Role of internally financed capex in rising Chinese corporate debts

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Abstract

China's corporate debt has risen substantially since the global financial crisis, reaching a very high level compared to those of its international peers. Our paper aims to understand potential major drivers behind corporate leverage, using an international aggregate panel dataset. We find strong evidence of negative and significant effects of the internally financed share of capex on the change of corporate debt/GDP: a rise in corporate earnings relative to corporate investment consistently slows corporate debt buildup. Our central finding is robust to choices of benchmark models, a host of control variables, and their various proxies. Our regressions also confirm more important roles played by domestic real economic factors such as income level, growth, investment rate than monetary factors such as interest rates. In particular, while the investment rate contributes to rising corporate debt, a higher saving rate actually dampens corporate leveraging. Finally, we find some tentative evidence of consistently negative impacts of government debt on corporate leveraging, suggesting that possible interactions between corporate and government debts may complicate their measurements.

Key words: Corporate Debt, Corporate earnings, Internal financing, Capital expenditure, China.

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1. Introduction

A decade after the global financial crisis, the total debt to the non-financial sector across the globe continued surging to a new high of nearly 250% of GDP by end 2017, a marked rise of more than 30 percentages compared that of ten years ago (Figure 1). Over the same decade, China's total debt almost doubled to above 250% of GDP, joining the club of the most indebted economies and becoming the champion among all the reporting emerging economies (Figure 1 and Figure 2). A major driver behind this trend of rising indebtedness, for both the world and China in particular, has been the steep increase in corporate debt. China's corporate debt to GDP ratio has now been among the very highest globally, rising by more than 65 percentages within a decade, the fastest among major economies around the world (Figure 2 and Figure 3).

Insert Figure 1 here

Insert Figure 2 here

Insert Figure 3 here

Rising corporate debt globally can pose financial stability risks as well as offer opportunities of deepening financial markets (McKinsey Global Institute, 2018). China's rising total and corporate debts have raised concerns among scholars and policymakers. Chen and Kang (2018) argue that China's credit boom of this magnitude is on a dangerous trajectory, unsustainable and with increasing risks of a disruptive adjustment and a marked growth slowdown. Ma and Laurenceson (2017) highlight that the decade-long big run-up in China's overall debt level has been propelled by all of its three major economic sectors: governments, corporations and households.

Both supply and demand side factors may be at play in China's corporate debt buildup. On the supply side, the large expansion of "shadow banking" in the wake of both the global financial crisis and domestic financial deregulation has to a large extent accommodated and catered the financing needs of Chinese local governments which had officially been prohibited by law from borrowing until recently (Elliott et al., 2015; Lowe, 2018). As a result, much of such "shadow borrowing" undertaken by local governments was often recorded as corporate debt. This in part helps explain China's interesting mix of exceptionally high corporate leverage and modest government debt obligations, when compared to its international peers (Figure 2). On the demand side, Ma and Laurenceson (2017) have put forward causal observations to suggest two possible major drivers behind China's rising corporate debt: the share of internally-funded corporate capital expenditure (IFCE) and the rising importance of real estate and construction firms as holders of corporate debt.

However, Ma and Laurenceson (2017) have not provided the needed formal empirical evidence to verify the potential role for the ratio of corporate earnings over corporate capital spending, although the familiar pecking order theory and internal financing model (Myers and Majluf, 1984; and Hubbard, et al 1995) would intuitively suggest that this ratio may be a major determinant of corporate borrowing. Higher corporate earnings for a given level of capital expenditure imply a less need for external financing, but higher gross corporate earnings also tend to lift corporate capital expenditure. What matters therefore is their ratio (Figure 4). This is more relevant in China's case, where its government is believed to expand infrastructure investment projects just when its corporate earnings weaken, often financed through debts issued by corporate vehicles which are backed by local governments rather than through more conventional fiscal borrowing (Mano and Stokoe, 2017; Lowe, 2018).

To our best knowledge, this paper is the first to formally investigate the effects of the share of internally financed corporate capital expenditure (IFCE) on corporate leverage, using an international panel dataset at the national level. This contrasts with most of the existing empirical studies related to the pecking order theory and internal financing model, which are mostly based on firm level data. Moreover, we also attempt to partially address the challenging issue that in China and some other cases, the demarcation between public and private obligations can be blurred and uncertain, and their interactions are not well known. Finally, our paper conducts robustness checks of our main findings about the impacts of the ratio of corporate earnings over corporate capital expenditure on corporate leverage, using a variety of benchmark specifications and control variables.

Our main findings are straightforward. First, we have strong and robust evidence on the significantly negative effects of the share of internally financed corporate capital expenditure (IFCE) on the pace of corporate debt buildup. A higher ratio of retained corporate earnings to corporate capital expenditure consistently slows the pace of corporate debt buildup. In addition, we also find some tentative evidence that indeed, government debt tends to have a negative impact on changes in the corporate debt/GDP ratio. This could suggest the potential interactions between government and corporate debts as well as raise questions of how they can be better measured, though this issue is far beyond the scope of our paper. Finally, our regressions suggest that domestic real economic factors tend to matter more than monetary and global factors in the determination of changes in corporate debt. In particular, a higher domestic saving rate actually slows corporate leverage, while a higher investment rate adds to corporate debt buildup.

The rest of our paper is organized as follows. Section 2 presents the baseline estimation framework, potential explanatory variables of corporate debt, the panel dataset and some preliminary analysis. Section 3 reports the main estimation results and discusses additional analysis for robustness checks. Section 4 concludes.

2. Estimation framework and methodology

This section lays out our benchmark estimation models and describes data and unit root tests.

2.1 Baseline framework

The baseline framework for our empirical estimation starts with the potentially central role of the share of internally financed capital expenditure in corporate leverage, intuitively motivated and inspired by the conventional corporate finance literature of the "pecking order theory" (Myers and Majluf, 1984) and "internal financing model" (Hubbard et al., 1995).

Specifically, we propose that the ratio of corporate debt to GDP is a function of the share of internally financed or funded capital expenditure by the corporate sector (IFCE), a dummy for the global financial crisis (Crisis), its interaction with IFCE (IFCExCrisis), the ratio of government debt to GDP (GovDebt) and a host of other control variables collected under θ.

$$CorpDebt = c + \lambda_1 IFCE + \lambda_2 GovDebt + \lambda_3 Crisis + \lambda_4 IFCE \times Crisis + \beta \cdot \theta + \epsilon$$

We measure the share of internally financed capital expenditure (IFCE) by the ratio of the retained corporate earnings over the gross capital formation of the non-financial corporate sector. Intuitively, a higher IFCE suggests a less need for external financing and therefore generally lowers corporate leverage, other things being equal (Ma and Laurenceson, 2017). Specifically, we expect the coefficient of IFCE, the central focus in our paper, to be negative, because according to the internal finance theory, stronger internal cash flows boost new corporate investment spending, while a rise in gross corporate earnings relative to capex typically means less need for external financing, slowing corporate debt buildup, according to the pecking order model. Moreover, stronger corporate earnings are often associated with higher economic growth and thus a lower corporate debt/GDP ratio. Finally, in China's case, its government often steps in to ramp up investment spending when its economy and corporate earnings weaken, often financed by new obligations of corporate vehicles that are backed local governments (Figure 4). As a consequence, as IFCE declines, corporate leverage tends to rise; and vice versa.

Insert Figure 4 here

Our baseline model above also includes the government debt/GDP ratio for two main considerations. First, there could be substitution and interactions between private and public borrowing. One possible channel for their interactions is the potential crowding out effect: increased government borrowing put upward pressure on interest rate, crowding private investment and thus dampening corporate borrowing (Alper and Forni, 2011; Hubbard, 2012). Alternatively, when an economy's private sector is unwilling to borrow, its government sector may have to undertake more public debt countercyclically (Mbaye et al, 2018; Schularick, 2013; Schularick and Taylor, 2012). Clearly, the possibility of two-way causalities between CorpDebt and GovDebt could not be ruled out.

Second, in China's case, there has been a wide range of estimates about the possible scale of implicit local government obligations sometimes disguised under corporate debt (those borrowings undertaken by local state firms, local government financing vehicles, and private-public partnership programs). These vehicles were often set up to circumvent the legal prohibitions to local government borrowing. Hence the demarcation of reported data on corporate and government debts can be uncertain (Mano and Stokoe, 2017). In both cases, a rise in the reported government debt should correspond to a fall in the reported corporate debt, other things being equal. The expected sign of its coefficient therefore should be negative. As such, the inclusion of government debt may partly help address the possible measurement error problem.

Finally, our baseline estimation equation considers the potential effects of a range of economic factors as control variables, collected under θ, for the purpose of testing the robustness of our findings. We group these economic factors into two. The first group covers domestic real economic factors such as growth, income level, economic structure, and saving or investment rate. The second group includes monetary variables, financial structure and global factors. The two groups are then combined in our estimation.

The choice of these two groups of economic factors is mainly motivated by the conventional literature, and the main purpose is for them to serve as control variables for the robustness testing of our core findings. Some of the coefficients of these considered control variables may offer more intuitively expected signs, while others can be ambiguous in theory. For instance, we would expect that a higher income level, as measured by per capita PPP, should lift corporate leverage, as it is typically associated with a deeper financial system and greater repayment and servicing capacities. Also, higher growth should directly help ease the corporate debt/GDP ratio, other things being equal. In addition, a higher investment rate may suggest a greater need for external financing, hence we may expect a positive coefficient. Finally, a lower saving rate may suggest a greater need to borrow on the one hand but less savings available to be intermediated on the other.

2.2 Data and Preliminary analysis (unit root tests)

Our data sample for empirical estimation is an uneven international aggregate panel dataset, covering a maximum period of 1995-2016 annual data and consisting of 22 economies at national level. The Appendix A details the data definitions and sources. Our main data sources are from the BIS, OECD, World Bank and Bloomberg. Our crisis dummy variable follows the specification of Moore and Mirzaei (2016): taking on the value of 1 for the crisis period of 2008–2010, and 0 otherwise. To test the robustness of our findings, we later also adopt a post-crisis dummy of an indicator function $I=1$ if $t \geqslant 2007$ (Cheung et al. 2018), in our additional analysis. Our central findings are robust to these two alternative specifications of the crisis dummy.

Before conducting our formal regressions in this paper, we first conduct a preliminary data analysis for all the variables used in our regressions. Following Hurlin and Venet (2008), we perform three panel unit root tests to ensure that all the variables included in the panel fixed-effect regressions are stationary: the W t-bar test (*W_IPS*) proposed by Im et al. (2003), the Fisher-type test (*P_MW*) proposed by Maddala and Wu (1999), and the Z test (*Z_CHOI*) proposed by Choi (2001). We use level for stationary variables and only first-difference for non-stationary or trend-stationary variables. First-differencing has the advantages of turning an integrated time series process into a weakly dependent process and minimizing the bias of the fixed effects estimator (Wooldridge, 2002).

As Appendix B details, our preliminary data analysis results show that only some variables are stationary: IFCE, national GDP growth, global growth, investment rate, saving rate, domestic bond rate, corporate debt to equity ratio. In particular, we identify that our dependent variable, the corporate debt/GDP ratio, is not stationary. Therefore, we use its first-difference as the dependent variable in all of our regressions. Also, to minimize the potential endogeneity risks related to using the government debt/GDP ratio as an explanatory variable, we use its lagged first-difference for all of our regressions.

Finally, to ensure the robustness of our estimations, we propose the four simple benchmark estimation equations, allowing for the inclusion and exclusion of both government debt and the interaction term of the crisis dummy and IFCE, in addition to the crisis dummy and IFCE. They are listed as the following four Equations of (A), (B), (C) and (D).

$$\Delta CorpDebt_{i,t} = c + \lambda_1 IFCE_{i,t} + \lambda_2 \Delta GovDebt_{i,t-1} + \lambda_3 Crisis + \lambda_4 IFCE_{i,t} \times Crisis + \beta\theta_{i,t} + f_i + \epsilon_{i,t} \quad \text{(eq.A)}$$

$$\Delta CorpDebt_{i,t} = c + \lambda_1 IFCE_{i,t} + \lambda_2 \Delta GovDebt_{i,t-1} + \lambda_3 Crisis + \beta\theta_{i,t} + f_i + \epsilon_{i,t} \quad \text{(eq.B)}$$

$$\Delta CorpDebt_{i,t} = c + \lambda_1 IFCE_{i,t} + \lambda_3 Crisis + \lambda_4 IFCE_{i,t} \times Crisis + \beta\theta_{i,t} + f_i + \epsilon_{i,t} \quad \text{(eq.C)}$$

$$\Delta CorpDebt_{i,t} = c + \lambda_1 IFCE_{i,t} + \lambda_3 Crisis + \beta\theta_{i,t} + f_i + \epsilon_{i,t} \quad \text{(eq.D)}$$

where the subscript i indexes the individual economy and the subscript t indexes the time period, and f_i is the economy-specific fixed effect which captures all unobserved, time-constant factors that may affect the dependent variable. We use the fixed-effects estimator for estimating those benchmarks equations because it allows isolating these unobservable economy-specific effects that may be correlated with some independent variables. It also allows correcting the omitted variable bias. Moreover, fixed effect estimators turn out to be less sensitive to the violation of the strict exogeneity assumption, especially with large T (Wooldridge, 2002). To confirm the choice of fixed rather than random effect models, we will run a Hausman test (Green, 2008).

3. Empirical results

This section presents our main empirical findings and additional analysis.

3.1 Core findings

Table 1 presents the regression results for the four aforementioned benchmark estimation equations of A, B, C and D, but initially excluding all of the control variables candidates collected under θ. The test developed by Hausman (1978) shows that unobserved economy-specific effect *fi* are at least correlated with IFCE and IFCExCrisis (see column D and C), justifying our choice of the fixed-effect estimator. Three points are worthwhile mentioning.

First, the estimated coefficient of IFCE is always significantly negative, suggesting that the ratio of gross corporate earnings to corporate gross capital formation consistently has a negative and significant impact on the change in the corporate debt/GDP ratio, regardless of the choices of the benchmark estimation equation. Take Benchmark A in Table 1 as an example, when IFCE doubles, the change in the corporate debt/GDP ratio would decrease by about 4.2 percent, meaning that the pace of corporate borrowing slows with a higher share of internally financed capital expenditure.

Second, for the two benchmark models that include the government debt/GDP ratio (A and B), their regression outcomes all show its significantly negative impacts on the change in the corporate debt/GDP ratio. Table 1 shows that for both benchmarks, if the change in the government debt/GDP ratio in the previous year increases by one percent, the change in the corporate debt/GDP ratio would fall by about 0.12 percent.

Third, the crisis dummy is significantly positive across all four benchmark equations, indicating that corporate leverage actually might accelerate during the crisis years of 2008-2010. On the other hand, its interaction term with IFCE is negative, suggesting that the negative impact of IFCE on corporate borrowing could be stronger during the crisis years. But this indirect effect is insignificant.

Insert here Table 1

Insert here Table 2

Next, we turn to the effects of including control variables, under various benchmark estimation models. Table 2 first shows the results of the inclusion of domestic real economic factors under Benchmark equation (A). So far, our initial list of domestic real economic factors considered consists of national real GDP growth, per capita PPP, investment rate, and share of industry in GDP. We first add one variable a time separately, and then put them all together at the end (Column A5, Table 2). The most important upshot is that the core findings of the significantly negative effects of both IFCE and government debt on the change in the government debt/GDP ratio hold up well in most cases.

Individually, each of the considered domestic real factor has the expected sign but is mostly insignificant, except investment rate; yet they become significant mostly when grouped together. For instance, Column A5 in Table 2 shows that a one percent higher growth rate slows down the pace of the change in corporate debt by 1.2 percent, while a higher investment rate leads to a pickup in the pace of changes in the corporate debt/GDP ratio. Both increases in per capita income and the share of industry in GDP accelerate the rise of the corporate debt/GDP ratio.

Table 3 shows the estimation outcomes of considering the same list of domestic real economic factors in Table 2 but now under Benchmark B equation. In all the cases, the estimated coefficients of both IFCE and government debt again remain significantly negative, while those for the same real economic factors are broadly similar to those reported in Table 2. Our findings of the effects of domestic real economic factors under Benchmark equations C and D are not listed in this paper but are broadly similar to those reported under Benchmark A and B in Table 4 and 5.

Insert here Table 3

Next, we consider the effects of another group of control variables (those of global and monetary factors), again under both benchmarks A and B. So far, our list of considered control variables consists of world GDP growth, the nominal effective exchange rate of the US dollar, the average G3 policy rate, 10-year national government bond yields, and corporate debt/public equity ratio (work in progress).

Tables 4 and 5 present their estimation results, following the same operational approach of adding one factor a time and then assembling them together at the end. Again, in all cases, both IFCE and government debt/GDP significantly slow the pace of corporate debt buildup, regardless of the choice of control variables and benchmark equations. While most of these new control variables generate the expected signs, they are insignificant in most cases, with the only exception of global growth individually. Our findings for the effects of monetary and global factors but under Benchmark equations C and D are not listed in this paper but are broadly similar to those reported under Benchmark A and B in Table 4 and 5.

Insert here Table 4

Insert here Table 5

Table 6 reports the regression outcomes from combining these two groups of control variables together and under all of the four benchmark estimation equations of A, B, C and D, regardless of their individual significances. Four findings are worthy highlighting. First, the coefficient of IFCE remains consistently negative and significant. Second, the effect of government debt continues to be negative, as expected, but now becomes insignificant.

Third, most of the domestic real economic factors are still significant, except the industrial sector's share. Fourth, most of the global and monetary factors remain insignificant but the estimated coefficient for global growth rate now becomes consistently significantly negative.

Insert here Table 6

Finally, Table 7 reports the results for the corresponding parsimonious specifications, by removing from Table 6 those variables that appear insignificant. Clearly, our main findings again remain broadly the same. All in all, our central finding, that the ratio of corporate earnings over corporate capital spending has significantly negative impacts on corporate leverage, is strongly robust to both the choices of benchmark estimation equations and control variables.

Insert here Table 7

3.2 Additional analysis

We have also conducted some additional analysis as further robustness checks for our central findings. These additional analyses may consist of alternative specifications of the crisis dummy, new control variables, and applying other estimation methods.

First, we adopt a different specification of the dummy variable for the global financial crisis. Following Cheung et al. (2018), we redefine the crisis dummy as an indicator function I=1 if $t \geqslant 2007$ and replicate the parsimonious specifications in Table 7 with this alternative dummy and its interaction term with IFCE, again for all four benchmark equations. Table 8 reports the effects of the proposed new dummy and confirms the robustness of the estimated coefficients for IFCE, government debt and most other retained controlled variables. The only main change is the swinging signs and significances of the new crisis dummy and its interaction term. One possible interpretation may relate to the fact that the new dummy is a "post crisis dummy", whereas the old one is a "dummy for the turbulent crisis years".

Insert here Table 8

Second, we also consider alternative control variables. One possibility is to include saving rate instead of investment rate as a new control variable. One argument, made popular by Zhou (2016), HSBC (2016), and Ma and Laurenceson (2017), is that China's high saving rate contributes to and even justifies its very high leverage, for both the corporate sector and the whole economy. Yet the effects of domestic saving on corporate leverage should in theory be ambiguous ex ante, as a higher saving rate may suggest a greater supply of loanable funds on the one hand and a less need to borrow on the other. Its net impact should only be determined empirically. In light of the highly positive correlation between domestic saving and investment rates both across nations and over time (Feldstein and Horioka, 1980), these two variables should not appear in the same estimation equation. But we can check the potential effect by replacing investment with saving in the parsimonious specifications of Table 7.

The results of this exercise are reported in Table 9. Three interesting points are noted. First, our central finding of negative effects of IFCE on changes of the corporate debt/GDP ratio still consistently holds up well, regardless saving or investment rate is used. Second, the negative effect of government debt on the change in corporate debt now becomes statistically significant. Third, contrary to the popular belief and the empirical findings of HSBC (2016) and Ma and Laurenceson (2017), we find that higher domestic saving actually dampens corporate leverage, though its statistical significance is low.

Insert here Table 9

4. Concluding remarks

Globally, the total debt/GDP ratio continued to rise substantially in the aftermath of the global financial crisis, more so for China, whose ratio almost doubled over the past decade. Based on the reported data, China's corporate sector has been the principal driver of this steep rise in its indebtedness. Nowadays, China's corporate leverage is among the very highest in the world. Such a rapid rise of corporate debt may not be sustainable, and together with high public sector debt obligations, can be a major source of financial stability risks (Jordà et al., 2013).

This paper formally investigates the role of a potentially important determinant of corporate leverage: the ratio of retained corporate earnings over corporate capital expenditure. This is in part motivated by the traditional corporate finance literature of the "pecking order theory" and "internal financing model". Our paper is also partly motivated by the observation that when Chinese corporate earnings weakened, the Chinese government typically stepped in to undertake large investment projects often officially financed by corporate debt. Therefore, these two considerations suggest that both rises in the ratio of corporate earnings to capital expenditure and in government debt should negatively affect the pace of corporate debt buildup, other things being equal.

We empirically estimate these effects on the basis of an international panel dataset of 22 economies at the national level for the period of 1995-2016, under a variety of benchmark estimation equations and with a host of control variables. Our core empirical finding is that a rising share of internally financed capital expenditure significantly slows corporate debt buildup. This central finding is strongly robust to choices of benchmark specifications and control variables. We also find more important roles played by domestic real economic factors such as income level, growth and investment rate than monetary and global factors such as interest rates. However, we find that domestic investment rate adds to corporate leverage but not domestic saving rate.

In addition, we find some evidence of consistently negative impacts of lagged government debt on corporate leveraging. This suggests possible substitution and interactions between corporate and government debts, which may complicate their measurements. This is more so in the China's context, wherein until very recently, its local governments were not allowed to borrow but had strong motives to leverage under the disguise of corporate debt obligations.

Our empirical results may have potentially useful policy implications. The significant surge in China's corporate borrowing may be mostly attributable to its government's big stimulus program in the wake of the global financial crisis, often financed with corporate borrowing. The central findings of the consistently negative effects of the ratio of gross corporate earnings over cooperate investment and consistently positive impact of investment rate on the pace of corporate debt buildup highlight the key role of efficiency of investment in containing corporate leverage. First, higher returns from more efficient investment contribute to higher IFCE, thus slowing down corporate leverage. Second, improved efficiency of investment may also directly lower the corporate debt/GDP ratio, since a given economic growth rate can now be supported by a lower investment rate (Ma, Roberts and Kelly, 2017). In other words, the quality of investment spending matters than its quantity.

Also, the consistently negative impact of government debt on corporate leverage can be viewed either as evidence of some general crowding out effects of de facto government spending or as an indication that in China's case, some of its government stimulus program might be financed de facto by corporate borrowing, especially at the local government level. Or both. That is, China's corporate debt may have been exaggerated, while its government obligations probably understated (Figure 2).

This is work in progress, as we will be looking into the immediate future research plans. First, we will consider the inclusion of additional control variables. Second, we will aim to expand our panel dataset. Third, for a dynamic panel data model characterized by the inclusion of lagged change in corporate debt in regressors, we can also use other estimators such as system-GMM to reduce the estimation bias. Fourth, we may also apply our analytical framework to some possible firm-level datasets.

Appendix A: Variables definitions and data sources

Corporate debt	Credit to Non-financial corporations from all sectors at market value in percentage of GDP. Data sources: BIS.
Internally funded corporate capital expenditure	Ratio of corporate earnings to gross capital formation of non-financial corporates. Corporate earnings defined as disposable income of non-financial corporates adjusted for the net acquisition of non-financial assets. Data sources: OECD, and authors' calculation.
Government debt	Credit to General government from all sectors at market value in percentage of GDP except Argentina, Brazil, China, Indonesia, India, Mexico, Russia, Saudi Arabia and South Africa and emerging markets (as a whole) for which we use the only available nominal values in percentage of GDP instead. Data sources: BIS and OECD.
Crisis	Dummy variable of the global financial crisis. Two alternatives: (1) crisis0810 takes value 1 for the crisis period of 2008–2010, and 0 otherwise (Moore and Mirzaei, 2016). (2) crisis0716 is given by the indicator function I=1 if t≥2007 (Cheung et al. 2018).
GDP growth rate	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates of GDP are based on constant 2010 U.S. dollars. Data source: World Bank WDI (NY.GDP.MKTP.KD.ZG).
GDP per capita in purchasing power parity (PPP)	Gross domestic product measured in purchasing power parity and divided by midyear population. Data are in constant 2011 international $. Data sources: World Bank WDI (NY.GDP.PCAP.PP.KD).
Saving rate	Gross domestic savings in percentage of GDP. Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption). Data sources: World Bank WDI (NY.GDS.TOTL.ZS).
Investment rate	Gross capital formation in percentage of GDP. Data sources: World Bank WDI (NE.GDI.TOTL.ZS)
Industry, value added	Industry, value added in percentage of GDP. Data source: World bank WDI (NV.IND.TOTL.ZS).
Market capitalization	Market capitalization of listed domestic companies in percentage of GDP. Market capitalization is the share price times the number of shares outstanding (all classes) for listed domestic companies, end of year values. Data sources: World bank WDI (CM.MKT.LCAP.GD.ZS).
Corporate debt to equity ratio	Ratio of corporate debt to total market capitalization. Data sources: BIS, World Bank WDI (CM.MKT.LCAP.GD.ZS), and authors' calculation.
Bond rate	Year-end 10-year government bond yield. Data sources: OECD and Bloomberg.
Global growth rate	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. Data source: World Bank and OECD.
G3 policy rate	Averaged policy interest rate of US, Japan and Euro area. Lombard rate of Bundesbank is used as policy rate for Euro area for the period from 1995 to 1998. Yearly averaged data and year-end data are both used. Data sources: BIS, St.

	Louis FED, and Bundesbank.
USDNEER	Nominal effective exchange rate of the US Dollar, based a broad basket of trade partner countries. Annual average of monthly data or year-end monthly data). Data sources: BIS.

List of countries (22):	
Austria	Italy
Belgium	Japan
China	Korea, Rep.
Czech Republic	Netherlands
Denmark	Norway
Finland	Portugal
France	Spain
Germany	Sweden
Greece	Switzerland
Hungary	United Kingdom
Ireland	United States

Appendix B (Unit-Root Analysis)

We perform three main panel unit root tests to ensure that all the variables included in the panel fixed-effect regressions are stationary: the W t-bar test of Im et al. (2003) with the W_IPS statistic, the Fisher-type test of Maddala and Wu (1999) with the P-MW statistic, and the Z test of Choi (2001) with Z_CHOI statistic. We run these three tests on two specifications: series only with a constant, and series with both constant and a trend. Our rules of thumb are the following: we conclude with stationarity (or non-stationarity) if more than 3 of 6 statistics reject (don't reject) the null hypothesis of unit root; we conclude with trend stationarity if more than 1 test statistics of 3 show the stationarity with the specification of both constant and trend. For global factors that are constructed as the same for each country, we perform two widely used unit root tests for times series: the KPSS test (Kwiatkowski-Phillips-Schmidt-Shin, 1992) and Ng-Perron test (Ng-Perron, 2001). We apply first KPSS test with the specification including a trend and a constant. According to the significance of the trend, we proceed with KPSS test (LM-statistic) and Ng-Perron test (with MZa and MZt statistics) for the chosen specification (trend and constant/constant). We conclude with stationarity (or unit-root) if more than 1 of statistics give the same conclusion of stationarity (or unit-root). In sum, for both panel variables and the ones constructed with same time series, only the level is used for stationary variables while only the first-difference is used for non-stationary variables and trend stationary variable for precautious reason.

	W_IPS		P_MW		Z_CHOI		Decision
Variable	constant	constant and trend	constant	constant and trend	constant	constant and trend	
Panel unit root tests							
CorpDebt	1.16908	1.58470	42.7069	38.3786	1.17699	1.99903	Non-stat.
IFCE	-2.55765 ***	-4.82707 ***	72.3284 ***	96.3496 ***	-2.50462 ***	-4.44482***	stationary
Growth	-8.17994 ***	-7.37698 ***	148.763 ***	132.844 ***	-7.75679 ***	6.65058***	stationary
PPP	-1.22987	-0.28320	62.2338 **	46.5226	-1.14834	-0.05595	Non-stat.
Invest	-1.46427*	-3.19468***	53.9895	75.3200 ***	-1.46373*	-2.91162***	Stationary
Industry	0.95034	-0.03618	49.9775	46.0911	1.15828	0.11591	Non-stat.
Debt2Equity	-7.08083 ***	-7.66116 ***	337.050 ***	123.661 ***	-6.75876***	-6.28467***	stationary
BondRate	-1.37597*	-6.92257***	63.6092**	126.042***		-6.48427***	stationary
GovDebt	2.12097	-0.57295	35.0259	60.6364 **	2.48442	-0.02975	Non-stat..
SavingRate	-1.74712 **	-1.93288 **	55.9969	65.0048 **	-1.66890 **	-1.78953 **	stationary
Time series unit root tests							
	LM (KPSS)		MZa (Ng-Perron)		MZt (Ng-Perron)		
	constant	constant and trend	constant	constant and trend	constant	constant and trend	
Globalgrowth	0.163079		-11.0561 **		-2.35112 **		stationary
G3Rate		0.056020		-8.40132		-2.00595	Non-stat.
USDNEER	0.105109		-1.58485		-0.65211		Non-stat.

Notes: The optimal number of lags is chosen by minimizing the AIC. ***, *, * are Significance at 1, 5, and 10 percent, respectively for rejecting the unit root null hypothesis (or the stationarity null hypothesis). W_IPS denotes the standardized IPS statistic based on simulated approximated moments (Im, Pesaran and Shin, 2003, table 3). P_MW denotes the Fisher's test statistic proposed by Maddala and Wu (1999) and on individual ADF p-values. Under H0; P_MW has a x2 distribution with 2N of freedom when T tends to infinity and N is fixed. Z_CHOI is the Choi (2001) standardized statistic used for large N samples: under H0; Z_MW has a N (0,1) distribution when T and N tend to infinity. MZa and MZt denote two statistics proposed by Ng-Perron (2001, Table 1). LM denotes de LM-statistic proposed by Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1) with the null of the stationarity.

References

Alper, C. Emre and Lorenzo Forni (2011): "Public Debt in Advanced Economies and its Spillover Effects on Long-term Yields", *IMF Working Paper*, WP/11/210.

Chen, Sally and Kang, Joong Shik (2018): "Credit Booms—Is China Different?" *IMF Working Paper* No. 18/2.

Cheung, YW, S Steinkamp and F Westermann (2018): "A Tale of Two Surplus Countries: China and Germany", memo.

Choi, I. (2001): "Unit root tests for panel data", *Journal of International Money and Finance*, 20 (2), pp. 249–272.

Christophe Hurlin and Baptiste Venet (2008): "Financial Development and Growth: A Re-Examination using a Panel Granger Causality Test," *Working Papers halshs*-00319995, HAL.

Elliott, Douglas, Arthur Kroeber and Yu Qiao (2015): "Shadow banking in China: A primer", *Economic Studies at Brookings*, Washington DC.

Feldstein, Martin, and Charles Horioka (1980): "Domestic Saving and International Capital Flows", *Economic Journal*, 90 (358), pp. 314–329.

Greene, William H. (2008): *Econometric analysis*. 6th ed., Upper Saddle River, N.J. : Prentice Hall.

Hausman, J. A. (1978): "Specification Tests in Econometrics", *Econometrica*, 46(6), pp. 1251-1271.

HSBC (2016): "How worrying is China's debt?", April. Available from: http://www.gbm.hsbc.com/insights/economics/how-worrying-is-chinas-debt

Hubbard, Glenn (2012): "Consequences of government deficits and debt", *International Journal of Central Banking*, 8(S1), pp 203-235.

Hubbard, R. Glenn, Kashap, Anil K. and Whited, Toni M. (1995): "Internal Financing and Firm Investment", *Journal of Money, Credit & Banking*, 27(3), pp. 683-701.

Im, K.S., Pesaran, M.H., Shin, Y. (2003): "Testing for unit roots in heterogeneous panels", *Journal of Econometrics*, 115 (1), pp. 53–74.

Jorda, Ò., Schularick, M. and Taylor, A. M. (2013): "When Credit Bites Back", *Journal of Money, Credit and Banking*, 45(s2), pp. 3-28. doi:10.1111/jmcb.12069

Kwiatkowski, Denis, Peter C.B. Phillips, Peter Schmidt, and Yongcheol Shin (1992), "Testing the Null Hypothesis of Stationary against the Alternative of a Unit Root: How Sure Are We that Economic Time Series Have a Unit Root?", *Journal of Econometrics*, 54(1-3), pp. 159-78.

Lowe, Philip (2018): *Australia's Deepening Economic Relationship with China: Opportunities and Risks*, Address to the Australia-China Relations Institute, Sydney.

Ma, Guonan and James Laurenceson (2017): “China’s debt challenge: stylized facts, drivers and policy implications”, *The Singapore Economic Review*, 2017, 61(1), pp 1-23.

Ma, Guonan, Ivan Roberts and Gerard Kelly (2017): “Rebalancing China’s Economy: Challenges and International Implications”, *China & the World Economy*, 2017, 25(1), pp 1-31.

Maddala, G.S., Wu, S. (1999): “A comparative study of unit root tests with panel data and a new simple test”, *Oxford Bulletin of Economics and Statistics*, pp. 631–652 (special issue).

Mano, Rui C. and Phil Stokoe (2017): “Reassessing the Perimeter of Government Accounts in China”. *IMF Working Paper,* WP/17/272.

McKinsey Global Institute (2018): “Rising corporate debt: peril or promise?” *McKinsey Global Institute Discussion Paper*, June.

Mbaye, Samba, Marialuz Moreno Badia, and Kyungla Chae (2018): “Bailing Out the People? When Private Debt Becomes Public”, *IMF Working Paper*, WP/18/141.

Myers, Stewart C. and Nicholas S Majluf (1984): "Corporate financing and investment decisions when firms have information that investors do not have", *Journal of Financial Economics*, 13 (2), pp. 187–221.

Moore, T. and Mirzaei, A. (2016): “The Impact of the Global Financial Crisis on Industry Growth”, *The Manchester School*, 84: 159-180. doi:10.1111/manc.12090

Ng, Serena, and Pierre Perron (2001): “Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power”, *Econometrica*, 69(6), pp. 1519-54.

Schularick, Moritz (2013): “Public and Private Debt: The Historical Record (1870–2010)”. *German Economic Review*, 15(1), pp. 1–17.

Schularick, Moritz and Alan M. Taylor (2012): “Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870––2008”, *The American Economic Review*, 102(2), pp. 1029-1061.

Wooldridge, Jeffrey M. (2012): *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Wooldridge, Jeffrey M. (2016): *Introductory Econometrics: A Modern Approach*, 6th Edition. Cengage Learning.

Zhou, X. (2016): PBC Governor speech at the 2016 China High-Level Development Forum" (中国人民银行行长周小川在 2016 中国发展高层论坛上的讲话及答问) Available from: http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/3035010/index.html.

Table 1: The four benchmark models without any control variables under θ

	A	B	C	D
IFCE	-4.111***	-4.484***	-5.231***	-5.676***
Lagged ΔGovDebt	-0.122***	-0.125***		
Crisis	5.626**	3.255***	5.646**	2.976***
IFCExCrisis	-2.336		-2.625	
Constant	5.513***	5.878***	6.478***	6.910***
Hausman test	0.5940	0.1895	0.0859	0.0169
N	468	468	468	468
R2	0.082	0.080	0.067	0.064
R2_a	0.030	0.030	0.017	0.016

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by*, **, and ***, respectively, for the t-statistics. *p*-values of Hausman test (Hausman, 1978) are reported. See Appendix A for more details.

Table 2: Control variables of domestic real economic factors (under Benchmark A)

	A1	A2	A3	A4	A5
IFCE	-4.167***	-4.177***	-2.334	-4.997***	-3.973**
Lagged ΔGovDebt	-0.126***	-0.115**	-0.097**	-0.114**	-0.077
Growth	-0.060				-1.244***
ΔPPP		0.000			0.003***
Invest			0.249**		0.400***
ΔIndustry				0.365	0.471
Crisis	5.524**	5.774**	5.766**	5.260**	4.920**
IFCExCrisis	-2.389	-2.205	-2.508	-1.862	-1.881
Constant	5.736***	5.385***	-2.222	6.486***	-2.627
N	468	468	468	463	463
R2	0.082	0.083	0.090	0.089	0.128
R2_a	0.028	0.029	0.036	0.035	0.069

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A for more details.

Table 3: Domestic real economic factors (under Benchmark B)

	B1	B2	B3	B4	B5
IFCE	-4.541***	-4.533***	-2.773*	-5.323***	-4.351**
Lagged ΔGovDebt	-0.128***	-0.117**	-0.101**	-0.115**	-0.078*
Growth	-0.054				-1.250***
ΔPPP		0.000			0.003***
Invest			0.243*		0.394***
ΔIndustry				0.382	0.480
Crisis	3.116***	3.560***	3.222***	3.377***	3.031***
Constant	6.085***	5.718***	-1.658	6.807***	-2.120
N	468	468	468	463	463
R2	0.080	0.081	0.083	0.088	0.144
R2_a	0.028	0.029	0.031	0.035	0.088

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A for more details.

Table 4: Control variables of global and Monetary factors (under Benchmark A)

	A1	A2	A3	A4	A5	A6
IFCE	-4.312***	-4.088***	-3.910***	-4.219***	-4.102***	-4.248***
Lagged ΔGovDebt	-0.120***	-0.123***	-0.119**	-0.126***	-0.122***	-0.118**
Globalgrowth	-0.395*					-0.430
ΔUSDNEER		0.021				-0.038
ΔG3Rate			-0.392			-0.443
BondRate				-0.128		-0.139
Debt2Equity					0.053	0.007
Crisis	4.951**	5.730**	5.265**	5.660**	5.617**	4.326*
IFCExCrisis	-2.340	-2.391	-2.164	-2.403	-2.346	-2.115
Constant	6.967***	5.457***	5.268***	6.243***	5.390***	7.677***
N	468	468	468	444	468	444
R2	0.088	0.082	0.083	0.087	0.083	0.095
R2_a	0.034	0.028	0.029	0.030	0.028	0.030

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. USDNEER is the annual average of the broad-based BIS nominal effective exchange rate of the US dollar; G3Rate denotes the year-end average of 3 policy interest rates of the US, Japan and Euro area; BondRate is the year-end 10-year government bond yield at national level. Debt2Equity is the year-end corporate debt/public equity ratio (see Appendix A for more details).

Table 5: Global and Monetary factors (under Benchmark B)

	B1	B2	B3	B4	B5	B6
IFCE	-4.685***	-4.472***	-4.231***	-4.630***	-4.477***	-4.583***
Lagged ΔGovDebt	-0.123***	-0.125***	-0.121***	-0.128***	-0.125***	-0.119**
Globalgrowth	-0.394*					-0.431
ΔUSDNEER		0.017				-0.042
ΔG3Rate			-0.435			-0.496
BondRate				-0.131		-0.147
Debt2Equity					0.052	0.010
Crisis	2.578***	3.295***	3.048***	3.209***	3.236***	2.133**
Constant	7.332***	5.838***	5.577***	6.669***	5.759***	8.043***
N	468	468	468	444	468	444
R2	0.085	0.080	0.081	0.084	0.080	0.093
R2_a	0.034	0.028	0.029	0.029	0.028	0.030

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. USDNEER is the annual average of the broad-based BIS nominal effective exchange rate of the US dollar; G3Rate denotes the year-end average of 3 policy interest rates of the US, Japan and Euro area; BondRate is the year-end 10-year government bond yield at national level. Debt2Equity is the year-end corporate debt/public equity ratio (see Appendix A for more details).

Table 6: Inclusion of all control variables under the four benchmarks

	A	B	C	D
IFCE	-3.899**	-4.332**	-4.102**	-4.565**
Lagged ΔGovDebt	-0.057	-0.059		
Growth	-1.314***	-1.312***	-1.340***	-1.338***
ΔPPP	0.003***	0.003***	0.004***	0.004***
Invest	0.429***	0.415***	0.476***	0.463***
ΔIndustry	0.414	0.425	0.421	0.432
Globalgrowth	-0.694**	-0.706**	-0.755**	-0.770**
ΔUSDNEER	-0.044	-0.049	-0.050	-0.055
ΔG3Rate	-0.339	-0.385	-0.367	-0.417
Bondrate	-0.014	-0.022	-0.006	-0.013
Debt2Equity	0.002	0.003	0.006	0.008
Crisis	4.089	2.083**	4.040	1.923**
IFCExCrisis	-1.940		-2.043	
Constant	-1.371	-0.556	-2.214	-1.381
N	441	441	441	441
R2	0.151	0.149	0.146	0.144
R2_a	0.080	0.080	0.076	0.077

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details.

Table 7: The inclusion of only significant control variables under four benchmarks

	A	B	C	D
IFCE	-3.527**	-3.913**	-3.836**	-4.253***
Lagged ΔGovDebt	-0.063	-0.065		
Growth	-1.204***	-1.210***	-1.235***	-1.243***
ΔPPP	0.003***	0.003***	0.004***	0.004***
Invest	0.395***	0.390***	0.437***	0.432***
Globalgrowth	-0.571**	-0.580**	-0.620**	-0.630**
Crisis	4.684**	2.622***	4.668**	2.490***
IFCExCrisis	-2.047		-2.160	
Constant	-1.799	-1.272	-2.436	-1.898
N	468	468	468	468
R2	0.132	0.131	0.129	0.127
R2_a	0.075	0.075	0.073	0.073

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details.

Table 8: An alternative crisis dummy (based on the specifications in Table 7)

	A	B	C	D
IFCE	-5.152***	-4.011**	-5.409***	-4.304***
Lagged ΔGovDebt	-0.061	-0.058		
Growth	-1.132***	-1.098***	-1.168***	-1.135***
ΔPPP	0.003***	0.003***	0.003***	0.003***
Invest	0.466***	0.431***	0.502***	0.467***
Globalgrowth	-0.745***	-0.752***	-0.786***	-0.791***
Crisis	-1.022	1.132*	-1.008	1.059*
IFCExCrisis	2.244		2.151	
Constant	-1.695	-1.896	-2.250	-2.421
N	468	468	468	468
R2	0.123	0.120	0.120	0.117
R2_a	0.065	0.064	0.064	0.063

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details.

Table 9: Saving rate replacing investment rate (based on the specifications in Table 7)

	A	B	C	D
IFCE	-6.023***	-6.351***	-7.000***	-7.338***
Lagged ΔGovDebt	-0.111**	-0.112**		
Growth	-0.907***	-0.919***	-0.924***	-0.936***
ΔPPP	0.003***	0.003***	0.003***	0.003***
SavingRate	-0.138	-0.129	-0.066	-0.057
Globalgrowth	-0.600**	-0.606**	-0.664**	-0.670**
Crisis	4.943**	2.980***	4.788**	2.783***
IFCExcrisis	-1.942		-1.983	
Constant	13.340***	13.452***	12.433***	12.544***
N	468	468	468	468
R2	0.117	0.115	0.106	0.105
R2_a	0.059	0.059	0.049	0.050

Notes: Δ denotes the 1st-difference operator for the variable. Significances at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details.

Figure 1: Change of total debt to the non-financial sector, % of GDP, over 2008Q1-2018Q1

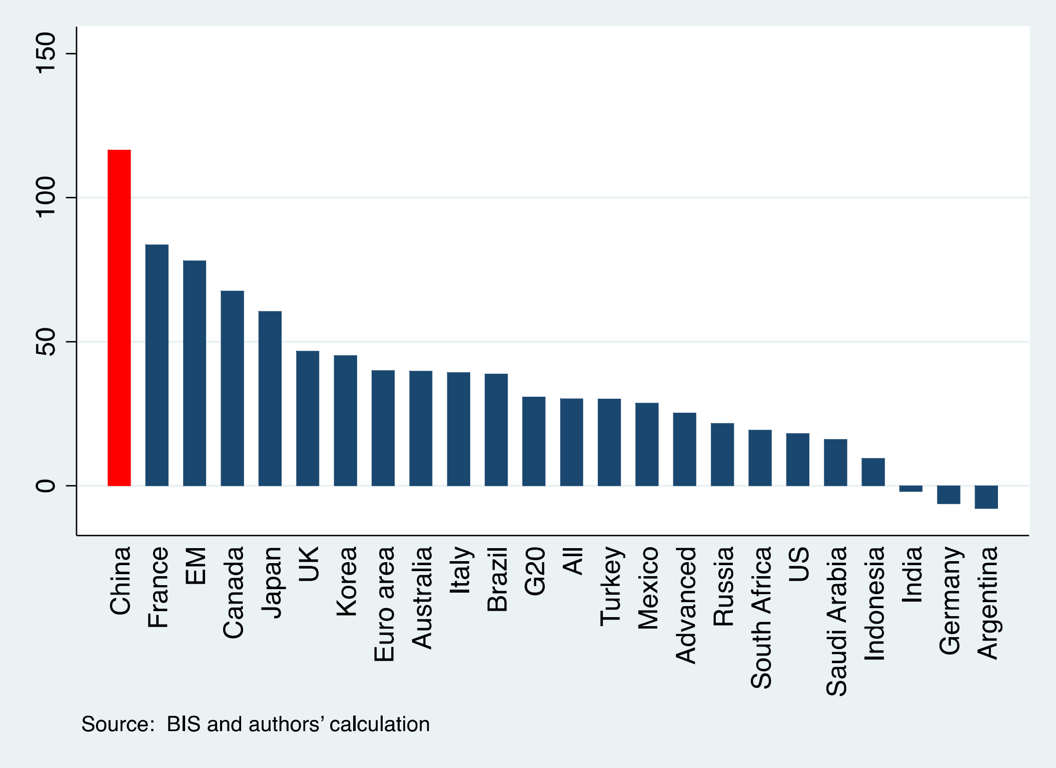

Figure 2: Total debt to the non-financial sector, % of GDP (end 2017)

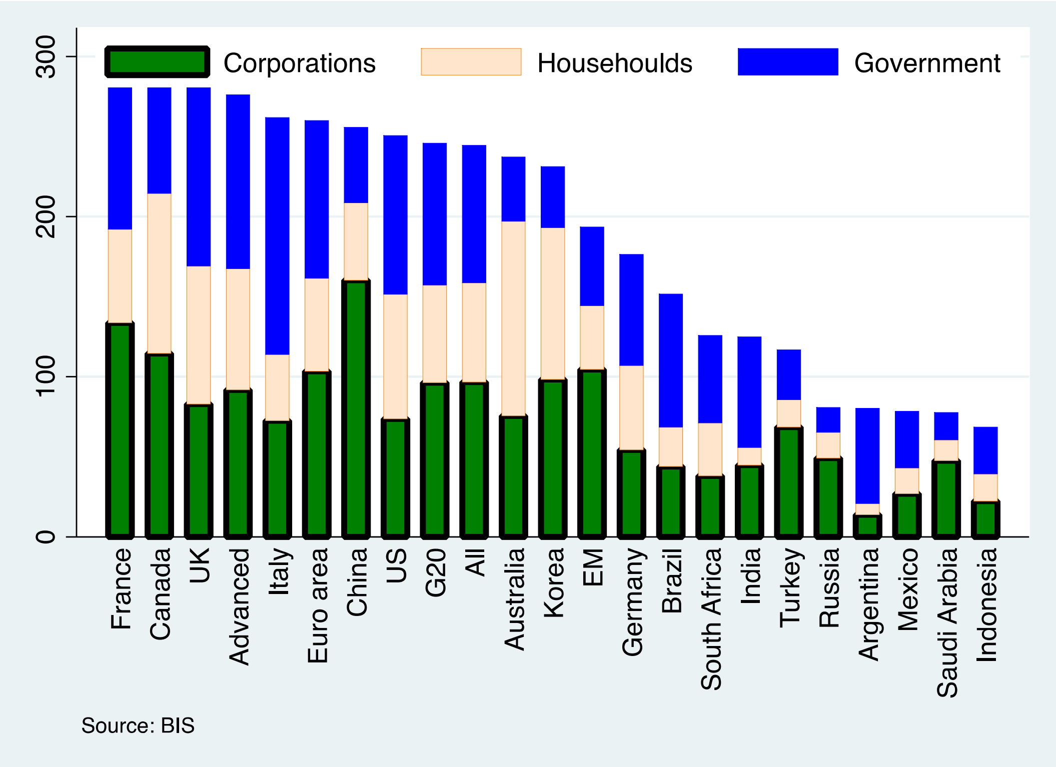

Figure 3: Change of corporate debt, % of GDP, over 2008Q1-2018Q1

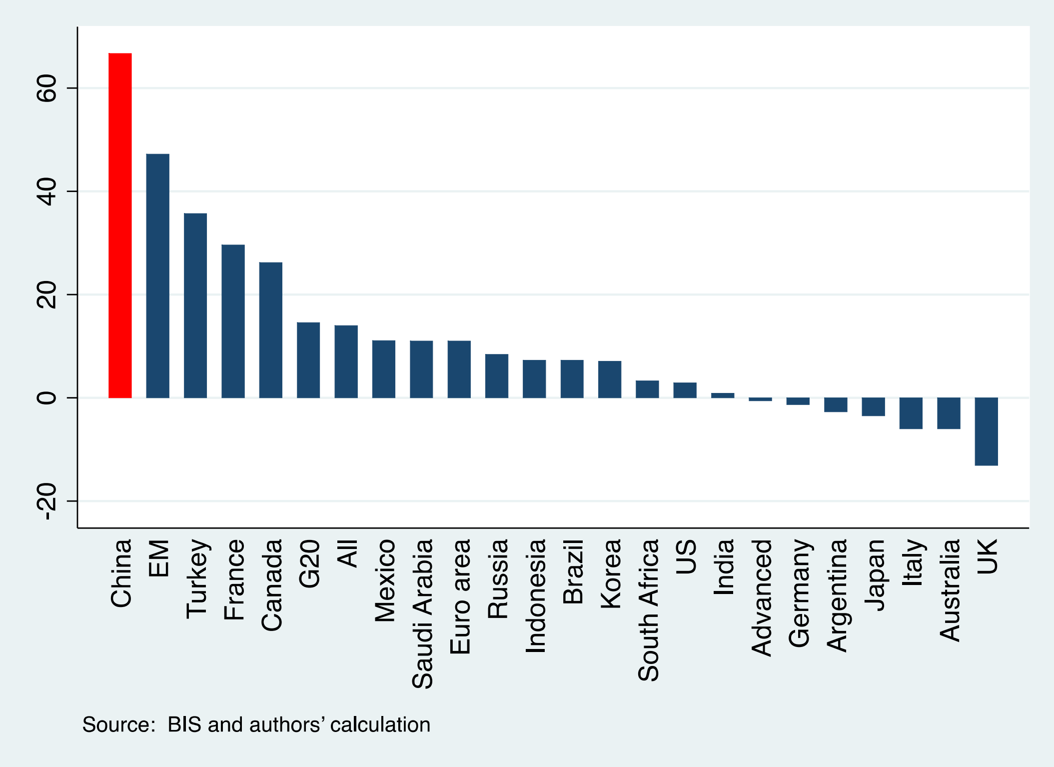

Figure 4: Corporate debt/GDP and Internally financed capital expenditure