ASEAN+3 Macroeconomic Research Office (AMRO)

Staff Working Paper (No. 01/2017)

High Corporate Debt in China:

Macro and Sectoral Risk Assessments *

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November 2017

Abstract

This study examines the risks stemming from the rise in corporate debt in China at both the macro and sectoral levels by using various data sources. Based on our estimates, the ratio of corporate debt-to-GDP in China was as high as 155 percent in 2016. Structural and institutional factors as well as the cyclical factors related to the stimulus package during the Global Financial Crisis (GFC) are the main drivers behind the rapid increase in corporate debt. Bank loans are the main source of financing for corporates but corporate debt is increasingly being financed by corporate bonds and shadow banking loans. Corporate debt is concentrated in the sectors under the investment-led growth model. Pockets of vulnerabilities associated with declining profits and debt repayment capacities are surfacing within the mining and real estate sectors, amongst manufacturing SOEs, particularly in the steel sector, and to a lesser extent the construction and utilities sectors. Although the exposure of the banking sector to vulnerable sectors is moderate, it is significantly higher for the smaller banks compared to the large banks. Although a systematic risk from high corporate leverage is unlikely in the near term, concerted policy efforts in the corporate, financial and fiscal areas are warranted to curb corporate debt-to-GDP and mitigate sector and financial stability risks ahead. Structural reforms that help increase investment efficiency are most crucial for successful deleveraging.

Acronyms and Abbreviations

ABS	Asset-Backed Securities
AFC	Asian Financial Crisis
AMRO	ASEAN +3 Macroeconomic Research Office
BIS	Bank for International Settlements
CASS	China Academy Social Sciences
CBRC	China Banking Regulatory Commission
CCDC	China Central Depository & Clearing Co
CSRC	China Securities Regulatory Commission
CTA	China Trustee Association
DAMPs	Directional Asset Management Plans
EME	Emerging Market Economies
GDP	Gross Domestic Product
FCY	Foreign Currency
GFC	Global Financial Crisis
ICOR	Incremental Capital-Output Ratio
IMF	International Monetary Fund
LGFV	Local Government Investment Vehicle
NBS	National Bureau of Statistics of China
NCDs	Negotiable Certificate of Deposits
NFC	Non-Financial Corporate
NPL	Non-Performing Loans
PBC	People's Bank of China
SOEs	State-Owned Enterprises
TBRs	Trust Beneficiary Rights
WMP	Wealth Management Products
PPP	Public-Private Partnerships
RMB	Renminbi
USD	US Dollar
bps	Basis points
EBIT	Earnings Before Interest and Taxes
yoy	Year-on-year
YtD	Year-to-date

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Executive Summary

Based on our estimates, the ratio of corporate debt-to-GDP in China was as high as 155 percent in 2016. This ratio, as well as the share of corporate debt to total debt in China are among the highest compared to international peers, although China's total debt level remains comparable to that of major advanced economies.

Structural and institutional factors as well as the cyclical factors related to the stimulus package during the Global Financial Crisis (GFC) are the main drivers of the rapid increase in corporate debt. A number of these factors are understandably linked to China's current stage of economic and financial development and are country-specific. These include the country's high saving rate alongside underdevelopment of equity financing facilities compared to debt financing, the presence of implicit guarantees to State Owned Enterprises (SOEs), and the investment-dominant structure of the post-GFC stimulus.

Bank loans are the main source of financing for corporates but corporate debt is increasingly being financed by corporate bonds and shadow banking loans. The current structure of corporate debt financing is likely to evolve further due to stricter regulations as well as higher interest rates.

Corporate debt is concentrated in the sectors under the investment-led growth model. The sectors that account for significant shares of total corporate debt include manufacturing (20 percent), real estate (15 percent), utilities (14 percent), construction (12 percent) and transport (12 percent).

The accumulation of debt has tapered off across sectors but corporate debt-to-GDP continues to rise as debt growth still exceeds output growth, especially in utilities, transport, real estate and construction. The debt-to-value added (VA) ratios in these sectors are very high and continue to rise. On the other hand, the overall debt-to-asset (leverage) level of Chinese firms has not risen but has remained stable across most sectors. This is because firms have increased assets in tandem with the accumulation of debt to expand and upgrade. With output growth lagging the growth in debt, profitability and debt payment capacities have eroded.

Pockets of vulnerabilities associated with declining profits and debt repayment capacities are surfacing within the mining, real estate, construction and steel sectors. Regarding exposure to liquidity risks, there are signs that firms are resorting more to short-term borrowing, in the form of shorter-maturity bonds, and shadow banking loans.

Although the exposure of the banking sector to vulnerable sectors is moderate, it is significantly higher for the smaller banks compared to the large banks. The smaller banks have a higher concentration of loans in real estate, construction, mining and wholesale & retail trade compared to the large banks. In general, banks are exposed to the risks of high corporate debt not just through bank loans but also through shadow banking activities and corporate bond holdings. Financing to vulnerable sectors through these channels is sizable and has been increasing.

Concerted efforts are warranted to reduce corporate debt-to-GDP in the medium term and mitigate sector and financial stability risks along the way. Strong growth in the services sector will be a major mitigating factor given that services can generate large outputs without incurring significant debt. However, it is still crucial that the authorities implement policy measures that would curb the overall debt growth in the vulnerable sectors.

Our simulations using a model that captures the different traits of SOEs and private firms suggest that comprehensive structural reforms are needed to bring down corporate debt-to-GDP in the medium term. The simulation results show that **structural reforms that help increase investment efficiency are crucial for successful deleveraging**. To achieve higher capital efficiency, the authorities need to further push ahead with the reduction in overcapacity.

Further efforts to deepen the capital markets will help provide firms with more sources of corporate equity financing and reduce the reliance on debt financing, particularly bank borrowing. Debt-to-equity swaps based on market-oriented procedures and proper legal frameworks could also help to reduce existing debt. Securitization using asset-backed securities (ABS) should be further developed to reduce the reliance on shadow banking activities. Likewise, improving market mechanisms, such as by allowing defaults to occur, will curb over-issuances of bonds and motivate firms to be more disciplined in their resource allocation.

Risks to financial stability can be mitigated by strengthening the buffers of financial institutions with high exposures to the vulnerable sectors. The move to tighten regulation and the implementation of the Macroprudential Assessment (MPA) to rein in the risk-taking behavior through off-balance sheet activities as well as interbank borrowing is a welcome policy direction. Stress tests should be conducted to identify potential losses due to high concentration in vulnerable corporates. Regulators should then require banks with significant risks to raise capital and improve their liquidity profiles.

Sufficient fiscal resources need to be set aside to support vulnerable workers, while firms in overcapacity sectors are encouraged to shed excess and obsolete assets. Meanwhile, macroprudential measures should be maintained at this juncture to rein in growing real estate debt. LGFVs should increase its transparency and accountability. At the same time, development of Public-Private Partnership (PPP) financing and help reduce the high debt-to-output ratio in the utilities, transport and construction sectors.

Lastly, further improvements to corporate and financial sector data are crucial for more comprehensive and effective risk assessment and monitoring. One area of priority is the need to consolidate granular data and develop a comprehensive database on corporate debt in each sector. Enhanced and coordinated efforts among relevant agencies are particularly important in improving data on shadow banking activities given the current insufficiency of data and the complexities of the lending structure.

1. Introduction

1 **Driven by a rapid rise in investment to boost growth after the Global Financial Crisis (GFC), China's non-financial corporate (NFC) debt (hereafter referred to as corporate debt) [1] has risen to historically high levels, raising concerns about risks to macroeconomic and financial stability**. Most researchers view that the big stimulus package in 2008-2009, which was funded through increased bank credit to SOEs and bourgeoning LGFVs, prompted the rise in China's corporate indebtedness. The rise in corporate debt has since continued albeit with some recent moderation. As the growth in corporate debt continues to exceed GDP growth, there is a growing concern that the ratio of corporate debt-to-GDP will remain elevated over the medium-term. High leverage, overcapacity and low investment efficiency may also have prolonged effects on profitability and debt repayment capacities. These conditions will make firms more vulnerable to real and financial shocks, which could in turn adversely affect the financial system.

2 **This paper examines the risks at both the macro and sectoral levels stemming from the rise in corporate debt in China and provides corresponding policy suggestions.** To date, there has been a fair amount of research on the rise in corporate debt in China (See Appendix A for a comprehensive literature review). However, there are significant differences in the estimated size of corporate debt-to-GDP and projections of its future trajectory, which could influence the nature and magnitude of recommended remedial policies. At the sectoral level, studies such as Chivakul and Lam (2015) and Zhang et al. (2015) showed that listed corporates in China did not appear to be over-leveraged but that there were pockets of vulnerabilities in the real estate and construction sectors as well as amongst the SOEs. In our view, it will be useful to policy makers that we reexamine China's corporate debt situation at this current juncture while incorporating a further analysis on the implications for banks. Compared with the earlier studies, this paper will rely on various sources of data at the macro and micro levels and several analytical tools alongside some existing research findings to answer the following questions comprehensively:

- What is the actual total corporate debt level and what are the major drivers behind the rise in corporate debt?
- Which corporate sectors have significantly contributed to high corporate debt and how vulnerable are they?

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[1] Debt refers to interest-bearing obligation of debtors to lenders such as bank loans and bonds. Non-financial corporate (NFC) debt consists of household, corporate, local and government debt. Household debt refers to debt owned by households. Corporate debt refers to debt owned by non-financial corporates. It excludes debt owned by financial institutions such as banks and insurance companies. Central government debt refers to debt owned by the Central Government and local government debt refers to debt owned by the provincial governments.

- Which lenders are highly exposed to these vulnerable corporates and what are the implications for banking sector stability?
- What is the likely trend of corporate debt-to-GDP in the medium- to long-term?
- What policies are needed to mitigate risks in the vulnerable sectors and reduce the corporate debt-to-GDP ratio?

3 **To answer these questions, the paper is organized into 6 sections as follows.** After this introduction, Section 2 provides the overview on total debt and corporate debt in China compared with international peers, and presents AMRO's corporate debt estimates. The drivers behind the rise in corporate debt are discussed by drawing on the results of other research papers. Using firm-level data, Section 3 then analyzes the contributions to high corporate debt by different sectors and examines the risks and vulnerabilities associated with corporate debt at the sectoral level. The focus is on the level and distribution of leverage across the different sectors as well as the performance of key financial indicators. Section 4 examines how different financing sources have contributed to the rise in corporate debt, followed by a discussion on the implications for stability in the banking sector. In Section 5, we construct a simple partial-equilibrium two-sector (with SOEs and private firms) model to conduct a forward-looking analysis on the trajectory of corporate debt going forward as well as evaluate policies that may help curb the ratio of corporate debt-to-GDP over the longer term. Section 6 concludes and provides policy suggestions.

2. Overview

2.1 International Comparisons

4   **China's total non-financial debt level is lower than major advanced economies but higher than most emerging market economies**. According to the BIS data[2], China's overall debt level (as a percentage of GDP) is comparable against that of major advanced and emerging market economies (EMEs). As of end 2016, China's overall debt was 269 percent of GDP, higher than the average of 235 percent. China's overall debt was lower than in most advanced economies and was slightly below the level in the US (Figure 2.1). Among major emerging market economies, however, China's overall debt as a percentage of GDP was higher than most as of end 2016.

Figure 2.1: Total non-Financial Debt/GDP (%)
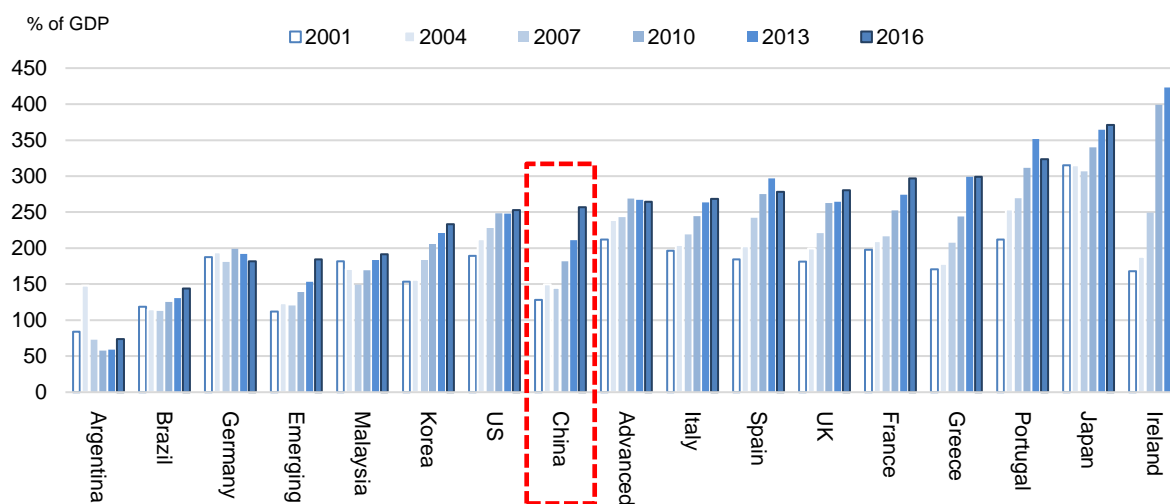
Source: BIS

5   **As a share of total debt, corporate debt in China is the largest compared to international peers.** BIS data shows that the share of China's corporate debt was as high as 65 percent of total debt as of end 2016. This was the highest among major advanced and emerging market economies (Figure 2.3). On the other hand, the shares of China's general government debt and household debt were lower than in most of the other countries, as shown in Figure 2.2.

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[2] This refers to total non-financial corporate debt, excluding debt between financial institutions..

Figure 2.2: Major Advanced and Emerging Market Economies: Debt by Type
(% Share of Total Debt as of end 2016)
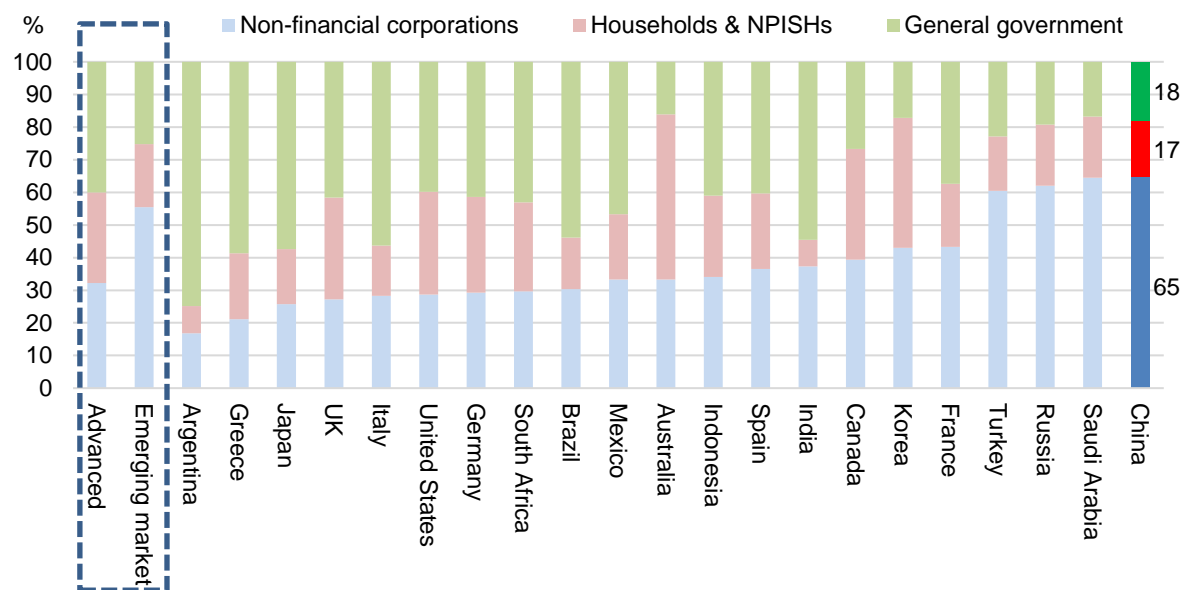
Source: BIS

Figure 2.3: Non-financial Corporation Debt/GDP (%)
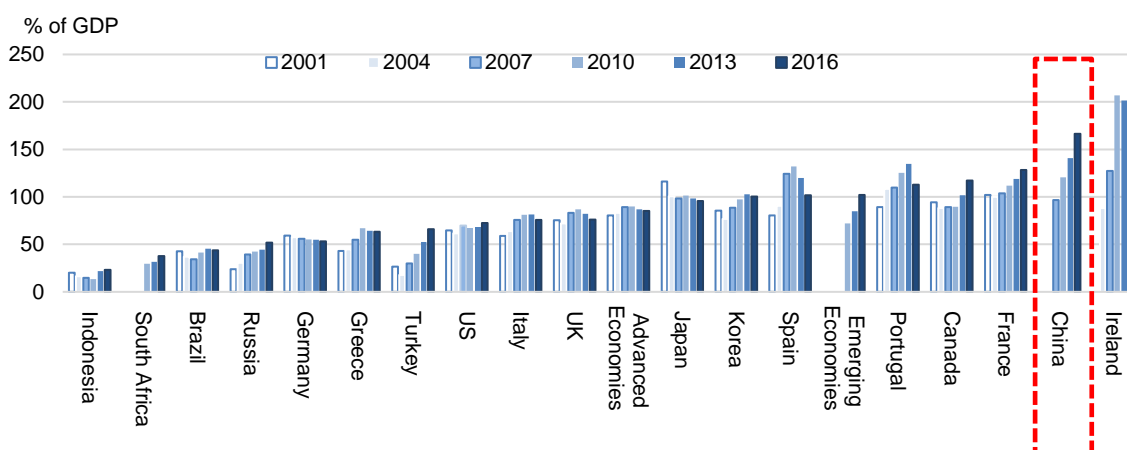
Source: BIS

6   **However, the estimate on China's corporate debt level varies significantly across
different studies.** Figure 2.4 summarizes the different estimates of China's corporate debt as
a percentage of GDP, ranging from around 120 percent to 180 percent of GDP. The sizeable
difference lies in whether Local Government Financing Vehicles' (LGFVs) debt[3] is included as
corporate debt and, if so, to what extent.[4] Our estimate of corporate debt-to-GDP of 144 and
155 percent in 2015 and 2016 respectively is in the middle of the range given that we had

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[3] LGFVs are Local Government Financing Vehicles which either borrow on behalf of the government or explicitly guaranteed by the government.
[4] Morgan Stanley, BIS, Bloomberg, and CASS count LGFV debt as corporate debt because official data only reports Total Social Financing (TSF)
numbers which include non-household bank loans and non-household shadow banking loans. Bank and shadow banking loans to non-financial
corporates are not available. McKinsey and Standard Chartered remove LGFV debt from total corporate debt, resulting in much lower levels of
total corporate debt in 2015. However, total corporate debt is underestimated in their cases as local government bonds, which are part of LGFV
debt, is also deducted from TSF.

decomposed total non-household loans and total shadow banking loans[5] into their corporate and local government portions (Please refer to Annex B for the estimation procedure).

Figure 2.4: Estimates of Corporate Debt by Different Institutions (as of Q4 2015)
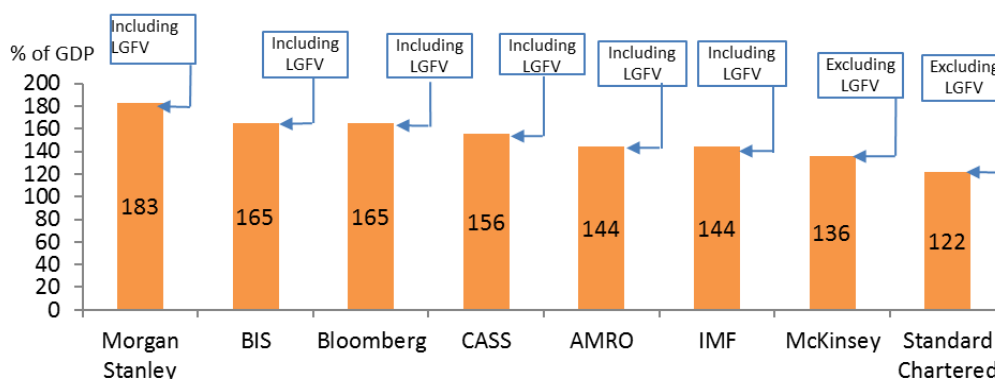
Note: The definitions of LGFVs differs across studies.
Source: Morgan Stanley, BIS, Bloomberg, CASS, IMF, McKinsey, Standard Chartered, AMRO

2.2 Recent Developments in Total Debt and Corporate Debt in China

7   **Overall debt has risen rapidly due to corporate and household sectors instead of government.** Reflecting the growth in mortgage loans, household debt grew the fastest while the share of corporate debt in total debt stabilized at around two-thirds throughout 2010-2016. On the other hand, local government debt, which rose quickly before 2014, started to moderate since 2014 due to stronger debt management. As for central government debt, its share in total debt has gradually declined since 2010 due partly to cautious debt issuances and continued fiscal surpluses at the central government level (Figures 2.5-2.6).

Figure 2.5: Total Debt/GDP (%)
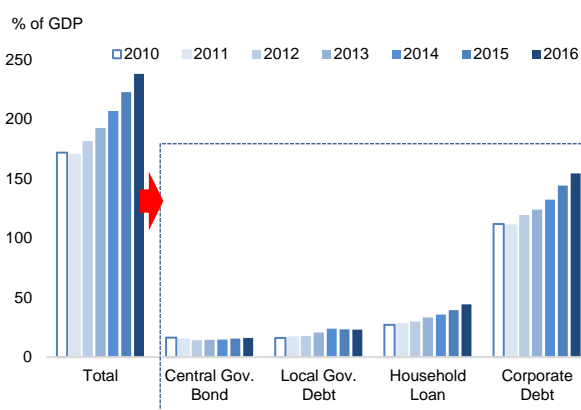
Figure 2.6: Total Debt Structure (%)
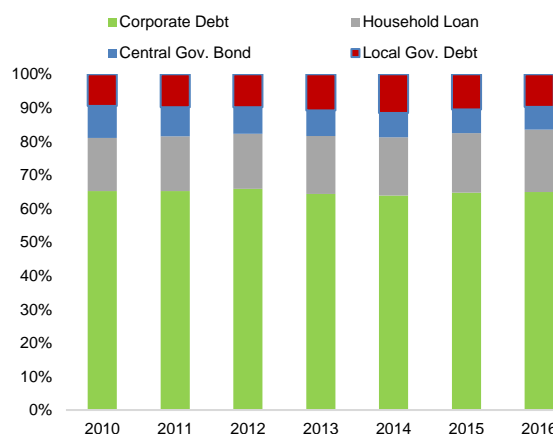
Source: AMRO

Source: AMRO

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[5] Shadow banking used in the paper refers to (1) entrusted loans, (3) trust loans and (3) banker's acceptance bill. This definition is consistent with shadow banking in PBC's total social financing.
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8   **Corporate debt has been increasingly financed by corporate bonds and shadow banking loans.** Although bank loans are still the most important source of financing, its share has gradually declined (Figures 2.7-2.8). On the other hand, corporate bonds have seen their share of financing increasing owing to the authorities' efforts to develop the bond market and firms' incentive to reduce financing costs. The share of shadow banking loans in corporate debt has also been on the rising trend. This is because (1) although shadow banking loans have higher interest rates, they provide more flexibility to corporates and hence become more popular, and (2) Investors earned higher interest rates on these products. As for overseas borrowing, its share increased in 2010-2014 amid the strengthening in RMB but has largely stabilized since 2015 with the depreciation in the RMB and boom in the domestic bond market, which offers an alternative source of financing. Figure 2.9 summarizes the structure of corporate debt and local government debt and by financing sources in 2016. In terms of corporate debt financing by LGFVs, our estimates are within the range of 12 to 18 percent of GDP,[6] which can be dressed up as corporate loans, shadow banking products or bonds.

Figure 2.7: Corporate Debt-to-GDP
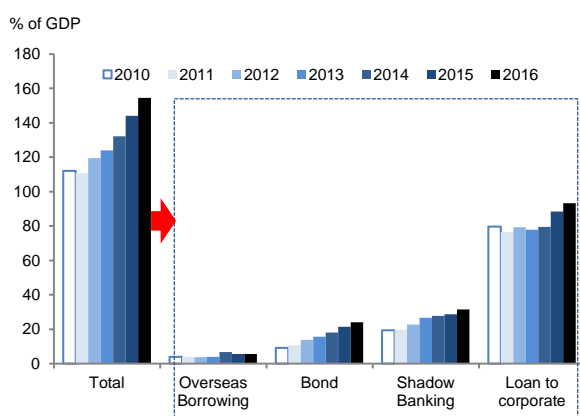
Source: AMRO

Figure 2.8: Corporate Debt Structure (%)
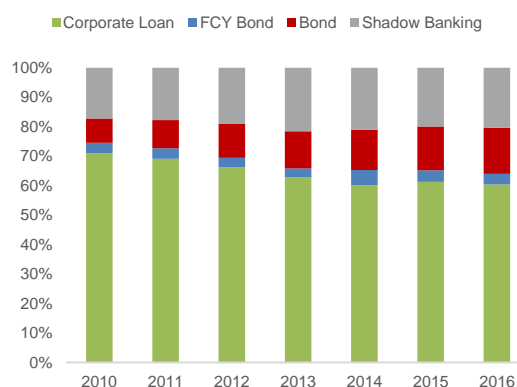
Source: AMRO

Figure 2.9: Structure of Corporate and Local Government Debt and LGFV Financing

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[6] This range is estimated by subtracting the total LGFV debt estimates by CASS and CEIC. See Appendix B for further details about the estimation procedure.

Local Government Debt Structure (2016, %)

Corporate Debt Structure (2016, %)

Shadow Banking, 5.5

Bank Loan, 25.2

Bond, 69.4

6% of GDP

LGFV Debt

12-18% of GDP

Overseas Debt, 3.7

Bond, 15.5

Shadow Banking, 19.5

Bank Loan, 61.3
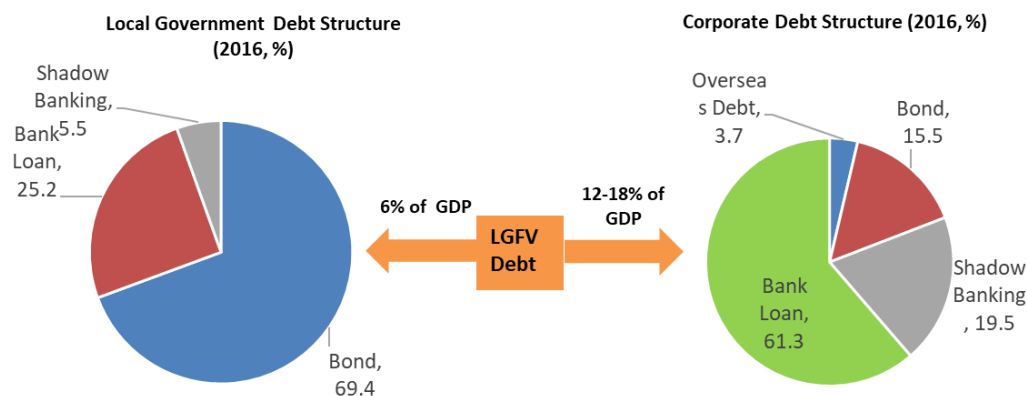
Source: AMRO, IMF, CASS

9   **The share of corporate debt financing sources is likely to change moving forward due to stricter regulations as well as higher interest rates.** Although the shares of shadow banking financing have increased in recent years, they may see a dip in the near future due to stricter regulations on shadow banking and banks' off-balance sheet activities. At the same time, the bond market will be adversely impacted by higher interest rates, due to factors such as the sound economic fundamentals in China and the U.S. Fed's interest rate spillover effect. Bank loans, especially bank loans by the large banks, however, are expected to be less sensitive to the tighter regulation and higher interest rates. Nevertheless, in the medium to long term, the shares of bond and equity financing are likely to increase further, taking more share from bank loans.

2.3 Drivers of Corporate Debt

10   **Structural and institutional factors combined with cyclical factor in the form of the stimulus package during the GFC have contributed to the rapid increase in corporate debt.** These factors have been thoroughly examined by several researchers such as Chivakul and Lam (2015), Zhang and Han (2015), Zhang et al. (2015), and Yu and Lu (2016). In this paper, we rely on those studies and categorize the drivers of corporate debt into the following groups:

11 **The structure of the post-GFC stimulus alongside other institutional factors.** During the post-GFC period, credit financing, especially to SOEs and industrial sectors with overcapacity, was a major tool to stimulate the economy. In addition, the rise in SOE leverage was also boosted by institutional factors such as implicit guarantees.[7] While the stimulus led to a significant increase in infrastructure spending, real estate and heavy industry investment, and in turn higher growth, investment efficiency and profits decreased sharply [8] as the

Figure 2.10: Credit-to-GDP Gap
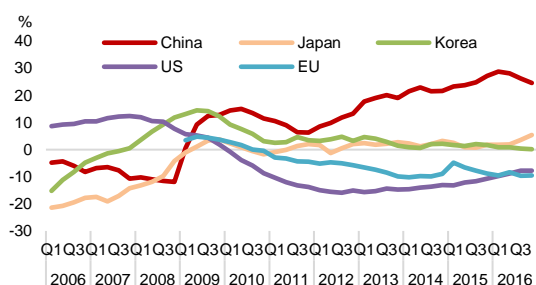
Source: BIS

Figure 2.11: Incremental Capital-Output Ratio

Source: CEIC and AMRO staff calculations

operational efficiency and competitiveness of many of these SOEs were subpar. Post GFC, therefore, the credit-to-GDP gap widened compared to that of other major economies (Figure 2.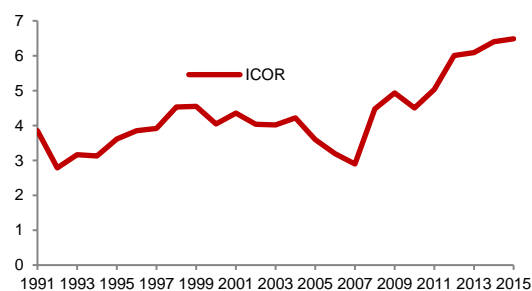10) while the Incremental Capital-Output Ratio (ICOR) deteriorated (Figure 2.11). [9] With profits declining sharply (Figure 2.12), SOEs and industrial sectors with overcapacity had to increase credit and other types of financing to maintain their output given their mandated task to help shore up growth.

Figure 2.12: Industrial Enterprise: Total Profit Growth
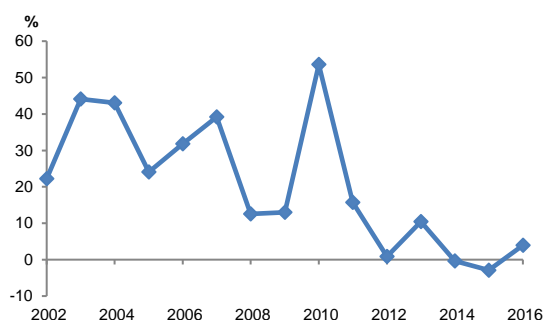
Source: CEIC

Figure 2.13: Saving Rate (Gross Domestic Savings)
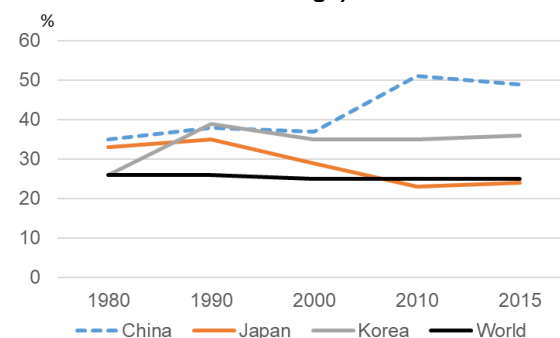
Source: World Bank

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[7] Chivakul and Lam (2015) found that the borrowing cost for SOEs was more than 20 bps lower than that of private firms prior to the GFC. Zhang and Han (2015) showed that unlike private enterprises, SOE's leverage had been mainly driven by implicit government support amid lower funding costs. Zhang et al (2015) found that SOE's borrowing costs were significantly lower for SOEs in major overcapacity sectors such as iron, coal, shipping, aluminum and cement and attributed this to the rise in SOEs' leverage. Yu and Lu (2016) showed that China's rising corporate debt is attributable to three main factors: worsening capital efficiency, weakening corporate profitability and high funding costs.

[8] Between 2008-2016, the ratio of SOE debt to total debt was higher than 50 percent but SOEs' share of contribution to growth averaged at only 20 percent.

[9] The incremental capital output ratio (ICOR) is a metric that assesses investment efficiency on a country level. It is the marginal amount of investment capital necessary for an entity to generate the next unit of production. A lower ICOR value is preferred because it indicates that the entity's production is efficient. ICOR is calculated as: annual increase in investment stock/annual increase in GDP.

12 **High savings has led to high debt financing, especially with underdevelopment of equity financing facilities.** China has one of the highest saving rates in the world at 46 percent of GDP (Figure 2.13). However, channels to mobilize these savings to meet firms' investment needs are still underdeveloped for equity relative to debt. Hence, corporates have relied heavily on debt financing post-GFC. Although the equity market has also grown fast and the market capitalization reached USD 7.7 trillion in September 2016, and the share of equity financing in total financing has still increased in recent years, and the share of equity market remains small (Figure 2.14).

Figure 2.14: Aggregate Financing in China: New Increased
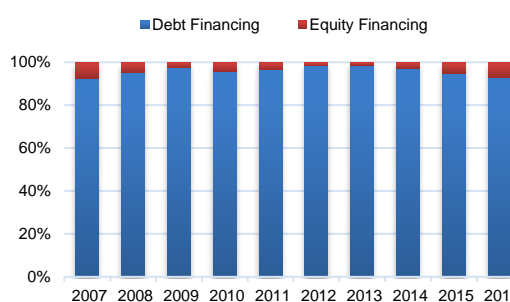
Note: Debt financing includes RMB and foreign currency loans, banker's acceptance bills, net corporate bond financing, entrust loans and trust loans; Equity financing refers to non-financial enterprise equity financing.
Source: CEIC

13 **A rapid urbanization process has relied significantly on debt financing for infrastructure and real estate projects.** According to the World Bank data, the urbanization rate in China increased from 42.5 percent in 2005 to 56.8 percent in 2016, and it has been much faster than most other economies (Figure 2.15). This requires the support of infrastructure and real estate construction, which has been financed by large corporate borrowings on top of fiscal resources. From 2010 to 2025, it is estimated by the Ministry of Housing and Urban-Rural Development that another 300 million Chinese in rural areas will move into cities. From 2010 to 2025, based on the estimate by the Ministry of Housing and Urban-Rural Development that another 300 million Chinese in rural areas will move into cities, and therefore, more financing for infrastructure will be needed.

Figure 2.15: China's Urbanization Rate
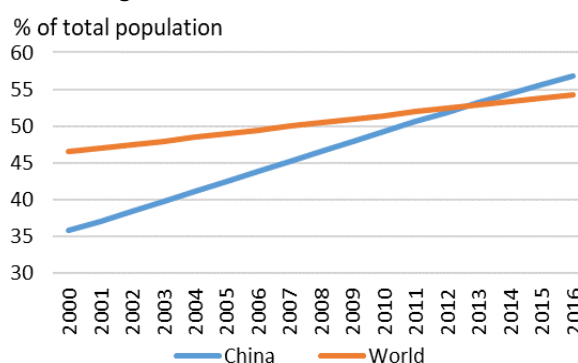
Source: World Bank

3. Sectoral Risk Assessment: Concentration of Debt and Corporate Vulnerabilities

14 **To assess where risks reside among Chinese corporates, this section examines the size of corporate debt and the potential vulnerabilities at the sectoral level.** This section aims to answer questions such as: "What is the sector concentration of corporate debt?", "Which sectors have a high debt burden compared to output?", "Which corporate sectors are highly leveraged?" and "Which sectors have weak solvency and liquidity positions?" In this section, **firms are classified into seven main sectors, namely manufacturing, mining, real estate, construction, transport, utilities and services.**[10] The grouping into these seven sectors is based on the China Securities Regulatory Commission (CSRC) sector classification as assigned in WIND (See Appendix C: Classification of Sectors).[11]

15 **The amount of debt in each sector is estimated using both micro-level and macro-level information from various sources.** As mentioned in the previous section, corporates obtain financing from bank loans, the onshore bond markets[12] and shadow banking loans. For this study, data are collected from various sources including WIND, Bloomberg, PBC, CBRC, China Trustee Association and banks' financial statements. The corporate debt of each sector is then calculated as the sum of yearly outstanding debt from all sources of financing as mentioned above. The data, estimation procedure and the relevant assumptions are explained in detail in Appendix D.

3.1 Sectoral Concentration of Corporate Debt

What is the sector concentration of corporate debt?

16 **Corporate debt is concentrated in the priority sectors of the investment-led growth model, which include utilities, transport, real estate, construction and manufacturing.** Based on our estimates, as shown in Figure 3.1, utility and transport firms collectively accounted for a large share of borrowings (26 percent in total) given their involvement in large infrastructure projects related to railway, toll road, bridges, water conservancy, environmental engineering and power stations. Borrowings by the real estate and construction were also

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[10] We view that this classification will help explain developments well. Corporate debt with ambiguous sector classification is excluded. Debt incurred in the "Farming, Forestry, Animal Husbandry & Fishery" sector is also excluded as the amount of debt is small (the sector is likely underbanked) and is not the focus of this paper.

[11] "Leasing and commercial services" is also excluded as this sector possesses certain characteristics that resemble that of financial services.

[12] Offshore bond financing is not included here as the characteristics and classification are different. As the size of offshore bond financing is small at around 3.5 percent of GDP, this exclusion will only marginally affect our assessment in this section. The development of offshore bond financing and risks are discussed separately in Box A.

substantial. The differences between the sector composition of corporate debt and GDP is quite apparent as shown in Figures 3.1 and 3.2 below.

Figure 3.1: Corporate Debt by Sector as of 2016
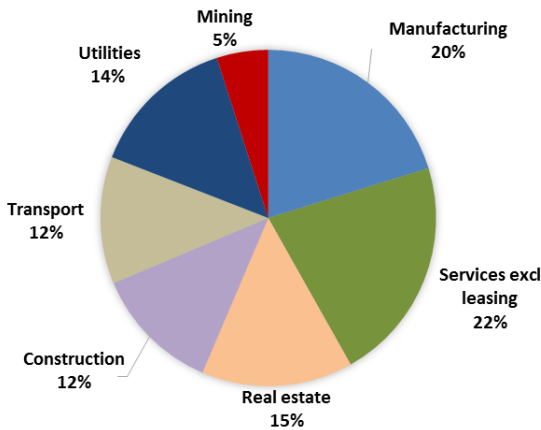
Figure 3.2: GDP by Sector as of 2016
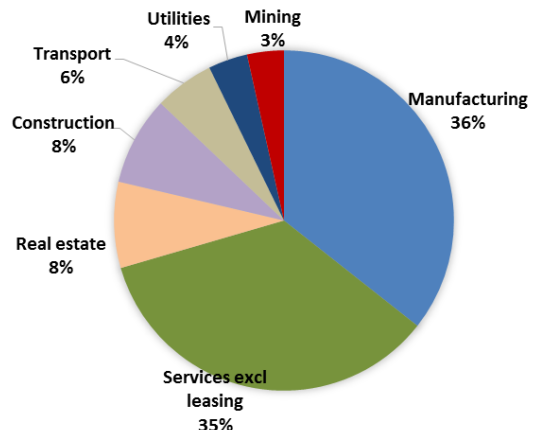
Source: WIND, PBC, CBRC, China Trustee Association, and AMRO staff estimates

Source: NBS and AMRO staff estimates

17   **In the industrial sector, SOEs account for a sizeable share of corporate debt.** Based on NBS data, the debt of SOEs accounted for as high as 42 percent of total debt in the industrial sector as of 2016 (Figure 3.3). While we are unable to estimate the SOE share of debt in the non-industrial sector, anecdotal evidence indicates that the SOE' shares are much higher than those of non-SOEs in the utilities and transport sectors and much lower than that of non-SOEs in the services sector.

Figure 3.3: Industrial Corporate Debt by Ownership as of 2016
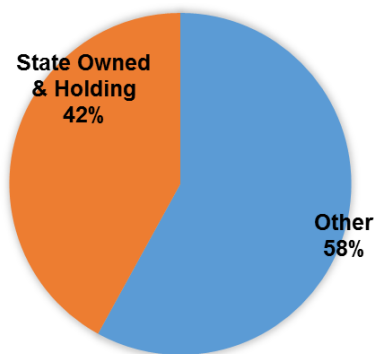
Figure 3.4: Industrial GDP by Ownership as of 2016
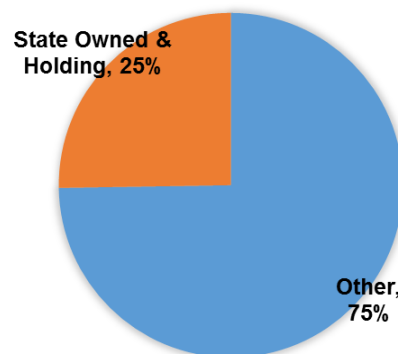
Note: The Industrial sector includes manufacturing, mining, electricity, gas and water production (a sub-sector of utilities) and construction
Source: NBS

3.2 Corporate Debt Vulnerabilities

3.2.1 How do the ratios of corporate debt to value added (VA) compare across sectors?

18   **Compared to their shares in total corporate debt (Figure 3.1), utilities, transport, real estate and construction have much lower VA shares (Figure 3.2) in GDP.** Although SOEs account for only 25 percent of Industrial GDP (Figure 3.4), its debt-to-VA ratio is much higher (almost double) than that of non-SOEs. With the real estate boom and as China ramped up infrastructure development and pushed ahead with other public investment projects, debt-to-output has increased rapidly for utilities, transport, real estate, construction and mining (Figure 3.5).[13] The high debt-to-VA ratios indicate that some firms in these sectors may encounter difficulties in repaying their debt if they are unable to generate significantly greater output and income in future. Meanwhile, China's manufacturing sector appears to be more efficient using credit as seen from its large share in total GDP (36 percent), which is higher than its share in total corporate debt (20 percent). At the same time, the VA share in GDP for the services sector is larger than its share in total corporate debt.

Figure 3.5: Debt-to-VA by Sector
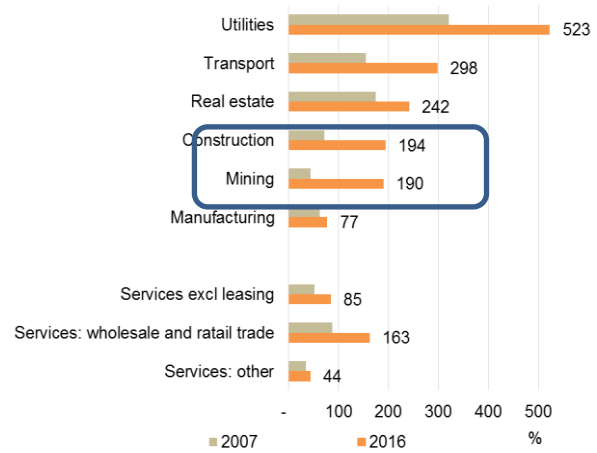
Source: NBS, WIND, Bloomberg, PBC, CBRC, China Trustee Association and AMRO staff estimates

Figure 3.6: Debt-to-VA: Mining, Construction and Real Estate

Source: NBS, WIND, Bloomberg, PBC, CBRC, China Trustee Association and AMRO staff estimates

Figure 3.7: Debt-to-VA: Utilities and Transport
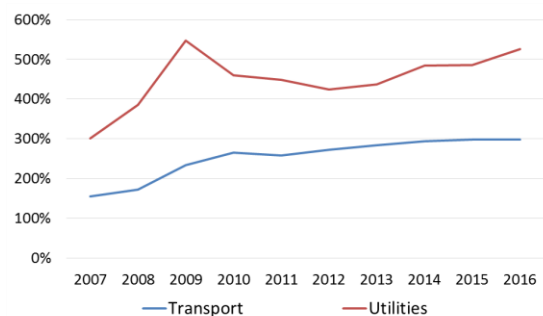
Source: NBS, WIND, Bloomberg, PBC, CBRC, China Trustee Association and AMRO staff estimates

19   **Debt-to-VA in infrastructure-related sectors has grown rapidly since 2008 owing to the sizable stimulus package (Figure 3.7).** In 2009 and 2010, the stimulus in response to

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[13] Sector output here refers to nominal GDP for each sector.

the GFC was largely financed by local financing vehicles that borrowed and spent on behalf of local governments (See Bai, Hsieh and Song (2016)). The debt of local financing vehicles continued to grow after the stimulus program ended.

20   **High debt-to-VA in infrastructure-related sectors is also due partly to China's rapid urbanization.** China needs to undertake many infrastructure projects to support the urbanization of the country, and these often require large amounts of capital investment, especially debt financing. However, the VA for each sector does not incorporate the indirect or second-round contribution of infrastructure-related sectors to the economy, which is likely to be sizeable. Hence, the high debt-to-VA ratios of these sectors could exaggerate to some extent. Nevertheless, in some cases and in some lower-tier cities, infrastructure projects could be overbuilt and underused, thereby weakening returns of these projects and also their debt repayment capability.

21   **Manufacturing and "other services" have low to moderate debt-to-VA ratios.** Manufacturing's debt-to-VA ratio increased gradually by only 15 percent to 77 percent in 2016 from 62 percent in 2007, well below that of the sectors mentioned above. In the services sector, the ratio of debt-to-VA in wholesale and retail trade was high at 163 percent given that wholesale trade, including international trade, requires sizable trade financing while retail trade loans grew with enhanced financial deepening[14]. Excluding wholesale and retail trade, debt-to-VA in "other services" sector was low at 44 percent. This could be partly because firms in this sector, including those involved in healthcare, software engineering, scientific research as well as recreation and education do not have significant collaterals to back their borrowings and therefore tend to rely more on equity financing.

22   **The accumulation of debt has tapered off in all sectors but corporate debt-to-VA continues to rise as debt growth still exceeds GDP growth, especially in the utilities, transport, real estate and construction sectors.** Figure 3.8 shows the contribution of each sector to debt growth and GDP growth between 2007 and 2016, and its contribution to debt-to-VA since 2007. In general, debt growth has slowed since 2011 in most sectors alongside moderating GDP growth. The moderation, however, has been more marginal in the real estate sector due to the 2015-2016 property market boom and also in the utility sector with infrastructure remaining an important pillar for economic growth over the near term.

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[14] A large proportion of retail trade borrowers are SMEs and micro enterprises that borrow mostly from the smaller banks.

Figure 3.8: Contribution of Selected Sectors to Output and Debt Growth

Source: NBS, WIND, Bloomberg, PBC, CBRC, China Trustee Association and AMRO staff estimates

23 **On the other hand, manufacturing has made similar contributions to both GDP and debt, and "other services" sector has helped mitigate the rise in corporate debt-to-VA.** Manufacturing's contributions to both GDP growth and debt growth have fallen almost hand in hand from its peak in 2011. With China's growth becoming increasingly consumption driven, the "other services" sector, which is more related to the "new economy", has been growing

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fast, thereby contributing more to GDP growth than to debt growth and helping to restrain the rise in corporate debt-to-VA.

3.2.2 Firm-level Solvency and Liquidity Indicators

24 **Corporate debt vulnerabilities are further assessed using solvency and liquidity indicators at the firm level.** For this part of the study, three sets of firm-level data between 2008 and 2016 were used[15]: (1) Chinese firm data from the corporate survey by the NBS, (2) Chinese-listed firm data from WIND, and (3) Global corporate peer data from S&P Credit Ratings. A snapshot of the coverage of these data sources is shown in Appendix E. Our analysis is largely based on NBS data as the main source of information given its fairly large sample size and that it covers both listed and non-listed firms.[16] Listed firm data from WIND, from which liquidity data is obtained, is used to supplement our analysis. Data on BB rated global firms by S&P is used as a reference for comparison as solvency indicators of these firms, in our view, would be more comparable to that of an average Chinese firm than other-rated firms. [17] The solvency indicators drawn from these three data sets are leverage (liabilities-to-assets)[18], profit margin[19] and the interest coverage ratio.[20] In addition, we also take into account an NPL ratio while recognizing that it is a lagging indicator. The liquidity indicators are average duration of newly issued corporate bonds and cash holdings of listed firms.

Do sectors with high debt have weak solvency conditions?

25 **Within the industrial sector, SOEs have much weaker solvency ratios than non-SOEs.** The NBS data suggests that compared to non-SOEs, SOE firms have higher leverage (Figure 3.9), lower profit margins (Figure 3.10), and lower debt repayment capacity, measured by the interest coverage ratio (Figure 3.11). In addition, in terms of leverage and profit margin, the gap between SOEs and non-SOEs has widened between 2014 and 2016, compared to the period between 2008 and 2010. Industrial firms and in particular, SOEs, has not been less efficient than their private counterparts and some of them have additional burden from social responsibilities such as providing pension, community service, education and medical expenses.

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[15] Our analysis focuses on the period during and post-GFC as corporate debt grew quickly during this period.

[16] The drawback is that the comparison based on the NBS data set cannot be done for all financial indicators due to limited financial information at the firm level in the NBS data set.

[17] From 2010 to 2015, the average annual default rate for BB and BBB rated firms was low at 0.19 percent and 0.01 percent respectively. From 1981 to 2015, the average annual default rate for BB and BBB rated firms was 0.93 percent and 0.21 percent respectively. Given that the historical default rate of BBB rated firms is extremely low, BB rated firms would be a more relevant and prudent benchmark than BBB rated firms for the average Chinese firm. In addition, the number of B rated firms by S&P is much lower than the BB rated universe, and it may not be representative. Therefore, BB rated firms by S&P are chosen as our point of reference for this study.

[18] We use liability-to-assets here rather than debt-to-asset as only liability data is available from the NBS.

[19] For the NBS sample, profit margin is estimated using profit before tax/ sales revenue. For S&P's global firms and WIND's Chinese-listed firms, profit margin is estimated using net income to sales revenue.

[20] Interest coverage ratio is defined as EBIT (earnings before interest and tax)/interest expense. For the NBS sample, the overall EBIT is calculated using the sum of profit before tax and interest expense.

**Figure 3.9: SOE vs Non-SOE.
Liabilities-to-Assets**

**Figure 3.10: SOE vs Non-SOE.
Profit Margin**

**Figure 3.11: SOE vs Non-SOE.
Interest Coverage Ratio**
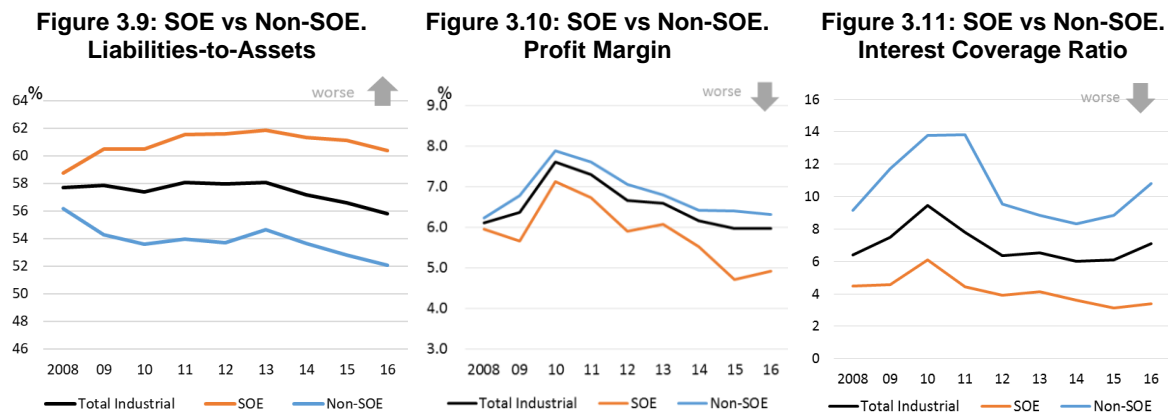
Source: NBS and AMRO staff estimates

26 **Utility firms have relatively high leverage and low profit margins, although they have been improving steadily.** The leverage ratios (Figure 3.12) of utility firms are higher than in other sectors[21]. However, as shown in Figure 3.13, the profit margin has improved substantially since 2008, from a low base (particularly for the NBS sample), likely due to increased utilization rates. Also, as shown by the interest coverage ratio in Figure 3.14, listed firms often generate enough profit and ample cash flows to cover financing costs[22]. However, the listed sample may not be a good representative as anecdotal evidence shows that some utility firms have low returns and rely on illicit and implicit local government guarantees to obtain funding. Going forward, with infrastructure investment remaining a key pillar for economic development, the leverage and debt-to-VA of this sector is expected to remain elevated. The authorities have taken measures to wean these firms from relying on such guarantees and have also imposed stricter conditions for these firms to borrow. For those with weak financial conditions, their credit outlook still depends on enforcement of policies to forbid illicit and implicit local government guarantees.

27 **The risk profile of listed transport firms is similar to that of utility firms.** While there is no NBS data available for transport firms, listed firm data from WIND shows that the risk profile of transport firms is largely similar to that of utility firms. Similar to utility firms, for the non-listed sample, some corporates in this sector are highly leveraged with low profit margin but they are still able to obtain low-cost financing in the capital markets.[23]

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[21] One reason for this is that these firms have stable cash flows and can therefore afford to take on more leverage to enhance returns.
[22] Although some infrastructure projects, such as the Beijing Metro system, have weak cash flows, these projects are usually not listed and financing is sourced from the fiscal budget. There are also firms that were set up as local government financing vehicles (LGFVs), but these are mostly not listed.
[23] An example is the China Railway Corp. It is the world leader in technology, construction and operation, but its rail fares are only a fraction of those in Europe and Japan.   It also needs to fulfill social responsibilities and is therefore only partially profit-driven.

Figure 3.12: Utilities: Liabilities-to-Assets
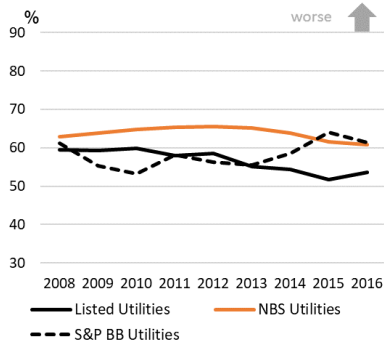
Figure 3.13: Utilities: Profit Margin
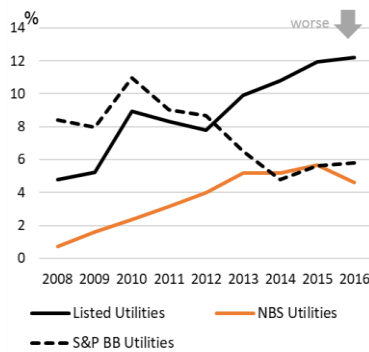
Figure 3.14: Utilities: Interest Coverage Ratio
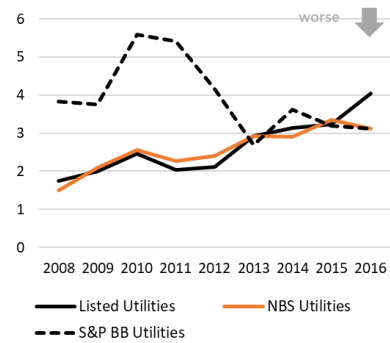
Source: NBS, WIND, Bloomberg and AMRO staff estimates

28 **Chinese real estate firms are highly leveraged and debt repayment capacities have declined.** Real estate profit margins are higher than that of other sectors, but have been declining over time (Figure 3.15)[24]. Amid declining profit margins, rising leverage (Figure 3.16) poses a concern in view of the sharp erosion in debt repayment capacities (Figure 3.17) despite the fact that interest rates on loans to this sector are lower than the average.

Figure 3.15: Real estate: Liabilities-to-Assets
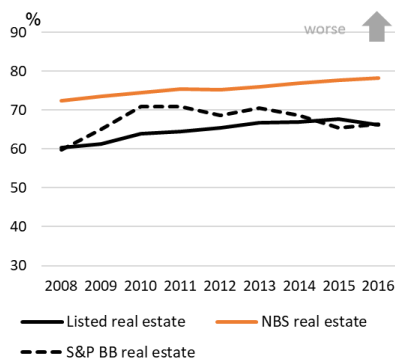
Figure 3.16: Real estate: Profit Margin
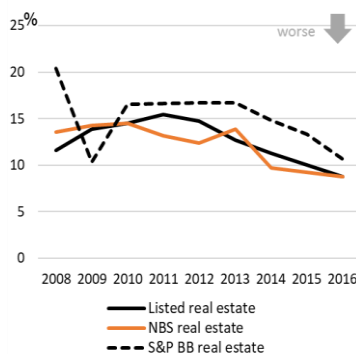
Figure 3.17: Real estate: Interest Coverage Ratio[25]
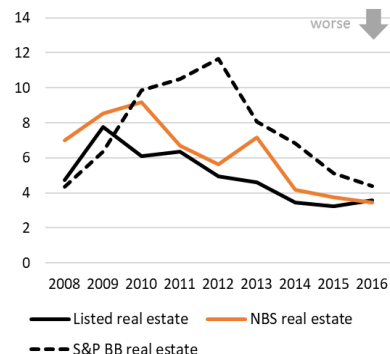
Source: NBS, WIND, Bloomberg and AMRO staff estimates

29 **Chinese construction firms are also highly leveraged, but profit margin and debt repayment capacities have remained stable.** Leverage is high in the construction while the profit margin and interest coverage ratio of this sector have also remained stable over the past 7 years (Figure 3.19 and Figure 3.20).[26] Despite stable profits and debt repayment capacities, however, this sector is sensitive to risks arising from the infrastructure and real estate sectors given its heavy involvement in infrastructure and real estate-related construction.

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[24] Real estate sector has high margins but a low asset turnover ratio.
[25] There are only a few real estate firms that are BB rated by S&P. As such, the sample may not be representative and the statistics may be volatile.
[26] The interest coverage ratio of the NBS sample of firms is higher than WIND's listed sample of firms. This could be due to different definitions and methods used to estimate interest expense and pre-tax profit.

Figure 3.18: Construction: Liabilities-to-Assets
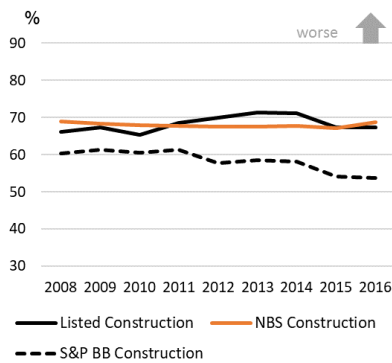
Figure 3.19: Construction: Profit Margin
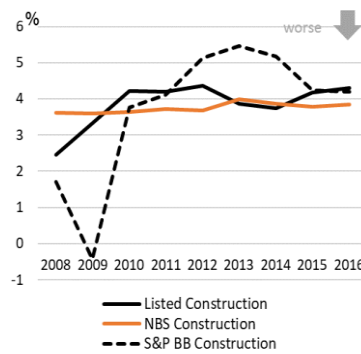
Figure 3.20: Construction: Interest Coverage Ratio
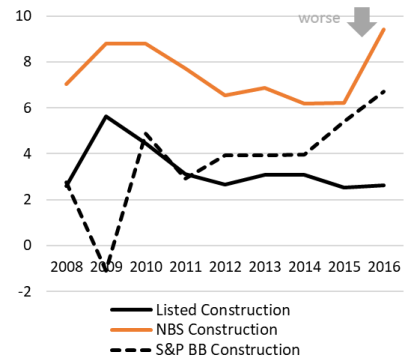
Source: NBS, WIND, Bloomberg and AMRO staff estimates

30   **The mining sector is highly vulnerable after experiencing boom and bust alongside global peers**. We use energy firms (including coal, oil and gas) as a global reference to illustrate the challenges of the mining sector. Those firms have experience boom and bust as the energy price went up and down. In the boom years, notably in China, debt was also used to fund corporate activities amid consolidations in 2011-2012 and the acquisition of smaller miners by the larger ones[27] and the debt level has remained elevated since then. The recent increase in energy prices will help ease the burden and will be a reprieve in the short term, however, long-term challenges remain.

Figure 3.21: Mining: Liabilities-to-Assets
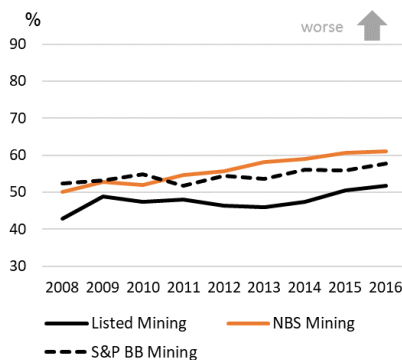
Figure 3.22: Mining: Profit Margin
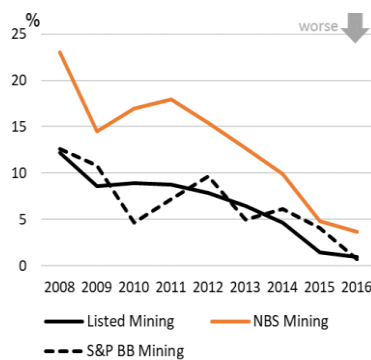
Figure 3.23: Mining: Interest Coverage Ratio
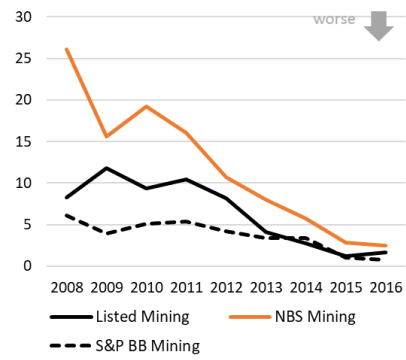
Source: NBS, WIND, Bloomberg and AMRO staff estimates

31   **Solvency conditions of the manufacturing sector remain reasonably favorable and stable.** As shown in Figures 3.24, leverage of Chinese-listed manufacturers remained stable as assets grew in tandem with debt.[28] The overall profit margin and interest coverage ratio have also kept stable (Figure 3.25 to 3.26). Nevertheless, as discussed previously, for

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[27] Among the incentives for acquisitions was that they enhanced operating efficiency and safety, and reduced pollution.
[28] There is a caveat on the stable leverage ratio of manufactures. Against the backdrop of the significant fall in the producer price index (PPI) between 2012 and 2016, the leverage ratio for manufacturers may not have been as stable if all asset prices were to be marked-to-market instead of retained at their book values.

industrial firms (a large share is manufacturing firms), SOEs are more vulnerable in terms of those financial indicators.

Figure 3.24: Manufacturing: Liabilities-to-Assets

Figure 3.25: Manufacturing: Profit Margin

Figure 3.26: Manufacturing: Interest Coverage Ratio
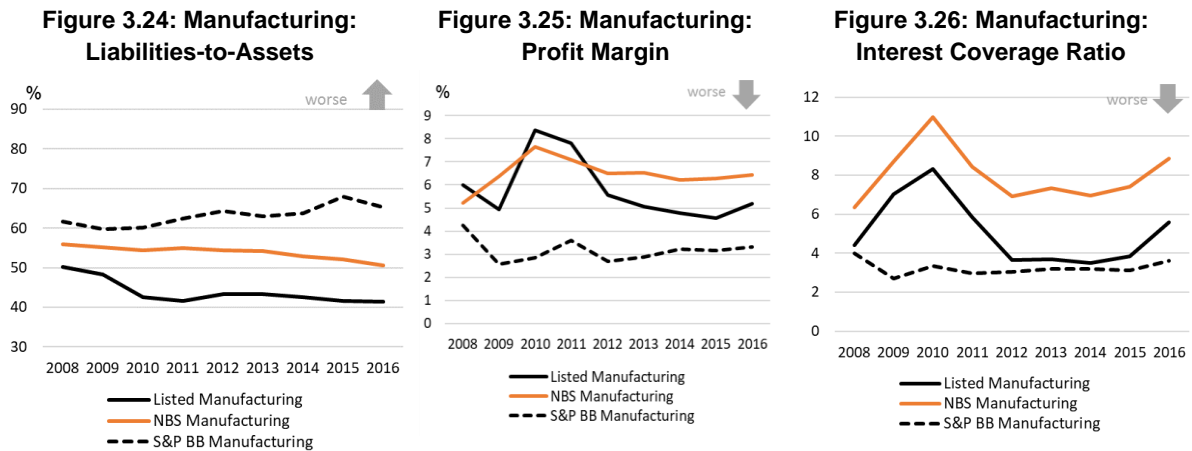
Source: NBS, WIND, Bloomberg and AMRO staff estimates

32 **Steel mills, as an example of manufacturing in the over-capacity sectors, until the supply-side reform recently, were not successful in disposing assets, curbing debt and enhancing profitability.** Overcapacity has been a challenge for steel mills worldwide, but the situation seems to be acuter for Chinese steel mills. To support economic growth and meet the demand of infrastructure and real estate construction, a number of steel mills were set up over the past two decades and now produce about half of world outputs. With over-capacity, profitability and debt repayment capacity indicators deteriorated considerably (Figure 3.27 to Figure 3.29). Not until recently did steel firms start to reduce their leverage and the debt repayment capacity also improved.

Figure 3.27: Steel: Liabilities-to-Assets

Figure 3.28: Steel: Profit Margin

Figure 3.29: Steel: Interest Coverage Ratio[29]
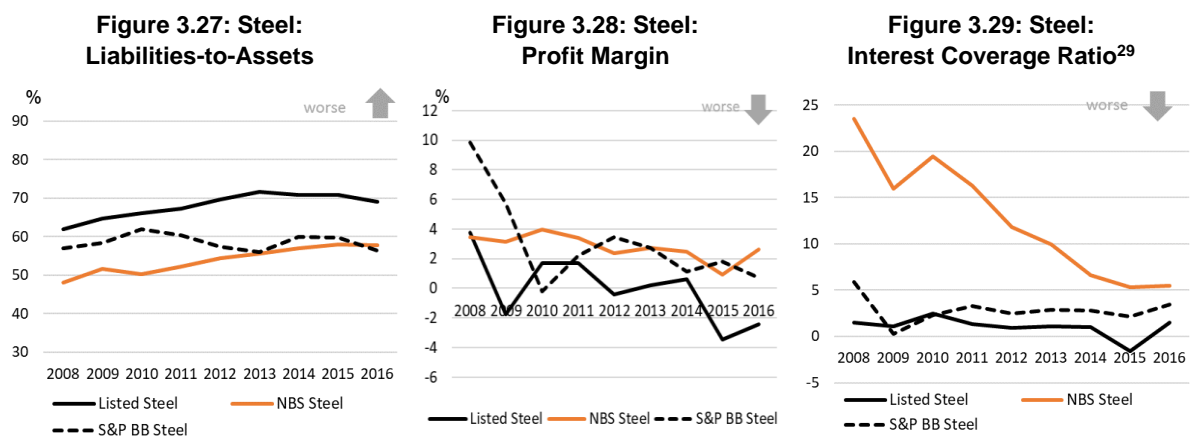
Source: NBS, WIND, Bloomberg and AMRO staff estimates

33 **Solvency risks for wholesale & retail trade are relatively high, given that its NPL ratio was the highest amongst all sectors as of 201**6 **at 4.7 percent.** This was a result of

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[29] The interest coverage ratio of NBS sample is very high and much higher than any of the listed steel mills. This could be due to different definitions, samples, and ways to estimate of interest expense and pre-tax profit.

fraudulent trade financing, speculation on commodities, moderating import and export demand and falling commodity prices, and hence falling collateral values. In addition to the high NPL ratio, its debt-to-VA ratio in 2016 was 163 percent compared to the aggregate corporate debt-to-GDP ratio of 155 percent. There is insufficient data from the NBS sample or the listed sample for us to carry out an analysis using financial indicators.

What are liquidity conditions like for firms across different sectors?

34   **Firms, especially those in the mining sector, have been relying more on short-term financing which exposes them to greater liquidity risks.** Firms have been relying more on shadow banking loans which are more prone to liquidity shocks compared to other means of financing. Tightened regulation could therefore have a more pronounced effect on these firms that have relied on shadow banking loans. In the bond market, as shown in Figure 3.30, compared to the past, corporates, particularly coal mining companies, have been issuing bonds with shorter tenures[30] and are faced with increasing refinancing risks amid the constant need to rollover their debt. As interest rates rise (Figure 3.31), it will become more expensive for these companies to refinance their debt. This is not a unique phenomenon in China, as corporates in other regional economies also rely more on short-term bond financing (AMRO 2016[31]). Our analysis shows that the proportion of listed firms' liabilities that are short-term (< 12 months) is more than 70 percent, which is higher than global peers.

Figure 3.30: Average Duration of Newly-Issued Corporate Bonds

Source: WIND, China Central Depository & Clearing Co (CDCC) and AMRO staff calculations

Figure 3.31: Average Coupon Rate of Newly-Issued Corporate Bonds

Source: WIND, China Central Depository & Clearing Co (CDCC) and AMRO staff calculations

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[30] There are a few reasons for this: (1) In some sectors, such as coal, investors have limited appetite for bonds with longer tenures as risks are high; (2) some corporates have more incentive to borrow short-term because of lower rate; (3) regulators had given corporates more liberty in structuring the tenure of their bonds.
[31] This is based on the findings of the article "Non-Financial Corporate Bond Financing in Foreign Currency: Trends and Risks in ASEAN +3 Emerging Economies". The link to the paper is: http://www.amro-asia.org/non-financial-corporate-bond-financing-in-foreign-currency-trends-and-risks-in-asean-3-emerging-economies/

35   **One mitigating factor to liquidity risks is the buffer provided by cash holdings to repay short-term liabilities.** In 2016, the average cash held by listed Chinese firms [32] was about 42 percent of its short-term liabilities[33], higher than the 33 percent for a BB rated global firm (Figure 3.32). However, this buffer is low for Chinese firms in steel sector at 31 percent and is below that of global BB rated firms within the same sector.

Figure 3.32: Cash as a Percentage of Short-term Liabilities (as of 2016)
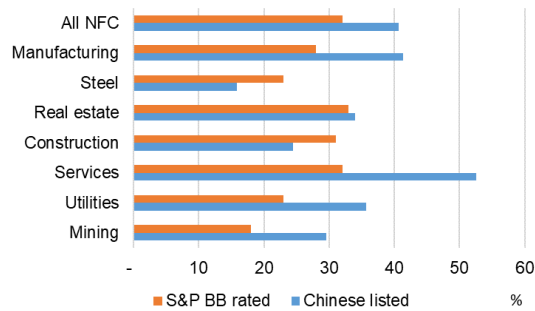
Source: WIND, Bloomberg and AMRO staff estimates

36   **In sum, corporate debt is concentrated in the sectors under the investment-led growth model and pockets of vulnerabilities are apparent in the mining, real estate, construction and steel sectors.** While the overall risk seems manageable, vulnerabilities vary significantly across sectors (Table 3.1). First, solvency conditions of SOEs are weaker than that of non-SOEs. Second, firms in the vulnerable sectors mentioned are faced with eroding profitability and debt payment capacities and can be sensitive to risks arising from the other vulnerable sectors. Another vulnerability is that firms across sectors are also relying more on short-term financing, while it has been partially mitigated by their cash holdings.

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[32] These refer to cash and near-cash assets such as bank deposits and other short-term, risk-free investments. Cash holding is available for listed Chinese firm data but not the NBS data**.**
[33] Short-term liabilities are liabilities that will mature in less than 12 months.

Table 3.1: Summary of Solvency Risks for Each Sector

Sector (share of debt)	Debt-to-VA	Leverage	Profitability	Debt repayment capacity
Industrial SOE (42% of industrial debt)	3	3	3	3
Industrial non SOE (58% of industrial debt)	2	2	2	2
Manufacturing (20% of total corporate debt)	2	2	2	2
• Steel	4	3	4	5
Mining (5% of total corporate debt)	4	4	5	5
Real estate (15% of total corporate debt)	4	4	4	4
Construction (12% of total corporate debt)	4	4	3	3
Transport (12% of total corporate debt)	4	4	2	2
Utilities (14% of total corporate debt)	5	4	2	2
Services: others (7% of total corporate debt)	1	1	1	1
Services: wholesale & retail (15% of total corporate debt)	3	3	3	3

1.Very low risk	2. Low risk	3. Moderate risk	4. High risk	5. Very high

4. Risks to the Financial Sector

37 **After analyzing the risk profile of each corporate sector, this section investigates the impact of elevated corporate debt on the financial system, particularly on banks.** Specifically, we seek to identify the lenders who are highly exposed to vulnerable corporates as identified in the previous section as well as analyze the implications for banking sector stability. To this end, we investigate the exposures of each category of lenders, particularly banks, to the seven main corporate sectors.

38 **Overall, the exposure of the financial sector to vulnerable sectors is moderate.** As of 2016, 31 percent of total corporate debt comprised debt in real estate, construction and mining, which, as discussed earlier, are the more vulnerable sectors. Mining is likely the riskiest sector, with a large proportion of firms still struggling with overcapacity, but it accounts for a small proportion of total corporate debt. Meanwhile, 55 percent of total corporate debt is in utilities, transport, manufacturing and other services, which are relatively less vulnerable. Figure 4.1 shows the exposures of lenders (largest banks, smaller banks, bondholders and shadow banking players) to the different corporate sectors using data from various sources as mentioned in Section 3.

Figure 4.1: Corporate Debt by Sector (as of 2016)
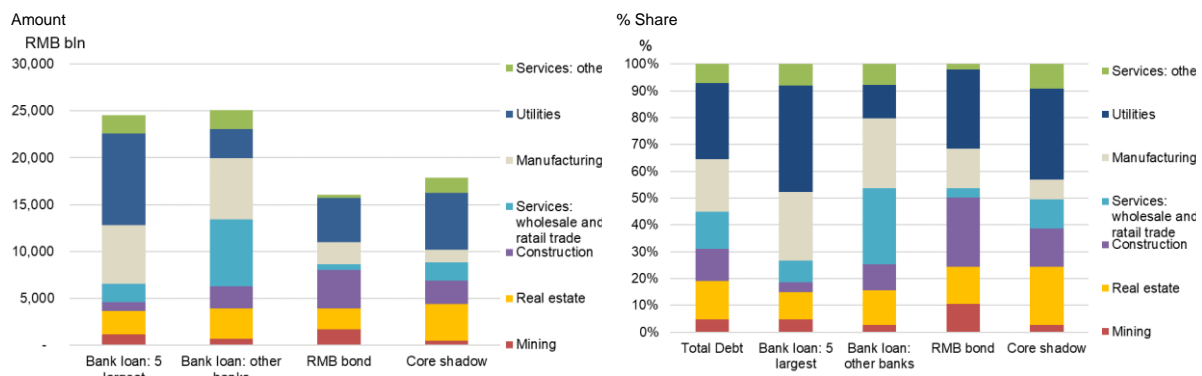
Note: Leasing and commercial services are excluded. Mining, real estate and construction are considered to be the more vulnerable sectors.

Source: WIND, Bloomberg, PBC, CBRC, China Trustee Association, Bank financial statements and AMRO staff estimates

39 **Bank loans by the large banks are more concentrated in the less risky sectors (Figure 4.1).** As of end 2016, bank loans by the five largest banks[34] were more concentrated in utilities, which has a high debt-to-VA ratio but relatively favorable solvency conditions and low NPLs [35], followed by manufacturing, a sector with relatively low vulnerabilities[36]. Exposure

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[34] Based on data from banks' financial statements.

[35] As discussed earlier, some utility companies, especially those that are listed, are quite profitable and show high debt repayment capacity. However, the overall debt-to-VA is high for the utility sector and there are some firms that are less profitable and still require local government support.

[36] Within the manufacturing sector, a more detailed breakdown disclosed in the financial statements of some of the largest banks revealed a pullback in loans to firms with overcapacity, such as steel firms, since 2015.

to sectors with high leverage or overcapacity in real estate (10 percent of large banks total corporate loan), mining (5 percent) and construction (4 percent) appears to be quite limited.

40 **Smaller banks recorded a higher concentration of loans in the riskier sectors (Figure 4.1).** Compared to the larger banks, as of end 2016, bank loans by the smaller banks[37] were skewed towards the risky sectors, such as real estate (13 percent of total smaller banks loan), construction (10 percent), as well as wholesale and retail trade (29 percent), which is a risky sub-sector of services. Smaller banks only had limited loans to the utility sector, as utility projects often require sizable long-term low-interest funding which does not appeal much to the smaller banks. Compared to the large banks, smaller banks also have much higher exposures to wholesale and retail trade, which is the sector with the highest NPL ratio[38].

41 **Shadow banking and the bond market provide sizable amounts of financing to the more vulnerable sectors such as real estate, construction and mining.** As of end 2016, financing from both shadow banking and the bond market were skewed towards real estate and construction[39]. These channels allow for more innovative means of raising funds, which benefits corporates especially when regulation on bank lending to certain sectors are tightened. The bond market also provides substantial financing to the mining sector. Coal miners, in particular, obtain close to 50 percent of their credit from the bond market. While there have been sporadic credit events occurring in the bond market amongst coal mining companies, these firms continue to receive strong local government support and hence credit risks associated with this sub-sector remain contained[40].

42 **In terms of the potential overall impact, banks are exposed to the risks of high corporate debt not just through bank loans but also through the shadow banking and corporate bond channels.** Ultimately, banks still play the most important role in lending to corporates. As shown in Figure 4.2, in addition to bank loans, banks hold large amounts of corporate bonds on their balance sheets. Banks are also active in shadow banking activities using both on and off-balance sheet vehicles with products being packaged as trust plans and brokers' asset management schemes, among others. In fact, banks' off-balance sheets are expanding with the rapid rise in wealth management products (WMP). As of end 2016, the amount of WMP outstanding stood at RMB 29 trillion, of which 17.5 percent was invested in non-standard products that are similar to bank loans. Risks are exacerbated by the fact that the actual exposure of banks to vulnerable sectors cannot be full ascertained given the opaqueness of activities within the boxed area in Figure 4.2. The risks posed by high corporate

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[37] Smaller banks' funding costs are higher than large banks. Compared to large banks, smaller banks' funding costs are also more sensitive to short-term interest rates, such as repo rates or NCD (Negotiable Certificate of Deposit) rates.
[38] In some districts, smaller banks run an extensive branch network and provide loans to a number of SMEs and micro enterprises in this sector.
[39] As of 2016, the bond market's exposure to real estate was 14 percent and to construction was 26 percent. Shadow banking's exposure to real estate was 22 percent and to construction, 14 percent.
[40] For example, Sichuan Coal Industrial Group incurred a few credit events in the bond market but was eventually bailed out each time.

debt therefore go beyond potentially affecting bank NPLs and could adversely impact the banking system through other channels.

Figure 4.2: The Relationship between Banking Products and Corporate Debt
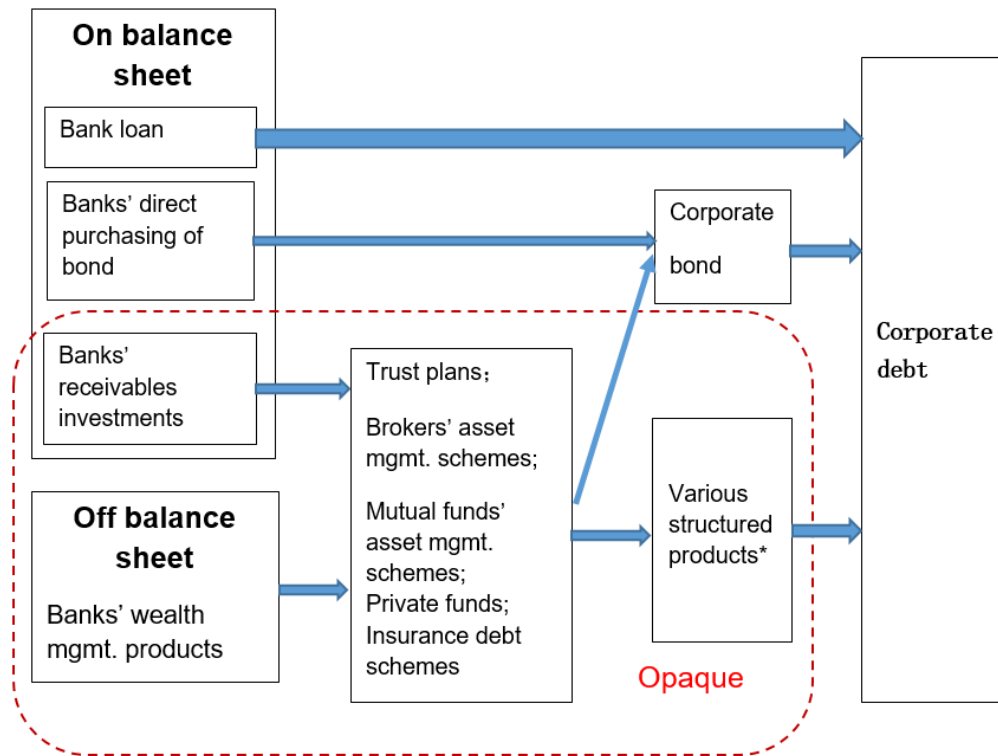
Note: * the amount of the various structured products are close to shadow banking. The products are often structured as Directional Asset Management Plans (DAMPs) or Trust Beneficiary Rights (TBRs)
Source: AMRO

Figure 4.3: Assets in Receivables
(as % of total assets as of 2015)
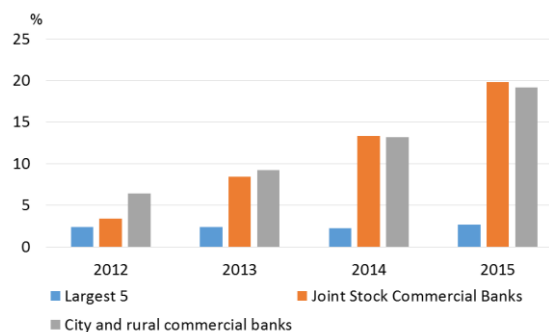
Source: Bank annual financial statements (26 listed banks)

43 **Overall, large banks are more resilient.** This is because (1) large banks' loan portfolios are skewed to those less risky sectors, (2) large banks have limited exposures to the shadow banking activities and hence more transparent, and (3) large banks have more abundant liquidity and risk management is more stringent.

44 **Smaller banks have been more aggressive in credit extension to risky sectors, and therefore have become more vulnerable.** Smaller banks lend mostly to corporates and have

limited lending to retail clients[41]. In terms of bank loans, smaller banks are skewed more to the vulnerable sectors. In terms of shadow banking activities, smaller banks are also more aggressive. As shown in Figure 4.3, investment in loans and receivables as a share of total assets, which is an indicator for bank lending through shadow banking (on balance-sheet), has been increasing in recent years. In addition to credit risk, we need to pay attention to liquidity risk of smaller banks. Smaller banks tend to rely more on short-term funding, such as repo and Negotiable Certificate of Deposits (NCDs). As such, smaller banks are facing higher corporate credit risks as well as liquidity risks.

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[41] Retail loans in China consist mostly of mortgages. While mortgage loans have low NPL ratios and low credit risks, the interest rate is also low and is therefore not appealing to the smaller banks.

5. Debt Simulations

45   **In this section, we conduct a scenario analysis of China's corporate debt levels by simulating a two-sector (SOEs and private firms) model.** With the help of quantitative model simulations, we aim to answer the following questions:

- What will the most probable trajectory for China's corporate debt levels be, going forward, under several plausible scenarios?

- What policy implications can we draw from these simulation exercises?

    o   How effective will macroeconomic policies, such as adjusting growth targets and interest rates, be in curbing the debt-to-GDP ratio without structural reforms?

    o   How will structural reforms help curb the debt-to-GDP ratio?

5.1 Different characteristics of SOEs vs Private Firms

46   **Chinese SOEs are exhibiting trends that are increasingly divergent from those of private firms**. Based on the compilation of data in the previous sections, Figures 5.1-5.4 show that SOEs are experiencing a decline in their share of fixed asset investment and share of the stock market by market capitalization, as well as becoming more leveraged and less profitable. Such divergence suggests that our debt simulation exercise should necessarily take these heterogeneous characteristics into account as different investment decisions and operating schemes will invariably affect the trajectory of total corporate debt.

Figure 5.1: Fixed Asset Investment Share by Ownership
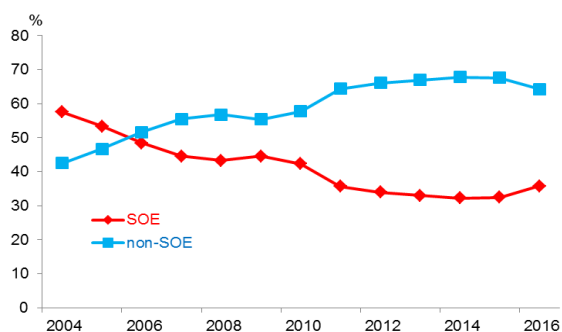
Note: SOEs include State Owned & Holding Enterprises
Source: NBS

Figure 5.2: Leverage Ratio (Liabilities-to-Assets) by Ownership
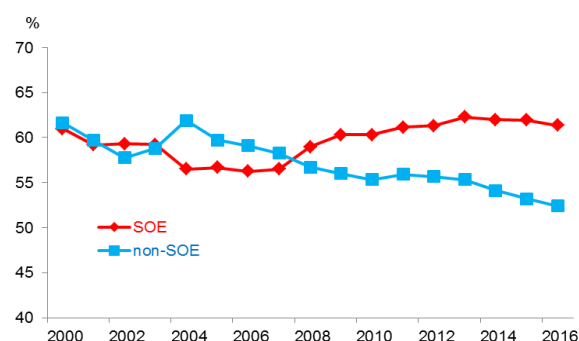
Note: SOEs include State Owned & Holding Enterprises
Source: NBS

Figure 5.3: Profitability (Profit-to-Asset) by Ownership
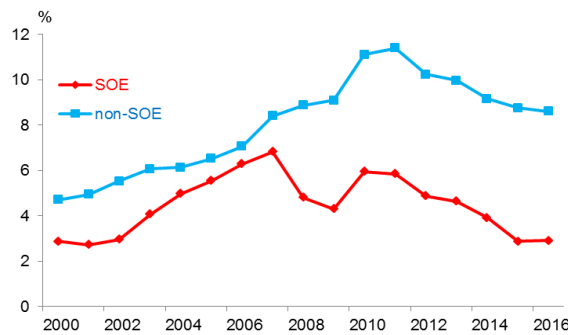
Note: SOEs include State Owned & Holding Enterprises
Source: NBS

Figure 5.4: Stock Market Capitalization Share by Ownership
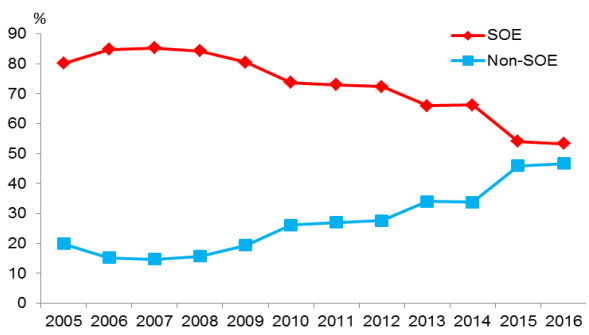
Note: Based on firms listed on the Shanghai and Shenzhen stock market exchanges
Source: Wind, AMRO Staff Calculations

5.2 Model Overview

47 **In our simulation exercises, we employ a dynamic model to project corporate debt-to-GDP.** Yu and Lu (2015) study China corporate debt growth trajectory and risk (refer to Appendix A), they argue that the debt-to-GDP ratio will continue to rise if the government fails to reverse its investment-driven growth model. We further extend and develop Yu and Lu's (2015) model. In similar vein to their study, we also consider debt increments as equivalent to the amount of investment unfilled by equity financing and corporate profits.

Figure 5.5: Simulation Model Structure
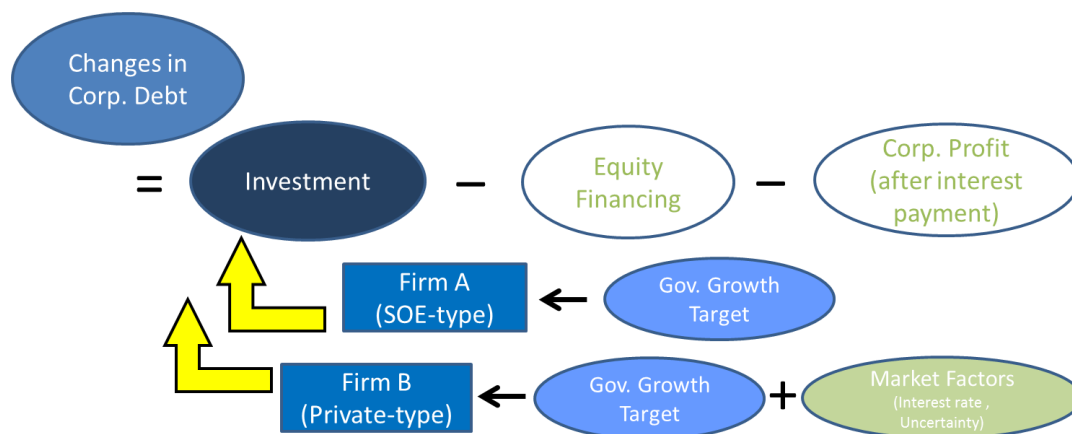
Source: AMRO

48 **Our model, however, is designed to accommodate the heterogeneous traits of Chinese SOEs and private firms, as well as improve its empirical fit to the data.** Our model, therefore, has several features that are distinct from the one set out in Yu and Lu (2015). First, giving due consideration to the stylized facts of Chinese firms, our model assumes that investment is made by two types of firms: the SOEs, whose investment decisions are guided predominantly by government growth targets, and private firms, whose investment decisions are guided also by market factors such as interest rates and

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uncertainties, in addition to government growth targets. Second, our model allows us to perform scenario analysis by changing policy variables, such as growth targets and interest rates, as well as key parameters related to the economic structure, such as capital efficiencies, dependence on equity financing, profitability, share in fixed asset investment and degree of market-driven investment decisions. Third, our model can be calibrated to replicate the path of China's corporate debt-to-GDP ratio over the period 2010-16 as shown in Section 1. More detailed description of the model and data is given in Appendix F.

5.3 Baseline Scenario

49   **Our baseline scenario assumes that structural reforms will remain limited.** Under this scenario, key parameters appear to remain on their current path throughout the forecasting period with the continuation of current trends - China's capital efficiency continues to worsen, firm profitability continues to moderate and SOEs' share in fixed asset investment continues to decline while reliance on equity financing improves gradually. Figure 5.6 summarizes our baseline projections of key parameters over the next decade. China's GDP growth is expected to slow down gradually to 4 percent by 2030 with CPI inflation stabilizing at the 2 percent level and the short-term interest rate gradually declining to 3.5 percent, as shown in Figure 5.7.

Figure 5.6: Key Parameters Under the Baseline Scenario

a.   Capital Inefficiency (Capital-Output Ratio)

b.   Firm Profitability (EBIT Margin)

c.   Access to Capital Market (Equity Finance in % of GDP)

d.   SOE Fixed Asset Investment Share
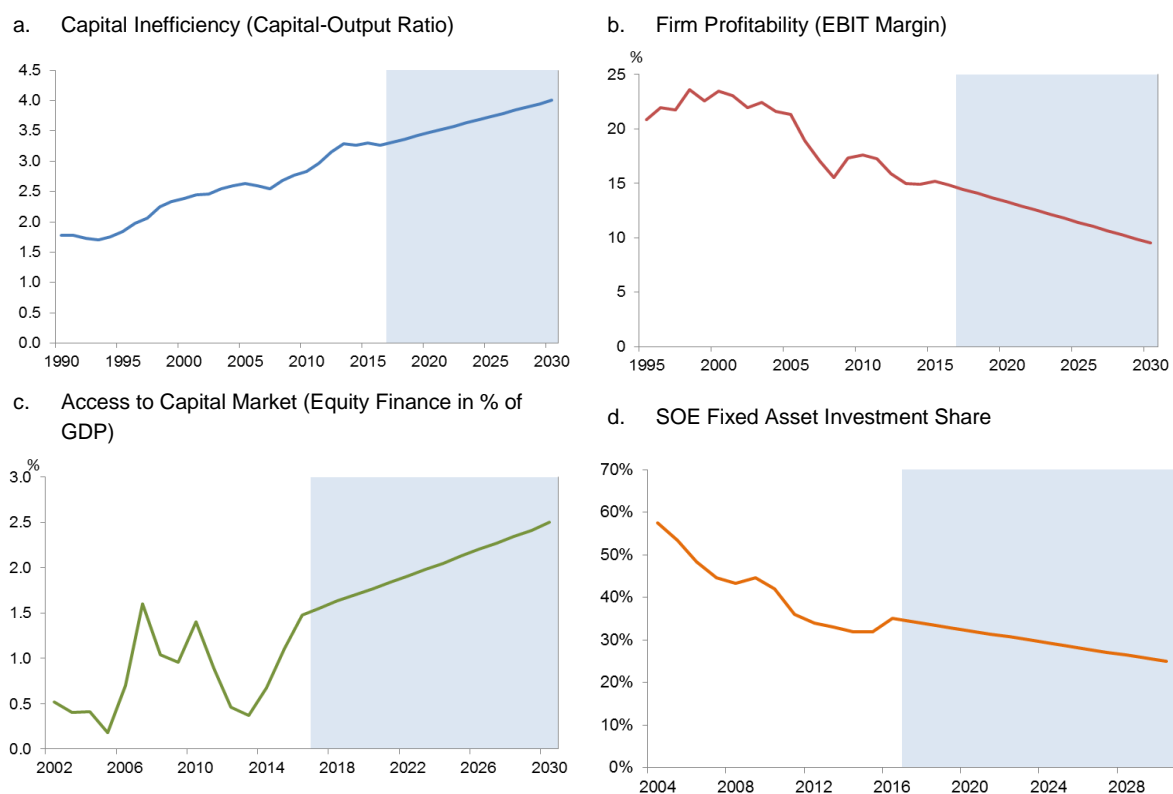
Note: EBIT Margin is defined as EBIT/Operating Revenues.
Source: NBS, PBC, WIND, CEIC, AMRO Staff Estimates

Figure 5.7: Key Macro Variables Under the Baseline Scenario
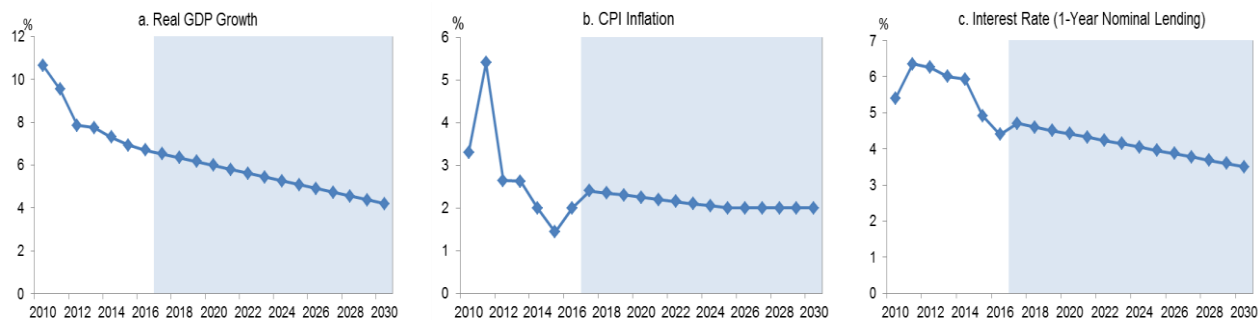
Source: NBS, PBC, AMRO Staff Estimates

50   **Under the baseline scenario, China's corporate debt is forecast to rise to around 200 percent of GDP by 2030.** Figure 5.8 shows that our model's in-sample-forecasts are largely comparable to the debt-to-GDP estimates (with markers) during the period 2010-16. The model forecasts that the debt-to-GDP will reach around 200 percent by 2030 under the baseline scenario. This is in line with the main findings of Yu and Lu (2016). *Ceteris paribus*, a higher growth target is likely to lead to a higher debt-to-GDP path as the rise in debt will outpace that of output under the growth target-led investment structure. Moreover, higher interest rates are likely to contribute to higher debt-to-GDP due to firms' higher interest burden, which erodes earnings and increases debt-financing dependence. For the sensitivity analysis under alternative GDP growth and interest rate assumptions, please refer to Appendix G.

Figure 5.8: China's Corporate Debt-to-GDP Projection Under the Baseline Scenario
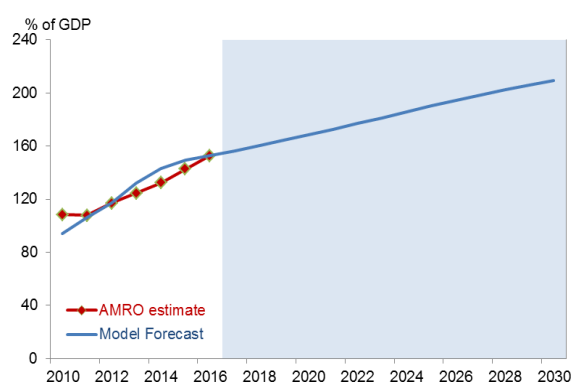
Figure 5.9: Corporate Debt-to-Sectoral Output Simulation by Ownership under the Baseline Scenario

Source: AMRO Staff Estimates
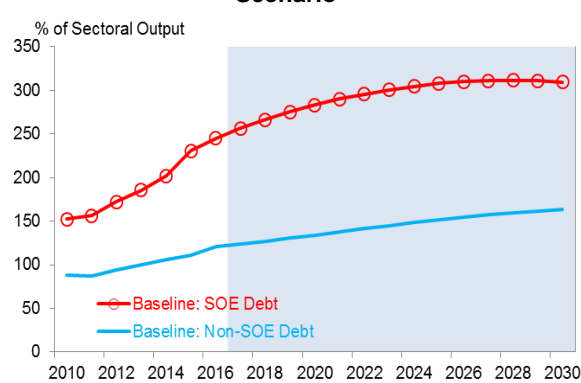
Note: SOEs include State Owned & Holding Enterprises
Source: NBS, AMRO Staff Estimates

51   **To clearly show the differences in debt growth between SOE and non-SOE firms[42], we project SOE debt to SOE output as well as non-SOE corporate debt to non-SOE corporate output.** These projections require an additional set of variables such as SOE and non-SOE output, preferential borrowing rates for SOEs as well as capital efficiency parameters

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[42] The Chinese corporate sector consists of three types of firms: i) SOEs, ii) private firms, and iii) 'semi-private' firms, which include firms that are collectively- owned, individually-owned, and jointly-owned. For simplicity, we classify private firms and 'semi-private' firms as 'non-SOE' firms and assume that 'semi-private' firms share the same characteristics as private firms as shown in Figures 5.1-5.4. This assumption is also necessary as data on the characteristics of semi-private firms are not sufficient.

for both SOEs and non-SOEs[43]. Plausible assumptions for this additional set of variables and parameters are discussed in Section G.2 in Appendix G. The respective debt-to-output ratios of SOEs and non-SOEs demonstrate the differences in the ability of these firms to generate output or income to service their outstanding debt.

52 **SOE debt to its own output is much larger than that of non-SOEs and is projected to grow quickly in the medium term given that the ability of SOEs to generate output from debt financing is much lower than that of non-SOEs**. Figure 5.9 shows that SOE debt to SOE output (244.9 percent in 2016) —estimated from value-added productions in industrial sectors—is much higher than that of non-SOEs (120.5 percent in 2016). It is also projected to grow much faster in the next ten years. This implies that the investment efficiency of SOEs compared to non-SOEs is much lower and borrowings by SOEs have not generated output that is sufficient to reduce the debt to output ratio.

5.4 Structural Reform Scenarios

53 **Next we perform simulations by varying the degree of structural reform progress.** The results of our baseline simulation with limited reforms suggest that macro policies, such as setting higher growth targets or raising interest rates, would not be sufficient to curb the debt-to-GDP ratio. This then leads to the question on whether structural reforms could help reverse the trend and which aspects need to be considered. To address these questions, we formulate alternative structural reform scenarios that correspond to the degree of reform progress: i) baseline scenario (limited reforms outcomes), ii) upside scenario (comprehensive reform outcomes). Key elements of these are captured in Figure 5.10.

Figure 5.10: China's Structural Reform Scenarios

Baseline Scenario (Limited Reform Outcomes)	Upside Scenario (Comprehensive Reform Outcomes)
• Moderating capital efficiency	• Rising capital efficiency
• Declining firm profitability	• Improving firm profitability
• Limited market-driven investment	• Significant market-driven investment
• Still low dependence on equity-financing	• Improving dependence on equity financing

Source: AMRO

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[43] The scaling factors were calibrated to ensure that these projections are consistent with the baseline projection on aggregate corporate debt.

54 **The key parameters take on different paths under the different reform scenarios.** Our projections of key parameters that characterize the structure of the economy, specifically the capital-output ratio, firm profitability, SOE-investment share, and equity-financing ratio, under the two reform scenarios, are shown in Figure 5.11. Compared with the baseline scenario (limited reforms with a continuation of recent trends), comprehensive reforms will lead to higher capital output efficiency, higher profitability despite a short-term dip in the initial stages of reform, substantial deepening of capital markets, and further declines in the share of SOE-led private investment in the medium to long term. Correspondingly, the GDP growth paths in our simulation exercises are assumed to diverge, with growth under the upside scenario dipping slightly in the short term compared with the baseline scenario before stabilizing at a higher growth rate over the longer term, as shown in Figure 5.12.

Figure 5.11: Key Parameters Under Different Structural Reform Scenarios

a. Capital Inefficiency (Capital-Output Ratio)

b. Firm Profitability (EBIT Margin)

c. Access to Capital Markets (Equity Finance in % of GDP)

d. SOE Fixed Asset Investment Share
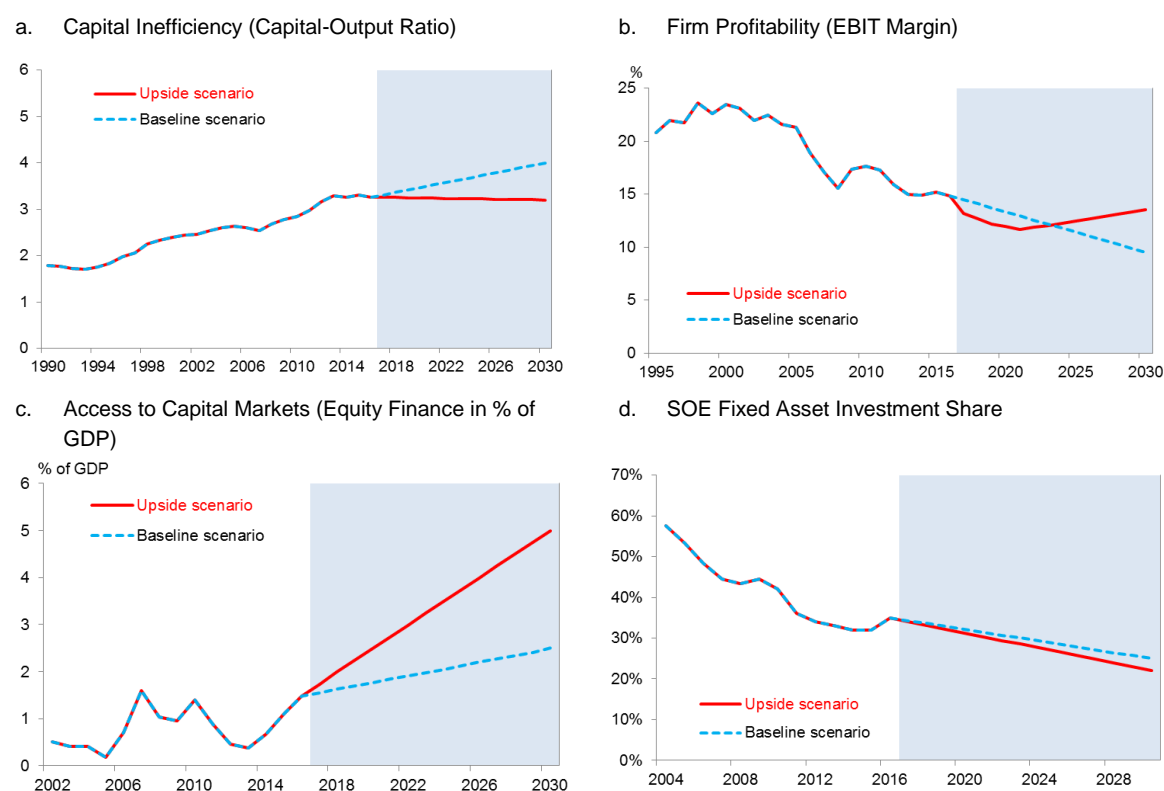
Note: EBIT Margin is defined as EBIT/Operating Revenue.
Source: NBS, PBC, WIND, CEIC, AMRO Staff Estimates

55 **Our model forecasts suggest that comprehensive reforms would lead to a gradual decline in China's corporate debt-to-GDP ratio in the medium-term, although the size of the reduction will depend on the reform progress.** Figure 5.13 provides our debt simulation results under the different reform scenarios. The importance of comprehensive reforms in lowering the debt ratio and the SOE debt to output ratio cannot be overstated – our simulations in the upside scenario show that after reaching a peak of 162 percent of GDP in

2021, the debt ratio will begin to decline from 2021 onwards. The SOE debt to output ratio will also gradually decline in the medium term, as shown in Figure 5.14. Our sensitivity analysis suggests that reforms which help improve capital efficiency will be most effective in reducing the debt ratio, while reforms that enhance equity financing dependence as well as firm profitability will also contribute significantly to deleveraging (See Appendix G.3).

Figure 5.12: Real GDP Growth Path under Alternative Reform Scenarios
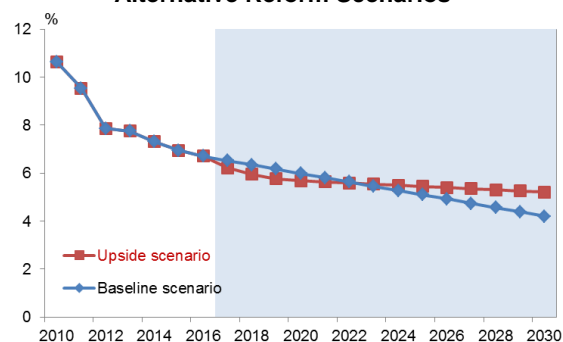
Source: NBS, AMRO Staff Estimates

Figure 5.13: Corporate Debt-to-GDP under Alternative Reform Scenarios
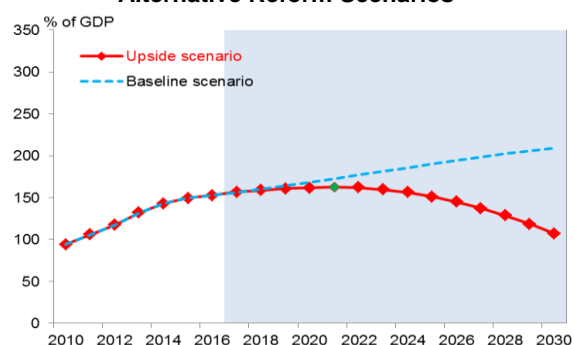
Source: NBS, AMRO Staff Estimates

56 **Overall, our simulation exercises highlight that comprehensive structural reforms are warranted for corporate debt reduction.** Under current growth targets, higher growth is likely to lead to higher corporate debt. On the other hand, low growth with low interest rates may cause the debt-to-GDP trajectory to decelerate, but will not be sufficient to reverse the rising trend of corporate debt. Hence, comprehensive structural reforms that help reduce capital inefficiency, improve firm profitability and promote market-driven investment decisions need to be pursued. More specifically, in order to achieve higher capital efficiency, the authorities need to push ahead with the reduction in overcapacity as scheduled. Meanwhile, profitability and market-driven investment will improve by successfully reducing "zombie" companies and pursuing SOE reforms. Further efforts to deepen capital markets will help provide firms with more sources of corporate equity financing and reduce the reliance on debt financing, particularly bank borrowing.

Figure 5.14: SOE Debt-to-Sectoral Output Under Alternative Reform Scenarios
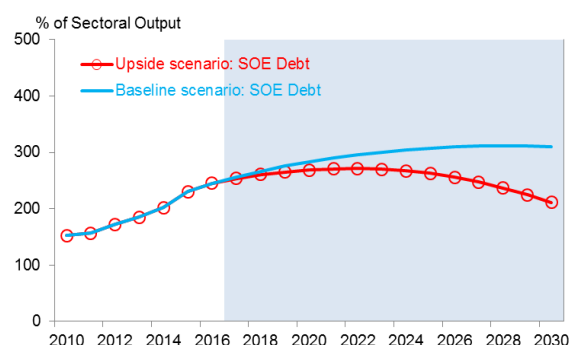
Note: SOEs include State Owned & Holding Enterprises
Source: NBS, AMRO Staff Estimates

6. Conclusion and Policy Suggestions

6.1 Conclusion

57 **The ratio of corporate debt-to-GDP in China is amongst the highest in the world and may continue to rise.** Based on our estimates, it was as high as 155 percent in 2016. In addition to the stimulus package during the GFC, structural and institutional factors have been the main contributors to the rapid increase in corporate debt. These include the high saving rate and underdevelopment of equity financing facilities compared to debt financing, the presence of implicit guarantees for SOEs as well as LGFVs, and the investment-dominant structure of the post-GFC stimulus. To a significant extent, these are country-specific factors that relate to China's current stage of economic and financial development, including rapid urbanization.

58 **While bank loans are the most important source of financing for corporates, financing through corporate bonds and shadow banking loans has increased significantly.** Shadow banking loans with the share above 20 of total corporate financing in 2016 are less transparent and subject to greater risks. In addition to higher credit risks, their liquidity risks are also much higher than bank loans and corporate bonds, as the maturities of the majority of shadow banking products are below 12 months. Moving forward, the structure of corporate debt financing is likely to evolve further, partly depending on future regulations as well as interest rates.

59 **Corporate debt is concentrated in the sectors under the investment-led growth model with pockets of vulnerabilities surfacing in the mining, real estate, construction and steel sector.** The sectors that account for a significant share of total corporate debt include manufacturing (20 percent), real estate (15 percent), utilities (14 percent), transport (12 percent) and construction (12 percent). The accumulation of debt has tapered off across the sectors but corporate debt-to-VA continues to rise as debt growth still exceeds output growth, especially in utilities, real estate and construction. Nonetheless, the overall leverage of Chinese firms across the sectors has remained stable. This is because firms have increased their assets in tandem with the accumulation of debt to expand and upgrade. As for liquidity risks, firms across sectors are relying more on short-term financing in the form of shorter-maturity bonds and shadow banking loans. Cash holdings may help mitigate liquidity risks to a certain degree.

60 **SOE debt is sizable and controlling SOE debt is key to restraining the overall corporate debt level in the future.** SOEs have the lion's share of total corporate debt and they are the main players in the sectors with high debt-to-VA level including the utilities and

transport sectors. In addition, our simulation exercise suggests that, compared to non-SOE, SOE debt is likely to contribute more to the ratio of corporate debt-to-GDP in the future. Therefore, controlling SOE debt is crucial for keeping corporate leverage in check.

61 **Although the exposure of the banking sector to vulnerable sectors is moderate, it is significantly higher for the smaller banks compared to the large banks.** Our analysis shows that the smaller banks have a higher concentration of loans in real estate and construction relative to the large banks. Financing to vulnerable sectors through the shadow banking channel is also sizable and increasing. In terms of the overall impact to banking sector stability, banks are exposed to the risks of high corporate debt not just through bank loans but also through the shadow banking and corporate bond channels.

6.2 Policy suggestions

62 **Concerted and enhanced efforts are warranted to reduce corporate debt-to-GDP in vulnerable sectors in the medium term and mitigate sector and financial stability risks (Figure 6.1).** The results from our study indicate that policy efforts need to focus on two main areas - curbing the pace of rising corporate debt and mitigating risks to corporates in vulnerable sectors as well as to the financial sector. The study highlights that risk assessments and monitoring need to be done at both the aggregate and sectoral levels. Policy efforts driving structural reform need to be pushed ahead while financial sector and fiscal policies could be enhanced to curb corporate debt and mitigate risks. Our experience from this data-extensive project also indicates that further disclosure in corporate and financial sector data are needed for better risk monitoring and policy decision-making going forward. **Enhanced coordination among policy-makers responsible for the relevant policies is crucial for successful corporate debt reduction and risk mitigation going forward.**

Corporate Sector Policy

63 **Our simulations using a model that captures the different characteristic of SOEs and private firms suggest that comprehensive structural reforms are needed to reduce corporate debt-to-GDP in the medium term.** A combination of limited reforms, macro policy that targets higher growth and monetary policy easing may help decelerate the pace of corporate debt accumulation. However, it would not be sufficient to reverse the trend's upward trajectory. If the current trend continues, China's corporate debt is projected to rise to 200 percent of GDP by 2030. Comprehensive reforms that enhance capital efficiency and firm profitability as well as deepen the capital markets will contribute more meaningfully to a gradual deleveraging in corporate debt, especially SOE debt, in the medium-term.

Figure 6.1: Comprehensive Policy Measures to Curb Corporate Debt and Mitigate Risks
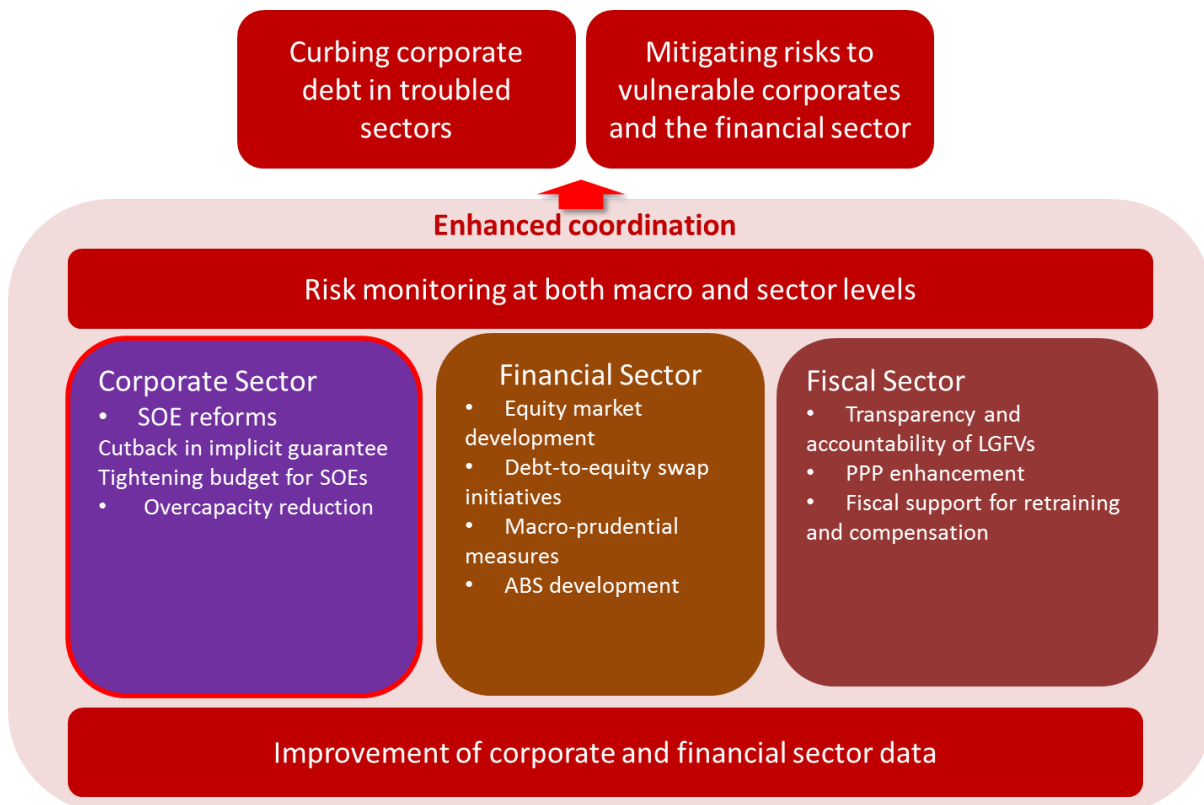
64   **To achieve higher capital efficiency and raise profitability, cutting back on implicit guarantees, tightening the budget constraints for SOEs and pushing ahead with the reduction in overcapacity as planned are encouraged.** The authorities have pushed forward market-oriented reforms of SOEs. Further efforts on this front together with hardening budget constraints and cutting implicit guarantees are needed to foster greater SOEs' awareness of market borrowing costs and deter them from incurring new debt for unproductive projects. In the meantime, profitability and market-driven investments will improve by successfully cracking down on "zombie" companies and further reducing overcapacity.

Financial Sector Policy

65   **Debt-to-equity swap initiatives and equity market development will help reduce corporate reliance on debt financing.** Both the market participants and the regulators are working on the mechanism and institutional arrangements to tackle relevant challenges. One of the key considerations is to ensure that creditors will have the ability to manage firms once their loans have been swapped into shares. The authorities insist that it shall be carried out based on market-orientation and proper legal framework, and this is welcomed. In the longer term, further efforts to deepen the capital markets will help provide firms with more sources of corporate equity financing and reduce the reliance on debt financing.

66　**The current macroprudential measures should be maintained to rein in debt in the real estate sector.** Our analysis shows that firms in the real estate sector are highly leveraged, especially the larger firms, as they are able to obtain loans at lower interest rates. With its large asset size and close linkages to other sectors, including banks and households, unfavorable developments in the real estate sector could have a large system impact on other real sectors of the economy as well as on the financial sector. Macroprudential measures for the real estate sector by various authorities have helped cool down overheating activities in tier-1 and tier-2 property markets, limit a further rise in property lending and mitigate risks to the banking sector, and should be maintained at this juncture. At the same time, the authorities also need to prevent or mitigate large volatility in the real estate markets.

67　**Enhanced regulation on shadow banking activities could help mitigate corporate leverage.** The regulation on shadow banking activities has been strengthened recently, such as through the inclusion of off-balance sheet activities in the MPA framework in 2017. According to Zhang[44] (2017), in terms of parameters, the MPA is less punitive to the smaller banks, but as smaller banks are more aggressive and more leveraged, they fell more constrained by the MPA.[45] With the implementation of MPA, leverage among the financial institutions has declined. At the same time, the corporate debt-to-GDP ratio has been growing at a slower pace. Unless economic outlook worsens materially, this current MPA measures should be maintained. In the process of MPA implementation, some individual institution may feel stress, and the authorities should also be prepared to swiftly deal with isolated cases of bank's stress by using targeted measures. Regulation on shadow banking activities could be stepped up further to reveal more transparent corporate debt and financial institution's risk profiles and to reduce liquidity risk. This will help limit corporate leverage through shadow banking loans further and mitigate risks to financial stability.

68　**Risks to financial stability can also be mitigated by strengthening the buffers of financial institutions with high exposure to vulnerable sectors.** As analyzed in Section 4, in terms of assets, the smaller banks are more exposed to riskier sectors though bank loans and shadow banking activities. In terms of liabilities, compared to the larger banks, the smaller banks also rely more on interbank market funding. Stress tests should be conducted to identify potential losses due to high concentration in vulnerable corporate sectors. Regulators should then encourage smaller banks with significant risks to raise more capital and improve their liquidity profiles. And if smaller banks would like to dispose some assets to alleviate pressures

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[44] Zhang Xiaohui (2017) "The exploration of macro-prudential policy in China", China Finance.
[45] Some of these banks, particularly those with assets above RMB500 billion, were targeting asset growth rates of between 60-70 percent in 2017 and would have incurred substantial risks associated with high interbank liabilities to fund such loan growth. In anticipation of tighter regulation, smaller banks will need to prepare to face some shocks given their elevated credit and liquidity risk profile and take steps to shore up capital, including core tier-one equity capital.

on capital and liquidity requirement, authorities may also consider establishing a mechanism to facilitate it.

69 **Securitization, such as using asset-backed securities (ABS), should be further developed to reduce vulnerable sectors' reliance on shadow banking activities.** One alternative to corporate reliance on shadow banking activities would be more transparent financing using instruments such as ABS. The ABS market in China has been developing rapidly but is still relatively fragmented, with different regulators setting different rules and supervising different markets. A more universal and integrated regulatory framework will greatly facilitate the development of ABS and encourage movement away from shadow banking activities. Likewise, stricter disciplines such as by allowing defaults to occur, will create a more market-oriented bond market and deter borrowing by corporates with weak prospects.

70 **As corporate debt in foreign currency (FCY) is likely to increase further, risk assessment and management should be enhanced.** This type of corporate debt remains a small portion of the total corporate debt but the share has been increasing (Box A on "Developments in Overseas Foreign Currency Bond Financing and Risks"). The share of FCY debt is likely to increase in the coming quarters as Chinese firms continue to seek overseas investment opportunities, domestic financial conditions may tighten and the USD may not strengthen further. Historically, in other countries, FCY debt has proven to be riskier than local currency debt, as there is possible mismatch between revenue in domestic currency and funding in FCY, and FCY liquidity could dry up quickly in stress periods. Therefore, while FCY debt size is still small, the authorities are recommended to step up efforts on monitoring corporates' liquidity and currency mismatch risks and to ensure that corporates have sufficient buffers.

Fiscal Policy

71 **Greater transparency in local government financing vehicles (LGFVs) could help reduce the high debt-to-output ratio in the utility, transport and construction sectors.** Successful reduction of overall corporate debt will depend on the reduction of debt in these sectors. For that to happen, each financing vehicle should have a clear and exclusive mandate as well as transparent management and separate accounts. They should also be set up to run on a commercial basis as market forces will help encourage discipline, and improve efficiency and profitability. In addition, economic returns on investment need to be a priority condition for approval of LGFV infrastructure-related projects.

72   **Increased disclosure and transparency of firms will help enhance the prospects for public-private partnership (PPP) financing and reduce the reliance on debt financing.** The government has identified PPP financing as a good alternative to debt financing for utility and transport projects. However, private firms are still doubtful of the returns and feel uncertain about the policy. Therefore, higher standards of disclosure and greater transparency will boost private firms' confidence in the local governments and encourage more equity financing in utility projects.

73   **As firms in the overcapacity sectors are encouraged to shed assets, fiscal resources should be utilized to help vulnerable workers.** Reducing excessive capacity has contributed to rein in leverage and improve debt repayment capacity in certain sectors such as coal and steel. A key consideration is for the government to set aside fiscal funds to relocate and retrain workers in the vulnerable sectors, such that they can be employed in other promising sectors. Such explicit subsidies will facilitate capacity reduction, lead to higher net efficiencies and enhance social welfare while curbing corporate debt. It is more important to relocate workers to more promising sectors. In May 2016, the Ministry of Finance announced a 100-billion-yuan aid for steel and coal companies to resettle laid-off workers. The experience from implementation of this assistance will be valuable for further related fiscal support.

Improvement of Corporate and Financial Sector Data

74   **Corporate and financial sector data should be strengthened to support more accurate and thorough risk assessment and monitoring.** There has been a significant improvement in corporate debt data collection, such as the compilation of total social financing statistics by the PBC. However, further improvements in data collection and compilation is essential for better risk detection. For example, to assess the risks of small and medium-sized banks (national joint stock banks, urban and rural commercial banks), regulators should request banks to provide data on credit exposures in different sectors, including through shadow banking activities. PPP financing should also be based on well-recognized standard in terms of mechanism design, accounting technique and data compilation. These efforts are essential for policy formulation. In addition, timely disclosure of these data will help enhance transparency and strengthen market confidence.

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Box A: Developments in Overseas Foreign Currency Bond Financing and Risks

Despite the rapid growth in recent years, corporate reliance on overseas corporate bonds as a source of financing is still low at 3.5 percent of China's GDP. In recent years, the overall outstanding amount of offshore corporate bonds has increased rapidly, especially between 2012 and 2015. However, the overall size is still small, and as of 2016, the outstanding amount stood at USD 381 billion, or 3.5 percent of China's GDP (Figure A1). Most of these offshore corporate bonds are denominated in US dollars. In terms of overseas bank loan, the amount is slightly lower than bond.

Figure A1: Chinese offshore corporate bonds: Amount outstanding (historical value)
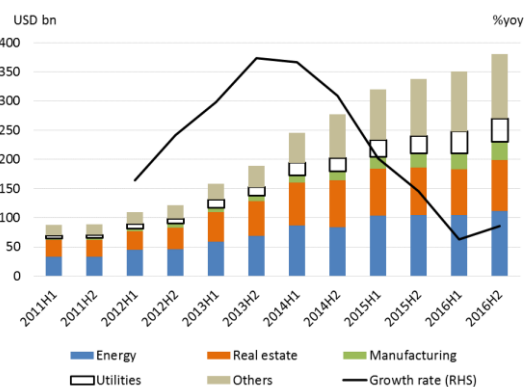
Figure A2: Chinese offshore corporate bonds: Sector breakdown (as of end 2016)
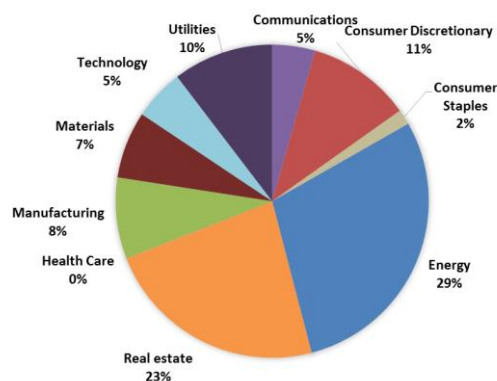
Note: To estimate the amount of bond financing by Chinese corporates, bonds issued by entities incorporated in China as well as bonds issued by entities incorporated in other economies (such as Hong Kong) but whose ultimate parent company is registered in China, are included in our sample. The sector classification used is based on Bloomberg's industry classification and hence may not be consistent with the seven sectors used in the rest of the article.
Source: Bloomberg and AMRO staff estimates

Energy and real estate firms are the most active borrowers in the offshore bond market. As shown in Figure A2, energy and real estate firms account for 29 percent and 23 percent of the total in 2016 respectively. The shares of the other sectors are significantly smaller.

For energy firms, most of the proceeds from overseas bond issuances are used to support their overseas operations. In the energy sector, bonds are predominantly issued by a few mega oil and gas SOEs. These oil and gas conglomerates need a sizable amount of funding for their overseas operations, such as to support the operation of offshore oil rigs and purchase crude oil. The interest rates on these bonds are quite low, which helps contain the debt repayment burden. In other sectors, the interest rates on offshore bonds are on average higher than in the energy sector but lower than in the real estate sector, indicating moderate risks.

For real estate firms, the proceeds from bonds issued overseas are used to support both overseas and domestic operations. In the real estate sector, funds raised through offshore bond markets may be used to finance firms' expansion overseas, especially in foreign cities with a large ethnic Chinese population. However, several firms also use the funds to finance their operations in China. For these firms, currency mismatching may be a risk. On average, the interest rates on offshore bonds are much higher for real estate bonds than for Chinese SOE energy bonds as mentioned above, and also higher than the rates on onshore RMB bonds issued by the same entity due to the credit risk premium required by offshore investors. The risks associated with offshore debt financing is hence higher in this sector than in the energy sector and warrants closer monitoring.

Overall, systematic risks to overseas foreign currency bond financing are low but there are pockets of vulnerabilities. As the amount of overseas bonds issued by Chinese corporates is still low, systematic risks posed to the overall financial system and the economy are limited. At the same time, the interest rates on these bonds for most sectors are low to moderate, and do not indicate a high-risk scenario. However, pockets of vulnerabilities, especially in the real estate sector, may merit closer attention.

Box B. Chinese authorities and institutions' Views about China's Corporate Debt Developments and Policy Solutions

To complement our assessments in the other parts the paper, this box summarizes our findings from AMRO's stakeholder survey on corporate debt developments, drivers and policy solutions. The interview-based survey was conducted during AMRO's interim visit to Beijing and Shanghai in February 2017 and had the participation of 18 institutions including government agencies, research institutions, SOEs, private firms and financial institutions.

1. Corporate Debt Developments

China's corporate debt level is likely to rise further. Most institutions were of the view that China's corporate debt level is rising and that the uptrend would continue in the coming years. Based on their observations, debt is rising significantly in sectors such as real estate, steel and coal, infrastructure and Public-Private Partnership (PPP)-related areas including electricity and water. Leverage is assessed to be the highest in the real estate and coal mining sectors[46].

High corporate debt is a long-term challenge rather than an immediate crisis. Although growth could benefit from more corporate borrowing through increased business activity, excessive debt could increase vulnerabilities in the economy and possibly trigger an economic crisis. Most institutions, however, viewed the high corporate debt as a long-term challenge rather than a potential trigger for crisis in the near term, partly because most corporates have high levels of cash holdings. According to the views of a few research institutes, the current level of corporate debt is still manageable compared to a similar situation in 1998.

China's corporate debt poses increasing risks to the financial system. Besides the traditional defaults, such as those that occur because of a prolonged decline in profits, the risks associated with short maturities need to be closely monitored. In 2016, several corporates had issued short-term bonds, and used the proceeds to purchase debt of other corporates. In this way, money was therefore being circulated within the financial system instead of flowing into the real sector, which increases the risks in the financial system.

2. Drivers behind the Increase in Corporate Debt

Structural and institutional factors were highlighted as the main drivers behind the rise in corporate debt. First, the rise in corporate debt was prompted by the investment-led economic growth model and diminishing returns of capital, and then catapulted by the economic stimulus package post-GFC which focused on boosting public investment. Second, SOEs were allowed to borrow to finance their loss-making businesses in order to fulfil their mandate of supporting growth. As a result, several capital-intensive sectors, such as steel and coal, are still able to obtain more debt financing even when they make loss, and this pushed up the debt level. In addition, SOEs, especially some at the local level with low management capacities and operational efficiencies, continued to obtain support from the local governments. Third, rapid development of the bond market and of local government finance vehicles also helped accommodate the rise in corporate debt.

3. Ways to Curb the Rise in Corporate Debt

First, it is crucial for SOE reforms to gather speed. SOEs reforms should focus on promoting market mechanisms for more effective and efficient allocation of resources, which will help lift overall capital and operational efficiency amongst corporates. Progress should be made on front, while also paying attention to maintaining stability during the process.

Second, debt-for-equity swaps may be beneficial in certain situations such as when a corporate encounters liquidity challenges. That said, some institutions were quite cautious about this. If the targeted company lacks the ability to turn around, obligatory debt-for-equity swaps will undermine the interest of creditors, which could contribute to another layer of risks to the financial system. Therefore, this approach should adhere to market-based principles and be backed by the effective legal framework.

Third, corporates should be encouraged to rely more on equity financing. Although this will not help significantly in the short term, it could be a very useful long-term solution. Further policy measures to enhance the infrastructure and product offerings in the equity market will be useful in this regard.

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[46] The electricity sector has the largest debt which stood at RMB7.8 trillion as of end 2016, followed by the steel sector at RMB4.4 trillion.

Box C. Measures to Curb Corporate Debt

The authorities have recognized that it is important to curb corporate leverage and have continually employed new measures towards this end (Table C1). A major initiative was the announcement of the "supply-side reform" in November 2015, which highlighted deleveraging as one of the five major reform goals. In October 2016, the State Council issued a guidance note which outlined seven main measures to promote corporate deleveraging, namely, promoting M&A, strengthening corporate governance, increasing asset liquidity, optimizing debt structure, carrying out debt-for-equity swap programs, allowing liquidation pursuant to the law and further developing equity financing. The State Council highlighted that deleveraging ought to be market-led and undergirded by legal regulation. Meanwhile, the authorities have attempted to improve coordination amongst themselves by establishing an inter-ministerial joint meeting system and providing supportive measures related to employment and tax, among others.

Table C1: Policy Measures to Curb Corporate Debt

	Time	Main Content
De-leverage	Nov 2015	Introducing supply-side reform with lower leverage as one of the major goals
	Jul 2016	Further encouraging equity and bond market development as sources of financing
	Aug 2016	Reducing costs for enterprises by cutting tax and fees, strengthening financing guarantees, optimizing commercial bank evaluation and supervision, encouraging equity financing and promoting the use of low-cost overseas capital
	Oct 2016	Reducing leverage through promoting M&A, revitalizing stock assets, optimizing debt structures, carrying out debt-for-equity swap programs, and further developing equity financing
	Oct 2016	Establishing an inter-ministerial joint meeting system to actively and steadily reduce enterprise leverage
	Dec 2016	Encouraging diversification of financing channels through the use of PPP and Asset-backed securities (ABS) to improve capital efficiency
	Mar 2017	Establishing a long-effect bond credit risk management mechanism and system
SOE Reform	2013	• Deciding to actively develop a diversified ownership economy • Allowing more state-owned enterprises and other-ownership enterprises to be developed into mixed-ownership enterprises • Allowing non-state shares in state capital investment projects • Improving management and strengthening supervision of state-owned assets • Establishing a number of state-owned capital operating companies and promoting the transformation of qualified state-owned enterprises into state-owned investment companies
	2015	Deepening state-owned enterprises reform by publishing guidelines to reorganize and restructure certain SOEs into becoming long-term, sustainable pillars of the Chinese economy.
	March 2017	Further promoting mixed ownership reform for firms involved in electric power generation, petroleum and natural gas production, railways and civil aviation construction, telecommunications, and defense

Appendix A: Literature Review on China's Corporate Debt and Related Issues

	Paper	Estimate (% of GDP, as of the end-2015)	Data	Note
Aggregate NFC Debt	IMF (July 2016) Staff Report for the 2016 Article IV Consultation	126% (120% for domestic, 6% for external) when excluding LGFV; 144% when including LGFV	• CEIC; CMOF	• LGFV (17% of GDP) consisted of two parts: 4% with "likely to be recognized" (based on the historical recognition ratio) and 13% with "unlikely to be recognized"
	BIS (June 2016) "Credit to non-financial sector" Dataset	170.8%, including LGFV	• PBC; IMF	• Credit to non-financial corporations: 1) domestic bank credit, 2) cross-border credit from non-resident banks, and 3) non-bank financing (estimated from PBC's Aggregate Financing of the Economy data): comprising entrusted and trust loans extended by non-bank financial institutions, corporate bonds issued in the domestic bond market, and others (including compensation payments by insurance companies, financing from Investment Real Estate, and loans by micro-lending companies and lending companies).
	McKinsey Global Institute (June 2016) "China's Choice: Capturing the $5 Trillion Productivity Opportunity"	136%, excluding LGFV	• PBC	• Sectoral breakdown available (7 categories): Heavy Manufacturing, Wholesale and Retail, Property and Construction, Transport, Light Manufacturing, Energy and Utilities, and Others.
	Bloomberg Intelligence (2016)	165.1%, including LGFV	• PBC; China Bond; BIS	• Bloomberg Ticker "CHBGDCO Index DES<GO>" • Includes bank loans, corporate bonds, shadow finance and offshore borrowing.
	Chinese Academy of Social Science (June 2016)	131%, excluding LGFV; 156%, including LGFV	• N.A.	• http://www.reuters.com/article/us-china-economy-debt-idUSKCN0Z10GW
	Standard Chartered (May 2016) "*China – Kicking the Debt Addiction*"	122%, excluding LGFV, but including the debt of the China Railway Corporation	• CEIC	• Also conducted simulations on China's total debt-to-GDP trajectory under three scenarios (Partial reform; No reform; Swift reform)
	Morgan Stanley (July 2016) China Economic Summer Outlook	183%	• CEIC; Haver	• N.A.
	Zhang (2016, WP/16/183) "*Rebalancing in China – Progress and Prospects*"	N.A.	• CEIC; BIS; IMF	• Provides the definition of rebalancing and the indicators. • Conducts simulations on growth and private debt-to-GDP ratio under rebalancing scenarios

	Paper	Key Takeaway	Methodology	Data / Classification	Key Indicator
Corporate Debt Risk	Chivakul and Lam (2015, IMF WP/15/72) "*Assessing China's Corporate Sector Vulnerabilities*" Also cited in IMF GFSR (Oct 2015, "*Corporate Leverage in Emerging Markets – A Concern?*" & Box 3.3 "*Corporate Leverage in China*")	• While China's corporate leverage on average is not high, there is a fat tail of highly leveraged firms accounting for a significant share of total corporate debt, mainly concentrated in the real estate and construction sector and SOEs. • The sensitivity analysis suggests that the share of debt that would be in financial distress would rise to about a quarter of total listed firm debt in the event of a 20 percent decline in real estate and construction profits.	• Financial statement analysis, focusing on firms' distributions with quintiles • Panel regressions • Sensitivity analysis	• WIND • Nonfinancial firm data, including all Chinese firms listed in Shanghai, Shenzhen and HK (2,571 nonfinancial firms) • From 2003 to 2013 • By Industry (based on CSRC industry classification – 13 industries) • By Ownership • By Geographical location	• Overall trend: Total liabilities, Total assets, Market capitalization • Leverage = Total liabilities (loan, debt, trade credit, account payables, and others) / Common equity [main measure], or Total debt (outstanding balance of bonds and loans) / Common equity • Profitability = EBIT / Total assets • Interest Coverage Ratio • Effective Interest Rate = Annual interest payment / Total debt
	IMF GFSR (Apr 2016, Ch.1) "*Potent Policies for a Successful Normalization*" (p.13-20) & Annex 1.1 "*China: Corporate Loans Potentially at Risk*"	• China's corporate balance sheet health has deteriorated and weak corporate health increases risks in financial markets. • Corporate weakness is mirrored in rising bank vulnerabilities. • China's debt-at-risk ratio (share of firms with interest coverage ratio less than 1) amounts to about 15 percent in 2015.	• Financial statement analysis • Sensitivity analysis	• S&P Capital IQ database • 2,871 nonfinancial firms (2,607 listed, 264 unlisted) • By Industry (12 sectors)	• Corporate vulnerability: "Debt-at-Risk" ratio = $\dfrac{\sum Borrowing\ of\ companies\ with\ ICR<1}{\sum Borrowings\ of\ all\ companies\ in\ the\ sample}$ where higher ICR thresholds also used: ICR<1.5 or 2; omitted bank exposures, such as policy banks and shadow products.
	Natixis (May 2016) "*China's Corporate Leverage: The Tale of Beauty and the Beast*" (Based on "*China Corporate Debt Monitor*", its first annual report on	• China's companies are heavily weighted towards old industry sectors in terms of asset size (vs. global peer group). • Chinese companies are more vulnerable than global peers and debt is concentrated in large companies, especially private. • Divergence in China's corporate health set to continue as growth in new industry sectors outpaces the old • Current monetary and fiscal stimulus may ease problems in the old	• Financial statement analysis using six indicators for financial vulnerability	• Bloomberg; CEIC; DataStream • 3,000 largest, nonfinancial Chinese companies – based on asset size - listed domestically and internationally, compared with global peers (ex-China companies)	• Leverage = Total liability / Common Equity • Funding Risk = Short term / Total liabilities • Repayment = EBITDA* / Interest Expense * Earnings Before Interest, Taxes, Depreciation and Amortization • Interest Burden = Interest Expense / Total debt • Tax = Effective tax rate

	Paper	Key Takeaway	Methodology	Data / Classification	Key Indicator
Corporate Debt Risk (Cont'd)	China's corporate health)	industries, but as China rebalances, old industry revenues will never regain their original levels • A wholesale restructuring of old industry sectors seems unavoidable		• By "Old China" (investment-driven) vs "New China" (consumption-driven) • By Ownership • By Company size (100 largest versus full sample); • By industry (14 sectors)	• Profit Margin = Net income / Revenue
	Zhang et al. (2015, HKIMR wp No.10) "*Corporate Leverage in China: Why has It Increased Fast in Recent Years and Where do the Risks Lie?*"	• China's corporate sector does not appear over-leveraged in aggregate, but some industries (real estate and over-capacity sectors) and SOEs have increased leverage. • SOE's leveraging has been mainly driven by implicit government support amid lower funding costs. • NFC credit intermediation activities – entrusted loans - not only add risks to banks' asset quality but also mislead policy makers as headline figures in credit expansion would overstate credit allocated to the real economy.	• Financial statement analysis • Using corporate finance model to conduct a counter-factual analysis for corporate funding costs • Panel regressions	• Bloomberg • Listed firm data • Covers 2003-2013 • By industry, using the official report (State Council 2013 Document No.41) to identify the industries with substantial overcapacity problems • By ownership (classified as SOEs if the state ownership exceeds 50%)	• Leverage = debt-to-asset ratio • Entrusted lending announced by listed firms in 2013
	Yu and Lu (2016, China & World Economy) "*China's Nonfinancial Corporate Debt Dynamics*"	• The study simulated the trajectories of China's corporate debt-to-GDP ratio and found that China's NFC debt-to-GDP ratio will continue to rise without converging to a limit if current trends in capital efficiency, corporate profitability and financing costs are not reversed • Against the intuition of most economists, higher economic growth will not help China to escape the corporate debt trap. On the contrary, it will worsen China's corporate debt problem • To avert a corporate debt crisis, China needs to speed up its structural reform and change the growth paradigm so as to enhance capital efficiency and firms' profitability while reducing firms' financing costs.	• Dynamic model simulation	• NBS; WIND; PBC • Macro aggregate data (Gross fixed capital formation, the fixed assets price index, CPI, GDP, the GDP index) for 1952-2014 • Companies' annual report data for A- listed companies on the Shanghai and Shenzhen Stock Exchanges for 1990-2014, (excluding financial firms, special treatment and particular transfer companies) • Total social finance for 2002-2014.	6 variables to determine China's corporate debt-to-GDP: • Growth rate of the economy • Capital-output ratio • Profitability prior to interest payment (= EBIT margin) • The average interest rate • Share of equity finance to total output • Inflation

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	Paper	Key Takeaway	Methodology	Data / Classification	Key Indicator
Corporate Debt Risk (Cont'd)	UBS (June 2016) "*Shadow Loan Books, WMPs and a Rmb1trn Capital Hole*"	• The credit exposures in banks' TBRs and DAMPs are estimated at RMB12.6trn in 2015, equivalent to 16% of commercial bank loans.	• Descriptive statistical analysis	• Financial information of 156 banks across China	• Total TBRs and DAMPs
	Financial Times (July 14, 2016) FT Confidential Research "*Preparing for the Storm amid Shadow Finance Calm*"	• Although core shadow finance segments are shrinking, non-core segments incl. DAMPs are expanding rapidly, helping drive the high growth of investment receivables on bank balance sheets.	• Descriptive statistical analysis	• WIND; China Central Depository & Clearing Company	• DAMPs, TBRs, and WMPs
	Chen, Ren and Zha (2016, NBER wp No.21890) "*What We Learn from China's Rising Shadow Banking: Exploring the Nexus of Monetary Tightening and Banks' Role in Entrusted Lending*"	• China's rising shadow banking was inextricably linked to potential balance-sheet risks in the banking system. • The study shows these findings by constructing a comprehensive transaction-based loan dataset, providing robust empirical evidence, and developing a theoretical framework to explain the linkages between monetary policy, shadow banking, and traditional banking (the banking system) in China.	• Regression analysis • Equilibrium model analysis	• WIND • Comprehensive micro transaction-based dataset on entrusted loans • Covers 2007-2013 • By types of loans: risky (real estate industry and 18 overcapacity industries identified by China's Ministry of Industry and Information Technology) vs. non-risky	• Entrusted loans, on which database was constructed by merging i) entrusted-loan announcements, ii) firms' annual reports and iii) banks' annual reports.

Source: AMRO Staff Summary

Appendix B: Total Corporate Debt Estimates

Total corporate debt in China is estimated using data from a number of sources, including the PBC for data on total social financing, MOF for data on government debt and Bloomberg for data on external corporate debt. Total corporate debt is then calculated as the sum of 1) outstanding bank loans to corporates, 2) outstanding shadow banking loans to corporates, 3) outstanding domestic corporate bonds, and 4) outstanding foreign currency corporate debt (borrowings and bonds).

Official data only reports outstanding non-household bank loans and non-household shadow banking loans in Total Social Financing (TSF). As such, to arrive at outstanding bank loans to corporates and outstanding shadow banking loans to corporates, outstanding local government bank loans and local government shadow banking loans need to be estimated and deducted from outstanding non-household bank loans and non-household shadow banking loans. The steps involved in the estimation of corporate debt are as follows:

(a) Local government debt is divided into three parts. Of the three, data on local government bank loans and local government shadow banking loans are not available:

Local government debt **=**

> Local government bond **+**
> **Local government bank loans (?) +**
> **Local government shadow banking loans (?)**

(b) Local government bank loans and local government shadow banking loans are estimated by assuming that the ratio of local government bank loans to local government shadow banking loans is equivalent to the ratio of total non-household bank loans to total shadow banking loans, or **R1=R2**, where

$$\textbf{R1:} \quad \frac{\text{Total non-household bank loans}}{\text{Total shadow banking loans}} \qquad \textbf{R2:} \quad \frac{\textcolor{red}{\text{Local government bank loans}}}{\textcolor{red}{\text{Local government shadow banking loans}}}$$

As R1 can be calculated from official data, this assumption allows us to estimate local government bank loans and local government shadow banking loans.

(c) Based on our estimates of local government bank loans and local government shadow banking loans, corporate loans and corporate shadow banking loans can then be computed using the following equations:

Corporate loan = Total non-household bank loans - Local government bank loans
Corporate shadow banking loans = Total shadow banking loans - Local government shadow banking loans

Finally, data for outstanding domestic corporate bonds is obtained from data on total social financing while data on outstanding foreign currency corporate debt is obtained from Bloomberg.

Corporate loans +	
Corporate shadow banking loans +	
Corporate bonds +	**= Corporate debt**
Corporate overseas borrowings	

As for LGFV debt, the authorities have classified part of it as local government debt and the rest is classified as corporate debts as the latter is on a commercial basis and not explicitly guaranteed by the provincial government. The estimate of total LGFV debts varies across different studies, ranging from 18% of GDP (IMF) to 24% of GDP (CASS). In our estimates, LGFV debt under the local government consists of bank loan and shadow banking borrowing, which accounts for about 6 % of GDP as of 2016 as shown in Table B.1. By subtracting these LGFV debts (6% of GDP) from the total LGFV debt (18-24% of GDP), the rest of LGFV debt under the corporate debts is around 12-18% of GDP.

Table B.1: Overall Debt Structure in China

			% of GDP	
			2010	2016
Central Gov. Bond			16.4	16.1
Local Gov. Debt			16.2	20.6
	Bond		1.0	14.3
	Bank Loan	LGFV debt in local gov. debt: 6% of GDP	12.9	5.2
	Shadow Banking		2.4	1.1
		Entrusted Loans	1.0	0.6
		Trust Loans	0.4	0.3
		Banker's Acceptance Bill	1.1	0.2
Household Loan			27.2	44.3
Corporate Debt			112.0	155.5
	Overseas Borrowing		3.9	5.7
	Bond	LGFV debt in corporate debt: 12-18% of GDP	9.2	24.1
	Bank Loan		79.0	95.4
	Shadow Banking		19.9	30.3
		Entrusted Loans	7.9	17.1
		Trust Loans	3.3	8.2
		Banker's Acceptance Bill	8.8	5.1
Total			171.8	236.5

Source: AMRO

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Appendix C: Classification of Sectors

In this report, firms are classified into seven main sectors (Table C.1), with each sector consisting of one or more CSRC sectors. Global firms in the S&P data set are also mapped to the seven sectors correspondingly. Real estate is kept distinct from construction, as the two sectors have quite different characteristics in terms of profit margins. As well, a large proportion of construction firms engage in transport and utility projects and not real estate. The CSRC "Integrated" sector is excluded as it cannot be adequately mapped to a corresponding sector. Two sub-sectors are highlighted in this report, namely steel, a sub-sector of manufacturing, and energy, a sub-sector of mining.

Table C.1: The Seven Sectors and Their Definitions

Seven sectors used in this study			Corresponding CSRC sector for Chinese-listed companies (based on WIND fields: CSRC)	Corresponding S&P rated classifications (based on Bloomberg fields)
1. Manufacturing			Manufacturing	Industry_sector level 1=Industrial and Industry_sector level 2 excludes Transportation & Logistics; Railroad
	Steel		CSRC level 1 = Manufacturing and CSRC level 2 = Ferrous metal smelting and rolling processing industry	Industry_subgroup= Steel-Producers.
2. Mining			Mining	Industry_sector= Energy; Basic Materials.
	Energy		CSRC level 1 = Mining and CSRC level 2 = Coal mining; oil and gas	Industry_sector= Energy;
		coal	CSRC level 2 = Coal mining	
3. Real estate			Real estate	Industry_subgroup = Real Estate Oper/Develop.
4. Construction			Construction	Industry_subgroup = Building-Heavy Construct; Bldg-Residential/Commer; Building&Construct-Misc; Building-Maint&Service; Bldg-Mobil Home/Mfd Hous.
5. Transport			Transport, Storage & Postal Service	Industry_sector level 2 = Transportation & Logistics; Railroad
6. Utilities			Electricity, Gas & Water Production & Supply	Industry_sector= Utilities.
			Water Conservancy, Enviro & Public Utility Management	
7. Services	**Services: other**		Wholesale & Retail Trade	Industry_sector= Consumer, Cyclical; Consumer, Non-cyclical; Technology.
			Accommodation & Catering Trade	
			Info Transmission, Computer Service & Software	
			Health Care, Social Security & Welfare	
			Resident & Other Service	
			Education	
			Culture, Sport & Recreation	
			Science Research, Polytech Service & Geological Prospect	
Excluded sectors			Leasing & Commercial Service	NA.
			Farming, Forestry, Animal Husbandry & Fishery	NA.
			Integrated (CSRC level 1) or "unclassified"	NA.

Appendix D: Estimation of Corporate Debt for each Sector

Micro-level and macro-level data are obtained from various sources and aggregated based on several assumptions. Where data was incomplete, certain assumptions had to be made to consolidate and aggregate the data**.** In summary:

a) The onshore RMB bond market[47] provides the most granular data, thus sector data is obtained through the aggregation of individual bonds by companies in that sector (Appendix D1);

b) Financial statements of the large commercial banks provide relatively complete data with sector breakdowns (Appendix D3);

c) The loans of all commercial banks to each sector is estimated using CBRC data;

d) The loans of the smaller banks to each sector is estimated based on the difference between the exposure of all commercial banks and that of large banks to a particular sector;

e) The China Trustee Association (CTA) provides sector breakdowns for trust loans. In assuming that the sector breakdown is the same for other types of shadow banking activities, we are able to estimate the sector breakdown for shadow banking (Appendix D4).

Data is only aggregated if they are mutually exclusive to each other to avoid double counting. Points a, b, d and e above are mutually exclusive to each other and can be summed up in the estimation of total credit to each corporate sector. While the sector breakdown of wealth management products (WMP) is available from Chinawealth.com, we have excluded WMP from the aggregation to avoid double counting as these products often invest in corporate bonds and shadow banking products.

Appendix D1 Onshore bonds

Basic information on onshore RMB bonds is obtained from WIND. If the date is later than the bond's carry date but earlier than the bond's maturity date, the bond's outstanding amount is taken to be equivalent to the issued amount. Otherwise, the outstanding amount is set to zero. The field names and names of the WIND tickers are given in Table D1.1.

Table D1.1: WIND Bond Data for Onshore RMB Corporate Bonds

Field name	Field code	Data source
Amount issued	b_info_issueamount	
Carry date	b_info_carrydate	
Maturity date	b_info_maturitydate	
CSRC industry classification	s_info_industry_csrc12	WIND
Ownership profile (SOE, private, etc.)	s_info_nature	
Listed market (interbank, Shanghai Exchange, etc.)	Listedmkt	
Coupon Rate	b_info_couponrate	

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[47] We do not include onshore foreign currency bonds in the analysis as the size is negligible.

We discard all observations if data is incomplete, that is if the industry classification, carry date or maturity date is missing. We also discard all observations that are classified under "Integrated", "Farming, Forestry, Animal Husbandry & Fishery". Table D1.2 summarizes the breakdown of our sample of onshore bonds, which consists of 24,980 observations.

Table D1.2: Onshore RMB Corporate Bonds: Sample Size

Sectors	CSRC sectors\Ownership	Central SOE	Local SOE	Private	Other	Sum
1. Manufacturing	Manufacturing	1,440	2,365	2,337	667	6,809
2. Mining	Mining	375	1,268	177	49	1,869
3. Real estate	Real Estate	93	1,284	277	381	2,035
4. Construction	Construction	434	4,592	356	90	5,472
5. Transport	Transport, Storage & Postal Service	543	1,694	47	154	2,438
6. Utilities	Electricity, Gas & Water Production & Supply	1,482	1,057	80	341	2,960
	Water Conservancy, Enviro & Public Utility Mgt	68	514	34	26	642
7. Services	Leasing & Commercial Service	56	213	94	128	491
	Wholesale & Retail Trade	300	738	349	145	1,532
	Accommodation & Catering Trade	-	41	20	2	63
	Info Transmission, Computer Service & Software	133	27	54	28	242
	Health Care, Social Security & Welfare	1	14	1	-	16
	Resident & Other Service	35	80	4	6	125
	Education	-	5	1	13	19
	Culture, Sport & Recreation	9	195	30	7	241
	Sci Research,Polytech Ser & Geological Prospect	8	5	11	2	26
Sum		4,977	14,092	3,872	2,039	24,980

Source: WIND and AMRO staff calculations

Based on the data collected, Figure D1.1 show the estimate of credit provided by the RMB bond market to each sector.

Figure D1.1: Onshore RMB Bond Market Outstanding by Sector
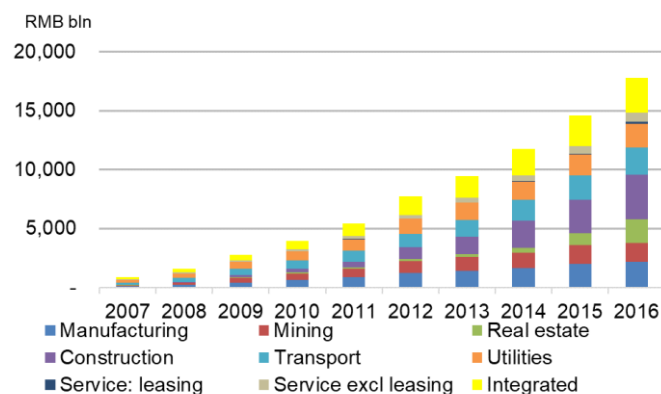
Source: WIND and AMRO staff estimates

Appendix D2 Offshore bonds

Offshore bonds are included only if they are issued by entities whose ultimate parents are Chinese entities. For each bond, the actual maturity date is estimated based on the issue date, scheduled maturity date and maturity type[48]. Then, similar to what was done for onshore bonds, the bond's outstanding amount is computed based on whether the date is later than the bond's carry date and earlier than the bond's estimated maturity date. The field names and names of the Bloomberg tickers are given in Table D2.1.

Table D2.1: Bloomberg Bond Data for Chinese Offshore (Overseas) Corporate Bonds

Field name	Field code	Data source
Amount issued	No code required	
Currency	CRNCY	
Country of the ultimate parent	CNTRY_OF_RISK	
Issue Date	ISSUE_DT	
Maturity	MATURITY	
Maturity Type	MTY_TYP	Bloomberg
Coupon Type	CPN_TYP	
Bloomberg industry classification level 1	BICS_LEVEL_1_NAME	
Bloomberg industry classification level 2	BICS_LEVEL_2_NAME	
Credit Spread	OAS_SPREAD_BID	

Observations with missing or incomplete data are discarded. Our final sample contains 1,198 observations (Table D2.2).

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[48] As some bonds are callable or puttable, the actual maturity dates will need to be estimated as they will differ from the scheduled maturity dates.

Table D2.2: Chinese Offshore Corporate Bonds: Sample Size

Sector\Currency	USD	HKD	Other	Sum
Manufacturing	113	14	19	146
Utilities	83	5	14	102
Real Estate	288	23	7	318
Energy	195	13	19	227
Consumer Discretionary	91	26	21	138
Consumer Staples	22	10	5	37
Communications	40	2	-	42
Health Care	12	3	1	16
Materials	88	15	15	118
Technology	39	14	1	54
Sum	971	125	102	1198

Note: The sectors listed in the table above corresponds to Bloomberg's Level 1 classification of industry sectors which is different from the seven sector classification outlined in this report.
Source: Bloomberg and AMRO staff calculations

Appendix D3 Bank loans

Overall bank loans by sector

Total bank loans by sector is provided by CBRC, whose sector breakdown is broadly similar to CSRC's sector classification.

Bank loans of the five largest banks

The five largest commercial banks in China are: ICBC (Industrial and Commercial Bank of China), CCB (China Construction Bank), ABC (Agricultural Bank of China), BOC (Bank of China), BOCom (Bank of Communications). The sector breakdown of loans is obtained from WIND, which compiles information based on the banks' financial statements. The sector classifications used in the financial statements of these five banks are largely consistent with each other, and also with CSRC.

Bank loans of the smaller banks

To arrive at the loans of the smaller banks to each sector, bank loans of the five largest banks are subtracted from overall bank loans.

Appendix D4 Shadow banking

Shadow banking loans to each sector

Sector information for trust loans is obtained from the China Trustee Association[49], whose industry classification is broadly similar to that of CSRC. As our focus is only on credit to non-financial corporates, credit to the finance industry is excluded. Based on the data collected, we estimate the percentage share of trust loans to each sector.
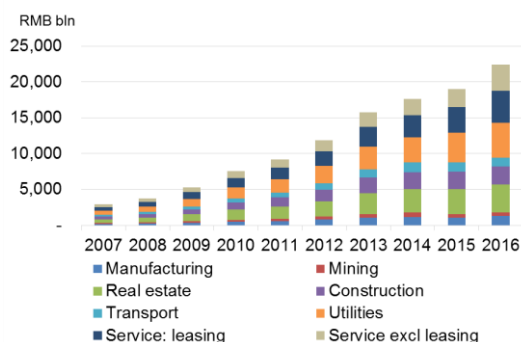
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[49] www.xtxh.net.

Figure D4.1: Shadow banking loans

Figure D4.2: Shadow banking loans by Sector
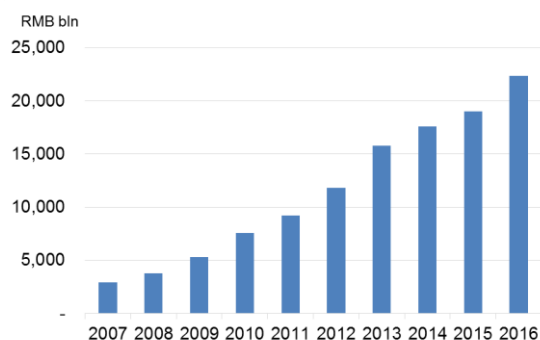
Source: PBC and AMRO staff estimates

Source: PBC, China Trustee Association and AMRO staff estimates

At any period, the share of credit to each sector for the entire shadow banking industry is assumed to be identical to that of trust loans. As China Trustee Association only provides sector breakdown since Q3 2014, therefore, we assume that the share of credit to each sector prior to Q3 2014 is the same as Q3 2014 in year. Therefore, based on the shares calculated this way and the total amount of estimated shadow banking loans using data from PBC (Figure D4.1), credit provided by the shadow banking industry to each corporate sector is estimated (Figure D4.2).

Other information related to shadow banking

Information on the 26 listed banks' investments in loans and receivables, which are shadow banking products, is obtained from their annual financial statements.

Data on wealth management products (WMP) is obtained from www.chinawealth.com.cn.

Appendix E: Treatment of Firm-level Data

Appendix E1 Summary of different samples

Table E1.1: Summary of Sample Sizes and Data Availability from Different Sources

Sample			Chinese-listed companies	NBS data for industrial companies	Global rated companies
Sample size	Total		2,124	383,148	2,017
	Manufacturing		1,310	-	290
		Steel	32	101	26
	Mining		67	-	425
	Energy		48 (coal, oil and gas) 27 (coal)	5,924 (coal)	228 [2]
	Utilities		188	1,766(Water) 7,346 (Electricity) 1,508(GAS)	173
	Real estate		130	94,948	75
	Construction		60	80,911	38
	Services		331	-	883
	Other		37	-	171
Leverage (reverse)	Asset to Debt		✓		✓
	Asset to Liability		✓	✓	✓
Efficiency	Return on Asset		✓		✓
	Profit Margin [1]		✓	✓	✓
Debt repayment capacity	EBIT to Interest		✓	Estimated	✓
	EBIT to Debt		✓		✓
Cash buffer	Cash to liability ratio		✓		✓

Note: (1) For Chinese-listed companies, the profit margin is calculated as gross profit/revenue. For global rated companies, profit margins are estimated using pre-tax income/revenue. For the NBS sample, the profit margin is defined by NBS.
 (2) There are only two S&P BB-rated companies that are coal mining companies, therefore, all S&P BB-rated energy companies are included in our sample for energy.

Appendix E2 Chinese-listed companies under study

Our sample includes firms listed in Mainland China just before the end of 2010, as this enables us to study the change in financial ratios from 2010 to 2016. For financial ratios between 2008 to 2009, firms that are just listed in these two years would show some missing information, and we take the median values of the financial ratios of firms with available information[50].

Most financial information is obtained from WIND but data on total debt and interest expenses are sourced from Bloomberg. The Bloomberg and WIND information is then merged with the firm's unique ISIN ID.

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[50] Another option is to include firms listed in Mainland China just before the end of 2008 instead of 2010, but that would greatly reduce the overall sample size.

Table E2.1: Data for Chinese-listed Firms

Field name	Field code	Data source
CSRC industry classification	s_info_industry_csrc12	WIND
Ownership profile (SOE, private, etc.)	s_info_nature	
Asset	s_stm07_bs(w45407132)	
Short-term liability	s_stm07_bs(w44562180)	
Total liability	s_stm07_bs(w47401840)	
Cash	s_stm07_bs(w47306417)	
Earnings before interest and taxes	s_fa_ebit	
Debt to asset ratio	s_fa_debttoassets	
Receivables	s_stm07_bs(w49136781)	
Liquid asset	s_stm07_bs(w43687060)	
Return on asset	s_fa_roa2	
Revenue	s_fa_or_ttm	
Overall margin	s_fa_ebit/ s_fa_or_ttm	
Total debt	short_and_long_debt	Bloomberg
Interest expense	IS_INT_EXPENSE	

Appendix E3 S&P's rated global universe

This sample includes all firms with a valid long-term local currency rating assigned by S&P. This is because Chinese firms' debt is mostly in local currency and the long-term rating is considered to be more stable. By examining the change in the financial ratios of a firm with the same rating over the 2008-2016 period, we are able to gauge the cyclical dynamics affecting the financial ratios of global peers.

Table E3.1: Data for Global Firms Rated by S&P

Field name	Field code	Data source
Industry sector level 1	INDUSTRY_SECTOR	Bloomberg
Industry sector according to GICS standard	GICS_INDUSTRY_GROUP_NAME	
Industry classification level 2	INDUSTRY_SUBGROUP	
Asset	BS_TOT_ASSET	
Earnings before interest and taxes	EBIT	
Debt	SHORT_AND_LONG_TERM_DEBT	
Return on asset	RETURN_ON_ASSET	
Operating margin	OPER_MARGIN	
Interest expense	IS_INT_EXPENSE	
Debt to Asset ratio	TOT_DEBT_TO_TOT_ASSET	
Overall profit margin	PROF_MARGIN	
Liabilities	BS_TOT_LIAB2	
Cash or near cash items	BS_CASH_NEAR_CASH_ITEM	
S&P long term rating, local currency	RTG_SP_LT_LC_ISSUER_CREDIT	S&P

Appendix F: Debt Simulation Model and Data description

F1 Model

Motivated by Yu and Lu (2016), China's corporate debt (D) grows by the amount of investment (I) unfilled by equity financing (X) and corporate profits (Ω) :

$$dD/dt = I - X - \Omega \tag{1}$$

where corporate equity financing

$$X = q \times PY \qquad (q: \text{equity financing share to nominal GDP})$$

and corporate profits after interest payment

$$\Omega = \omega \times PY - r \times D \qquad (\omega: \text{profitability ratio}, \ r: \text{interest rate})$$

We decompose investment into 'SOE' and 'private'-type firms characterized with different investment-decision behaviors: $\quad I = I_{soe} + I_{prv} \tag{2}$

- 'SOE' investment : strongly binding with government growth targets (n)

$$I_{soe} = z_{soe} \times [v \times n \times PY] \qquad (z_{soe}: \text{SOE investment share}, \ v: \text{capital-output ratio})$$

- 'Private' investment: binding with growth targets, but also considers market factors, such as interest rate (r) and uncertainties (uc)

$$I_{prv} = (1 - z_{soe}) \times [v \times n \times \exp(\alpha \cdot r + \delta \cdot uc) \times PY]$$
$$(\alpha, \ \delta: \text{Elasticities to interest and uncertainties})$$

Combining (1)-(2) yields the debt-to-GDP dynamic relation:

$$\frac{d\left(\frac{D}{PY}\right)}{dt} \equiv \frac{d\beta}{dt} = k_1 \times [v \times n \times \{z_{soe} + (1 - z_{soe})\exp(\alpha \cdot r + \delta \cdot uc)\} - q - \omega + (r - n - \rho) \times \beta]$$

where k_1 a scaling factor to calibrate with real data.

Our model extension with two firm types (SOE and Non-SOE) allows us to experiment on the debt-to-output ratio for each sector with several policy variables as well as different structural environments:

- Policy variables: growth target (n), inflation rate (ρ), interest rate (r)
- Economic structure: capital efficiency (v), share of SOE firms/private firms (z_{soe}), profitability (ω), degree of market-driven investment decisions ($\alpha, \ \delta$)
- Financial development: degree of equity financing (q)

F2 Data Description

Macro and financial data are obtained from the official sources:

- Growth target (n) : The Chinese government's growth targets
- Inflation rate (ρ) : CPI inflation rate
- Interest rate (r) : 1-year nominal lending rate
- Investment share of 'SOE' firms (z_{soe}) : Fixed asset investment share
- Equity financing : Non-financial corporate equity financing, newly raised during the year

Some data are constructed from the existing data:

- Capital efficiency (v) : Capital stock-to-output ratio, estimated by Wu (2015)
- Firm's profitability (ω) : Listed firms' EBIT margin, using the WIND data
- Market uncertainty (uc) : Annualized standard deviation of monthly Shanghai stock returns
- Degree of market-driven investment decisions ($\alpha = -1.17,\ \delta = -0.19$) : investment elasticity to interest and uncertainty, estimated from regressions

Appendix G: Supplements to Debt Simulation

G1 Debt Simulations Under Alternative Growth and Interest Rate Scenarios

First, with the goal of assessing the sensitivity of the corporate debt-to-GDP ratio to growth targets, we conduct simulations under alternative growth trajectories, including high and low growth paths as shown in Figure G1.1. Our simulation results (Figure G1.2) suggest that a higher growth target is likely to fuel a faster increase in the debt-to-GDP ratio as debt will rise much faster than GDP under the growth target-led investment structure.

Figure G1.1: Alternative Scenarios for Real GDP Growth
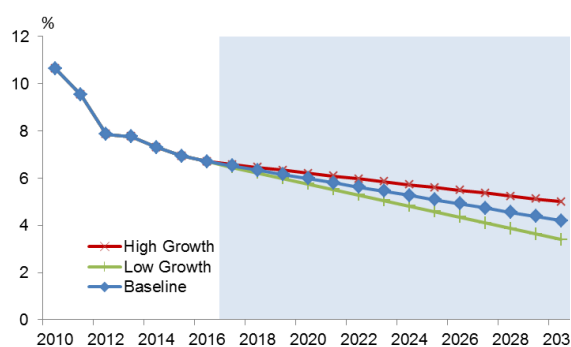
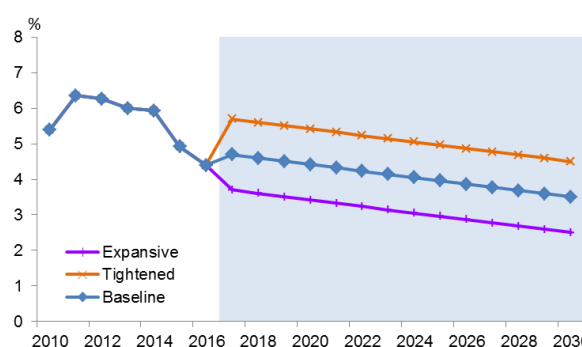Note: SOEs include State Owned & Holding Enterprises
Source: NBS

Figure G1.2: Corporate Debt-to-GDP Simulations Under Alternative Growth Scenarios
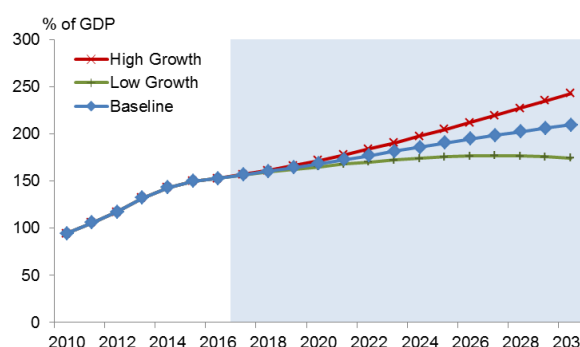
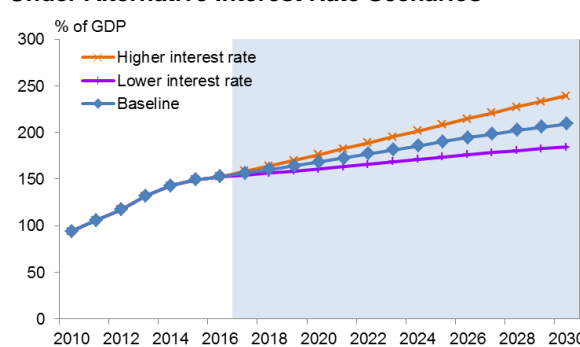Note: SOEs include State Owned & Holding Enterprises
Source: NBS

Next, our simulation under alternative interest rate scenarios (Figure G1.3) suggests that a higher interest rate is likely to lead to higher debt-to-GDP ratios (Figure G1.4) due to firms' higher interest burden, which erodes earnings and increases debt-financing dependence.

Figure G1.3: Alternative Interest Rate Scenarios

Note: SOEs include State Owned & Holding Enterprises
Source: NBS

Figure G1.4: Corporate Debt-to-GDP Simulations Under Alternative Interest Rate Scenarios
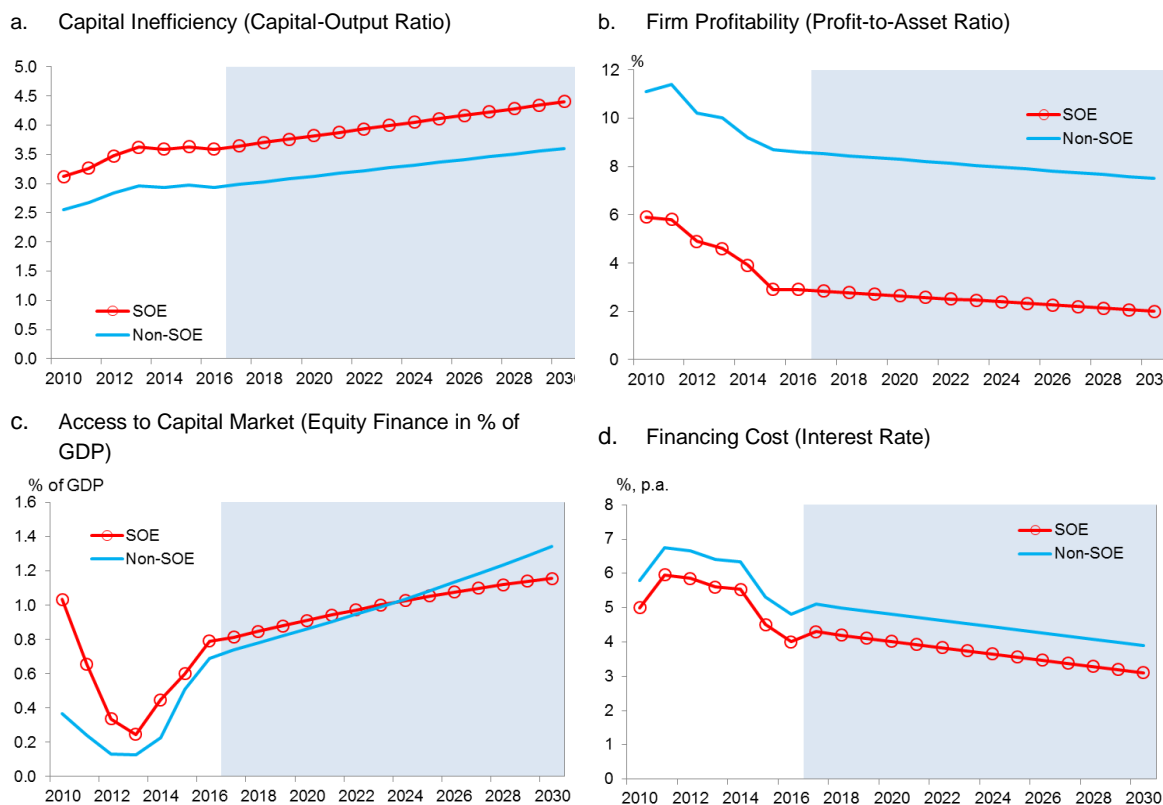

Note: SOEs include State Owned & Holding Enterprises
Source: NBS

G2 Key Parameter Assumptions for SOE and non-SOE Debt to Output Simulation

The simulations for the SOE and non-SOE debt to output ratios require further specification and calibration for both types of firms. Firm profitability and equity finance ratios are estimated from existing data by NBS and WIND. However, due to the limited availability of sectoral data, we rely upon some plausible assumptions for the other key parameters. For instance, in the absence of sectoral capital-

output ratio data, we assume that those of SOE and non-SOE are equivalent to 110 percent and 90 percent of the aggregate, respectively. Moreover, reflecting the practice that banks' do offer preferential lending rates to SOE, we differentiate the cost of borrowing by ownership. Figure G2.1 summarizes key parameter values by ownership over time for the baseline case. Note that due to sectoral data limitations, the precision of our simulation results may be subject to more uncertainty.

Figure G2.1: Key Parameters By Ownership Under the Baseline Scenario

a. Capital Inefficiency (Capital-Output Ratio)

b. Firm Profitability (Profit-to-Asset Ratio)

c. Access to Capital Market (Equity Finance in % of GDP)

d. Financing Cost (Interest Rate)

Source: AMRO staff estimates

G3 Sensitivity Analysis of the Upside Scenario Components on Debt Ratios

Figure G3.1: Marginal Effects of Improving Capital Efficiency on Debt Ratios
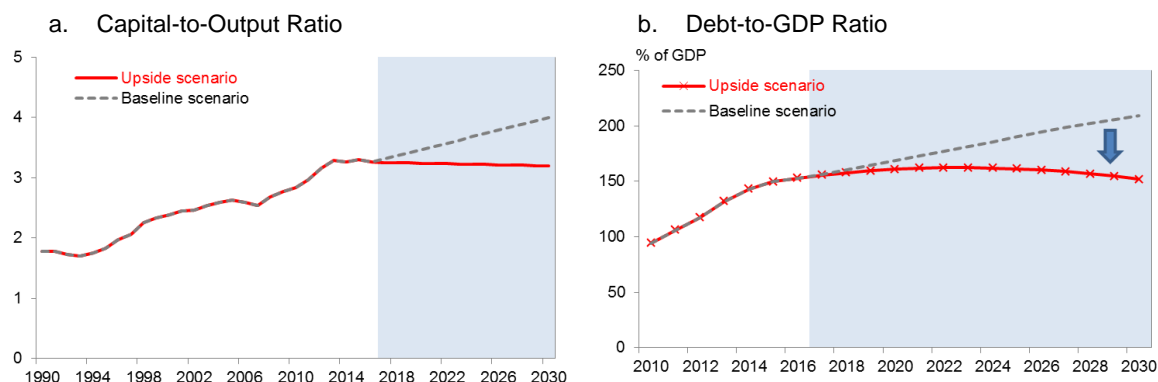
a. Capital-to-Output Ratio

b. Debt-to-GDP Ratio

Note: To calculate the marginal effects, the capital-to-output ratio is assumed to follow the trajectory under the Upside scenario, while all other parameters are set to the Baseline scenario.
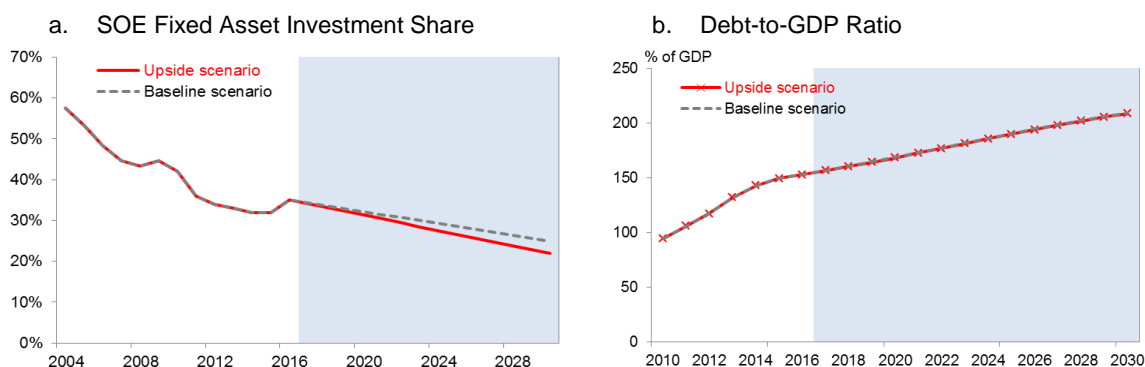
Source: AMRO Staff Estimates

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Figure G3.2: Marginal Effects of Improving Firm Profitability on Debt Ratios
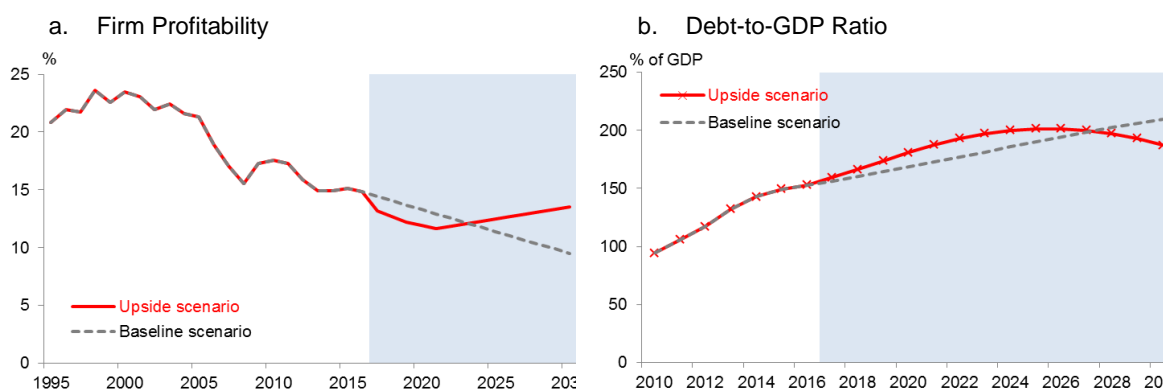
a.   Firm Profitability

b.   Debt-to-GDP Ratio

Note: To calculate the marginal effects, the capital-to-output ratio is assumed to follow the trajectory under the Upside scenario, while all other parameters are set to the Baseline scenario.

Source: AMRO Staff Estimates

Figure G3.3: Marginal Effects of Lowering SOE Investment on Debt Ratios

a.   SOE Fixed Asset Investment Share

b.   Debt-to-GDP Ratio

Note: To calculate the marginal effects, the capital-to-output ratio is assumed to follow the trajectory under the Upside scenario, while all other parameters are set to the Baseline scenario.
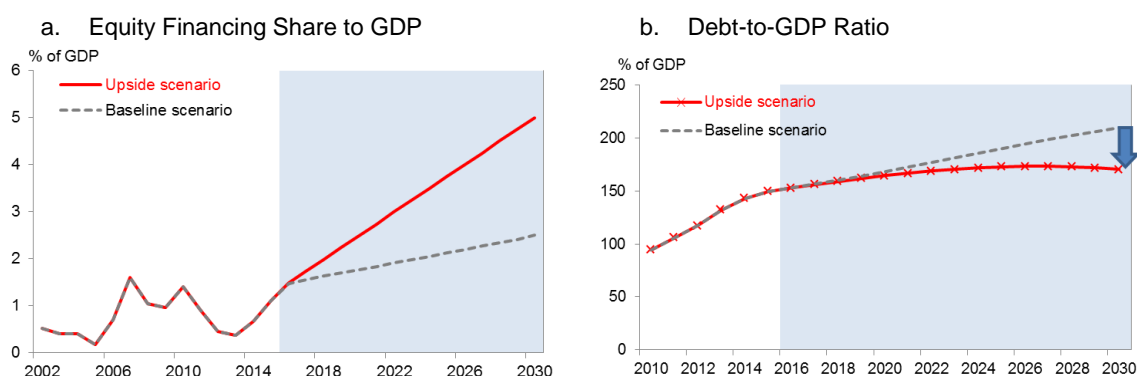
Source: AMRO Staff Estimates

Figure G3.4: Marginal Effects of Increasing Equity Financing on Debt Ratios

a.   Equity Financing Share to GDP

b.   Debt-to-GDP Ratio

Note: To calculate the marginal effects, the capital-to-output ratio is assumed to follow the trajectory under the Upside scenario, while all other parameters are set to the Baseline scenario.

Source: AMRO Staff Estimates