of monitored sections were deemed to be grade IV or worse (Table 2.2). Recent data confirm that other parts of the freshwater system also suffer from serious pollution, with 85% of lakes deemed to have water quality grade IV or worse and over half of all lakes and reservoirs assessed as suffering from eutrophication.

Table 2.2. **Water quality in China**

In per cent, in 2011

	Grade I-III	Grade IV-V	Grade V-plus
Major river systems			
Yangtze	80.9	13.8	5.3
Yellow	69.8	11.6	18.6
Pearl	84.8	12.2	3.0
Songhua	45.2	40.5	14.3
Huaihe	41.9	43.0	15.1
Haihe	31.7	30.2	38.1
Liaohe	40.5	48.7	10.8
National	**61.0**	**25.3**	**13.7**
Major lakes and reservoirs			
Lakes	17.6	70.6	11.8
Reservoirs	88.9	11.1	n.a.
	Grade I-II	**Grade III-IV**	**Worse than grade IV**
Coastal areas			
Yellow Sea	83.3	16.7	0.0
East China Sea	36.9	23.1	40.0
South China Sea	78.6	13.6	7.8

Note: For river systems and coastal areas figures refer to the proportion of water monitoring stations meeting a particular water quality grade. For lakes and reservoirs an overall assessment is given to each water body. A five plus one grade system applies to the freshwater system and a four plus one system to coastal areas, with a lower grade indicating lower levels of pollution.
Source: MEP (2012).

Some sections of coastal waters are also heavily polluted. For marine areas a separate four plus one grading system is used to assess water quality with grade I the most pristine, grade IV the most polluted and water meeting grade II standard deemed appropriate for bathing. Coastal water quality along the three main seas monitored varies considerably. Along the Yellow Sea, in the north of the country, 83% of areas monitored reached the grade II standard. In contrast, over 60% of coastal areas of the East China Sea, to the south, failed to meet this grade. Coastal areas around some heavily populated sub-regions, including Bohai Bay, were also found to be heavily polluted. Official monitoring of water quality near river deltas underscores the impact of upstream pollution on coastal water quality, with over half of the monitored sections of rivers flowing into the East China Sea judged to be grade IV or worse on the freshwater grading system.

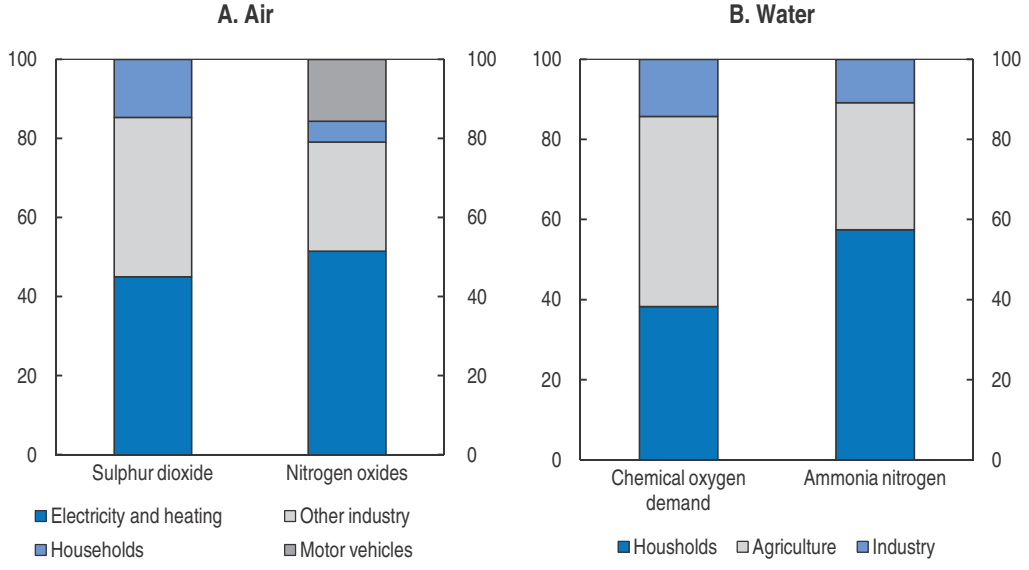
Less systematic environmental monitoring makes an accurate assessment of conditions in rural areas difficult. However, in 2011 the Ministry for Environmental Protection (MEP) undertook a trial to assess air, soil and water quality in a sample of 364 villages. The results suggest that wide-ranging environmental pressures are not

confined to cities, with a sizeable proportion of the villages surveyed failing to meet air and soil standards (Wu, 2012). This is consistent with recent studies showing significant pollution spillovers from cities into surrounding areas and high levels of pollution coming from rural areas themselves (Cao *et al.*, 2006, Suthawaree *et al.*, 2012; Xu *et al.*, 2011; Yang *et al.*, 2012). Likewise, rivers can transport pollution over large distances such that populations living in areas without high concentrations of heavily polluting industries may be exposed to upstream activities as well as environmental accidents which continue to pose a serious threat (He *et al.*, 2012; Zhang and Zheng, 2012). Data on air quality assessed using satellite imagery confirm that the challenge of severe air pollution highlighted from *in situ* monitoring stations extends to rural areas (OECD, 2011a). Indeed, an overwhelming proportion of the national population was deemed to be exposed to PM 2.5 levels in excess of WHO guidelines.

Several factors contribute to China's environmental challenges

China's environmental challenges stem from a range of factors, not least the sheer pace of economic expansion and associated resource demand growth, as well as underlying production and consumption patterns. By international and historical standards the manufacturing and investment shares of the economy are large, implying that economic activity has been focussed in more resource-intensive and heavily-polluting sectors. More specifically, high volumes of pollution originate from a range of point and non-point sources, with air pollution emitted primarily from energy production and industrial sources and water pollution from households and agriculture (Figure 2.5).

Figure 2.5. **Sources of air and water pollution in China**



Note: Air pollution figures refer to 2010 and water pollution figures to 2011.
Source: MEP (2011b) and MEP (2012).

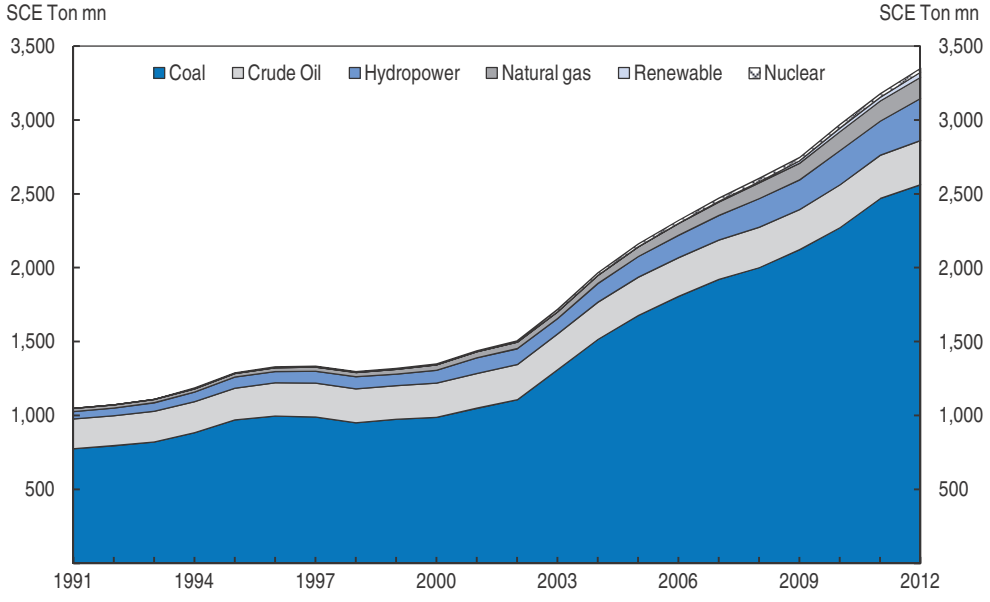
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Sizeable air pollution emissions from energy production and industry reflect China's growing energy demand and supply structure, which continues to be dominated by coal for electricity production and direct use by industry in furnaces and boilers. China has one of the world's largest recoverable coal reserves and is the largest coal consumer and producer. In 2011,

coal accounted for around 78% of total energy production, one of the highest shares of any major economy. Renewable and nuclear energy as well as cleaner fossil fuels, notably natural gas, have all expanded very quickly. In recent years China along with the United States has led global renewable energy investment and installed wind capacity has risen from almost nothing in the early 2000s to the world's largest (Pew, 2012). Photovoltaic and other solar capacity has also taken off, with China accounting for the majority of the global expansion in installed solar water heater capacity during the 2000s and half of world capacity by 2009 (IEA, 2011a). The 12th Five Year Plan targeted the installation of 5 GW of solar energy capacity by 2015. This initial target has been raised several times. In January 2013, the government announced that it expected 35 GW of solar power to be installed by 2015. However, not all of the expansion in renewable energy capacity has been efficient, particularly in the wind sector: most capacity is located in northern regions, where weather conditions are conducive to wind power generation but which are distant from major sources of demand along the coast. Owing to this mismatch and problems with grid connectivity less than 70% of installed wind capacity had been connected to the grid in 2010 (Ni and Yang, 2012). Some of the problems have been resolved since then with better planning. The State Electricity Regulatory Commission estimates that on average only 16% of wind electricity was lost due to curtailment problems in 2012.

Despite the impressive expansion in renewable and nuclear power, shares of these alternative energy sources remain small, at under 10% of total production in 2011 and with hydropower accounting for much of this. Indeed the share of coal in primary energy production has risen since the early 2000s as the contribution from oil declined (Figure 2.6). Aside from emitting large quantities of primary air pollutants such as SO_2 and NO_X, coal-powered generators produce large quantities of mercury as well as airborne dust and soot and inhalable primary particulate matter. There are other adverse consequences from the current heavy reliance on coal. Though safety has improved the coal mining industry continues to be plagued by accidents. Coal mining also consumes large quantities of water and coal washing, while beneficial for reducing SO_2, contributes to water pollution.

Figure 2.6. **Energy production in China**



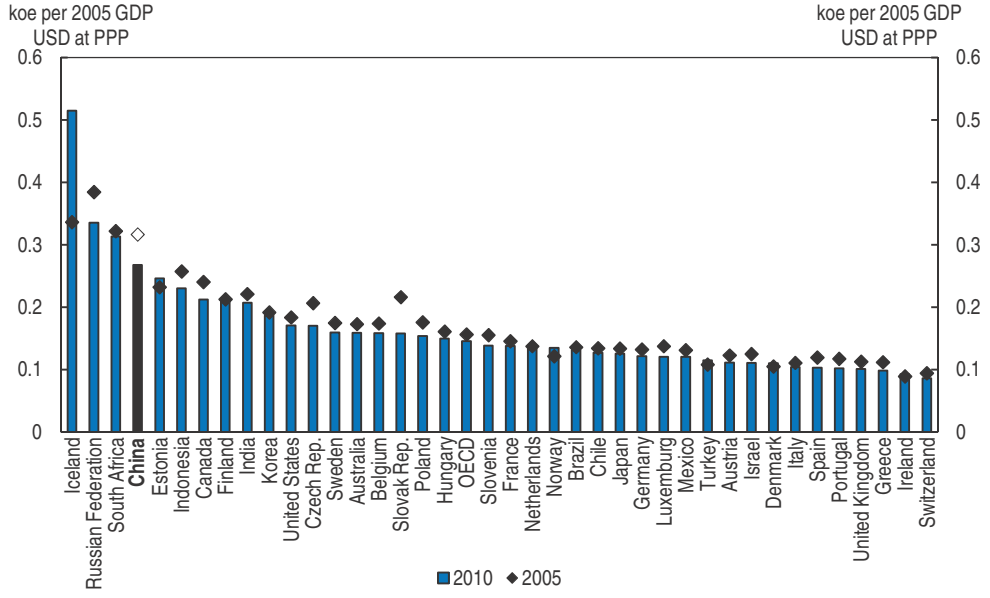
Source: China Statistical Yearbook.

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Resource inefficiency compounds problems

China has achieved major progress in energy efficiency over the past two decades but there is room for further progress. Improvements were particularly rapid during the 1990s before being partially reversed in the early 2000s. This led to authorities redoubling efforts and targeting a stringent 20% improvement in energy efficiency during the 11th FYP, which was almost achieved. Even so, energy use continued to rise fast and China overtook the United States as the world's largest energy consumer in 2009 (IEA, 2010). China also remains less energy efficient than most OECD countries and some other large emerging economies (Figure 2.7). Most of the energy efficiency gains thus far are due to improvements within sectors rather than from rebalancing towards lower energy sectors (Wu, 2012). In general, energy efficiency is highest in the more economically advanced regions of the country and national improvements partly reflect inefficient provinces converging towards better performing regions.

Figure 2.7. **International energy intensities**



Source: OECD and IEA.

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Improving water efficiency is also imperative, with relative water scarcity in China compounding water pollution problems. Per-capita renewable water resources, which reflect precipitation less losses due to evaporation, amount to around 2 080 m^3 in China, higher than in India but much lower than in a number of other sizeable countries. Moreover, rainfall is highly uneven across China, with much of the interior of the country and densely populated Northern provinces suffering very low rainfall. Indeed, the major river basins in the south, including the Yangtze and Pearl, capture around 80% of the country's total precipitation. In drier regions there is a heavy reliance on groundwater which is being extracted faster than it can be naturally replenished, resulting in declining water tables and land subsidence in cities and, for households without access to piped water and farmers, larger outlays for digging deeper wells (Gleik, 2009).

To address water shortages the government has invested heavily in water infrastructure projects, including agricultural irrigation. These and other measures have helped achieve significant improvements in water efficiency, enabling the economy to maintain strong growth with little increase in aggregate water consumption (Medianu and Whalley, 2012). In general, therefore, water infrastructure projects have represented a sound investment. However, some of them have been very costly financially and ecologically, including the largest scheme, the South-North Water Transfer Project. This massive undertaking is to link several of the nation's largest rivers and divert water from high rainfall areas in the south to dry and densely populated agricultural and urban areas in the north, including Beijing (Freeman, 2011).

Desertification and forests

In large parts of China, the land has become desert. By 2010, about one quarter of the landmass was classed as desert and a further 15% had a rainfall level so low that it was at risk of turning to desert. Indeed during the 1990s, the deserts expanded by 3%. Human intervention in the natural environment was the principal reason for this increase. The transformation of grasslands into cultivated land produced a temporary gain of crop land. However, tilling the land exposed the surface and resulted in wind erosion. Moreover, the quality of the grassland soil was not adequate to support crops over the long term and so it fell into disuse. Without its previous grassland cover the land became at risk of turning into desert (Cao *et al.,* 2011). In addition, the nomadic herders did not reduce their herds in line with the reduction in grassland and so land became over-grazed and likely to turn to desert (Wang *et al.*, 2012). Apart from the environmental damage caused by the land transformation, the risk of dust-storms was heightened, with the desert region being only 250 kilometres from Beijing.

Dust storms can cause severe environmental problems. While the number of observed dust storms has tended to decline over the past 50 years (Shao and Dong, 2006), their severity seems to have increased. In 2006, for example, a severe dust storm deposited 30 kg of sand per person in the Beijing area. The long-term decline in the number of dust storms appears to have been caused by the rise in temperatures in China's desert areas. While this could be caused in part by global warming, it appears to be linked to more local factors. In particular, simulation models suggest that the increase in black carbon emissions appears to have played a key role (Gu *et al.*, 2010).

Excessive use of natural resources has also created problems of severe flooding. Three waves of forest cutting in the past 40 years have resulted in the elimination of forest cover in a large part of the steeply sloping catchment area of the upstream Yangtze River. This has resulted in surface erosion that has caused the river bed to rise so increasing the risk of flooding.

In order to counter the environmental risks of desertification and flooding, the government launched a series of major forestation projects. The objective was to reforest areas that had been cut in river valleys and also to create barriers against dust storms and to reclaim desert areas. The overall result of these projects, the largest such programme in the world, has been to substantially increase China's forest cover. However, there has been extensive planting of single species forests which are vulnerable to disease. Also in some cases, species that are not native to the area have been planted that have drained excessive water from under ground and lessened surface vegetation cover leading to the failure of planting (Trac *et al.*, 2007).

The area of commercial forests has decreased markedly in the past decade due, in part, to the collective nature of the ownership of most forests. As with agricultural land, forest land is owned by the village collective. Until 2008, individual members of the collective were assigned areas of the forest in which they could cut timber, but their rights were not secure. Since 2005, collectives have been instructed to register forestry rights. Once this happened, the ownership of the trees was transferred to the farmer and a 70-year, renewable use-right was granted to the farmer. Households were free to transfer the use-rights though newly established forestry exchanges, while they could cut trees according to their own priorities on those parts of the parcels not classified as ecologically sensitive (Yin *et al.*, 2012). At the same time, levies raised by local government were abolished and the local government forestry departments slimmed in size.

These policy changes have had some success. The desert area has started to fall, albeit slightly. The portion of the country covered by forest has risen substantially. Between 1990 and 2010, the area of forest used for environmental protection has grown four-fold (Table 2.3). The increase in forest cover is estimated to have absorbed almost 100 million tonnes of carbon per year between 2000 and 2010. The conversion of grasslands into agricultural land appears to be continuing, which could have adverse long-term consequences as soil erosion is likely to increase and, eventually, when soil nutrients are exhausted the land is at risk of desertification. The increase in conversion has more than offset the loss in agricultural land stemming from urbanisation. Nonetheless, despite the expansion of agricultural land into areas that, presumably, have lower yields, real agricultural output per hectare of cultivated land increased by nearly 4% per year in the decade to 2011.

Table 2.3. **The evolution of land use**

	Share of land surface	Total land surface	Change in land area		
	2010	2010	1990 to 2000	2000 to 2005	2005 to 2010
	%	Million ha	Million ha		
Desert and scrub	37.8	363.1	2.9	4.3	-4.1
Grasslands	17.9	171.8	-28.2	-41.7	-22.5
Desert, scrub and grasslands	55.7	534.9	-25.3	-37.4	-26.5
Forests	13.2	127.0	36.8	18.0	14.8
Commercial forests	8.3	79.8	-20.7	1.9	-1.0
Total forests	21.5	206.9	16.0	19.9	13.8
Forest, desert, scrub, grasslands	77.3	741.8	-9.3	-17.5	-12.7
Sown agricultural land					
Land gain		n.a.	9.3	17.5	12.7
Land loss		n.a.	-10.1	-9.6	-7.5
Cultivated land (net)	16.7	160.7	-0.8	7.9	5.2
Built land	4.2	40.1	10.1	9.6	7.5
Inland water	1.8	17.5	0	0	0

Note: The area of grasslands has been calculated as a residual as no one source was available for land use categories.
Source: FAO (2010) for forest data, *China Statistical Yearbook* for cultivated land and built land.

Environmental degradation has major costs

Environmental degradation has major economic and broader costs. Exposure to heavily polluted outdoor air and hazardous chemicals as well as the consumption of

unsafe drinking water can damage health through many channels. Climate change may also entail sizeable costs, notably through changes in infectious diseases and weather. Indeed, Chinese cities are among the most exposed in the world to coastal flooding associated with climate change (Nicholls *et al.*, 2008). General increases in temperatures can magnify the adverse effects of air pollution on health (Kan, 2011). Indoor air pollution generated from burning biomass fuel, which is still widely used in rural China, also harms health (Baumgartner *et al.*, 2011).

China has amongst the highest incidence of premature mortality due to outdoor PM exposure and this could worsen without policy action (OECD, 2012a). Indeed, studies from the United States show that the level of this type of pollution seen, on average, in China in 2010 results in a 50% increase in the risk of death (Schwartz *et al.*, 2008). In the cities which reported the level of such pollution in the first half of 2012, the excess risk of death, relative to deaths at the WHO limit, maybe as high as 70%. Such levels of outdoor air pollution from particulates are estimated to be the fourth largest source of lost healthy years of life in the East Asian area which mainly covers China, while indoor air pollution is the fifth largest cause of death (Global Burden of Disease Study, 2012). At a more local level, in recent years there have been reports of serious health threats related to pollution across the country (Jianrong, 2011; Economy, 2010). These have highlighted cases of elevated exposure and in some cases high blood concentrations of pollutants, such as lead, threats to drinking water safety and high localised incidences of disease including cancer.

Recent estimates suggest the economic costs of environmental degradation in China are high, warranting a strong policy response. Combined health costs from PM and water pollution reached nearly 4% of GNI by the late 2000s (World Bank-DRC, 2012). The cost of CO_2 emissions, imputed using a fixed price for carbon emissions, together with material damage from air pollution and soil nutrient depletion adds some 2.5% of GNI. Incorporating additional costs associated with energy and mineral depletion brings the total costs of environmental degradation to around 9% of GNI. A separate study, which incorporates the impact of cumulative exposure to air pollution rather than applying static analysis, estimates that health related costs of pollution alone were around 6% of GDP in the mid-2000s (Matus *et al.*, 2012). In this study the cost of pollution is also reported to have risen over time, as urbanisation sees more people exposed to heavily polluted air and as rising incomes increase the monetary value of health damages. However, as pollution levels have been relatively stable and there has been a strong sustained expansion of the economy, pollution costs as a share of GDP have declined. Nonetheless, the evidence is that a reduction in the level of air pollution reduces the level of lost years of life within two years so ensuring a relatively high return on efforts to reduce pollution (Schwartz *et al.*, 2008).

Empirical analysis has examined the link between surface water quality and digestive cancers, highlighting the strong links between water pollution and health in China, as well as the large gains from efforts to reduce pollution (Ebenstein, 2012). A one grade deterioration in water quality, as measured on the national water quality system discussed above, is found to be associated with an almost 10% increase in the incidence of cancer. Further, the compliance costs for improving industrial wastewater quality appears low when compared with statistical value of life estimates for China, implying a compelling economic case for mitigation. Indeed, with an improvement of water quality by about one-fifth, the economic gain could be as high as 0.1% of GDP annually, with the cost of improving water quality being recovered in one year. This is particularly so as the study focuses on only one type of illness associated with poor quality water. Estimates covering

a wider range of pollutants and health impacts put the economic costs of water pollution at 0.5% of GDP (World Bank, 2009).

The Chinese government has invested heavily over a number of years to increase access to improved drinking water, which has helped to boost public health (Zhang, 2012). These investments have focussed on expanding the mains network, in order to increase access to piped water, as well as treatment facilities, to improve water quality. In urban areas access to piped water has risen rapidly and is now approaching universal levels. However, water quality remains a concern with government officials stating that 17% of water supplies failed to meet official standards, possibly because water is so heavily polluted that standard water treatment facilities are less than fully effective (Liu, 2012). Though access to piped water in rural areas has also risen rapidly, still less than half of the population is covered. A further 40% of the rural population have access to water from an "improved source" such as a well but the extent to which these sources provide protection from pollution is unclear (WHO-UNICEF, 2012). A sizeable share of the population likely remains exposed to water pollution related health threats either through direct ingestion or through food chain contamination. The latter can occur directly, through the consumption of fish or other aquatic life, or through the use of polluted water to irrigate crops (Zhang *et al.*, 2010a).

Though aggregate estimates of the costs of environmental degradation are useful in underscoring the justification for policy intervention they do not, in general, take account of distributional concerns. Health problems associated with pollution can have disproportionately large impacts on the poor, who may suffer greater exposure to pollution and have fewer options to relocate, working against government objectives to promote a harmonious society. In the case of water pollution, this is corroborated by Ebenstein (2012) who shows the association between pollution and health problems is higher in areas with lower access to tap water. Although public spending on health care and health insurance coverage have improved considerably in China, significant out-of-pocket expenses for serious illness remain a problem (OECD, 2010a). Consequently the poor may also endure a greater financial burden from adverse health caused by environmental problems. In addition, farmers and the poor stand to lose the most from environmental pressures such as climate change, which could lead to more volatile weather and hence less reliable agriculture production patterns and farm incomes, and greater volatility in food prices.

In a number of ways, environmental developments in China have global repercussions. Many types of harmful air pollutants travel across national boundaries or continents, depending on their size and residence time, potentially affecting local air quality far from their source (OECD, 2008). CO, ozone, mercury and particulate matter can travel well beyond China's borders. Indeed, empirical modelling by Sakkara *et al.* (2009) indicates that Chinese emissions of SO_2 and black and organic carbon have had serious adverse health impacts abroad, especially in neighbouring regions. They report that under a business-as-usual baseline such adverse impacts would rise substantially but also that significant benefits would accrue, both to China and other countries, from efforts to reduce air pollution over the medium term.

Policies that impact the future path of Chinese GHG emissions will have a major bearing on the outcome of international efforts to avoid the most serious adverse consequences of climate change. Modelling presented in the *OECD Environment Outlook* (OECD, 2012a) shows how collective commitments countries have given to controlling their

own emissions can be compatible with the internationally agreed objective of limiting global GHG concentrations to 450 parts per million of CO_2 equivalent by the end of the century. For China, in the short run this includes reducing CO_2 intensity, increasing forest areas and boosting reliance on renewable energy. As China has overtaken the United States as largest emitter and is on one of the fastest near-term emission growth trajectories, under a least-cost scenario the absolute reduction in GHG emissions to be achieved by China relative to a business-as-usual baseline is larger than for any other single country. Deviations from this abatement scenario would therefore set back global progress in addressing climate change.

Given the severity of pollution in China, efforts to tackle environmental challenges are likely to deliver large co-benefits. As noted, several types of pollution originate from the same sources and in major Chinese cities, concentrations of the key air pollutants such as SO_2, NO_X and PM tend to be strongly correlated. Interactions between some pollutants mean that lowering primary air pollutants will also help reduce secondary pollutants. Efforts to promote cleaner energy and improve energy efficiency will reduce various types of pollution, lower compliance costs and promote better health, thereby lowering health care costs. Several co-benefits can also arise from efforts to make cities more environmentally friendly, including expanded public transport, which can reduce energy consumption and improve mobility, especially amongst poorer households.

Addressing environmental priorities in the 12th FYP will require a broad policy response

Improving environmental outcomes is one of the central aims of government policy, as underscored by the 12th FYP which includes a number of environmental targets to build on successes in the 11th FYP (Box 2.1). Targets to further reduce SO_2 and COD and, for the first time, for NO_X and ammonia nitrogen, have been included. As a signatory to a number of key international environmental agreements, including the UNFCCC and Kyoto Protocol, China abides by the principle of "common but differentiated responsibilities" and has signalled its appreciation of the importance of aligning domestic climate change policies with international efforts. In 2009, the government announced a commitment to reduce the carbon intensity of production by between 40% and 45% in 2020 relative to 2005 and as a stepping stone to meeting this goal the 12th FYP includes, for the first time, a target to reduce CO_2 intensity by 17%. The Plan also foresees further significant improvements in energy and water efficiency, which are intended to yield indirect environmental gains, as well as increases in forest coverage.

Aside from improving energy efficiency the government plans to diversify energy sources and reduce reliance on coal by continuing to raise the share of non-fossil fuels in primary energy production by just over 3 percentage points, to around 11% by 2015. Beyond the 12th FYP this share is targeted to increase further to 15% by 2020 (Information Office of the State Council, 2012). The planned expansion in nuclear capacity is very large, with the number of reactors set to rise from the current 16 to a total of 41. However, following the 2011 nuclear disaster in Fukushima the Chinese government promptly halted construction of new reactors and ordered a safety review of existing facilities. The results of the audit showed that the 16 operating reactors were basically sound but that some plants need better flood and earthquake protection, while others had no severe accident mitigation plans available on site. Overall, 16 areas for improvement were flagged, including dealing with radioactive leakages. The government intends to spend

Box 2.1. **China's five year plans for environmental protection**

The medium-term priorities and principal objectives of Chinese public policy are laid out in five year plans (FYPs). The national plan, which provides the broad direction across the full range of policy areas and sets out key performance targets, including an objective for economic growth, is formally prepared by the State Council with the National Development and Reform Commission playing a lead role in co-ordination and drafting, in conjunction with ministries and other agencies. Once the national plan has been approved by the National People's Congress, sector-specific plans, including for the environment, are devised by line ministries. Policy planning is conducted in a top-down manner with the national plan used as the basis for establishing sub-national plans with their own specific policies and targets in a cascading manner, first at the provincial level and then down to more local levels of government. As emphasised in the current environmental plan, local governments ultimately have primary responsibility for effective policy implementation.

Efforts to address environmental challenges have gathered momentum over time and this has been reflected in recent FYPs. In the 9th FYP (1996-2000), the government for the first time articulated numerical targets for controlling some types of air and water pollution, as well as other environmental objectives (Chang and Wang, 2010). More stringent SO_2 and COD reduction targets were set out in the 10th FYP but were not achieved. In contrast marked progress was made during the 11th FYP which again set targets for reducing key pollutants as well as improving air and water quality and increasing energy and water efficiency (Table 2.4).

Table 2.4. **Summary of main environment related targets and outcomes for the 11th and 12th Five-Year Plans**

	11th FYP		12th FYP
	Targets	Outcomes	Targets
Pollution emissions			
Sulphur dioxide	↓ 10%	↓ 14.3%	↓ 8%[1]
Chemical oxygen demand	↓ 10%	↓ 12.5%	↓ 8%[1]
Nitrous oxides	No target	n.a.	↓ 10%[1]
Ammonia nitrogen	No target	n.a.	↓ 10%[1]
CO_2 emissions per unit of GDP (%)	No target	n.a.	↓ 17%[1]
Air and water quality			
Proportion of cities meeting Grade II air quality standard	↑ 5.6%	↑ 4.1%	↑ 5%
Proportion of water system meeting Grade III standard	↑ 2%	↑ 18.9%	↑ 8%
Proportion of water system worse than Grade V standard	↓ 4.1%	↓ 10.6%	↓ 2.7%
Energy production and resource use			
Share of non-fossil fuel usage in primary energy consumption	No target	n.a.	↑ 3.1 percentage points[1]
Energy consumption per unit of GDP	↓ 20%	↓ 19.1%	↓ 16%[1]
Water consumption per unit of industrial value-added	↓ 30%	↓ 36.7%	↓ 30%[1]
Forests and farmland			
Forest coverage rate	No target	n.a.	↑ 1.3%[1]
Forest stock	No target	n.a.	↑ 4.4%[1]

1. Denotes binding rather than notional targets for the 12th FYP.
Note: Urban air quality refers to the number of days in which urban air quality of key cities is superior to Grade II for more than 292 days of the year.
Source: Chang and Wang (2010), Guerin and Wang (2012), CCICED (2011), NBS-MEP (2011) and State Council (2012).

Box 2.1. **China's Five Year Plans for environmental protection** *(cont.)*

In the 12th FYP (2011-15), targets have been set to further reduce SO_2 and COD emissions as well as to improve ambient air quality in cities and surface water quality across lakes and rivers. For the first time an official target to reduce NO_X emissions and ammonia nitrogen discharge, both by 10%, as well as a target to reduce CO_2 intensity, by 17%, have been included. Reflecting the government's concerns for regional equity and disparities in development and industrial and energy structures, carbon intensity targets vary across provinces, ranging from a 10% reduction for the poorer western provinces of Qinghai and Tibet up to a 19.5% reduction for the wealthier coastal province of Guangdong. Each of these targets are prescribed as "binding" rather than "notional", underscoring the importance the government attaches to ensuring they are met. A numerical target to reduce emissions of heavy metal pollutants in some regions, and to cap discharges elsewhere, has also been set. In addition, the Plan specifies strategies for monitoring and controlling other pollutants, including persistent organic pollutants and VOCs, though it does not prescribe targets. The other main environmental targets relate to increasing the forest stock and coverage rate as well as improvements in resource efficiency and lessening the reliance on fossil fuels. Following a fall in energy intensity during the 11th FYP, a further reduction of 16% has been enshrined in the 12th FYP while water intensity, measured as water consumed per unit of industrial value-added, is set to decline by 30%. An interim assessment of progress in implementing these targets and other Plan objectives will be made at the end of 2013 before a full assessment at the end of 2015.

USD 12 billion in the three years to 2015 to remedy these defects. For the future, plants will not be approved unless they meet Generation 3 safety standards which notably require passive cooling equipment. This will have a major impact on the nuclear programme as 14 of the 25 planned plants were only compliant with Generation 2 safety standards. Moreover, plants will only be built at coastal locations, meaning that work on 12 planned reactors will cease. With such a degree of uncertainty about planning, no new schedule for opening has been announced, though construction on existing projects resumed in 2012. Changing to cleaner energy sources will help meet CO_2 emissions and other environmental targets although even if the intended rebalancing is achieved, consumption of coal and other fossil-fuels will continue to rise strongly.

A broad suite of measures have been introduced to encourage renewable energy investment with the *Renewable Energy Law*, which came into effect in 2006 before being amended in 2009, and associated regulations providing the legislative umbrella. Critically, it requires grid companies to connect all renewable energy projects and purchase the supplied electricity. This was complemented by the introduction of a feed-in tariff (FIT) for wind power in 2009, which varies across provinces depending on local weather patterns, and for photovoltaic energy in 2011. These incentives have been financed by an electricity surcharge that applies to all end-users. Such measures have been complemented by other incentives under the auspices of special schemes including the "Golden Sun" initiative, which provides direct subsidies to investment in photovoltaic projects. The renewable energy and other environmental sectors have also benefited from considerable funding channelled through the Clean Development Mechanism. China accounts for 71% of all primary market Certified Emission Reduction permits issued between 2005 and 2011 (World Bank, 2012). However, with the decline in European carbon prices this source of funding has contracted. Furthermore, in rural areas the government promotes the use of

cleaner indoor fuels for cooking. In 2011, subsidies for biogas purchases were raised to between CNY 1 300 and 2 000 per household depending on the location and the government has spent CNY 4.3 billion improving biogas distribution systems (MEP, 2012).

Aside from furthering environmental goals, diversifying the energy mix supports energy security objectives. Despite a large coal endowment, China recently became a net importer of coal. It then quickly overtook Japan as the world's largest importer in 2011, accounting for around 18% of the global total (IEA, 2012b). The largest coal-producing regions in China are located in the north and western provinces whereas as demand is greatest in the eastern provinces. Given poor electricity network interconnectivity and the strain placed on the domestic rail network from transporting coal, foreign sourced seaborne coal is often more economic. China has been a net importer of oil for many years and despite the continued expansion in domestic production dependence on foreign sources has risen, reaching over 55% in the first half of 2012. In this context, the government has pursued the development of large domestic reserves of other fossil-fuel resources, notably unconventional natural gas, including shale gas (IEA, 2012c). It has also set up a strategic petroleum reserve, which is intended to ease short-term oil supply constraints and smooth price fluctuations (IEA, 2012d).

Governments at all levels, as well as the private sector, have invested vast sums in key environmental related infrastructure to reduce immediate sources of pollution, notably in water and waste treatment facilities and public transport. Investment in pollution treatment alone amounted to 1.7% of GDP in 2010, up from 1% of GDP in 2000 (NBS-MEP, 2011).This has led to a more than doubling of the wastewater treatment rate in urban areas, which reached over 80% by 2010. A further expansion of infrastructure for the collection and treatment of household sewerage, including in towns and villages, is envisaged. At the same time efforts will be stepped up to reduce environmental risks from accidents, including spillage of toxic material, and strengthen solid waste collection and promote the "circular economy", a term which refers to reducing waste and reusing and recycling materials. Farmers will also be encouraged to make better use of low-impact techniques, including manure recycling, as well as to rationalise the use of fertilisers and pesticides. For larger livestock farms the 12th FYP envisages a rapid expansion in excrement treatment facilities. High importance is attached to reducing pollution in heavily degraded areas such as the Chaochi and Dianchi watersheds and the Huaihe River basin. In these areas it appears that local authorities will be expected to apply particularly stringent standards to emissions sources or possibly restrict the scope of polluting activities altogether.

Success in reducing emissions of some pollutants, especially from industrial sources, has been achieved principally through end-of-pipe technological solutions supported by large expenditures on environmental infrastructure. This includes a strong ramp-up of desulphurisation technology which had been installed in 95% of thermal power generators by 2011, a large increase from even a few years earlier (MEP, 2012). Swift progress was aided by a policy to pay power generators higher electricity prices where desulphurisation technology is installed. The uptake of denitrification technologies has lagged in comparison and less than 5% of NO_X emissions were removed from industrial sources in 2010 (MEP, 2011a). However, in 2011 the government also began offering subsidies to power generators to install denitrification equipment which may accelerate progress in this area. In addition, new standards for thermal power generation were introduced in early 2012, in line with EU and US ones, with similar caps for emissions of NO_X, PM, SO_2 and mercury. All new large thermal power generators are now expected to install

denitrification as well as desulphurisation technology and similar standards are being applied to heavy industry.

Improvements in energy efficiency have been targeted through several measures, many of which have come under the "Ten Key Energy Conservation" scheme through which financial support was disbursed to encourage firms to deploy newer, more efficient equipment. The "Top 1 000 Enterprises" programme involved energy audits and the promotion of energy conservation plans in around a third of the nation's highest energy consuming enterprises. Under the 11th FYP, many small, less efficient thermal power generators were shut down, as was a sizeable chunk of outdated industrial production capacity, especially in highly polluting and energy-intensive sectors (Information Office of the State Council, 2011). Total closures amounted to over 76 million kWs of generation capacity as well as significant capacity in the cement, coke, glass, iron and paper sectors. Further progress in these areas was made in 2011 (NDRC, 2012). Large-scale retrofitting for residential and commercial buildings has also made a major contribution to energy conservation. A focus has been retrofitting central heating facilities, to increase household metering, install technology allowing local temperature regulation and improve heat transfer efficiency. During the 11th FYP retrofitting of this kind was undertaken in a total of 190 million square metres of residential floor space (Bao *et al*., 2012).

Moves to tackle pollution and promote energy efficiency and renewable energy have led to an expansion in environmental-related sectors of the economy. During the second half of the 2000s the number of energy conservation service companies ballooned more than ten-fold to over 800 with a similar rise in employment (Information Office of the State Council, 2011). The expansion of renewable energy capacity has also occurred in tandem with China's rise as a leading manufacturer and exporter of renewable energy equipment. In 2010, China accounted for over half of global solar module production, up from 39% just a year earlier (IEA, 2011a). This expansion has been accompanied by sharp falls in module prices which have supported the expansion of renewable energy around the world. Further efforts to strengthen environmental policy will continue to create new economic and employment opportunities in these areas. In addition, many of the strategic sectors that the government is actively promoting are intended to have strong environmental linkages, notably energy conservation and environmental protection, new energy sources (which includes renewable energy) and alternative energy vehicles.

Further closures of outdated and inefficient power generation and industrial capacity are envisaged in the 12th FYP, which also expands some 11th FYP initiatives, including the "Top 1 000 Enterprise" programme, which has become the "Top 10 000 Enterprise" scheme. While there are likely to be further gains from such measures the scope has undoubtedly diminished and administrative costs could well rise substantially given the larger number of smaller firms involved. The scope for large improvements in thermal power generation and industrial energy efficiency has also narrowed. As a result of policy interventions and investments in more modern facilities the share of larger and more efficient thermal generators rose from less than half in 2005 to over 70% by 2010 and over the same period the proportion of large-scale industrial furnaces more than doubled (National Energy Conservation Center, 2011). In some areas of the country wastewater treatment rates have risen to very high levels and the application of desulphurisation technology is reaching saturation point. Although there may be scope for expanding use in industrial boilers, the very large number of these facilities makes verification difficult while it may be technically or financially infeasible for smaller scale units (Wang *et al*., 2012a). Moreover, the cost of

relying on command-and-control approaches was underscored towards the end of the 11th FYP when the achievement of the Plan targets was at risk (Zhang, 2010). In several provinces local governments implemented rolling blackouts for thousands of factories, shutting off power supplies for five days after nine days of continuous operation. In addition to disrupting production, power shortages impair productivity and increase uncertainty and are estimated to have raised firm operating costs by up to 20% in China during past episodes (Fisher-Vanden *et al.*, 2012).

While significant, in some respects the environmental achievements to date represent the "low-hanging fruit", amenable to command-and-control measures and infrastructure upgrading. This is particularly so regarding reductions in SO_2 and COD from point sources, including power generation and heavy industry that have been accomplished primarily through end-of-pipe solutions. Going forward more emphasis ought to be placed on the use of a broader range of tools, including well-implemented market-based measures, to tackle a broader range of challenges. Such changes will form part of the broader reform effort needed to rebalance the structure of the Chinese economy, including moving towards more consumption and services-oriented growth. Indeed the greatest scope for increasing employment in less polluting and energy-intensive industries is likely to lie in the expansion of labour-intensive service sectors, which are the predominant employers in mature economies and will account for an increasing share of the Chinese economy over the medium term.

Market-oriented reforms will help improve resource efficiency

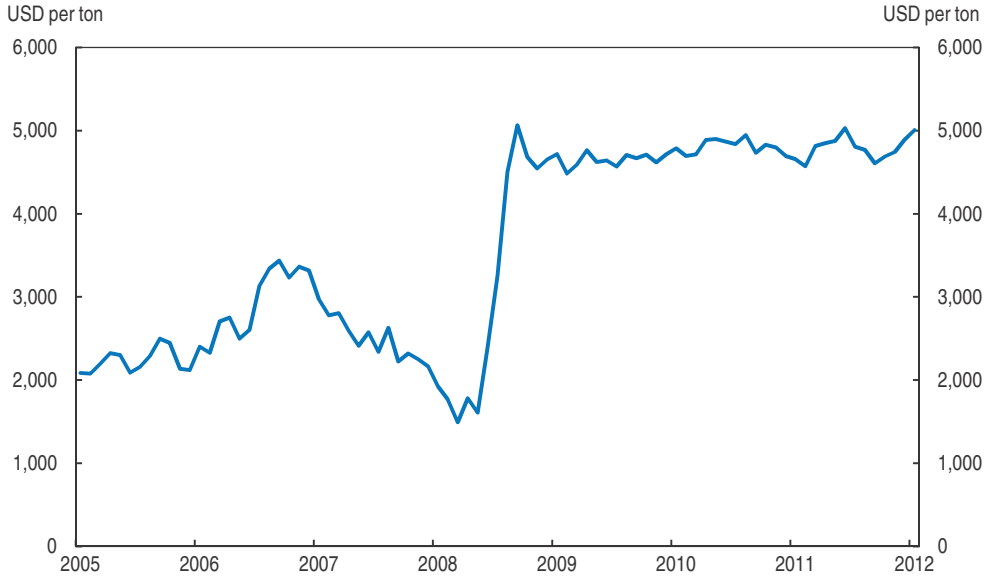
Energy policies have improved but further changes are required

Ensuring that energy prices faced by end-users reflect underlying costs is key to achieving energy efficiency and environmental goals (OECD, 2012b). This is especially so in China given the heavy reliance on coal as the primary source of energy. As in many other countries, energy pricing policies in China have been guided by a range of economic, social, strategic and, more recently, environmental objectives. Historically, prices of many energy products have been heavily regulated to ensure price stability and to pin down costs faced by end-users. However, gradually price liberalisation has promoted convergence between domestic and international prices. In the case of coal, progress was made by the mid-2000s, when the government eased price guidance and allowed domestic coal prices to move up sharply in line with international prices (IEA, 2009). However, coal suppliers are still required to sell some coal to power generators below market cost. Price regulation of other energy sources endures, sheltering consumers from cost changes or redistributing costs across types of consumers.

Regulated domestic oil product prices in China have been set with reference to international crude oil prices for over a decade. End-user prices and the extent of price pass-through have also been determined taking into account the profit margins of domestic state-owned oil refineries, which dominate the Chinese market. In 2007 and early 2008 the pricing mechanism came under pressure as international oil prices surged. The government's initial response was to hold back increases in retail prices, resulting in rising subsidies and mounting financial losses for refineries. As international crude prices rose above USD 120 per barrel in mid-2008 the government changed track, lifting regulated prices sharply. This raised refinery profit margins and stemmed financial losses (Figure 2.8). At the same time it announced a new pricing mechanism that has been in operation since

the beginning of 2009. Under these arrangements, so long as international prices remain below USD 130 per barrel, domestic prices are adjusted when the average of three international crude spot prices (Brent, Cinta and Dubai) moves by 4% or more over a 22-day period. Since the implementation of this policy, the unit difference between oil and gasoline prices has been very stable, implying strong pass-through. However, it is unclear how the government would respond were international oil prices to rise above USD 130 per barrel.

Figure 2.8. **Oil refinery margins in China**



Note: Margins are calculated as the difference between crude and average unleaded gasoline prices.
Source: CEIC.

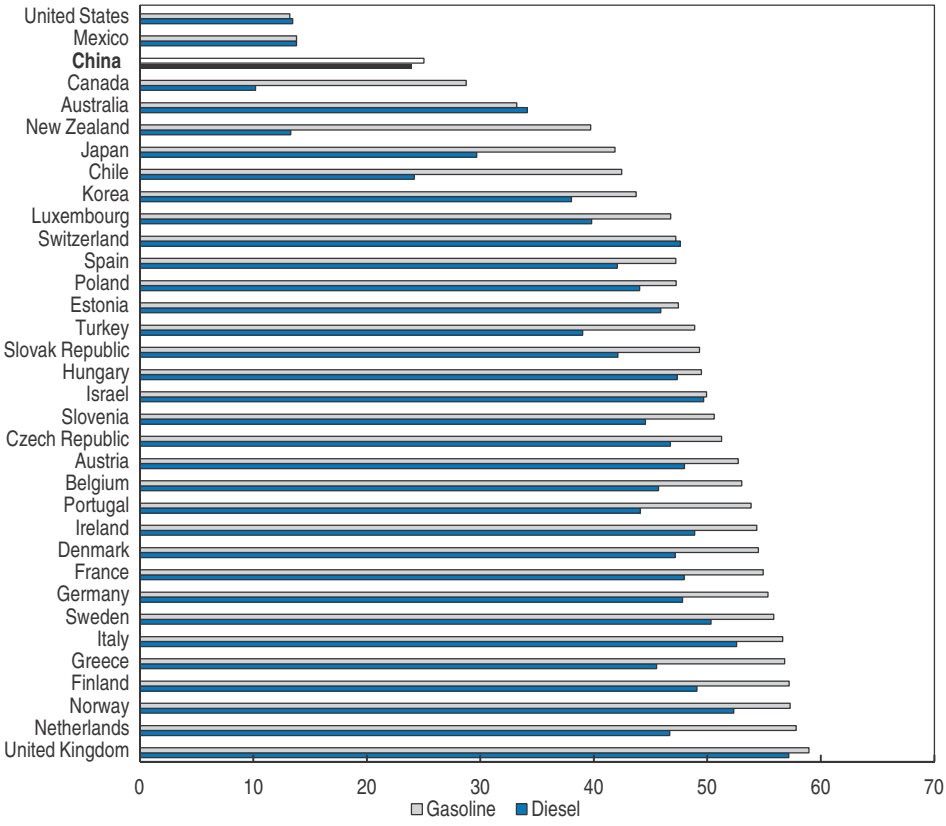
StatLink http://dx.doi.org/10.1787/888932788018

Complementing these changes, in 2009 a fuel excise tax was introduced, at a rate of CNY 1 per litre for gasoline and CNY 0.8 per litre for diesel (Wang, 2011). However, these changes were partially offset by the removal of other taxes. By international standards Chinese gasoline prices remain relatively low, even though they are higher than in some OECD countries, notably the United States. Following recent price reforms, tax-exclusive prices in China are now close to the average for OECD countries, hence differences in final prices primarily reflect lower taxes – at less than 30% versus 50% of the final price (Figure 2.9). Thus, there is considerable scope to increase excise rates on gasoline and other petroleum products in order to support a number of policy objectives, though identifying the optimal level of taxation raises several issues. An ideal (Pigouvian) tax would reflect the full suite of externalities. A further consideration is that petroleum-related taxes are often less distorting and more economically efficient than alternatives as the price elasticity of demand tends to be low (Lin and Zeng, 2012a). Lin and Zeng (2012b) estimate that a Pigouvian tax could be in the order of CNY 2.8 per litre, close to CNY 1 per litre more than the current total tax. However, an even higher rate could be justified given the low estimated price elasticity of demand. Thus at a minimum the current excise rate should be doubled.

In contrast to the oil sector, little progress has been made in reforming natural gas pricing. The government currently sets prices paid to producers based on production costs and adjusted according to prices for alternative types of energy. Prices also depend on

Figure 2.9. **Tax share of retail diesel and gasoline prices**

Second quarter of 2012



Source: IEA and OECD.

StatLink http://dx.doi.org/10.1787/888932788037

whether the gas is destined for household or industrial users. This has led to large variations in prices nationally, with consumers in areas that can access cheaper domestically-produced gas enjoying lower prices, to the detriment of local producers, while consumers relying on imported gas face higher, internationally determined prices. The government has launched pilot schemes to experiment with more market-oriented pricing in the southern provinces of Guangdong and Guangxi, which already rely heavily on imported gas. Under these schemes city gate prices will be based on a market-determined reference rate which no longer depends on the end-user or gas source, thereby ensuring that all consumers face a price determined by prevailing supply and demand. Once the government is satisfied that these arrangements are workable it should unroll them nation-wide.

Likewise, little progress has been made in reforming electricity since the early 2000s, when a large vertically integrated state-owned monopoly was broken up in an attempt to move towards a more market-oriented set-up (Ma, 2011). Prices received by generators and faced by end-users remain regulated and although electricity generation is separated, transmission and distribution remain bundled together. Most assets are still directly or indirectly controlled by the government. While private investment in power generation has been allowed for many years, and has expanded, the market is dominated by a small number of state-owned operators and local government ventures. Moreover, as generators are required to sell power directly to the grid at a government-determined price there is currently little effective competition in this segment. The distribution and transmission

sector is highly concentrated with only two enormous state-owned operators serving almost the entire market, either directly or through their subsidiaries.

Prices paid by end-users and received by generators are supposed to be set by the State Council through the NDRC. In theory, a cost-based approach is applied to determine on-grid prices paid to coal-powered generators with the aim of ensuring a rate of return that encourages sufficient investment and growth in capacity (Liu and Zhang, 2012). The price is set in tandem with a quota for the amount of power each generator must supply to the grid. In practice, however, prices received by generators have not kept pace with rising coal prices. This has led to a financial squeeze on power generators and forced them to offset losses incurred from power generation by expanding activity in profitable non-core businesses including component manufacturing. Electricity prices to end-users also often deviate from the nationally-determined benchmark, with provincial and local governments at times employing preferential pricing to support industrial objectives (Chen, 2011). Prices also vary geographically depending on the level of affluence, with lower prices offered in poorer regions. Electricity prices are hence used as both a redistributive tool as well as an instrument for industrial policy. However, as environmental protection sometimes lags in the poorer parts of the country, luring businesses to these areas through cheaper energy is likely to be particularly environmentally harmful.

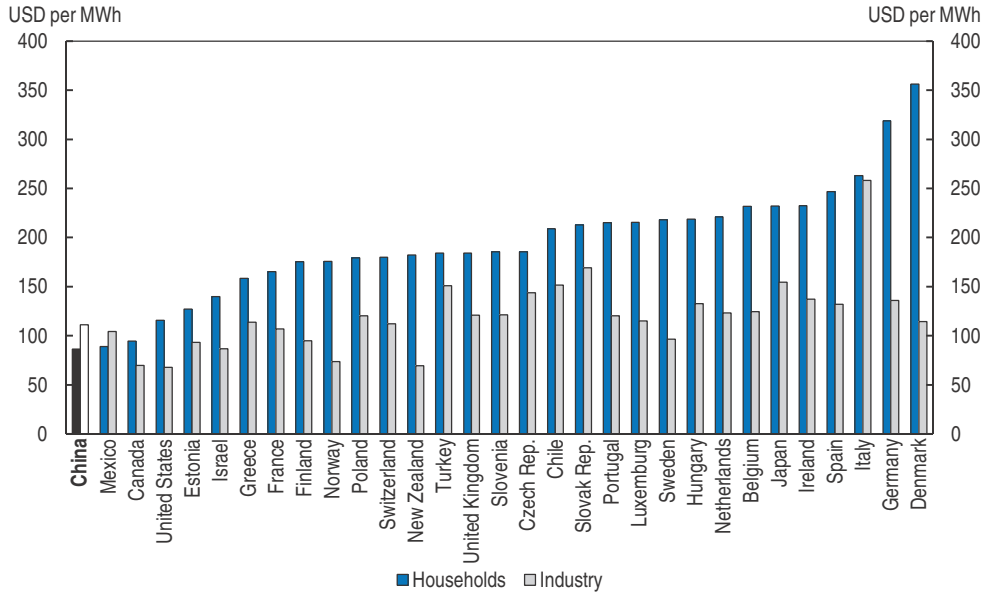
On average, electricity prices faced by industrial users in China are not unusual compared with many OECD countries but household prices are much lower (Figure 2.10). In most OECD countries prices for industrial users are lower than for households but in China the situation is reversed. Households, select businesses, and consumers in poorer regions are the main beneficiaries of the current approach to pricing in China. Increasing price differentiation across households is in fact one of the aims of reforms to pricing structures introduced in 2012. Under this new approach the unit price rises when consumption exceeds a threshold so that higher-consuming households pay more (the precise formula applied varies across provinces). While representing an improvement, prices are still comparatively low. Arrangements in the electricity sector have ensured a massive expansion in capacity but limiting the pass-through of higher generation costs to end-users hinders efforts to improve energy efficiency and, given the ongoing reliance on coal as the primary source of energy, reduce pollution.

Reforming electricity prices can promote environmental objectives and strengthen competition, which would improve efficiency and ultimately benefit downstream users. There is evidence that under the current pricing arrangements less efficient generators are paid a higher price (Beirne *et al.*, 2012). This reduces the incentive for electricity producers to minimise costs, penalises more efficient generators and, ultimately, firms and households. As a first step forward wholesale prices need to better reflect costs to restore the financial health of generators and ensure adequate investment in capacity. At the same time the government should fully liberalise the market for thermal coal. It should then experiment with separating transmission from distribution in some segments. If this proves successful it should be generalised with a view to creating a market-based system for electricity pricing.

On the basis of a price-gap method, which measures the difference between final consumer prices and the cost of supply, it is estimated that in 2010 fossil-fuel related subsidies amounted to just under 0.4% of GDP in China (IEA, 2011b). This is low compared to some other large emerging economies including India, where subsidies amounted to around 1.4% of GDP, and Indonesia and Russia, where they exceeded 2% of GDP. The largest

Figure 2.10. **International household and industrial electricity prices**

In 2011



Source: IEA.

StatLink http://dx.doi.org/10.1787/888932788056

component of the subsidy relates to electricity, with smaller amounts for oil and coal. The value of Chinese fossil-fuel subsidies has fallen considerably in a short period reflecting the important reforms undertaken to allow a fuller pass-through of changes in raw energy prices. Nevertheless, enduring subsidies of this type, which are economically and environmentally damaging and work against several government policy objectives, underscores that reform in this area is incomplete. Changes that lead to the elimination of all fossil-fuel subsidies and allow full pass-through of energy prices should be prioritised. Aside from improving energy efficiency, eliminating such subsidies and recycling the fiscal windfall has been shown to produce significant co-benefits in China by boosting economic output and employment as well as reducing CO_2 and SO_2 emissions (Lin and Jiang, 2011).

Reforms to improve water conservation

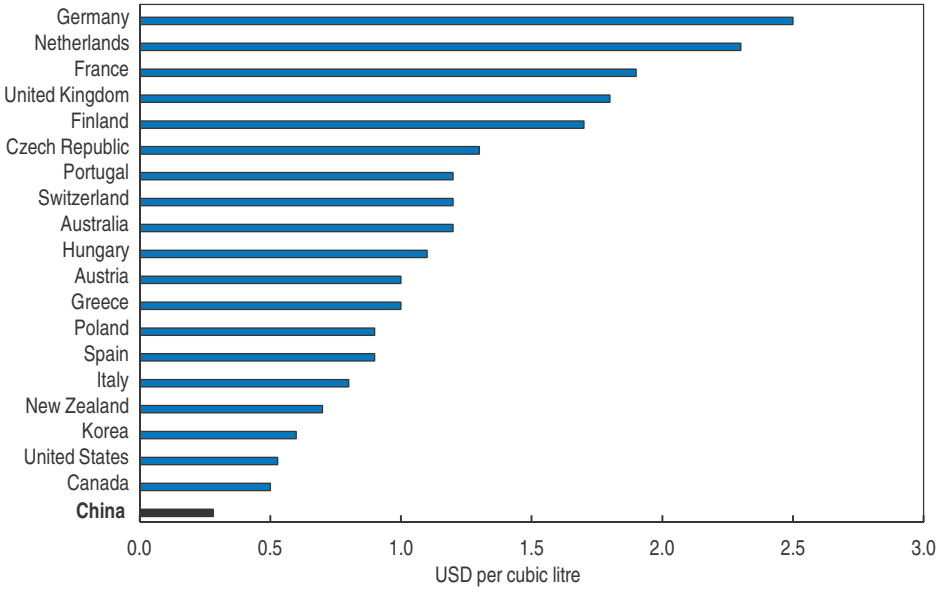
Just as better pricing of energy can help improve energy efficiency and reduce energy-related pollution, appropriate water pricing can help ensure water is used more efficiently and lower water pollution. It can also help ensure adequate funding and incentives for essential water infrastructure. As noted above, water efficiency in China has improved but overall water consumption across all sectors except agriculture has risen over the past decade and water pricing policies have evolved with the aim of discouraging waste and recouping water supply costs (Zhong and Mol, 2010; Li *et al.*, 2011). Water charges are determined at the local level and levied either by water supply companies that deliver piped water to households and industry or by local water resource bureaus for direct abstractions from rivers and lakes or groundwater reserves. A two-part tariff often applies for water obtained through either channel, whereby unit prices increase beyond a threshold level of consumption or abstraction. Water companies often bundle together water supply and wastewater treatment components into a single fee that is set by the government at a level sufficient to earn a return on capital of 8-10%. In addition, there is a

water resource charge that is supposed to reflect the scarcity cost of raw, untreated water. National guidelines for abstraction fees are less clear but are notionally determined on the basis of local water scarcity and equity considerations, which in practice mean that many farmers face very low prices.

Average household water prices in cities rose steadily through the 2000s, but remain low compared with OECD countries, averaging around USD 0.28 per cubic meter in 2010 (Figure 2.11). Abstraction fees are often even lower and in many cities the national policy to recoup wastewater service costs has not been enforced. As with special arrangements with energy pricing, preferential water prices have also sometimes been offered by local government officials as an inducement to business. Weak institutional capacity, including inadequate staffing amongst local water authorities, may also contribute to a low collection rate for water fees. A further problem that needs to be addressed at the national level is the absence of clear abstraction targets and the lack of a regional focus in determining usage limits or prices; abstractions are determined locally but have consequences for users downstream. Though river basin management committees exist, they lack the authority to set terms for local water authorities and their task is also often hampered by a lack of reliable data on water use and resources. Water prices are low and should be raised further to promote more efficient use. This should be done in tandem with institutional reforms to strengthen the effectiveness of market incentives although by virtue of raising the opportunity cost of offering exemptions or forgoing fee collection, raising prices will in itself strengthen the incentive to ensure that all water users meet their financial obligations.

Figure 2.11. **International household water prices**

In 2010



Note: England and Wales for the United Kingdom.
Source: OECD (2010b), EPA (2011) and MRW (2011).

StatLink http://dx.doi.org/10.1787/888932788075

Strengthening other incentives for better water management, including rewards for conservation, can also help improve water efficiency in the agricultural sector without

necessarily affecting production levels. In response to water shortages farmers often resort to sinking tube wells, which facilitate access to groundwater, increasingly on a private rather than collective basis. The shift towards private ownership of these resources, which offer a finite supply of water, appears to promote more efficient as well as higher value added farming methods (Wang *et al.*, 2009). At the same time, the proliferation of private tube wells has given rise to local water markets, with owners selling water to other users. In addition to providing an additional income stream for those farmers selling water, as well as an additional water supply source for buyers, it has helped promote efficiency, with those farmers who need to buy water using less of it to generate the same crop yields. To help promote water efficiency in rural areas the government has a longstanding policy of decentralising water management, which has led to the emergence of irrigation management contractors. However, an analysis of the impact of these contractors revealed that they only helped improve water efficiency when regulations allowed them to generate profits through water savings (Wang *et al.*, 2009).

As water and energy pricing arrangements are often motivated by equity considerations, reforms in this area can be politically challenging, as underscored by international experience (OECD, 2011b). It is therefore often necessary to offset any distributional consequences by recycling fiscal windfalls back to households. In China, such reforms need not hurt the poor and in some cases could support equity objectives. Although car ownership is rising strongly across all household groups, ownership rates remain much higher in more affluent groups. Increases in gasoline and diesel taxes may therefore have a much smaller impact on the poor and could be further offset through higher subsidies for public transport. Where the impact on the poor is likely to be larger, including electricity and water reforms, transfers through the tax and benefit system could be raised. For the poor, direct financial support could be delivered through increases in the minimum living allowance (MLA), the coverage of which has expanded rapidly in recent years (OECD, 2010a). Indeed, following recent reforms the level of the MLA, which is determined by local governments, is supposed to adjust frequently in response to changes in the cost of living and hence would be expected to rise in tandem with higher energy and water prices.

Appropriate pricing of pollution and support for renewable energy should form the cornerstone of policy

Pricing pollutants either through taxes or levies or by introducing an emissions trading scheme (ETS) that creates a market for the right to pollute, offers an economically attractive and increasingly popular approach to help meet policy objectives (OECD, 2011b). When faced with a pollution price, each polluter decides on their own optimal level of investment in costly abatement. This ensures that the marginal cost of abatement is equalised across polluters and the goal of pollution reduction is achieved at the lowest possible aggregate cost. In addition, pollution pricing provides an ongoing incentive to find cheaper methods of mitigation through innovation, thereby promoting dynamic efficiency. Finally, pollution taxes or trading schemes create opportunities to generate fiscal revenue, a double-dividend, which can be used to fund public expenditures or reduce other more distorting taxes.

Instruments for pricing carbon and other pollutants, notably SO_2, are well established in a number of countries, having gained favour with several governments around the world who have adopted carbon pricing as the focus of their efforts to limit emissions and meet climate change obligations (Ranson and Stavins, 2012). One of the largest, longest running and most successful schemes is the SO_2 cap-and-trade scheme in the United States,

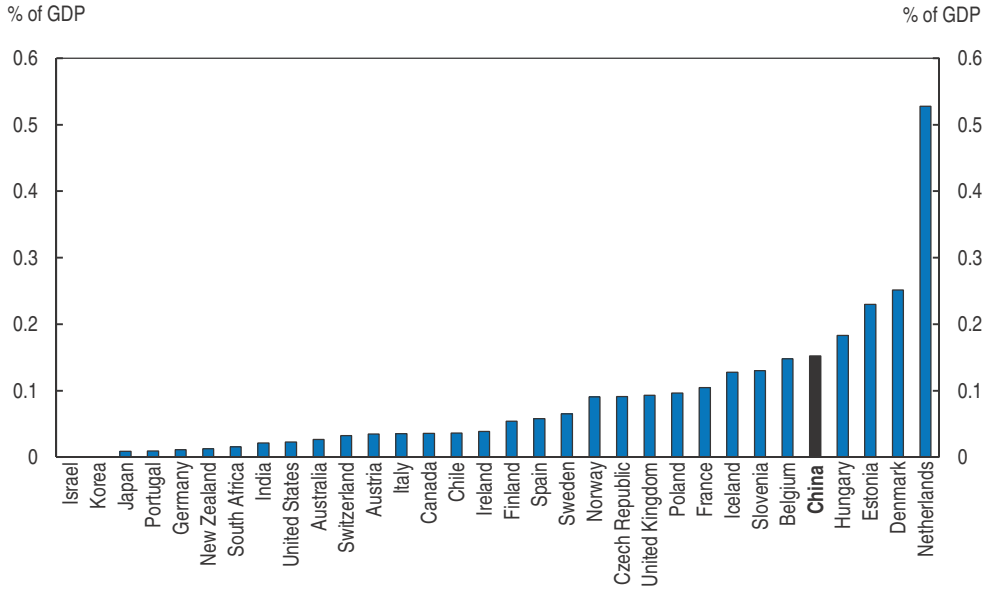
established in the 1990s to help address acid rain problems. This facilitated lower emissions at a much lower cost than using command-and-control approaches (Chan *et al.*, 2012). The EU emissions trading scheme (EU-ETS), established in the mid-2000s, is by far the largest carbon pricing regime in operation, covering about half of all CO_2 emissions from 30 countries. More recently, smaller carbon trading schemes have been established in New Zealand, Switzerland and Tokyo, and are set to start in California, Quebec and South Korea. In Australia, a carbon tax was introduced in 2012 and is to be converted into a trading scheme in 2015.

Market-based environmental policies have a long history in China

China has a long history of pricing pollution, having first established a pollutant levy system in the 1980s that covered different types of air and water pollution as well as waste discharge and noise (Wang and Wheeler, 2005; Ge *et al.*, 2011). Reflecting high emissions, the revenue generated is sizable compared with most of the OECD countries that have dedicated pollution and other environmental charges, levies and taxes (Figure 2.12). Most of the revenues from these levies are generated from industrial air and water pollution and are often allocated to local mitigation projects as well as other environment-related spending, including for better monitoring facilities. Initially the wastewater levy was based on discharge standards, with

Figure 2.12. **Environmental charges, levies and tax revenues**

In 2010



Note: Includes all revenues from environmental-related charges, levies and taxes except those relating to energy and motor vehicles. For Canada data refer to 2009.
Source: OECD Environmental Tax Database.

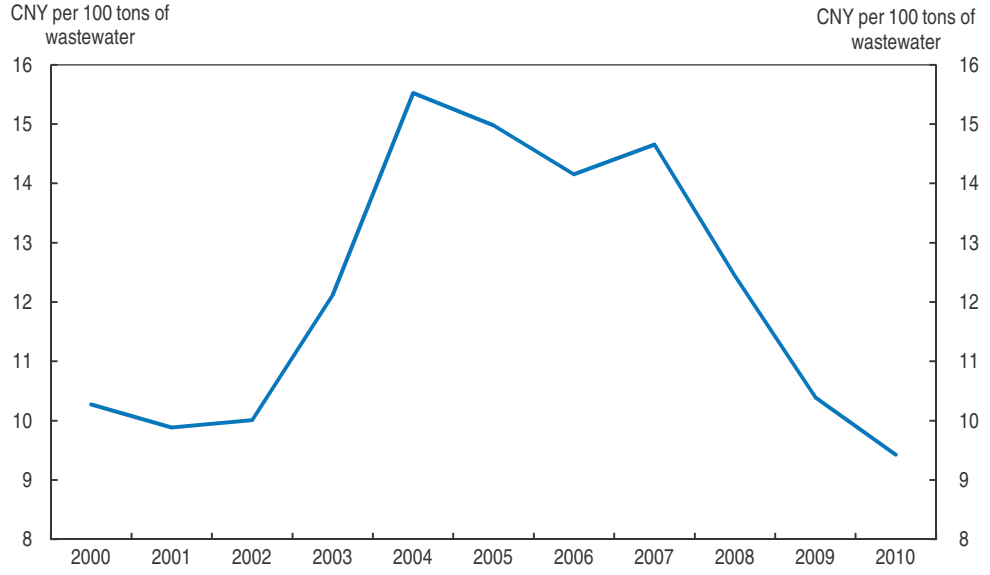
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levies only applying to those discharges which failed to meet a minimum standard. However, it was later revised to apply to all discharges, with a higher rate for those below the standard. In contrast, a flat rate applies to air pollution emissions. Levy rates vary across the country with a base rate set by the central government supplemented by an additional levy determined by local governments. In determining total levy liabilities the concept of "pollution equivalents" for a variety of different air and water pollutants is applied (McElwee, 2011). Despite continued

high pollution emissions the value of national revenues generated from pollution levies is modest, amounting to less than 0.1% of GDP in 2010.

Implementation problems, including a lack of monitoring and enforcement capacity, have plagued the pollution levy system. Although they are prescribed in legal instruments which stipulate penalties for non-compliance, in practice enforcement has been weak, with firms at times bargaining with local officials over their liabilities. A further problem has been that the levies have been too low to provide an incentive for firms to invest in mitigation efforts. During the 2000s, for example, only after a third increase did the SO_2 levy exceed the average cost of pollution mitigation (Schreifels *et al.*, 2012). The process of collecting pollution levies is also cumbersome, relying on a combination of self assessment and inspection by local environmental officials, and drains valuable resources from local agencies. In recent years revenues have fallen, reflecting the decline in total pollution discharges, which have narrowed the revenue base, but also declining levy rates. Although the SO_2 levy rate rose until 2007 it has not changed since, implying a declining rate in real terms, while the average water pollution price has fallen in nominal terms since the mid-2000s (Figure 2.13).

Figure 2.13. **Average water pollution price**



Note: The average water pollution price is calculated by dividing total wastewater levy revenues by the total volume of wastewater discharges.
Source: OECD and MEP.

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Several experimental pollution emissions trading schemes, focussing on SO_2 and to a lesser extent different types of water pollution, have also been undertaken in China (Jinnan *et al.*, 2009); Chang and Wang, 2010). These have been promoted by the central government but have been implemented and administered by local governments and tended to be small in scale. The earliest pilot scheme that operated on a significant scale was established in 1991, focussed on SO_2 emissions trading and initially involved 16 cities before expanding to a further six. Later, a small number of water pollution trading schemes were established in different localities and through the second half of the 2000s several new schemes covering air and water pollution arose across the country. However, in

general, these schemes do not seem to have functioned well, often resembling a pollution charging system with only a notional possibility of pollution permits being traded freely.

Some schemes, particularly the early ones, appear to have operated with the narrow objective of facilitating the closure of old or outdated power generation or industrial capacity. Rather than allowing market forces to determine which firms had the right to pollute, governments required new operators to compensate those firms which were forced to exit the market. Where genuine trading of permits has occurred, in the absence of exchange platforms governments have played the role of intermediary and often had a major role in determining the price. A more fundamental problem is that firms have been reluctant to engage in voluntary market transactions owing to uncertainty. Part of the problem is that the schemes have lacked a clear legal basis. Though national environmental laws refer to the possibility of pollution emissions trading, the pilot schemes have been implemented on the basis of local regulations which provide less assurance. How these schemes interact with national policy measures and targets has also created uncertainty amongst firms. A further problem, particularly early on, was the absence of well-defined pollution targets. As a result firms have sometimes hoarded permits, leading to very low trading volumes and unclear price signals. These problems have been exacerbated by insufficient scale. As the schemes have typically been confined to a small geographic area such as a city or sub-jurisdiction, the number of participants in each scheme has been low, curtailing the potential size of the market.

Going forward more emphasis is needed on better implementation

Despite the mixed experience with pollution charges and trading schemes thus far in China, the 12th FYP highlights market mechanisms as a tool to control pollution and carbon pricing is an element of the longer-term strategy to control GHG emissions and meet international climate change obligations (Information Office of the State Council, 2011). Against this backdrop, the government is establishing new pilot CO_2 emissions trading schemes in seven sub-national jurisdictions: the provinces of Guangdong and Hubei and the cities of Beijing, Chongqing, Shanghai, Shenzhen and Tianjin. Some of these schemes will be operating at least on a preliminary basis in 2013 and the remainder by 2014. Initially, they will function separately but may be unified into a national trading scheme in the future. Trading will occur through local exchange facilities that were originally established to facilitate government asset sales and which could in the future be used to trade environmental instruments other than CO_2 permits. In the first phase permits will be issued freely to enterprises covered by the schemes.

The emissions cap applying under each scheme will be set on the basis of local targets, as determined in the 12th FYP. As the Plan targets are based on emissions intensity, rather than absolute emissions, local governments will have to make estimates of the expected expansion in industrial output and then use these to impute the cap. Sector coverage varies across schemes but in general power generation and energy and emission intensive industrial sectors are to be included. In the largest jurisdiction with a pilot scheme, Guangdong, the first phase of the scheme will cover around 800 of the largest emitting enterprises in nine sectors: power generation, cement, ceramics, petrochemicals, steel, textiles, non-ferrous metals, plastics and paper. This will ensure that around 60% of industrial power consumption in the province will be covered.

The decision to establish separate pilot trading schemes was intended to provide the government with a rich source of information on how it might best set up a broader, national

scheme. Some features of the pilots will, however, limit their usefulness as policy experiments. Disallowing trading across economically diverse jurisdictions limits the scope for trading and hence raises the aggregate cost of mitigation. In addition, in the case of Beijing, which imports most of its electricity from elsewhere in the country, indirect emissions from electricity consumption will be imputed on the basis of an assumed average level of emissions intensity. As no distinction is made for how electricity is generated the incentive to switch to cleaner power generation is reduced. The absence of trading between the schemes also makes it impossible for the government to identify problems it may encounter in moving towards a unified national system. If the pilot schemes are to be extended it may therefore be advantageous to merge some of them and monitor this transition.

A further difficulty in evaluating these pilots is that as they are intended to operate for a relatively short duration making it doubtful they can create the kind of market incentives necessary for firms to undertake costly mitigation investments with long-time horizons, such as building new renewable energy capacity. On a positive note, at least some of the schemes have the potential to operate on a sufficiently large scale to overcome many of the problems that have plagued earlier ETS experiments in China. In particular the scheme in Guangdong, which has a population exceeding 100 million and an economy similar in size to Turkey's, could create a trading market comparable in size to some national schemes.

An effective carbon pricing scheme must incorporate several key elements in order to function smoothly and meet its intended objectives of constraining emissions, whether it be an ETS or carbon tax (Box 2.2). An institutional framework that is credible and provides firms with sufficient certainty is needed at the outset and several lessons can be learnt from domestic and international experience in this area. The difficulties faced by pollution trading schemes and levies within China underscore the importance of a clear and effective nationwide legal framework. The difficulty of providing clear and stable signals to firms and investors in a trading scheme is illustrated by carbon price volatility in the EU ETS. Determining an appropriate cap and avoiding an excess supply of permits is critical and hinges on an accurate assessment of current emissions. Though direct government intervention in the operation of an ETS is generally considered undesirable owing to the risk that it may give rise to inefficiencies, some interventions may be beneficial and indeed even necessary. If there is major uncertainty concerning the price of pollution the government can guide prices by establishing a ceiling (by issuing as many additional permits as required to limit price rises), or impose a price floor by reducing the number of permits released or entering the market to buy permits. The scope for such interventions could be built into the design of the scheme to avoid undue surprises. Ideally, carbon pricing should cover as many polluting sources as is practical. In practice this can present political difficulties and revenues generated from carbon pricing can be recycled to ease resistance. In the case of an ETS, auctioning permits not only provides revenues that can be used to help facilitate implementation but can also avoid disputes between different polluters that may arise from decisions about how free allocations are made.

As noted, a diverse range of market-based and other policy tools has been used by the Chinese authorities, which can be an effective way to achieve environmental policy objectives. However, if not designed and implemented correctly, overlapping policies and tools can reduce the potency of market-based policies and raise mitigation costs. For example, mandating technology standards with a view to reducing emissions that are also covered by a trading scheme reduces the scope for firms to select the least costly mitigation method. In this regard it is telling that the highly successful United States' SO_2

Box 2.2. **Key features of effective carbon emissions pricing**

Carbon pricing can be achieved either through a carbon tax or an emissions trading scheme (ETS) where the latter represents a market for the right to pollute, as determined by the ownership of a pollution permit, created by government regulations. If designed and implemented effectively, a tax or ETS can ensure that carbon emissions goals are met in a cost-effective manner. However, if key elements of either approach are poorly designed or implemented their functioning and effectiveness can be undermined. Requisite features of a robust and effective approach to carbon pricing include the following:

- The **coverage** defines the emissions of the sectors and firms, and if limited geographically, physical areas, that are subject to taxation or require a permit. Ideally the coverage should be as broad as possible to capture a diverse range of polluters. Indeed, an ETS works on the principle that mitigation is undertaken by firms with the lowest mitigation costs and total mitigation costs will be minimised with the broadest possible coverage. If necessary, coverage can be altered over time, beginning, for example, with a relatively narrow range of heavily polluting firms or industries and then expanding.
- Effective and reliable **monitoring, reporting and verification** systems are essential. As with any other kind of market, the effective operation of an ETS is dependent on the availability of pertinent information. Unreliable or incomplete information creates uncertainty, threatens smooth operation and could ultimately undermine confidence, and therefore the durability, of a scheme. Likewise, inadequate information could hinder carbon tax collection.
- A clearly specified system of **sanctions** enforced in a transparent and rigorous manner is needed to penalise firms which do not meet their carbon tax liabilities or fail to hold adequate permits to meet their emissions under an ETS. In the case of an ETS, such penalties must be set at a level exceeding the value of the shortfall in permits in order to provide an incentive for firms to hold sufficient permits.

In addition, an ETS requires a clearly defined target, which creates scarce rights to pollute and a price for pollution, and a mechanism for allocating permits.

- The **target** can be set as a cap, defined in physical units, which sets a ceiling on the total allowable emissions for a given period. Alternatively, a relative (rate based) target can be set whereby emissions per unit of output are required to fall by a specified amount. Under this configuration, a firm exceeding the required intensity target is entitled to an allocation of valuable credits while firms failing to meet the target are required to purchase these credits.
- The **allocation**, or method for distributing permits to polluters, has important implications for wealth distribution given that permits have value. A free allocation of permits bestows firms a valuable asset whereas requiring firms to pay for their initial permits implies the public, through the government, are compensated for granting firms the right to pollute. A free allocation can be grandfathered, where permits are distributed on the basis of past emissions, or on the basis of a benchmark, such as an industry average. Alternatively, the government can sell permits through an auction. A third option is to distribute a portion of the permits freely and auction the remainder.

Source: Reinaud and Philibert (2007).

ETS largely avoided imposing supplementary mandates (Chan *et al.*, 2012). A further consideration in designing an efficient and effective trading scheme relates to interactions with taxes and charges that directly or indirectly penalise the same emissions. In the case

of a CO_2 trading scheme an additional instrument would include any form of fossil fuels tax. Assuming that a trading scheme is binding, in that emissions are capped at a level below what would prevail in the absence of any policy intervention, the co-existence of additional instruments can make these instruments redundant from the point of view of reducing total emissions (OECD, 2011c). For example, the introduction of new taxes and charges or increases in existing ones in the presence of a trading scheme would simply reduce demand for permits and push down the equilibrium price for permits and leave the total level of emissions unchanged. This calls for relevant taxes and other measures to be designed in a manner that provides consistent incentives for pollution mitigation.

An analysis of the impact of carbon pricing using a CGE model of the Chinese economy shows that the introduction of a modest carbon price of CNY 10 per tonne and recycling the revenues as tax cuts would, over the medium term, reduce emissions by around 1% compared with a business-as-usual baseline and leave the level of GDP largely unchanged (Box 2.3). A higher carbon price would thus be needed to meet the policy goal of substantially reducing carbon intensity over the coming years. The results also highlight that as with any other reform that causes a change in relative prices, carbon pricing would lead to a reallocation of resources across the economy with relatively carbon-intensive sectors contracting and others expanding. It would also help promote further domestic and external rebalancing, thereby supporting broader policy objectives.

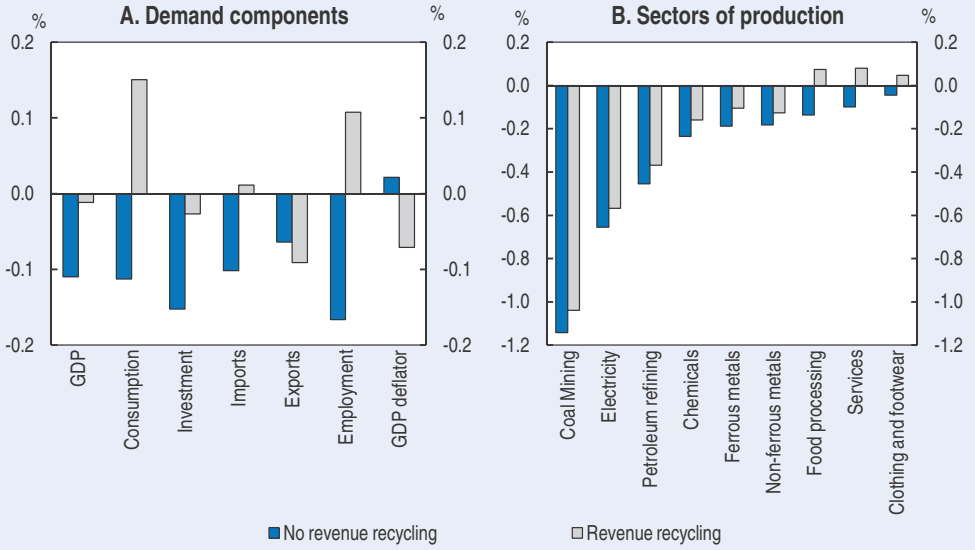
Box 2.3. **Assessing the impact of carbon pricing in China**

Like any major reform, the introduction of carbon pricing can have wide-ranging economic effects. By altering production and energy costs it changes the relative prices of goods and services. This in turn leads to changes in demand across different sectors and a reallocation of resources, including capital and labour. Some areas of the economy would contract while others would typically expand. The effects of carbon pricing in China are examined here using a computable general equilibrium model of the Chinese economy developed jointly by the State Information Center of the Chinese government with help from Monash University. The model is based on the 2007 input-output table of the Chinese economy and features 137 production sectors. Production is based on inputs of capital, energy, labour and land, where labour is differentiated to account for workers with different skills while primary energy is supplied as either coal or a hybrid of oil and gas. There is substitutability between different factors of production including different types of energy.

The impact of a carbon price of CNY 10 per ton is considered under two scenarios both of which suggest the overall medium-term impact on the economy would be relatively muted. In each scenario full pass-through of carbon pricing to electricity prices is assumed. In the first, GDP is around 0.1% lower compared with the baseline assumption of no carbon price (and no specific command-and-control policies), implying only slightly lower short-run growth, while carbon emissions fall by just over 1% relative to the baseline (Figure 2.14, Panel A). Domestic prices rise, leading to an appreciation of the real exchange rate. Consumption falls, as does domestic investment, reflecting a decline in the real rate of return. Overall employment is just under 0.2% lower relative to the baseline. As expected carbon pricing has a stronger negative impact in energy-intensive sectors, with coal mining and power generation declining by around 1.1% and 0.7% respectively (Figure 2.14, Panel B).

Box 2.3. **Assessing the impact of carbon pricing in China** *(cont.)*

Figure 2.14. **Impact of carbon pricing on the Chinese economy: a simulation**



Note: Changes relative to a baseline without carbon pricing are shown. Services refers to services other than wholesale trade and transport.
Source: State Information Center.

StatLink http://dx.doi.org/10.1787/888932788132

In the second scenario, carbon pricing is assumed to be revenue neutral so that the windfall to the government is recycled back into the economy through a reduction in consumption taxes. The overall impact is more muted than under the first scenario, with GDP declining only marginally, while the decline in carbon emissions is only slightly smaller. One of the main reasons for the different overall impact under this alternative scenario is that consumption rises in response to the tax cut, thereby improving the domestic balance of the economy and boosting production in some sectors. Employment is pushed up as labour is substituted for energy. Externally, the trade surplus falls. In addition, output in light manufacturing and the services sector (other than transport and wholesale trade) increases, while it declines in more energy and capital-intensive industries.

As noted a pricing regime could be established with either an ETS or a tax which are equivalent with perfect competition and foresight (OECD, 2009). Even with perfect competition though, each instrument offers advantages and disadvantages which may affect the optimal policy choice in the Chinese context. While a tax offers certainty regarding the cost of pollution it can be difficult to know exactly how agents will respond to its introduction and therefore the precise impact on emissions. In contrast, a cap imposed under an ETS ensures certainty regarding the maximum level of emissions but the price of carbon, and therefore the impact on agents is, *ex ante*, unknown. A tax may offer a lower administrative burden given the additional complexities associated with regulating a trading scheme, a not insignificant advantage in China given the difficulties faced hitherto.

Depending on the experience with the carbon trading pilots it may be preferable to adopt a staged approach to carbon pricing whereby fossil fuels taxation is first reformed and then broadened to a carbon tax. Carbon trading, ideally eventually linked to other

international schemes, could be implemented at a later stage. Irrespective of the approach taken to pricing carbon, given the important contribution from the electricity generation sector it is critical to allow increases in electricity prices in line with changes in generation costs (IEA, 2012e). In addition to moving ahead with carbon pricing, the system of pollution levies needs to be transformed into a system of pollution taxes with revenues collected by tax authorities and allocated to government coffers rather than earmarked to environmental projects. Such changes would ensure a stronger legal basis for enforcement as well as providing improved incentives for collection. At the same time levy rates should be hiked to provide stronger incentives for mitigation and a commitment made to adjust them frequently to account for inflation and changes in pollution and mitigation costs.

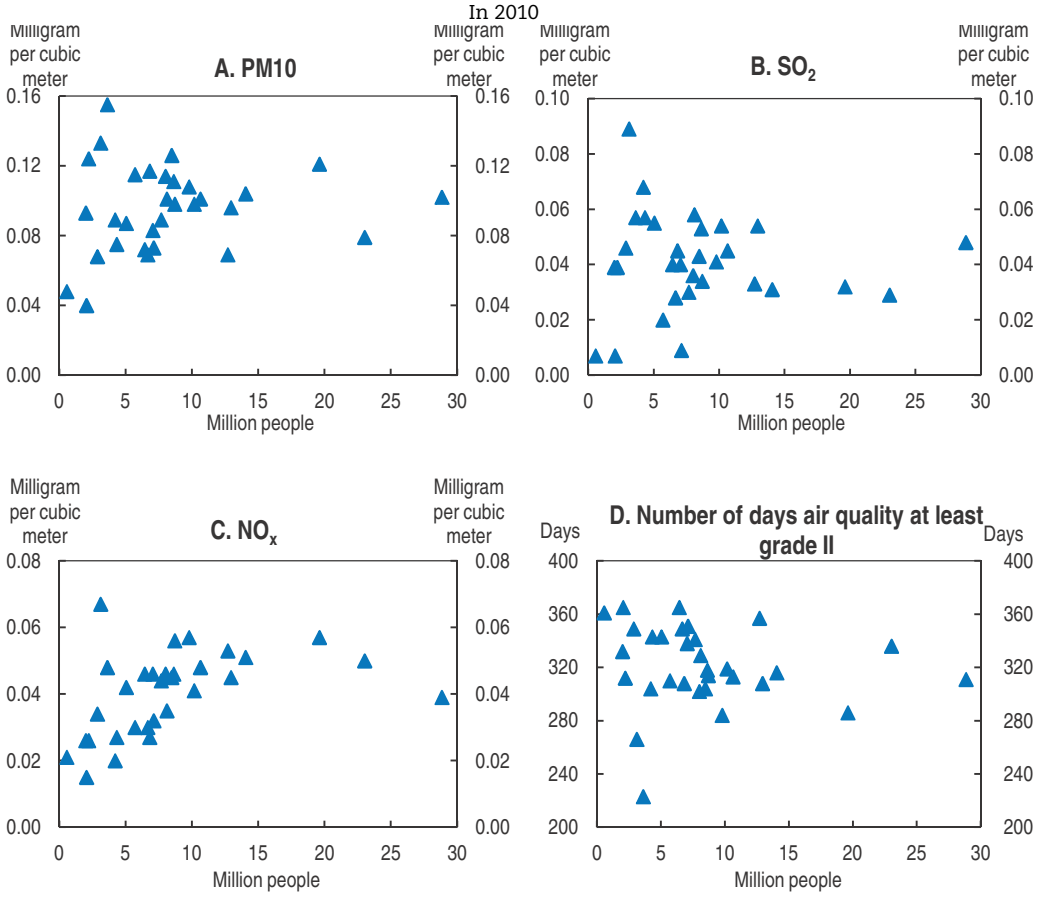
Implementing an effective strategy for pricing carbon and other pollutants would support the expansion of renewable energy. In several OECD countries this is often complemented by other measures and, as noted, China has taken a multi-pronged approach to expanding renewable energy, including the introduction of FITs for solar and wind power. A guiding principle for setting FITs is that the implied subsidy should be consistent with the cost of the pollution they aim to mitigate. In this regard FITs in China are relatively modest though still sufficiently generous to support new investment (IEA, 2011a). Going forward, until a more comprehensive framework for pollution pricing is implemented an appropriate level of support ought to be provided for renewable energy consistent with environmental objectives. At the same time problems that have impeded the efficient expansion of renewable energy, particularly poorly co-ordinated wind power projects, need to be addressed. In this respect some improvements have already been made. The approvals process for all new wind projects has been centralised, which should help avoid past problems associated with local governments authorising developments without due regard to grid connectivity (Ni and Yang, 2012). However, more fundamental issues including management of variable power loads and facilitating national transmission of electricity will require a well co-ordinated approach to grid management and expansion (IEA-ERI, 2011).

Effective planning and strong standards are also needed

Well-planned cities are an important part of a long-term environmental and urbanisation strategy

As noted, urbanisation rates remain relatively low by international standards but are on a rising trend. As cities expand, it is important that policy frameworks address possible adverse environmental and other effects associated with urbanisation such as congestion and the concentration of pollution and waste. Policies that promote green cities will not only serve narrow environmental objectives but economic and urbanisation goals as well. Workers will be drawn to cleaner and more attractive cities and conversely may demand compensation for working in a polluted and less attractive environment, thereby adding to costs faced by firms. This is likely to be especially true for highly-skilled workers needed to ensure the development of higher value added service industries, who tend to be more mobile. Indeed there is evidence that higher levels of pollution in Chinese cities depress property prices (Zheng *et al.*, 2011). There are many factors which influence urban air quality, including local policies, geography and economic structures. In China, there is not always a clear relationship between city size and air pollution suggesting that the growth of large cities does not necessarily lead to poorer air quality in urban areas (Figure 2.15). While ambient NO_X concentrations do tend to increase with population, likely reflecting

Figure 2.15. **Population and air pollution in Chinese cities**



Note: Population figures include urban districts only.
Source: *China Statistical Yearbook*.

StatLink http://dx.doi.org/10.1787/888932788151

higher motor vehicle use, SO_2 and PM 10 concentrations and overall air quality show little relationship with city size.

International experience shows that a key determinant of the environmental performance of a city is its urban form and in particular population density (OECD, 2012c). When carefully planned and developed, compact cities can offer several advantages. *First*, shorter travel distances, increased financial viability for public transport and a reduced dependency on motor vehicles lead to energy savings and lower air pollution. *Second*, higher density can result in better energy efficiency for buildings and public services and improve the feasibility of using combined power generation and central heating systems as well as smart grids which can offer potential for energy savings. *Third*, compact cities allow for a better use of land resources, conserving farmland and natural reserves in areas nearby cities while avoiding fragmented land use within the urban core. *Fourth*, compact cities offer advantages as regards mobility, access to social services and quality of life. *Finally*, access to well designed and reliable transport systems can lower congestion and reduce operating costs for firms and commuting times.

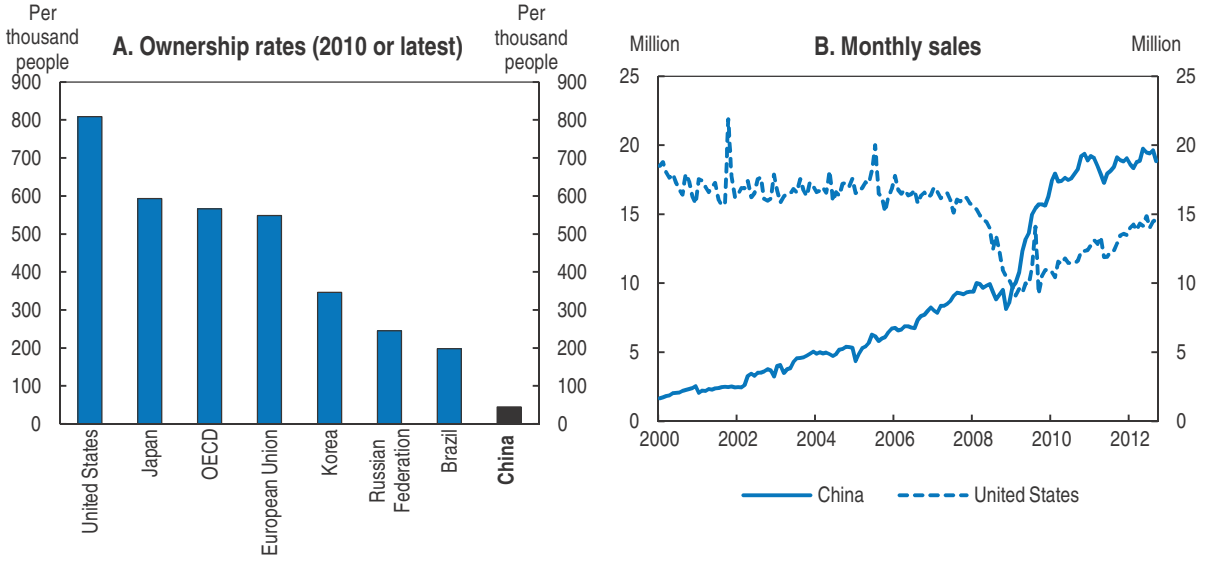
Recent empirical evidence for major Chinese cities suggests that compactness, assessed using different metrics including population density, is associated with stronger

environmental performance and superior energy efficiency (Liu *et al.*, 2012). Most carbon emissions in urban areas in China come from industrial use including power generation and in selected cities such emissions are high compared to cities in other countries (Sugar *et al.*, 2012; Wang *et al.*, 2012b). However, the density of Chinese cities has helped limit carbon emissions from non-industrial sources, including transport. As noted in Chapter 1, as urbanisation continues density in Chinese cities has remained high by international standards. Going forward, sound planning together with strong investment in public transport will support environmental and other objectives.

Better environmental standards and practices are needed to complement market-based approaches

Motor vehicle ownership rates in China remain low by international standards but have been rising rapidly (Figure 2.16, Panel A). China has surpassed the United States as having the largest market for new motor vehicles and may have the largest fleet in the world within a decade (Figure 2.16, Panel B) (Huo and Wang, 2012). Mindful of the implied environmental challenge, the government has adopted measures to control motor vehicle energy consumption and associated pollution emissions. Some, including lower sales tax rates for more fuel-efficient cars, apply nationally. In other areas the largest and most economically advanced cities and regions are taking the lead (Hao *et al.*, 2011). Shanghai has a well established system of discouraging motor vehicle purchases by limiting the number of new registrations and auctioning new license plates. Strict limits and rising incomes have seen the average price of licence plates rise significantly, reaching over CNY 64 000 (USD 10 000) by mid-2012. In Beijing, policies to restrict motor vehicle use first introduced for the 2008 Olympic Games have been preserved with the current policy preventing the same motor vehicle from being used every day of the week. In 2012, Guangzhou followed suit implementing a mixed lottery and auction system.

Figure 2.16. **Motor vehicle ownership rates and sales**



Source: CEIC, Datastream and *World Development Indicators*.

StatLink http://dx.doi.org/10.1787/888932788170

However, there is evidence that loopholes are being exploited with these measures, for example Shanghai residents sometimes register their vehicles in neighbouring cities to reduce registration costs (Wang, 2010). A further downside to these approaches is that they are likely less efficient than other measures which directly increase the cost of motor-vehicle use. Where governments wish to continue rationing licence plates, allocation through an auction would be preferable as it is more economically efficient than a lottery system. Better still would be focusing on measures that target motor vehicle use such as raising fuel excise rates and implementing congestion charges, as has been done in some countries including Singapore and Sweden (OECD-ITF, 2010).

As in OECD countries, an important element of the strategy to control motor vehicle pollution in China has been the implementation of emissions standards for new light and heavy-duty motor vehicles. A national system based on the EU "Euro" standards was established in 2000 followed by successively more stringent standards specifying lower permissible emissions of key pollutants. A national roll-out of the China IV standard, similar to the Euro V standards introduced in 2009, is now underway and in a number of more economically advanced parts of the country, including Beijing, an even more stringent China V standard is being planned. The evidence suggests that the gradual tightening of emissions standards in Beijing has been by far the most important factor in reducing motor vehicle emissions of key pollutants such as CO, hydrocarbons, NO_X and PM in the context of a rapidly expanding motor vehicle fleet (Wu *et al.*, 2011). Indeed, without these measures such emissions would have continued to rise through the 2000s with attendant adverse effects on local air quality and health. Nationally, the importance of higher standards is further underscored by the disproportionately large air pollution emissions from older, lower standard motor vehicles. Though comprising less than 13% of the national fleet in 2010, pre-China I standard vehicles emitted more than half of all motor vehicle related PM pollution (MEP, 2011c).

While higher emissions standards help contain pollution, their effectiveness depends on the quality of diesel and gasoline. Many motor vehicle technologies that limit NO_X and PM emissions work best with low sulphur fuels, and in the case of diesel particulate filters the leading technical solutions for reducing PM emissions from diesel vehicles require fuel with sulphur concentrations below 50 ppm (Sharpe *et al.*, 2011). Some progress has been made in improving fuel quality in China, notably with the phasing out of leaded fuels in the early 2000s. However, improvements in other areas, including sulphur content, have lagged behind. The current national standard sets limits on sulphur content at 150 ppm and 350 ppm for gasoline and diesel respectively, although again some cities such as Beijing have successfully implemented higher standards (Ma *et al.*, 2012). This is well above leading international benchmarks and what is needed to maximise the benefit of lower motor vehicle emission standards.

The problem with sulphur content is so acute that it has delayed the implementation of China IV emissions standards for diesel vehicles in some areas thus making it more difficult for the government to achieve its 12th FYP air pollution reduction goals, notably for NO_X. This is particularly unfortunate given that diesel vehicles produce a disproportionately large share of some types of motor vehicle related pollution (MEP, 2011c). Producing cleaner fuels requires the dominant domestic refineries to invest in costly new facilities. The practice of keeping gasoline and diesel retail prices below cost has hindered the feasibility of passing on the higher cost of cleaner fuels to consumers. However, in light of the recent changes to pricing policies discussed above this now poses

less of an obstacle and the government should move ahead with enforcing higher fuel standards and allowing the cost of higher quality fuels to be reflected in retail prices. At the same time promoting more competition in the refinery sector would help ensure that costs associated with the transition to cleaner fuels are minimised. The leading role played by cities such as Beijing shows how stronger emissions and fuel standards can limit motor vehicle pollution. Nationwide implementation of leading China standards, and over time higher standards still, should be a high priority for the central government.

As noted, alternative energy vehicles, including electric vehicles, is one of several strategic industries the government is actively promoting and represents another response to the challenge posed by rising transport sector energy use and pollution. While electric vehicles do not produce air pollution directly, their environmental benefit depends largely on how and where the electricity they consume is generated. If renewable energy and other cleaner energy sources comprise a significant share of the underlying electricity supply mix then electric vehicles have the potential to reduce pollution significantly. However, if electricity supply is dominated by dirtier sources such as coal, as in China, electric vehicles could potentially exacerbate air pollution problems. Indeed, because of the reliance on coal a recent analysis focussing on Chinese cities found that pollution emissions from electric vehicles were higher than conventional gasoline vehicles (Ji *et al.,* 2012). Moreover, even after accounting for the closer proximity of emissions from conventional vehicles, electric vehicle use was estimated to account for more premature deaths, casting serious doubt on the merit of current policies promoting their use.

Energy consumed by buildings in China has lagged behind many OECD countries, reflecting both a lower per-capita built-up area and lower energy usage per unit of floor space on account of different norms concerning temperature regulation (Zhang *et al.*, 2010b). However, with ongoing urbanisation and expected increases in absolute and per-capita residential and commercial building space, promoting energy-efficient buildings will be important. Since the 1990s, China has developed a mandatory energy efficiency standards system for new buildings which has been gradually upgraded in different parts of the country. Low compliance has proved a problem in the past, with only around half of all new buildings meeting standards at the design stage and less than a quarter at the construction stage in 2005 (Bin and Jun, 2012). In response, the Ministry of Housing and Rural and Urban Development (MHRUD) launched a new inspection system covering most provinces and by 2010 compliance rates at both design and construction stages had risen above 95%. The government has now launched a programme to ensure that by 2015, 20% of all new buildings will meet new higher efficiency standards.

Alongside these efforts, standards for consumer durable energy efficiency have been strengthened (Yuan *et al.*, 2011). In 2005, the government introduced an energy efficiency labelling system for air-conditioners and refrigerators which has since been broadened to cover a larger range of goods and modified to incorporate some mandatory standards. More recently the government banned the sale of 100-watt or greater incandescent light bulbs (NDRC, 2012).

Mandatory building efficiency requirements have been complemented by a rise in voluntary green building certification systems of the kind that exist in OECD countries. The two leading schemes in China are the Three Star system developed by the MHRUD and the Leadership in Energy and Environmental Design system, which originated in the United States. Though the number of construction projects earning certification under

these systems remains relatively low, it has increased rapidly and they offer significant potential to encourage green property development as they have in OECD countries. Such schemes can complement mandatory standards by providing an incentive for property developers to respond to market demands for higher energy and environmental standards. In the same way, industry-based standards can also help encourage further energy-enhancing retrofitting. Governments can also play a facilitating role by filling information gaps through the initiation of building energy audits which can be used as the basis for energy management contracts. Under this model, which has been successfully applied in some Chinese cities, third-party firms finance retrofitting of energy conservation and are allocated the financial windfall of lower energy costs in return.

Enforcement and implementation capacity need to be enhanced

The legal framework for environmental protection in China has evolved to encompass a comprehensive range of laws (McElwee, 2011). In addition, existing core legislation has been modernised and amended, and new regulations implemented to reflect evolving environmental needs. Recent revisions to the *Civil Procedure Law* also open the door to stronger environmental enforcement (Song and Ye, 2012). The increased importance attached to environmental issues is reflected in the evolution of institutional arrangements for environmental governance. In 2008, environmental protection was given full ministerial status when the then State Environmental Protection Administration became the Ministry of Environmental Protection. The MEP, which comprises a head office as well as six regional branches, has broad responsibility for formulating the government's environmental strategies, including input into national plans, as well as the preparation of specific policies and associated legislation. In general the MEP it is not engaged in direct oversight or enforcement issues, which are primarily the domain of local environmental protection bureaus (EPBs) which report to MEP but are ultimately controlled by local governments. The main mechanism by which national environmental goals and targets filter down to local authorities responsible for implementation and enforcement is the "Target Responsibility System" which is an agreement between one layer of government and its subordinate units specifying actions to be taken and targets to be achieved. This then forms the basis on which local officials are evaluated on environmental performance.

A key constraint in implementing environmental policies and ensuring that national goals are met relates to the sometimes conflicting incentives faced by local governments. Local EPBs are subordinate to local government directives and their ability to execute enforcement functions have at times been stymied when environmental concerns have been overridden by other imperatives. This challenge was highlighted during the roll-out of the stimulus package during the global downturn in 2008 when normal procedures for assessing environmental aspects of new development proposals were bypassed to expedite spending (Liu and Raven, 2010). Strong central government oversight has been essential for progress, notably reductions in SO_2 emissions, and a continued effort is needed going forward. A further weakness in the environmental enforcement framework has been the very low fines for polluting which in the past has led some firms to choose to pay a fine rather than undertake costly mitigation. In response, the government has taken steps to strengthen penalties by raising fines and targeting individuals responsible in order to improve accountability. In the case of prosecutions involving severe environmental damage under the *Law on Water Pollution Prevention and Control* a dual fine applies: one

component is based on economic loss associated with the damage caused, and the other on the salary of the person held responsible (Yuan and Wu, 2011).

One specific area of environmental regulation highlighted as needing strengthening in the 12th FYP is nuclear and radiation safety, with an emphasis on improving the reliability of nuclear facilities and reinforcing regulatory and management capabilities. As noted above, the response by the authorities to events in Fukushima reaffirmed the importance given to nuclear safety. As the nuclear sector continues to grow in China, regulatory resources need to expand and regulations need to evolve in line with international best practice. Strong and effective nuclear regulation encompasses several elements (OECD, 2011d). The envisaged expansion of the industry is unprecedented in speed and scale and effective oversight presents a major challenge (Zhou *et al.*, 2011). As events in other sectors in China have demonstrated, rapid infrastructure expansion can entail safety problems. The number of official regulatory personnel per unit of nuclear energy produced in China is relatively low by international standards and increasing regulatory capacity in concert with the expansion of the industry raises broader problems of limited training and research capability. A further issue is ensuring that the nuclear safety regulator, the National Nuclear Safety Administration, has an adequate voice at the highest levels of government. By virtue of being part of MEP it has access to the State Council but the same is true of the three large companies which operate nuclear energy facilities, as they are SOEs. Finally, nuclear energy is governed by a framework which operates on the basis of dated regulatory instruments. Issuing a law expressly for this purpose, akin to those in many other countries with a nuclear energy industry, would provide an opportunity to update the legal framework and further clarify issues such as liability for damages incurred in the event of an accident.

Better monitoring and information disclosure will also help

The government continues to strengthen environmental monitoring capacity. A major milestone was a national pollution census undertaken in the late 2000s which involved assessing close to six million separate pollution sources spanning the full gamut of economic activities. This exercise highlighted a major gap in regular reporting of water pollution. Until the census results were published in 2010, official statistics only reported industrial and household sectors, ignoring the agriculture sector which was then found to be a major contributor of pollution. Efforts have been made to introduce more advanced technology to track industrial emissions, particularly for SO_2. More recently, in 2012 MEP conducted a pilot programme to monitor ambient mercury emissions which involved the installation of continuous monitoring equipment in thermal power generators in several provinces. Ambient air quality standards were also revised in 2012, setting lower limits for pollutants already included and broadening coverage to incorporate others. This includes fine particulate matter which, as noted, has begun to be incorporated in the suite of pollutants monitored and reported on a regular basis, bringing China closer to best practice in this area.

Despite these improvements, publicly available information on some types of ambient pollution remains limited, even for pollutants included in official air quality standards (Renmin University of China Law School and IPE, 2011). Key pollutants for which data are not readily available include CO, ozone and VOCs. There is also a dearth of official data for CO_2 and other GHG emissions at both the national and sub-national levels, despite the government having adopted CO_2 targets for the 12th FYP and beyond. The government has committed to improved monitoring of some pollutants in the 12th FYP. Looking ahead it

should specify targets for controlling emissions of a more diverse range of pollutants as part of a move towards establishing broader environmental targets based on scientific and economic analysis.

Public awareness and interest in environmental issues has increased, particularly with regard to air quality in large cities, and environmental information disclosure is being boosted alongside improvements in monitoring. Disclosure plays an important role in raising awareness of environmental issues and promoting more effective enforcement. Polluting firms that are exposed risk suffering consumer or investor boycotts as well as litigation and therefore even the threat of information dissemination can induce better practices. A milestone in promoting improved disclosure practices was the implementation in 2008 of the national *Measures on Environmental Information Disclosure*. These stipulate requirements for local environmental authorities to make public information pertaining to environmental policies, plans and laws as well as blacklisted firms (Johnson, 2011). The MEP, through the China National Environmental Monitoring Center and local EPBs, makes a wide range of timely environmental indicators available through government websites, including ambient levels of pollution as well as the status of water quality in rivers and lakes. It has also committed to further improving the dissemination of such information in the coming years.

While these responses represent a step forward, implementation varies across the country and there remains room for local officials to sidestep national requirements. The national government could further strengthen efforts in this area by revising the guidelines to be more prescriptive. A further challenge relates to the way in which some information is made available to the public. One of the main tools the government uses to report air quality in cities is an official Air Pollution Index (API). Based on national standards which have evolved to encompass a broader range of pollutants, the API assigns qualitative descriptions of air quality to numerical outcomes based on prevailing pollution levels. This mechanism has also been used to determine "blue sky" days, which are counted when API values are below a threshold level and reported in official sources. The usefulness of the API hinges on the language used to describe pollution levels associated with different API levels and on this score past practice has been poor. In particular, levels of pollution deemed high by international standards, as well as the standards applied in Hong Kong, were referred to in benign terms, including "blue skies" in mainland cities. The Beijing government is leading the way with reform in this area, announcing that it would abandon the blue sky concept and instead focus on timely reporting of ambient concentrations of different pollutants.

Conclusions

Rapid economic growth focussed on manufacturing and investment has led to strong increases in energy demand, high levels of pollution and other environmental pressures. Air quality is invariably poor owing to high emissions from a range of industrial and other sources. Many lakes and rivers also suffer from severe pollution and water scarcity presents a threat in some parts of the country. These pressures entail health and other costs, warranting further environmental and related reforms. So far the government has relied heavily on command-and-control measures to reduce pollution and promote other environmental goals. In some cases these have been very costly and looking ahead more emphasis needs to be given to effective implementation of market-based reforms, complemented by other measures (Box 2.4).

Box 2.4. **Main policy recommendations on the environment**

Improve energy and water efficiency

- Increase excise duties on gasoline and other petroleum products to bring end-user prices closer to the norm of advanced economies. Complete reforms to deregulate prices to allow full pass-through of changes in international oil prices.
- Following the conclusion of pilot schemes for market-based natural gas pricing extend arrangements nationally and move to full market-based pricing of coal. Reform prices in the power generation sector to better reflect costs including carbon and other pollution pricing. Avoid preferential electricity pricing for selected industrial users. Experiment with the separation of transmission and distribution with a view to moving towards price deregulation.
- Raise piped water prices to end-users to better reflect scarcity and encourage conservation. In doing so pay attention to distributional consequences and where necessary support poorer households by providing financial assistance through the minimum living allowance or direct transfers. In rural areas continue to encourage the formation of local water markets.

Strengthen pollution price signals

- Increase air and water pollution levies and strengthen their legal basis by moving towards a system of explicit pollution taxes. Promote a streamlined collection process to ease the burden on local governments and businesses.
- Ensure effective implementation of CO_2 pilot emissions trading schemes. Move towards national carbon pricing, preferably by implementing a carbon tax, depending on experiences with the pilot schemes.
- Focus on measures that directly discourage motor vehicle use, including congestion charges, rather than license plate rationing, as a way to reduce associated externalities.

Provide appropriate support to renewable energy investment

- Until effective national CO_2 pricing is established, and the pollution levy system strengthened, continue to provide assistance to renewable energy investment at a level consistent with carbon reduction and other environmental goals. Avoid providing more support to one type of renewable energy source. Address supply bottlenecks with wind and solar energy and continue to promote improved investment co-ordination and grid connectivity.

Raise environmental standards and improve enforcement and implementation

- Continue to improve national standards for motor vehicles and fuels, especially regarding sulphur content, by extending high standards in leading cities across the country. Gradually phase in still stronger standards in line with technological advances and international best practice.
- Establish targets for a broader range of environmental objectives, including additional air and water pollutants, based on scientific and economic analysis and continue to ensure that local governments are held responsible for achieving environmental objectives. Improve national data collection and dissemination of all major pollutants including CO_2 and other greenhouse gases.
- Strengthen nuclear energy safety including by increasing regulatory capacity to keep pace with rising nuclear energy investment. Update regulatory framework to provide clearer accountability and ensure regulatory authorities have direct access to the highest levels of government.

Prices for petroleum products are relatively low and applicable excise duties should be raised to promote conservation. There is also scope to raise electricity and water prices, which could be done alongside offsetting measures to protect poorer households. Poor implementation has stymied the effectiveness of pollution pricing as a tool for supporting environmental objectives in China. Therefore, reforms are needed to strengthen the existing pollution levy system. Careful attention also needs to be paid to implementation details of pilot CO_2 emissions trading schemes. Serious consideration ought to be given to the introduction of a carbon tax, especially if the administrative challenges associated with trading schemes prove difficult to address. Both types of carbon pricing, if implemented correctly, would support further growth in renewable energy. Until then an appropriate level of direct support should continue but efforts are called for to improve the efficiency of investments in this area. These reforms should be complemented by stronger standards, especially with regards to motor vehicles and fuels. Finally, monitoring and regulatory enforcement capacity should be enhanced, especially at the local level. In the area of nuclear energy safety it is important that regulatory capacity keeps pace with the rapid growth of the sector.

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(10 2013 05 1 P) ISBN 978-92-64-18259-2 – No. 60539 2013

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Volume 2013/4
March 2013

ISSN 0376-6438
2013 SUBSCRIPTION (18 ISSUES)
ISSN 2072-5035
SUBSCRIPTION BY COUNTRY

ISBN 978-92-64-18259-2
10 2013 05 1 P

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