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Inflation and Exchange Rate Targeting Challenges Under Fiscal Dominance

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Abstract[*]

Countries have increased significantly their public-sector borrowing since the Global Financial Crisis. In this context, we document several potential fiscal dominance effects during 2000-2017 under Inflation Targeting (IT), and non IT regimes. Higher ratio of public debt to GDP are associated with lower policy interest rates in advanced economies. In Emerging Market economies under non-IT regimes, composed mostly of exchange rate targeters, the interest rate effect of higher public debt is non-linear, and depends both on the ratio of foreign-currency to local-currency debt, and on the ratio of hard-currency debt to GDP. For these Emerging Market economies under non-IT regimes, real exchange rate depreciations and a higher international reserves to GDP ratio are significantly associated with higher interest rates. Sorting countries into low, medium and high nominal exchange rate volatility bins, we find that the high nominal exchange rate volatility group of Emerging Market economies, composed mostly of commodity intensive countries, show the most persuasive evidence of debt levels influencing policy interest rates.

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1. Introduction and overview

A notable outcome of the Global Financial Crisis (GFC) has been the search for yields by OECD investors, manifested by their growing demand for Emerging Markets (EMEs) debt. The QE policies adopted by the US and the Euro Zone in the aftermath of the GFC induced sharp decline of interest rates and risk premia, propagating 'yield chasing' by institutional investors, increasing thereby the demand for EMEs' hard and local currency sovereign debt. These developments mitigated the 'original sin' concerns identified by Eichengreen, Hausmann and Panizza (2007) – the inability of most EMEs to borrow abroad in their currency.[1] The resultant rise of the external debt of EMEs led to an unprecedented increase in their Debt/GDP, putting to the fore concerns about growing debt overhang and fragility, including the possibility of fiscal dominance. This possibility is the case when growing debt/GDP constrains the conduct of monetary policy, inducing the central bank to pay growing attention to reducing the costs of serving the public debt, and county's external debt [Blanchard (2004)].[2] Our paper investigates fiscal dominance channels, with a particular focus on EMEs and Developing countries before and after the GFC.

[1] The share of EMEs debt in local currency is estimated at 87.1 percent of total EMEs debt ($21.9 trillion) in 2017. The local currency debt outstanding has also increased from 40 percent of GDP in the early 2010s to almost 60 percent of GDP recently (IMF, 2018).

[2] The distinction between fiscal and monetary dominance regimes is due to Sargent and Wallace (1981). If the government adjusts the primary deficit to limit debt accumulation, the central bank is not forced to inflate away the debt, allowing the central bank to focus on inflation targeting, in line with monetary dominance. Long period of large fiscal deficits and high public debt-to-GDP ratios raises the concerns of growing fiscal dominance by heightening the links between fiscal policy, monetary policy and government debt management. This may be the case when higher policy interest rates or depreciating currencies raise concerns about debt sustainability, limiting monetary independence. Possible manifestations of these concerns include the 'fear of floating,' fiscal pressure to mitigate rises of policy interest rates, financial repression, and the like.

A clear example of fiscal dominance challenges is inflation targeting regimes in countries with large hard currency external debt/GDP, possibly Turkey in recent years, and a fair share of Latin American economies in past decades. Their policymakers are exposed to growing 'fear of floating' (Calvo & Reinhart, 2002). Specifically, real exchange rate depreciation increases the costs of serving their hard currency external debt by the debt/GDP times the depreciation rate (the cost measured as a fraction of the country's GDP). This condition, in turn, may induce the Central Bank to put higher weight on stabilizing the real exchange rate. While the original inflation targeting and Taylor's Rule ignored the real exchange rate as a policy goal in OECD countries, the research dealing with Emerging Market Economies put it to the fore [Aizenman, Hutchison, Noy (2011); Berganza, Carlos, Broto (2012); Ghosh, Ostry, Chamon (2016)]. Indeed, exchange rate targeting [aka exchange rate stabilization] may be accomplished in a hybrid Inflation Targeting (IT) regime by putting higher policy weight on stabilizing the real exchange rate, possibly by proactive management of sizable buffers of international reserves (IR) and sovereign wealth funds (SWFs).[3]

The impact of growing local currency debt overhang on Inflation Targeting (IT) countries and managed flexible exchange rate regimes may be more intricate. One expects their policy interest rate to go up with increasing debt overhang, reflecting higher risk premia. The higher interest rate may also associated with nominal depreciation and more significant inflationary

[3] Russia provides vivid examples of such a policy before and after the GFC, hoarding IR at times of improving terms of trade, mitigating thereby the real appreciation associated with higher oil prices. This policy was reversed during the collapse of oil prices; Russia sold third of the accumulated IR at times of deteriorating terms of trade, thereby mitigating the real depreciation induced by declining oil prices and lowering the cost of serving Russia's large hard currency external debt. Such a policy stabilizes the real exchange rate, reducing the odds of external debt crises in countries with large debt overhang and exposure to larger terms of trade shocks [see Edwards (1989), Aizenman, Edwards, Riera-Crichton (2012), Aizenman and Sun (2012), Frankel (2017), Aizenman and Jinjarak (2019)].

pressure. Countries with sizable IR may also opt to mitigate these effects by selling IR to lean against the currency depreciation.[4]

We conclude this section with a road map of the main results. In section 2, using de jure inflation targeting classification, we find evidence of fiscal dominance among Developed Market Economies (henceforth DMEs) under IT, where interest rates tend to be negatively associated with rising public debt levels. Among EMEs under non-IT regimes, we find a negative interest rate effect accounted by foreign currency public debt. For EMEs under non-IT regimes, the composition of public debt matters, as larger proportions of debt denominated in foreign currency is associated with higher interest rates: a risk premium effect. We also document evidence showing that fiscal dominance effect among EMEs following non-IT regimes is non-linear and depends on both debt composition and hard currency debt-to-GDP ratio.

In Section 3, under a simple de facto classification binning groups of countries by their nominal exchange rate volatility into low, moderate and high exchange rate volatility groups, we find evidence of fiscal dominance among both DMEs and EMEs. Among DMEs, total public debt/GDP tends to suppress policy rates on average, and the effect size is more substantial for high-volatility countries, composed mostly of de facto inflation targeters. Among EMEs, the channel is more nuanced. The fiscal dominance effect transmits through the level of foreign denominated debt, and the impacts on interest rates are non-linear as they also depend on the total level of public debt/GDP and the composition of public debt; which are both impacted by the level of foreign currency denominated debt. A common feature of our results is the salient impact of larger hard currency external debt overhang on the policy interest rate, possibly mitigated by the proper IR adjustment. Among EMEs, our de facto analysis highlights that interest rates under inflation targeting are more sensitive to the fiscal position of the country. In contrast, ignoring the de facto analysis and solely referencing the de jure classification would find that EMEs under non-IT regimes are more susceptible to fiscal dominance.

[4] Alternatively, policy makers may opt for greater financial repression, as a funding mechanism that increases the tax base associated with a given inflation, mitigating the possible interest rate and depreciation pressure associated with growing debt overhang.

By stratifying EMEs further by commodity intensity in Section 4, we find that Inflation plays a much larger role in interest rate policy for commodity-intensive countries compared to non-commodity EMEs. When we do not condition on the monetary regime, we find that commodity-intensive EMEs also consider fluctuations in the real exchange rate and international reserves when determining interest rates while non-commodities do not. Under the de jure classification, the output gap plays a noticeably larger role in interest rate setting for commodity-intensive inflation targeters, but not for their non-commodity inflation targeting counterparts. We also find that under the de jure classification, evidence of fiscal dominance is present among non-commodity inflation targeting EMEs. De facto classification based on exchange rate volatility tells a different story. Output gaps are associated with higher interest rates among non-commodity inflation targeters but not among commodity-intensive EMEs. Changes in the real exchange rate are negatively (positively) associated with interest rates in commodity (non-commodity) inflation targeting EMEs. Finally, fiscal variables are highly significant among commodity-based inflation targeters, but not among their non-commodity EME counterparts. Non-linear effects of hard currency debt accumulation are present, as fiscal dominance effects of lower interest rates offset risk premium effects of higher interest rates. We also observe that commodity intensity is positively associated with exchange rate volatility. This association makes it crucial to stratify the high volatility group of emerging market countries on commodity intensity. Even among high exchange rate volatility EMEs, it is those who are commodity-intensive that show the most persuasive evidence of debt levels influencing policy interest rates.

2. IT and fiscal dominance

We collect quarterly frequency data on a variety of macroeconomic variables across both Developed (DME) and Emerging Market Economies (EMEs). While this study pays particular attention to EMEs, investigating the effects of limited fiscal space in developed countries provides for an additional benchmark of comparison. The data among some (mostly DME) countries begin in the mid 90's, and our baseline analysis spans the period 2000 Q1 to 2017 Q4. Data among EMEs were sparsely populated until more recent decades and in large part the public debt and foreign-currency-denominated public debt statistics start in the early 2000s. *De*

jure Inflation Targeting classifications are taken from the IMF. There are 23 IT *de jure* Targeters in our sample, of which 18 adopted it by 2002 (see Figure 1). While the United States began explicit Inflation Targeting in 2012, we rely on the fact that the monetary authority has implicitly targeted inflation since 1999.[5] In total, our data set is composed of 29 countries, 18 of which are classified as EMEs (according to IMF WEO classification). The key dependent variable of interest is the short-term nominal interest rate or policy rate, and covariates include: inflation, real GDP gap, real effective exchange rate (REER) changes, changes in international reserves, public debt/GDP, foreign currency denominated public debt/GDP and currency composition of public debt (foreign currency denominated debt/total public debt). All changes and growth rates are quarterly. Note that a positive change in the NEER/REER corresponds to exchange rate *appreciation*. We've also collected data on government tax revenues, which we substitute for GDP in debt ratio construction as a robustness check. Additional details, including sources of the data, are provided in the appendix (Table A1).

2.1 Preliminaries

Tables A2 and A3 describe and summarize the main variables across 4 strata: Developed Market Inflation Targeting and Non-IT, and Emerging Market Inflation Targeting and Non-IT. The IT statistics are constructed from country-quarter observations which fall within the IMF *de jure* classification, while Non-IT statistics consist of data from countries which either never pursued explicit inflation targeting, or data preceding the beginning of Inflation Targeting for countries that currently do. In our data, there are 11 countries that adopted IT within the sample period (on or after 2000 Q1), including South Africa, Thailand, Mexico, Norway, South Korea, Hungary, Indonesia, Turkey, Japan, Russia and India; in our estimation we use both de jure and de facto measures to address such potential attrition bias in the analysis. Figures 2 and 3 provide density plots for the main variables.

Notice that there is interesting heterogeneity between Emerging Market Inflation Targeters and Non-Inflation Targeters. As shown in Figure 3 and corresponding t-tests (Table A3), inflation and interest rates tend to be lower and less volatile in IT EMEs compared to Non-

[5] See Goodfriend (2003) and Rose (2007).

IT EMEs. The output gap is about three times more volatile in Non-IT EMEs. International reserves mean and variation are larger under Non-IT regimes. Both total public debt/GDP ratios and foreign currency denominated public debt/GDP ratios tend to be lower under IT regimes. Similarly, the raw distributions across DME Inflation Targeters versus Non-Inflation Targeters (Figure 2) show that interest rates and inflation rates tend to be higher in IT regimes. International reserves are accumulated at a faster rate, and total public debt/GDP ratios are larger under Non-IT regimes among DMEs.

We conduct two separate panel unit root tests (Table A4) across each variable to assess the time-series properties of our series and determine the appropriate estimation strategy. We incorporate the test described in Levin, Lin and Chu (2002) along with Im, Pesaran and Shin (2003) as each test offers different alternative hypotheses. Both tests reject the unit root hypothesis for all variables except for public debt/GDP ratio, which is rejected by the LLC test at the 10% level while IPS fails to reject the null.

2.2 Baseline Results

To establish our baseline results, we follow Aizenman et al. (2011) in which the authors estimate augmented Taylor Rule regressions to investigate whether fluctuations in exchange rates or international reserves factor into a country's monetary policy rule.[6] The literature on Taylor Rules is extensive, originating from Taylor (1993). Consistent with the literature, we assume that the monetary authority follows a policy reaction function in the form:

$$i_t = \rho i_{t-1} + \alpha(y_t - y_t^*) + \beta(\pi_t - \pi_t^*) + \gamma X_t.$$

The monetary authority sets the nominal (short-term) interest rate based on the output gap and the inflation deviation from the target inflation rate. Additionally, we introduce policy inertia

[6] They find that IT emerging markets follow a "mixed strategy" whereby both inflation and real exchange rates are important determinants of policy interest rates. However, the response of IT emerging markets to real exchange rates is more constrained than in non-IT regimes. The response to real exchange rates is strongest in those countries following IT policies that are relatively intensive in exporting basic commodities.

in the form of a lagged interest rate variable, which incorporates the assumption that the policymaker smooths the interest rate over time (see English and Sack (2002)). Finally, X_t includes additional variables that may potentially enter the interest rate rule. For example, in Aizenman et al. (2011), these variables included the real exchange rate and international reserves. We include these international target variables and further augment the regressions with debt-related measures mentioned previously to test for evidence of fiscal dominance (public debt/GDP, foreign currency denominated public debt/GDP, and currency composition of public debt). Note that the above specification is a single time-series. Our panel consists of advanced and developing economies, under both IT and Non-IT regimes. Therefore, we properly modify the specification above:

$$i_{it} = \mu_i + \rho i_{i,t-1} + \alpha\left(y_{i,t} - y_{i,t}^*\right) + \beta\pi_{i,t} + \gamma X_{i,t} + \epsilon_{i,t},$$

where the inflation target π_t^* is assumed to be time-invariant and therefore absorbed by the country-specific fixed effect μ_i. As such, our [baseline] sample is subject to sample attrition corresponding to the *de jure* adoption of inflation targets $\pi_{i,t}^*$ shown in Figure 1; we subsequently conduct further tests using the *de facto* grouping of country bins according to exchange rate volatility. We estimate the following model via fixed-effects least squares (LSDV),[7] and estimate the model on four subgroups of the data to allow for flexibility across all coefficients: EME IT, EME Non-IT, DME IT and DME Non-IT. The results are displayed in a format comparing EME IT versus EME Non-IT, and DME IT to DME Non-IT, though interesting comparisons can be made between inflation targeting in Emerging Markets and inflation targeting Developed Countries as well.

[7] The specification taking the form of a dynamic panel model is well known to suffer from Nickell (1981) bias when the time dimension is small. However, our quarterly sample provides T ranging from mid-50 to mid-70 depending on the subsample and country. Judson and Owen (1999) show through Monte-Carlo studies that the LSDV estimator performs well in comparison with GMM and other estimators when T=30.

Foreign currency denominated debt is a key risk factor and feature among EMEs. Hence in the case of EMEs, we sharpen our analysis by including external variables for not just total public debt, but also foreign currency denominated public debt (reported in Table A7). Moreover, we control for debt composition measured as the percent of hard currency public debt to total public debt. Including public debt/GDP, foreign currency denominated public debt/GDP, and debt composition variables in the same regression then helps identify whether the effect of hard currency debt on interest rates is non-linear; statistically, debt composition can be viewed as an interaction term between the public debt and foreign currency public debt variables.

Tables A5 and A6 present the baseline results under inflation targeting and non-inflation targeting for EMEs and DMEs, respectively. Regarding fiscal rules, these regressions examine the impact of total public debt on interest rates. Columns 1 and 5 present the benchmark model without the inclusion of any external variables. Columns 2 and 6 introduce changes in the REER and international reserves as external variables, while columns 3 and 7 additionally include both the ratio of Public Debt-to-GDP. To control for the effect of debt/GDP driven by output growth, Columns 4 and 8 include nominal GDP growth as a control. The high explanatory power of these regressions can be accounted for by country-specific fixed effects and the inclusion of the lagged policy, as the interest rate series display significant persistence. The contribution of either feature varies by specification and subgroup, but the country fixed effects or lagged policy rate can separately account for anywhere between 20% to 50% of the variation, depending on the specification.

2.3 Developed Market Economies

Among DMEs, the coefficient on inflation (ranging from 0.148 to 0.217) is highly significant under Inflation Targeting and contrasts starkly with the broadly insignificant effect of inflation in the policy rule under the Non-IT regime. The short-run response of the interest rate to a 1 percentage change in quarterly inflation (which would increase the annual inflation rate by 0.25 percentage points) is estimated to be a rise in the policy rate of about 0.20 percentage points – nearly a 1-to-1 response. Given the persistence in policy rates dynamics, the cumulative response in the policy rate over 4 quarters (t through $t+3$) after a 1% rise (0.25% increase in annual inflation) in period t inflation is estimated to be 61 basis points (based on the short-run

coefficient of 0.181), indicating a considerably aggressive monetary policy over the following year. Under the Non-IT regime, similar policy responses to inflation are absent. We find that under inflation targeting, the output gap is significantly associated with interest rates, but this is generally not the case for DME's under Non-IT regimes. Under IT, the coefficient on the output gap is roughly half of that on inflation.

External variables also show significant contrasts in importance under IT and Non-IT regimes. For DMEs, interest rates are positively associated with REER appreciation under the IT regime, while the coefficient on REER changes is negative and mostly insignificant under Non-IT regimes. Under IT, over one year, a 1 percent appreciation in the REER is associated with interest rates, which are 17 basis points higher before controlling for GDP growth. Conditional on output growth, the same 1 percent appreciation in the REER is associated with a 5 basis point rise in interest rates over one year. Once the control for GDP growth is included, the coefficient on REER changes drops considerably (from 0.05 to 0.015), suggesting that underlying economic growth is jointly influencing the co-movement of monetary policy and exchange rates in DMEs undertaking IT. Alternatively, this effect is consistent with Uncovered Interest Rate Parity, as higher interest rates (or the anticipation of) appreciate the nominal exchange rate today hence lowering the expected return going forward.[8] Among non-IT DMEs, the evidence points slightly to Fear of Floating, with REER depreciation associated with higher interest rates (a coefficient of -0.022). DMEs consider international reserves when setting interest rates under both IT and non-IT regimes. Among non-IT DMEs, reducing international reserves is associated with higher interest rates (with estimates ranging from -0.010 to -0.008): A 10 percent reduction (accumulation) of international reserves is associated with a cumulative 1-year increase (decrease) in the policy rate of about 30 basis points. This response is consistent with the Fear of Floating where the policy rate and international reserves serve as tools for exchange rate stabilization. In contrast, column 6 shows that DMEs under IT regimes respond about half as

[8]Alternatively, REER appreciation can also be driven by an increase in the country's price index and therefore, a positive policy response could also be linked to REER appreciation as a response to inflation. The facts 1) that short-term REER volatility is dominated by the nominal component and 2) our specification already controls for inflation, suggest that the former explanation is more consistent than the latter.

aggressively as the non-IT group in terms of easing (tightening) monetary policy in response to international reserve inflows (outflows).

Column 3 document evidence of fiscal dominance in developed countries under IT regimes in the form of negative effects of public debt on interest rates – this is generally not the case among non-IT DMEs. The effect remains significant after controlling for GDP growth (column 4), hence the variation in the debt/GDP ratio that is influencing monetary policy is not driven by the denominator. The ratio of public debt/GDP is statistically significant at the 5% level under IT (coefficient estimate of -0.009) and these effects are economically significant: Over a 4-quarter period, an increase in public debt/GDP ratio of 6% (1-standard deviation of debt/GDP growth) is associated with a cumulative cut in interest rates of (-18 basis points). Note that this is the effect from a one-period transitory fiscal shock. A permanent 6% rise in the debt/GDP ratio would further impact monetary policy, with interest rates expected to be 46 basis points lower after 4 quarters. The sensitivity to fiscal space under IT suggests debt matters for monetary policy: The commitment to target inflation appears to loosen with rising debt levels.

2.4 Emerging Market Economies

Table A6 reports analogous results for EMEs under IT and Non-IT regimes, focusing on total public debt. Total public debt does not appear informative in the case of EMEs, whether under an IT or non-IT regime. Table A7 deepens the analysis and investigates the effects of foreign currency denominated public debt. The latter is of particular focus as hard-currency borrowing through international capital markets is a distinctive feature of EMEs. Moreover, borrowing in foreign currency adds layers of additional risk to the balance sheet associated with exchange rate and interest rate fluctuations. Columns 1 and 7 introduce baseline Taylor Rule variables, with columns 2 and 8 introducing changes in REER and international reserves for IT and non-IT EMEs, respectively. Columns 3 and 9 introduce foreign currency denominated public debt/GDP, with columns 4 and 10 controlling for total public debt/GDP, columns 5 and 11 controlling for debt currency composition (FX public debt/public debt), and finally columns 6 and 12 additionally controlling for nominal GDP growth.

In Table A7, Interest rate policy in EMEs under IT is significantly smoother than under Non-IT regimes, with coefficient estimates (about 0.86) being well aligned with their DME IT

counterparts compared to Non-IT EMEs (coefficients ranging from 0.407-0.471). Unlike DMEs, both IT and Non-IT regimes see significant importance put on inflation rates for interest rate setting. Coefficient estimates are stable and range between 0.45 and 0.50 under IT, while coefficients range between 0.70 to 1.13 under Non-IT regimes specifications. These estimates suggest that short-run responses to a 1% increase in quarterly inflation (0.25% increase in annual inflation) are particularly aggressive in EMEs relative to their DME counterparts, as the implied policy response is considerably greater than 1-for-1. The 4-quarter cumulative response to a 1% rise in quarterly inflation translates to nominal interest rates approximately 1.5 and 1.36 percentage points higher under IT and Non-IT, respectively (short-run response to a 1% rise in inflation are +46 and +77 basis points, respectively). The aggressive response to combat inflationary pressures in EMEs could result from several explanations. In EMEs where the expected inflation is not well anchored, risks of accelerated inflation leading to out-of-control inflationary processes and capital flight warrant the aggressive interest rate responses to inflation observed among EMEs compared to their DME counterparts. In the presence of significant foreign currency balance sheet exposure, aggressive interest rate responses can additionally stabilize financial conditions via valuation effects and this, in turn, can help reduce the risk of a vicious cycle turning into a financial crisis.

Under the Non-IT regime, the introduction of the exchange rate and international reserves variables cut the coefficient on inflation in nearly half (from column 7 to 8), implying a significant degree of exchange rate targeting in non-IT EMEs, which is generally *not* the case under IT regimes. A real exchange rate depreciation of 1% is associated with an immediate rise in the interest rate of 0.43 percentage points after controlling for GDP growth, with a 1-year cumulative response of +76 basis points, offsetting 75% of the exchange rate depreciation within 4 quarters. International reserves also play a significant role in policy rate setting among Non-IT EMEs but *not* among EMEs under the IT regime. Interestingly, IR accumulation plays a significant role among DMEs under Non-IT regimes as well (a negative effect on interest rates), but the sign of the coefficient is switched: For EMEs under Non-IT regimes, changes in international reserves are positively associated with higher interest rates. It is important to note that the significance of IR is contingent on whether REER changes enter the regression or not: When removing REER from the regression, the effect of IR becomes statistically insignificant.

Hence, the interaction of managing international reserves and exchange rate stability must be taken jointly in the determination of policy rates under non-IT regimes.

Foreign currency denominated public debt bears negative effects across all regressions, yielding significant estimates under non-IT regimes once total debt and composition are controlled for (column 12, a coefficient estimate of -0.367). Among non-IT EMEs, controlling for debt composition also has a significant and positive effect (coefficient of 0.213), implying that the larger the proportion of public debt that is denominated in foreign currency, the higher the interest rate, all else fixed. A one percentage point increase in the proportion public debt that is foreign currency denominated is associated with a 21 basis point rise in the interest rate in the same period and +37 basis points over 4 quarters. This finding can be interpreted as a risk premium effect, as exchange rate exposure has first-order effects on the credit risk of the institution, hence lenders require additional compensation to bear such risks. Countries most susceptible to rises in debt composition are those who do not hold a large amount of hard currency debt initially. The hypothetical country which already holds all debt in hard currency is not expected to be hit with this risk premium effect in the interest rate. Once we control for this debt composition effect, we see significant negative effects on non-IT EME interest rates associated with the total hard currency debt held (in relation to GDP). Possible evidence of fiscal dominance is found among non-IT EMEs, with a one percentage point increase in hard currency public debt associated with interest rates which are 37 basis points lower the same period, and 63 basis points lower after 4 quarters. Non-IT EMEs have significant coefficients on both foreign currency public debt/GDP and the debt composition variables, hence through such interactions, the overall impact on interest rates from hard currency debt is non-linear. While coefficient signs are consistent with among EMEs under inflation targeting, we do not find statistical significance.

To summarize, extending the baseline Taylor Rule model is important in characterizing the monetary reaction function, as observed by significant associations between variation in a variety of external variables and interest rates among inflation targeters and non-IT countries alike. Using de jure inflation targeting classification, we find evidence consistent with fiscal dominance among DMEs under IT, where interest rates tend to be negatively associated with rising public debt levels. In the case of EMEs under non-IT regimes, we also find that the composition of public debt matters, as larger proportions of debt denominated in foreign

currency associated with higher interest rates: a risk premium effect. The interest rate effect evidenced among EMEs following non-IT regimes is non-linear and depends on both debt composition and total hard currency debt/GDP ratio. In the following section, we investigate whether a different classification method of IT versus non-IT regimes paints a different picture. Thus far, we have relied on the IMF's explicit de jure classification. In practice, however, countries may target inflation, or operate hybrid monetary regimes without explicitly stating so. The following section takes a de facto approach, ranking countries in terms of their Fear of Floating manifested by their nominal exchange rate stability patterns. Classifying groups by exchange rate stability provides an alternative approach for identifying groups of countries for which debt overhang may interact with monetary policy.

Moreover, we want to emphasize that the fiscal dominance and risk premium effects are possible interpretations of the above results (and subsequent results), and more data and a longer sampling period would be required to test these interpretations fully. For example, additional data on debt maturity profile, sovereign spreads, and the extent of capital controls would be necessary. Countries committed not to default will hold larger reserves and work harder to have longer debt maturity. Also, data on local currency public and private debt would be necessary to control for the effects of financial repression.[9]

3. IT, exchange rate stability, and fiscal dominance

In the previous section, we employ a de jure method of monetary regime classification and uncovered mixed evidence of fiscal dominance across the sample. However, many countries implicitly follow an inflation targeting rule without a public announcement. By taking a de facto approach to monetary regime classification, we aim to circumvent this issue and provide an additional set of results to complement those from the previous section.

[9] The interdependence of active research management, foreign currency debt, and fiscal capacity could also give rise to multiple equilibria in the financial stability; see Bocola and Lorenzoni (2018). Therefore, while we keep these interpretations for consistency, it is important to keep an open mind to other possible explanations.

Our de facto approach involves classifying countries by the volatility of their nominal effective exchange rate (NEER). Figure 4 shows sorted quarterly NEER return volatility by country. The idea is that countries with low exchange rate volatility are more likely to follow a de facto exchange rate targeting rule. Analogously, countries with high exchange rate volatility are de facto currency floaters, which suggests that such countries target an alternative nominal anchor – the interest rate to control inflation. We first separate the sample into developed and emerging market countries. The second step is to then sort within each group, countries into three quantiles based on their exchange rate volatility. This yields a low, medium, and high volatility "bin" of countries for both DMEs and EMEs.

Table A9a shows countries by volatility bin. Among DMEs, bin 1 and 2 (the low and mid-volatility bins) are comprised of four countries each. Bin 3, the high-volatility bin contains three countries: Australia, Japan and New Zealand. Notably, Australia and New Zealand are commodity-intensive DMEs. The three bins for EMEs each contain six countries. The low-volatility bin contains China, Czech Republic, India, Israel, Malaysia, Thailand, while the high NEER volatility bin, bin 3, is composed of: Argentina, Brazil, Colombia, Russia, South Africa and Turkey. Table A9b reports median statistics of key variables across respective volatility quantiles. An interesting pattern among EMEs is that foreign currency denominated public debt ratios, inflation, and policy rates all rise monotonically with NEER volatility. Comparing statistics in the high-volatility quantiles (bin 3) between EMEs and DMEs, median statistics are strictly larger in the high-volatility EME group, as not only are they more leveraged compared to their high-volatility DME counterparts, they also tend to experience higher inflation, interest rates and nominal GDP growth.

With de facto groups in hand, we estimate the full Taylor Rule regression model, which includes public debt variables. For the DMEs, we use public debt/GDP measures, analogous to specifications 4 and 8 of Table A5. For the EMEs, we report results using foreign currency denominated debt measures and controls[10] similar to specifications 6 and 12 of Table A7. Tables

[10] We also estimate the EME regressions using total public debt/GDP only, without foreign currency debt variables, but results are not reported since it is not the focus of the study. As shown in the de jure analysis, total public debt is not as important of a factor for Fiscal Dominance among emerging markets relative to foreign currency denominated debt holdings.

A8 and A9 (and Figures 5 and 6) report regression results by NEER volatility bins for DMEs and EMEs, respectively.

3.1 Developed Market Economies

In Table A8 (Figure 5), we report the results for developed market economies across volatility bins. Persistence of the lagged interest rate is stable across groups while the coefficients on inflation (ranging from 0.008 to 0.20) are highest for the high-volatility bin. The interest rate responses to a 1% increase in quarterly inflation over four quarters are 67 bps for this group. A 1 percent jump in quarterly inflation is equal to a 0.25 percent increase in annual inflation, hence inflation targeters (the high-volatility bin) aggressively respond on a greater-than 1-for-1 basis. A statistically significant coefficient (estimate of 0.09) is also reported for Bin 1, the low-volatility group. This group contains the U.S. and Hong Kong –which pegs its exchange rate to the U.S. Dollar and therefore also mimics its inflation targeting monetary policy. This group has a four-quarter response about half as strong as the high volatility group: a 1 percent jump in quarterly inflation is met with a 31 basis point rise in the interest rate over the following year, which is slightly greater than a 1-for-1 response. While bin 2, the mid-volatility DMEs do not show a significant coefficient on inflation, they are the only group of countries with a highly significant estimate on the GDP gap (estimate of 0.092).

Changes in the real exchange rate show significant effects and interesting heterogeneity across bins. DMEs with low exchange rate volatility (bin 1) tend to respond to exchange rate depreciation with higher interest rates while DMEs in bin 2 respond to depreciation with lower interest rates (coefficients on REER change are -0.027, 0.029, -0.005, for bin 1, 2 and 3, respectively). The negative association between exchange rates and interest rates in bin 1 may be due to the concentration of exchange rate targeters: Hong Kong, Singapore and Switzerland all have histories of intervening via policy to stabilize the currency. Bin 2, containing Canada, Norway and Sweden, all of which are oil-exporting countries, are more likely to see exchange rate appreciation with a rise in commodity prices, therefore a positive interest rate response to currency appreciation may be an attempt to curb future inflation and overheating related to a positive terms-of-trade shock. A 1-year cumulative interest rate response to a quarterly REER depreciation of 1 percent is +9.4 and -9.7 basis points for bin 1 and 2, respectively (the coefficient is statistically insignificant for bin 3). While the coefficient on REER is insignificant

for bin 3, we do find a significant interest rate response to changes in international reserves (estimate of -0.003). The negative effect suggests easing monetary policy in response to inflows of international reserves. A 1-year cumulative interest rate response to a 10 percent increase in international reserves would amount to a rate cut of -10 basis points.

Among DMEs, the effect of the public debt/GDP ratio on interest rates is more negative for higher volatility bins, with statistically significant coefficients among bin 2 and 3. It appears monetary policy is most constrained by debt positions among de facto inflation targeters, or countries lying in bin 3. For these high-NEER volatility DMEs, larger public debt/GDP ratios tend to suppress interest rates, and the effect is statistically significant, consistent with the analysis in Section 2 which finds the monetary policy of DMEs under de jure IT regimes sensitive to debt levels. Public Debt/GDP ratios are insignificant among low-NEER volatility DMEs, and statistically significant among the middle group (coefficients are 0.004, -0.009, -0.011, respectively). Taking estimates from the high-volatility group (bin 3), the 4-quarter interest rate response to a *transitory* 6% increase in the public debt/GDP ratio (1-standard deviation) is -22 basis points. However, a *permanent* 6% increase in the debt ratio implies an expected monetary easing of -59 basis points over a similar horizon. In contrast, the low-volatility group has a coefficient on public debt/GDP, which is statistically indifferent from zero.

3.2 Emerging Market Economies

Table A9 (Figure 6) reports results of the de facto classification analysis for EMEs. Again, the countries are sorted into three bins by NEER volatility, with bin 1 (3) containing EMEs with the lowest (highest) NEER volatility over the sample period. While we do observe coefficients on inflation monotonically increasing with NEER volatility (coefficients are 0.12, 0.36, 0.93, respectively and statistically significant), we don't observe similar patterns with GDP Gap (coefficients are 0.018, 0.100, -0.034). Upon inspecting the countries within each bin, the pattern in inflation coefficients is consistent with the country characteristics across bins: Bin 1 contains countries that are mostly manufacturing-based (China, India, Malaysia, Thailand, etc.), with anchored inflation, with limited need for NEER changes. Bin 2 is composed of a mixed composition (Chile, Indonesia, South Korea, Mexico, etc.) with greater exposure to terms-of-trade shocks, and with lesser anchored inflation, while bin 3, the high-volatility bin, tend to be countries with governance challenges (Argentina, Brazil, Russia, Turkey, etc.), with a history of

inflation and limited anchoring, constraining thereby reactions dealing with output [see Vegh et al. (2017)]. This view is supported in Table A9b, reporting that both median foreign currency denominated debt levels and inflation rates are highest among bin 3 (and lowest among bin 1).

A 1% rise in quarterly inflation corresponds with a 4-quarter interest rate increase of +42, +110, +200 basis points, for the low, medium and high NEER volatility bins, respectively (contemporaneous, short-run responses are equivalent to the coefficient estimates: +12, +36, +93 basis points). More aggressive responses from high NEER volatility EMEs is consistent with those countries following de facto inflation targeting, although these responses are considerably larger than those of de facto inflation targeting DMEs. One explanation for this may be the additional risk premium EMEs require to incorporate into their policy rates when battling higher inflation rates. This scenario can be related to the relatively weaker anchoring of inflation expectations in EMEs compared to DMEs, warranting both more aggressive responses by the monetary authority and higher risk premia demanded by investors facing hyperinflationary risks. GDP gaps enter statistically significant among bin 1 and bin 2 (coefficients of 0.018 and 0.100), while bin 3, the high volatility bin, has an insignificant coefficient estimate. Bin 2, the set of EMEs bearing relatively high terms-of-trade exposure, sensibly puts more importance on output gap fluctuations when setting monetary policy compared to the other subgroups of emerging markets.

Changes in the REER enter as highly significant among high-volatility EMEs, but not bin 1 or 2. The coefficient for bin 3 is -0.28 which implies that these EMEs tend to increase interest rates by about 26 basis points for a 1% depreciation in the real exchange rate in the short-run, with a 1-year interest rate response of +59 basis points. International reserves do not enter significantly into any specification. Under de jure IT classifications, both the real exchange rate and international reserves entered significantly for EMEs under non-IT regimes. It's interesting to note that in contrast, the de facto analysis paints a different picture. We find that de facto inflation targeters (bin 3) respond strongly to exchange rate depreciation, compared to non-IT (bin 1).

Foreign currency denominated debt enters significantly and negatively across all bins and is increasing in exchange rate volatility with a large increase from bin 2 to bin 3 (coefficients of -0.19, -0.21, and -0.45, respectively). Controls for total public debt/GDP (coefficients of 0.007,

0.014, 0.19) and the proportion of public debt denominated in foreign currency (coefficients of 0.066, 0.064, and 0.23) enter significantly and positively for bin 3, the high-volatility subgroup of EMEs. Again, these results closely resemble those of the non-IT EME group under the de jure classification. However, when we classify based on a simple de facto rule like binning by exchange rate volatility, those more likely to act as inflation targeters appear to have monetary policy more constrained by fiscal factors.[11]

Total public debt and the composition of public debt, having positive coefficients, can be interpreted as a risk premium effect. Possible fiscal dominance effects of foreign currency denominated debt/GDP is negative and offsets the risk premium effect as the level of hard currency debt rises. The significant coefficients across these debt variables reflect a non-linear relationship between foreign currency denominated debt and monetary policy among this set of EMEs. As mentioned in the previous section, as the composition of total public debt approaches 100% hard currency, the fiscal dominance effect tends to dominate any risk premium effect on the interest rate. Under this scenario, a 1 percentage point increase in the hard currency debt/GDP ratio would also increase the total public debt/GDP ratio by 1 percentage point. Because the coefficient estimates on foreign currency debt are larger than that on total public debt in absolute value, the net effect on the interest rate will be negative. For bin 3, interest rates would be -55 basis points lower (-90 basis points lower in the absence of the risk premium effect of rising total public debt) over 4 quarters from a *transitory* 1% rise in hard currency debt (-170 basis points lower from a *permanent* increase). Bins 1 and 2 have statistically significant estimates on foreign currency debt/GDP but not on controls for total public debt or debt composition, hence the effect is relatively linear for these countries: a 1 percentage point *transitory* increase in the hard currency debt/GDP ratio corresponds with interest rates roughly -65 basis points lower over a 4-quarter period for both bins (-170 basis points lower from a *permanent* increase). Under the limiting case of 100 percent of public debt is foreign currency denominated, interest rate responses are quite similar across EME bins after considering bin 3's risk premium offset.

[11] A sharper identification of this possible channel requires additional data, including debt maturity profile, sovereign spreads, the extent and efficacy of macro prudential regulations capital controls, international reserve levels, etc.

To summarize, under our simple de facto classification in which we bin groups of countries by their nominal exchange rate volatility, we find evidence of possible fiscal dominance among both DMEs and EMEs, as monetary policy is constrained by fiscal space (or lack thereof). Among DMEs, total public debt/GDP is associated with lower policy rates on average, and the effect size is larger for high exchange-rate volatility countries, the de facto inflation targeters. Among EMEs, the channel is more nuanced. The fiscal dominance effect transmits through the level of foreign denominated debt, and the impacts on interest rates are non-linear as they also depend on the total level of public debt/GDP and the composition of public debt; which are both impacted by the level of foreign currency denominated debt. The de facto analysis bears some similarities with the de jure analysis, while also highlighting key differences. In particular, among EMEs, our de facto analysis highlights that interest rates under inflation targeting may be more sensitive to the fiscal position of the country. In contrast, ignoring the de facto analysis and solely referencing the de jure classification would find that EMEs under non-IT regimes are more susceptible to fiscal dominance.

4. Fiscal Dominance, IT and Commodity Exposure in Emerging Markets

Within emerging markets, there is large heterogeneity across economies in terms of their reliance on key commodities. To pin down drivers of fiscal dominance across EMEs, we further split our EME sample into two subgroups: commodity intensive countries and countries which are not commodity intensive. A country is defined as commodity intensive if at least 25% of exports are in commodities[12]. By leveraging the IMF data on commodity-exporting countries along with UN Comtrade statistics, we compile our list of commodity-intensive EMEs: Argentina, Brazil, Chile, Colombia, Indonesia, Mexico, Russia and South Africa. The first cut of the analysis ignores monetary regime and estimates the Taylor Rule regression specification (which includes foreign currency denominated debt, the same specification as Table A6) on non-commodity and commodity EMEs separately. The second set of results incorporate de jure inflation targeting regimes, thus investigating how monetary policy setting differs between commodity and non-commodity inflation targeters. Finally, the third set of results apply our de

[12] We apply a definition similar to that found in Aizenman et al. (2011).

facto classification of the monetary regime with realized NEER volatility. We compare commodity versus non-commodity EMEs, which have the highest realized exchange rate volatility – countries which fall within the third quantile (bin 3, high volatility) from the previous analysis. Because EME bin 3 coincidentally contains all commodity-intensive countries, the comparison group are non-commodity intensive EMEs from bin 2, the second highest quantile in terms of exchange rate volatility.

Table A10 reports regression estimates upon splitting the EMEs into commodity-intensive and non-commodity countries. All three pairs of results suggest that commodity-intensive countries follow an interest rate rule which puts much more weight (ranging from a factor of 1.5 to 4) on inflation rates compared to non-commodity EMES. Given commodity countries and their exposure to international market volatility, spillovers through terms-of-trade shocks can be an important source of inflation that these central banks are required to lean against with aggressive monetary policy.

The first two columns are not conditional on the monetary regime; rather, we look at EMEs based on commodity-intensity. The role of international reserves and exchange rate fluctuations in setting monetary policy among EMEs is driven specifically by the commodity-intensive countries. Changes in the REER and international reserves are statistically significant for commodity-intensive EMEs, and moreover, the effects are significantly different from their non-commodity counterparts. A negative coefficient (estimate of -0.22) on REER changes and a positive coefficient (estimate of 0.046) in international reserves suggest that commodity EMEs respond with higher interest rates in the face of exchange rate depreciation and inflows of international reserves. Positive global commodity price shocks can lead to capital inflows, overheating and inducing inflationary pressures in such economies, hence the positive coefficient on international reserves may reflect the joint response of reserve accumulation to prevent an over-strengthening of the exchange rate in the presence of capital inflows plus the interest rate response to inflationary pressures. We do *not* see a significant effect of international reserves on interest rates among non-commodity EMEs. Finally, foreign currency debt/GDP is significant and negatively associated with interest rates for both commodity and non-commodity EMEs (estimate of -0.34 for commodity EMEs, -0.15 for non-commodity EMEs), and the effect size is quantitively larger for commodity-intensive EMEs. Controlling for public debt composition, we

see that the proportion of debt that is denominated in hard currency is also statistically significant across both subgroups of countries (estimate of 0.21 for commodity EMEs, 0.041 for non-commodity EMEs), but quantitatively larger among commodity EMEs. Hence, both fiscal dominance and risk premium effects of hard currency debt accumulation on interest rates are relatively stronger in commodity-intensive emerging markets.

The second pair (columns 3 and 4) of Table A10 conditions on de jure inflation targeting regimes via IMF classifications. Under the de jure classification, both commodity-intensive EME under IT and non-commodity intensive EMEs under IT have significant responses to lagged policy rates and inflation, with commodity-intensive EMEs responding more aggressively to inflation compared to non-commodity intensive EMEs (inflation coefficients of 0.504 vs 0.369, respectively). While commodity-intensive inflation targeters respond significantly to output gaps (estimate of 0.066), this is generally not the case for non-commodity intensive inflation targeters (based on the de jure classification). Upon conditioning on de jure inflation targeting regimes, the coefficient on the real exchange rate is rendered statistically insignificant (now for both commodity and non-commodity EMEs). The estimate on international reserves (coefficient of 0.019) however remains significant at the 10% level for commodity EMEs but is not significantly different from zero for non-commodity EMEs. Interestingly, foreign currency public debt/GDP is significant and negative (estimate of -0.18) among non-commodity EME inflation targeters, but not significant among commodity-intensive inflation targeters. It is important to note that these results are under the de jure classification of inflation targeting. Under our simple de facto classification, a very different picture emerges.

The final pair (columns 5 and 6) of Table A10 applies our de facto inflation targeting classification defined by NEER volatility bins with high levels of exchange rate volatility. Here, we take the commodity EMEs with the high NEER volatility and compare them against non-commodity EMEs with high NEER volatility. Again, lagged interest rates and inflation enter significantly, with the coefficient on inflation four times larger among commodity countries than non-commodity countries. The GDP gap enters significantly and positively (estimate of 0.25) among non-commodity EMEs under IT, but not for commodity EMEs under IT. Commodity EMEs under de facto IT respond to exchange rate depreciation with higher interest rates (coefficient of -0.25) while non-commodity EMEs under IT respond positively (coefficient of

0.092). Finally, a sharp difference under the de facto IT classification is that fiscal variables are statistically significant for commodity-intensive inflation targeters, while this is generally not the case for non-commodity ITs. Evidence of possible fiscal dominance can be displayed by the coefficient on foreign currency denominated debt/GDP (estimate of -0.45), with higher hard currency debt levels associated with lower interest rates. Risk premium effects are evident as positive coefficients on controls for total public debt/GDP and debt composition (0.17 and 0.28, respectively). Comparable estimates are non-significant in the non-commodity group. Again because of the non-linear relationship between fiscal space and interest rates caused by interactions between debt variables, we consider the limiting case where all debt is hard currency denominated. Under this scenario, the fiscal dominance effect is strongest, with a 1 percent *transitory* rise in foreign currency denominated debt associated with a cumulate 4-quarter change in interest rates of -51 basis points. A 1 percent *permanent* rise is associated with a -170 basis point cut in the policy rate over 4 quarters.

By stratifying EMEs further by commodity intensity, we sharpen our analysis and identify an additional potential factor that drives possible fiscal dominance effects in emerging market economies. Inflation plays a much larger role in interest rate policy for commodity-intensive countries compared to non-commodity EMEs. When we do not condition on the monetary regime, we find that commodity-intensive EMEs also consider fluctuations in the real exchange rate and international reserves when determining interest rates while non-commodities do not. We then condition on monetary regime using both de jure and de facto classifications for inflation targeting. Under the de jure classification, the output gap plays a noticeably larger role in interest rate setting for commodity-intensive inflation targeters, but not for their non-commodity inflation targeting counterparts. We also see that under the de jure classification, evidence of fiscal dominance is present among non-commodity inflation targeting EMEs. De facto classification based on exchange rate volatility tells a different story. Output gaps are associated with higher interest rates among non-commodity inflation targeters but not among commodity-intensive EMEs. Depreciation of the real exchange rate are positively (negatively) associated with interest rates in commodity (non-commodity) intensive inflation targeting EMEs. Finally, fiscal variables are highly significant among commodity-based inflation targeters, but not among their non-commodity EME counterparts. Consistent with the previous sections, non-linear effects of hard currency debt accumulation are present, as fiscal dominance effects of

lower interest rates offset risk premium effects of higher interest rates. One note is the association between exchange rate volatility, our de facto measure of the monetary regime, and commodity intensity. We can observe that commodity intensity is positively associated with exchange rate volatility. This association makes it crucial to stratify the high volatility group of emerging market countries on commodity intensity as done in this exercise. Importantly, we find that even among high exchange rate volatility EMEs, it is those who are commodity-intensive that show the strongest evidence of debt levels influencing policy interest rates. Importantly, the de facto, exchange rate volatility based method of IT classification strikes a contrast to the de jure analysis, highlighting the crucial and complex nature of classifying monetary regimes.

5. Robustness checks

Debt/Tax Base in Emerging Market Economies

Among emerging markets, the tax base is often an alternative measure used to assess fiscal space as it is more representative of the underlying country [see Aizenman et al. (2019)]. To establish the robustness of our findings, the baseline regressions using de jure and de facto classifications are re-estimated for EMEs, but traditional debt overhang variables which were normalized by GDP are instead normalized by tax revenue. We take 5-year moving averages of tax revenues to reduce seasonality and ensure that the variation of debt overhang is dominated by the fluctuations in debt rather than economic growth.

Table A11 and A12 report similar baseline regressions on EMEs analogous to A6 and A7 but replacing foreign currency denominated public debt/GDP and total public debt/GDP replaced with foreign currency denominated public debt/tax base (5-year moving average of the tax base) and total public debt/tax base, respectively. Using tax base yields results consistent with the original analysis. Under the de jure classification, emerging markets under non-IT regimes still respond significantly and negatively to higher levels of foreign currency denominated debt (columns 11 and 12 of Table A11) and positively to the proportion of foreign currency denominated debt to total public debt.

Table A13 shows the results under de facto classification similar to the initial analysis reported in A9. Again, results remain consistent with the initial analysis: Significant negative

coefficients on the foreign currency public debt variables for the subgroups of EMEs with high NEER volatility (our de facto inflation targeters), along with significant positive effects (risk premium effects) of public debt/tax and debt composition on interest rates. In Table A9, possible fiscal dominance effects were present in the lower volatility subgroups too, with significant negative coefficients on foreign currency debt/GDP among bins 1 and 2 – though to a far lesser extent than the effect size in bin 3. The significant effects among bin 1 and 2 are not present when replacing GDP with tax revenue, though overall, our main results remain consistent regardless of using GDP or tax revenue.

6. Conclusion

Advanced countries and emerging markets have increased substantially their public-sector borrowing as a share of GDP since the Global Financial Crisis. This trend has been driven by the low risk-free interest-rate, as well as by other challenges associated with the GFC. In our study, we find that total public debt levels are associated with lower policy interest rates in advanced economies. Foreign currency public debt adds downward pressure to interest rates in Emerging Market Countries. Using a de jure measure of inflation targeting, we find that EMEs under non-IT regimes (mostly exchange rate targeters) are less likely to raise interest rates when foreign currency debt levels are higher. In contrast, the overall effect of debt on monetary policy is more nuanced as the risk premium effect of larger total debt loads encourages higher policy rates to match any increase in risks associated with higher debt. In addition to inflation and output fluctuations (and of course, debt levels), real exchange rate depreciations are significantly associated with higher interest rates. Sorting countries by nominal exchange rate volatility, we find that the high-volatility group of EMEs have the most robust debt-interest rate relationship. Among inflation targeting EMEs, non-commodity intensive countries show stronger evidence of fiscal dominance compared to commodity-intensive countries under the de jure measure. Under our de facto IT classification, however, fiscal dominance effects are more significant for commodity-intensive EMEs.

Comparing the advanced countries with the emerging markets, the public debt/GDP ratio is positively associated with a short-term interest rate of the high-currency-volatility emerging markets, but negatively associated with the high-currency-volatility advanced countries. Fiscal dominance and risk premium effects are possible interpretations of the above results. Thereby,

more data and a longer sampling period would be useful to test these interpretations thoroughly. Debt maturity profile, the extent and effectiveness of capital controls, more detailed data on local currency public and private debt would allow sharper identification of the forces at work. These issues are left for future research.

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APPENDIX

TABLE A1: DATA DETAILS

Variable	Definition	Source
Foreign Reserves Change	First-difference of log foreign reserves	IMF IFS
FX Denominated Public Debt/GDP Ratio	Value of public debt denominated in foreign currency divided by nominal GDP.	BIS, IMF IFS
FX Denominated Public Debt/GDP Growth	First-difference of log FX Denominated Public Debt/GDP Ratio	BIS, IMF IFS
FX Denominated Public Debt/Tax Revenue Ratio	Value of public debt denominated in foreign currency divided by Tax Revenue.	BIS, IMF IFS, OECD
FX Denominated Public Debt/Tax Revenue Growth	First-difference of log FX Denominated Public Debt/Tax Revenue Ratio	BIS, IMF IFS, OECD
GDP Gap	Real GDP relative to trend calculated with a Hodrick-Prescott filter	IMF IFS
Inflation	First-difference of log CPI	BIS
De Jure Inflation Targeting Classification	Dummy variable indicating quarters in which country prescribed inflation targeting regime	IMF
Interest Rate	Nominal short-term interest rate or central bank policy rate	IMF IFS
Public Debt/GDP Ratio	Value of public debt divided by nominal GDP	IMF IFS
Public Debt/GDP Growth	First-difference of log Public Debt/GDP Ratio	IMF IFS
Public Debt/Tax Revenue Ratio	Value of public debt divided by tax revenue	IMF IFS, OECD
Public Debt/Tax Revenue Growth	First-difference of log Public Debt/Tax Revenue Ratio	IMF IFS, OECD
Real Exchange Rate Change	First-difference of log real effective exchange rate	BIS

Market value of debt used for countries with available data. In other cases, the face value of debt is used.

TABLE A2: DESCRIPTIVE STATISTICS FOR DEVELOPED MARKET ECONOMIES

	IT Sample (552 obs.)		Non-IT Sample (284 obs.)			
variable	mean	std.dev	mean	std.dev	t-stat for difference between samples	
Interest Rate	0.026	0.022	0.014	0.018	8.667	***
Inflation	0.005	0.007	0.002	0.009	4.181	***
Output Gap	1.000	0.019	1.001	0.035	-0.383	
REER Change	0.000	0.034	-0.001	0.028	0.218	
NEER Change	0.000	0.035	0.002	0.027	-1.048	
Foreign Reserves Change	0.013	0.091	0.026	0.07	-2.317	**
Debt/GDP	0.396	0.225	0.543	0.284	-7.482	***
Debt/GDP Growth	0.003	0.057	0.007	0.06	-0.977	
Debt/Tax	3.053	2.637	5.652	1.881	-14.926	***
Debt/Tax Growth	0.004	0.062	0.001	0.049	0.731	
FX Debt/GDP	0.017	0.025	0.003	0.003	11.492	***
FX Debt/GDP Growth	-0.019	0.222	-0.005	0.124	-0.923	
FX Debt/Tax	0.144	0.21	0.004	0.004	14.156	***
FX Debt/Tax Growth	-0.019	0.222	-0.017	0.112	-0.117	

Mean and standard deviation for all variables. Differenced variables are quarterly changes

*,**,*** Indicate significance at the 10%, 5% and 1% level, respectively

Positive values for REER/NEER change correspond with exchange rate appreciation

TABLE A3: DESCRIPTIVE STATISTICS FOR EMERGING MARKET ECONOMIES

	IT Sample (964 obs.)		Non-IT Sample (404 obs.)			
variable	mean	std.dev	mean	std.dev	t-stat for difference between samples	
Interest Rate	0.058	0.043	0.101	0.103	-7.709	***
Inflation	0.010	0.011	0.019	0.026	-6.83	***
Output Gap	0.999	0.029	1.001	0.061	-0.643	
REER Change	0.001	0.049	-0.001	0.066	0.521	
NEER Change	-0.003	0.051	-0.014	0.073	2.868	***
Foreign Reserves Change	0.021	0.059	0.031	0.086	-2.052	**
Debt/GDP	0.379	0.210	0.465	0.245	-5.871	***
Debt/GDP Growth	0.004	0.068	-0.005	0.096	1.684	*
Debt/Tax	2.074	0.745	3.900	2.684	-11.71	***
Debt/Tax Growth	0.004	0.072	-0.004	0.123	1.069	
FX Debt/GDP	0.048	0.044	0.071	0.134	-3.072	***
FX Debt/GDP Growth	0.006	0.142	-0.015	0.200	1.743	*
FX Debt/Tax	0.261	0.207	0.719	1.524	-5.317	***
FX Debt/Tax Growth	0.005	0.144	-0.014	0.227	1.401	

Mean and standard deviation for all variables. Differenced variables are quarterly changes

*,**,*** Indicate significance at the 10%, 5% and 1% level, respectively

TABLE A4: UNIT ROOT TESTS

	LLC		IPS	
Foreign Reserves Change	-40.632	***	-43.716	***
FX Denominated Public Debt/GDP Ratio	-7.457	***	-2.813	***
FX Denominated Public Debt/GDP Growth	-28.468	***	-30.191	***
FX Denominated Public Debt/Tax Revenue Ratio	-2.737	***	-2.246	**
FX Denominated Public Debt/Tax Revenue Growth	-30.233	***	-29.962	***
GDP Gap	-9.234	***	-14.065	***
Inflation	-10.455	***	-20.918	***
Interest Rate	-4.3	***	-2.44	***
Public Debt/GDP Ratio	-1.421	*	0.729	
Public Debt/GDP Growth	-40.7	***	-40.361	***
Public Debt/Tax Revenue Ratio	-3.158	***	-2.272	**
Public Debt/Tax Revenue Growth	-32.694	***	-32.462	***
Real Exchange Rate Change	-48.166	***	-48.804	***

The resulting test statistics are based on Levin et al. (2002) and Im et al. (2003) tests. As is true for all other panel unit root tests, these tests should be interpreted with caution. The LLC test assumes a common process, while the IPS test assumption is more general, where the rejection of the null can be interpreted as providing evidence in favor of rejecting the unit root hypothesis for a non-zero fraction of panel members. Data sets were balanced before performing unit root tests, thus removing earlier dates, which only contained data for select countries. *, ***, *** indicate rejection at the 10%, 5%, 1% significance level, respectively.

Table A5

ESTIMATED TAYLOR RULES: DEVELOPED MARKET ECONOMIES

Variable	IT				Non-IT			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interest Rate (t-1)	0.898***	0.906***	0.867***	0.868***	0.866***	0.864***	0.843***	0.851***
	(0.011)	(0.011)	(0.036)	(0.032)	(0.075)	(0.075)	(0.086)	(0.086)
Inflation	0.217***	0.181***	0.178***	0.148***	-0.007	0.007	0.013	0.028
	(0.039)+++	(0.050)+++	(0.047)+++	(0.047)+	(0.044)	(0.046)	(0.045)	(0.048)
GDP Gap	0.084***	0.095***	0.099***	0.096***	0.006	0.008	0.006	-0.010
	(0.013)+++	(0.012)+++	(0.015)+++	(0.013)+++	(0.015)	(0.014)	(0.013)	(0.019)
REER Change		0.049***	0.050***	0.015**		-0.016	-0.015	-0.022*
		(0.009)+++	(0.009)+++	(0.007)+++		(0.013)	(0.013)	(0.013)
Reserves Change		-0.005	-0.004	-0.006*		-0.008*	-0.008*	-0.010*
		(0.003)	(0.003)	(0.003)		(0.004)	(0.005)	(0.005)
Public Debt/GDP Ratio			-0.010*	-0.009**			-0.005	-0.005
			(0.005)	(0.004)			(0.006)	(0.006)
GDP Growth				0.039***				0.022***
				(0.004)+++				(0.004)
Observations	542	542	535	535	279	279	277	277
Adj. R-Squared	0.87	0.88	0.89	0.89	0.87	0.87	0.87	0.87

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

+,++,+++ Indicate significance of the difference between IT and Non-IT estimate at the 10%, 5%, and 1% level, respectively.

De jure IT classification based on IMF.

Table A6

ESTIMATED TAYLOR RULES: EMERGING MARKET ECONOMIES

Variable	IT				Non-IT			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interest Rate (t-1)	0.859***	0.860***	0.856***	0.857***	0.407**	0.471***	0.471***	0.475***
	(0.027)+++	(0.027)+++	(0.029)+++	(0.028)+++	(0.159)	(0.120)	(0.112)	(0.115)
Inflation	0.492***	0.497***	0.476***	0.446***	1.132*	0.698***	0.701***	0.597**
	(0.089)	(0.089)	(0.088)	(0.074)	(0.595)	(0.244)	(0.231)	(0.233)
GDP Gap	0.038**	0.037**	0.031*	0.048***	-0.062	-0.026	-0.026	0.064
	(0.017)	(0.017)	(0.017)	(0.016)	(0.159)	(0.082)	(0.088)	(0.050)
REER Change		-0.014	-0.010	0.008		-0.495***	-0.496***	-0.394***
		(0.01)+++	(0.009)+++	(0.019)+++		(0.104)	(0.112)	(0.063)
Reserves Change		0.005	0.006	0.010		0.088*	0.089**	0.127***
		(0.009)+	(0.009)+++	(0.009)+++		(0.048)	(0.036)	(0.034)
Public Debt/GDP Ratio			-0.004	-0.005			-0.002	-0.010
			(0.011)	(0.012)			(0.060)	(0.058)
GDP Growth				-0.023				-0.167**
				(0.017)++				(0.069)
Observations	928	928	921	921	343	343	342	341
Adj. R-Squared	0.82	0.82	0.82	0.82	0.36	0.53	0.53	0.55

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

+,++,+++ Indicate significance of the difference between IT and Non-IT estimate at the 10%, 5%, and 1% level, respectively.

De jure IT classification based on IMF.

Table A7

ESTIMATED TAYLOR RULES: EMEs, FOREIGN DENOMINATED PUBLIC DEBT

Variable	IT						Non-IT					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Interest Rate (t-1)	0.859***	0.860***	0.859***	0.859***	0.856***	0.856***	0.407**	0.471***	0.471***	0.467***	0.449***	0.460***
	(0.027)	(0.027)	(0.029)	(0.029)	(0.033)	(0.033)	(0.159)	(0.120)	(0.122)	(0.097)	(0.086)	(0.091)
Inflation	0.492***	0.497***	0.488***	0.487***	0.485***	0.457***	1.132*	0.698***	0.764***	0.780***	0.919***	0.771***
	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.076)	(0.595)	(0.244)	(0.259)	(0.197)	(0.223)	(0.200)
GDP Gap	0.038**	0.037**	0.033*	0.032*	0.032*	0.047***	-0.062	-0.026	-0.03	-0.04	-0.036	0.04
	(0.017)	(0.017)	(0.019)	(0.017)	(0.018)	(0.017)	(0.159)	(0.082)	(0.098)	(0.085)	(0.099)	(0.054)
REER Change		-0.014	-0.012	-0.012	-0.012	0.005		-0.495***	-0.519***	-0.531***	-0.519***	-0.429***
		(0.010)	(0.008)	(0.008)	(0.008)	(0.019)		(0.104)	(0.107)	(0.098)	(0.089)	(0.047)
Reserves Change		0.005	0.005	0.005	0.005	0.009		0.088*	0.098**	0.073***	0.066***	0.103***
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)		(0.048)	(0.049)	(0.016)	(0.013)	(0.014)
FX Public Debt/GDP Ratio			-0.016	-0.014	-0.105	-0.113			-0.052	-0.171	-0.412***	-0.367***
			(0.044)	(0.047)	(0.096)	(0.100)			(0.039)	(0.108)	(0.126)	(0.136)
Public Debt/GDP Ratio				-0.002	0.011	0.011				0.082	0.152*	0.128
				(0.011)	(0.015)	(0.015)				(0.094)	(0.087)	(0.091)
FX Public Debt/Public Debt Ratio					0.043	0.045					0.242***	0.213***
					(0.031)	(0.032)					(0.037)	(0.051)
GDP Growth						-0.021						-0.151*
						(0.016)						(0.082)
Observations	928	928	905	905	905	905	343	343	298	298	298	298
Adj. R-Squared	0.82	0.82	0.82	0.82	0.82	0.83	0.365	0.53	0.54	0.55	0.56	0.57

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

+,++,+++ Indicate significance of the difference between IT and Non-IT estimate at the 10%, 5%, and 1% level, respectively.

De jure IT classification based on IMF.

Table A8

ESTIMATED TAYLOR RULES: DMEs, GROUPED BY NEER

Variable	DME Groups by NEER Volatility		
	(1)	(2)	(3)
Interest Rate (t-1)	0.910***	0.880***	0.880***
	(0.047)	(0.043)	(0.022)
Inflation	0.090**	0.008	0.200***
	(0.036)	(0.062)	(0.056)
GDP Gap	-0.012	0.092***	0.036
	(0.016)	(0.014)	(0.037)
REER Change	-0.027**	0.029***	-0.005
	(0.012)	(0.005)	(0.003)
Reserves Change	-0.013	-0.005	-0.003**
	(0.008)	(0.005)	(0.001)
Public Debt/GDP Ratio	-0.004	-0.009*	-0.011**
	(0.004)	(0.005)	(0.005)
GDP Growth	0.019***	0.041***	0.031***
	(0.005)	(0.005)	(0.006)
Observations	295	295	221
Adj. R-Squared	0.885	0.92	0.9

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

Groups based on quantiles sorted by historical nominal exchange rate volatility, with (1) being the lowest volatility group, and (3) being the highest.

Table A9

ESTIMATED TAYLOR RULES: EMEs, GROUPED BY NEER VOLATILITY

Variable	EME Groups by NEER Volatility		
	(1)	(2)	(3)
Interest Rate (t-1)	0.910***	0.810***	0.580***
	(0.016)	(0.039)	(0.096)
Inflation	0.120*	0.360***	0.930***
	(0.066)	(0.069)	(0.210)
GDP Gap	0.018*	0.100***	-0.034
	(0.010)	(0.037)	(0.089)
REER Change	-0.011	0.007	-0.280**
	(0.014)	(0.027)	(0.120)
Reserves Change	0.003	0.007	0.037
	(0.005)	(0.007)	(0.026)
FX Public Debt/GDP Ratio	-0.190*	-0.210**	-0.450***
	(0.100)	(0.088)	(0.074)
Public Debt/GDP Ratio	0.007	0.014	0.190***
	(0.009)	(0.017)	(0.045)
FX Public Debt/Public Debt Ratio	0.066	0.064	0.230***
	(0.041)	(0.043)	(0.050)
GDP Growth	0.012	-0.021*	(0.024)
	(0.008)	(0.011)	(0.042)
Observations	360	419	423
Adj. R-Squared	0.90	0.86	0.62

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

Groups based on quantiles sorted by historical nominal exchange rate volatility, with (1) being the lowest volatility group, and (3) being the highest.

Table A9a

COUNTRY GROUPINGS BY NEER VOLATILITY

Country	Group	Quantile
Hong.Kong.SAR	DME	1
Singapore	DME	1
Switzerland	DME	1
United.States	DME	1
Canada	DME	2
Norway	DME	2
Sweden	DME	2
United.Kingdom	DME	2
Australia	DME	3
Japan	DME	3
New.Zealand	DME	3
China	EME	1
Czech.Republic	EME	1
India	EME	1
Israel	EME	1
Malaysia	EME	1
Thailand	EME	1
Chile	EME	2
Hungary	EME	2
Indonesia	EME	2
Korea	EME	2
Mexico	EME	2
Poland	EME	2
Argentina	EME	3
Brazil	EME	3
Colombia	EME	3
Russia	EME	3
South.Africa	EME	3
Turkey	EME	3

Table A9b

MEDIAN STATISTICS BY NEER VOLATILITY QUANTILE

Quantile	Group	FX Debt/GDP	Public Debt/GDP	Inflation	Interest Rate	GDP Growth
1	DME	0.000	0.613	0.006	0.008	0.010
2	DME	0.017	0.367	0.004	0.020	0.013
3	DME	0.004	0.293	0.004	0.025	0.010
1	EME	0.017	0.367	0.005	0.030	0.025
2	EME	0.042	0.299	0.009	0.048	0.018
3	EME	0.056	0.383	0.016	0.095	0.028

Inflation and (nominal) GDP growth are measured at the quarterly frequency. Interest Rate is annualized.

Table A10

ESTIMATED TAYLOR RULES: EMEs, GROUPED BY COMMODITY INTENSITY

Variable	Commodity	Non-Commodity	Commodity IT (De Jure)	Non-Commodity IT (De Jure)	Commodity IT (De Facto)	Non-Commodity IT (De Facto)
Interest Rate (t-1)	0.510***	0.870***	0.827***	0.817***	0.480***	0.750***
	(0.100)+++	(0.013)	(0.038)	(0.032)	(0.085)+	(0.140)
Inflation	0.910***	0.320***	0.504***	0.369***	1.000***	0.250*
	(0.310)+	(0.099)	(0.079)	(0.097)	(0.330)++	(0.140)
GDP Gap	-0.022	0.030*	0.066***	0.04	-0.048	0.210***
	(0.097)	(0.017)	(0.021)	(0.031)	(0.110)++	(0.072)
REER Change	-0.220**	-0.006	-0.005	0.018	-0.250**	0.092*
	(0.110)+	(0.034)	(0.010)	(0.037)	(0.110)+++	(0.047)
Reserves Change	0.046**	-0.004	0.019*	-0.002	0.048	0.006
	(0.022)++	(0.006)	(0.010)+	(0.007)	(0.033)	(0.004)
FX Public Debt/GDP Ratio	-0.340***	-0.150***	0.112	-0.180***	-0.450***	0.23
	(0.120)	(0.043)	(0.082)+++	(0.052)	(0.100)+++	(0.200)
Public Debt/GDP Ratio	0.13	0.005	-0.012	0.018	0.170**	-0.072
	(0.079)	(0.009)	(0.013)	(0.016)	(0.081)+++	(0.049)
FX Public Debt/Public Debt Ratio	0.210***	0.041*	0.006	0.021	0.280***	(0.210)
	(0.055)+++	(0.023)	(0.028)	(0.024)	(0.039)+++	(0.160)
GDP Growth	-0.052	-0.005	-0.018	-0.012	-0.061	-0.058
	(0.041)	(0.012)	(0.011)	(0.017)	(0.057)	(0.036)
Observations	556	647	423	481	358	221
Adj. R-Squared	0.52	0.94	0.85	0.83	0.52	0.89

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

+,++,+++ Indicate significance of the difference between Commodity and Non-Commodity intensive estimates at the 10%, 5%, and 1% level, respectively.

De jure IT classification based on IMF.

De facto IT classification based on nominal exchange rate volatility. De facto IT classified as high-volatility quantile

Commodity-intensive EMEs: Argentina, Brazil, Chile, Colombia, Indonesia, Mexico, Russia, South Africa

Table A11

ESTIMATED TAYLOR RULES: EMERGING MARKET ECONOMIES USING TAX REVENUE

Variable	IT				Non-IT			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interest Rate (t-1)	0.859***	0.860***	0.859***	0.860***	0.407**	0.471***	0.418***	0.434***
	(0.027)+++	(0.027)+++	(0.027)+++	(0.027)+++	(0.159)	(0.120)	(0.108)	(0.110)
Inflation	0.492***	0.497***	0.486***	0.461***	1.132*	0.698***	1.100***	0.974***
	(0.089)	(0.089)	(0.089)+++	(0.075)+++	(0.595)	(0.244)	(0.191)	(0.149)
GDP Gap	0.038**	0.037**	0.036*	0.050***	-0.062	-0.026	-0.118*	-0.053*
	(0.017)	(0.017)	(0.018)+++	(0.017)+++	(0.159)	(0.082)	(0.063)	(0.029)
REER Change		-0.014	-0.013	0.002		-0.495***	-0.488***	-0.427***
		(0.01)+++	(0.009)+++	(0.019)+++		(0.104)	(0.068)	(0.025)
Reserves Change		0.005	0.005	0.009		0.088*	0.076**	0.101***
		(0.009)+	(0.009)+	(0.009)+++		(0.048)	(0.037)	(0.036)
Public Debt/Tax Ratio			0.002	0.002			-0.005***	-0.006***
			(0.001)+++	(0.002)+++			(0.001)	(0.001)
GDP Growth				-0.019				-0.104
				(0.016)				(0.089)
Observations	928	928	907	907	343	343	238	238
Adj. R-Squared	0.82	0.82	0.82	0.82	0.36	0.53	0.60	0.61

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

+,++,+++ Indicate significance of the difference between IT and Non-IT estimate at the 10%, 5%, and 1% level, respectively.

De jure IT classification based on IMF.

Table A12

ESTIMATED TAYLOR RULES: EMEs, FOREIGN DENOMINATED PUBLIC DEBT USING TAX REVENUE

Variable	IT						Non-IT					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Interest Rate (t-1)	0.859***	0.860***	0.862***	0.860***	0.860***	0.861***	0.407**	0.471***	0.434***	0.420***	0.402***	0.417***
	(0.027)+++	(0.027)+++	(0.028)+++	(0.027)+++	(0.027)+++	(0.026)+++	(0.159)	(0.120)	(0.089)	(0.117)	(0.093)	(0.092)
Inflation	0.492***	0.497***	0.488***	0.487***	0.487***	0.461***	1.132*	0.698***	1.025***	1.090***	1.223***	1.108***
	(0.089)	(0.089)	(0.087)+++	(0.087)+++	(0.088)+++	(0.075)+++	(0.595)	(0.244)	(0.136)	(0.216)	(0.264)	(0.202)
GDP Gap	0.038**	0.037**	0.035*	0.036*	0.036**	0.050***	-0.062	-0.026	-0.130*	-0.119*	-0.123	-0.07
	(0.017)	(0.017)	(0.019)++	(0.019)+++	(0.018)++	(0.018)+++	(0.159)	(0.082)	(0.069)	(0.062)	(0.080)	(0.043)
REER Change		-0.014	-0.011	-0.013	-0.013	0.002		-0.495***	-0.502***	-0.490***	-0.458***	-0.411***
		(0.010)+++	(0.008)+++	(0.008)+++	(0.008)+++	(0.018)+++		(0.104)	(0.078)	(0.063)	(0.055)	(0.024)
Reserves Change		0.005	0.005	0.005	0.005	0.009		0.088*	0.056**	0.073*	0.041	0.064
		(0.009)+	(0.009)+	(0.009)	(0.009)	(0.009)		(0.048)	(0.025)	(0.042)	(0.042)	(0.048)
FX Public Debt/Tax Ratio			0.004	0.003	0.003	0.002			-0.008***	-0.001	-0.030**	-0.028*
			(0.007)+	(0.007)	(0.014)+	(0.014)			(0.001)	(0.007)	(0.013)	(0.014)
Public Debt/Tax Ratio				0.001	0.001	0.001				-0.005	0.007	0.006
				(0.002)	(0.002)	(0.002)				(0.005)	(0.007)	(0.008)
FX Public Debt/Public Debt Ratio					-0.001	0.002					0.293***	0.273***
					(0.030)+++	(0.031)+++					(0.091)	(0.099)
GDP Growth						-0.019						-0.085
						(0.016)						(0.084)
Observations	928	928	905	905	905	905	343	343	238	238	238	238
Adj. R-Squared	0.82	0.82	0.82	0.82	0.82	0.82	0.365	0.53	0..60	0.61	0.62	0.62

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

+,++,+++ Indicate significance of the difference between IT and Non-IT estimate at the 10%, 5%, and 1% level, respectively.

De jure IT classification based on IMF.

Table A13

ESTIMATED TAYLOR RULES: EMEs, GROUPED BY NEER VOLATILITY USING TAX REVENUE

Variable	EME Groups by NEER Volatility		
	(1)	(2)	(3)
Interest Rate (t-1)	0.918***	0.874***	0.551***
	(0.027)	(0.019)	(0.128)
Inflation	0.134	0.412***	1.001***
	(0.087)	(0.106)	(0.288)
GDP Gap	0.021**	0.097***	-0.119
	(0.009)	(0.027)	(0.087)
REER Change	-0.005	-0.007	-0.261**
	(0.012)	(0.033)	(0.112)
Reserves Change	0.002	0.004	0.015
	(0.005)	(0.008)	(0.036)
FX Public Debt/Tax Ratio	-0.026	0.014	-0.036***
	(0.021)	(0.025)	(0.006)
Public Debt/Tax Ratio	0.0005	-0.0004	0.014***
	(0.002)	(0.001)	(0.004)
FX Public Debt/Public Debt Ratio	0.069	(0.032)	0.236***
	(0.061)	(0.041)	(0.087)
GDP Growth	0.008	(0.003)	0.002
	(0.007)	(0.019)	(0.031)
Observations	319	419	405
Adj. R-Squared	0.83	0.86	0.62

Dependent variable: Nominal interest rates. Panel fixed-effects estimation. The associated standard errors are noted below each estimated coefficient in parenthesis.

*, **, *** Indicate significance at the 10%, 5%, and 1% level, respectively.

Groups based on quantiles sorted by historical nominal exchange rate volatility, with (1) being the lowest volatility group, and (3) being the highest.

Figure 1: Inflation-Targeting Adoption (de jure)

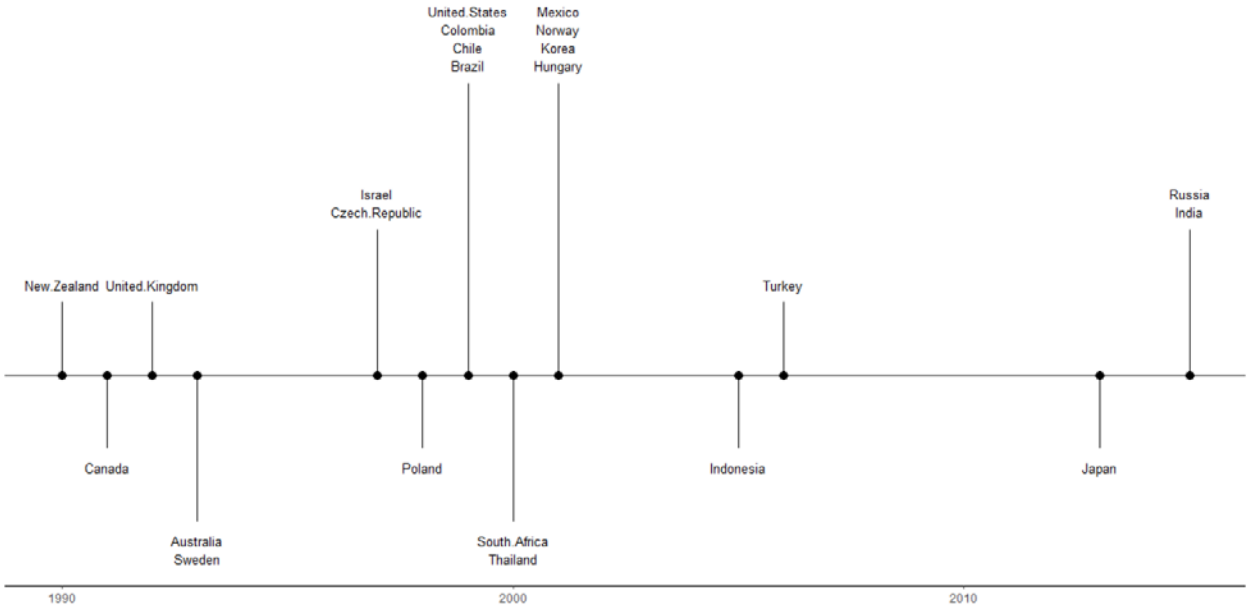

Figure 2: Developed Market Economies Summary Statistics by IT vs non-IT (de jure)

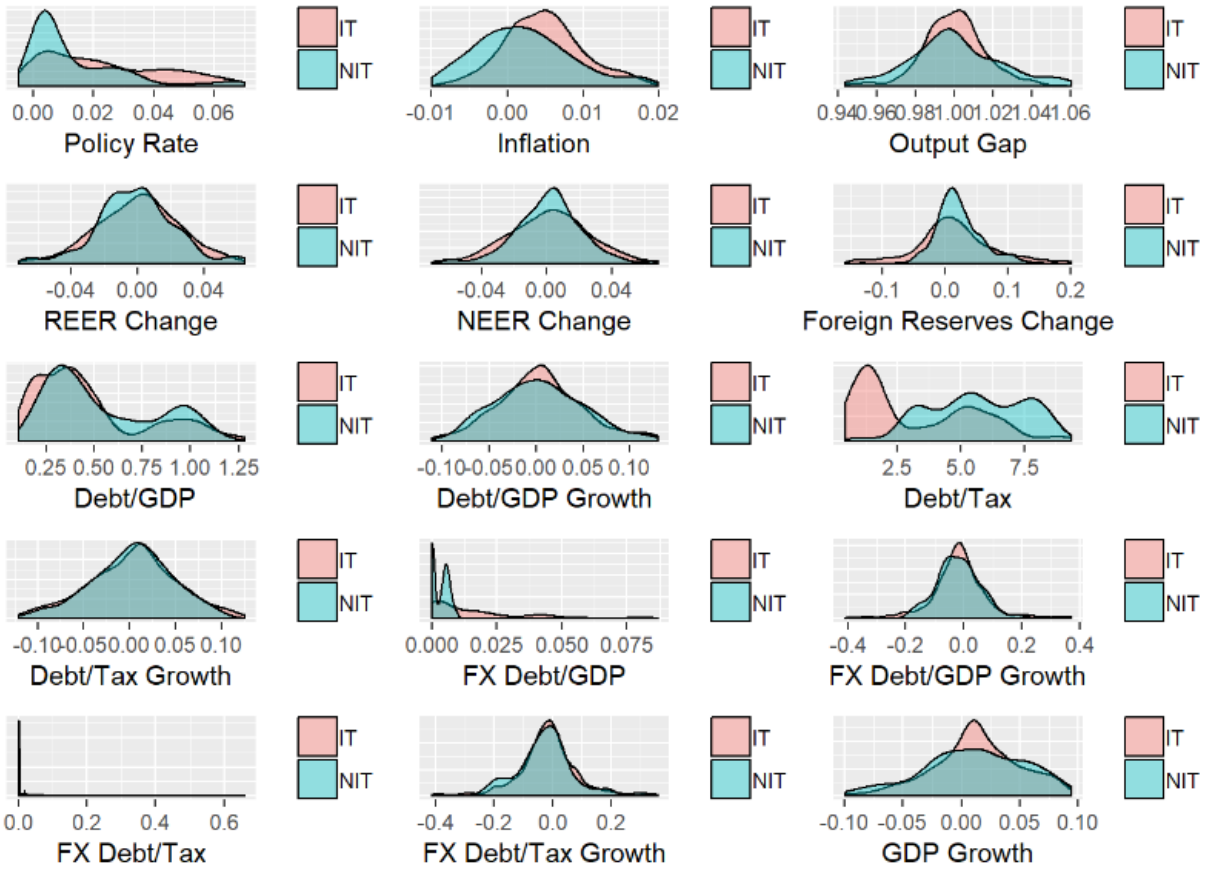

Figure 3: Emerging Market Economies Summary Statistics by IT vs non-IT (de jure)

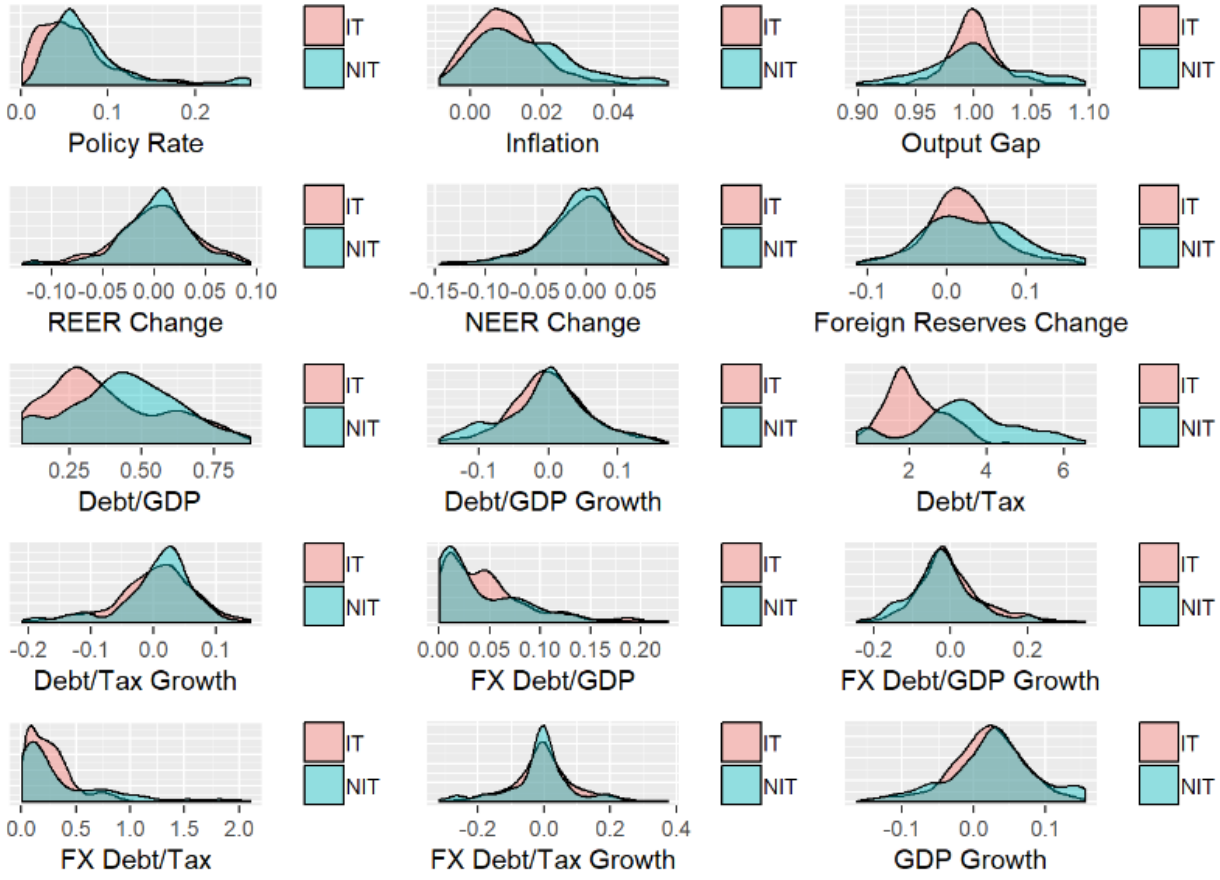

Figure 4

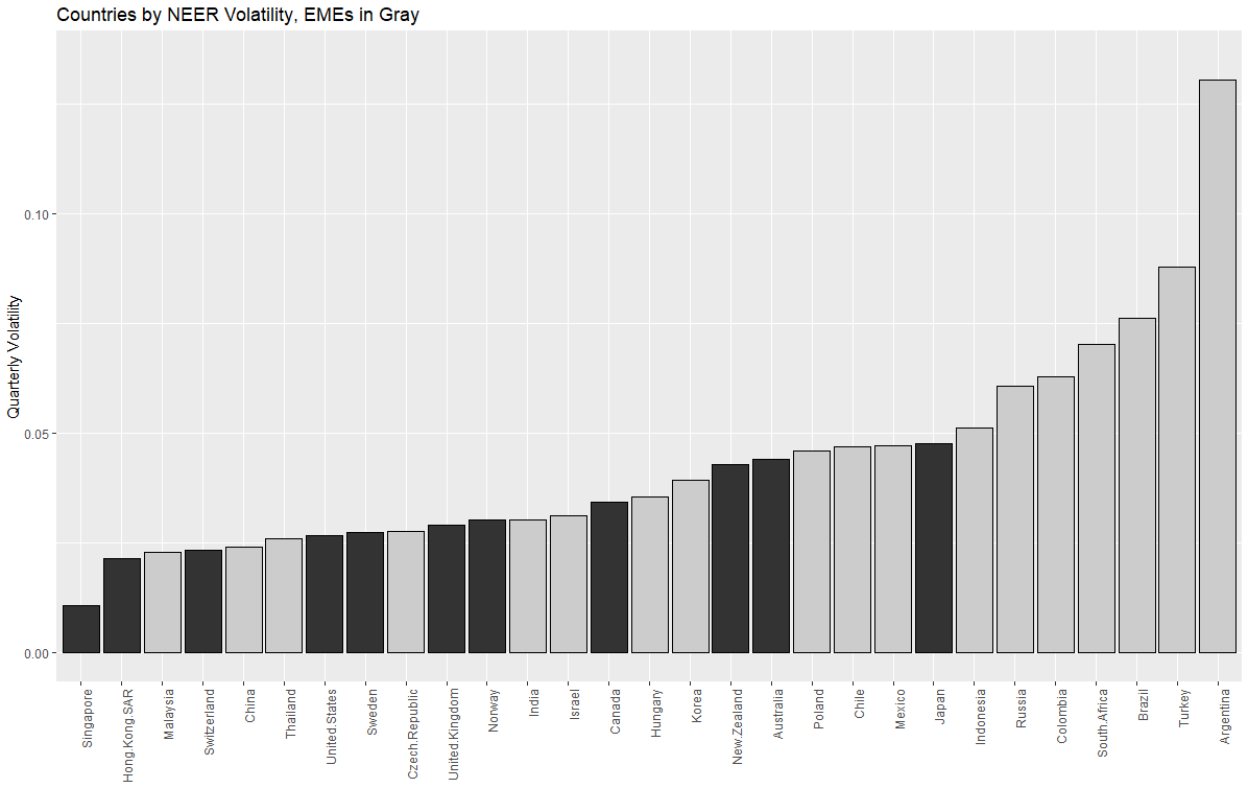
Countries by NEER Volatility, EMEs in Gray
Quarterly Volatility
0.10
0.05
0.00
Singapore
Hong.Kong.SAR
Malaysia
Switzerland
China
Thailand
United.States
Sweden
Czech.Republic
United.Kingdom
Norway
India
Israel
Canada
Hungary
Korea
New.Zealand
Australia
Poland
Chile
Mexico
Japan
Indonesia
Russia
Colombia
South.Africa
Brazil
Turkey
Argentina

Figure 5: Estimates from Table A8 Regressions, DME by Volatility Bin

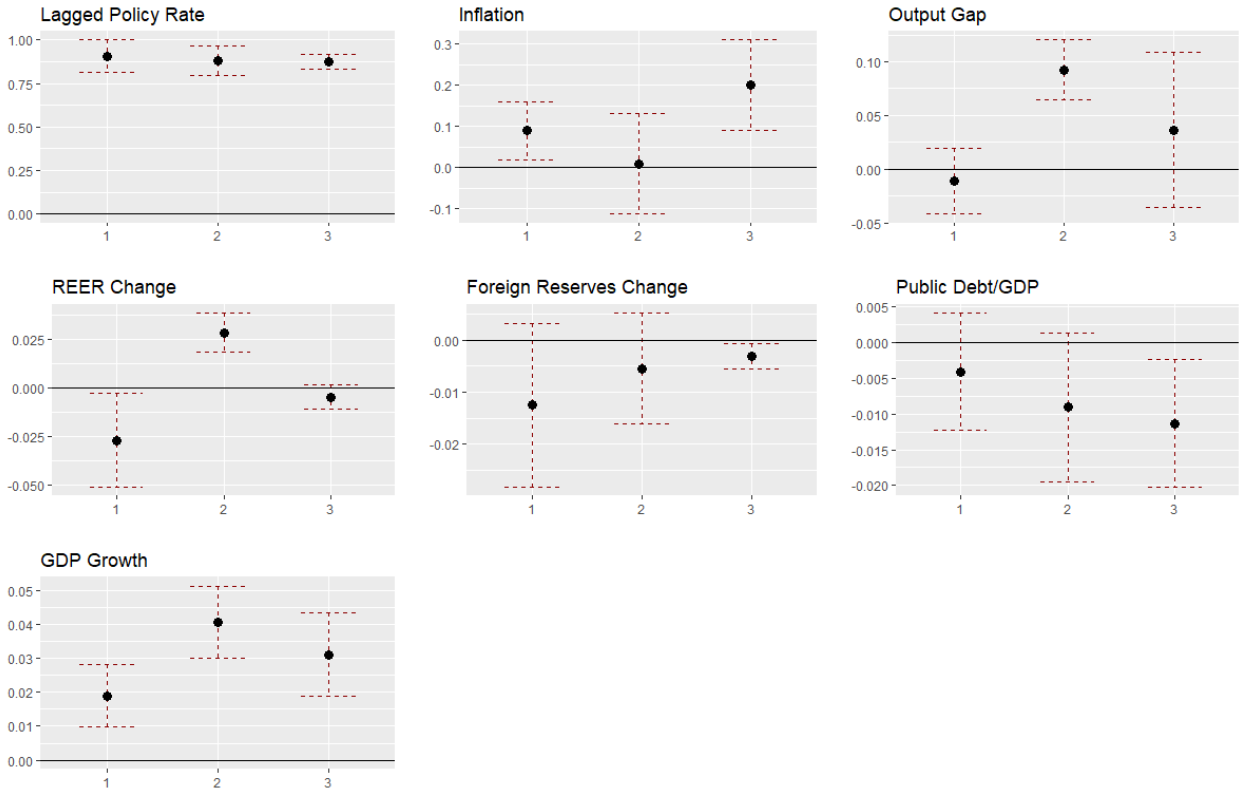

Figure 6: Estimates from Table A9 Regressions, EME by Volatility Bin