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THE LIMIT OF EVIL: EFFECTS OF INFLATION AND PUBLIC DEBT ON CAPITAL MARKET DEVELOPMENT

Key Points:

- *It is almost self-evident that capital markets can thrive only in a benign macroeconomic environment. What is often overlooked is that malign macro factors such as inflation and government debt, provided that they are kept under control, can have their bright sides.*

- *Previous studies typically presume that the impact of inflation or government debt on capital market development is monotonic, thus precluding the possibility that these factors could be beneficial within a certain limit or threshold. In this study, we take into account this possibility.*

- *Our study finds an inverted U-shaped relationship between inflation and the size of the stock market. Hence, inflation within a certain limit may act as a lubricant to the market and help lower the cost of capital in real terms. However, when inflation is too high, long-term investment decisions would be difficult, which is detrimental to stock market growth.*

- *An inverted U-shaped relationship is also found between the size of the government bond market and that of the corporate bond market. This suggests that public debt under a certain threshold can benefit corporate bond market development, supporting the notion that the sovereign yield curve plays an important role in pricing private sector debt securities. However, excessive public debt would stifle it.*

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I. INTRODUCTION

It is almost self-evident that capital markets can thrive only in a benign macroeconomic environment with stable economic growth, low inflation and sustainable fiscal policy. What is often overlooked is that some of the supposedly malign macro factors can have their bright sides as well. For example, high inflation is definitely not conducive to capital market development and functioning. However, inflation at a low level can serve as a lubricant for the economy. Similarly, excessively large public debt is detrimental to capital markets as fiscal mismanagement entails considerable risks for the investor and crowds out private sector bonds. However, an economy with insufficient or thinly-traded public debt is equally unfavourable to the development of its bond market since the government yield curve may not be representative enough to serve as a risk-free benchmark for pricing corporate sector credits.

As the effects of inflation and public debt on the development of capital markets are not necessarily monotonic, it is dangerous to subscribe to the simplistic view that policies should always be directed at eliminating them altogether or as much as possible. Previous studies generally specify a linear relationship between a macro variable and the development of capital markets in their econometric models, thus precluding the possibility of a more complicated relationship. Against this backdrop, this study, covering 21 advanced economies (AEs) and 19 emerging market economies (EMEs), attempts to provide a more realistic picture about the relationship. Admittedly, the significant heterogeneity across a large number of economies makes it impossible for any model to generate any one-size-fits-all estimates and therefore a grain of salt must be taken in interpreting the empirical results. Nonetheless, this study represents a useful first step in providing empirical evidence on the potential critical thresholds of inflation and public debt that warrant attention from policymakers.

In the next section, we review the research literature about the effects of inflation and public debt on capital market development. Section 3 provides the details of the econometric model for the empirical analysis. Section 4 discusses the dataset used for the analysis. Section 5 presents the empirical results. The conclusion is in Section 6.

II. LITERATURE REVIEW

Not surprisingly, the driving forces of capital market development have been subject to extensive research. However, no study focuses on the effects of inflation or public debt, and direct evidence of such effects is scare and fairly mixed. A majority of previous studies examine the impact of non-economic factors such as political institutions, legal origin, rule of law, protection of investors' or creditors' rights, and effectiveness of regulatory regimes (e.g., La Porta et al (1997, 2006), Demirguc-Kunt & Maksimovic (1998) and Gu & Kowalewski (2016)). Nonetheless, most of them recognize the importance of the macroeconomic environment and typically include inflation and/or public debt (or other fiscal policy variables) as additional explanatory variables or for controlling purposes in their econometric models. Although their results are in broad agreement with the popular belief that high inflation and large public debt are detrimental to the development of capital markets, the evidence is not entirely conclusive. Moreover, a linear relationship between these macro variables and capital market development is typically assumed in their econometric models, thus precluding the possibility that the effects of these variables are not monotonic.

Regarding the impact of inflation on capital markets, most of the studies offer only indirect evidence. For example, Demirgüç-Kunt & Maksimovic (1998) show that high and/or variable inflation rates substantially increase the contracting cost of investors and firms, which is not conducive to the growth of firms (measured in terms of sales revenues) in 30 economies and consequently their external financing including both long-term debt and equity financing. Bae et al (2006) show that low inflation is usually associated with a higher degree of financial stability in their sample of bond markets in 45 countries, which arguably lowers the cost of capital and drives market growth in general.

The direct evidence about the impact of inflation on bond market development is not entirely consistent and is subject to interpretation. In an analysis of 49 domestic bond markets, Burger & Warnock (2006) find that countries with low and stable inflation tend to have a better development of their local currency bond markets and attribute the result to the conjecture that high inflation discourages corporates from issuing bonds in the domestic market and prompts them to resort to issuing in overseas markets despite the resultant currency mismatch risk. Their study echoes the experience of the Chilean bond market, for which Braun & Briones (2006) find that low and stable inflation fosters the growth of the market for long-term bonds, which are arguably more susceptible to

uncertainties about inflation. However, these findings are quite different from those of Eichengreen et al (2006) who analyze the bond markets in Latin America and East Asia for the period of 1990-2005. In this study, they do not find a statistically significant effect of inflation on the size of government and private bond markets relative to GDP, though the associated coefficients are negative. Instead, the *standard deviation* of the inflation rate is found to be significant and negative. Based on these results, they argue that the volatility or unpredictability of inflation is more harmful than inflation *per se*.

The empirical findings about the impact of inflation on stock market development are even less clear-cut. For example, Meng & Pfau (2010) find that inflation volatility has negative and significant impacts on stock market depth in 32 AEs and EMEs. Draženović & Kusanović (2016) also find negative effects of inflation on the stock market capitalisation relative to GDP of the six countries joining the European Union during 1995-2010. However, Garcia & Liu (1999) and Claessens et al (2006) find that the effect of inflation on stock market development, though negative, is not significant in most of their model specifications. Admittedly, these divergent findings are partly explicable by technical reasons such as differences in sample periods and sampled countries. However, we cannot ignore the distinct possibility that these studies presume an overly simplistic relationship between inflation and stock market development. In particular, their econometric models specify that inflation affects stock market development in a linear and monotonic manner, thus ruling out scenarios that inflation below a certain threshold could aid market development but beyond that threshold could hurt.

Regarding the impact of government debt on capital market development, the evidence from research literature is also mixed. Previous studies typically focus on fiscal deficit rather than government debt but their results are still indicative due to the close correlation between the two fiscal variables. De la Torre & Schmukler (2007) find that fiscal deficit is negatively associated with stock market capitalisation, possibly reflecting the fact that large fiscal deficit often contributes to macroeconomic instability, thus discouraging the incentives to engage in financial market transactions. However, Burger & Warnock (2006) and Meng & Pfau (2010) find no evidence to support that lower fiscal deficit contributes to stock market development. Like in the case of inflation, such mixed findings suggest that the effect of government debt on capital market development may not be monotonic.

In summary, although previous studies broadly support the notion that inflation and public debt are harmful to capital market development, empirical findings are less clear cut than generally thought. Furthermore, in all the studies reviewed above, their econometric models generally presume that the effects of these macro variables are linear, thus ruling out the possibility of non-linear effects. In view of the inconclusiveness of previous studies and the inadequacy of their models, this study focuses on the effects of inflation and government debt on capital market development, in particular investigating the possibility of the existence of a non-monotonic relationship.

III. METHODOLOGY

In light of the empirical studies reviewed in the preceding section, we conduct a panel cross-country analysis that explicitly takes into account the non-linear effect of inflation and government debt on capital market development. The econometric models for stock market and corporate bond market development are specified as follows:

$$MKCAP_{it} = \alpha + \beta_1 log(GDPPC_{it}) + \beta_2 INF_{it} + \beta_3 INF_{it}^2 + \beta_4 GD_{it} + \beta_5 YS_{it} + \beta_6 CR_{it} + \varepsilon_{it} \quad (1)$$

$$CORBD_{it} = \alpha + \beta_1 log(GDPPC_{it}) + \beta_2 INF_{it} + \beta_3 GD_{it} + \beta_4 GD_{it}^2 + \beta_5 YS_{it} + \beta_6 CR_{it} + \varepsilon_{it} \quad (2)$$

where the dependent variables MKCAP and CORBD stand for stock market capitalisation and outstanding corporate bonds as a percent of GDP respectively. The explanatory variables are GDP per capita (GDPPC), inflation rate (INF), outstanding gross government debt as a percent of GDP (GD), sovereign yield spread (YS) and credit rating (CR). A cross-section fixed effect is specified in these models so that the heterogeneity across the economies can be better controlled. The models are estimated separately for AEs and EMEs since the parameters of these two groups of economies tend to differ a lot from each other, reflecting their different stages of capital market development.

Our models have two salient features. First, in equation (1), a squared term of INF is introduced to capture any non-linear effect of inflation on capital market development. Specifically, when inflation is close to zero, an increase in inflation may be beneficial to market development in the sense that it can serve as a

lubricant for businesses, making it easier to adjust wages and prices in the face of shifting demand. However, as inflation rises, the volatility of inflation tends to be high as well, generating uncertainties and making it difficult for long-term business planning. Second, in equation (2), there is a squared term for GD as government bonds set a risk-free benchmark yield curve that facilitates the pricing of private-sector bonds. However, if government indebtedness is excessive, it would raise the cost of capital and crowd out private sector issuance. The effects of such a two-sided sword are captured by the squared term.

Other features of the models are fairly standard in the literature of financial market development. The dependent variables of equations (1) and (2) are metrics of capital market development that are scaled to GDP to enable comparison across economies. As pointed out by Garcia & Liu (1999), market development has multiple aspects that should be captured by different metrics. For the case of stock market development, we choose market capitalisation as a percent of GDP since it is less arbitrary than other measures such as market liquidity, market efficiency and quality of corporate governance (or a composite index based on these measures). Furthermore, Demirgüç-Kunt & Levine (1996) find that various measures of stock market development tend to be highly correlated and, hence, for the purpose of econometric analysis it does not matter too much which one is chosen. Regarding bond market development, the metric chosen for in this study is the amount of outstanding corporate bonds relative to GDP. Bonds issued by financial institutions are excluded since we wish to focus on the role of the bond market as a financial intermediary that channels household savings to corporate end-users. The explanatory variables in our model are key characteristics of the economy commonly chosen in previous studies, and they include GDP per capita, inflation, size of government bonds and sovereign yield spread.

We estimate equations (1) and (2) by panel data regression with cross-section fixed effect to control for the significant heterogeneity across the economies. The standard errors are estimated based on the White cross-section method since this estimator is robust to contemporaneous cross-section correlation and heteroskedasticity. On the potential endogeneity of the explanatory variables, the reverse causal relationship if any should be rather weak, as these variables (e.g., per capita GDP, credit rating) are determined by much broader factors than capital market size. The role of capital market is much smaller than a multitude of other factors such as rule of law, capital accumulation, educational system, and cultural tradition. We could therefore safely neglect the potential reverse causality and use only the standard panel regression in this study.

IV. DATA

The data set used in this study covers annual data of 21 AEs and 19 EMEs for 2000-2016 (see Appendix for a full list of the sampled economies and the economies actually included in each regression panel). The choice of the economies from this sample for each regression panel and the corresponding study period are subject to data availability. The classification of an economy between AE or EME follows that of the IMF World Economic Outlook Database.

The dependent variables are two size measures of the stock and bond markets compiled by the Working Group on Establishing Viable Capital Markets under the auspices of the Committee on Global Financial System of the Bank for International Settlements. Stock market size is measured by stock market capitalisation to GDP ratio. Since our interest is in the portion of the stock market that is actively traded, the market capitalisation is free-float-adjusted.[1] For bond market size, the BIS Total Debt Securities statistics (TDS) are chosen as a proxy indicator for corporate non-financial sector bonds.[2] Bonds issued by financial institutions are excluded since our purpose is to measure the bond market size as a financial intermediary channel raising funds for corporate end-users. While TDS should ideally be measured in market value and commensurate with GDP, most countries do not report TDS data in market value. Such data limitation, however, should not materially affect our results since the market value of investment grade bonds in AEs differs little from their nominal value.[3]

Regarding the explanatory variables, the data are obtained from various sources including the World Bank, IMF, JP Morgan and Moody's. The sovereign yield spread (YS) is defined as the yield to maturity (YTM) of the JP Morgan sovereign bond index for the economy concerned minus the YTM of the US sovereign bond index. The credit rating (CR) is based on Moody's foreign currency long-term sovereign bond rating, with a higher score indicating a better rating.

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[1] Since the free-float ratios from various data sources (e.g. MSCI, Bloomberg, Worldscope) do not always agree with each other, the CGFS Working Group made some judgement calls.

[2] The ideal measure is the size of domestic bond markets relative to GDP. However, the BIS Domestic Debt Securities (DDS) statistics only exist for 22 of the 40 economies. To increase our coverage, we will instead use the Total Debt Securities statistics (TDS), which exist for 29 countries. As it turns out, countries that have a higher share of TDS/GDP also have a higher share of DDS/GDP. Therefore, TDS will be a good enough proxy for the size of corporate bond markets.

[3] In our sample, only six countries report TDS data in market value, namely, Australia, Chile, Norway, the Philippines, Poland and the United Kingdom. For EME bonds, robustness check is conducted by estimating the model with inflation-adjusted TDS data, and the results are largely in line with the ones reported in this paper.

The descriptive statistics of all the variables are shown in Table 1. It is obvious that huge disparity exists between AEs and EMEs in terms of capital market development.[4] For example, the median stock market capitalisation to GDP ratio for EMEs was 16.1%, which is significantly lower than 56.9% for AEs. Similarly, the median corporate bonds outstanding to GDP ratio for EMEs is 5.5%, which is also noticeably lower than the 13.1% for AEs. Besides, there is considerable heterogeneity among the economies in terms of their capital market development or macroeconomic setting. As an illustration, the stock market capitalisation to GDP ratio ranges from 15% at the 25th percentile to 69% at the 75th percentile, while the interquartile range for the government bonds outstanding to GDP ratio measures between 33% and 70%.

Table 1. Descriptive statistics

			Mean	Median	Max.	Min.	Std. Dev.	Obs.
$\frac{MarketCap}{GDP}$	%	All	55.86	33.52	605.11	1.98	75.70	671
		EME	26.29	16.09	207.17	1.98	31.19	315
		AE	82.03	56.85	605.11	2.69	92.16	356
$\frac{CorpBond}{GDP}$	%	All	12.06	10.98	47.87	0.00	9.53	443
		EME	9.99	5.46	47.87	0.00	11.70	145
		AE	13.07	13.13	33.16	1.04	8.11	298
log (GDP per capita)	US$	All	9.76	9.93	11.43	6.64	1.07	680
		EME	8.81	9.02	10.70	6.64	0.72	324
		AE	10.62	10.65	11.43	9.60	0.37	356
Inflation	%	All	3.69	2.54	54.92	-3.69	5.10	677
		EME	5.84	4.41	54.92	-1.54	6.62	321
		AE	1.76	1.80	6.52	-3.69	1.42	356
$\frac{GovBond}{GDP}$	%	All	54.30	45.99	236.07	0.06	35.51	678
		EME	43.58	41.94	152.25	1.56	21.72	324
		AE	64.11	56.67	236.07	0.06	42.25	354
Yield spread	%	All	1.94	0.73	36.29	-4.64	3.83	548
		EME	4.61	3.78	36.29	-2.18	4.53	231
		AE	0.00	-0.01	4.35	-4.64	1.24	317
Credit rating	-	All	16.52	17.00	21.00	2.00	4.44	641
		EME	12.92	13.00	20.00	2.00	3.57	299
		AE	19.66	21.00	21.00	12.00	2.16	342

Sources: Bloomberg, IMF, JP Morgan, Moody's, World Bank and CGFS WG on Establishing Viable Capital Markets.

V. EMPIRICAL RESULTS

The full estimation results of equations (1) and (2) are listed in Table 2.

[4] Indeed, the Working Group also finds that there still remain significant differences in the size of capital markets across economies, despite the fact that EMEs have already caught up a lot over the last two decades or so (CGFS, 2019).

Most of the explanatory variables in equations (1) and (2) are significant at the 1% significance level. However, the high adjusted R^2 should not be taken as reflecting an exceptionally strong explanatory power of the models as it is mainly attributed to the significance of the cross-section fixed effect, a result that confirms the importance of recognizing the heterogeneity across the economies. We discuss the impact of the variables one by one.

GDP per capita

GDP per capita, being a measure of the stage of economic development, is found to be an important factor for both stock and corporate bond market development. In general, EMEs are often handicapped by a lack of the minimum efficient scale needed to develop deep and liquid bond markets, which makes it hard to attract multinational corporations and other potential foreign issuers (Eichengreen & Luengnaruemitchai (2004)). Moreover, it is difficult for smaller economies to develop derivative instruments for hedging a wide range of risks associated with investing in financial assets, e.g., exchange rate risk. Relatively speaking, AEs are in a more competitive position to attract a diversified issuer base. Therefore, the size of both the equity and bond markets is positively associated with GDP per capita. The results are in line with those of the previous studies (e.g., La Porta et al (2006), Borensztein et al (2006) and Yartey (2008)).

Inflation

In the regression of the corporate bond market, inflation is found to be negatively related to the relative size of the corporate bond market. High inflation, often associated with high inflation expectations, brings more uncertainty in the valuation of bond-related financial instruments, which tends to reduce the appeal of bond investment. As a consequence, investors demand a premium for compensation, which *ceteris paribus* discourages bond issuance. Our result is consistent with the finding of Burger & Warnock (2006) that inflation variance is significant in explaining the size of the corporate bond market.

Regarding the regression of the stock market, an inverted U-shaped relationship is found between inflation and the size of the stock market. Provided that inflation is low and under control, a higher rate is positively related to the size of the stock market, probably reflecting that inflation may act as a lubricant to the market, which helps lower the cost of capital in real terms. However, when

inflation rises above a certain threshold, uncertainties about the future price level would make long-term investment decisions more difficult, which is detrimental to stock market growth. Our empirical findings suggest that the threshold is 7.2% for EMEs and 3.5% for AEs. Previous studies (Garcia & Liu, 1999 and De la Torre & Schmukler, 2007) do not find inflation significant, probably because they presume a linear relationship between inflation and stock market size, which does not have to be the case.

Table 2. Estimation results

	$\frac{MarketCap}{GDP}$				$\frac{CorpBond}{GDP}$			
	EME		AE		EME		AE	
$Constant$	-186.184	***	-2492.957	***	-136.176	***	-84.354	***
$log\,(GDP\ per\ capita)$	21.168	***	240.692	***	15.167	***	8.907	***
$Inflation$	1.023	*	28.856	***	-0.143	*	-0.536	***
$Inflation^2$	-0.0713	**	-4.178	***				
$\frac{GovBond}{GDP}$	0.229	*	0.132		0.460	***	0.0775	***
$\left(\frac{GovBond}{GDP}\right)^2$					-0.00426	***	-0.000290	***
$Yield\ spread$	-0.464	*	-8.151	***	0.0727		-0.312	
$Credit\ rating$	1.496	**	-0.311		-0.0245		0.00909	
Cross-section fixed effect	Y		Y		Y		Y	
Year fixed effect	N		N		N		N	
Adj. R-squared	0.869		0.899		0.971		0.915	
Log likelihood	-865.209		-1456.659		-244.779		-600.564	
F-statistic	64.536		113.333		243.327		130.135	
Sample period	2000-2016		2000-2016		2000-2016		2000-2016	
Cross-sections included	18		19		11		17	
Total panel observations	222		304		117		266	

Note:
1. White cross-section standard errors and covariance are used.
2. ***, ** and * denote 1%, 5% and 10% significance levels respectively.
3. Based on the IMF World Economic Outlook Database's AE/EME classification of the 40 economies covered by the WG on Establishing Viable Capital Markets. For the full list of economies included in each regression, please refer to the Appendix.

Government bond market

An inverted U-shaped relationship is also found between the size of the government bond market and the corporate bond market. In general, the government bond market is essential to the domestic corporate bond market as sovereign yields serve as an important pricing benchmark for private sector debt issuance and trading. However, if the government debt market exceeds a certain threshold, higher credit risk lifts borrowing cost and crowding-out effects kick in,

suffocating the development of the corporate bond market.[5] Our estimation results suggest that government bond market size is supportive of the corporate bond market development until government debt reaches a certain threshold, beyond which it is found to be negatively related to corporate bond market size. The threshold is approximately half the size of an EME's economy (i.e., 54.5% of GDP) but much higher for AEs (i.e., 132.2% of GDP), probably reflecting a greater tolerance of the market for the latter group of economies. Our results can be seen as an extension of Tendulkar (2015) which finds a linear relationship between the size of the government bond market and that of the corporate bond market. As for the stock market, this metric only marginally, if not insignificantly, contribute to the development of the equity market.

Sovereign credit risk

Neither sovereign yield spread nor country credit rating is found to be statistically significant in the regression of the corporate bond market. A possible explanation is that lower sovereign credit risk alone is not sufficient for fostering the development of capital markets, as its effects may work through an interaction with other factors such as bond market liquidity and exchange rate risk. However, for the stock market, sovereign yield spread is found to be negatively related to the size of the stock market and the effect is very significant for AEs, whereas a higher EME sovereign credit rating contributes to a larger stock market size. The evidence suggests that higher sovereign risk discourages foreign investors from participating in the domestic stock market.

VI. CONCLUSION

In summary, our empirical findings show that the effects of inflation and government debt on capital market development are not always monotonic. In particular, inflation displays an inverted U-shaped relationship with stock market development, suggesting that the evil is not always bad. While high inflation is definitely detrimental to market development, inflation at a low level may serve as a lubricant for businesses. Indeed, the results show that within a certain limit inflation aids the development of capital markets. Similarly, government debt also displays an inverted U-shaped relationship with the development of domestic

[5] As the credit rating of private sector debt is always kept below the sovereign credit rating, poor sovereign credit rating almost always means high borrowing cost not only the government but also for the private sector.

corporate bond market, suggesting that a certain size of government debt is instrumental in the development of the bond market. This lends support to the belief that a liquid government bond market is needed to establish a risk-free benchmark yield curve for pricing private-sector debt securities. However, evils are still evils, and beyond those limits high inflation and large public debt would stifle capital market development.

We also find that the relationship between these macro factors and capital market size depends on the stage of economic development. EMEs are found to have a higher threshold for inflation but a lower level of government debt when these macroeconomic variables turn from “benign” to “malign”. However, the precise level of such a turning point is dependent on many factors in relation to the characteristics and circumstances of a particular economy. In view of the significant heterogeneity across the economies in this study, there are no one-size-fits-all thresholds and a grain of salt must be taken in interpreting the estimates. Nevertheless, it is crucial for policymakers to be aware of the fact that such a turning point exists, and not to take the simplistic view that the impact of these variables on capital market development is always monotonically negative.

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Appendix: List of economies included in the regression panel

Ref	Economy	Market		Ref	Economy	Market	
		Bond	Stock			Bond	Stock
1	Argentina*	✓	✓	21	Italy	✓	✓
2	Australia	✓	✓	22	Japan	✓	✓
3	Belgium	✓	✓	23	Korea		✓
4	Brazil*		✓	24	Mexico*		✓
5	Canada	✓	✓	25	Malaysia*	✓	✓
6	Switzerland			26	Netherlands	✓	✓
7	Chile*	✓	✓	27	Norway		
8	China*	✓	✓	28	New Zealand		✓
9	Colombia*		✓	29	Peru*	✓	✓
10	Czech Republic	✓	✓	30	Philippines*	✓	✓
11	Germany	✓	✓	31	Poland*	✓	✓
12	Denmark	✓	✓	32	Romania*		✓
13	Spain	✓	✓	33	Russian Federation*	✓	✓
14	France	✓	✓	34	Saudi Arabia*		
15	United Kingdom	✓	✓	35	Singapore	✓	✓
16	Hong Kong SAR	✓	✓	36	Sweden	✓	✓
17	Hungary*	✓	✓	37	Thailand*	✓	✓
18	India*		✓	38	Turkey*	✓	✓
19	Indonesia*		✓	39	United States	✓	✓
20	Israel	✓	✓	40	South Africa*		✓

* indicates EME. The AE/EME classification is based on the classification used in the IMF World Economic Outlook Database.