Global Research Unit Working Paper #2019-003

The role of internally financed capex in rising Chinese corporate debts

Guonan Ma, About Capital Management
Jinzhao Chen, ESSCA

香港城市大學
City University of Hong Kong
專業 創新 胸懷全球
Professional · Creative For The World
城大商學院
College of Business
CITY UNIVERSITY OF HONG KONG
Department of ECONOMICS & FINANCE

The role of internally financed capex in rising Chinese corporate debts

Guonan Ma and Jinzhao Chen[1]

Abstract

Our paper aims to understand potential drivers behind China's rising corporate leverage, using an international aggregate panel dataset. We find strong evidence of significantly negative 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. This finding is robust to choices of benchmark models, control variables, and data samples. Our regressions also confirm more important roles played by real economic factors than monetary factors. While the investment rate contributes to rising corporate debt, a higher saving rate dampens corporate leveraging. Finally, we find some evidence of consistently negative impacts of government debt on corporate leveraging, suggesting possible interactions between corporate and government debts.

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

---

[1] Guonan Ma: senior advisor of About Capital Management (Hong Kong): guonan@aboutcap.com; Jinzhao Chen (corresponding author): ESSCA, School of Management, France: jinzhao.chen@essca.fr. This paper was written in part while Guonan Ma visited University of Macau and ESSCA School of Management. We would like to thank our discussant Wang Yabin and the participants of the Conference on "China's Economic Reforms: Where Do We Stand" in December 2018 in Hong Kong for their valuable suggestions. Errors remain ours.

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 30 percentages compared that of ten years ago (Figure 1). Over the same decade, China's total debt almost doubled to about 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 nearly 65 percentage points within a decade, the fastest among all the 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). 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 slowdown in economic growth. Ma and Laurenceson (2017) highlight that the decade-long big run-up in China's overall debt level was propelled by all three sectors: governments, corporations and households.[1]

There are two sets of factors, one on the borrowing side and another on the lending side, that have contributed to China's big and rapid corporate debt buildup over the past decade. First, from the borrowing side, is the "shadow borrowing" undertaken by local Chinese governments often via corporate debt. The Chinese government implemented huge infrastructure investment programs, in response to the global financial crisis (Ma et al., 2012). Such investment was mostly funded through debt issued by legal corporate entities linked to Chinese local governments which faced

[1] During 2008-2018, the Chinese household debt rose much faster than the corporate debt, yet starting from a very low base of below 20% of GDP in 2008, compared to almost 100% for the corporate debt. Meanwhile, the Chinese corporate debt rose at a somewhat faster pace than that of the earlier decade, accounting for more than half of the climb in the country's overall debt/GDP ratio since the global financial crisis.

official and legal borrowing constraint specified by the 1994 Budget Law (Zhang and Barnett, 2014; and Bai et al., 2016). These local government-linked, sponsored or even owned legal corporate entities are called “local government financing vehicles” (LGFVs). In addition, local government officials faced effectively weak fiscal discipline and had powerful motives to circumvent legal borrowing restrictions, since they often got faster political promotion by pursuing higher GDP growth often funded with these LGFV debts. 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 relatively modest government debt obligations, when compared to its international peers, and raises a big question of whether and how much of these LGFV debt should be regarded as corporate or government debt (Figure 2).

The second set of main drivers, from the lending side, is a big expansion of “shadow banking” in the Chinese financial system following the global financial crisis. China’s financial system has experienced broad-based liberalization and deregulations over the past decade, with increased banking entries and competition, growing consumer lending, partial interest rate liberalization, greater exchanger rate flexibility, and gradual capital account opening (Ballantyne, et al, 2014; Elliott et al., 2015; Bai, et al, 2016; and Chen et al., 2017). Many of those LGFVs initially borrowed from bank to fund their investment projects in 2008-2009 but soon came under rollover and refinancing pressure. To accommodate such local government “shadow borrowing”, “shadow banking” and the corporate bond market both expanded substantially under a less tightly regulated Chinese financial system. China’s fragmented financial regulatory regime further facilitated the sizable rise of this “shadow banking”.

Complementing these narratives, Ma and Laurenceson (2017) also suggest two other possible 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 an important determinant of corporate borrowing. Higher corporate earnings relative to capital expenditure imply a less need for external financing, but higher gross corporate earnings also tend to lift corporate capital expenditure. For a given capital structure, therefore, what matters more for corporate debt financing is the ratio of retained corporate earnings over corporate capital expenditure (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 officially recorded corporate debts issued by LGFVs rather than through more conventional fiscal borrowing (Zhang and Barnett, 2014; Bai et al., 2016; and Mano and Stokoe, 2017).

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 mainly based on firm-level data. Moreover, we also attempt at least partially to address the challenging issue that in China and possibly some other economies, the demarcation between public and private obligations can be blurred and uncertain, and their interactions are not well understood. 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, control variables, samples and estimators.

Our main findings are straightforward. First, we provide 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. Second, we also find some 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 addressing this issue fully is beyond the scope of our paper. Moreover, our regressions suggest that real economic factors tend to matter more than monetary factors in the determination of changes in corporate debt. In particular, a higher investment rate adds to corporate debt buildup, while a higher domestic saving rate actually slows corporate leverage. Finally, we find some evidence that both expected real interest rate and expected dollar strength appear to have discouraged corporate leverage.

The rest of our paper is organized as follows. Section 2 presents the baseline estimation framework, potential central explanatory variables of corporate debt, the panel dataset and some preliminary analysis. Section 3 reports the core empirical findings from our fixed-effects estimations, while Section 4 discusses additional analysis for multiple robustness checks. Section 5 concludes.

2. Estimation framework and methodology

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

2.1 Baseline framework

The baseline framework for our empirical estimation starts with the potentially important 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 (CorpDebt) is a function of the share of internally financed or funded capital expenditure by the corporate sector (IFCE), the ratio of government debt to GDP (GovDebt), a dummy for the global financial crisis (Crisis), its interaction with IFCE (IFCExCrisis), and a set of control variables $\boldsymbol{X}$.

$$CorpDebt = \lambda_1 IFCE + \lambda_2 GovDebt + \lambda_3 Crisis + \lambda_4 IFCE \times Crisis + \beta \boldsymbol{X} + \epsilon$$

Our central focus is the role of the corporate capital expenditure funded internally in corporate debt financing. 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. It can be viewed as a measure of profitability and cash flow relative to capex.[2] 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 (λ_1), the central focus in our paper, to be negative. This is because while according to the internal finance theory, stronger internally generated cash flows may boost new

[2] An alternative to our indicator of the share of internally financed capex would be the operating cash-flow to capex ratio, to measure the financial autonomy of a firm (Alexandre and Charreaux, 2004). Such an indicator is typically derived from firm-level data, a potential future research topic.

corporate investment spending, 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. Hence one would expect corporate profitability and the corporate debt/GDP ratio to be negatively related (Ma et al., 2012). As a consequence, for both of these the two channels, we expect that $\lambda_1$to be negative: as IFCE declines, corporate leverage tends to rise; and vice versa. Indeed, using a sample of listed Chinese companies, Roberts and Zurawski (2016) empirically confirm a robustly negative correlation between corporate leverage and profitability.

Our baseline model above also includes the government debt/GDP ratio as a potential determinant of corporate leverage 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 may put upward pressure on interest rate or in the presence of financial frictions, tighten the credit constraint facing private firms, crowding out private investment and thereby dampening corporate borrowing (Alper and Forni, 2011; Hubbard, 2012; Huang et al., 2016). Alternatively, when an economy's private sector is unwilling to borrow, its government sector may potentially step in to undertake more public debt obligations 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 could be additional complications related to measurement error problems about reported corporate debt data, as discussed in Section 1. There has been a wide range of estimates about the possible scale of implicit local government obligations often disguised under corporate debt: those borrowings undertaken by LGFV (such as local state firms, local government financing vehicles, and private-public partnership programs). These vehicles were mostly set up to circumvent the 1994 China Budget Law that prohibited local government borrowing (Zhang and Barnett, 2014; and Bai, et al 2016). Yet the China Budget Law was modified in 2014 to allow local governments to legally undertake new debts and swap some of the existing debt undertaken by these LGFV, subject to the approval of the Chinese central government. Hence the demarcation of reported data on corporate and government debts can be uncertain, both in terms of size and over time (Zhang and Barnett, 2014; Mano and Stokoe, 2017; and IMF, 2017).[3]

In any case, the Chinese government often steps in to ramp up investment spending when its economy and corporate earnings weaken, often financed by LGFV debts (Figure 4). A slowdown in the reported government debt issuance thus may in turn add to corporate debts issued by these LGFV (Zhang and Barnett, 2014; and Bai, et al, 2016). Therefore, 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 (λ_2) therefore should be negative. As such, the inclusion of government debt as a determinant of corporate debt may at least partly help address the possible problems of both two-way causality and measurement error.

Insert Figure 4 here

Finally, our baseline estimation equation considers the potential effects of a range of economic factors as control variables, collected under **X**, for the purpose of testing the robustness of our findings. For convenience, we group these economic factors into two. The first group covers domestic real economic factors such as growth, income level, economic structure, and investment or saving rate. The second group includes monetary variables, financial structure and global factors. These two groups of control variables are first individually considered and 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 control variables we consider 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 economic growth should directly help ease the corporate debt/GDP ratio, other things being equal. Its coefficient therefore should be expected to be negative. In addition, a higher

[3] IMF has provided its own estimate of China's augmented fiscal deficit, mostly by taking into consideration debt issued by LGFVs. However, their estimate of augmented debt is only available since 2012 and its methodology can be debated (IMF 2017).

investment rate may suggest a greater need for external financing, hence we may expect a positive coefficient. Moreover, a weaker US dollar may encourage corporate borrowing globally (Borio et al., 2011; McCauley et al., 2015; and Bruno and Shin 2017). Finally, a higher domestic saving rate may suggest a smaller need to borrow on the one hand but more savings available to be intermediated on the other. So its coefficient should be ambiguous ex ante in theory and ascertained empirically.

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 41 economies at national level. Our main data sources are from the BIS, OECD, World Bank and Bloomberg. The Appendix A details the data definitions and sources. Our baseline 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 also consider alternative crisis dummies in the additional analysis in Section 4.

Before conducting the formal regressions, we first conduct a preliminary data analysis for all the variables used in our regressions. As detailed in Appendix B, we follow Hurlin and Venet (2008) and perform three panel unit root tests to ensure that all the variables included in the 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 also 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 shows, 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 throughout all of our regressions in the paper. Also, to minimize the potential endogeneity risks related to the inclusion of the government debt/GDP ratio as an explanatory variable, which is also non-stationary, 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 the interaction term of the crisis dummy and IFCE (IFCExCrisis) and government debt, in addition to the crisis dummy and IFCE. They are listed as the following four benchmark estimation equations of (A), (B), (C) and (D).

$$\Delta CorpDebt_{i,t} = \lambda_1 IFCE_{i,t} + \lambda_2 \Delta GovDebt_{i,t-1} + \lambda_3 Crisis + \lambda_4 IFCE_{i,t} \times Crisis + \beta X_{i,t} + FE + \epsilon_{i,t}$$ (Eq. A)

$$\Delta CorpDebt_{i,t} = \lambda_1 IFCE_{i,t} + \lambda_2 \Delta GovDebt_{i,t-1} + \lambda_3 Crisis + \beta X_{i,t} + FE + \epsilon_{i,t}$$ (Eq. B)

$$\Delta CorpDebt_{i,t} = \lambda_1 IFCE_{i,t} + \lambda_3 Crisis + \lambda_4 IFCE_{i,t} \times Crisis + \beta X_{i,t} + FE + \epsilon_{i,t}$$ (Eq. C)

$$\Delta CorpDebt_{i,t} = \lambda_1 IFCE_{i,t} + \lambda_3 Crisis + \beta X_{i,t} + FE + \epsilon_{i,t}$$ (Eq. D)

where the subscript i indexes the individual economy and the subscript t indexes the time period.

FE is the economy-specific fixed-effect which captures all unobserved, time-constant factors that may affect the dependent variable. In this paper, we use the fixed-effects estimator for estimating those benchmarks equations in part 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 estimator turns 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 run a Hausman test and also consider the system-GMM estimator in robustness checks.

3. Empirical results: core findings

This section summarizes the main results of our baseline estimation.

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 **X**. The Hausman (1978) test shows that unobserved economy-specific effect *FE* are at least correlated with IFCE and IFCExCrisis, justifying our choice of the fixed-effect estimator. Three points about these preliminary estimation outcomes reported in Table 1 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 choice of the benchmark estimation equations. Take Benchmark A in Table 1 as an example, when IFCE doubles, the change in the corporate debt/GDP ratio would decrease by about 5.8 percent, meaning that the pace of corporate borrowing slows with a higher share of internally financed capital expenditure. This finding is expected and consistent with those reported by Roberts and Zurawski (2016), which use firm-level data. We come back to this central finding multiple times to ensure its robustness in the rest of our paper.

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. Again, the sign of the estimated coefficient is as expected: slower lagged government debt accelerates corporate leverage. Table 1 shows that for these two 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 0.11 percent.

Third, the crisis dummy is positive across all four benchmark equations but not always significant, indicating that corporate leverage might actually accelerate during the crisis years of 2008-2010. On the other hand, the coefficient of its interaction term with IFCE is also positive, suggesting that the negative impact of IFCE on corporate borrowing could be weakened 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 reports 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 of this exercise 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 mostly hold up well.

Individually, each of the considered domestic real factors has the expected sign but is mostly insignificant, except investment rate; yet they mostly become significant 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 1.1 percent, while one percent higher investment rate leads to a pickup of 0.3 percent in the pace of changes in the corporate debt/GDP ratio. Both increases in per capita income and the share of industry in GDP also accelerate the rise of the corporate debt/GDP ratio.

Table 3 repeats the same exercise in Table 2 but now under Benchmark equation B. In most of 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 reported in Table 4 and 5.

Insert here Table 3

Next, we consider the effects of the second 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 for this group 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.

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 often insignificant, with the exceptions of global growth and G3 policy rate. 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 under Benchmark A and B and reported 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 statistical significances. Five 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. Finally, the G3policy rate is no longer significant, while the nominal effective exchange rate of USD gains some significance for all four benchmark models.

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 robust and 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 consistently robust to both the choices of benchmark estimation equations and control variables. Also, the effect of lagged government debt on the change in corporate debt is consistently negative, but losing some statistical significance from time to time. Finally, most of the real economic factors appear more important than the chosen monetary and financial factors, though our robust checks in Section 4 indicate other financial factors do have significant effects on corporate leverage.

Insert here Table 7

4. Empirical results: additional analysis

In this section, we conduct multiple robustness checks for our central findings discussed in Section 3. These additional analyses include alternative specifications of the crisis dummy, new control variables, different data samples, and 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 new crisis dummy as an indicator function I=1 if t⩾ 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 our findings on IFCE, government debt and most other retained controlled variables.[4]

Insert here Table 8

Second, we consider alternative control variables. One possibility is to include saving rate instead of investment rate as a new control variable. One popular argument (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, whether 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

[4] We also consider another crisis dummy that takes the value of 1 for the period of 2007-2010, and 0 otherwise. The main estimation findings on IFCE and other control variables remain broadly robust. These results are not reported but will be available upon request.

(2017), we find that higher domestic saving actually dampens corporate leverage, though its statistical significance is low.

Insert here Table 9

Third, we also consider alternative monetary factors in our control variable set, which are mostly insignificant in the baseline estimations discussed in Section 2. In particular, two such monetary factors are discussed here. One is a proxy of expected real interest rate for the borrowing cost facing firms. We use the 10-year US Treasury Inflated-Indexed Securities yield (TIPS) as a measure of expected real borrowing cost. TIPS is estimated as the difference between 10-year US government bond yield and 10-year US breakeven inflation rate (see Appendix A). However, we have to downsize the data sample for our regressions by more than 10 percent due to limited data availability on the US TIPS. As expected, Table 10 shows a negative impact of US TIPS on the change in the ratio of corporate debt/GDP under all four benchmark estimation equations, suggesting that a higher value of TIPS (i.e. higher expected real borrowing cost) discourages the corporate debt buildup. However, this negative impact is not significant statistically. In any case, the inclusion of this new control variable doesn't affect our main findings on roles of the IFCE and other real economic factors.

Insert here Table 10

Another monetary factor is some measure of the expected US dollar appreciation or depreciation. As detailed in Appendix A, we measure this factor as the lagged ratio of the effective 12-month US dollar forward exchange rate to its spot counterpart (NEER). A value higher than (less than) 1 indicates an expected appreciation (depreciation) of the US dollar. We would expect a negative sign of this variable, since an expected weaker dollar may encourage corporate borrowing globally through carry trade and an expansion of dollar credit (Borio et al, 2011; McCauley, et al, 2015; and Bruno and Shin, 2017). Table 11 reports the results under the Table 7 specification and shows significantly negative impact of the lagged expected effective dollar appreciation: an expected US dollar appreciation discourages the corporate leverage buildup. Our main findings on the roles of the IFCE and other real economic factors hold up well, with the only exception of government debt whose sign turns insignificantly positive.

Insert here Table 11

Fourth, we also allow for the possibility of some dynamic relationship between IFCE and corporate debt. For instance, IFCE could intuitively lead new corporate debt undertaking, as firms may formulate their decisions about the next period's borrowing according to the current IFCE. One simple way to address this issue is to have a lagged IFCE in place of IFCE in the parsimonious specification of Table 7. This exercise under all of the four benchmark equations is reported in Table 12. Again, the coefficient of lagged IFCE has the expected negative sign and remains significant, even though size of the estimated coefficient of the lagged IFCE is slightly different from that of IFCE previously reported. Our core findings remain robust.

Insert here Table 12

Fifth, although our paper mostly takes a China perspective, one may ask the question of whether more generally from a global perspective, China is an outlier, potentially resulting in outsized influences on the impact of IFCE. To address this question, we use a sample excluding China and reproduce the estimation of the same parsimonious specification of Table 7. The estimation results on an ex-China sample under the Table 7 specification are reported in Table 13. Again, the negative impact of IFCE remains significant statistically.

Insert here Table 13

Finally, we also consider a dynamic panel model by allowing the lagged change in corporate debt among the regressors. As its inclusion may introduce endogeneity due to its correlation with the error terms, we use the system-GMM estimator to reduce the estimation bias and inconsistency.[5] To have sufficient instruments that consist of lagged variables in level and in first difference, we downsize our initial sample to a balanced one of 21 economies. Moreover, the lagged change in government debt now should be removed, since the inclusion of both lagged corporate debt and lagged government debt together can be redundant, as they may be correlated and have conflicting classification and measurement issues, as mentioned earlier.

Table 14 reports the results of this simple dynamic panel modelling exercise. First, the impact of lagged dependent variable is significantly negative, indicating the speed of increase in corporate debt in previous year decreases its speed this year. Yet interpreting the half-life here can be tricky,

[5] The potential weakness of the difference-GMM estimator is that lagged levels are often rather poor instruments for first differenced variables. The system-GMM estimator includes lagged levels as well as lagged differences (Arellano and Bover, 1995; Bond et al. 2001).

as our dependent variable is a first-difference and an AR(2) process. Its negative coefficient indicates a mean-reverting process to an "equilibrium speed" of corporate leverage adjustment in the long run, with a half-life of approximately 0.4 years. Second, the negative impact of IFCE remains significant, even after the inclusion of the lagged dependent variable. The change in the size of the IFCE coefficient relative to the previous fixed-effects estimations may be partially understood by the explanatory power of the lagged change in corporate debt and partially related to fewer observations.

In sum, our main findings of significantly negative effects of IFCE on the pace of corporate leverage remain highly robust to the multiple robustness checks.

Insert here Table 14

5. 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 is unsustainable.

This paper 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". Internally generated cash flows allow firms to pay down their debt or fund new capital expenditure with less leverage. Our paper is also partly motivated by the observation that when Chinese corporate earnings weakened, the Chinese government often stepped in to undertake large investment projects officially financed by corporate debt issued by LGFVs. These two considerations suggest that a rise in the ratio of corporate earnings to capital expenditure and higher government debt should both 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 41 economies at the national level for the period of 1995-2016, under a variety of benchmark estimation equations and with a range of control variables and data samples. Our core empirical finding is that a rising share of internally financed capital expenditure significantly slows the speed of corporate debt buildup. This central finding is consistently robust to the choices of benchmark specifications, control variables, samples, and estimators.

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, potentially giving rise to the problems of measurement errors and two-way causality. This is more so in China's context, wherein until very recently, its local governments had been prohibited from borrowing but had strong motives to leverage under the disguise of corporate debt obligations issued by LGFVs.

We also find more important roles played by real economic factors such as income level, growth and investment rate than those by monetary factors such as interest rates. In particular, we find that domestic investment rate adds to corporate leverage but not domestic saving rate. That is, a high saving rate neither explains nor justifies China's high corporate leverage. While most of the monetary factors considered so far have insignificant effects and sometime do not even have the anticipated signs, we do find some evidence of significantly negative effects of both the expected real interest rate and expected US dollar strength on the pace of corporate leverage.

Our empirical results may have potentially useful policy implications, especially for China. First of all, our consistent findings of the significantly negative effects of the ratio of gross corporate earnings over corporate investment and positive impact of investment rate on the pace of corporate debt buildup together highlight a central role for investment efficiency. First, higher returns on more efficient investment strengthen corporate cash flows and potentially 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 et al., 2017). Hence if corporate debt funds profitable investment, efficiency and productivity should not suffer. In other words, the marked and prolonged surge in China's corporate debt/GDP ratio over the past decade could be a consequence of declining investment efficiency (Figure 4).

Moreover, the consistently negative impact of government debt on corporate leverage can be viewed as an indication of both general crowding out effects of government spending and the shadow borrowing undertaken by Chinese local governments. In the latter case, effectively, the significant surge in China's corporate borrowing over the past decade may be partly attributable to rising debts issued by legal corporate entities that are linked to local governments (LGFVs). That is, China's corporate debt may have been exaggerated, while its government obligations probably understated. If so, the latest Chinese government policy to swap some of the reported LGFV corporate debts into local government debt should facilitate corporate deleveraging but meanwhile also adds to government debt obligations.

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, OECD and IMF.
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, OECD, and IMF.
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 $t \geq 2007$ (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 US 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 and constant 2010 U.S. dollars. Data sources: World Bank and OECD.
G3 policy rate	Averaged policy interest rate of US, Japan and Euro area. Lombard rate of Bundesbank is used for the 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 on a broad basket of trade partner countries. Annual average of monthly data or year-end monthly data. Data sources: BIS.
USTIPS	Year-end US 10-Year Treasury Inflation (or Protected)-Indexed Securities yield, percent per annum. Measured as the difference between 10-year US government bond yield and 10-year US breakeven inflation rate, which represents a measure of expected inflation in the next 10 years. Data sources: Bloomberg.
Expected USD appreciation	Expected effective appreciation of US dollar over the next 12 months. Measured as the ratio of the effective 12M US dollar forward exchange rate to the NEER, based on a narrow basket of trade partner countries. Annual average of monthly or daily data. Data sources: BIS, Bloomberg.

List of countries (41):			
Australia	Estonia	Lithuania	Slovenia
Austria	Finland	Luxembourg	South Africa
Belgium	France	Mexico	Spain
Brazil	Germany	Netherlands	Sweden
Canada	Greece	New Zealand	Switzerland
Chile	Hungary	Norway	Turkey
China	Ireland	Peru	United Kingdom
Colombia	Italy	Poland	United States
Costa Rica	Japan	Portugal	
Czech Republic	Korea, Rep.	Russia	
Denmark	Latvia	Slovak Republic	

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: (1) series only with a constant; (2) series with both a constant and 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 out of 3 show stationarity with the specification of both constant and trend. For global factors that are the same for each country, we perform two 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 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 single time series (i.e. global factors), 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	1.73162	0.79629	72.0376	83.2772	1.81649	1.43835	Non-stat.
IFCE	-3.83248***	-3.13355***	133.806***	142.369***	-3.54595***	-4.45349***	stationary
Growth	-12.0654***	-9.63171***	297.905***	239.182***	-11.5073***	-8.93756***	stationary
PPP	1.97683	0.61966	83.1302	72.6696	2.03109	0.96003	Non-stat.
Invest	-3.77857***	-4.97668***	128.441***	153.407***	-3.77194***	-4.52228***	Stationary
Industry	-1.99771**	-0.03233	112.574**	87.9366	-0.43331	0.19980	Non-stat.
Debt2Equity	-8.22439***	-4.63829***	356.519***	162.966***	-7.89897***	-4.58199***	stationary
BondRate	-3.49761***	-6.44322***	330.667***	142.168***	-0.37257	-3.84067***	stationary
GovDebt	1.27889	0.09918	73.4323	91.3652	1.65731	0.56783	Non-stat..
SavingRate	-4.13477***	-3.21125***	134.769***	123.604**	-4.05120***	-3.02592***	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.
USTIPS		0.112803		-9.60162		-2.10256	Non-stat.
USDNEER	0.105109		-1.58485		-0.65211		Non-stat.
Expected USD appreciation		0.221598**		-22.9252**		-3.33409**	stationary

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

Alexandre, H and Charreaux, G. 2004: Efficiency of French Privatizations: A Dynamic Vision. Journal of Corporate Finance 10: 467–494.

Alper, CE and Forni, L. 2011: Public Debt in Advanced Economies and its Spillover Effects on Long-term Yields. IMF Working Paper WP/11/210, International Monetary Fund: Washington DC.

Arellano, M and Bover, O. 1995: Another look at the instrumental variable estimation of error- components models. Journal of Econometrics 68 (1): 29-51.

Bai, C, Hsieh, C and Zheng S. 2016: The long shadow of a fiscal expansion. Brookings Papers on Economic Activity. 60: 309–327.

Ballantyne, A, Hambur, J, Roberts, I and Wright, M. 2014: Financial Reform in Australia and China. Reserve Bank of Australia Research Discussion Paper RDP 2014-10.

Borio, C, McCauley, R and McGuire, P. 2011: Global credit and domestic credit booms. BIS Quarterly Review (September): 43-57.

Bond, S, Hoeffler, A, and Temple, J. 2001: GMM estimation of empirical growth models. Economics Papers 2001-W21, Economics Group, Nuffield College, University of Oxford: Oxford.

Bruno, V and Shin, H-S. 2017: Global Dollar Credit and Carry Trades: A Firm-Level Analysis. Review of Financial Studies 30(3): 703–749.

Chen, S and Kang, J. 2018: Credit Booms—Is China Different? IMF Working Paper No. 18/2, International Monetary Fund: Washington DC.

Chen, Z, He, Z and Chun Liu, C. 2017: The Financing of Local Government in China: Stimulus Loan Wanes and Shadow Banking Waxes. THE UNIVERSITY OF CHICAGO BOOTH SCHOOL OF BUSINESS discussion paper.

Cheung, YW, Steinkamp, S and Westermann F. 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): 249–272.

Elliott, D, Kroeber, A and Yu, Q. 2015: Shadow banking in China: A primer. Economic Studies at Brookings, Washington DC.

Feldstein, M, and Horioka C. 1980: Domestic Saving and International Capital Flows. Economic Journal 90 (358): 314–329.

Hausman, JA. 1978: Specification Tests in Econometrics. Econometrica 46(6): 1251-1271.

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

Huang, Y, Pagano, M and Panizza, U. 2016: Public Debt and Private Firm Funding: Evidence from Chinese Cities. Working Paper, IHEID Working Papers 10-2016, Economics Section, The Graduate Institute of International Studies.

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

Hubbard, RG, Kashap, AK and Whited, TM. 1995: Internal Financing and Firm Investment. Journal of Money, Credit & Banking 27(3): 683-701.

Hurlin, C and Venet B. 2008: Financial Development and Growth: A Re-Examination using a Panel Granger Causality Test. Working Papers halshs-00319995, HAL.

Im, KS, Pesaran, MH and Shin, Y. 2003: Testing for unit roots in heterogeneous panels. Journal of Econometrics 115 (1): 53–74.

International Monetary Fund 2017: 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, International Monetary Fund: Washington DC.

Kwiatkowski, D, Phillips, PCB, Schmidt, P and Shin, Y. 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): 159-78.

Ma, G and Laurenceson, J. 2017: China's debt challenge: stylized facts, drivers and policy implications. The Singapore Economic Review 61(1): pp 1-23.

Ma, G, Roberts, I and Kelly, G. 2017: Rebalancing China's Economy: Challenges and International Implications. China & the World Economy 25(1): 1-31.

Ma, G, McCauley, R and Lam, L. 2012: Narrowing China's current account surplus: the roles of saving, investment and the renminbi. In: McKay, H and Song L (eds). Rebalancing and Sustaining Growth in China, Chapter 4. The Australian National University Press: Canberra.

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

Mano, RC and Stokoe, P. 2017: Reassessing the Perimeter of Government Accounts in China. IMF Working Paper WP/17/272, International Monetary Fund: Washington DC.

McCauley, R, McGuire, P and Sushko, V. 2015: Global dollar credit: links to US monetary policy and leverage. Economic Policy 30(82): 187-229.

McKinsey Global Institute 2018: Rising corporate debt: peril or promise? McKinsey Global Institute Discussion Paper, June.

Mbaye, S, Badia, MM and Chae, K. 2018: Bailing Out the People? When Private Debt Becomes Public. IMF Working Paper WP/18/141, International Monetary Fund: Washington DC.

Myers, SC and Majluf, NS. 1984: Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13 (2): 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, S, and Perron, P. 2001: Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power. Econometrica 69(6): 1519-54.

Roberts, I and Zurawski, A. 2016: Changing Patterns of Corporate Leverage in China: Evidence from listed companies. In: Song, L, Garnaut, R, Cai, F and Johnston, L (eds). China's New Sources of Economic Growth: Reform, Resources and Climate Change, Chapter 12. Australian National University Press: Canberra.

Schularick, M. 2013: Public and Private Debt: The Historical Record (1870–2010). German Economic Review 15(1): 1–17.

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

Wooldridge, JM. 2002: Econometric Analysis of Cross Section and Panel Data. MIT Press: Cambridge, MA.

Zhang, S and Barnett, S. 2014: Fiscal Vulnerabilities and Risks from Local Government Finance in China. IMF Working Paper WP/14/4, International Monetary Fund: Washington DC.

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) http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/3035010/index.html. Accessed 2 January 2019.

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

	A	B	C	D
IFCE	-5.775***	-5.586***	-6.323***	-6.161***
Lagged ΔGovDebt	-0.109**	-0.108**		
Crisis	1.081	1.727**	0.973	1.524*
IFCExCrisis	0.677		0.577	
Constant	7.018***	6.845***	7.413***	7.265***
Hausman test	0.0000	0.0020	0.0000	0.2622
N	736	736	740	740
R2	0.049	0.048	0.042	0.042
R2_a	-0.012	-0.011	-0.017	-0.016

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels 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	-5.989***	-5.870***	-3.981***	-5.981***	-6.976***
Lagged ΔGovDebt	-0.114**	-0.095*	-0.080	-0.110**	-0.051
Growth	-0.099				-1.129***
ΔPPP		0.001			0.003***
Invest			0.264**		0.310**
ΔIndustry				0.031	0.100
Crisis	0.997	1.317	1.261	0.929	1.555
IFCExCrisis	0.461	0.986	0.450	0.799	0.002
Constant	7.541***	6.724***	-0.988	7.267***	2.158
N	736	736	736	718	718
R2	0.050	0.052	0.056	0.050	0.092
R2_a	-0.012	-0.010	-0.006	-0.014	0.027

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels 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	-5.869***	-5.594***	-3.846***	-5.746***	-6.976***
Lagged ΔGovDebt	-0.114**	-0.095*	-0.079	-0.110**	-0.051
Growth	-0.102				-1.129***
ΔPPP		0.001			0.003***
Invest			0.266**		0.310**
ΔIndustry				0.021	0.100
Crisis	1.428*	2.243***	1.691**	1.684**	1.556*
Constant	7.440***	6.482***	-1.144	7.050***	2.158
N	736	736	736	718	718
R2	0.050	0.052	0.056	0.049	0.092
R2_a	-0.011	-0.008	-0.005	-0.013	0.028

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels 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	-6.053***	-5.754***	-5.494***	-4.862***	-5.593***	-4.612***
Lagged ΔGovDebt	-0.103**	-0.110**	-0.100*	-0.135**	-0.108**	-0.114**
Globalgrowth	-0.538**					-0.526*
ΔUSDNEER		0.029				-0.067
ΔG3Rate			-0.812*			-1.115**
BondRate				0.006		-0.056
Debt2Equity					-0.091	-0.110
Crisis	0.176	1.191	0.435	-0.097	1.161	-2.078
IFCExCrisis	0.676	0.624	0.940	2.053	0.604	2.526
Constant	8.978***	6.958***	6.677***	6.306***	7.090***	8.263***
N	736	736	736	644	735	644
R2	0.056	0.049	0.052	0.041	0.049	0.055
R2_a	-0.006	-0.013	-0.009	-0.025	-0.013	-0.016

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels 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: Control variables of global and Monetary factors (under Benchmark B)

	B1	B2	B3	B4	B5	B6
IFCE	-5.864***	-5.580***	-5.239***	-4.316***	-5.423***	-3.980***
Lagged ΔGovDebt	-0.103**	-0.110**	-0.100*	-0.133**	-0.108**	-0.113**
Globalgrowth	-0.538**					-0.532*
ΔUSDNEER		0.030				-0.062
ΔG3Rate			-0.794			-1.030*
BondRate				0.019		-0.031
Debt2Equity					-0.092	-0.117
Crisis	0.821	1.789**	1.341	1.922**	1.738**	0.446
Constant	8.805***	6.796***	6.445***	5.727***	6.935***	7.587***
N	736	736	736	644	735	644
R2	0.056	0.049	0.052	0.039	0.049	0.053
R2_a	-0.004	-0.012	-0.008	-0.025	-0.012	-0.016

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels 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	-6.203***	-5.291***	-6.284***	-5.371***
Lagged ΔGovDebt	-0.028	-0.028		
Growth	-1.725***	-1.739***	-1.732***	-1.746***
ΔPPP	0.005***	0.005***	0.005***	0.005***
Invest	0.413***	0.434***	0.430***	0.452***
ΔIndustry	0.093	0.086	0.097	0.091
Globalgrowth	-0.985***	-0.947***	-1.013***	-0.975***
ΔUSDNEER	-0.131*	-0.121*	-0.133*	-0.124*
ΔG3Rate	-0.865	-0.776	-0.879	-0.790
Bondrate	-0.048	-0.022	-0.046	-0.020
Debt2Equity	-0.120	-0.129	-0.119	-0.127
Crisis	-3.116	-0.121	-3.200	-0.202
IFCExCrisis	3.041		3.046	
Constant	2.845	1.352	2.545	1.046
N	628	628	628	628
R2	0.135	0.132	0.135	0.132
R2_a	0.062	0.060	0.063	0.061

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels 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	-6.708***	-6.653***	-6.962***	-6.916***
Lagged ΔGovDebt	-0.030	-0.029		
Growth	-0.998***	-1.000***	-1.017***	-1.019***
ΔPPP	0.003***	0.003***	0.003***	0.003***
Invest	0.328***	0.329***	0.319***	0.320***
Globalgrowth	-0.767***	-0.765***	-0.782***	-0.780***
Crisis	0.675	0.852	0.657	0.808
IFCExCrisis	0.189		0.161	
Constant	3.266	3.191	3.712	3.648
N	736	736	740	740
R2	0.102	0.102	0.101	0.101
R2_a	0.039	0.041	0.040	0.041

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels 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	-9.955***	-6.787***	-10.128***	-7.077***
Lagged ΔGovDebt	-0.043	-0.037		
Growth	-0.963***	-0.955***	-0.989***	-0.978***
ΔPPP	0.003***	0.003***	0.003***	0.003***
Invest	0.395***	0.339***	0.386***	0.332***
Globalgrowth	-0.760***	-0.769***	-0.783***	-0.788***
N	736	736	740	740
R2	0.114	0.105	0.112	0.103
R2_a	0.052	0.044	0.052	0.043

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details. Constant, Crisis dummy and IFCEXCrisis are included as the specification of Table 7.

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

	A	B	C	D
IFCE	-8.577***	-8.491***	-9.071***	-8.969***
Lagged ΔGovDebt	-0.083	-0.083		
Growth	-0.889***	-0.892***	-0.913***	-0.916***
ΔPPP	0.004***	0.004***	0.004***	0.004***
SavingRate	-0.200	-0.202	-0.147	-0.150
Globalgrowth	-0.792***	-0.789***	-0.839***	-0.836***
N	736	736	740	740
R2	0.096	0.096	0.093	0.093
R2_a	0.033	0.034	0.031	0.033

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details. Constant, Crisis dummy and IFCEXCrisis are included as the specification of Table 7.

Table 10: Including USTIPS (based on the specifications in Table 7)

	A	B	C	D
IFCE	-8.707***	-8.555***	-8.798***	-8.654***
Lagged ΔGovDebt	-0.029	-0.029		
Growth	-1.149***	-1.154***	-1.156***	-1.161***
ΔPPP	0.004***	0.004***	0.004***	0.004***
Invest	0.270*	0.274*	0.285**	0.289**
Globalgrowth	-0.846***	-0.840***	-0.863***	-0.858***
Δ USTIPS	-0.157	-0.169	-0.179	-0.190
N	645	645	645	645
R2	0.117	0.117	0.117	0.117
R2_a	0.045	0.046	0.046	0.047

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. USTIPS is Year-end US 10-Year Treasury Inflation (or Protected)-Indexed Securities yield. See Appendix A and Table 2-5 for more details. Constant, Crisis dummy and IFCEXCrisis are included as the specification of Table 7.

Table 11: Including expected US dollar appreciation (based on the specifications in Table 7)

	A	B	C	D
IFCE	-8.747***	-8.518***	-8.728***	-8.497***
Lagged ΔGovDebt	0.01	0.01		
Growth	-1.203***	-1.211***	-1.200***	-1.208***
ΔPPP	0.004***	0.004***	0.004***	0.004***
Invest	0.268*	0.274*	0.263*	0.269*
Globalgrowth	-0.816***	-0.809***	-0.812***	-0.804***
Lagged Expected USD Appreciation	-7.571*	-7.561*	-7.355*	-7.340*
N	618	618	618	618
R2	0.122	0.122	0.122	0.122
R2_a	0.046	0.048	0.048	0.049

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. Expected USD Appreciation is the expected effective appreciation of US dollar over the next 12 months. See Appendix A and Table 2-5 for more details. Constant, Crisis dummy and IFCEXCrisis are included as the specification of Table 7.

Table 12: Replacing IFCE with lagged IFCE (based on the specifications in Table 7)

	A	B	C	D
Lagged IFCE	-4.132***	-3.847***	-4.201***	-3.988***
Lagged ΔGovDebt	-0.046	-0.038		
Growth	-0.677***	-0.675***	-0.682***	-0.680***
ΔPPP	0.003***	0.003***	0.003***	0.003***
Invest	0.430***	0.431***	0.431***	0.428***
Globalgrowth	-0.700**	-0.688**	-0.712**	-0.700**
N	714	714	718	718
R2	0.088	0.087	0.085	0.084
R2_a	0.022	0.023	0.020	0.021

Notes: Δ denotes the 1st-difference operator for the variable. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details. Constant, Crisis dummy and IFCEXCrisis are included as the specification of Table 7.

Table 13: Excluding China from the regression sample (based on the specifications in Table 7)

	A	B	C	D
IFCE	-6.394***	-6.324***	-6.659***	-6.597***
Lagged ΔGovDebt	-0.027	-0.027		
Growth	-1.002***	-1.005***	-1.022***	-1.024***
ΔPPP	0.003***	0.003***	0.003***	0.003***
Invest	0.364***	0.365***	0.353***	0.354***
Globalgrowth	-0.684**	-0.682**	-0.696**	-0.694**
N	715	715	719	719
R2	0.095	0.095	0.094	0.094
R2_a	0.031	0.033	0.032	0.033

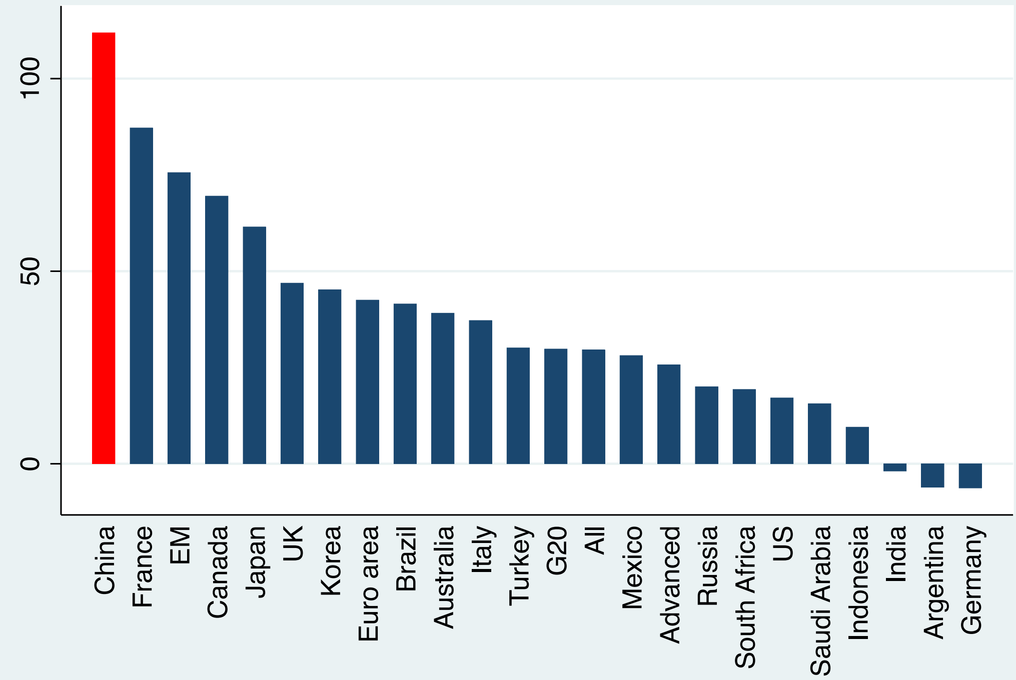
Notes: Δ denotes the 1st-difference operator for the variable. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. See Appendix A and Table 2-5 for more details. Constant, Crisis dummy and IFCEXCrisis are included as the specification of Table 7.

Table 14: Estimation with the system-GMM estimator (based on the specifications in Table 7)

	C	D
Lagged Δ CorpDebt	-0.184***	-0.182***
	(0.001)	(0.001)
IFCE	-3.507*	-3.984**
	(0.061)	(0.047)
Growth	-1.207***	-1.214***
	(0.002)	(0.002)
ΔPPP	0.002*	0.002*
	(0.061)	(0.057)
Invest	0.377*	0.369*
	(0.067)	(0.069)
Globalgrowth	-0.210	-0.190
	(0.556)	(0.587)
N	454	454

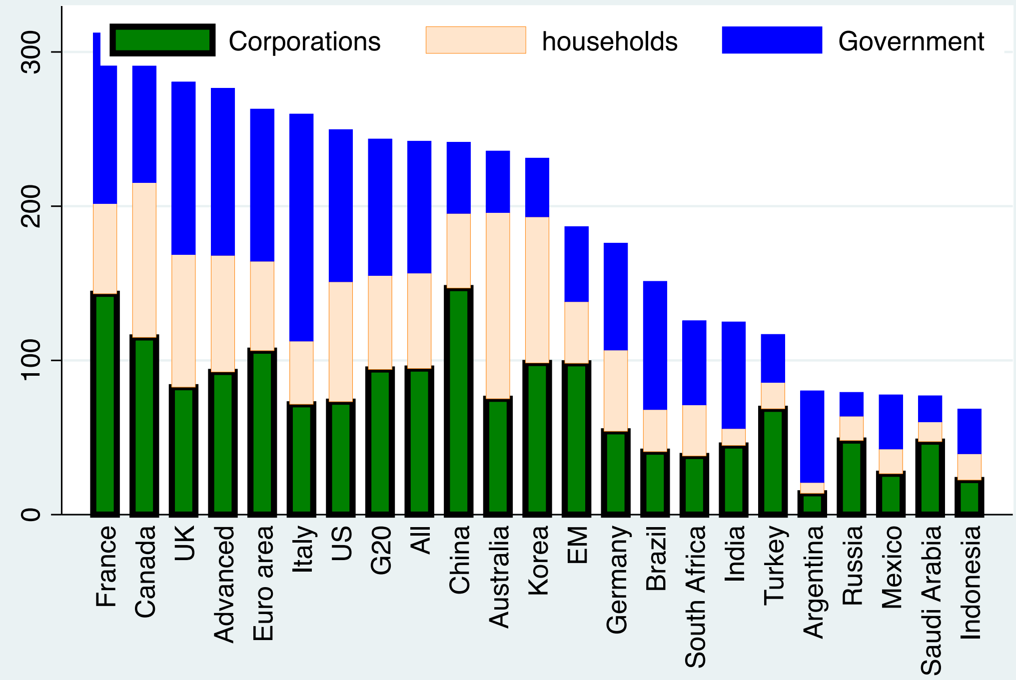
Notes: Δ denotes the 1st-difference operator for the variable. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively, for the t-statistics. Standard errors are reported in parenthesis. See Appendix A and Table 2-5 for more details. In these GMM specifications, *IFCE, IFCExCrisis, Growth,* Δ *PPP, Invest* are treated as potentially endogenous. Constant, Crisis dummy and IFCEXCrisis are included as the specification of Table 7.

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



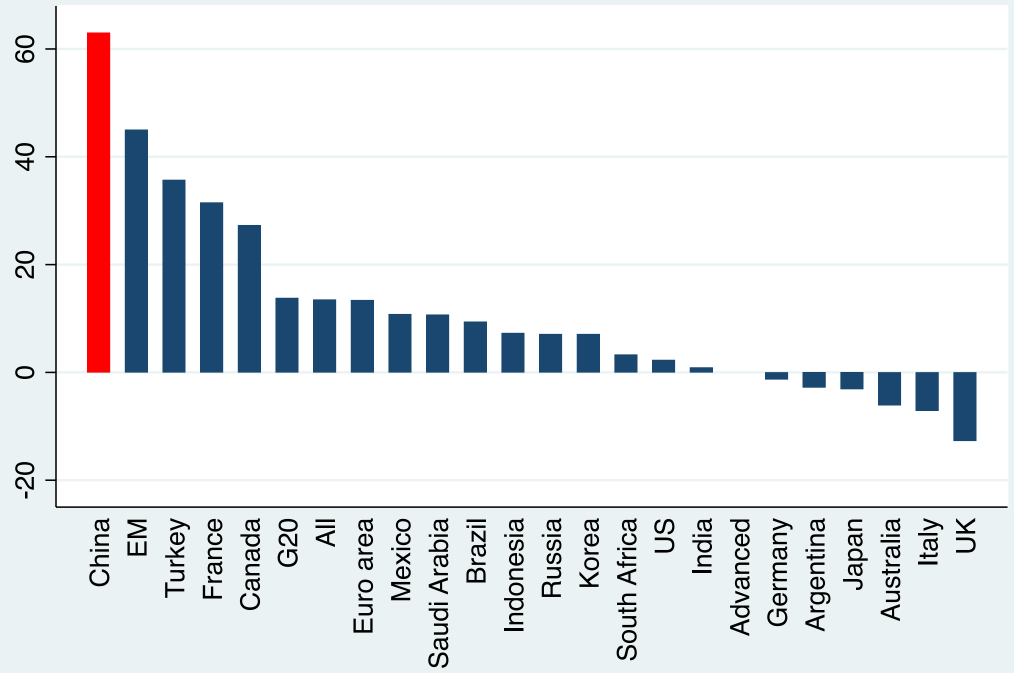
Source: BIS and authors' calculation

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



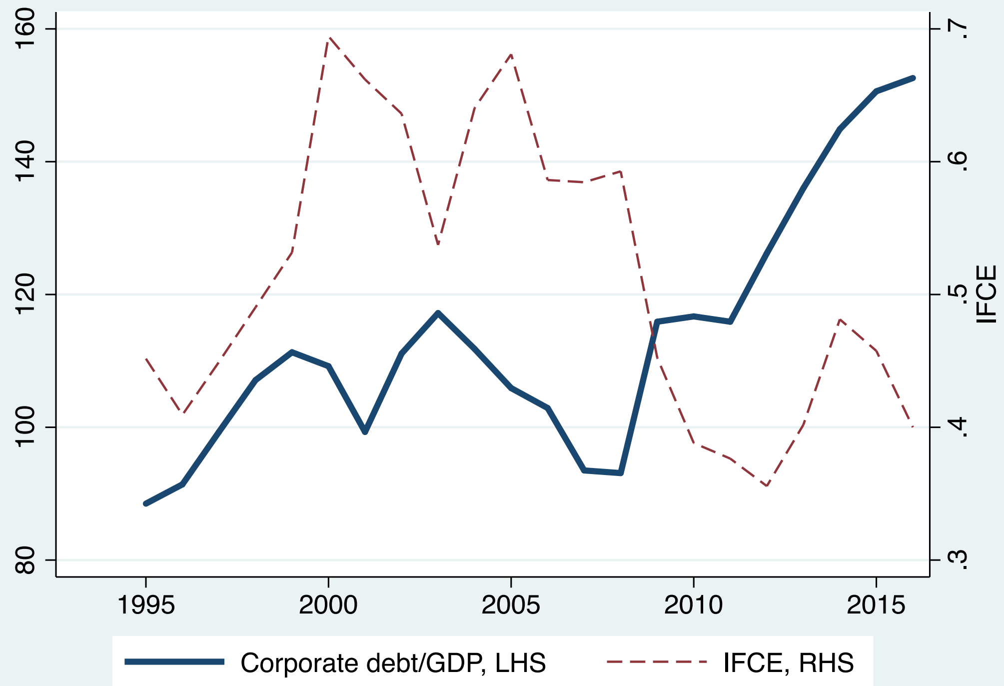
Source: BIS and authors' calculation

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



Source: BIS and authors' calculation

Figure 4: Corporate debt/GDP and internally financed capital expenditure in China



Source: BIS, OECD, and authors' calculation