

Debt and Growth*

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Abstract

This paper studies empirically the dynamic relationship between debt and output growth in a panel of 72 countries over 1970–2014. Focusing on how changes in debt/GDP correlate with future output growth, we dissect debt data by indebted sectors (households, firms, and governments) and by sources of financing (domestic and external). We examine countries with varying degrees of economic development (developed and developing) and different exchange rate regimes (fixed and flexible). We find that the negative correlation between household debt and future output growth is stronger for developing countries and for countries with a fixed exchange regime. The empirical analysis suggests that it is through investment rather than consumption that an expansion of household debt is transmitted to a decline in output growth.

JEL Classifications: E44, F32, F34, F41

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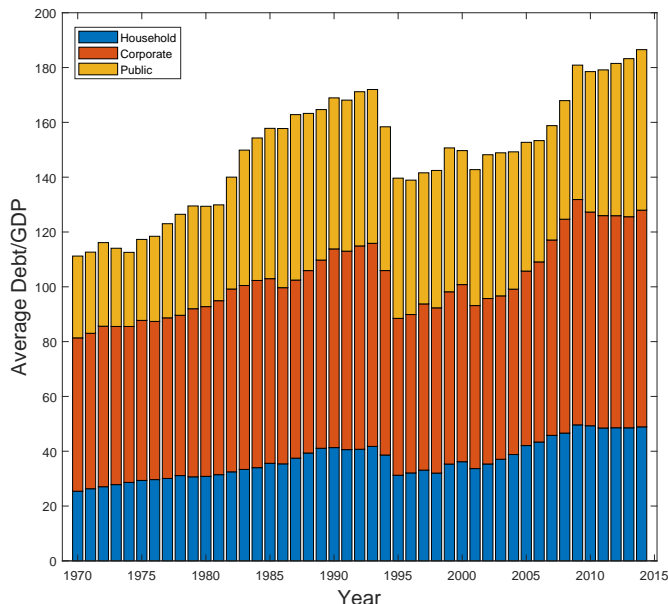
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1 Introduction

The global economy has experienced a large increase in indebtedness. Figure 1 shows that the average total debt to GDP ratio rose from 111.2% in 1970 to 186.5% in 2014. Overall, the global debt to GDP ratio reached an all-time high in 2018, generating many concerns among both academic researchers and policymakers about what the ramifications for global growth might be. Debt might be beneficial for raising consumption, accelerating capital accumulation, and increasing output, but increased debt services might also leave countries vulnerable to financial risks and lower GDP growth in the medium run. To shed light on the discussion and provide support to policy analysis, this paper investigates the empirical relation between debt dynamics and subsequent output growth.

Figure 1: Global Debt to GDP, Percent



Not all debt is the same, nor is the relationship between debt and output growth the same across countries. Debt has different correlations with future output growth depending on the sector taking it on: households, firms, or governments. The relationship also depends on the source of financing: domestic versus external. Particularly, different forms of foreign debt (foreign direct investment or FDI, foreign equity, foreign loans and reserves) have different correlations with output growth in the medium term. Importantly, all of these patterns differ across countries with varying degrees of economic development or different exchange rate regimes. This paper investigates the relationship between debt and output growth along all these dimensions of the data. Understanding these patterns is critical for investigating the mechanisms underlying the linkages between indebtedness and growth.

This paper studies empirically the dynamic relationship between debt and output growth in a panel of 72 countries over 1970–2014. Focusing on the medium-run impact, we regress three-year output growth over the subsequent five years on the expansion of indebtedness in the previous three years, controlling for country and time fixed effects. We dissect debt data by indebted economic sectors (households, firms, or governments), by sources of financing (domestic and external), and by types of external debt (FDI, foreign equity, foreign loans and reserves). We also look for non-linearity in the relationship by the level of indebtedness. To shed light on the mechanisms of the results, we examine countries with varying degrees of economic development (developed and developing economies) and different exchange rate regimes (fixed and flexible). In addition, we investigate whether the link from indebtedness to output growth channels through consumption or investment.

We find strikingly different relations between the change in indebtedness of each sector and subsequent output growth across the developed and developing countries. An expansion in household debt/GDP is associated with a decline in output growth in the immediate and medium terms. This negative correlation exists for both groups of countries, but it is stronger in the developing countries. A one standard deviation increase in household debt/GDP (6.6 percentage points) is associated with a 1.3 percentage points decline in GDP growth over the next three years in the developed countries and a 1.8 percentage points decline in the developing countries. An increase in firm debt/GDP is negatively associated with immediate output growth only in the developed countries. An increase in public debt/GDP is negatively associated with medium-term output growth only in the developing countries.

We find some evidence of a nonlinear relation between debt expansions and subsequent output growth for household debt in the developing countries, but not in the developed countries. When the developing countries have lower levels of household debt, an expansion in household indebtedness is associated with higher output growth, although the coefficients are not significant, over the near and medium terms. In contrast, when they have high levels of household debt, an expansion in household debt/GDP is associated with a large and significant decline in output growth in the near and medium terms. We find no evidence of a nonlinear relation between firm or public debt and output growth in both groups of countries.

Furthermore, we find that the negative relationship between an expansion in household debt and subsequent output growth is more pronounced in countries with a fixed exchange rate regime than in countries with a flexible exchange rate regime. The magnitude of the negative relationship is almost twice as large under the fixed exchange rate regime as under the flexible exchange rate regime. Also, the negative effect persists longer under the fixed exchange rate regime than under the flexible exchange rate regime. These results suggest that nominal rigidities or constraints on monetary policy might be important for understanding the linkage

between household debt expansions and declines in future growth.

Turning to the source of debt financing, we find that different forms of foreign debt have distinct relations with future output growth across developed and developing countries. An expansion in FDI or equity inflows is negatively correlated with output growth in the developed countries, but is positively correlated with output growth in the developing countries. On the other hand, an expansion in foreign debt/GDP is negatively correlated with output growth in both groups and is particularly significant and strong in the developed countries. Finally, an increase in reserves/GDP is significantly, positively correlated with immediate output growth in both groups and is significant over longer horizons in the developing countries.

We also examine the joint dynamics of foreign debt and output growth across different exchange rate regimes. FDI and equity inflows show contrasting relations with output growth across exchange rate regimes. An expansion in FDI or foreign equity debt is associated with a significant decline in future output growth under a fixed exchange rate regime, but with a significant boost to growth under a flexible exchange rate regime. On the other hand, foreign loans and reserves display similar patterns across exchange rate regimes. An increase in foreign loans is negatively associated with future output growth, and an increase in reserves is positively associated with subsequent output growth, in both regimes. Not surprisingly, these patterns for foreign loans and reserves are more pronounced and stronger under the fixed exchange rate regime than under the flexible exchange rate regime.

Lastly, we investigate whether the channel from credit booms to subsequent output growth is driven through consumption or investment. The empirical results highlight the role of investment in transmitting household debt dynamics into output growth. An expansion of household debt/GDP is associated with a decline in subsequent investment growth, but a rise in subsequent consumption growth. These findings are intriguing; intuitively one would have thought that the bust of household debt leads to declines in consumption growth and thus declines in output growth. On the other hand, an expansion in public debt/GDP is associated with a significant decline in consumption growth instead of investment growth in the medium term, particularly in the developing countries.

There is a large empirical literature on the role of debt in macroeconomic stability and continued growth. These studies have focused on either private sector debt, public sector debt, or external debt, of particular sample groups. We build on this literature by examining a large set of countries with a comprehensive set of debt statistics. Reinhart and Rogoff (2009) illustrate the history of debt, crisis, and growth and document that when debt ratios are beyond a certain level, financial crises become more likely and severe. There is a large set of recent studies analyzing the empirical relationship between government debt and economic performance. Reinhart and Rogoff (2010) find that countries with public debt over 90% of GDP

experience notably slower growth.¹ Several papers (Cecchetti et al. 2011; Cecherita-Westphal and Rother 2012; Baum et al. 2013; Panizza and Presbitero 2014; Kumar and Woo 2015) have estimated versions of the dynamic growth model to alleviate omitted variable bias and concerns of reverse causality and find mixed evidence of the threshold effect.

The concerns with the growth of private sector debt have emerged more recently. Using the historical data constructed by Schularick and Taylor (2012) for advanced economies, Jorda et al. (2013) show a systematic link between private sector credit booms, financial crisis, and slow growth. While household debt booms and busts in advanced economies have attracted much attention since the Great Recession, the buildup of corporate debt in emerging markets, notably China, is now raising concerns (see IMF, 2015). Cecchetti et al. (2011) study 18 OECD countries from 1980 and 2010 and find that beyond a certain level, corporate debt is a significant drag on growth, while the estimates for household debt are insignificant. In contrast, the recent work by Mian et al. (2017) shows that an increase in the household debt to GDP ratio predicts lower GDP growth in the medium run for an unbalanced panel of 30 countries from 1960–2012. In their study, the growth in corporate debt does not imply a slower growth. Bernardini and Forni (2017) study a sample of emerging economies and find that both private debt buildup and public debt buildup exacerbate the duration and intensity of recessions.

A related literature has focused on the role of external debt in growth, particularly among developing countries. The Asian financial crisis and sovereign debt crisis of Latin American countries in the 1980s have attracted a large deal of attention to the potentially adverse implications of external debt. Patillo et al. (2002) show that for a country with average indebtedness, doubling the external debt ratio would lower annual growth by between 0.5 and 1 percentage point. Similarly, Chowdhury (2001) finds that the negative relationship between external debt and growth holds for both HIPC and non-HIPC country groups. Several other studies find mixed results. Lin and Sosin (2001) find a strongly negative relationship between external debt and growth in African countries, but no statistically significant relationship in Latin American and Asian countries. Changyong et al. (2012) find that if the debt transformation rate is low, economic growth will be hindered and may even trigger economic crisis when the debt ratio rises over a certain point. However, with a high debt transformation rate, external debt can facilitate economic growth. Using Pakistan as a case study, Ramzan and Ahmad (2014) find that external debt has a negative impact on economic growth, but this negative effect can be

¹This finding inspired extensive follow-up studies that provide mixed results. Cecchetti et al. (2011), Padoan et al. (2012), Cecherita-Westphal and Rother (2012), and Baum et al. (2013) confirmed this finding for similar sets of countries. Nevertheless, Caner (2010), Elmeskov and Sutherland (2012), Baglan and Yoldas (2016), Eberhardt and Presbitero (2015), Herndon et al. (2013), Pescatori et al. (2014), and Egert (2015) showed that finding a negative nonlinear relationship is extremely difficult and sensitive to modelling choices and data coverage.

reduced, or even reversed, in the presence of sound macroeconomic policy.

The remainder of the paper is organized as follows. Section 2 describes data sources and summarizes the key features of the data. Section 3 conducts the main regression analysis to study the relation between credit booms and subsequent output growth. Section 4 investigates the potential channels of the transmission from debt expansions to future output growth and also conducts the sensitivity analysis of the main results. Section 5 concludes.

2 Data

To examine the implications of debt accumulations on the economy, we collected a large panel dataset of 72 countries over the period 1970-2014. Specially, we have 21 developed countries and 51 developing countries.² For macroeconomic variables, we collect data on real GDP and its components from the *World Development Indicators* database by the World Bank. For debt statistics, we retrieve series of total debt, private debt, and public debt from the IMF's *Global Debt Database*. Total debt is the sum of private debt and public debt. Private debt is the total stock of loans and debt securities issued by households and nonfinancial corporations. Public debt is gross debt issued by the public sector. For a smaller sample of 56 countries, we have household debt and firm debt separately, but the coverage is unbalanced over time. Most developed countries have full coverage, while most developing countries start in the mid-1990s.

We also collected data on foreign debt, which is defined as net debt financed by foreigners using the the 2016 update of the *External Wealth of Nations Mark II* database by Lane and Milesi-Ferretti (2007). The difference between total debt and foreign debt gives us a proxy for the debt financed by domestic agents, which we refer to as domestic debt. Moreover, the database provides us with four subcategories of foreign debt: FDI, equity, loans, and reserves. Specifically, foreign debt equals the sum of FDI, equity and loans minus reserves.

We report the summary of debt statistics as a percentage of GDP in Table 1 for the samples of the developed and developing countries. The developed countries on average have much larger debt to GDP ratios, particularly for the household sector and the firm sector. The household debt to GDP ratio is on average 56% in the developed countries, but only 22% in the developing countries. The firm debt to GDP ratio is 83% in the developed countries, but only 48% in the developing countries. This is not surprising given that the degree of financial development—often measured by total private debt/GDP—is highly correlated with income. The scale of this difference is smaller for the public debt to GDP ratio between the developed and developing countries, 59% versus 45%. Thus, the public sector accounts for a disproportionately larger share of total debt in the developing countries than in the developed countries.

²The list of countries is described in the Appendix Table A1.

Table 1: Summary of Debt/GDP, Percent

	mean	median	std.
Developed Countries			
Household Debt/GDP	56.24	53.15	26.45
Firm Debt/GDP	82.72	80.49	30.40
Public Debt/GDP	59.06	53.54	34.02
Foreign Debt/GDP	12.00	11.83	39.58
FDI/GDP	-1.74	-0.61	18.64
Foreign Equity/GDP	4.73	0.43	43.30
Foreign Loans/GDP	15.11	15.78	46.39
Reserves/GDP	5.88	4.12	6.31
Developing Countries			
Household Debt/GDP	21.63	16.64	17.29
Firm Debt/GDP	47.52	41.74	27.30
Public Debt/GDP	44.46	39.14	28.82
Foreign Debt/GDP	16.19	22.18	48.91
FDI/GDP	16.53	9.27	21.03
Foreign Equity/GDP	-1.66	0.00	15.92
Foreign Loans/GDP	16.44	17.45	29.13
Reserves/GDP	15.17	9.95	18.51

Next we look at financing of total debt by domestic agents and foreigners. The foreign debt to GDP ratio is higher in the developing countries than in the developed countries: 16% versus 12%. Given their smaller magnitude of total debt to GDP, the developing countries disproportionately finance their total debt using external resources relative to the developed countries. When the developing countries borrow from abroad, portfolio flows are on average negligible, while loans and debt securities, FDI, and reserves are more important. In the developed countries, foreign loans and debt securities are the most important form of borrowing, followed by reserves.

The dynamics of debt/GDP ratios vary substantially over time and across countries, as shown by the large standard deviations of all debt-to-GDP ratios in Table 1. We plot the dynamics of household, firm, public, and foreign debt as a share of GDP in Figure A1–A4 of the Appendix. Our empirical analysis focuses on changes in GDP and debt/GDP ratios over three years, following Mian et al. (2017). Table 2 reports the summary statistics for GDP growth and debt changes over three years and over one year as well.³ The mean and median annual GDP growth rates are 1.65% and 1.85%, respectively, for the developed countries. The mean and median annual growth rates for the developing countries are higher at 2.42% and

³GDP growth is measured by the change in log real GDP per capita. Changes in debt ratios are measured by the difference in debt/GDP ratios. GDP growth is in percentages and debt changes are in percentage points.

2.81%, respectively. The standard deviation in GDP growth is also much larger in developing countries than in developed countries: 4.78 versus 2.35.

Table 2: Summary of GDP Growth and Changes in Debt/GDP, Percent

	one-year change			three-year change		
	mean	median	std	mean	median	std
Developed Countries						
GDP	1.65	1.85	2.35	5.22	5.57	5.22
Household Debt/GDP	1.32	1.07	2.70	4.13	3.50	6.62
Firm Debt/GDP	1.30	1.03	5.32	4.01	2.98	11.25
Public Debt/GDP	1.48	1.09	4.86	4.23	3.10	11.70
Foreign Debt/GDP	0.14	0.15	8.74	0.73	1.31	15.59
FDI/GDP	-0.38	-0.16	5.57	-1.06	-0.37	9.35
Foreign Equity/GDP	0.39	0.00	9.29	1.11	0.00	19.94
Foreign Loans/GDP	0.22	0.42	9.00	0.97	2.04	17.96
Reserves/GDP	0.07	-0.02	2.07	0.19	-0.04	3.82
Developing Countries						
GDP	2.42	2.81	4.78	7.46	7.58	11.12
Household Debt/GDP	1.01	0.81	2.56	3.23	2.53	5.93
Firm Debt/GDP	1.13	0.92	5.21	3.83	3.63	10.37
Public Debt/GDP	0.41	-0.05	8.61	1.34	0.84	17.47
Foreign Debt/GDP	0.12	-0.01	10.39	0.67	0.97	17.77
FDI/GDP	0.49	0.10	3.96	1.67	0.53	7.53
Foreign Equity/GDP	-0.11	0.00	4.93	-0.17	0.00	6.71
Foreign Loans/GDP	0.17	0.00	7.79	0.55	0.63	13.70
Reserves/GDP	0.40	0.15	3.89	1.27	0.62	7.14

In the developed countries, household, firm, and public debt as a share of GDP have been rising at a similar speed of 1.3 percentage points per year on average. The average one-year changes in the developing countries are slightly lower than those in the developed countries in terms of household and firm debt. However, the public debt/GDP ratio increases much more slowly in the developing countries: 0.4 versus 1.5 percentage points. Thus, total debt has been growing much faster in developed countries than in the developing countries.

The average one-year change in foreign debt to GDP is about 0.14 percentage points in both groups. Among the four major components of foreign debt, the rise in foreign equity and loans contributes most to the increase in foreign debt/GDP in the developed countries. The one-year average change for FDI is negative 0.38 percentage points in the developed countries. The rise in foreign debt/GDP in the developing countries is mainly driven by the rise in FDI, followed by bank loans and debt securities. The average one-year rise in reserves is about 0.4 percentage points in developing countries.

As for volatility, the three-year change in the household debt/GDP ratio is more volatile in the developed countries (6.6 versus 5.9), while the three-year change in the public debt/GDP ratio is substantially more volatile in the developing countries (17.5 versus 11.7). When we look at the creditor side, the three-year change in the foreign debt/GDP ratio is more volatile in the developing countries: 17.8 versus 15.6. Among foreign liabilities and assets, FDI, equity, and loans to GDP are more volatile in the developed countries, while reserves/GDP is more volatile in the developing countries.

3 Empirical Findings

This section examines the full dynamic relation between debt and output growth using a regression framework. We focus on not only how household debt, corporate debt, and public debt relate to GDP growth, but also how foreign debt and domestic debt relate to output growth. Moreover, we examine whether these relations are similar for developed countries and developing countries. These empirical findings are important for understanding the potential mechanisms at work and for formulating theories to rationalize these findings.

3.1 Household, Firm, and Public Debt

We start with the analysis of debt taken on by three economic sectors: households, firms, and the government. Following Mian et al. (2017), we study how the past three-year changes in household debt/GDP, firm debt/GDP, and public debt/GDP from period $t - 4$ to $t - 1$ affect three-year real GDP growth in period $t + k$, for $k = 0, \dots, 5$. The regression specification is given by

$$\Delta_3 y_{it+k} = \beta^H \Delta_3 d_{it-1}^H + \beta^F \Delta_3 d_{it-1}^F + \beta^P \Delta_3 d_{it-1}^P + \delta X_{it} + \alpha_i + \gamma_t + u_{it}, \quad (1)$$

where, y_{it} denotes logged real GDP per capita of country i in period t , and $\Delta_3 y_{it+k}$ denotes the three-year change in logged GDP per capita given by $y_{it+k} - y_{it+k-3}$. d_{it-1}^j denotes the type- j debt over GDP ratio in period $t - 1$, and $\Delta_3 d_{it-1}^j$ denotes the three-year change in the debt-output ratio given by $d_{it-1}^j - d_{it-4}^j$. Specifically, superscript H, F , and P denote households, firms, and governments, respectively. X_{it} denotes the co-variate of the change in the saving rate and the population growth rate. We include both the country-fixed effect α_i and the time-fixed effect γ_t to control for time-invariant country characteristics and the influence of aggregate trends. This reduces the chance that a relationship between debt and GDP growth is driven by omitted variables. We also include lagged one-year GDP growth variables over the same period as the change in debt, Δy_{it-1} , Δy_{it-2} , and Δy_{it-3} , to control for persistence in output growth.

We run this regression for the developed and the developing countries. Panel A of table 3 reports the results for the developed countries. We find that an expansion in household debt/GDP is associated with lower output growth, significantly at horizon $k = 0, 1, \dots, 4$. The magnitude of this negative relation is large. For instance, a one standard deviation increase in the household debt to GDP ratio in the past three years (6.6 percentage points) is associated with a 1.3 percentage point decline in GDP growth over the next three years. This result is consistent with Mian et al. (2017), although they find a greater magnitude of 2.1 percentage points decline in GDP growth for an increase in household debt/GDP of 6.2 percentage points for the developed countries.

Now we turn to firm and public debt. A rise in firm debt is associated with a smaller and more immediate negative effect on GDP growth, but the negative correlation becomes insignificant at horizon $k = 3$. In contrast, an increase in public debt/GDP has no statistically significant correlations with future output growth for most of the horizon. The coefficient is significantly positive only at $k = 5$. Thus, it is the credit expansion in the private sector, particularly in the household sector, rather than in the public sector, that is associated with a decline in medium-term GDP growth.

Table 3: Household, Firm, and Public Debt, Baseline

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Developed Countries						
$\Delta_3 d_{it-1}^H$	-0.015	-0.081*	-0.162**	-0.198**	-0.179**	-0.134
$\Delta_3 d_{it-1}^F$	-0.021*	-0.053**	-0.064**	-0.035	0.019	0.053
$\Delta_3 d_{it-1}^P$	-0.006	-0.019	-0.008	0.017	0.048	0.064*
R^2	0.834	0.493	0.174	0.149	0.124	0.100
Obs	622	622	622	622	601	580
Panel B: Developing Countries						
$\Delta_3 d_{it-1}^H$	-0.058*	-0.152**	-0.274**	-0.273**	-0.173	-0.012
$\Delta_3 d_{it-1}^F$	0.003	0.009	0.024	0.017	-0.005	0.003
$\Delta_3 d_{it-1}^P$	0.000	-0.017	-0.040	-0.061**	-0.075***	-0.071**
R^2	0.777	0.416	0.111	0.149	0.113	0.091
Obs	462	462	462	462	427	390

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

Panel B of table 3 reports the results for the developing countries. The negative relation between household debt expansion and future output growth is stronger in the developing countries. A one standard deviation increase in the household debt to GDP ratio in the past three years (5.93 percentage points) is associated with a 1.62 percentage point decline in GDP

growth over the next three years. The negative coefficient is significant for horizons up to three years. An expansion in firm debt/GDP has no significant correlation with output growth for all horizons. An increase in public debt/GDP is negatively correlated with output growth, and the relation becomes significant for the medium term $k = 3, 4, 5$. The magnitude of the negative impact is large: a one standard deviation increase in public debt/GDP in the past three years (17.68 percentage points) is associated with a one-percentage-point decline in GDP growth over the next three years.

In sum, our baseline analysis shows that an increase in household debt/GDP is significantly negatively correlated with subsequent output growth for both the developed and developing countries. An increase in firm debt/GDP is negatively associated with immediate output growth only in the developed countries. An increase in public debt/GDP is negatively associated with medium-term output growth only in the developing countries.

3.2 Nonlinearity

This subsection explores the possibility of a nonlinear relation between the change in debt and future output growth. The negative implications of debt are pronounced only at higher debt levels, which is a common prediction in theories of debt overhang. When the outstanding debt levels are high, the agents are close to the credit constraints with little room for extra credit. A negative shock is more likely to be amplified to a persistent decline in output growth.⁴ To test the non-linearity in our data, we run the following regression:

$$\Delta_3 y_{it+k} = \sum_{j=\{H,F,P\}} [\beta_1^j \mathbb{1}(d_{it-1}^j > m_{it-1}^j) + \beta_2^j \mathbb{1}(d_{it-1}^j \leq m_{it-1}^j)] \Delta_3 d_{it-1}^j + \delta X_{it} + \alpha_i + \gamma_t + u_{it}, \quad (2)$$

where m_{it-1}^j denotes the cutoff value of the debt-output ratios in year $t - 1$ for household, firm and public debt. Our focus is whether the relationship between the change in debt/GDP and output growth varies with the level of debt/GDP. Equivalently, we check whether β_1^j and β_2^j are significantly different, and particularly whether the coefficients for higher levels of indebtedness are more negative or lower. In the baseline analysis, we set the cutoff value to be the median value of each type of debt in the sample year. Thus, the cutoff levels are time-varying and also depend on the sample of analysis. Setting the cutoff values to higher values barely changes the results.

Table 4 reports the regression results. Looking first at the developed countries, an increase in household debt/GDP is associated with a decline in future growth, regardless of levels of debt. The difference is that the negative correlation is significant in the near term for countries

⁴The issue of the nonlinearity has been in the center of the debate on the implications of public debt on economic growth.

with high indebtedness, but in the medium term for countries with low levels of indebtedness. The magnitudes of the coefficients for the high and low debt levels are similar at the three-year horizon. An increase in firm debt/GDP has similar correlations with output growth, again regardless of levels of indebtedness. An increase in public debt/GDP on the other hand tends to have a lower correlation with output growth under higher levels of debt, although the differences are not statistically significant in general. Thus, we find no evidence of non-linearity for the developed countries.

Table 4: Household, Firm, and Public Debt, High vs. Low Levels

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Developed Countries						
$\Delta_3 d_{it-1}^H * \mathbb{1}(d_{it-1}^H \leq m_{t-1}^H)$	0.004	-0.033	-0.110	-0.194**	-0.232**	-0.217**
$\Delta_3 d_{it-1}^H * \mathbb{1}(d_{it-1}^H > m_{t-1}^H)$	-0.022	-0.099*	-0.180*	-0.199*	-0.150	-0.076
$\Delta_3 d_{it-1}^F * \mathbb{1}(d_{it-1}^F \leq m_{t-1}^F)$	-0.027*	-0.055**	-0.064	-0.031	0.005	0.014
$\Delta_3 d_{it-1}^F * \mathbb{1}(d_{it-1}^F > m_{t-1}^F)$	-0.019*	-0.052**	-0.064*	-0.037	0.023	0.062
$\Delta_3 d_{it-1}^P * \mathbb{1}(d_{it-1}^P \leq m_{t-1}^P)$	0.003	0.004	0.018	0.032	0.047**	0.068*
$\Delta_3 d_{it-1}^P * \mathbb{1}(d_{it-1}^P > m_{t-1}^P)$	-0.011	-0.030	-0.021	0.009	0.043	0.048
R^2	0.835	0.499	0.180	0.150	0.129	0.119
Obs	622	622	622	622	601	580
Panel B: Developing Countries						
$\Delta_3 d_{it-1}^H * \mathbb{1}(d_{it-1}^H \leq m_{t-1}^H)$	-0.016	0.011	0.044	0.117	0.175	0.147
$\Delta_3 d_{it-1}^H * \mathbb{1}(d_{it-1}^H > m_{t-1}^H)$	-0.066*	-0.201***	-0.360***	-0.372***	-0.254*	-0.029
$\Delta_3 d_{it-1}^F * \mathbb{1}(d_{it-1}^F \leq m_{t-1}^F)$	0.009	-0.019	0.006	0.027	0.070	0.131
$\Delta_3 d_{it-1}^F * \mathbb{1}(d_{it-1}^F > m_{t-1}^F)$	-0.003	0.010	0.018	0.005	-0.043	-0.039
$\Delta_3 d_{it-1}^P * \mathbb{1}(d_{it-1}^P \leq m_{t-1}^P)$	-0.021	-0.046	-0.087	-0.101*	-0.114*	-0.125*
$\Delta_3 d_{it-1}^P * \mathbb{1}(d_{it-1}^P > m_{t-1}^P)$	0.005	-0.005	-0.019	-0.040*	-0.056**	-0.064**
R^2	0.778	0.425	0.144	0.196	0.158	0.116
Obs	462	462	462	462	427	390

Note: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

Now let's look at the developing countries. When countries have lower levels of household debt, an expansion in household debt is associated with higher output growth, although the coefficients are not significant, over all the horizons. In contrast, countries with high levels of household debt/GDP have a significant negative relationship between household debt expansion and future output growth. The coefficients are large and significant across all horizons except $k = 5$. This is the first and clear evidence of a nonlinear relation. We observe no significant differences for firm debt across different levels of the indebtedness. For public debt, the negative association between its expansion and output growth is significant only at the far end of the horizons. Moreover, countries with *lower* levels of public debt/GDP experience a *stronger* negative relation between an expansion in public debt and subsequent output growth, although the coefficients are not significantly different across levels of indebtedness. In sum, we find

some evidence of the nonlinear relation between debt expansions and output growth only for household debt in the developing countries.

3.3 External versus Domestic Debt

Switching focus to the source of financing, we investigate whether domestic versus external debt matters for future output growth. In Section 2, we show that developing countries borrow more heavily from foreigners than from domestic agents, relative to developed countries. External debt is often denominated in foreign currency, particularly in the developing countries. High indebtedness in foreign debt exposes countries to currency crises and severe real contractions, which is different from domestic debt. The Asian financial crises in 1998 are largely the consequences of high exposure to foreign debt by the private sector. The Latin American sovereign debt crises in the 1980s are examples of consequences of high external indebtedness by the public sector.

By differentiating the implications of foreign and domestic debt, we shed light on the important issues of the costs and risks of international borrowing. To do this, we conduct similar analysis as in regression (1) for domestic and different types of foreign debt. Domestic debt is the sum of private and public debt minus net foreign debt. Table 5 reports the coefficients on these debt statistics for the developed and developing countries.

Table 5: Domestic Debt and Foreign Debt

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Developed Countries						
$\Delta_3 d_{it-1}^{DOM}$	-0.016***	-0.038***	-0.048***	-0.034**	-0.006	0.017
$\Delta_3 d_{it-1}^{FDI}$	-0.024***	-0.056***	-0.073***	-0.062**	-0.038	-0.013
$\Delta_3 d_{it-1}^{EQT}$	-0.016**	-0.030**	-0.032*	-0.007	0.025	0.050
$\Delta_3 d_{it-1}^{LOAN}$	-0.032***	-0.078***	-0.113***	-0.099***	-0.054**	-0.006
$\Delta_3 d_{it-1}^{RES}$	0.037**	0.080*	0.096	0.057	-0.011	-0.046
R^2	0.810	0.489	0.191	0.165	0.122	0.082
Obs	818	818	818	818	797	776
Panel B: Developing Countries						
$\Delta_3 d_{it-1}^{DOM}$	-0.010**	-0.019*	-0.027*	-0.027	-0.021	-0.021
$\Delta_3 d_{it-1}^{FDI}$	0.035**	0.068*	0.081	0.047	0.023	0.027
$\Delta_3 d_{it-1}^{EQT}$	0.025***	0.073***	0.120***	0.100**	0.058	-0.007
$\Delta_3 d_{it-1}^{LOAN}$	-0.020***	-0.041***	-0.052**	-0.036	-0.024	-0.017
$\Delta_3 d_{it-1}^{RES}$	0.065***	0.114***	0.144***	0.100**	0.057	0.025
R^2	0.804	0.460	0.101	0.048	0.016	0.006
Obs	1,410	1,409	1,408	1,407	1,357	1,307

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

Each component of foreign debt has very different relations with future output growth across developed and developing countries. An expansion in FDI inflows is significantly and negatively correlated with immediate and medium-term output growth in the developed countries. In contrast, an increase in FDI/GDP is positively correlated with output growth in the developing countries, although the coefficients are significant only in the immediate term. An expansion in equity debt/GDP is negatively correlated with immediate output growth in the developed countries, but it is positively correlated with immediate and medium-term output growth in the developing countries. On the other hand, an expansion in foreign debt/GDP is negatively correlated with output growth in both groups and is particularly significant and strong in the developed countries. Finally, an increase in reserves/GDP is significantly, positively correlated with output growth only in the near term in the developed countries. In contrast, the correlation is significantly positive at horizons $k = 0, 1, 2, 3$ in the developing countries.

4 Potential Channels from Debt to Growth

Theories that link credit booms to lower subsequent growth rely on frictions, such as financial frictions, nominal rigidities, or constraints on monetary policy. Examples include Curdia and Woodford (2010), Eggertsson and Krugman (2012), Martin and Philippon (2017), Farhi and Werning (2016), Korinek and Simsek (2016), Schmitt-Grohé and Uribe (2016), and Guerrieri and Lorenzoni (2017). In these works, constraints, frictions or rigidities exacerbate negative shocks and lead to adverse outcomes in economic growth, when debt expansions or credit booms stall. To shed light on these mechanisms, we study the implications of debt expansions on output growth across exchange rate regimes of different rigidities, which broadly captures the macroeconomic rigidities across countries. In theory, these frictions either work through the investment channel or the consumption channel.⁵ Thus, we also examine the implications of debt expansions on consumption and investment dynamics and compare the patterns across the developed and developing countries.

4.1 Macro Frictions: Exchange Rate Regimes

We now look at countries with a fixed exchange rate regime versus a floating exchange rate regime. We divide the sample into fixed and floating exchange rate regimes based on the *de facto* exchange rate regime from Reinhart and Rogoff (2004), updated in Ilzetzki et al. (2017). “Fixed regimes” include no separate legal tender, currency boards, pegs, and narrowly defined

⁵Examples on the investment channel include Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Caballero and Krishnamurthy (2003), Lorenzoni (2008), and Brunnermeier and Sannikov (2014). Mian et al. (2013) provide empirical support for this channel for the United States during the Great Recession.

horizontal bands (coarse ERA code 1 from Ilzetzi et al., 2017). “Floating regimes” include widely defined horizontal bands, crawling pegs, crawling bands, moving bands, managed floats, and freely floating regimes (coarse ERA codes 2 to 4). We run the baseline regression (1) for household, firm, and public debt and for domestic and foreign debt for these two samples by exchange rate regime.

Table 6 reports the baseline regression results by exchange rate regime for household, firm, and public debt. An increase in household debt/GDP has a stronger negative association with GDP growth in countries with a fixed exchange rate regime. The magnitude of the negative relationship is almost twice as large under the fixed exchange rate regime as under the flexible exchange rate regime. Also, the negative effect persists longer under the fixed exchange rate regime than under the flexible exchange rate regime. On the other hand, expansions in firm debt/GDP and in public debt/GDP have no significant correlation with output growth in both exchange rate regimes.

Table 6: Household, Firm and Public Debt, by Exchange Rate Regime

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Fixed Exchange Regime						
$\Delta_3 d_{it-1}^H$	-0.058**	-0.170**	-0.283**	-0.318**	-0.343*	-0.377**
$\Delta_3 d_{it-1}^F$	-0.007	-0.034	-0.031	-0.008	0.052	0.116
$\Delta_3 d_{it-1}^P$	-0.021	-0.015	0.033	0.099*	0.107	0.073
R^2	0.829	0.499	0.263	0.276	0.199	0.154
Obs	348	348	348	348	325	298
Panel B: Flexible Exchange Regime						
$\Delta_3 d_{it-1}^H$	-0.020	-0.085*	-0.169**	-0.183**	-0.099	0.008
$\Delta_3 d_{it-1}^F$	-0.007	-0.014	-0.016	-0.007	-0.005	0.011
$\Delta_3 d_{it-1}^P$	0.001	-0.015	-0.025	-0.029	-0.028	-0.023
R^2	0.767	0.400	0.075	0.092	0.080	0.075
Obs	721	721	721	721	689	656

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

We also explore the relationship between foreign debt and GDP growth across different exchange rate regimes in Table 7. FDI and equity inflows show strikingly different relationships with future output growth across different exchange rate regimes. An increase in FDI and foreign equity debt is significantly and negatively related with output growth in countries with fixed exchange rate regime. The significantly negative effect persists longer for an expansion in FDI inflows than for an expansion in equity inflows. By contrast, both FDI and equity inflows are significantly positively related with subsequent output growth in countries with flexible exchange rate regimes.

Table 7: Domestic and Foreign Debt, by Exchange Rate Regime

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Fixed Exchange Regime						
$\Delta_3 d_{it-1}^{DOM}$	-0.030***	-0.071***	-0.096***	-0.072***	-0.023	0.019
$\Delta_3 d_{it-1}^{FDI}$	-0.025	-0.076**	-0.122***	-0.148***	-0.140***	-0.105***
$\Delta_3 d_{it-1}^{EQT}$	-0.021***	-0.042***	-0.048**	-0.026	0.007	0.036
$\Delta_3 d_{it-1}^{LOAN}$	-0.044***	-0.114***	-0.171***	-0.167***	-0.122***	-0.065*
$\Delta_3 d_{it-1}^{RES}$	0.081***	0.163***	0.230***	0.207***	0.194***	0.155**
R^2	0.830	0.517	0.210	0.177	0.150	0.128
Obs	706	706	706	705	675	642
Panel B: Flexible Exchange Regime						
$\Delta_3 d_{it-1}^{DOM}$	-0.003	-0.014	-0.020	-0.025	-0.018	-0.010
$\Delta_3 d_{it-1}^{FDI}$	0.034***	0.067***	0.096***	0.087**	0.095***	0.118***
$\Delta_3 d_{it-1}^{EQT}$	0.027***	0.058**	0.096**	0.087**	0.069**	0.032
$\Delta_3 d_{it-1}^{LOAN}$	-0.016*	-0.034**	-0.046*	-0.037	-0.020	-0.004
$\Delta_3 d_{it-1}^{RES}$	0.052***	0.097***	0.125***	0.087	0.028	-0.024
R^2	0.805	0.453	0.119	0.093	0.067	0.046
Obs	1,428	1,428	1,428	1,428	1,388	1,348

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

Next let's turn to foreign loans. An increase in foreign loans is negatively associated with future output growth in both the fixed and floating exchange rate regimes. However, the magnitude of the negative correlation between inflows of foreign loans and output growth is much larger in the fixed exchange rate regime than in the floating exchange rate regime. A 10 percentage point increase in foreign loans/GDP over the past three years is associated with a 1.67 percentage point decline in output growth over the next three years under the fixed exchange rate regime, but only a 0.46 percentage point decline under the floating exchange rate regime. Moreover, the significantly negative relation persists longer in the fixed exchange rate regime.

Finally, we look at the implications of reserve accumulations across different exchange rate regimes. Reserve inflows are positively correlated with output growth in both exchange rate regimes, but the positive correlation is larger and lasts longer under the fixed exchange rate regime. A 5 percentage point increase in reserves/GDP over the past three years is associated with a 1.04 percentage point decline in output growth over the next three years under the fixed exchange rate regime, but only a 0.44 percentage point decline under the floating exchange rate regime.

4.2 Transmission through Consumption or Investment

We now conduct similar regression analysis for the three-year change in the consumption-output ratio and the investment-output ratio on the changes in different debt/GDP ratios as in equation (1). Table 8 reports the results for the developed countries in the upper panel and for the developing countries in the lower panel. In each panel, we present the results for the change in the consumption-output ratio and in the investment-output ratio. Contrasting these results with the baseline results on output growth, we shed light on the possible transmission mechanisms from credit booms to future output growth. Specially, the results show whether the implications on output growth are driven through consumption or investment.

Table 8: Channels of Debt: Developed and Developing Countries

Panel A: Developed Countries						
	$\Delta_3 c_{it}$	$\Delta_3 c_{it+1}$	$\Delta_3 c_{it+2}$	$\Delta_3 c_{it+3}$	$\Delta_3 c_{it+4}$	$\Delta_3 c_{it+5}$
$\Delta_3 d_{it-1}^H$	0.017**	0.040**	0.056*	0.037	0.013	-0.011
$\Delta_3 d_{it-1}^F$	-0.006	-0.006	-0.009	-0.008	-0.017*	-0.024**
$\Delta_3 d_{it-1}^P$	-0.013***	-0.018***	-0.023***	-0.017*	-0.018	-0.020*
	$\Delta_3 x_{it}$	$\Delta_3 x_{it+1}$	$\Delta_3 x_{it+2}$	$\Delta_3 x_{it+3}$	$\Delta_3 x_{it+4}$	$\Delta_3 x_{it+5}$
$\Delta_3 d_{it-1}^H$	-0.010	-0.039*	-0.084**	-0.106**	-0.096**	-0.064*
$\Delta_3 d_{it-1}^F$	-0.017***	-0.029***	-0.037***	-0.009	0.017	0.030
$\Delta_3 d_{it-1}^P$	-0.014***	-0.022*	-0.025	-0.002	0.019	0.031
Panel B: Developing Countries						
	$\Delta_3 c_{it}$	$\Delta_3 c_{it+1}$	$\Delta_3 c_{it+2}$	$\Delta_3 c_{it+3}$	$\Delta_3 c_{it+4}$	$\Delta_3 c_{it+5}$
$\Delta_3 d_{it-1}^H$	-0.032**	-0.051***	-0.035	0.028	0.092	0.082
$\Delta_3 d_{it-1}^F$	0.014	0.042**	0.063**	0.047*	0.014	-0.026
$\Delta_3 d_{it-1}^P$	-0.016***	-0.028***	-0.049***	-0.051***	-0.053**	-0.035
	$\Delta_3 x_{it}$	$\Delta_3 x_{it+1}$	$\Delta_3 x_{it+2}$	$\Delta_3 x_{it+3}$	$\Delta_3 x_{it+4}$	$\Delta_3 x_{it+5}$
$\Delta_3 d_{it-1}^H$	-0.024*	-0.063***	-0.108***	-0.108***	-0.081**	-0.019
$\Delta_3 d_{it-1}^F$	-0.016**	-0.030**	-0.041*	-0.035	-0.027	0.000
$\Delta_3 d_{it-1}^P$	-0.003	-0.008	-0.007	-0.004	-0.002	-0.003

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively. c and x denote the consumption-output and investment-output ratios.

For the developed countries, it is interesting to see that the negative implications of household debt on subsequent output growth are through investment rather than consumption. Indeed, an expansion in household debt/GDP is associated with a significant and immediate boom in consumption relative to output and a decline in the investment-output ratio, which is

significant over all horizons. Recall that an expansion in firm debt is associated with an immediate decline in output growth. Clearly, this negative correlation also shows up through the decline in the investment-output ratio. An increase in firm debt/GDP is negatively correlated with investment growth, significant at the immediate terms, and negatively correlated with consumption growth, significant only at the four-year and five-year horizons. An expansion in public debt/GDP also negatively correlates with both consumption and investment growth, more significantly for consumption growth.

The developing countries display similar transmission channels as the developed countries. The negative association between an expansion in household debt/GDP and subsequent output growth is mainly through investment growth. Consumption growth is significantly and negatively correlated with the expansion in household debt only in the near term. An expansion in firm debt negatively correlates with investment growth, but positively correlates with consumption growth, in the near term. This explains the baseline result that firm debt/GDP does not have a significant relation with future output growth. Similar to the developed countries, an increase in public debt/GDP is strongly and negatively correlated with consumption in the near and medium terms. In contrast, an increase in public debt/GDP has no significant correlation with investment growth in any horizon.

We also study the channel through which different types of foreign debt affects future output growth: consumption or investment growth. The results are summarized in Table 9. The first impression of this table is that most of the statistically significant coefficients belong to the regressions of the investment rate for both groups of countries. This implies that investment is the main channel through which the expansion in foreign debt transmits into subsequent output growth. For the developed countries, an expansion in FDI, equity, and foreign loans is associated with a decline in investment growth. Among these categories, foreign loans have the largest magnitude and the longest duration of the implications. An increase in foreign equity inflows is also associated with a decline in consumption growth, which is significant in the medium term. On the other hand, an increase in reserves is associated with an increase in both consumption and investment growth, particularly significant for investment.

For the developing countries, an increase in FDI debt/GDP has no significant correlation with either consumption or investment growth. An increase in foreign equity inflows is significantly negatively correlated with consumption growth. An increase in foreign loans/GDP is associated with a decline in both consumption and investment growth, stronger for investment. Unlike for the developed countries, an increase in reserves/GDP for the developing countries is associated with a significant increase in investment, but not in consumption.

These empirical results highlight the role of investment in transmitting household debt dynamics into output growth. An expansion of household debt/GDP is associated with a decline

Table 9: Channels of Foreign Debt: Developed and Developing Countries

Panel A: Developed Countries						
	$\Delta_3 c_{it}$	$\Delta_3 c_{it+1}$	$\Delta_3 c_{it+2}$	$\Delta_3 c_{it+3}$	$\Delta_3 c_{it+4}$	$\Delta_3 c_{it+5}$
$\Delta_3 d_{it-1}^{FDI}$	0.003	0.012	0.019	0.016	0.007	-0.009
$\Delta_3 d_{it-1}^{EQT}$	-0.004	-0.007*	-0.011**	-0.017***	-0.025***	-0.032***
$\Delta_3 d_{it-1}^{LOAN}$	-0.002	0.002	0.006	0.004	-0.009	-0.028***
$\Delta_3 d_{it-1}^{RES}$	0.028**	0.049*	0.060*	0.039	0.024*	0.007
	$\Delta_3 x_{it}$	$\Delta_3 x_{it+1}$	$\Delta_3 x_{it+2}$	$\Delta_3 x_{it+3}$	$\Delta_3 x_{it+4}$	$\Delta_3 x_{it+5}$
$\Delta_3 d_{it-1}^{FDI}$	-0.014***	-0.029***	-0.037***	-0.016	0.006	0.013
$\Delta_3 d_{it-1}^{EQT}$	-0.011***	-0.018***	-0.018***	-0.001	0.014	0.024*
$\Delta_3 d_{it-1}^{LOAN}$	-0.020***	-0.041***	-0.061***	-0.050***	-0.032***	-0.013
$\Delta_3 d_{it-1}^{RES}$	0.023***	0.045***	0.068***	0.048**	0.027	-0.001
Panel B: Developing Countries						
	$\Delta_3 c_{it}$	$\Delta_3 c_{it+1}$	$\Delta_3 c_{it+2}$	$\Delta_3 c_{it+3}$	$\Delta_3 c_{it+4}$	$\Delta_3 c_{it+5}$
$\Delta_3 d_{it-1}^{FDI}$	-0.016	-0.022	-0.023	-0.019	-0.024	-0.052
$\Delta_3 d_{it-1}^{EQT}$	-0.056*	-0.094**	-0.126***	-0.080***	-0.033	0.006
$\Delta_3 d_{it-1}^{LOAN}$	-0.013**	-0.019**	-0.027**	-0.012	-0.005	0.014
$\Delta_3 d_{it-1}^{RES}$	0.019	0.024	0.019	-0.006	-0.019	-0.008
	$\Delta_3 x_{it}$	$\Delta_3 x_{it+1}$	$\Delta_3 x_{it+2}$	$\Delta_3 x_{it+3}$	$\Delta_3 x_{it+4}$	$\Delta_3 x_{it+5}$
$\Delta_3 d_{it-1}^{FDI}$	-0.005	-0.014	-0.019	-0.020	-0.023	-0.018
$\Delta_3 d_{it-1}^{EQT}$	-0.014	-0.035	-0.044	-0.024	0.015	0.057
$\Delta_3 d_{it-1}^{LOAN}$	-0.023***	-0.043**	-0.052**	-0.032	-0.007	0.010
$\Delta_3 d_{it-1}^{RES}$	0.053***	0.099***	0.112***	0.051***	0.006	-0.039

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively. c and x denote the consumption-output and investment-output ratios.

in subsequent investment growth, but a rise in subsequent consumption growth, although an overall decline in subsequent output growth. These findings are intriguing; intuitively one would have thought that the bust of household debt leads to declines in consumption growth and thus declines in output growth. On the other hand, an expansion in public debt/GDP is associated with a significant decline in consumption growth rather than investment growth in the medium term, particularly in the developing countries.

4.3 Robustness Analysis

We conduct several robustness checks on our main results. First, we check whether our results, particularly for the developed countries, are driven by the episode of the Great Recession. Specifically, we limit the sample periods up to 2006 and redo the regression analysis. Although some coefficients for the developed countries become slightly weaker quantitatively, the main results remain robust. We have included these results in the Appendix tables.

Second, given the large heterogeneity across the developing countries, we separate the developing sample further into two groups: emerging markets and other developing countries. We find some results for the baseline developing countries are strengthened for the emerging markets, but weakened for the other developing countries. We have included these result tables and detailed discussions in the Appendix.

5 Conclusion

The global economy is at record high level of indebtedness. The phenomenon of increasing debt exposure occurs in every economic sector (households, firms, and governments) across the globe. Often the bust of a debt expansion is associated with severe and enduring real contractions, where output growth is depressed for many years. Academic researchers and policy makers are increasingly concerned about these ramifications of the current outstanding debt levels. On the other hand, not all types of debt are created equal. Different types of debt differ in their implications for subsequent output growth, which is thoroughly investigated and documented in this paper for a panel of 72 countries over 1970–2014. The empirical findings are useful for further academic research and policy studies.

We find that an expansion in household debt/GDP is associated with a decline in subsequent output growth for both developed and developing countries. This negative relation is stronger for developing countries and for countries with a fixed exchange regime. An increase in firm debt/GDP is negatively associated with immediate output growth only in the developed countries. An increase in public debt/GDP is negatively associated with medium-term output growth only in the developing countries. The empirical analysis suggests that it is through

investment rather than consumption that an expansion of household debt is transmitted to a decline in output growth.

Our work also examines different sources of external debt financing. We find that an expansion in FDI or equity inflows is negatively correlated with output growth in the developed countries, but is positively correlated with output growth in the developing countries. On the other hand, an expansion in foreign loans/GDP is negatively correlated with output growth in both groups and is particularly significant and strong in the developed countries. Finally, an increase in reserves/GDP is significantly, positively correlated with immediate output growth in both groups, significant over longer horizons in the developing countries.

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Appendix

A1. Country Coverage

Table A1: List of Sample Countries

Developed Countries (21)		
Australia	Germany	Norway
Austria	Greece*	Portugal
Belgium	Ireland	Spain
Canada	Italy	Sweden
Denmark	Japan	Switzerland
Finland	Netherlands	United Kingdom
France	New Zealand	United States
Developing Countries (51)		
Algeria	Guatemala	Philippines*
Argentina*	Hungary*	Poland*
Bahrain	India*	Russian Federation*
Bangladesh	Indonesia*	Saudi Arabia*
Bhutan	Iran	Singapore
Botswana	Israel	Slovak Republic
Brazil*	Kazakhstan	Slovenia
Cambodia	Kenya	South Africa*
Chile*	Korea*	Sri Lanka
China, Mainland	Latvia	St. Lucia
Croatia	Lithuania	Thailand
Czech Republic*	Malaysia*	Turkey*
Dominican Republic	Mexico*	United Arab Emirates*
Ecuador	Morocco	Ukraine
Egypt*	Nepal	Uruguay
El Salvador	Oman	Vanuatu
Estonia	Pakistan*	Venezuela

*: Emerging market countries from the Morgan Stanley Capital International (MSCI) Emerging Markets Index.

A2. Data Sources

National Accounts National Accounts data come from the World Bank's World Development Indicators. For output, we use annual data in constant 2010 U.S. dollars for GDP per capita. For consumption and investment, we use household and NIPSH final consumption expenditure, and gross fixed capital formation, respectively.

Exchange Rate Regime Information about the *de facto* exchange rate regime comes from

Reinhart and Rogoff (2004), updated in Ilzetzi et al. (2017). “Fixed regimes” include no separate legal tender, currency boards, pegs, and narrowly defined horizontal bands (coarse ERA code 1 from Ilzetzi et al., 2017). “Floating regimes” include widely defined horizontal bands, crawling pegs, crawling bands, moving bands, managed floats, and freely floating regimes (coarse ERA codes 2 to 4).

Private Debt Private debt data comes from the Private Debt, Loans and Securities series in IMF’s Global Debt Database. It is defined as total stock of loans and debt securities issued by households and nonfinancial corporations as a share of GDP.

Public Debt Public debt data comes from the IMF’s Historical Public Debt Database. Public debt is gross government debt as a share of GDP.

Foreign Debt Foreign debt data come from the 2016 update of the External Wealth of Nations Mark II database of Lane and Milesi-Ferretti (2007). Net foreign debt is defined as total external liabilities minus total external assets. Total external liabilities are broken into portfolio equity, foreign direct investment, and debt liabilities. Total external assets are decomposed into portfolio equity, foreign direct investment, debt, and reserve assets. We exclude financial derivative assets and liabilities as they are negligible for most countries.

A3. Additional Figures on Debt Statistics

Figure A1: Household Debt

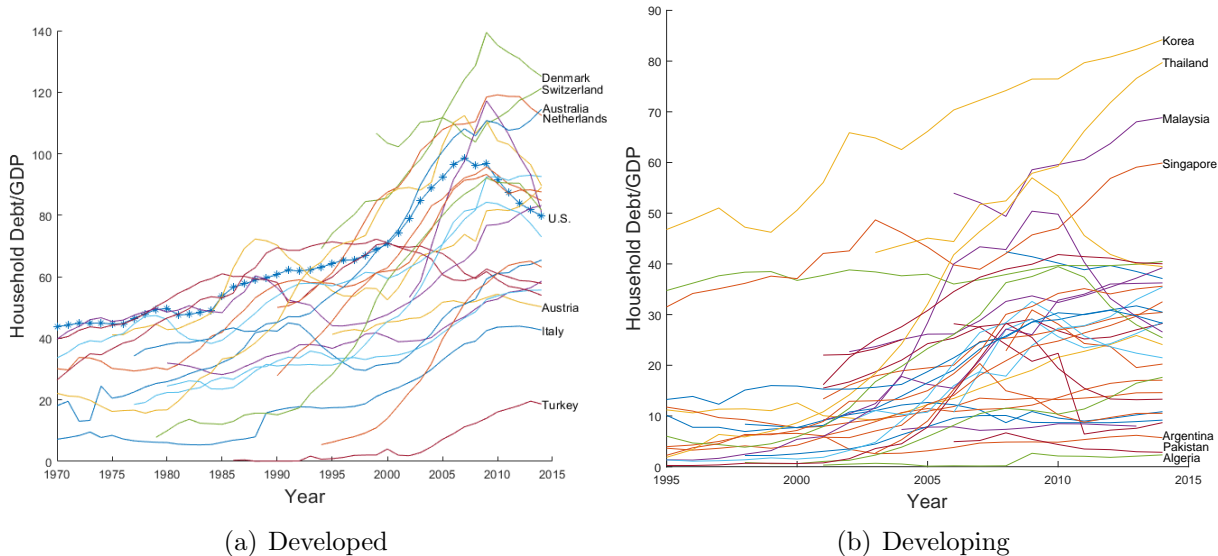
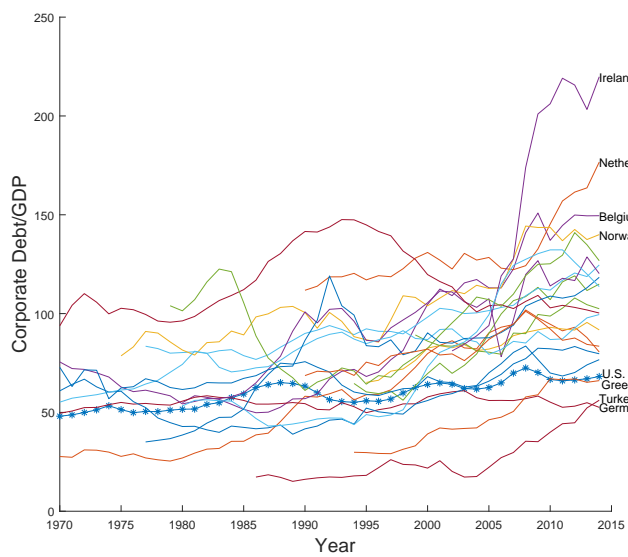
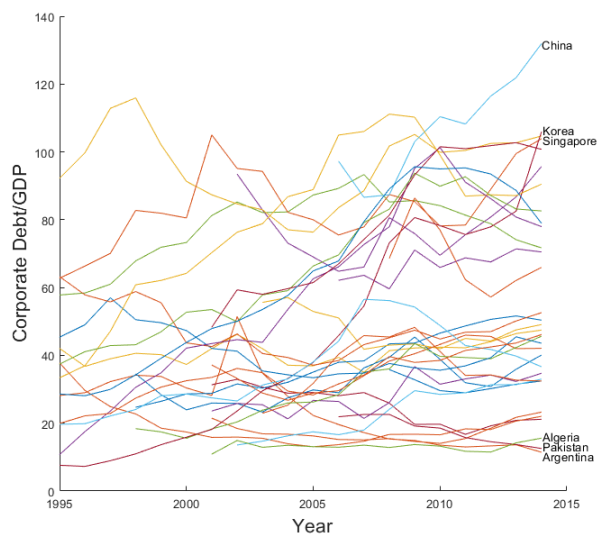


Figure A2: Corporate Debt

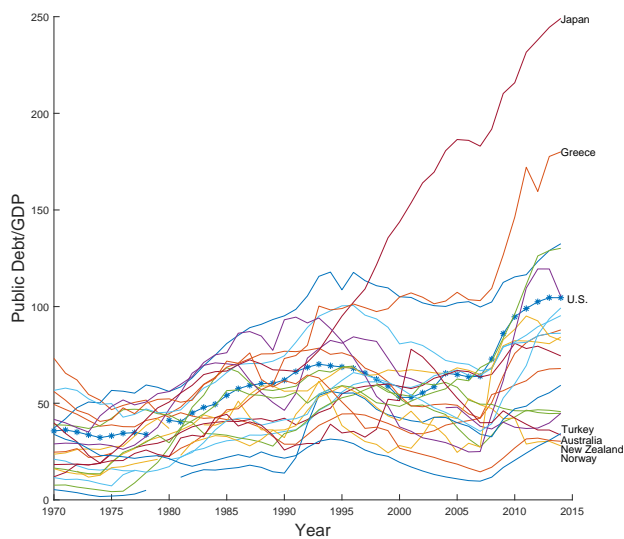


(a) Developed

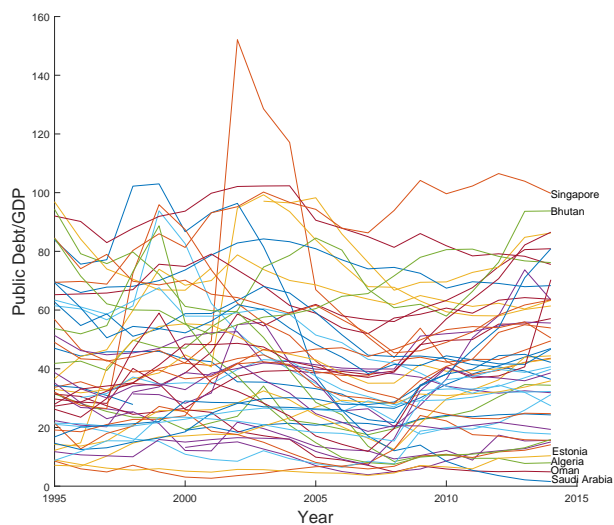


(b) Developing

Figure A3: Public Debt

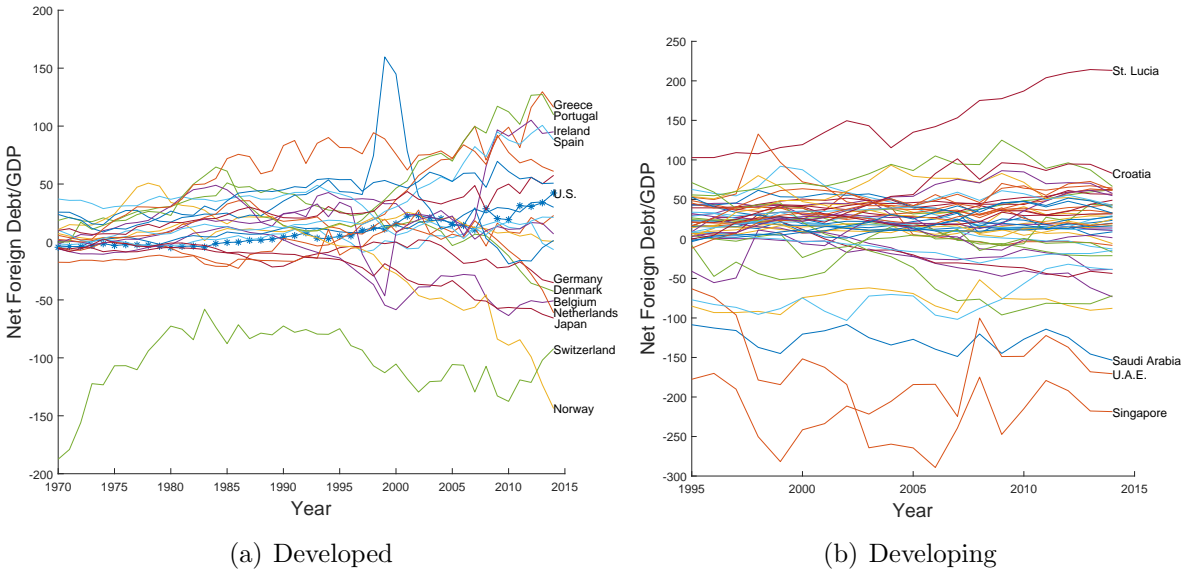


(a) Developed



(b) Developing

Figure A4: Net Foreign Debt



A.4 Robustness Checks

To see whether our results, particularly for the developed countries, are driven by the episode of the Great Recession, we run regressions excluding the recession period. Table A2 reports the results for private and public debt for the sample up to 2006. In the pre-global recession sample, output growth is still negatively correlated with increases in both household and firm debt in the developed countries, similar to the whole sample. However, the effect of household debt becomes weaker, while that of firm debt becomes stronger. In the developing countries, the negative association between household debt and output growth in the pre-global recession sample tends to appear more delayed than in the whole sample. Public debt now is positively correlated with GDP growth in the short run, different from the whole sample.

We also present the foreign debt results for the pre-global recession sample in table A3. In the developed countries, FDI, equity, and loan inflows are negatively related with future output growth in the pre-global recession sample as well. For the developing countries, equity inflows are positively associated with output growth, the same as in the whole sample, but loan inflows lose the significance in the pre global recession sample. Reserve inflows remain positively correlated with output growth in the pre global recession sample as well. In sum, although some coefficients become somewhat weaker and the timing of correlation slightly changes in the pre-global recession sample, most main results are qualitatively similar to those for the whole sample.

Table A4 reports the results for private and public debt for the emerging markets and the other developing countries. The negative relation between the household debt expansion and

Table A2: Private and Public Debt, Pre-Global Recession

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Developed Countries						
$\Delta_3 d_{it-1}^H$	-0.005	-0.043	-0.092	-0.110*	-0.103	-0.078
$\Delta_3 d_{it-1}^F$	-0.033**	-0.065**	-0.087**	-0.065*	-0.026	0.002
$\Delta_3 d_{it-1}^P$	-0.006	-0.022	-0.031	-0.018	0.009	0.032
Obs	454	454	454	454	454	454
Panel B: Developing Countries						
$\Delta_3 d_{it-1}^H$	-0.089	-0.141	-0.381*	-0.735***	-0.906***	-0.627***
$\Delta_3 d_{it-1}^F$	-0.005	-0.011	-0.004	-0.028	-0.071	-0.039
$\Delta_3 d_{it-1}^P$	0.044***	0.054***	0.052**	0.017	-0.024	-0.078**
Obs	200	200	200	200	200	200

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A3: Domestic and Foreign Debt, Pre-Global Recession

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Developed Countries						
$\Delta_3 d_{it-1}^{FDI}$	-0.033***	-0.064***	-0.078**	-0.050	-0.009	0.008
$\Delta_3 d_{it-1}^{EQT}$	-0.013	-0.032*	-0.052***	-0.058***	-0.056**	-0.043
$\Delta_3 d_{it-1}^{LOAN}$	-0.037***	-0.073***	-0.098***	-0.076***	-0.040*	-0.009
$\Delta_3 d_{it-1}^{RES}$	0.011	0.013	-0.029	-0.093	-0.157**	-0.138*
Obs	651	651	651	651	651	651
Panel B: Developing Countries						
$\Delta_3 d_{it-1}^{FDI}$	0.028	0.065	0.108	0.127	0.146**	0.165***
$\Delta_3 d_{it-1}^{EQT}$	0.052***	0.109***	0.133***	0.061	-0.032	-0.082
$\Delta_3 d_{it-1}^{LOAN}$	-0.012	-0.020	-0.018	-0.007	-0.008	-0.017
$\Delta_3 d_{it-1}^{RES}$	0.081***	0.126***	0.131***	0.037	-0.035	-0.057
Obs	1,010	1,010	1,010	1,010	1,010	1,010

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A4: Private and Public Debt, Emerging and Other Developing Countries

	$\Delta_3 y_{it}$	$\Delta_3 y_{it+1}$	$\Delta_3 y_{it+2}$	$\Delta_3 y_{it+3}$	$\Delta_3 y_{it+4}$	$\Delta_3 y_{it+5}$
Panel A: Emerging Markets						
$\Delta_3 d_{it-1}^H$	-0.172**	-0.375***	-0.598***	-0.664***	-0.686***	-0.561**
$\Delta_3 d_{it-1}^F$	0.010	0.030	0.064	0.089	0.090	0.080*
$\Delta_3 d_{it-1}^P$	0.007	-0.006	-0.026	-0.056**	-0.068**	-0.076**
R^2	0.798	0.539	0.225	0.232	0.210	0.191
Obs	272	272	272	272	252	230
Panel B: Other Developing Countries						
$\Delta_3 d_{it-1}^H$	0.005	-0.051	-0.147	-0.153	-0.034	0.106
$\Delta_3 d_{it-1}^F$	-0.026	-0.057	-0.077	-0.110	-0.155**	-0.133*
$\Delta_3 d_{it-1}^P$	-0.035	-0.047	-0.043	0.019	0.051	0.086
R^2	0.793	0.389	0.129	0.202	0.185	0.159
Obs	207	207	207	207	191	175

Notes: *, **, *** indicate significance at the 0.1, 0.05, 0.01 levels, respectively.

future output growth is much stronger in the emerging markets. The negative coefficient is significant for all horizons up to five years. In the other developing countries, the negative relationship between the change in household debt/GDP and GDP growth is entirely non-significant in all horizons. An expansion in firm debt/GDP has a positive correlation with output growth in the emerging market countries, although the relation is not statistically significant except at horizon $k = 5$. An expansion in the firm debt/GDP ratio is negatively correlated with output growth in the other developing countries, significant at horizon $k = 4, 5$. Turning to public debt, an increase in public debt/GDP is negatively correlated with output growth, and the relation becomes significant for the medium term $k = 3, 4, 5$ in the emerging markets. The magnitude of the negative impact is large. In the other developing countries, by contrast, there is no significant relation between the change in public debt and output growth. In sum, the ramification of household debt expansions on medium-term output growth is a feature of the developed countries and the emerging markets, but not of the other developing countries. Public debt also has negative association with medium-term output growth only in the emerging markets. The results for foreign debt are similar across the emerging markets and the other developing countries.