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State-owned enterprises leverage as a contingency in public debt sustainability analysis: The case of the People's Republic of China

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STATE-OWNED ENTERPRISES LEVERAGE AS A CONTINGENCY IN PUBLIC DEBT SUSTAINABILITY ANALYSIS: THE CASE OF THE PEOPLE'S REPUBLIC OF CHINA

Benno Ferrarini and Marthe Hinojales

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Benno Ferrarini and Marthe Hinojales

No. 534 | January 2018

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ABSTRACT

We reflect state-owned enterprises' (SOE) leverage within the standard debt sustainability assessment framework. Based on company data and the interest coverage ratio as a measure of debt at risk, aggregate baseline projections and fan charts gauge SOE debt as a contingent liability to the public sector. We find that SOE leverage in the People's Republic of China has grown to a large liability that deserves the urgent attention it has been receiving from the authorities. While there is no room for complacency, there is no need for panic either; even if authorities had to step into mop up as much as 20% of SOE debt at risk gone bad, this would appear to be manageable at roughly 2.7% of the gross domestic product in 2016 or 5.5% by 2021. These findings are reflective of discretionary assumptions about future developments in the SOE sector and the broader economy—including baseline conditions premised on preventive government action to slow borrowing—that are adjustable to reflect analysts' prerogatives and expectations.

Keywords: contingent liabilities, corporate leverage, People's Republic of China, public debt sustainability, state-owned enterprises

JEL codes: G01, G21, H30, H60

I. INTRODUCTION

Public debt sustainability analysis (DSA) involves the projection of the general government debt ratio over a 5-year horizon in reflection of macroeconomic and fiscal forecast assumptions. Baseline projections of the debt ratio to gross domestic product (GDP) show whether expected developments are stabilizing, and policies that would lead to exploding debt are deemed unsustainable. Scenario analysis and stress tests quantify the effects of alternative assumptions about the key drivers of the debt ratio, such as economic growth, interest rates, or the primary fiscal balance (IMF 2017a).

The International Monetary Fund's (IMF) DSA framework, tested and refined over time, provides a valuable analytical tool for public debt sustainability for emerging economies.[1] We have previously shown that its analytical limits can be bridged with risk-based methods, such as contingent claims analysis applied in Brière, Ferrarini, and Ramayandi (2016) and value at risk analysis discussed in Kopits, Ferrarini, and Ramayandi (2016). We also argued that the framework requires ad hoc expansion for better applicability to country circumstances. For example, DSA for oil exporting countries should account for oil price variability and its effects on sovereign wealth funds, transfers to the government fiscal budget, and debt ratio stabilization (Ferrarini, Greene, and Hinojales 2016).

Continuing our exploration of DSA methodological issues, this paper addresses the question of how to reflect state-owned enterprises (SOEs) debt as a contingent liability. With SOE liabilities high and rising in several Asian economies, the issue of accounting for this source of public sector risk has risen to the fore of DSA but has not yet been given sufficient treatment in the applied literature.

The methodology proposed in this paper entails balance sheet analysis at the firm level to project interest coverage ratios (ICRs) (i.e., the ratio of a firm's earnings over interest payments) over a 6-year horizon. Aggregating across a country's pool of SOEs with data available, total liability and related contingency measures are derived and assessed against the overall public debt profile. Moreover, individual SOEs' financial and debt ratios are bootstrapped (i.e., repeatedly random sampled and projected forward) to generate firm-level distributions that are then averaged into a fan chart of the economywide SOE contingent liability. This provides a spectrum of possible outcomes if this liability came to bear down on general government debt.

Given the scrutiny that SOE debt in the People's Republic of China (PRC) has been receiving recently, we illustrate the method for SOEs in the PRC, expanding a data set created for a previous analysis (Ferrarini, Hinojales, and Scaramozzino 2017a, 2017b). The ensuing projections are reflective of discretionary assumptions about future developments in the SOE sector and the broader economy—including baseline conditions premised on preventive government action to slow borrowing—that are adjustable to reflect future analysts' prerogatives and expectations. These are not further explored in this paper, which takes focus on providing a broadly applicable method of analysis, not a comprehensive discussion about corporate leverage in the PRC as such. The latter has received much attention elsewhere lately, such as in the IMF (2016b, 2017b) and the daily business news (Financial Times 2017a, 2017b).

The paper is structured to present, in section II, an enhancement of the DSA framework suitable to reflect SOE leverage as a sovereign contingent liability. Against this backdrop, the current situation in the PRC is briefly discussed. Section III takes focus on data sources and the creation of an

[1] The debt dynamics in the IMF's DSA framework for market-access countries are summarized in Appendix 3.

SOE data set to integrate the IMF's latest DSA for the PRC. Section IV implements and interprets the debt ratio projections and fan chart analysis, and section V concludes.

II. DEBT SUSTAINABILITY ANALYSIS WITH STATE-OWNED ENTERPRISE CONTINGENT LIABILITIES

The IMF framework for public DSA in emerging economies (or market-access countries, as opposed to low-income countries) is routinely applied by international and national bodies and has undergone multiple rounds of revisions since its inception in 2002. The latest such reform, in 2011, emphasized the need for DSA to more accurately reflect specific risks associated with countries' debt profiles, especially in relation to contingent liabilities (IMF 2013a).

A 2012 review of the framework by the Asian Development Bank (ADB) took focus on its applicability to Asian emerging economies and reached conclusions similar to the IMF's, especially regarding contingent risks and off-budget liabilities that affect emerging economies' risk profiles but escape basic DSA analysis (Ferrarini, Jha, and Ramayandi 2012). For the PRC in particular, the review recommended that DSA be expanded to reflect mounting debts incurred by local governments through off-budget local government financing vehicles' (LGFV) borrowing.

LGFVs are platforms used by local governments of the PRC to finance infrastructure development in circumvention of legal restrictions that limit their access to market financing in the form of bond and loans. Total leverage involving these off-budget solutions mushroomed after 2008, as PRC provinces, cities, and counties were called upon to enact a massive, credit-fueled investment surge to keep the economy growing despite the global financial and economic crisis. In 2009, LGFV borrowing in the PRC represented a third of total bank lending and, in 2010, nearly 27% of the GDP (Hemming 2012). Notwithstanding authorities' efforts to restrict LGFV activity—mainly by allowing local governments to borrow directly from the markets and by swapping CNY8 trillion of outstanding LGFV debt into on-budget local government bonds—borrowing keeps expanding. World Bank confidential data (reported in Financial Times 2017a) suggest that LGFV liabilities grew more than 20% each year since 2012 and further accelerated in 2014 and 2015.

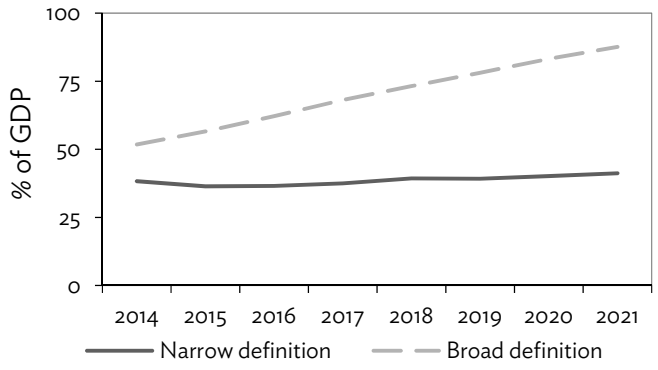
Recognizing growing fiscal risks from highly leveraged local governments, the IMF started reflecting these off-budget liabilities in the PRC's DSA for 2013 Article IV consultations (IMF 2013b). Since then, IMF's yearly DSA analysis for the PRC has centered on a broader coverage measure of general government debt—incorporating local governments' off-budget operations in the form of net proceeds from land sales and LGFV borrowing into baseline projections of the debt ratio—besides the standard, narrow, coverage of budgetary operations by the general government.[2]

A comparison of the IMF's latest projection of the narrow and broader baseline debt ratios emphasizes the weightiness of local government debt in the PRC's public finances (Figure 1). While the standard DSA baseline with narrow, central government coverage suggests a flat debt ratio of about 40% of GDP, the inclusion of local government debt

[2] The narrow definition includes central government debt and "on-budget" local government debt identified by the authorities. The broad definition adds other types of local government borrowing, including off-budget liabilities (explicit or contingent) borrowed by local government financing vehicles (LGFVs) via bank loans, bonds, trust loans, and other funding sources, estimated by IMF staff. It also covers debt of government-guided funds and special construction funds.

catapults the broader ratio well above comfort level. By 2021, the IMF expects nominal gross general government debt approaching 88% of GDP under baseline assumptions.

Figure 1: General Government Debt of the People's Republic of China



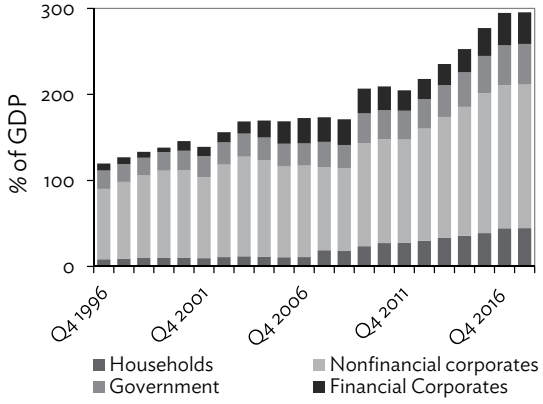
Source: IMF. 2017b. "People's Republic of China–2017 Article IV Consultation. Press Release; Staff Report; and Statement by the Executive Director for the People's Republic of China." IMF Country Report No. 17/247.

Besides local government debt, soaring lending to the nonfinancial corporate sector has added to concerns about the PRC's debt sustainability in recent years. Nonfinancial corporate debt ballooned, to nearly 166% of GDP in 2016, pushing total debt above 290% of GDP (Figure 2). The bulk of this is domestic debt; in 2015, only 5.7% of noncorporate debt was foreign debt (Castle 2016). Much of the government's monetary and fiscal stimulus to stem growth from slowing in the wake of the global financial crisis was directed to the SOEs, which account for about two-thirds of the nonfinancial corporate sector's leverage. The credit-fueled surge in investment worsened industrial overcapacity, particularly in the traditional, SOE-dominated sectors, such as steel, cement, and energy. It has also been feeding asset bubbles in the property, equity, and bond markets, against the backdrop of declining benchmark lending rates set by the People's Bank of China (Ferrarini, Hinojales, and Scaramozzino 2017a).

Weakening industrial profits caused nonperforming loans (NPLs) to rise. According to official national sources, NPLs amounted to 1.7% of total loans by the fourth quarter of 2016. Market analysts suggest that this figure may be significantly higher, exceeding 15%, plus the bad debt accumulated in the nonbanking financial system, estimated to add a further 10% to the NPL ratio (CLSA 2016, Fitch Ratings 2016, S&P Global Ratings 2016). Firm-level analysis of the sustainability of earnings against interest payments confirms that a large and growing share of total debt is being held by companies whose ICR is less than unity; this rose from 3.5% until 2011, to 7% in 2012, and to more than 14% in 2015 (Figure 3).

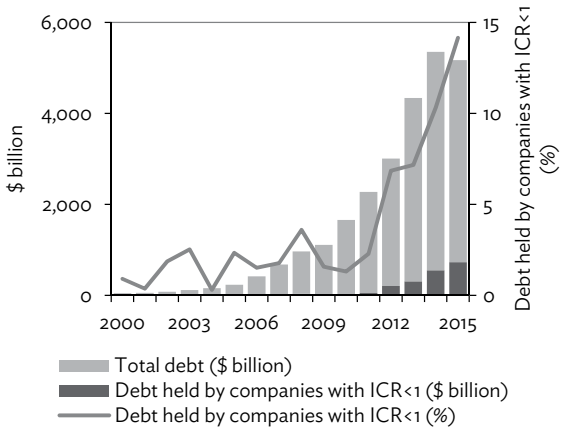
For the case of widespread defaults and the need for policy actions to avert systemic repercussions across the corporate landscape and domestic economy, the nonperforming share of SOE debt constitutes a contingent liability for the government. Typically, crisis intervention would have to involve the establishment of government bond-backed asset management companies (AMCs) to mop up toxic loans from the formal and shadow banking systems, and to disentangle liability implications across the nonfinancial corporate sector.

Figure 2: Total Debt of the People's Republic of China



Source: Authors' calculations based on data from International Institute of Finance.

Figure 3: Nonfinancial Corporate Debt at Risk



ICR = interest coverage ratio.
Source: Ferrarini, Hinojales, and Scaramozzino. 2017a. "Leverage and Capital Structure Determinants of Chinese Listed Companies." ADB Economics Working Paper Series No. 509.

The role of AMCs in response to the 1999 banking crisis provides some insights in this regard. By the late 1990s, state-owned commercial banks of the PRC had accumulated large volumes of unrecognized NPLs. The four largest state-owned banks had amassed 42% of NPLs in their books, accounting for about 30% of the GDP. To bail out the banking sector and restore balance sheets, the government established four state-owned AMCs that became operational in 1999 and absorbed CNY1.4 trillion of bad loans. Paid for at par by the issuance of 10-year AMC bonds as well as with the Ministry of Finance and People's Bank of China cash injections, AMCs ended up recovering about 21% of NPLs by 2006 (Hemming 2012). The remaining assets remained on the books of AMCs, but shrank considerably in relation to GDP, thanks to double-digit growth rates during much of the 2000s. As a result, the public debt-to-GDP ratio was largely unaffected by the banking crisis and stayed relatively low in the PRC.[3]

Whatever form government intervention takes, and whether in support of or to the demise of failed SOEs, bad loans must be absorbed by the economic system eventually, with implications for the government budget. For example, if transferred to an AMC, government support could take the form of government-backed bonds amounting to a fraction of the face value of nonperforming debt being absorbed by this intervention.

Limiting focus on the narrow DSA context of possible SOE implications for the public debt ratio, our analysis does not rely on assumptions about the specific modalities of government intervention in the case of an SOE debt crisis. Instead, we regard the share of SOE debt at risk as a contingent public burden that, if realized, will shift the sovereign debt ratio upward by an amount equal to the nonrecoverable portion of SOE debt weighing on the government fiscal accounts. For illustrative purpose, we will assume a shock scenario equal to 20% of SOE debt at risk being realized, but this arbitrary parameter can be altered without qualitatively affecting the insights from the analysis.

[3] See Bottelier (2004) for a detailed analysis of previous debt workouts in the PRC through AMCs.

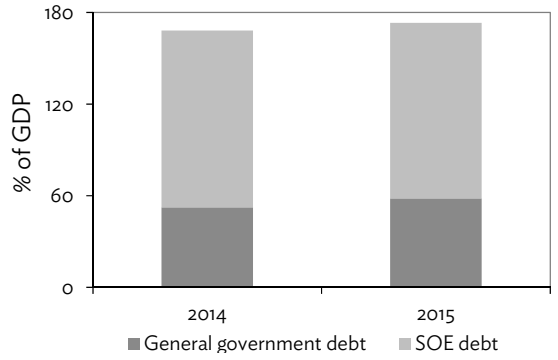
The steps toward accounting for SOE debt as a contingent liability start with sourcing suitable company financial data to allow for identification of firms at a risk of possible financial distress.

III. STATE-OWNED ENTERPRISE DEBT AT RISK: DATA SOURCES AND DEFINITIONS

We draw the PRC company balance sheet and financial statistics from the Standard & Poor's (S&P)-based data set in Ferrarini, Hinojales, and Scaramozzino (2017a). The available information from S&P on the 161,623 Chinese companies comprised in our data is insufficient to separate state owned from private entities. To identify the SOEs among these companies, we integrate our data with ownership information from the Orbis database, which includes 238,602 Chinese company data as of May 2017. This allows us to identify as SOEs all companies that are explicitly categorized as such in the Orbis data, as well as those with shares owned to more than 25% by the state. Of the 3,004 SOEs thus identified, only 672 have reported earnings and interest payments for both 2014 and 2015, the base years for projections. These constitute the pool of companies available for analysis.

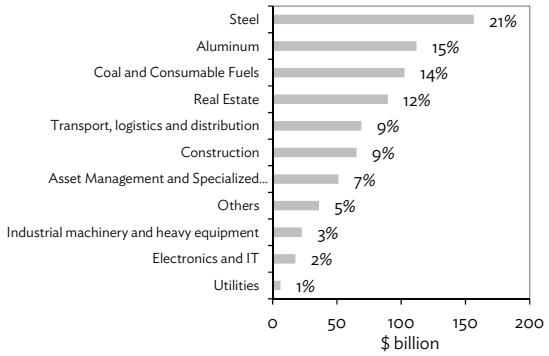
Totaling $5,712 billion in 2015, the 672 firms' combined debt constituted 31.3% of nonfinancial corporate debt or 50.9% of GDP. All the debt is domestic. Due to data limitations, our sample falls significantly short of total SOE debt, which Moody's Investors Service (2016) estimates at 115% of GDP in 2015. To derive an estimate of total SOE debt from our limited sample, we will scale our measures and projections of SOE debt by a factor of 2.26, which results from dividing 115% (Moody's ratio of SOE debt to GDP) with 50.9% (the sample we identified). We thereby assume that our sample of SOEs determined by data availability is representative of the PRC's entire population of SOEs, regardless of any selection bias that may exist in relation to firms that reported data against those that have not.[4] By this measure then, SOE debt during 2014–2015 was about twice the size of the PRC's general government debt, inclusive of local government debt and their local investment platforms (Figure 4).

Figure 4: Public Sector Debt



SOE = state-owned enterprise.
Source: Author's calculations.

Figure 5: State-Owned Enterprises Debt at Risk, by Industries (2015)



Source: Authors' calculations.

Next, we identify the share of SOE debt held by companies at risk. Following Ferrarini, Hinojales, and Scaramozzino (2017a) and IMF (2016a), companies at risk are those with ICRs less than

[4] Likely, companies with poor or no financial reporting have higher NPL ratios and worse interest coverage compared to those with better reporting, everything else the same. If so, our measure underestimates SOE debt at risk in the entire population of companies.

unity. ICR is the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) over interest payments. When companies are unable to cover interest payment obligations out of current earnings (ICR<1), this signals financial distress, liquidity shortages, and NPLs down the line. Out of the 672 firms in the sample, this threshold allows us to identify a total of 133 firms deemed at risk in 2015, or roughly 20% of our sample. Average annual debt at risk across these SOEs amounted to $560 billion during 2014–2015, the base period. Scaled by a factor of 2.26, this corresponds to11.3% of GDP.

An industry breakdown of SOE debt at risk, shown in Figure 5, confirms a familiar pattern in the PRC's industrial landscape: nearly 36% of debt at risk is in the steel and aluminum sectors, where overcapacity is rampant and profits have been low (IMF 2016b, Forbes 2016). Firms operating in the real estate and asset management sectors combined account for nearly a fifth of debt deemed at risk in 2015. Large shares are associated also with sectors such as coal and consumable fuels (14%); transport, logistics, and distribution (9%); and construction (9%).

IV. STATE-OWNED ENTERPRISE CONTINGENT LIABILITIES PROJECTIONS AND FAN CHARTS

From the sample of 672 SOEs in the PRC—assuming that all SOEs will remain operational throughout this period—we derive an aggregate estimate of the contingent liability. This estimate integrates the PRC's public DSA for the years from 2016 to 2021, reflecting the latest IMF estimates (IMF 2017b).

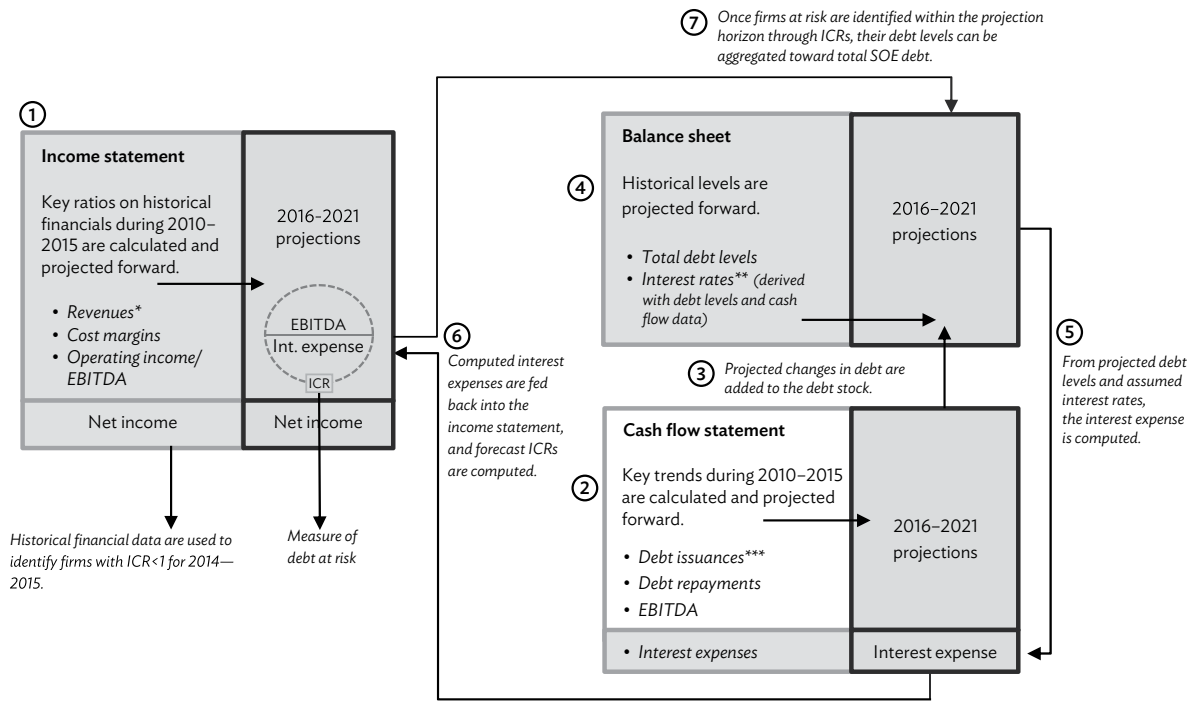
To estimate each firm's interest coverage ability until 2021, we apply the three-statement model. Given their simplicity, this model is commonly used in corporate finance analysis and accounting, and the foundation on which more advanced financial models are built (CFI 2017). Essentially, it consists in dynamically connecting firms' three financial statements, from the income statement, to the balance sheet, and to the cash flow statement as the last step. The particular order of sequencing is crucial in financial statement preparation, as it reflects information flowing from one statement to the other. For example, net income—the bottom line of the income statement—flows to the balance sheet and into the stockholder's equity via retained earnings, and is also the first line in the cash flow statement.[5] The balance sheet, on the other hand, consist of items that have a cash impact, such as working capital, and thus contribute to any changes in the final cash flow statement (WSP 2017).

Figure 6 illustrates the sequential, iterative process: projected forward to 2021 are individual firms' earnings (EBITDA, from the income statement), level of debt (from the balance sheet) and interest expense (from the statement of cash flows), assuming that historical averages will hold into the future and that cost margins stay unchanged. To see the working of the process, let us assume a hypothetical firm, XYZ, out of our sample comprising 672 firms. We begin by computing its revenues and corresponding EBITDA until 2021, using their historical growth averages from 2010 to 2015 (see ① in Figure 6). This step gives us the new set of numerators to compute the ICRs from 2016 to 2021. The denominators—the interest expenses of XYZ—are first determined by using historical changes in debt acquisition (netting new issuances with principal repayments) to project the total debt stock for the next 6 years (see ② to ④). From the projected debt levels in the balance sheet, one can compute for the 2016–2021 interest expense in the cash flow statement by using the historical levels of interest

[5] There is also a Statement of Retained Earnings, also known as "Statement of Owner's Equity," "Equity Statement" or "Statement of Shareholders' Equity." This shows changes in retained earnings for a specified period, and links the income statement to the balance sheet. This can appear as a separate statement, or included in either of the two.

rates (see ⑤).[6] From the cash flow statement, this information then feeds back into the income statement projections—indicated by the bottom-most arrow in Figure 6—and as the denominator in determining following periods' new ICR ratios and debt at risk (see ⑥). Lastly, total debt at risk is derived by summation across SOEs, and divided by nominal GDP forecasts from the IMF's *World Economic Outlook* released in April 2017.

Figure 6: Illustrative Three-Statement Projections of State-Owned Enterprises Debt



EBITDA = earnings before interest, taxes, depreciation, and amortization; ICR = interest coverage ratio.
Notes:
* Variable shocked under the revenue shock scenario.
** Variables shocked under the interest rate shock scenario.
*** Variable lowered under the baseline scenario.
Source: Authors' illustration.

Following this procedure for each of the SOEs in our sample, projections are made to reflect baseline and historical scenario assumptions, as well as the effects from shocks to the interest rate and firms' revenues.

A. Baseline, Shocks, and Historical Scenarios[7]

Our baseline scenario assumes that SOEs' future revenues and interest rates remain at their 2010–2015 average historical levels. It further assumes that companies' rate of debt acquisition throughout

[6] Interest rates are generally included in the notes to financial statements, and not as a statement item. Nonetheless, it is fairly easy to estimate them using the income statement's interest expense item, and the amount of debt outstanding from the balance sheet. By dividing the interest expense by debt outstanding, one can calculate the firm's average interest rate for the period.

[7] All the assumptions underlying baseline and alternative scenarios for the ICR and debt projections are summarized in Appendix 1.

the projection horizon will be 20% below their 2011–2015 average annual rates of change. This is to reflect, qualitatively, recent policy efforts to curb excessive corporate leverage.[8]

Based on these assumptions, we project firms' ICR over the period 2016–2021 and compute the total level of debt associated with firms deemed at risk. Figure 7 shows that, from 133 SOEs with ICR below unity in 2015, this number grows by roughly 20 units each year and reaches 248 by 2021. These firms jointly carry debt at risk that increases by 27% each year on average, despite the slowdown of leverage growth enshrined in the baseline assumptions.

Debt at risk would increase threefold as a result, from $661 billion in 2016 to $1,993 billion in 2021.[9] Scaled by a factor of 2.26 and expressed as a ratio to GDP—to resemble the full scale of SOE leverage—Figure 11 shows SOE debt at risk expanding more than twofold under baseline assumptions, from 13.3% in 2016 to 27.6% in 2021. Baseline projections thus carry an important message for policy makers who, to avoid such a significant buildup of corporate leverage into the future, would have to devise measures far more incisive than the 20% slowdown underlying the baseline scenario.

For a comparison with the baseline, a so-called "historical" scenario relaxes the policy of SOE leverage constraint, assuming instead that SOEs will continue to ramp up debt unabated, at the same pace of 51% per year observed between 2010 and 2015. Other baseline assumptions are kept intact. Figure 8 shows that this leads to an explosive hike in SOE debt at risk, particularly from 2018 onward. This is because the additional firms falling into distress (i.e., with an ICR<1) each year carry increasing amounts of debt, thus pushing up the total amount of debt deemed at risk. By 2021, 310 SOEs and nearly $4,900 billion debt are at risk. Scaled up and expressed as a share of GDP, Figure 11 shows that the historical scenario delineates a highly unsustainable SOE leverage profile. This reinforces the message carried by the baseline projection and calls for policy action to decisively break with past rates of corporate borrowing.

Two additional scenarios illustrate the effects of unfavorable shocks affecting companies' ICR. The first involves a 5 percentage point permanent interest rate hike from 2017 onward, on top of the 4.4% interest rate embodied in the baseline. Figure 9 suggests that, compared to the baseline, higher interest rates would push into distress 139 more SOEs by 2017, unable to cover interest payments out of revenue streams (ICR<1). After scaling and dividing by GDP, Figure 11 shows that the larger pool of SOE debt at risk causes a large shift upward in the debt ratio, to roughly twice the distance against the baseline.

The second shock scenario envisages a 20% temporary fall of SOE revenues in 2017, followed by a gradual recovery back to historical averages by 2021. Compared to the baseline, more firms would now be pushed into distress, and total SOE debt at risk would rise to $2,526 billion by 2021 (Figure 10). Though significantly milder than the interest rate shock—see Figures 9 and11 to compare—the risk from any compressions in SOE revenues is sizable. In the light of weakening revenues during the past decade or so, this cautions against the risks from failure to tackle the urgent issue of rampant overcapacity and need for industrial restructuring in the Chinese SOE landscape.

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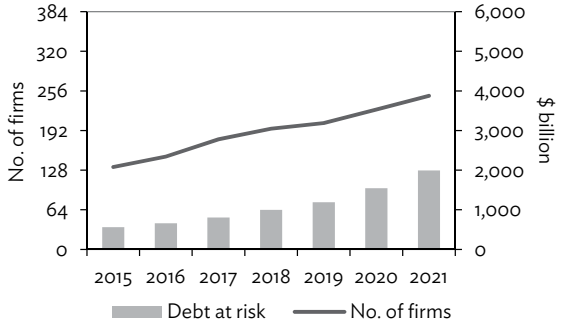
8 For a discussion of recent policies see, for example, Deng and Wei (2017) and Moody's Investor Service (2017).

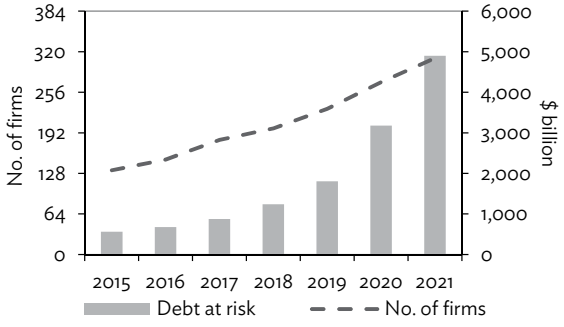
9 The underlying breakdown of data by sector—not shown in the charts—reveals that debt overhang and distress would be highest in the steel and aluminum industries, as well as in the real estate, construction and related activities, where overcapacity and revenue compression has long been ripe.

Figure 7: Baseline Projections



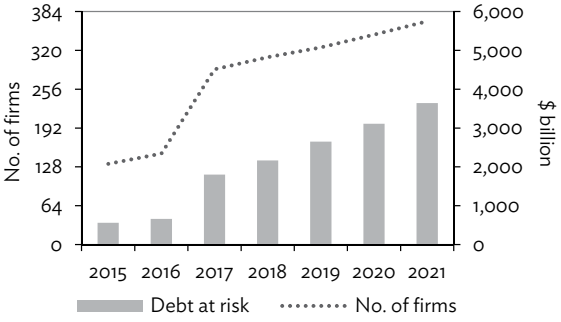
Source: Author's calculations.

Figure 8: Historical Scenario



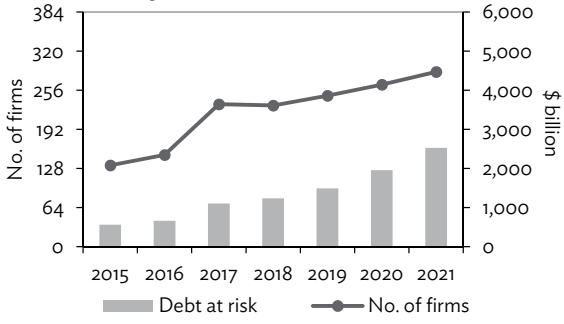
Source: Author's calculations.

Figure 9: Interest Rate Shock



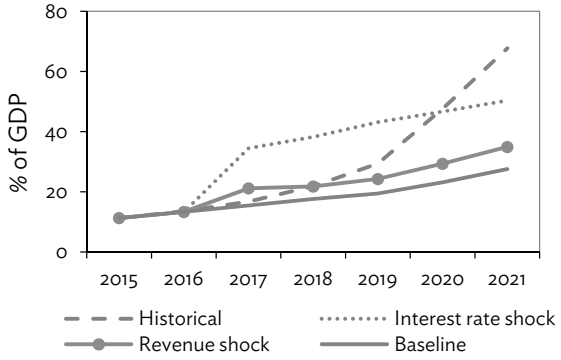
Source: Author's calculations.

Figure 10: Revenue Shock



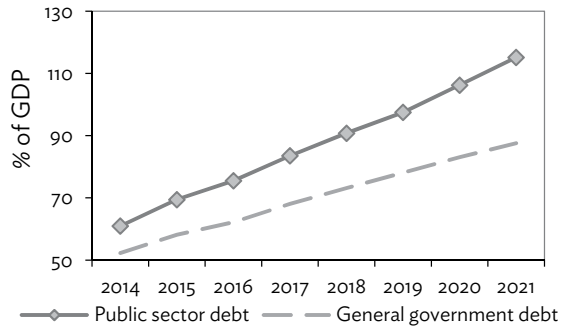
Source: Author's calculations.

Figure 11: Baseline and Scenario Analysis of State-Owned Enterprises Debt at Risk



GDP = gross domestic product.
Source: Author's calculations.

Figure 12: Total Public Sector Debt (notional)



GDP = gross domestic product.
Source: Author's calculations.

Both shocks indicate vulnerability to adverse shocks with regard to baseline assumptions, calling for extra caution while devising containment measures to corporate leverage. It is crucial for authorities to enable a stable macroeconomic environment to allow for a gradual winding down of corporate debt over time without the occurrence of sudden shocks to domestic interest rates and other key variables.

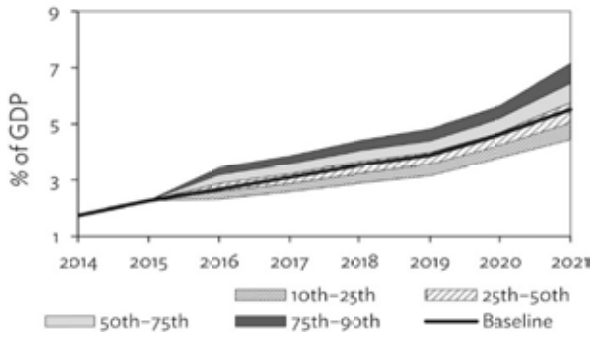
B. State-Owned Enterprise Debt as a Contingent Liability

The share of SOE debt at risk may be thought of as part of a notional total public sector debt ratio, adding directly to general government debt.[10] Figure 12 shows the PRC's augmented general government debt—reflecting the latest estimates by the IMF (2017b)—as well as SOE debt at risk. The latter is seen adding increasing (contingent) pressure to the sovereign debt profile over time. By 2021, the baseline projection has SOE debt at risk raise the notional public debt ratio to nearly 116% of GDP.

Most likely, a crisis scenario would see only a portion of SOE debt at risk turn out to be nonrecoverable and eventually come to bear onto the general government budget. How exactly this would play out in the PRC or any other economy—whether through a direct government bailout or mandatory intervention by state-owned banks or specially designated AMCs—will influence an SOE crisis' systemic impact and fiscal burden, but is exogenous to DSA and this analysis.

Instead, we simply assume that an arbitrary share of SOE debt at risk, equal to 20%, represents the contingent liability from SOE debt at risk. Under baseline assumptions, the SOE contingent liability would thus span from roughly 2.7% of GDP in 2016 to 5.5% in 2021. This is shown as the solid line in Figure 13. While sizable, an intervention of this magnitude would appear to be manageable by the public sector in the PRC without jeopardizing debt sustainability. As a ratio of GDP, its impact could be even smaller if timely corrective actions managed to successfully curb corporate leverage risk without substantially undermining growth targets for the economy as a whole.

Figure 13: SOE Contingent Liability Baseline and Fan Chart



GDP = gross domestic product.
Source: Authors' estimates.

C. Fan Chart Analysis

The baseline projection of the SOE contingent liability thus determined embodies arbitrary assumptions about how SOE finances may evolve and impact sovereign fiscal accounts and debt in

[10] IMF Government Finance Statistics guidelines suggest that government debt statistics cover all the entities affecting fiscal policy, including those that are owned or controlled by the government and engage mainly in commercial activities (IMF 2001). SOEs in the PRC fit the description, in that they have been serving quasi-fiscal purposes and are largely commercial in nature. However, treating their entire debt as public appears not particularly analytically relevant and would blur discussions about fiscal policy at the level of the government and beyond (Hemming 2012). Therefore, for a measure of the maximum estimated notional public debt burden of the SOE contingent liability, we include the share of SOE debt deemed at risk, not SOE debt as a whole.

different states of the world (Ferrarini, Jha, and Ramayandi 2012). To account for uncertainty about the debt ratio's future evolution and avoid the arbitrariness of assumptions about it, the DSA framework can be made to capture the stochastic nature of the drivers of the debt ratio to an extent. This is done through fan charts that encompass a range of likely outcomes, rather than a selective set of assumptions embodied by the baseline.

In the context of standard DSA, fan chart analysis involves a limited number of macroeconomic variables, such as GDP growth rates, interest and exchange rates, and inflation. Here, however, the focus is on the firm level, and fan chart analysis concerns uncertainty about the evolution of the determinants of individual firms' financial sustainability, which jointly determine the stochastic characteristics of the SOE sector's debt at risk. Specifically, we first estimate variability for SOEs individually over the period 2010–2015. Variance–covariance matrices define the joint normal distribution for four selected ICR drivers: revenue growth, effective interest rates, change in debt level, and the efficiency ratio (defined as operating expense over revenue). To generate an aggregate fan chart, we average these statistics across SOEs and bootstrap aggregates through to 2021.[11]

Figure 13 shows the resulting fan chart as 80% (spanning the 10th–90th percentiles) and 50% (25th–75th) confidence intervals wrapped around the baseline. Providing a spectrum of probable outcomes over the period of projection, the fan chart indicates that, in 2016, 20% of SOE debt gone bad may translate into a sovereign fiscal burden between 2.1% and 3.2% of GDP which, by 2021, could be as high as 6.9% of GDP.

It should be noted that the upper and lower bounds of the fan chart and anything in between may be realized with equal likelihood. Its spread relates to the degree of uncertainty at the time of projections. With the confidence spectrum of a fan chart then, the baseline in Figure 13 entails no higher confidence of occurring than any other debt ratio trajectory analysts may envisage holding true at the time of projections.

For the specific case at hand, stochastic projections serve as a reminder that the financial and macroeconomic conditions in the PRC may turn out more challenging compared to those envisaged by baseline assumptions, adding pressure to struggling SOEs and pushing up the sectorwide share of debt at risk. This further justifies authorities' heightened alertness and sense of urgency in managing the SOE debt situation before it will transform into something more difficult to contain.

Finally, for a breakdown by sectors, Appendix 2 shows fan charts for the 11 largest industry aggregates. Assumptions and projection methods for both baseline and fan charts are the same as those underlying the SOE sectorwide analysis in Figure 13. The aggregation by sector suggests a pattern of steeply rising debt at risk and contingencies in industries such as construction, real estate, transport, logistics, and distribution. Relatively narrow fan charts for these sectors indicate that the historically observed pattern of variability corroborates the rather dim outlook enshrined in the upward sloping baseline projections.

By contrast, baseline projections of the projected contingent burden from risky leverage in heavy industries, such as steel, aluminum and diversified metals, industrial machinery and heavy equipment, show that it has plateaued. However, wide fan charts suggest that these projections are

[11] In this context, bootstrapping implies repeated random sampling out of the variance–covariance matrix, to create a debt ratio distribution that reflects the correlation structure of the variables involved. For this paper, we use 6,000 simulations to obtain the distribution. For an excellent introduction to bootstrapping, see Efron and Tibshirani (1993).

fraught with a high degree of uncertainty and there is little confidence for baseline projections to realize. By and large, SOE sector contingent liabilities are projected to increase, as in Figure 13, if baseline assumptions were to apply during the forecast horizon.

V. CONCLUSION

This paper introduced a method to reflect SOE leverage within the standard DSA framework of analysis. Based on the ICR as our core measure of debt at risk, we showed that baseline assumptions and forecasts at the firm level can be aggregated and projected as a sectorwide contingent liability associated with SOE debt. This, in turn, is suitable for integration with the standard DSA framework, to analyze the public debt burden of SOE debt.

We further showed that SOE-focused DSA can extend to fan chart analysis, which we derived from estimated variabilities of the drivers of ICRs at the level of individual firms. Averaged and projected forward, these historically anchored patterns of variation relativize the message carried by the deterministic, assumptions-driven baseline and envisage a vaster spectrum of possible, probabilistic, outcomes.

As far as it concerns SOE debt in the PRC, specifically—the case study we applied the methodology to—we gathered company data from two different sources and came up with a sample of 672 SOEs with the necessary financial information available. We estimated the likely size of SOE debt at risk and aggregated firm-level projections to provide a measure of a sectorwide contingent liability. Our findings suggest that this liability has been mushrooming and deserves the urgent attention it has been receiving from the PRC authorities.

Under baseline assumptions, which reflect a policy to curb SOE borrowing to an extent, the SOE contingent liability could span between roughly 2.7% of GDP in 2016 and 5.5% in 2021, if the government had to intervene in response to as much as 20% of SOE debt gone bad. Fan chart analysis suggests that the fiscal burden could be as high as 6.9% of GDP by 2021, if less favorable macroeconomic or sector financial developments are accounted for.

These estimates are reflective of discretionary assumptions that are easily amenable to adjustment to suit future analysts' prerogatives. However, whatever the assumptions, it would appear that expanding leverage at past rates is not a feasible option: a scenario projecting forward historical SOE borrowing rates and financial conditions shows that this could precipitate a cascade of distress involving a growing number of companies and causing an unsustainable rise in the ratio of total SOE debt at risk to GDP.

Notwithstanding the arbitrariness of the assumptions, this analysis conveys a sense of urgency for an orderly SOE deleveraging in the PRC. While there is no room for complacency, the size of the SOE contingent liability in relation to GDP appears to be manageable if dealt with decisively and bar a continuation of the past. Corrective action that could curb corporate leverage risk without substantially undermining the growth target set for the economy would help in keeping the relative weight of the contingent liability in check. To policy makers, the balancing act essentially consists in weighing the benefits from credit as a driver of growth against its intoxicating effects within the corporate and industrial landscape, delaying structural change. In either case, the authorities seem to have plenty of room and options to maneuver.

Appendix 1: Assumptions Underlying Baseline and Scenario Projections

(a) Baseline scenario

	2011–2015 Averages (%)	2016	2017	2018	2019	2020	2021
Gross domestic product (GDP) growth	8.3	6.7	6.6	6.2	6.0	5.9	5.8
Revenues	15.4	Growth at zero, i.e., constant 2010–2015 levels					
Interest rates	4.4	Same as 2010–2015 levels (firm level)					
Annual change in debt	51.0	Debt acquisition is 20% lower than its 2011–2015 annual change(firm level)					

(b) Historical scenario

	2011–2015 Averages (%)	2016	2017	2018	2019	2020	2021
GDP growth	8.3	6.7	6.6	6.2	6.0	5.9	5.8
Revenues	15.4	Same as baseline					
Interest rates	4.4	Same as baseline					
Annual change in debt	51.0	Same as 2011–2015 annual change (firm level)					

(c) Interest rate shock scenario

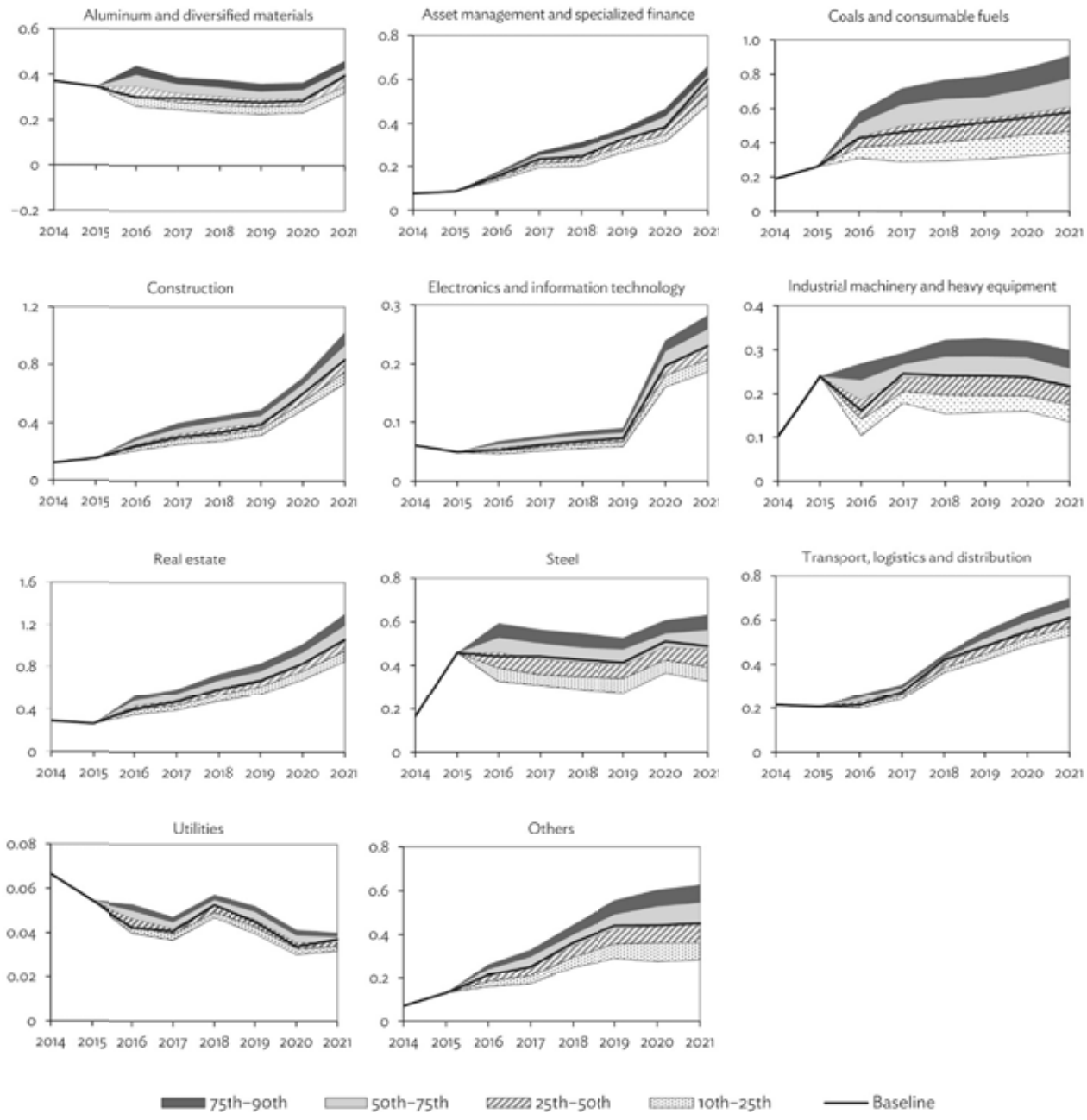
	2011–2015 averages (%)	2016	2017	2018	2019	2020	2021
GDP growth	8.3	6.7	6.6	6.2	6.0	5.9	5.8
Revenues	15.4	Same as baseline					
Interest rates	4.4	A one-off interest rate shock equal to 5 percentage points is introduced in 2017 in the baseline, carried through to 2021 (firm level)					
Annual change in debt	51.0	Same as baseline (firm level)					

(d) Revenue shock scenario

	2011–2015 averages (%)	2016	2017	2018	2019	2020	2021
GDP growth	8.3	6.7	6.6	6.2	6.0	5.9	5.8
Revenues	15.4	SOE revenues decline by 20% in 2017 against the baseline, then gradually recover to their 5-year average levels by 2021					
Interest rates	4.4	Same as baseline					
Annual change in debt	51.0%	Same as baseline					

Source: Authors' assumptions.

Appendix 2: Contingent Liability Baseline and Fan Charts by Sectors (% of GDP)



Note: "Others" include all other firms that do not fall under the 10 other sectors and too few to merit their own sectoral illustration.
Source: Authors' calculations.

Appendix 3: Debt Dynamics in the IMF Debt Sustainability Framework for Market-Access Countries[12]

The IMF framework characterizes the evolution of the public debt ratio in the following way:

$$\frac{D_{t+1}}{Y_{t+1}} = (1+\varepsilon_{t+1}) * \left(1+i^f_{t+1}\right) * \frac{D^f_t}{Y_{t+1}} + \left(1+i^d_{t+1}\right) * \frac{D^d_t}{Y_{t+1}} - \frac{PB_{t+1}}{Y_{t+1}} + \frac{O_{t+1}}{Y_{t+1}} + \frac{RES_{t+1}}{Y_{t+1}} \quad \text{equation (1)}$$

where:

$1+\varepsilon_{t+1} = \frac{e_{t+1}}{e_t}$, and e_{t+1} is the nominal exchange rate (LC/USD) in period *t+1*.

PB_{t+1} is the primary balance in *t+1*.

D^f_t is the stock of foreign currency-denominated debt in *t*.

D^d_t is the stock of local currency-denominated debt in *t*.

i^f_{t+1} is the effective nominal interest rate on foreign currency-denominated debt in *t+1*.

i^d_{t+1} is the effective nominal interest rate on local currency-denominated debt in *t+1*.

O_{t+1} are other identified debt-creating flows in *t+1*, such as the realization of contingent liabilities, privatization receipts, or banking sector recapitalization.

RES_{t+1} is a residual ensuring the identity holds.

Let $Y_{t+1} = (1+g_{t+1}) * \left(1+\pi^d_{t+1}\right) * Y_t$, where g is the real growth rate of the economy and π is the domestic inflation, as measured by the change in the GDP deflator. Using small caps to express contemporaneous ratios (e.g., $d_{t+1} = \frac{D_{t+1}}{Y_{t+1}}$), and expressing i_{t+1} as the weighted average of the effective nominal interest rate, further manipulation of equation (1) yields an expression that isolates the factors contributing to changes in the debt ratio:

$$d_{t+1} - d_t = \frac{1}{\rho_{t+1}}\Big[\underbrace{d_t * \left(i_{t+1} - \pi_{t+1} * (1+g_{t+1})\right)}_{\text{Contribution of the effective interest rate}} + \underbrace{\varepsilon_{t+1} * \left(1+i^f_{t+1}\right) * d^f_t}_{\text{Contribution of the exchange rate}} - \underbrace{d_t * g_{t+1}}_{\text{Contribution of real GDP growth}}\Big] - \underbrace{pb_{t+1}}_{\text{Contribution of primary balance}} + \underbrace{o_{t+1}}_{\text{Contribution of other factors}} + res_{t+1}$$

In the context of the current paper, o_{t+1} represents the estimated impact of a corporate debt distress episode, according to the assumptions specified in the main text. The contingent liability associated with corporate leverage in distress shifts the public debt ratio upward, allowing stakeholders interpreting the DSA projections to explicitly recognize and factor in the fiscal impact and risks associated with a possible event.

The baseline itself is drawn from the IMF's latest DSA for the PRC, as released in August 2017 Article IV Consultation (IMF 2017b). The table below lists the contribution to changes in public debt (in its broad definition) computed by the IMF in accordance with the above formula. Automatic debt dynamics are dominated by strong real GDP growth, which is seen detracting from the debt ratio to GDP, and are countered by real interest rates, which pushes up the debt ratio. Because only a small portion of debt is denominated in foreign currency, exchange rate depreciation does not affect debt dynamics in this country.

[12] This appendix draws on IMF (2013a), which the reader is referred to for a fuller analytical description of the standard framework.

Contribution to Changes in PRC Public Debt (% of GDP)

	Actual			Projections							
	2006–2014	2015	2016	2017	2018	2019	2020	2021	2022	cumulative	debt-stabilizing primary balance[5]
Change in gross public sector debt	1.4	4.4	5.6	5.9	5.2	4.8	5.1	4.5	3.9	29.3	
Identified debt-creating flows	0.5	4.5	6.8	5.5	5.4	5.3	5.1	4.7	4.4	30.3	
Primary deficit	6.4	7.5	9.6	9.6	9.3	9.2	8.8	8.2	7.5	52.6	–3.2
Primary (noninterest) revenue and grants	24.0	28.5	28.2	27.4	27.3	27.2	26.9	26.8	26.7	162.3	
Primary (noninterest) expenditure	30.5	36.1	37.8	37.0	36.7	36.4	35.7	35.0	34.2	214.9	
Automatic debt dynamics[1]	–3.6	–1.2	–0.8	–2.2	–2.2	–2.3	–2.3	–2.2	–2.1	–13.3	
Interest rate/ growth differential[2]	–3.6	–1.2	–0.8	–2.2	–2.2	–2.3	–2.3	–2.2	–2.1	–13.3	
Of which: real interest rate	0.0	2.1	2.8	1.6	1.8	2.0	2.2	2.4	2.6	12.7	
Of which: real GDP growth	–3.5	–3.3	–3.6	–3.8	–4.0	–4.3	–4.5	–4.6	–4.7	–26.0	
Exchange rate depreciation[3]	0.0	0.0	0.0	…	…	…	…	…	…	…	
Other identified debt-creating flows	–2.3	–1.9	–2.0	–2.0	–1.7	–1.6	–1.4	–1.3	–1.1	–9.0	
Net privatization proceeds (RMB billion) (negative)	–2.3	–1.9	–2.0	–2.0	–1.7	–1.6	–1.4	–1.3	–1.1	–9.0	
Residual, including asset changes[4]	0.9	–0.1	–1.3	0.4	–0.3	–0.5	0.0	–0.2	–0.5	–1.0	

1 Derived as $[(r - \pi(1+g) - g + ae(1+r)]/(1+g+\pi+g\pi))$ times previous period debt ratio, with r = interest rate; π = growth rate of GDP deflator; g = real GDP growth rate; a = share of foreign-currency denominated debt; and e = nominal exchange rate depreciation (measured by increase in local currency value of U.S. dollar).
2 The real interest rate contribution is derived from the numerator in footnote 5 as $r - \pi(1+g)$ and the real growth contribution as -g.
3 The exchange rate contribution is derived from the numerator in footnote 5 as ae(1+r).
4 Includes asset changes and interest revenues (if any). For projections, includes exchange rate changes during the projection period.
5 Assumes that key variables (real GDP growth, real interest rate, and other identified debt-creating flows) remain at the level of the last projection year.
Source: Figure 6 of IMF. 2017b. "People's Republic of China–2017 Article IV Consultation. Press Release; Staff Report; and Statement by the Executive Director for the People's Republic of China." IMF Country Report No. 17/247.

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State-Owned Enterprises Leverage as a Contingency in Public Debt Sustainability Analysis: The Case of the People's Republic of China

The paper demonstrates a method to include state-owned enterprises (SOE) debt as a contingent liability in the public debt sustainability assessment framework. Based on data about corporate leverage in the People's Republic of China and arbitrary assumptions to exemplify the process, the authors extrapolate and project forward to 2021 a measure of contingent liability, on top of the public debt ratio. They conclude that, while corporate leverage is large indeed and deserves the attention it has been receiving from the authorities, it appears fully manageable as a contingency even if less favorable scenarios of some corporate distress came to bear.

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