EXECUTIVE BOARD MEETING

SM/16/213
Correction 1

July 25, 2016

To: Members of the Executive Board

From: The Secretary

Subject: **People's Republic of China—Selected Issues**

Board Action:	The attached corrections to SM/16/213 (7/8/16) have been provided by the staff:
Evident Ambiguity	**Pages 4, 6 (para. 6), 39 (para. 5, second bullet, line 1), 40**
Factual Errors Affecting the Presentation of Staff's Analysis or Views	**Pages 6 (figure 6), 13, 17, 18, 32**
Typographical Errors	**Pages 15, 39 (para. 5, second bullet, line 4), 45**
Questions:	Mr. Daniel, APD (ext. 39698) Mr. Guo, APD, (ext. 34705)

REBALANCING IN CHINA: ANALYTICS AND PROSPECTS[1]

- *China is transitioning to a more consumer and service-based economy. This paper reviews progress along various dimensions of rebalancing and presents staff projections for the medium-term rebalancing path.*
- *External rebalancing has advanced well, while progress on internal rebalancing has been mixed—substantial on the supply side, moderate on the demand side, and limited on credit dependence. Rebalancing on the environment and inclusiveness has lagged.*
- *Going forward, the high national saving is expected to fall owing to demographic change and a stronger social safety net. The consumption ratio is expected to increase with rising labor income share and falling household savings. The investment ratio is forecast to fall in line with national saving, with external balance becoming more entrenched.*
- *Supply side rebalancing from industry to services is expected to advance further, helping reduce carbon intensity of output and promote income equality. Credit rebalancing is likely to progress slowly unless decisive corporate restructuring and SOE reforms are implemented.*

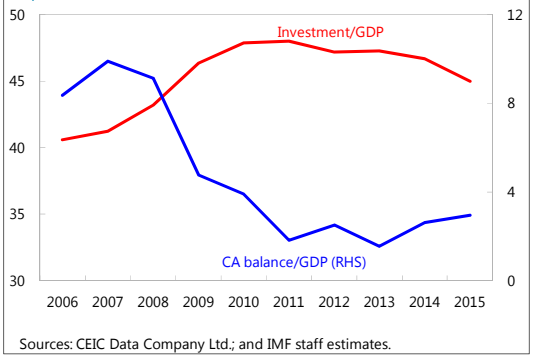
A. Definition of Rebalancing

1. Rebalancing in China contains four important elements: external, internal, environmental, and distributional. While external rebalancing focuses on the role of external demand versus domestic demand, internal rebalancing has a much richer content: shifting from investment to consumption on the demand side, transitioning from industry to services on the supply side, reducing credit intensity of output, and improving the efficiency of resource allocation. They are closely interlinked and often reinforce each other. Environmental rebalancing aims to reduce the carbon intensity of output and make growth more environment-friendly. Income distribution rebalancing aims to create a more equal society by increasing the share of labor income in GDP and reducing income inequality.

B. Progress on Rebalancing

2. External rebalancing has advanced well, but at the cost of growing internal demand imbalances until 2011. After the Global Financial Crisis, substantial progress has been made on external rebalancing. China's current account surplus has come down from the peak of 10 percent of GDP in 2007 to around 2–3 percent in recent years, and the contribution of net exports to growth has been fluctuating around zero (from 2 percentage points of GDP annually in the pre-GFC peak).

Figure 1. External Rebalancing vs. Internal Rebalancing
(In percent of GDP)

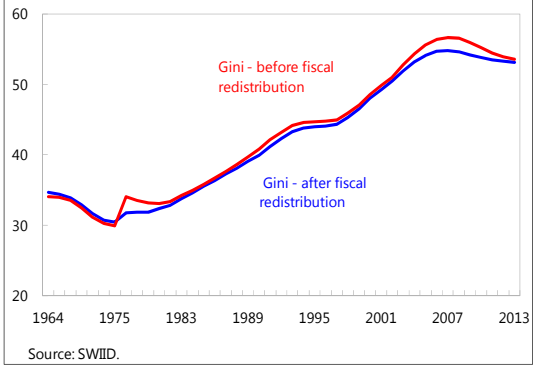


Sources: CEIC Data Company Ltd.; and IMF staff estimates.

[1] Prepared by Longmei Zhang (APD).

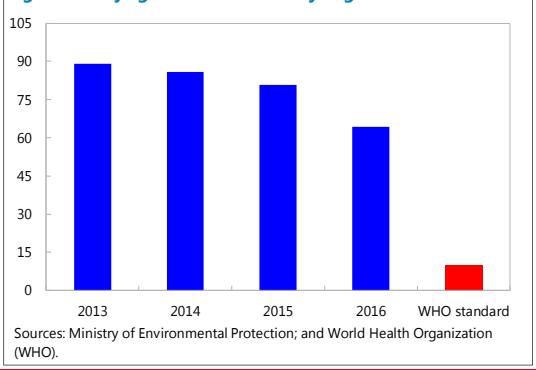
6. Rebalancing on environment and inequality are lagging. Some progress has been made in reducing the energy and carbon emission intensity of GDP, however, PM 2.5 indexes (fine particle air pollution) in cities remains very high. Rapid growth has been accompanied by growing income inequality, with the Gini index[2] rising from 0.3 in the 1980s to 0.53 in 2013. Progress has been made in recent years, with labor income gaining a larger share in GDP, but the redistributive role of fiscal policy remains limited as shown in the small difference between gross and net Gini index.

Figure 5. Gini Index: Very High



Source: SWIID.

Figure 6. Beijing PM 2.5 Index: Very High



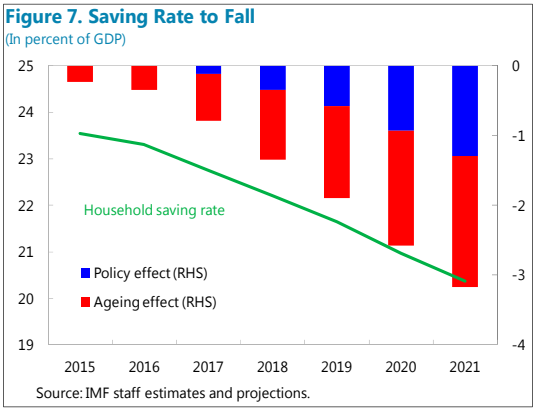
Sources: Ministry of Environmental Protection; and World Health Organization (WHO).

C. Prospects for Rebalancing

Staff's baseline envisages substantial progress in pro-consumption and services reform, but a lack of decisive SOE reforms and slow progress on hardening budget constraints. This will give rise to continued internal rebalancing on the demand and supply side, but less on credit side. The improvement in external balancing is likely to continue.

7. The household saving rate is projected to fall, reflecting demographic changes and pro-consumption reforms. China will experience rapid ageing in the next 15 years, with the old-age dependence ratio forecast to double from its current level by 2030. Cross-country evidence suggests such demographic change would significantly reduce the saving rate. In addition, precautionary saving is expected to fall with the strengthening of the social safety net, achieved through higher government spending on health care (rising from current 1.5 percent of GDP to 2.1 percent by 2021). As a result, household saving is expected to fall from 24 to about 20½ percent of GDP by 2021. Recently, the government has lifted the one-child policy, which may induce the saving rate to fall faster than staff projections, depending on the effect on the fertility rate.

Figure 7. Saving Rate to Fall
(In percent of GDP)



Source: IMF staff estimates and projections.

[2] Data from Standardized World Income Inequality Database (SWIID).

system and short-term market interest rates increasingly contain information about the monetary policy stance. Although money growth (M2) remains the official intermediate target (now at 13 percent y/y for 2016), the PBC has recently de-emphasized its importance, which paves the way to a money market rate as the intermediate target. Short-term repo rates have become much less volatile after the PBC introduced reserve averaging for banks and appears to calibrate the liquidity impact of its various policy measures to ensure that money market rates move closely with its own benchmark rates.

4. The seven-day interbank repo rate appears to have become the targeted short-term money market rate. Over the past few quarters, this rate has consistently traded just above the PBC's reverse repo rate, which banks have to pay for PBC funds with maturity of one week. On October 26, the PBC cut its seven-day reverse repo rate by 10 bps to 2.25 percent and since then the seven-day interbank repo rate fixing—a daily trade-volume weighted average—has traded closely above this rate, averaging 2.38 percent. This implies that the PBC largely accommodates banks' liquidity demand at the "policy" reverse repo rate. At the beginning of this year, the PBC increased the frequency of its open market operations from bi-weekly to daily.

5. The corridor around the seven-day repo rate is likely to be defined by the interest rate on excess reserves (lower bound) and the standing lending facility (upper bound). Together with its open market operations (OMOs), the PBC also operates several standing lending facilities with various maturities. The standing lending facility (SLF) offers overnight (currently at 2.75 percent), seven-day (currently at 3.25 percent), and one-month (currently at 3.6 percent) liquidity to domestic banks and other local financial institutions. The PBC is exploring the use of the seven-day SLF to set the upper limit of an interest rate corridor. The interest rate that banks receive on their excess reserves deposited at the PBC (currently at 0.72 percent) sets the lower bound of the interest rate corridor.

6. The PBC's other longer-term lending facilities complement the daily open market operations and provide longer-term funding mainly for national priority projects. The PBC also operates a number of medium-term lending facilities (3-month, 6-month, 1-year maturities) but access to these facilities is mostly granted to a number of large banks ~~(primarily policy banks)~~ and the amount available is preset. With these facilities, the PBC aims to guide market interest rates at longer tenors but often these tools are also employed to support other policy objectives, such as lending to small- and medium-term enterprises. The pledged supplemental lending facility (PSL) provides funds with one-year maturity to policy banks to finance urban upgrades.

7. The PBC requires banks to post central government bonds, central bank bills or policy bank bonds as collateral for its open market operations. Local government bonds do not currently qualify as collateral but the PBC is reportedly exploring the possibility of adding these to the eligible pool of assets for OMOs. Other liquidity operations may each have their own collateral requirements but there is limited transparency on the specifics.

8. Reserve requirements continue to play a role in the PBC's liquidity management but do not seem to be an independent signal of the policy stance. The PBC has traditionally adjusted reserve requirements to help with the sterilization of large liquidity injections and withdrawals related to its intervention in the foreign exchange markets. The rate on reserve requirements peaked in 2011 (at

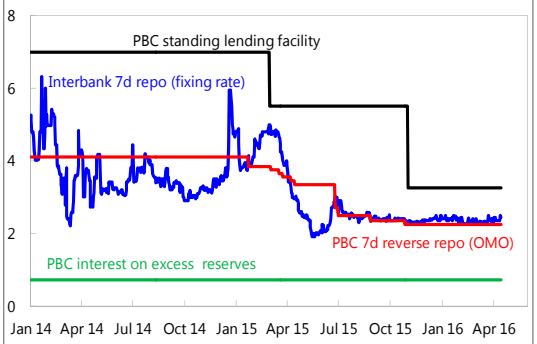
lending levels do not once other policy variables are taken into account. They use a broad set of Chinese economic indicators and a dynamic factor model framework to estimate Chinese economic activity and inflation as latent variables in a factor-augmented vector autoregression (FAVAR) to estimate the effects of Chinese monetary policy on the Chinese economy. Their approach is particularly well-suited to such analysis due to concerns about Chinese data quality, a lack of a long history for many series, and the rapid institutional and structural changes that China has undergone. As more data under the new regime of liberalized financial markets and interest rates become available, it should become easier to identify and estimate the effect of changes in the policy interest rate on activity and inflation.

13. To complete the transition towards a more market-based framework, the key next steps for the authorities to consider include:

- **Objectives:** Although the PBC does not operate under an explicit inflation targeting regime its official mandate is "maintain the stability of the currency value and thereby promote economic growth". This is similar to that of other central banks with a focus on price stability and the next step should be the introduction of an explicit medium-term inflation target or a range (set by the government/state council) together with operational (instrument) independence for the PBC.

- **Instrument:** The PBC should declare the seven-day repo rate its new intermediate policy target for monetary policy purposes, permit more flexible use of reserves averaging and publish a new market rate (7-day repo) representative of lending conditions for Tier 1 banks only. Longer-term rates should be market-determined, reflecting expectations of the central bank's future policy rates, future inflation, among other factors. The clearer the policy framework, the easier it will be for the market to establish a yield curve. Standing facilities should act as a backstop with unlimited access for banks on demand against appropriate high-quality collateral. Eligibility and collateral requirements for the PBC's liquidity facilities should be clear and transparent.

Figure 1. Narrowing Corridor around 7-day Repo Rate



Sources: CEIC Data Company Ltd.; and People's Bank of China.

- **Communication** of the PBC's policy stance and economic outlook would increase the effectiveness of a flexible inflation targeting framework. Historically, many central banks kept markets guessing, to some extent, about their policy intentions; but most central banks have found that policy operates more efficiently and effectively if (i) the policy is clearly and simply communicated; and (ii) implementation fully supports the stated policy. Simultaneous publication of monetary policy reports (at least the conjunctural chapter) in English would support these goals.

CHINA: FINANCIAL SYSTEM VULNERABILITIES—SHADOW EXPOSURES, FUNDING, AND RISK TRANSMISSION[1]

- *The proliferation of "shadow" credit products and growing reliance on short-term, wholesale funding could pose substantial risk. Oversight should be enhanced commensurately.*
- *Recent supervisory action seems to close the major regulatory gaps but will need to be implemented strongly and should ensure that losses on existing shadow credit holdings are promptly recognized.*
- *On funding, liquidity frameworks should be reviewed, tightening of leverage mechanisms in the interbank market considered, and the overall shift toward wholesale and interbank sources closely monitored with a view to imposing more measures if recent trends continue.*

1. The proliferation of "shadow" credit products and growing reliance on short-term, wholesale funding, could pose substantial risks. Recent work by the Fund and others suggest that borrower solvency is deteriorating and that potential defaults on corporate loans by 'at-risk' borrowers could potentially imply significant costs (e.g., the April 2016 *Global Financial Stability Report*). But the process of loss realization on loans is likely to be gradual and the system has mechanisms, such as state backstops, to prevent loan deterioration from rapidly metastasizing. A possibly greater risk to stability may reside in the potential for defaults on widely-held "shadow products" to trigger risk-aversion that results in the withdrawal of liquidity from short-tenor investments in high-risk borrowers. This risk is intensified by financial institutions' own increasing reliance on short-term wholesale (including interbank) funding, a structure potentially susceptible to rapid risk transmission and destabilizing liquidity events.

2. "Shadow credit products" are large and growing rapidly. Shadow credit products are investment instruments, mainly with loans or other credit as underlying assets, structured by trust or securities companies, or their asset management subsidiaries~~structured by trust, securities or asset management companies~~. The volume of these products grew by 48 percent in 2015, to RMB 40 trillion, equivalent to 40 percent of banks' corporate loans and 58 percent of GDP.

3. About half of shadow credit products appear to pose elevated risk of default and loss. Some shadow products appear benign; but others appear to contain significantly higher default risk and loss potential than banks' corporate loan portfolios. These high-risk products offer yields of 11–14 percent, compared with 6 percent on loans and 3–4 percent on bonds. Those whose underlying assets are 'nonstandard credit assets' (NSCA)—untradeable debt, typically loans—are probably of lowest quality; and shadow products based on equities are also risky. RMB 19 trillion,

[1] Prepared by John Caparusso and Kai Yan (both MCM).

nearly half of total shadow products, have either NSCA or equities as underlying and appear high-risk relative to corporate loans.

4. Banks' on-balance sheet exposures to shadow products are large and growing fast. At end-2015, banks held RMB 15.2~~16~~tn[2] of shadow products—equivalent to 8 percent of banks' assets and 92 percent of capital buffers, and up 58 percent year-on-year for listed banks. Because these positions appear to be motivated in part by some banks' practice of repacking deteriorating loans into investment securities to avoid recognizing and providing for nonperforming loans (NPLs), banks' exposures are likely skewed toward the riskier products (those with NSCA as underlying asset). The "big four" banks have small exposures, but several other listed banks and the unlisted in aggregate have exposures that are several times their capital.

5. Shadow products also can generate transmission risks that are potentially less manageable than loan losses. Where shadow products differ qualitatively from high-risk loans is in their greater power to transmit risk across the financial system. Of greatest concern are holdings by investors who have little ability or incentive to continue supporting market liquidity in the face of shocks or deterioration in credit conditions. Vulnerable segments include 'collective' instruments (RMB 10.9 trillion at end-2015); and holdings by nonbank financial institutions (particularly investment funds), corporates and individuals. Sizing the 'high-transmission' segment of the shadow system is difficult; but it appears sufficient to potentially catalyze significant liquidity challenges.

6. Rapid asset growth has increased banks' and other financial institutions' reliance on wholesale funding. From 2010 to 2015, total financial system assets grew by 5½ times more than GDP, twice as much as total social financing and three times as much as loans. Thus while the banking system loan-deposit ratio remained stable, total assets have grown much faster than deposits. Financial system assets relative to the stable bank deposit funding in the system rose from 163 percent in 2010 to 193 percent in 2015; and for banks, from 130 to 143 percent. The gap has been funded from wholesale sources; staff estimate that wholesale sources as a percent of total bank funding essentially doubled, from 15 to 34 percent, over the period 2013 to 2015. (Counting banks' principal-protected wealth management products as quasi-deposits would lower wholesale funding dependence to 30 percent at end-2015.) This wholesale funding is potentially less stable than deposits.

7. The interbank market, which accounts for about half of bank wholesale funding, may become a stress transmitter in the event of a shock. Banks source about 16 percent of their total funding from the interbank market, up from 8 percent at the end of 2010. Financial institutions, including banks, are in aggregate net borrowers in the interbank market. The funding providers are investment vehicles, mostly structured as 'wealth management products', by which trust and fund management companies source funds (mostly less than three months in tenor) from yield-seeking investors. The interbank market is also shifting toward riskier practices—for example, increasing use

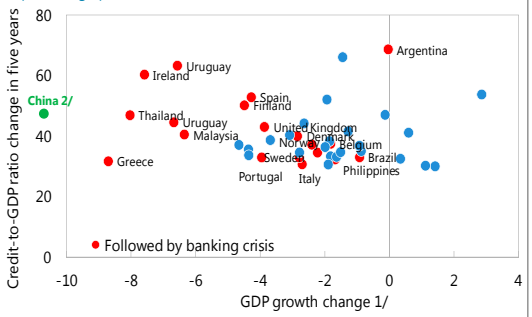
[2] Excluding Agricultural Bank of China due to data availability.

RESOLVING CHINA'S CORPORATE DEBT PROBLEM[1]

- *Corporate credit growth in China has been excessive in recent years. This paper looks at the causes and consequences of this credit boom and outlines a strategy to address the problem of excessive corporate debt.*
- *The credit boom is largely related to the large rise in investment after the global financial crisis. Investment efficiency has fallen and the financial performance of corporates has deteriorated steadily, affecting asset quality in financial institutions.*
- *The corporate debt problem should be addressed urgently with a comprehensive strategy. Key elements: identifying companies in financial difficulties; proactively recognizing losses in the financial system; burden sharing; corporate restructuring and governance reform; removing debt overhang through workouts; and hardening budget constraints.*
- *A proactive strategy would trade off short-term economic pain for larger longer-term gain.*

1. China's high credit growth points to elevated economic and financial risks. In response to the Global Financial Crisis (GFC) and collapse in external trade, China deployed policies to boost domestic demand supported by high credit growth, which averaged around 20 percent per year between 2009 and 2015—much higher than nominal GDP growth and the previous trend. The (broadly defined) nonfinancial private credit-to-GDP ratio rose from around 150 percent to over 200 percent over the same period as a result, and 15–25 percentage points above the level consistent with the historical trend at end-2015—a potentially dangerous, high 'credit gap.' The gap is comparable to countries that experienced painful deleveraging (Borio and Drehmann, 2009).

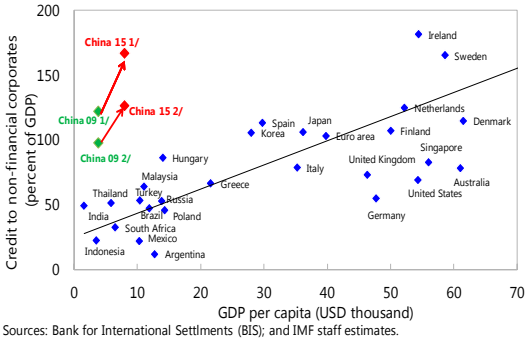
Figure 1. Credit Booms Tend to End Badly
(In percentage points)



Source: IMF staff estimates.
1/ Average growth differential between 5-year post-boom and 5-year pre-boom periods.
2/ No growth change as China's boom has not ended.

2. Credit growth in China is concentrated in the corporate sector. The rapid increase in credit could reflect financial deepening in a fast-growing economy. But the credit-to-GDP ratio for the corporate sector is significantly higher in China than in countries at a similar level of development and exceeded the level typical for developed economies. This indicates that credit growth has been faster than a normal path of financial deepening.

Figure 2. Corporate Credit: High vs. Peers
(Selected economies, 2014)



Sources: Bank for International Settlments (BIS); and IMF staff estimates.
1/ Calculated as total social financing minus equity and household loans.
2/ Calculated as total social financing minus equity, LGFV borrowing and household loans.

[1] Prepared by Joong Shik Kang (APD), drawing on a forthcoming paper by W. Maliszewski, S. Arslanalp, J. Caparusso, J. Garrido, S. Guo, J. S. Kang, W. Lam, D. Law, W. Liao, N. Rendak, P. Wingender, J. Yu, and L. Zhang.

guarantees are reflected in SOE's credit ratings that are about two to three notches above those of comparable private firms.

4. SOEs continue to build up leverage rapidly, while their financial performance has deteriorated further. Much of the rise in aggregate corporate leverage (the ratio of total liabilities to owners' equity) since 2009 was channeled to SOEs. Their leverage ratios have risen rapidly to around 200 percent on average, mostly concentrated in overcapacity and heavy industries. At the same time, returns on SOE assets have deteriorated to about 2–3 percent, well below those of private enterprises. Their productivity is only about 30–40 percent that of private enterprises (Hsieh and Song, 2015). Moreover, the efficiency of Chinese SOEs appears to be lower than that in other developing economies, further underscoring the urgency of SOE reforms.

B. Current SOE Reform Plans

5. The government has made SOE reform a cornerstone of its reform efforts and announced a number of initiatives. The new Five-Year plan highlights the need to have "diverse forms of ownership and private participation in SOEs" as well as "restructuring zombie enterprises." At the same time, it also stresses "making SOEs bigger and stronger to strengthen the influence and to serve national strategies." Key principles include the following:

- *Repositioning the state as a capital investor rather than operator*. Mixed-ownership reforms envisage a spectrum of ownership structures (for example, cross-share holdings and public listings) and greater private sector participation in SOEs. The reforms envisage professional management and a better alignment of respective rights and responsibilities between owners and the board, with checks and balances.

- *Classifying SOEs into ~~three~~ broad categories, each with specific ownership structures, reform plans, and assessment criteria*: (a) commercial strategic SOEs (such as defense, telecommunications, and major energy companies) will continue to have protected markets and will be entrusted to pursue ~~natural~~ national strategies such as "going global" and "creating global champions," possibly through mergers—the state will continue to hold majority ownership; (b) commercial nonstrategic SOEs will compete directly in the market; and (c) SOEs with social functions will be tasked to improve public services.

- *Institutionalizing the leadership role of the communist party*, such as through mobility between Party and corporate ranks. A Party member will serve as the chairman of the board.

- *Resolving nonviable SOEs.* The State Council committed to cutting aggregate SOE losses by 2017 and expediting the exit of nonviable "zombie" SOEs, including resolving near 350 subsidiaries of central SOEs and near 4,000 local SOEs.

6. In some areas, the current reform proposals are more closely aligned with international good practices, however, important details still need to be defined. According to the Organization for Economic Co-operation and Development (OECD), the proposed governance

reforms would be broadly consistent with their Guidelines, provided that there is sufficient transparency on the role of state. The announced plan, however, leaves much room for interpretation given that it envisions both greater market discipline and state leadership in major decisions.

7. So far implementation has been uneven. Ten pilot programs with a few selected SOEs have started in 2016, focusing on mixed-ownership reforms and professional management through recruitment, compensation, and board of directors. The State Council recently announced the removal of certain social functions of SOEs (the provision of utilities and property management services for SOE employees). Coastal provinces have advanced faster, and in some cases, resolved near half of the identified zombies, while progress is slow in regions where SOEs play an outsized role in the local economy. Reform of central SOEs has advanced slowly, in part because of their complex multi-layer subsidiary structure.

C. SOE Reforms to Unleash Growth

8. Building on current reforms, measures should focus on improving efficiency and resource allocation. Critical elements include:

- **Restructuring or resolving SOEs.** Triage the universe of SOEs to (i) identify those that are fundamentally sound; (ii) liquidate nonviable SOEs (which does not necessarily mean closure); (iii) establish a restructuring plan for viable but insolvent SOEs. Expedited out-of-court restructuring for priority distressed companies that would use independent experts may complement the existing insolvency framework. Given the size and complexity, progress should be kick-started with a few high-profile pilot cases for indebted SOEs. Noncore objectives such as social functions (e.g., hospitals, schools, and provision of utilities) should be transferred to the fiscal budget with the related assets and expenses accounted for.

- **Hardening budget constraints.** Gradually removing implicit guarantees through greater tolerance of defaults and carefully allocating losses to firm owners and creditors will improve the markets' assessment of credit risks in a financial system unaccustomed to defaults. Removing implicit SOE support through credit, land endowment, and natural resources would not only help address the existing debt overhang, but also improve the efficiency of new credit allocation. At the same time, increasing as soon as possible the transfer of SOE profit (a target of 30 percent by 2020), which is now mostly reinvested (including providing capital injections, subsidies and addressing their legacy costs) and well below the target, to the fiscal budget and allocating SOE capital to social security funds would contribute to hardening budget constraints.

- **Introducing greater competition.** Reducing entry barriers and phasing out restrictions that give SOEs a privileged role will send a clear signal. Allowing entry of private firms in the state-dominated services sector such as logistics and telecommunications (currently more stringent than in OECD markets), breaking up administrative monopolies, and promoting the growth of dynamic small and medium-sized enterprises would foster competition and promote growth.

in coal prices. Coal accounts for 83 percent of CO_2 in 2015, while natural gas accounts for 3 percent and oil products 13 percent.

- *A carbon tax rising from 15 RMB per ~~year~~ ton from 2017 to reach 230 RMB by 2030*[2] reduces CO_2 by about 20 percent below baseline levels in 2030 (Figure 1, panel b), meeting China's CO_2 intensity target for Paris,[3] with less coal use accounting for about 95 percent of the CO_2 reductions. A carbon tax reaching 455 RMB per ton by 2030 reduces 2030 emission by 30 percent. Taxing coal only (at the same rate) achieves around 95 percent of the CO_2 reductions under the carbon tax.

- *An ETS* will be introduced in China in 2017 for the power sector and large industrial sources, building on seven regional pilot programs, and will be about twice as large as Europe's trading market.[4] Nevertheless, an ETS (establishing the same emissions price trajectories as in the carbon tax scenarios) is estimated by the model to generate only about half of the CO_2 reductions as the carbon and coal taxes because it excludes coal use from small-scale users. The effectiveness of other policies at reducing CO_2 emissions—including taxes on electricity and road fuels, and policies to reduce the CO_2 intensity of power generation, to increase energy efficiency in the power, transport, and other energy sectors, and to increase renewable generation fuels—is significantly, or in many cases, substantially less than for the ETS (Figure 1, panel b).

- *The carbon tax also has the greatest fiscal benefit*, raising revenues of 1.7 percent of GDP in 2030 or 3 percent for the RMB 230 and 455 tax scenarios, respectively (Figure 1, panel c), despite shrinkage in the tax base relative to GDP. Again, the coal tax is not far behind, raising revenues of about 83 percent of those under the carbon tax. The ETS—*if allowances are auctioned*—and the electricity tax raise revenues of about 45 and 35 percent, respectively, as from the carbon tax. Other policies raise much smaller amounts of revenue, no revenue, or lose revenue in some cases.

- *Lives saved* (the difference between deaths in the baseline and under different policies) progressively increases over time as cleaner local air lowers incidence of pulmonary diseases, lung cancer, strokes and heart disease in many Chinese cities. Cumulated over 2017 to 2030, the higher carbon and coal tax scenarios save about 4 million lives, and the ETS about 1.9 million (Figure 1, panel d).[5]

- *Net economic gains*. On economic grounds, the carbon and coal tax also perform far better than other policies, causing (in the high tax scenarios) costs of about 0.7 percent of GDP but domestic

[2] The carbon tax should be introduced progressively with rates announced in advance so firms and consumers have time to adapt and undertake mitigation investments (e.g., wind and solar plants, more efficient buildings).

[3] The target is to lower the CO_2 to GDP ratio by 60–65 percent below 2005 levels by 2030.

[4] The ETS will cover electricity, domestic aviation, iron and steel, chemicals, cement, paper and other sectors.

[5] The analysis may overstate the domestic health benefits of carbon mitigation policies as it assumes incremental benefits are the same, regardless of pollution concentrations. Recent evidence suggests a possible concave relation between mortality and pollution concentrations.