The effect of public debt on investment in emerging markets: an analysis for 1996-2018

Ytallo Brito
Departamento de Economia - Universidade Federal Fluminense

Helder Ferreira de Mendonça
Departamento de Economia - Universidade Federal Fluminense e Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)

Abstract

This paper provides empirical evidence of the relationship between public debt/GDP ratio and investment. Based on panel data analysis considering 24 emerging markets from 1996 to 2018, we investigate the effect of an increase in public debt on investment at three levels: aggregate, private sector, and public sector. Moreover, we consider the possibility of the global financial crisis of 2007-2008 (GFC) has changed the relationship between public debt and investment. We also assess the effect of a public debt/GDP ratio higher than the prudential level of 60% on investment. The findings indicate that an increase in the public debt/GDP ratio has a significant harmful effect on investment. In particular, we observe that after the GFC, the adverse effect of a higher public debt/GDP ratio on investment increased considerably. Moreover, our results show that the highest adverse effect of a rise in the public debt/GDP ratio is on the public sector investment.

Key words: public debt, investment, emerging markets, private and public sectors.

JEL classification: E22, E60, H63.

Resumo

Este artigo fornece evidências empíricas da relação entre a relação dívida pública/PIB e o investimento. Com base na análise de dados em painel considerando 24 mercados emergentes de 1996 a 2018, investigamos o efeito de um aumento da dívida pública sobre o investimento em três níveis: agregado, setor privado e setor público. Além disso, consideramos a possibilidade de a crise financeira global de 2007-2008 (GFC) ter alterado a relação entre dívida pública e investimento. Avaliamos também o efeito de uma relação dívida pública/PIB superior ao nível prudencial de 60% sobre o investimento. Os resultados indicam que o aumento da relação dívida pública/PIB tem um efeito prejudicial significativo sobre o investimento. Em particular, observamos que após o GFC, o efeito adverso de uma maior relação dívida pública/PIB sobre o investimento aumentou consideravelmente. Além disso, nossos resultados mostram que o maior efeito adverso de uma elevação da relação dívida pública/PIB é sobre o investimento do setor público.

Palavras-chave: dívida pública, investimento, mercados emergentes, setores público e privado.

Área 4 - Macroeconomia, Economia Monetária e Finanças

1. Introduction

Public debt is one of the most important elements regarding the economic fundamentals. The global financial crisis of 2007-2008 (GFC) brought back to the debate the importance of using an expansionary fiscal policy to combat a recession. There is a connection between public debt and investment because when public debt is high can discourage investment decisions due to the higher risk of a government default.[1] Nevertheless, a higher public debt in times of crisis may represent an injection of resources capable of stimulating the economy. In particular, an increase in public debt can be beneficial to the economy due to the strong correlation with public investment and the possibility of creating a crowding-in effect on private investment (Adb, Furceri, and Topalova, 2016; Sánchez-Juárez and García-Almada, 2016). Therefore, the GFC brought a trade-off between seeking fiscal balance or adopting a loose fiscal policy.

This study uses panel data analysis to investigate the effect of public debt on investment in 24 emerging markets. Specifically, we analyze investment from three perspectives: aggregate investment, private sector investment, and public sector investment. While aggregate investment represents the total realized in the economy, that is, the sum of investments from the private and public sectors, there are differences between them that can show different results. Private sector investment reflects the economy's expected result, while public sector investment can be a countercyclical tool. We also considered that the relationship between investment and public debt might have changed due to the GFC. While the pre-crisis period accounted with a commitment to fiscal policies considered healthy that prevented a public debt/GDP ratio deterioration, the post-crisis period had fiscal packages that led to an increase in public indebtedness, but which contributed to avoiding a worsening in economic growth (Chen, Mrkaic, and Nabar, 2019). Although a beneficial outcome for the economy is possible due to a higher public debt/GDP ratio, there is a limit to this result. International organizations, such as the International Monetary Fund (IMF), consider that a public debt/GDP ratio greater than 60% is harmful (IMF, 2011). Therefore, we also analyze how a public debt/GDP ratio higher than 60% affects investment in emerging markets.

Our analysis uses annual investment and public debt data for 24 emerging markets from 1996 to 2018.[2] The data set corresponds to the period after introducing macroeconomic policies concerned with promoting the stability of variables considered necessary for long-term economic growth, such as price level control, exchange rate flexibility, and public debt solvency.[3] The analysis regarding investment and public debt in emerging markets is relevant because, in the period under analysis, according to data from DataBank/World Bank, the average share of aggregate investment in these economies corresponds to 31.62% of aggregate investment in the planet, and the public debt/GDP ratio average is approximately 44.69%.[4] Because our focus is to analyze the effect of public debt (public debt/GDP ratio) on investment (gross fixed capital formation/GDP), we regress our variables of interest on investment measures (aggregate, private sector, and public sector). To control issues regarding simultaneity and omitted variables in the models, we used two methods that are robust to these problems: Difference Generalized Method of Moments (Diff-GMM) and the System Generalized Method of Moments (Sys-GMM).

Our findings show that a shock of 10% in public debt/GDP ratio leads to a reduction of approximately 2% in investment. We also observe an adverse effect caused by an increase in public debt when considering investment from the private and public sectors. In particular, a shock of 10% on public debt leads to a reduction of approximately 2% in private sector investment and 3% in public sector investment. Our results also show that the harmful effect of public debt on investment became more pronounced in the period after the GFC, and the highlight was the effect of reducing public sector

[1] Besides high public debt, several channels restrict growth and investment, such as the rise in interest rates, the increase in the sensitivity of investment in cash flow of companies with credit restrictions, the decrease in the formation of private savings, and the reduction in the total productivity factor (see Huang, Panizza, Varghese, 2018; Cherita-Westphal and Rother, 2012; and Laubach, 2009).

[2] Table A.1 (appendix) shows the list of countries.

[3] For an analysis on the use of inflation targeting in emerging markets, see de Mendonça and Guimarães e Souza (2012). On the adoption of more flexible exchange rate regimes, see Pontines and Siregar (2012). On the increase in public debt concerns in emerging markets countries, see Daniel et al. (2003).

[4] Data on aggregate investment and public debt/GDP are available on https://databank.worldbank.org/ and https://www.imf.org/en/Publications/WEO/weo-database/2020/October, respectively.

investment. While the reduction in public sector investment using the total sample (1996 to 2008) was approximately 2.5%, the fall in public sector investment using the subsample (2009 to 2018) jumps to approximately 6%. It is noticeable that our results are robust for applications of different methods (Diff-GMM and Sys-GMM) that make use of instrumental and control variables and also for different time samples.

Since the public debt/GDP ratio level is one of the main conditioning factors of fiscal policy, its impact on the economy has been widely studied. In particular, public debt in emerging markets tends to be an obstacle to the economy's smooth functioning. Although there is a view that public debt can be beneficial for economic growth due to the increase in short-term resources in the economy, higher public debt can create an environment of greater uncertainty, which, therefore, harms economic growth (Chudik et al., 2017; Cochrane, 2011). An important strand of literature, based on country-level data, shows a negative relationship between public debt and economic growth (Woo and Kumar, 2015; Checherita-Westphal and Rother, 2012; and Cecchetti, Mohanty, and Zampolli, 2011). In general, high public debt implies higher interest rates due to the increased risk of default in the public sector, leading to lower growth. The literature also points out that greater indebtedness leads to a reduction in the total factor of productivity due to the decrease in capital accumulation, a decrease in private savings, and investment.[5]

In dissonance with the literature mentioned above, some studies show evidence that higher public indebtedness can generate beneficial economic growth effects. Guerini et al. (2020), based on an analysis for the USA, suggest that increases in public debt positively and persistently affect the product, as it can encourage private consumption and investment. Moreover, some studies indicate a lack of causality from the negative impact of increased public debt on economic growth. For example, Jacobs et al. (2020) and Panizza and Presbitero (2014), based on a cross-country data analysis for the OECD and European Union countries, find that, although there is a negative correlation between public debt and economic growth, such a relationship is not significant.

Policymakers are concerned with investment because it can improve economic activity by increasing the total factor of productivity. Therefore, one of the literature's main aims is to investigate the main investment determinants (Checherita-Westphal and Rother, 2012; and Khan and Reinhart, 1990). One aspect of the literature has focused on studying the mechanisms that show how a higher public debt can reduce investment. Despite the countercyclical aspect of the increase in indebtedness, high public debt generates adverse effects on investment (Andrade and Duarte, 2016; and Fischer and Easterly, 1990). The negative effect of public indebtedness on investment is relevant not only for advanced countries but also for emerging and developing markets that, by raising their indebtedness, generate fiscal imbalances, which ends up increasing the perceived risk by investors and, therefore, damage the loan and credit markets (Pegkas, 2018).

In general, the volume of private investment is predominant in comparison to public investment. While private sector investment may reflect the expected conditions for the economy, public investment may be the result of a government strategy to, for example, expand infrastructure (IMF, 2020; and Kose et al., 2017). Another fact is that the literature is not unanimous regarding the crowding-out effect between public investment and private investment. Some studies point out the negative effect of increasing interest rates on private sector investment in a scenario of high indebtedness (Bende−Nabende and Slater, 2003). Moreover, because public investment depends on fiscal balance when countries have high public debt levels, there is a tendency for governments to reduce investments (Bacchiocchi, Borghi, and Missale, 2011).

Our study distinguishes oneself from the existing literature in several respects. Firstly, besides considering the effect of public debt on aggregate investment, we analyze the effect on private investment and public investment separately. In other words, our analysis allows one to see how much an increase in public debt can wreck private decisions on investment and put a limit to governments to use loose fiscal policies to stimulate the economy. Secondly, there is a lack of studies investigating the effect of public debt on investment in emerging markets. Hence, we make a comprehensive empirical analysis taking into account all emerging markets (IMF classification). Thirdly, because the relationship between public debt

[5] For an analysis of public debt thresholds and economic growth, see Osinska (2020), Qureshi and Liaquat (2020), Chudik et al. (2017), and Eberhardt and Presbitero (2015).

and investment can be changed over time, especially after the GFC, we provide empirical evidence from several sample periods (full sample – 1996 to 2018, pre-crisis – 1996 to 2008, and post-crisis – 2009-2019). Lastly, we also analyze the impact on investment when the public debt/GDP ratio exceeds the prudential limit of 60%.

This article proceeds as follows. Section 2 presents the main variables of interest and introduces the empirical specification and estimation strategy used in the study. Section 3 provides empirical evidence of the relationship between public debt and investment and the interpretation of the results. Lastly, section 5 concludes.

2. Data and methodology

The dependent variable in our models is the investment. In order to consider data from the 24 countries classified by the International Monetary Fund (2015) as emerging markets, we used the main investment proxy found in the literature, that is, the gross formation of fixed capital.[6] The World Bank provides information on gross fixed capital formation - % of GDP (*INV*) and gross fixed capital formation of the private sector - % of GDP (*INVPRIV*) from the DataBank database (https://databank.worldbank.org/). Therefore, we extract the gross fixed capital formation of the public sector - % of GDP (*INVPUB*) through the difference between the two investment measures mentioned above. The period under analysis is from 1996 to 2018, and it is marked by the standardization of economic policy in emerging markets. The second half of the 1990s was characterized by the adoption of variations in fixed exchange rate regimes, while from the 2000s onwards, the use of inflation targets began to increase. In short, although instabilities have occurred, the period under consideration is marked by greater control of the inflation rate compared, for example, to the 1980s. Therefore, this period is more appropriate to observe as a fiscal deterioration, revealed by an increase in the public debt/GDP ratio, affects investment.

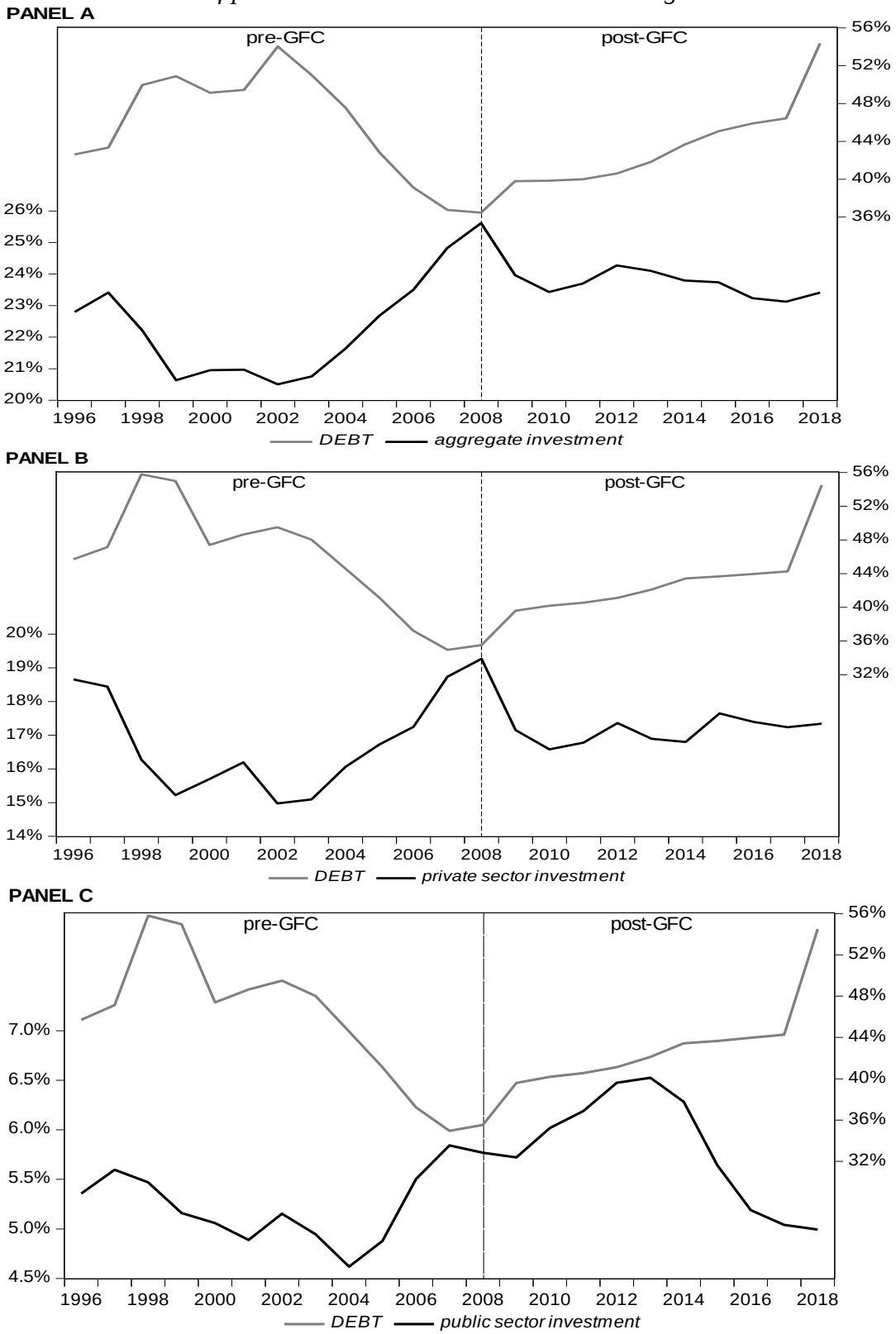
Our key independent variable in the models is public debt. Public debt is one of the main fundamentals of the economy and represents one of the main indicators for investors' decision-making process. According to Hakura (2020), a high public debt/GDP ratio hinders economic growth and investment. Hence, considering information available in the World Economic Outlook/International Monetary Fund (WEO/IMF) database, we use General government gross debt - % of GDP (*DEBT*) to measure public debt ratio/GDP.

To a preliminary view of the relationship between the public debt/GDP ratio and investment over time, we provide a graphical inspection of the trajectories (cross-country average) of our measures of investment (*INV*, *INVPRIV*, and *INVPUB*) and public debt (*DEBT*). In general, the graphs in figure 1 show that the paths of investment and public debt have opposite inclinations, which suggests a negative relationship between them. Concerning investment, in general, we can see three phases independent of the measure (aggregate investment, private sector investment, and public sector investment). Firstly, a decrease in investment from 1996 to 2002. Secondly, a healthy recuperation in investment from 2003 to 2008. Finally, a decrease and stabilization of investment at a level close to 1996. We can also observe three phases for public debt trajectory covering the same periods with a trend opposite to those related to investment.

[6] Regarding the use of gross fixed capital formation as an investment proxy, see Asif et al. (2020), Binding and Dibiasi (2017), and Young (2003).

Figure 1

Evolution of public debt/GDP and investment in emergent markets



Note: The sample is composed of 24 emerging markets (table A1 - appendix). Pre-GFC and post-GFC – are the periods before and after the Global Financial Crisis of 2007-2008. The percentage is the cross-country average regarding general government gross debt/GDP ratio (*DEBT*) and gross fixed capital formation/GDP (aggregate investment, private sector investment, and public sector investment) from 1996 and 2018.

Panel A of figure 1 shows the trajectories for the aggregate investment and public debt. Regarding investment, the trajectory is compatible with the fact that during the late 1990s, most emerging markets

experienced a significant reduction in the level of aggregate investment caused by financial crises and speculative currency attacks that became recurrent in that period. Those turbulences resulted in a high degree of uncertainty in emerging markets that reflected a drop in investment rates. With the overcoming of the financial crises and the acceleration of the world economic growth, investment levels increased throughout most of the first decade of the 2000s. However, this trend was interrupted by the GFC, which slowed investments in the emerging markets due to increased uncertainty, and established a new level of investment that has remained practically stable throughout the decade of 2010.

Panel B in figure 1 suggests that the evolution of the private sector investment is close to the aggregate investment in panel A. This observation indicates a strong sensitivity of private sector investment to the cyclical phenomena that impacted aggregate investment. On the other hand, although investment in the public sector had had a similar trajectory during the period before 2008, during the years that followed the GFC, there was a significant rise in public sector investment (see panel C). A possible explanation for this observation is that several governments increased their debts to fund public sector investment to struggling against the recession. An indication of this possibility is the positive slope for both public debt and public sector investment trajectories from 2009 to 2013.

In order to observe the impact of public indebtedness on investment, our baseline model is the following:

(1) $$INV_{k,i,t} = \beta_0 INV_{k,i,t-1} + \beta_1 DEBT_{i,t} + \beta_2 X_{i,t} + \eta_i + u_{i,t},$$

where: $INV_{k,i,t}$ corresponds to investment (log of gross fixed capital formation/GDP - %) for the country i in the year t. INV_k corresponds to investment (in log), where k=1 is the aggregate investment, k=2 is the private sector investment, and k=3 is the public sector investment. *DEBT* corresponds to the general government gross debt/GDP ratio - % (in log). i=1, ..., N is the cross-section unit (countries). t=1, ..., T is the time index (annual frequency). $u_{i,t}$ is the stochastic error term. η_i represents a vector of country-specific factors.

Regarding the control variables matrix in equation 1 ($X_{i,t}$), we gathered from the literature usual determinants of investment such as (data available from the DataBank/World Bank database): economic growth (*GROWTH*), inflation rate (*INF*), and trade openness (*TRADE*). *GROWTH* is the annual GDP growth rate at market prices based on the constant local currency (Peltonen, Sousa, and Vansteenkiste, 2012). *INF* is the inflation rate measured by the consumer price index (Naudé and Krugell, 2007). *TRADE* is the trade openness measured by the ratio between the sum of exports and imports of goods and services and the GDP (Blonigen and Piger, 2014).[7]

In equation 1, the β_1 coefficient measures the effect on investment (aggregate, private, and public) due to a shock on the public debt/GDP ratio. Because we are considering that an increase in the public debt/GDP ratio must deteriorate business confidence and thereby decreases investment, we expect that β_1 is negative in all specifications.

We use dynamic panel data analysis based on a sample of 24 developing countries covering the period 1996 to 2018.[8] Because we are working with dynamic models and short panel data ($T<N$), then they are subject to Nickell's bias (1981).[9] Moreover, as the investment can influence some of the regressors, such as the growth rate, we cannot rule out endogeneity in the models. Therefore fixed effect models do not perform well under these circumstances. Hence, we employ the Generalized Method of Moments from two perspectives to deal with the above-mentioned issues.

Firstly, we use the Difference Generalized Method of Moments (Diff-GMM) as suggested by Arellano and Bond (1991). According to this view, estimating the model in first differences instead of fixed effects eliminates the bias because the fixed country-specific effect is removed (it does not vary with time). The lagged dependent variable is also instrumented with its past levels ($INV_{k,i,t-s}$ for $s>1$) and thus define a consistent estimator. Besides, an advantage to present the estimator using the GMM framework is because

[7] Table A.2 (appendix) shows the descriptive statistics and sources for all variables in the models. Moreover, to check the presence of unit root, the tests Im-Pesaran-Shin and Fisher-ADF were performed (see table A.3 - appendix). The results do not indicate that the series are non-stationary.

[8] Due to the availability of data from DataBank/World Bank, the sample of countries in private sector investment and public sector investment decreased to fifteen (see table A.1 – appendix).

[9] According to Judson and Owen (1996), when $T<30$, Nickell's bias cannot be ignored. In our case, we have T=23.

the set of instruments $\{INV_{k,i,t-2}, \ldots, INV_{k,i,1}\}$ increases with increasing t.

Secondly, as pointed out by Blundell and Bond (1998) and Arellano and Bover (1995), if the autoregressive process is too persistent, then the lagged levels are weak instruments. Consequently, we also perform the System Generalized Method of Moments (Sys-GMM). The main difference in relation to the previous estimator is the use of additional moment conditions in which lagged differences of the dependent variable are orthogonal to levels of the disturbances. Specifically, Sys-GMM "combines the standard set of equations in first-differences with suitably lagged levels as instruments, with an additional set of equations in levels with suitably lagged first-differences as instruments" (Bond, Hoeffler, and Temple, 2001, p. 9).

The number of countries in our sample is not too high; thus, many instruments may weakness the Sargan test. Concerned with this possibility, we perform each model obeying the following rule of thumb: the ratio between the number of instruments and the number of cross-sections is lower than 1 (de Mendonça and Barcelos, 2015). Obeying this condition, then we execute the overidentification restrictions test (J-test) to check the instruments' validity in the models (Arellano, 2003). Finally, we carry out tests of first-order (AR1) and second-order (AR2) serial correlation.[10]

To sum up, our empirical analysis has three main blocks. Firstly, considering the full sample period (1996 to 2018), we estimate the effect of an increase in the public debt/GDP ratio on investment (aggregate, private, and public) based on Diff-GMM and Sys-GMM. Secondly, to analyze whether the influence of the public debt/GDP ratio on investment is different before and after the GFC, we re-estimate the previous Sys-GMM models using two subsample periods: 1996 to 2008 and 2009 to 2018. Lastly, to check the impact of high public debt (*HDEBT*) on investment, we consider the case where the public debt/GDP ratio (in log) is greater than 60% (a benchmark for a high default risk – see IMF, 2011):

$$HDEBT_{i,t} = \begin{cases} DEBT_{i,t}, & \text{if } DEBT_{i,t} > 60\% \\ 0, & \text{otherwise} \end{cases}, \tag{2}$$

we re-estimate all Sys-GMM models.

[10] Besides lagged values of the regressors, we use external instruments gathered from World Bank and Aizenman, Chinn, and Ito (2008). Our set of instrument variables is composed of three groups. Governance indicators: control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, the rule of law, and voice and accountability. Trilemma indexes: monetary independence, exchange rate stability, and financial openness. Other economic variables include a change in the nominal exchange rate, GDP per capita, gross fixed capital formation, and a GFC dummy. The list of instruments in each model is available from the authors upon request.

3. Analysis of results

The results are consistent with the assumption that a higher public debt/GDP ratio is associated with a reduction in aggregate investment. The regressions of both Diff-GMM and Sys-GMM show that regardless of the model under consideration, the coefficients on *DEBT* are negative and have statistical significance (see table 1).

The regressions in table 1 point out a relationship between public debt and investment that is consistent with the view that a fiscal deterioration is harmful to investments in emerging markets.[11] Regarding the models' control variables, we observed that the results are consistent with the theoretical view of their relationship with investment. In general, the coefficients on *GROWTH* are positive and significant. This result is in line with that found by, for example, Tang, Selvanathan, and Selvanathan (2008) and Choe (2003). The coefficients on *INF* are negative and significant in almost all specifications. Hence, the evidence suggests that an increase in inflation induces a reduction in investment (see Gillman and Kejak, 201; and Smith and Egteren, 2005). Finally, the coefficients on *TRADE* are positive and significant in the models, suggesting that an increase in trade openness helps realize investments (see Al-Sadig, 2013 and Razin, Sadka, and Coury, 2003).

To assess whether the negative effect of an increase in the public debt/GDP ratio on investment is similar when considering investment from the private and public sectors, we re-estimate the previous models using the Sys-GMM method. The findings show that, in both cases, public debt is detrimental to investment (see table 2). An important observation is that, although the coefficients on *DEBT* are negative and significant for private sector investment and public sector investment, the negative effect of an increase in the public debt/GDP ratio is more remarkable when we consider the public sector. One possible explanation for this result is that higher public debt is associated with a reduction in government savings, which would reduce the capacity to invest.

[11] For examples related to the fact that a worsening of the fiscal environment harms investment, see Hakura (2020) and Aysan, Pang, and Véganzonès-Varoudakis (2009).

Table 1

Effects of public debt/GDP on investment

Regressors	*Diff-GMM*				*Sys-GMM*			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$INV_{1,i,t-1}$	0.236**	0.269***	0.388***	0.418***	0.424***	0.529***	0.425***	0.454***
	(0.084)	(0.033)	(0.083)	(0.041)	(0.089)	(0.102)	(0.060)	(0.035)
$DEBT_{i,t}$	-0.324***	-0.286***	-0.389***	-0.332***	-0.225***	-0.140***	-0.198***	-0.199***
	(0.051)	(0.008)	(0.069)	(0.053)	(0.038)	(0.032)	(0.039)	(0.036)
$GROWTH_{i,t}$		0.055***	0.120***	0.107**		0.161***	0.128**	0.124*
		(0.010)	(0.038)	(0.040)		(0.051)	(0.070)	(0.065)
$INF_{i,t}$			-0.0004	-0.004**			-0.008***	-0.007**
			(0.001)	(0.001)			(0.002)	(0.003)
$TRADE_{i,t}$				0.376***				0.068*
				(0.081)				(0.036)
N. inst./N. cross-sec.	0.7391	0.7826	0.8261	0.9130	0.6087	0.7826	0.6522	0.6087
J-Statistic	21.485	22.818	16.060	13.423	10.988	18.070	6.871	6.021
(p-value)	(0.122)	(0.353)	(0.378)	(0.642)	(0.530)	(0.259)	(0.650)	(0.738)
AR(1)	-0.505	-0.512	-0.509	-0.502	-0.269	-0.337	-0.166	-0.183
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	0.003	-0.001	-0.031	-0.043	-0.102	-0.139	-0.130	-0.125
(p-value)	(0.969)	(0.989)	(0.670)	(0.479)	(0.137)	(0.144)	(0.106)	(0.126)

Notes: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.1. White's heteroscedasticity consistent covariance matrix was applied in regressions. Standard errors between parentheses. Sys-GMM – uses two-step of Arellano and Bover (1995) without time period effects. Diff-GMM – uses two-step of Blundell and Bond (1998) without time period effects. Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel of 24 countries from 1996 to 2018.

Table 2

Effects of public debt/GDP on private sector investment and public sector investment

Regressors	*Private Investment* (k=2)				*Public Investment* (k=3)			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$INV_{k,i,t-1}$	0.131*	0.634***	0.987***	0.808***	1.059***	0.170***	0.781***	1.105***
	(0.070)	(0.068)	(0.047)	(0.098)	(0.050)	(0.046)	(0.088)	(0.144)
$DEBT_{i,t}$	-0.275***	-0.169***	-0.144***	-0.191***	-0.386***	-0.678***	-0. 452***	-0.315***
	(0.062)	(0.044)	(0.045)	(0.037)	(0.043)	(0.238)	(0.139)	(0.106)
$GROWTH_{i,t}$		0.150*	0.358***	0.275***		1.291***	1.070***	1.282***
		(0.085)	(0.064)	(0.122)		(0.355)	(0.218)	(0.318)
$INF_{i,t}$			-0.007*	-0.020**			-0.031**	-0.029**
			(0.004)	(0.005)			(0. 013)	(0.013)
$TRADE_{i,t}$				0.576***				0.849**
				(0.139)				(0.351)
N. inst./N. cross-sec.	0.3846	0.9231	0.9231	0.9231	0.5000	0.7692	0.9231	0.9231
J-Statistic	1.208	9.182	9.479	8.583	5.727	8.531	9.077	6.772
(p-value)	(0.751)	(0.516)	(0.306)	(0.284)	(0.334)	(0.288)	(0.336)	(0.453)
AR(1)	-0.258	-0.444	-0.360	-0.337	-0.127	-0.242	-0.228	-0.238
(p-value)	(0.094)	(0.002)	(0.000)	(0.000)	(0.094)	(0.065)	(0.070)	(0.030)
AR(2)	0.018	-0.059	-0.064	-0.051	-0.257	-0.176	-0.176	-0.235
(p-value)	(0.895)	(0.730)	(0.578)	(0.725)	(0.110)	(0.153)	(0.203)	(0.133)

Notes: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.1. White's heteroscedasticity consistent covariance matrix was applied in regressions. Standard errors between parentheses. Sys-GMM – uses two-step of Arellano and Bover (1995) without time period effects. Diff-GMM – uses two-step of Blundell and Bond (1998) without time period effects. Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel of 15 countries from 1996 to 2018.

The GFC was associated with fiscal aspects that hurt several economies more sharply in the period of crisis. The best-known example of this situation was the so-called PIGS (Portugal, Ireland, Greece, and Spain). To analyze whether the GFC led to changes in the relationship between public indebtedness and investment in emerging markets, we re-estimate the previous models (Sys-GMM) in order to verify whether there was a change in the magnitude of the estimated coefficients for the pre-crisis (1996-2008) and post-crisis (2009-2018) periods. The results presented in table 3 indicate that the harmful impact of an increase in the public debt/GDP ratio on investment was higher in the post-crisis period for all cases considered (aggregate investment, private sector investment, and public sector investment). The highlight is the deleterious effect of a greater public debt on investment in the public sector. When we compare the regressions for the pre-crisis and post-crisis periods, we can see that the coefficient on *DEBT* more than doubled in absolute terms.

Institutions such as the IMF emphasizes that when the public debt/GDP ratio exceeds certain levels, the risk of insolvency becomes higher. In emerging markets, it is recommended that the public debt/GDP ratio is less than 60% (IMF, 2011). To assess the situations where the debt-to-GDP ratio is higher than the benchmark value for maintaining fiscal balance, we perform new regressions (Sys-GMM) that substitute *DEBT* in equation 1 by *HDEBT*. The results regarding aggregate investment, private sector investment, and public sector investment, considering the total period, pre-crisis, and post-crisis, show that, regardless of the specification used, a public debt/GDP ratio higher than 60% affects negatively and significantly investment (see table 4). As in previous results, the post-crisis period represents the case where the harmful effect of an increase in the public debt/GDP ratio is greatest.

Table 3

Effects of public debt/GDP on investment (pre-GFC and post-GFC)

Regressors	*Pre-GFC*			*Post-GFC*		
	Aggregated Investment (*k*=1)	*Private Investment* (*k*=2)	*Public Investment* (*k*=3)	*Aggregated Investment* (*k*=1)	*Private Investment* (*k*=2)	*Public Investment* (*k*=3)
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$INV_{k,i,t-1}$	0.396***	0.408***	0.483	0.133*	0.321***	0.130
	(0.072)	(0.132)	(0.391)	(0.071)	(0.099)	(0.147)
$DEBT_{i,t}$	-0.135***	-0. 181***	-0.251**	-0.236***	-0.286***	-0.604**
	(0.044)	(0.059)	(0.109)	(0.075)	(0.068)	(0.255)
$GROWTH_{i,t}$	0.150**	0.435*	0.822*	0.023	0.177***	0.457
	(0.065)	(0.222)	(0.456)	(0.036)	(0.033)	(0.517)
$INF_{i,t}$	-0.003***	-0.004	-0.012	-0.002***	-0.002	-0.015
	(0.001)	(0.002)	(0.011)	(0.001)	(0.002)	(0.010)
$TRADE_{i,t}$	0.303***	0.863***	0.660	0.117**	0.371***	0.280
	(0.021)	(0.202)	(0.497)	(0.050)	(0.060)	(0.414)
N. inst./N. cross-sec.	0.8636	0.8462	0.9167	0.818	0.9231	0.7692
J-Statistic	10.399	10.481	6.061	16.605	8.619	5.121
(p-value)	(0.732)	(0.106)	(0.416)	(0.218)	(0.281)	(0.401)
AR(1)	-0.189	-0.216	-0.263	-0.403	-0.132	-0.220
(p-value)	(0.004)	(0.038)	(0.067)	(0.000)	(0.023)	(0.052)
AR(2)	-0.090	-0.213	-0.322	0.004	-0.012	-0.179
(p-value)	(0.499)	(0.120)	(0. 477)	(0.983)	(0.908)	(0.121)

Notes: Pre-GFC (1996-2008) and post-GFC (2009-2018). Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.1. White's heteroscedasticity consistent covariance matrix was applied in regressions. Standard errors between parentheses. Sys-GMM – uses two-step of Arellano and Bover (1995) without time period effects. Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel of 24 countries.

Table 4

Effects of a high public debt/GDP (HDEBT) on investment

Regressors	*Full Sample*			*pre-GFC*			*post-GFC*		
	Aggregated Investment (k=1)	*Private Investment* (k=2)	*Public Investment* (k=3)	*Aggregated Investment* (k=1)	*Private Investment* (k=2)	*Public Investment* (k=3)	*Aggregated Investment* (k=1)	*Private Investment* (k=2)	*Public Investment* (k=3)
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$INV_{k,i,t-1}$	0.608***	0.705***	0.367***	0.673***	0.380***	0.492**	0.380***	1.133***	1.080***
	(0.032)	(0.091)	(0.123)	(0.035)	(0.077)	(0.187)	(0.085)	(0.194)	(0.279)
$HDEBT_{i,t}$	-0.052***	-0. 047***	-0.142***	-0.012***	-0. 060*	-0.099***	-0.124 ***	-0.124**	-0.184**
	(0.008)	(0.016)	(0.047)	(0.001)	(0.033)	(0.033)	(0.041)	(0.056)	(0.072)
$GROWTH_{i,t}$	0.133***	0.223*	1.321***	0.089***	0.180	0.572***	0.027	0.425***	1.000**
	(0.033)	(0.124)	(0.482)	(0.023)	(0.207)	(0.204)	(0.042)	(0.147)	(0.431)
$INF_{i,t}$	-0.002***	-0.014***	-0.24*	-0.002***	-0.001	-0.015***	-0.001***	-0.007**	-0.026*
	(0.001)	(0.004)	(0.013)	(0.001)	(0.002)	(0.005)	(0.001)	(0.004)	(0.014)
$TRADE_{i,t}$	0.209***	-0.173	0.240	0.398***	0.140	0.366***	0.066**	0.176*	-0.282
	(0.032)	(0.133)	(0.430)	(0.036)	(0.116)	(0.129)	(0.025)	(0.096)	(0.349)
N. inst./N. cross-sec.	0.9562	0.9167	0.7692	0.9545	0.7692	0.9167	0.7826	0.9231	0.9231
J-Statistic	17.591	6.515	2.135	17.858	5.473	6.380	16.950	9.267	3.853
(p-value)	(0.415)	(0.368)	(0.830)	(0.332)	(0.361)	(0.426)	(0.202)	(0.234)	(0.797)
AR(1)	-0.351	-0.291	-0.271	-0.313	-0.255	-0.195	-0.355	-0.523	-0.544
(p-value)	(0.002)	(0.012)	(0.022)	(0.013)	(0.005)	(0.061)	(0.013)	(0.000)	(0.001)
AR(2)	-0.123	-0.102	-0.172	0.098	-0.231	-0.400	0.158	0.125	0.164
(p-value)	(0.3695)	(0.486)	(0.201)	(0. 559)	(0.162)	(0.323)	(0.273)	(0.217)	(0.467)

Notes: Full sample (1996-2018), pre-GFC (1996-2008), and post-GFC (2009-2018). Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.1. White's heteroscedasticity consistent covariance matrix was applied in regressions. Standard errors between parentheses. Sys-GMM – uses two-step of Arellano and Bover (1995) without time period effects. Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel of 24 countries.

To quantify how a higher public debt/GDP ratio affects aggregate investment, private sector investment, and public sector investment, in the total period, pre-crisis, and post-crisis, we consider the effect of a shock of 10% on *DEBT* (see table 5). Because we are using "log-log" models, we calculate the impact of shocks directly from the coefficients estimated in the Sys-GMM models that consider all the control variables in tables 1, 2, and 3. The results confirm that an increase in the public debt/GDP ratio is detrimental to all kinds of investment, and the damaging effect is higher for the public sector investment. Considering the full sample period (1996 to 2018), a shock of 10% on *DEBT* implies a decrease of around 2% in aggregate investment, 1.9% in private investment, and 3.2% in public investment, respectively. When we consider the subsample periods, the impact of a greater public debt/GDP ratio on investment changes considerably between them. In general, the harmful effect on investment amplifies in the post-crisis period (2009-2018). The difference between pre-crisis and post-crisis periods shows that the adverse effects of a shock of 10% on *DEBT* increased approximately: 1 pp in aggregate investment and private sector investment and 3.5 pp in public sector investment. To sum up, the evidence indicates that although an increase in the public debt/GDP ratio is harmful to any investment, it wrecks public sector investment.

Table 1

Effect of public debt/GDP shocks on investment

	full sample	*pre-GFC*	*post-GFC*	*difference (pre-post GFC)*
Aggregated investment	-1.992%	-1.350%	-2.363%	1.013 pp
Private sector investment	-1.914%	-1.815%	-2.859%	1.044 pp
Public sector investment	-3.150%	-2.512%	-6.042%	3.530 pp

Note: Impact of shocks of 10% on public debt/GDP based on coefficients estimated through sys-GMM (see: table 1 – model 8, table 2 – models 4 and 8, table 3 – models 1 to 8). Full- sample (24 countries from 1996 to 2018), pre-crisis (15 countries from 1996 to 2008), and post-crisis (15 countries from 2009 to 2018).

4. Concluding remarks

Public debt plays a central role in determining investment in emerging markets. From this point of view, we analyze the effect of public debt on investment based on 24 countries classified as emerging markets from 1996 to 2018. To guarantee more robust results, we use different estimation methods: Diff-GMM and Sys-GMM. Moreover, to investigate the impact of public debt on investment, we work with three investment types: aggregate investment, private sector investment, and public sector investment. We also consider subsamples periods that take into account the pre-GFC and post-GFC to ascertain whether there was a change in the effect of public debt on the different types of investment after the GCF. Finally, we also assess the case where there is a high risk of insolvency, that is when the public debt/GDP ratio exceeds the benchmark of 60% (IMF, 2011).

The results show that regardless of the sample, the effect of an increase in public debt is negative and significant in explaining investment. Therefore, the fiscal deterioration resulting from a higher public debt is capable of causing a fall in investment in emerging markets. Our findings show that a shock of 10% in public indebtedness generates a drop of around 2% in aggregate investment. Furthermore, the adverse effect caused by an increase in public indebtedness on investment is also observed, with statistical significance, for the situation where the public debt/GDP exceeds 60%, suggesting that there is a penalty in terms of investment for countries that have a fiscal framework that is too deteriorated.

The subsamples' results confirm the harmful effect of a greater public debt/GDP ratio on investment. When we compare the effect of public debt in the pre-GFC and post-GCF period, we observe that public debt is especially more adverse for investment in the period after the GCF, where a shock of a 10% increase in public debt causes a fall of approximately 2.4% in aggregate investment. In particular, when we analyze the different types of investments (aggregate, the private sector, and the public sector), we observe that public indebtedness affects public sector investment more intensely in comparison to the others, which suggests that, as the fiscal framework deteriorates, the government's ability to make investments decreases. In the sample that considers the whole period of the analysis (1996-2018), a shock

of a 10% increase in public debt generates a decrease of approximately 3.2% in public sector investment. However, when we consider only the period after the GCF, a shock of a 10% increase in public debt leads to a reduction of approximately 6% in public sector investment.

Our analysis contributes to the debate on the impact of public debt in emerging markets. Furthermore, it is possible to conjecture that our findings have significant consequences for the fiscal policy in times of economic crisis like the current one caused by the COVID-19. According to the Keynesian view, an expansionary fiscal policy represents an injection of resources capable of stimulating the economy. However, a side effect of this strategy is an increase in the public debt/GDP ratio. In brief, governments must be concerned with their debts' solvency. Our findings show that an increase in the public debt/GDP ratio, especially after the GFC, generated relevant investment falls.

6. References

ADB, A.A., FURCERI, D., TOPALOVA, P. (2016). "The macroeconomic effects of public investment: Evidence from advanced economies." *Journal of Macroeconomics*, 50(C), 224-240.

AIZENMAN, J., CHINN, M., ITO, H. (2008). "Assessing the emerging global financial architecture: measuring the trilemma's configurations over time." NBER Working Papers, 14533.

AL-SADIG, A. (2013), "Outward foreign direct investment and domestic investment: The case of developing countries, IMF Working Paper, WP/13/52.

ANDRADE, J.S., DUARTE, A.P. (2016). "Crowding-in and crowding-out effects of public investments in the Portuguese economy." *International Review of Applied Economics*, 30(4), 488–506.

ARELLANO, M. (2003). "Panel data econometrics". Oxford University Press.

ARELLANO, M., BOND, S. (1991). "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations." *Review of economic studies*, 58(2), 277-297.

ARELLANO, M., BOVER, O. (1995). "Another look at the instrumental variable estimation of error-components models." *Journal of Econometrics*, 68(1), 29-51.

ASIF, M., KHAN, K.B., ANSER, M.K., NASSANI, A.A., ABRO, M.M.Q., ZAMAN, K. (2020). "Dynamic interaction between financial development and natural resources: Evaluating the 'Resource curse' hypothesis." *Resources Policy*, 65(C).

AYSAN, A., PANG, G., VÉGANZONÈS-VAROUDAKIS, M. A. (2009). "Uncertainty, economic reforms and private investment in the Middle East and North Africa." *Applied Economics*, *41*(11), 1379-1395.

BACCHIOCCHI, E., BORGHI, E., MISSALE, A. (2011). "Public investment under fiscal constraints." *Fiscal studies*, 32(1), 11-42.

BENDE-NABENDE, A., SLATER, N.J. (2003). "Private capital formation: Short- and long-run crowding-in (out) effects in ASEAN, 1971− 99." *Economics Bulletin*, 3(28), 1-16.

BINDING, G., DIBIASI, A. (2017). "Exchange rate uncertainty and firm investment plans evidence from Swiss survey data." *Journal of Macroeconomics*, 51(C), 1-27.

BLONIGEN, B.A., PIGER, J. (2014). "Determinants of foreign direct investment." *Canadian Journal of Economics*, *7*(3), 775-812.

BLUNDELL, R., BOND, S. (1998). "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics*, 87(1), 115-143.

BOND, S., HOEFFLER, A., TEMPLE, J. (2001). "GMM estimation of empirical growth models." *Economics Papers W21*. Economics Group, Nuffield College, University of Oxford.

CECCHETTI, S.G., MOHANTY, M., ZAMPOLLI, F. (2011). "Achieving growth amid fiscal imbalances: the real effects of debt." *Economic Symposium Conference Proceedings*, 352(8), 145-96. Federal Reserve Bank of Kansas City.

CHECHERITA-WESTPHAL, C., ROTHER, P. (2012). "The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area." *European economic review*, 56(7), 1392-1405.

CHEN, M. W., MRKAIC, M. M., NABAR, M. M. S. (2019). "The global economic recovery 10 years after the 2008 financial crisis." *IMF Working Paper*.

CHUDIK, A., MOHADDES, K., PESARAN, M. H., RAISSI, M. (2017). "Is there a debt-threshold effect

on output growth?". *Review of Economics and Statistics*, 99(1), 135-150.
CHOE, J. I. (2003). Do foreign direct investment and gross domestic investment promote economic growth? *Review of Development Economics*, 7(1), 44–57.
COCHRANE, J.H. (2011). "Understanding policy in the great recession: Some unpleasant fiscal arithmetic." *European Economic Review*, 55(1), 2-30.
DANIEL, J., CALLEN, T., TERRONES, M. E., DEBRUN, X., ALLARD, C. (2003). "Public debt in Emerging markets: Is it too high?" *World Economic Outlook*, 113, September, 129-154.
de MENDONÇA, H., GUIMARÃES e SOUZA, G.J. (2012). "Is inflation targeting a good remedy to control inflation?" *Journal of Development*, 98(2), 178-191.
de MENDONÇA, H.F., BARCELOS, V.I. (2015), "Securitization and credit risk: Empirical evidence from an emerging economy." *North American Journal of Economics and Finance*, 32(C), 12-28.
EBERHARDT, M., PRESBITERO, A.F. (2015) "Public debt and growth: Heterogeneity and non-linearity." *Journal of International Economics*, 97(1), 45-58.
FISCHER, S., EASTERLY, W. (1990). "The economics of the government budget constraint". *World Bank Research Observer*, 5(2), 127–142.
GILLMAN, M., KEJAK, M. (2011). "Inflation, investment and growth: a money and banking approach." *Economica*, 78(310), 260-282.
GUERINI, M., MONETA, A., NAPOLETANO, M., ROVENTINI, A. (2020). "The janus-faced nature of debt: Results from a data-driven cointegrated SVAR approach." *Macroeconomic Dynamics*, 24(1), 24-54.
HAKURA, D. (2020). "Finance & Development: What is debt sustainability? Many factors go into assessing how much debt an economy can safely carry." *International Monetary Fund*, Washington, September.
HUANG, Y., PANIZZA, U., VARGHESE, R. (2018). "Does public debt crowd out corporate investment?." Graduate Institute of International and Development Studies, International Economics Department.
IMF (International Monetary Fund), 2011. Modernizing the Framework for Fiscal Policy and Public Debt Sustainability Analysis. *Fiscal Affairs Department and the Strategy, Policy, and Review Department*, Washington (August 5th).
IMF (International Monetary Fund), 2015. World Economic Outlook: Adjusting to Lower Commodity Prices. Washington, October.
IMF (International Monetary Fund), 2020. Fiscal Monitor: Public Investment for the Recovery. Washington, October.
JACOBS, J., OGAWA, K., STERKEN, E., TOKUTSU, I. (2020). "Public Debt, Economic Growth and the Real Interest Rate: A Panel VAR Approach to EU and OECD Countries." *Applied Economics*, 52(12), 1377-1394.
KHAN, M.S., REINHART, C.M. (1990). "Private investment and economic growth in developing countries." *World Development*, 18(1), 19-27.
KOSE, M.A., OHNSORGE, F., YE, L.S., ISLAMAJ, E. (2017) World Bank Policy Research Working Paper 7990: Weakness in Investment Growth. Causes, Implications and Policy Responses. (March).
LAUBACH, T. (2009). "New evidence on the interest rate effects of budget deficits and debt." *Journal of the European Economic*, 7(4), 858-885.
NAUDÉ, W.A., KRUGELL, W.F. (2007). "Investigating geography and institutions as determinants of foreign direct investment in Africa using panel data." *Applied Economics*, 39(10), 1223-1233.
NICKELL, S.J. (1981). "Biases in Dynamic Models with Fixed Effects." *Econometrica*, 49(6), 1417-1426.
OSIŃSKA, M., KUFEL, T., BŁAŻEJOWSKI, M., KUFEL, P. (2020). "Modeling mechanism of economic growth using threshold autoregression models." *Empirical Economics*, 58(3), 1381-1430.
PANIZZA, U., PRESBITERO, A.F. (2014). "Public debt and economic growth: is there a causal effect?" *Journal of Macroeconomics*, 41(C), 21-41.
PEGKAS, P. (2018). "The effect of government debt and other determinants on economic growth: The Greek experience." *Economies*, 6(1), 10.
PELTONEN, T., SOUSA, R., VANSTEENKISTE, I. (2012). "Investment in emerging market economies."

Empirical Economics, 43(1), 97-119.
PONTINES, V., SIREGAR, R. Y. (2012). "Exchange rate asymmetry and flexible exchange rates under inflation targeting regimes: evidence from four East and Southeast Asian countries." *Review of International Economics*, 20(5), 893-908.
QURESHI, I; LIAQAT, Z. (2020). "The long-term consequences of external debt: Revisiting the evidence and inspecting the mechanism using panel VARs." *Journal of Macroeconomics*, 63, 103184.
RAZIN, A., SADKA, E., COURY, T. (2003). Trade openness, investment instability and terms-of-trade volatility. *Journal of International Economics*, 61(2), 285-306.
SÁNCHEZ-JUÁREZ, I., GARCÍA-ALMADA, R. (2016). "Public debt, public investment and economic growth in Mexico." *International Journal of Financial Studies*, 4(2), 1-14.
SMITH, R.T., van EGTEREN, H. (2005). "Inflation, investment and economic performance: The role of internal financing." *European Economic Review*, 49(5), 1283-1303.
TANG, S., SELVANATHAN, E. A., SELVANATHAN, S. (2008). "Foreign direct investment, domestic investment and economic growth in China: A time series analysis. *World Economy*, 31(10), 1292–1309.
WOO, J., KUMAR, M.S. (2015). "Public debt and growth." *Economica*, 82(328), 705-739.
YOUNG, A. (2003). "Gold into base metals: Productivity growth in the People's Republic of China during the reform period." *Journal of Political Economy*, 111(6), 1220-1261.

Appendix

Table A.1

List of countries

Code	*Country name*	*Code*	*Country name*
ARG	Argentina	MAR	Morocco
BGD	Bangladesh *	PAK	Pakistan *
BRA	Brazil	PER	Peru *
BGR	Bulgaria	PHL	Philippines *
CHL	Chile	POL	Poland *
CHN	China	ROU	Romania *
COL	Colombia	RUS	Russian Federation *
HUN	Hungary	ZAF	South Africa *
IND	India *	THA	Thailand *
IDN	Indonesia	TUR	Turkey *
MYS	Malaysia *	UKR	Ukraine *
MEX	Mexico *	VEN	Venezuela, RB *

Source: International Monetary Fund (2015). * countries considered in the sample of private sector investment and public sector investment.

Table A.2

Description of the variables, sources of data, and descriptive statistics

Variable name	Variable description	Data Source	Mean	Median	Max.	Min.	Std. Dev.
INV_1	Gross fixed capital formation/GDP (%) – aggregated (log).	DataBank/World Bank	3.100	3.088	3.796	1.493	0.253
INV_2	Gross fixed capital formation/GDP (%) – private sector (log).	DataBank/World Bank	2.795	2.821	3.460	1.795	0.269
INV_3	Gross fixed capital formation/GDP (%) – public sector (log).	DataBank/World Bank	1.532	1.636	2.749	-1.521	0.630
DEBT	General government gross debt/GDP - % (log).	WEO/IMF	3.669	3.743	5.197	1.356	0.556
HDEBT	$HDEBT_{i,t} = \begin{cases} DEBT, & \text{if } DEBT > 60\% \\ 0, & \text{otherwise} \end{cases}$	Devised by authors - WEO/IMF	0.946	0.000	5.197	0.000	1.758
GROWTH	Annual growth rate of GDP at market prices based on constant local currency (%).	DataBank/World Bank	0.064	0.076	0.417	-1.011	0.142
INF	Inflation as measured by the consumer price index (%).	DataBank/World Bank	11.292	5.051	1058.4	-1.545	49.833
TRADE	Trade is the sum of exports and imports of goods and services measured as a share of GDP (%).	DataBank/World Bank	4.065	4.019	5.395	2.750	0.523

Note: WEO/IMF - World Economic Outlook/International Monetary Fund.

Table A.3

Unit root tests

Im-Pesaran-Shin and Fisher-ADF

Series	Im-Pesaran-Shin		ADF-Fisher	
	Statistic	Prob	Statistic	Prob
INV_1	-3.638	0.000	92.537	0.000
INV_2	-3.013	0.001	56.641	0.000
INV_3	-2.441	0.007	51.443	0.002
DEBT	-1.925	0.027	87.235	0.001
GROWTH	-7.793	0.000	139.995	0.000
INF	-5.774	0.000	159.919	0.000
TRADE	-3.131	0.001	91.436	0.000

Note: Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All tests assume asymptotic normality. Null hypothesis: Unit root (assumes individual unit root process). Automatic lag difference term and bandwidth selection (using the Schwarz criterion for the lag differences, and the Newey-West method and the Bartlett kernel for the bandwidth). Exogenous variables: individual effects, individual linear trends.