
Imperfect Governance and Price Stickiness in Emerging Economies

Document de Travail
Working Paper
2018-17

Zouhair Aït Benhamou



UMR 7235

Economix - UMR7235
Université Paris Nanterre
Bâtiment G - Maurice Allais, 200, Avenue de la République
92001 Nanterre cedex

Email : secretariat@economix.fr

 **Université
Paris Nanterre**

Imperfect Governance and Price Stickiness in Emerging Economies

Zouhair Ait Benhamou*

`m.ait_benhamou@parisnanterre.fr`

EconomiX, UMR 7235 CNRS and University Paris Nanterre †

February 23, 2018

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Abstract

Imperfect governance exacerbates macroeconomic fluctuations in emerging economies. We use strategic interactions between public and private goods to link price stickiness and institutional failure. The government as a provider of public goods exhibits agency in its relationship with households, and that yields to welfare losses for the latter. The government also faces a sub-optimal Laffer curve because of its inability to extract taxes. Imperfect governance also has an impact on terms of trade, as it distorts domestic prices in comparison to those of imported goods.

1 Introduction

Macroeconomic fluctuations in emerging economies have been documented extensively in the literature (See [Schmitt-Grohé & Uribe \(2017\)](#)). There is a wide consensus as to its properties with respect to developed economies and their respective business cycles. In particular, the literature shows that compared to developed economies, emerging countries exhibit a higher degree of volatility in their macroeconomic fluctuations. This is the case in absolute terms for output, as well as the ratio of household consumption to GDP. The literature argues that this excess in macroeconomic fluctuations is driven by trend productivity shocks, but remains evasive as to the effects of nominal rigidities, market imperfections and institutional failures. For instance, [Aguar & Gopinath \(2007\)](#) posit that all these sources of fluctuations can be consolidated into a real productivity shock with a unit root component. This oversight is particularly relevant to government expenditure and the public sector in emerging economies. Most of those exhibit non-negative correlation between output and fiscal policy. This is ascribed in the literature to these economies' political economy, an argument made by [Gavin & Perotti \(1997\)](#). They argue that fiscal policy in Latin America contradicts predictions made by [Barro \(1979\)](#) regarding government expenditure. He posits that purchase

*EconomiX, UPL, Univ Paris Nanterre, CNRS, F92000 Nanterre France

†The author thanks for their comments and remarks Jean-Pierre Allegret, Ludovic Julien and participants at the 2017 IX SIGE workshop, Paris Nanterre University.

of public goods represents a constant fraction of output, and expenditure follows an exogenous path. The government seeks to smooth the business cycle, and as a result will adopt an countercyclical fiscal policy. The Barro hypothesis is contradicted by the positive correlation between output and government expenditure in Latin American economies, and we argue, in other emerging countries as well.

The literature has fallen broadly into three categories in dealing with fiscal policy in a general equilibrium framework: the first is inaugurated by Barro (1979), who formulates a pure Keynesian framework for the role of government, whose size in the economy remains constant over time. This means that when the economy is in recession or at the trough of the business cycle, the public sector increases spending and/or cuts taxes, and *vice-versa* during expansion phases. Fiscal policy in this case is not only countercyclical, but its correlation should be close to unity in absolute terms.

The second strand of the literature does not deviate significantly from the first one, in that it assumes a great deal of exogeneity in government expenditure. As reported in Schmitt-Grohé & Uribe (2004) this literature focuses on the revenue side, as it assumes that government is usually faced with an exogenous stream of expenditure, and thus has to formulate the least distortionary tax framework in order to finance it. We look in particular to Chari, Christiano & Kehoe (1994), whose argument is based on Barro's (1979) and focus on the tax revenue-side of the public sector budget. In their view, an unexpected decline in output calls for an increase in contemporaneous government spending, and increased taxes later on, so that the expected present values of expenditure and revenues remain equal and constant. The focus on tax policy is also observed in Turnovsky (1996), whose model incorporates government expenditure as proportional to wages and household expenditure. This model framework substantially decreases exogeneity in setting public sector purchases, and assumes explicitly that households value public goods in their utility function. Nonetheless, the focus on the tax structure neglects questions as to what the government actually does with its purchases in a small open economy. A more elaborate setting is offered in Schmitt-Grohé & Uribe (2004,2007). Their model introduces a certain degree of price stickiness. This departure from the benchmark neo-classical model creates new topics for fiscal and monetary authorities to deal with, ranging from inflation and price stability, to debt. However, their focus is still on the distortionary effects of taxation on the economy, and government expenditure is still assumed to be exogenous.

The third strand of the literature delves into the political economy of fiscal policy. As mentioned above, Gavin & Perotti (1997) observed that fiscal policy is not countercyclical in emerging economies, and so all the models described above are bound to miss out in their predictions and fail to replicate this specific stylised fact when it comes to emerging countries.

The main theme of this paper reprises the argument laid out by Gavin & Perotti (1997) as well as Alésina, Campante & Tabellini (2008). Namely, institutional failures account for pro-cyclical fiscal policies and beyond that, provide a better understanding of macroeconomic fluctuations in emerging economies. To that effect, we deal with four main topics: first, the stylised fact of pro-cyclical fiscal policy is mainly observed among emerging economies. This points to preferences endogenous to the public sector, and this belies the literature's assumption of government spending as a sequence of exogenous shocks. Second, imperfect governance yields sub-optimal fiscal policy in term of tax revenues. The framework formulated by Trabandt & Uhlig (2013) is

modified in order to account for institutional failures and their impact on the Laffer curve. We argue that the Laffer optimum level is going to be comparatively lower in emerging economies with respect to developed ones, even if the former are below the maximum amount of tax revenues it can raise. Third, institutional imperfections exacerbate the effects of strategic interactions between public and private goods. When consumers value public goods in their utility function, the resulting strategic interaction increases price stickiness, and that accounts for inflation dynamics observed in emerging economies. Fourth, the price stickiness generated by the strategic interaction described above distorts domestic prices. Should the government try to engage in fiscal devaluation, as described in [Farhi, Gopinath & Itskhoki \(2017\)](#), then it is unlikely to achieve the desired result.

The paper is laid out as follows: the first section establishes stylised facts related to government expenditure and fiscal policy in emerging and developed economies. The purpose of this section is to identify features common or specific to emerging economies. The section then moves on to establish the empirical basis for nominal rigidities in emerging economies, and compares their results against those for developed countries. The second section formulates a modified Neo-Keynesian model where households value government expenditure. There is agency between the public sector and consumers, and the resulting level of public goods is a function of the effort put by the government in supplying those. Private firms take into account pricing by public goods providers, and the resulting strategic interaction raises price stickiness. The model shows therefore that regardless of calibrated values for the structural parameters, the main determinant for price stickiness is the strategic interactions between private and public goods. This model introduces the strategic interactions component using an endogenous markup. Price rigidity is such that prices increase after a positive productivity shock, in contradiction to findings in the literature. The third section summarises the results and concludes.

2 Stylised facts

2.1 Public sector dynamics

In this section, we describe the stylised facts of fiscal policy and government expenditure in emerging economies. Although the literature inaugurated by [Gavin & Perotti \(1997\)](#) establishes fiscal pro-cyclicality as a salient feature of macroeconomic fluctuations in emerging economies, the concept itself remains subject to debate, as reported in [Iltzetzki & Vegh \(2008\)](#). We seek in this section to document fiscal pro-cyclicality as exhaustively as possible for a large set of countries, consolidated into regional groups. This preliminary step allows us to achieve two objectives: first, an exhaustive description of common and specific features of public sector dynamics in emerging economies. Second, those stylised facts are then used in order to formulate a micro-founded setting for imperfect governance.

For reasons exhaustively discussed by [Agénor, McDermott & Prasad \(2000\)](#) this subsection will systematically compare emerging economies between themselves and against developed and industrialised countries. To that effect, we build a large sample of countries, and consolidate them into regional groups using the World Bank's World

Development Indicators (WDI) database and its nomenclature. We use available data for 123 countries over a period ranging from 1960 to 2014 or available years within this time period. These macroeconomic variables are then consolidated into their respective regional groups, and we build indicators for fiscal policy and its cyclicality with respect to de-trended output.

We start by looking at the correlation between the cyclical components of government spending and GDP. We supplement the investigations of Frankel, Vegh & Vuletin (2012) with regional groups, and test for statistically significant differences between and across regional groups of emerging economies on the one side, and industrialised economies on the other.

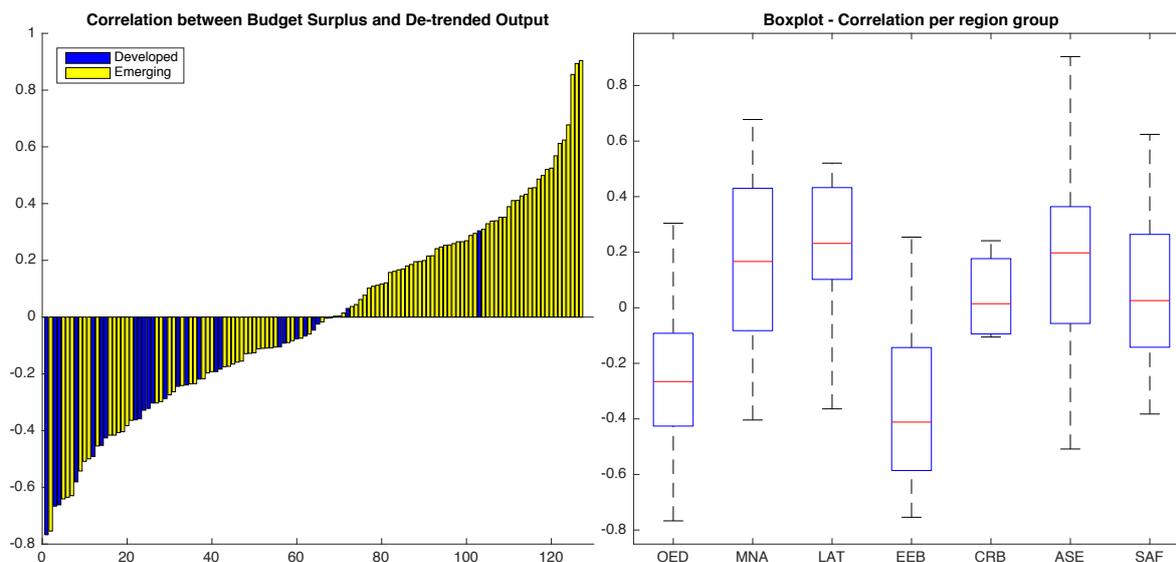


Figure 1: Correlation between de-trended output and lagged primary budget surplus (1960-2014)

Note: OED: OECD. MNA: MENA. LAT: Latin America. EEB: Eastern Europe Balkans. CRB: Caribbeans. ASE: South Asia. SAF: Sub-Sahara Africa.

On the left-hand side, figure 1 ranks correlation levels obtained for lagged primary budget surplus and detrended output, our selected proxy for the output gap. On the right-hand side, the boxplot compares the correlation distribution for each of the seven regional groups that comprise our country sample. We select the lagged primary budget surplus as a more appropriate indicator of fiscal policy, since government budget surpluses (or deficits) do not react to contemporaneous cycle phases.

We can see that although countercyclical fiscal policy is not the sole preserve of developed economies, most, if not all countries that exhibit positive correlation between budget surplus and the output gap are emerging economies¹. These correlation results closely mirror those in Frankel & al. (2012), even as we have used different indicators for fiscal policy correlation with output. The authors have computed the correlation between de-trended output and government expenditure, whereas we have used the

¹Greece is a significant outlier among developed economies with its positive correlation, the effect of the ongoing fiscal austerity regime it endures. Sweden exhibits a small but insignificant positive correlation as well.

lagged budget surplus instead, as it is more in line with the overall investigation of stylised facts. Whatever the level of discretionary spending, government budgets have a lagged response to exogenous shocks, and take time to adjust to swings in the business cycle. This argument is implicit to the model specification proposed in Alésina & al. (2008), where budget surplus is a function of its lagged value and other control variables. In addition, the fact that so many emerging economies show on the countercyclical fiscal policy spectrum in figure 1 is a testament to improved fiscal management and governance reform. Nonetheless, many more still exhibit the tell-tale sign of policy failure with positive correlation between their budget surplus and the output gap.

The boxplot on the right-hand side of figure 1 breaks down fiscal policy correlation in region groups, and fits them in their respective whiskerplots. The figure shows that there is significant heterogeneity among the regional groups of emerging economies. The OECD benchmark group shows a significant negative correlation of -0.275 on average, a similar countercyclical correlation level of observed for the regional group of Eastern Europe and the Balkans. On the other side of the spectrum, Latin America and South Asia exhibit strong positive correlations of 0.191 and 0.207 respectively, a slightly higher average for MENA at 0.149. By contrast, the average correlation level for Sub-Sahara Africa is positive but low at 0.057 which is due to the heterogeneity among the regional group, as shown in the whiskerplot.

The figures reported above show that there are significant differences in fiscal policy and its cyclicity between developed and emerging economies, as well as among the latter. Although pro-cyclical fiscal policy appears to be more prevalent in emerging economies, the correlation level between the budget surplus and de-trended output does not show that there is a causal link between discretionary government spending on the one hand, and procyclical fiscal policy on the other hand. Given the issues related to data availability highlighted by Agénor & al. (2000), we restrict ourselves to a self-contained, tractable model specification.

The baseline for regression is derived from Alésina & al. (2008) and writes the budget surplus S relative to GDP as a function of its lagged value, the output gap \tilde{o} and a vector of controls X described in details below. The baseline specification writes:

$$S_t = \rho S_{t-1} + \beta \tilde{o}_t + X' \delta + \epsilon_t \quad (1)$$

The component relevant to our investigation of stylised facts is the estimated value for β and its economic interpretation of its sign. If $\hat{\beta} > 0$ then the fiscal policy is countercyclical, since the government increases its deficit when output dips below its potential level, *i.e.* when the output gap is negative. Conversely, if $\hat{\beta} < 0$ the fiscal policy is pro-cyclical. We offer five specifications for equation (1), and these are described below:

$$S_t = \rho S_{t-1} + \beta \tilde{o}_t + \alpha_0 + \epsilon_t \quad (2)$$

$$S_t = \rho S_{t-1} + \beta \tilde{o}_t + \alpha_1 D_t + \alpha_0 + \epsilon_t \quad (3)$$

$$S_t = \rho S_{t-1} + \beta \tilde{o}_t + \alpha_1 D_t + \alpha_2 X R_t + \alpha_0 + \epsilon_t \quad (4)$$

$$S_t = \rho S_{t-1} + \beta \tilde{o}_t + \alpha_1 D_t + \alpha_2 X R_t + \alpha_3 N R_t + \alpha_0 + \epsilon_t \quad (5)$$

$$S_t = \rho S_{t-1} + \beta \tilde{o}_t + \alpha_1 D_t + \alpha_2 X R_t + \alpha_3 N R_t + \delta_0 \mathbb{I}_{\tilde{o}_t} + \alpha_0 + \epsilon_t \quad (6)$$

The control variables are incorporated gradually, and are seek to capture various effects

that may account for fiscal pro-cyclicality other than imperfect governance. These control variables are listed as follows:

- D_t denotes public debt as a percentage of GDP. This variable is a proxy measure for fiscal management soundness. It is assumed that a government with a high debt-to-GDP ratio relies excessively on debt to finance its expenditure, a sign of fiscal profligacy and mismanagement. The higher the reported debt ratio, the more likely the government is to engage in discretionary, and thus pro-cyclical fiscal policy.
- XR_t are logged total reserves in current dollars. Following Alésina & al. (2008) it is a measure of financing constraints faced by emerging economies, and provides an alternative explanation to pro-cyclical fiscal policy other than political economy. Following Kaminsky, Reinhart, & Vègh (2005) governments in emerging economies may engage in pro-cyclical fiscal policy because of global capital flows. In particular, these tend to increase (decrease) public spending in periods of capital inflows (outflows), which exacerbates macroeconomic fluctuations.
- NR_t are natural resources rents as a percentage of GDP, and controls for the natural resources curse effect, as described in Frankel (2012). Governments in resource-rich economies may come under political pressure to share proceeds during commodity booms, and tighten their fiscal policy when receipts from their commodities decline when global prices plummet.
- $\mathbb{I}_{\hat{o}t}$ is a dummy variable equal to 1 when the output gap is negative, and null otherwise. It is supposed to filter out the countercyclical effect in the budget surplus. It is sensible to assume that government budgets are not symmetrical to booms and recessions in the business cycle. Indeed, if fiscal policy is truly pro-cyclical, then the estimated β coefficient should be positive. If not, it should be either negative, non-significant or a lower estimated in comparison to previous specifications.

Results for the other regional groups are broadly in line with the assumption that emerging economies experience pro-cyclical fiscal policy effects. The Latin American regional group mirrors the results for the OECD benchmark group, the estimated β is negative and robust to all specifications apart from (5). Eastern Europe and the Balkans also experience significant pro-cyclical fiscal policy, although the estimated coefficient declines significantly for specification (4) which captures the natural resources effect. MENA experiences a comparatively smaller estimated value for β , although it is quite sensitive to the dummy variable as well as the effect of natural resources on public finances. Results for Sub-Sahara Africa are not as consistent however, as shown in the changes in the sign of the estimated coefficient β and its values.

The results are broadly consistent for the OECD regional group, Specifications (1) to (4) are close to those in Alésina & al. (2008). We report close average and median estimate for $\hat{\beta}$ and of positive value. This suggests that counter-cyclical fiscal policy is quite common in the OECD regional group, and there are very few outliers in this sub-sample. The coefficients for all specifications are positive, which means that this specification is robust to all control variables except for specification (5). The dummy

variable controlling for true counter-cyclical fiscal policy generates the expected effect and does not contradict the general result for the OECD overall.

Estimated coefficients for emerging economies are however quite heterogeneous, although most of them report a negative estimated value for β , thus suggesting that their fiscal policies are pro-cyclical. The fact that the coefficients are less robust to each specification also suggests that the controlling variables added gradually to the benchmark equation do have an impact on fiscal policy in emerging economies.

Table 1 below reports the estimated results for β for all five specifications, as well as summary statistics. The specifications offered in equation (2) through (6) test for the robustness of our estimated coefficient for fiscal policy cyclical, and is therefore the only value reported on the table below:

Table 1: Estimated values for β in equation (1): Regional breakdown.

Region	(1)	(2)	(3)	(4)	(5)
Sub-Sahara Africa					
Average β	-0.092	-0.163	-0.167	-0.130	-0.037
Median β	-0.132	-0.153	-0.182	-0.118	0.103
Average R^2	34,00%	43,60%	45,30%	44,90%	45,20%
South Asia					
	-0.044	-0.007	-0.014	-0.179	-0.116
	-0.119	-0.125	-0.114	-0.171	-0.250
	40.40%	43,60%	46,00%	48,00%	48,00%
Caribbean					
	0.001	-0.114	-0.124	-0.088	0.147
	0.061	-0.063	-0.061	0.010	0.198
	35,80%	53,00%	53,20%	57,30%	57,90%
E.Europe & Balkans					
	-0.298	-0.284	-0.251	-0.129	-0.243
	-0.191	-0.177	-0.176	-0.115	-0.172
	43,10%	51,30%	54,50%	56,30%	56,70%
Latin America					
	-0.221	-0.280	-0.262	-0.204	-0.038
	-0.267	-0.352	-0.348	-0.221	-0.146
	26,90%	33,90%	34,50%	35,90%	36,00%
MENA					
	-0.014	-0.064	-0.073	-0.096	-0.169
	-0.045	-0.045	-0.048	-0.206	-0.208
	31,20%	34,50%	35,90%	38,60%	38,20%
OECD					
	0.318	0.259	0.252	0.243	0.112
	0.250	0.228	0.237	0.235	0.174
	49,70%	58,80%	59,90%	60.50%	60.70%
Average R^2	38,20%	46,00%	47,60%	48,70%	48,90%

Note: Reported estimated coefficients are regional averages and medians.

Given the heterogeneity reported for emerging economies, we seek to check if the estimated coefficients for these country groups are indeed statistically different from those reported for the OECD benchmark. To that effect, we carry out an ANOVA regression using the OECD category as the benchmark regional group. The coefficients for each category are tested for statistical differences. The ANOVA results are reported on the table below:

Table 2: ANOVA Regression results: OECD as base region group.

Region	(1)	(2)	(3)	(4)	(5)
MENA	-0,332** (0,162)	-0,323** (0,156)	-0,325** (0,158)	-0,338** (0,161)	-0,281* (0,166)
Latin America	-0,499*** (0,126)	-0,508*** (0,121)	-0,489*** (0,123)	-0,426*** (0,125)	-0,117 (0,129)
E.Europe & Balkans	-0,616*** (0,138)	-0,543*** (0,133)	-0,503*** (0,135)	-0,372*** (0,137)	-0,356** (0,142)
South Asia	-0,362*** (0,134)	-0,266** (0,128)	-0,266** (0,131)	-0,422*** (0,133)	-0,228* (0,137)
Sub-Sahara Africa	-0,410*** (0,116)	-0,422*** (0,111)	-0,419*** (0,113)	-0,373*** (0,115)	-0,150 (0,118)
Intercept	0,318*** (0,085)	0,259*** (0,082)	0,252*** (0,083)	0,243*** (0,085)	0,112 (0,087)
N	123	123	123	123	123
R^2	18,14%	18,32%	16,47%	12,77%	6,27%
Adjusted R^2	14,64%	14,83%	12,91%	9,04%	2,27%
RMSE	0,436	0,418	0,426	0,433	0,446
RSS	22,222	20,446	21,201	21,903	23,229
Fisher	5,184	5,249	4,616	3,426	1,566
Log-Likelihood	-69,296	-64,173	-66,405	-68,407	-72,022

Note: Estimated coefficients are reported with standard errors in parentheses.

Legend p-value: * 10% 5%** 1%***

Specifications (1) to (4) yield substantial and robust results for all regional groups, which suggests that there are stark differences in terms of fiscal policy between emerging and developed economies. The differences between each regional group and the OECD benchmark is robust across specifications, which means that the fiscal policy effect is adequately captured by the specification offered in equation (1). Specification (5) offers fewer statistically significant results, which is expected given the fact that the dummy variable introduced to account for countercyclical fiscal policy substantially affects the estimated coefficient $\hat{\beta}$. Nonetheless, MENA, Eastern Europe & the Balkans and South Asia appear to exhibit statistically significant negative estimations for β , since the estimate for the OECD benchmark group is not different from zero.

The results described above fall broadly in line with those in Alésina & al. (2008) and Frankel, & al. (2012). Emerging economies do experience pro-cyclical fiscal policies, even when controlling for variables such as fiscal management, foreign currency

reserves and natural resources. This means that the β parameter does capture adequately pro-cyclicality in fiscal policies as far as emerging economies go. The only controlling variable that significantly weakens the estimated value for the parameter is the dummy variable that accounts for episodes when the output gap is negative. Even so, pro-cyclical fiscal policy remains a hallmark of government dynamics in emerging economies.

We look at the particulars of government expenditure in developed and emerging economies. Public sector purchases are bound to be different across developed and emerging economies, and may contradict the assumption in the literature that government expenditure is a stream of exogenous shocks. We compare the autocorrelation functions (ACFs) of each regional group with the OECD benchmark for growth in government expenditure as well as its de-trended value.

Figure 2 below reports computed ACFs for individual countries, and consolidated into regional groups. The boxplots report the distribution of each autocorrelation order.

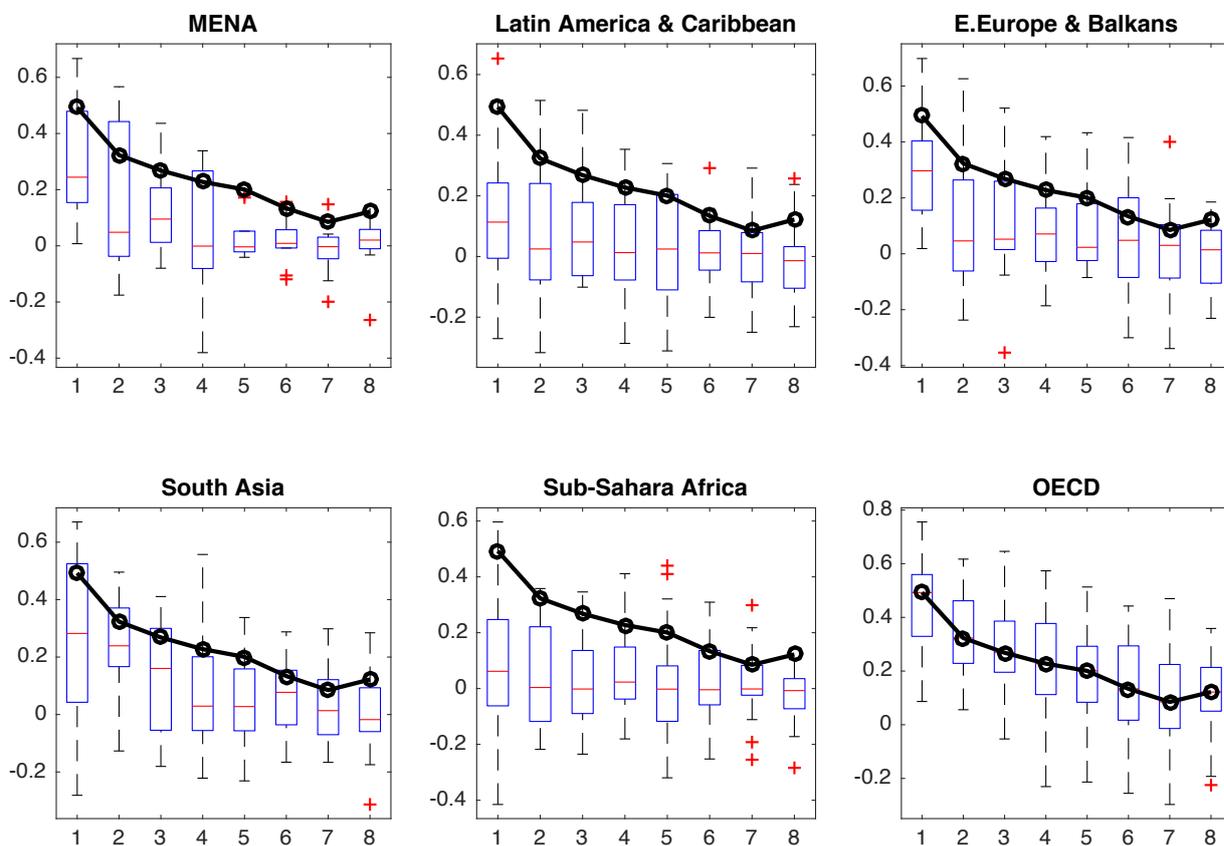


Figure 2: ACFs government expenditure (annual growth) 1960-2014

Growth in government expenditure is quite persistent for the OECD benchmark group, and starts at 0.492 for the first order, and then gradually declines to the 6th order. By contrast, the ACF for each regional group is substantially lower, and suggests that government expenditure growth rates are uncorrelated in emerging economies. This lends credence to the literature's assumption that government expenditure is wholly exogenous. The literature's use of de-trended government expenditure should

be taken into consideration however, and the same ACF computation is carried out for the de-trended aggregate. Figure 3 shows the ACF for each regional group compared against that of the OECD benchmark category.

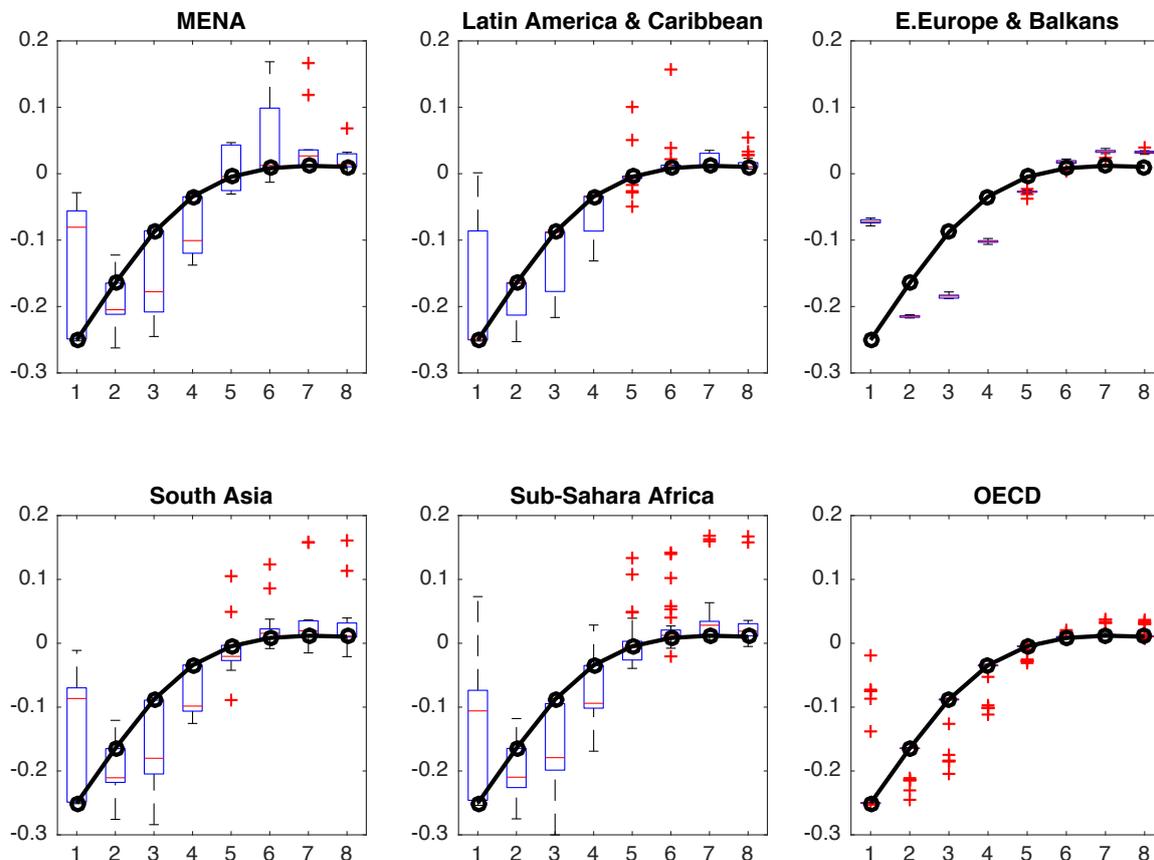


Figure 3: ACFs government expenditure (de-trended) 1960-2014

median ACF for the OECD region group exhibits similar patterns, with a gradual
 5 decline in autocorrelation, moving up from -0.250 in the first order to -0.034 in the
 fourth. Although such a stable behaviour is not always observed in other regional
 groups, the discrepancies between the OECD benchmark and the distribution of ACFs
 in emerging economies are not large, apart for the Eastern Europe & Balkans. It can be
 reasonably inferred that de-trended government expenditure exhibits similar patterns
 10 across regional groups.

To sum up, we have established relevant stylised facts that are subject to consensus
 in the literature, and formulated others that give added nuances to it. A positive
 correlation between lagged budget surplus and the output gap is mostly observed among
 emerging economies, although many of those exhibit counter-cyclical fiscal policy with
 15 a negative correlation. We then formulate a specification similar to the one put forward
 in *Alésina & al (2008)* in order to test for the robustness of a parameter capturing the
 cyclicity of fiscal policy. When controlled for, the selected indicator for fiscal policy
 cyclicity is statistically robust, and is only weakly affected when specific episodes
 of output drop below its potential level are flagged. Finally, government expenditure
 20 fluctuates only marginally more in emerging economies than developed ones.

For reasons discussed above, we have selected the budget surplus as the appropriate indicator of fiscal policy. We now turn to the dynamics of tax policy in emerging *versus* developed economies using the Laffer curve effect: how much tax revenue can a government extract before a marginal increase in the tax rate starts yielding decreasing revenues? If so, would the maximum tax rate be influenced by quality of governance?

2.2 Laffer curve effects

The sub-section below deals also with public sector dynamics, and focuses on the revenue side by looking at the Laffer curve of emerging economies, and compare it against that of developed countries.

Table 3: Tax rates, structure and revenues (1961-2015)

Region	Labour	Profits	VAT	Capital	Total	Revenues
Sub-Sahara Africa						
Average	13,63	17,83	8,38	22,15	55,97	14,76
Std.err.	(9,48)	(8,39)	(4,05)	(10,08)	(48,74)	(8,28)
Median	11,30	18,37	8,96	19,47	43,15	14,22
South Asia						
	10,66	16,09	8,61	22,49	37,98	12,72
	(7,47)	(6,48)	(5,88)	(13,34)	(16,01)	(4,58)
	10,33	17,53	7,34	19,60	33,78	12,6
Caribbean						
	12,92	21,42	9,20	33,28	38,66	22,48
	(4,55)	(1,19)	(3,16)	(10,9)	(5,28)	(5,98)
	12,79	21,43	9,02	33,00	37,28	25,09
E.Europe & Balkans						
	27,49	9,84	16,24	12,70	41,98	19,19
	(10,49)	(4,52)	(8,41)	(4,68)	(9,61)	(9,79)
	27,03	8,60	14,68	12,91	43,50	16,77
Latin America						
	16,66	17,31	8,77	22,45	53,01	13,93
	(8,05)	(8,63)	(2,74)	(11,13)	(22,03)	(2,78)
	17,6	19,85	8,83	20,62	46,47	13,8
MENA						
	19,08	12,25	7,39	22,38	39,85	15,50
	(6,94)	(9,25)	(5,59)	(16,79)	(21,01)	(10,74)
	19,3	14,47	6,29	21,06	44,15	16,93
OECD						
	22,71	15,49	9,8	31,41	41,95	19,74
	(13,72)	(7,25)	(4,32)	(12,86)	(12,75)	(6,32)
	19,68	15,37	11,03	29,42	42,14	20,9

Note: Figures for labour, profits, VAT and capital gains taxes: % of taxed income. Total tax rate: % of commercial profits. Tax revenues: % GDP.

Table 3 above reports the summary statistics of tax revenues for the seven regional groups of our country sample. Table 3 shows that there is significant heterogeneity to the tax structure in each regional group. This suggest that the Laffer Curve as known and applied to developed economies may not be relevant to emerging economies. The figure also shows the quadratic fit to both sub-groups. As reported in Mankiw & Weinzierl (2006) there are two extremes to the economic analysis of tax policy impact evaluation: on the one hand, static scoring assumes that there is no feedback effect from taxes on output and other macroeconomic aggregates. On the other hand, the pure Laffer effect assumes that tax cuts can pay for themselves thanks to the excess economic growth they generate. The authors then use a neo-classical growth model in order to evaluate the dynamic effects of a tax cut on revenues, and how much subsequent growth pays for them.

The purpose of this sub-section is slightly different, in the sense that it looks as the Laffer curve extremum tax rate for each regional group, and compares it against the OECD benchmark. Figure 4 below plots total taxes as a percentage of commercial profits against tax revenues in terms of GDP for all emerging economies in our sample, as well as the OECD group benchmark. The Laffer curve built out of the quadratic fit from tax rates and tax revenues assumes that the latter is pro-cyclical to output, but has decreasing returns as the tax rate reaches its optimum. The quadratic explanatory variable captures the returns of a marginal increase in the tax rate. The fitted equation writes:

$$T_i = \alpha_0 + \alpha_1 T(Y_i) + \alpha_2 T(Y_i)^2 \quad (7)$$

The plotted quadratic regression for the OECD sub-sample replicates the expected bell shape and corresponding optimal tax rate. The expected optimal tax rate is around 18% of commercial profits, which yields a maximum of 56% of taxes as a percentage of GDP. The quadratic fit does not yield the same bell-shaped curve as far as emerging economies are concerned, as shown on figure 4. There are many ways to account for this result, most of them related to the dynamics of the underground economy. The literature has documented exhaustively the size and importance of the underground economy, which eludes fiscal authorities, yet contribute to create goods and services. Schneider & Enste (2000) argue that individuals may be compelled to join the shadow economy when they feel the tax burden is too high, or that the expected public goods in return are not worth it. This combination of high-taxation environment and poor governance is underlined in Torgler & Schneider (2009), as well as Talvi & Vegh (2005) who show that frequent changes in the tax base can lead the government to engage in pro-cyclical fiscal policy. The Laffer curve seemingly does not apply to emerging economies, as shown by figure 4. It is therefore sensible to assume that it does not materialise because the tax base is too volatile to extract any meaningful tax-smoothing policy predictions. In addition, a growing underground economy posts distorted indicators for the legitimate sector. Data-based public policies may therefore run into an unanticipated set of outcomes, thus making matters worse for legitimate economic activities, and more profitable for the shadow economy. Finally, there is a feedback effect on the legitimate sector, since a substantial share of income generated by the shadow economy is ploughed back into legitimate structures.

Setting aside for a moment the legitimate aspect of the dynamics between the un-

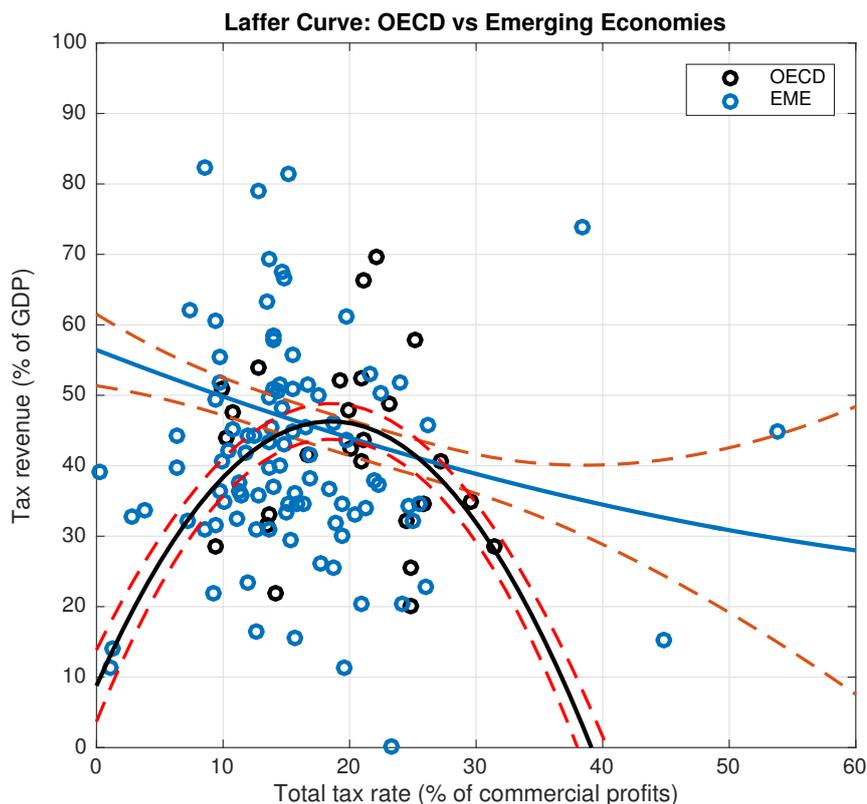


Figure 4: Laffer curve Total tax rate vs fiscal revenues: OECD (**black**) vs Emerging Economies (**blue**) (1961-2015)

derground economy and tax policy, we disentangle the various tax rates and relevant bases in order to extract meaningful Laffer curve-effects. In particular, fitting the overall tax rate to tax revenues belies the intrinsic differences in tax structures across countries. This is not particular to emerging economies, as there are significant differences between European economies and the United States, as documented by [Trabandt & Uhlig \(2013\)](#). Differences across emerging economies in terms of tax structure can be accounted for with factor allocation, a critical aspect of economic growth in those countries as documented by [Poirson \(2000\)](#). More recently, [Gourinchas & Jeanne \(2013\)](#) extend this analysis to capital flows and the puzzle they represent. The differences in factor allocation across countries means that the tax base is bound to be different for governments to extract their taxes. Accordingly, lumping tax revenues altogether under one heading for an aggregate tax rate makes little sense, and may account for the counter-intuitive results reported above. The Laffer curve should therefore be built for various macroeconomic aggregates instead of the overall level of taxation and revenues it yields in the economy.

As reported in [Chari, Christiano & Kehoe \(1994\)](#) capital is highly sensitive to tax rates, and as such, the Laffer curve is likely to yield its expected relationship between tax rates and revenues. To that effect, we use the advertised corporate tax rate and compare it against tax revenues and their share in corporate profits.

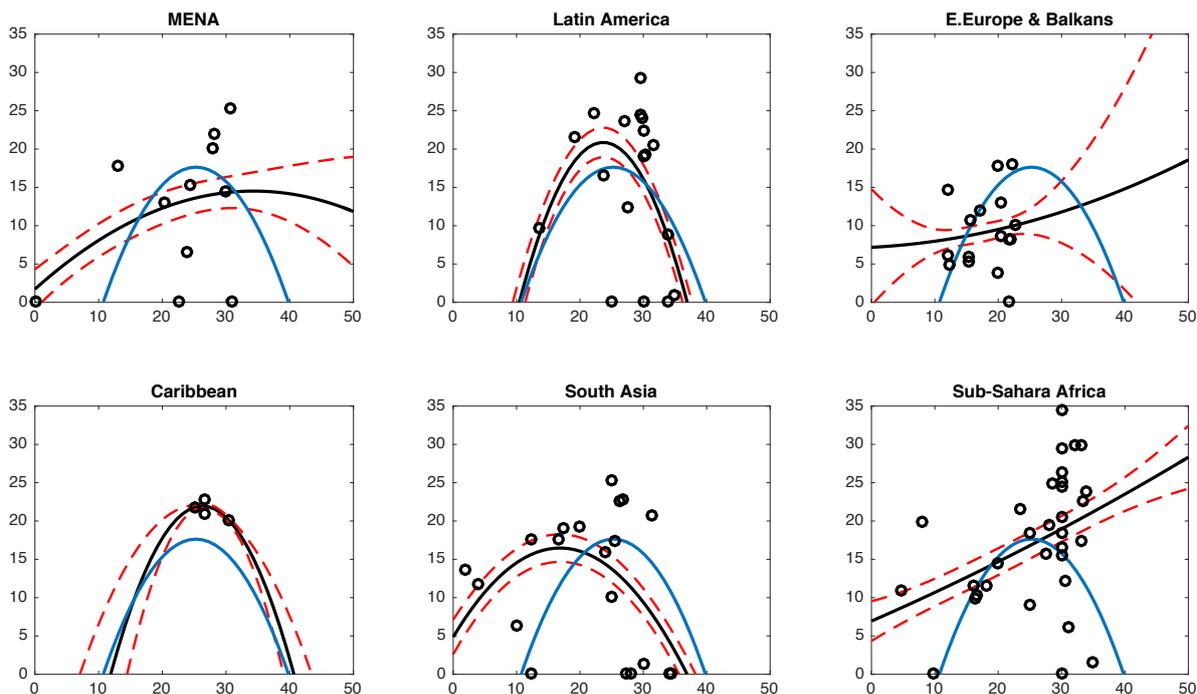


Figure 5: Advertised corporate tax rate vs revenues from commercial profits : OECD (blue) vs Emerging Economies (black) (1961-2015)

The Laffer effect is readily observable for many regional groups. The maximum advertised corporate rate for the OECD group is around 25% and yields tax revenues of about 17.6% of commercial profits. MENA and South-Asia both exhibit the bell shape for corporate taxes and revenues, and their optima are below that of the OECD benchmark group. Their respective optimal rates are 34.3% and 17.1% with yields in commercial profits of 14.5% and 17.1%, respectively. That is not the case however for countries in Latin America, where the optimum is slightly above that of OECD economies, and the same can be said with respect to countries in the Caribbean: their respective optimal corporate rates are at 23.2% and 26.2%, and their yields in commercial profits are 20.8% and 22%, respectively.

Other regions however, such as Eastern Europe & the Balkans as well as Sub-Sahara Africa, did not exhibit the expected bell-shaped quadratic curve. This suggests that the quadratic fit is unable to verify the Laffer maximum tax level. We account for these contradictory results with region-specific factors that influence capital accumulation, such as differences in initial capital stocks, inefficiencies in the tax structure, and the importance of the underground economy. Nevertheless, stylised facts can be obtained by computing the explicit impact of the corporate rate on the capital stock. To that effect, we strip the capital steady-state value in [Trabandt & Uhlig \(2013\)](#) to its most basic expression, which writes:

$$\bar{K} = \bar{N} \left(\frac{(1 - \tau^k) \alpha \beta \bar{Z}}{1 - \beta + \beta \delta} \right)^{1/(1-\alpha)} \quad (8)$$

Where β , α , δ and τ^k refer respectively to the discount factor, capital share of production, depreciation and its tax rate. \bar{Z} , \bar{N} and \bar{K} refer to the steady states of

productivity, labour and the capital stock, respectively. The expression in equation (8) is extracted from the Euler equation at the steady-state, and marginal returns from capital are re-arranged to express capital as a function of labour, structural parameters and the steady-state capital tax. The steady-state capital stock is then computed for our country sample, and the regional median is reported against that of the OECD benchmark group in the figure below:

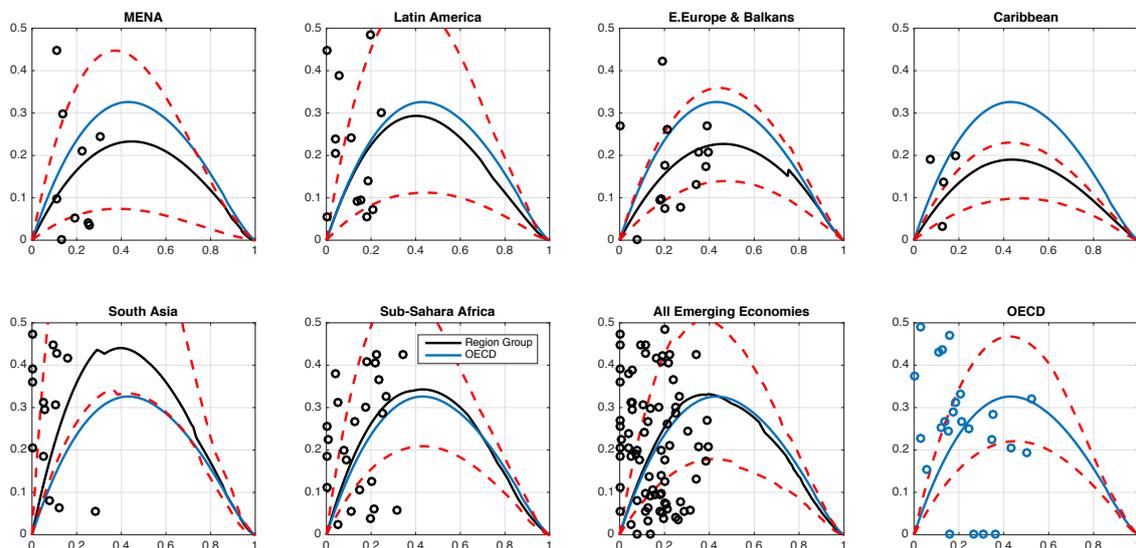


Figure 6: Median capital tax rates and the Laffer curve at the steady-state: OECD (blue) vs Emerging Economies (black) (1961-2015). Dashed red lines represent the 25th and 75th percentiles for the region group Laffer curves.

In figure 6, the steady-state capital stock yields results more in line with the predictions of the Laffer curve. We also observe that excluding the South Asia sample, all emerging economies exhibit a lower maximum for the capital tax rate and its revenues. We also observe that most, if not all emerging economies are to the left of the Laffer curve, meaning that they have not reached their maximum rate. By contrast, a few of the OECD sample are either at, or beyond the maximum rate, as shown on the graph plot to the bottom right. The discrepancies between emerging and developed economies suggest there are factors at play, other than relative scarcity of capital stock. In particular, regional groups like MENA and Sub-Saharan Africa exhibit a relatively higher taxation peak because of the many resource-rich countries incorporated in the sample. Similarly, countries in South Asia exhibit higher tax revenues that can be ascribed to a well-developed financial market in comparison to other emerging economies.

The converse is readily demonstrated with the Laffer curve for labour taxes. The steady-state for labour is computed with its tax wedge and writes:

$$\bar{C}^\sigma \bar{N}^\varphi = \frac{1 - \tau^w}{1 + \tau^c} \bar{W} \quad (9)$$

All countries in the data sample are calibrated for their respective parameters. In this case σ represents inter-temporal elasticity of substitution, and φ labour supply elasticity to wages. Equation (9) sets the marginal rate of substitution between labour and consumption equal to wages, which are treated as the marginal productivity of

labour. The ratio of consumption and income taxes is the tax wedge, which introduces distortion on the labour market, and on households' labour supply schedule. This equation is then plotted for each regional group and compared against the OECD benchmark in figure 7 below:

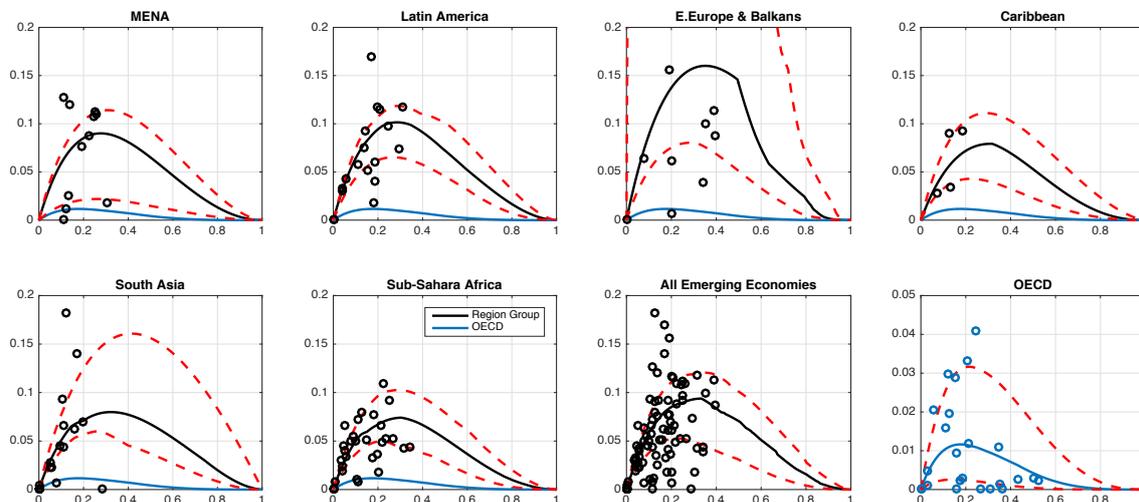


Figure 7: Median labour tax rates and the Laffer curve at the steady-state: OECD (blue) vs Emerging Economies (black) (1961-2015). Dashed red lines represent the 25th and 75th percentiles for the region group Laffer curves.

5 Figure 7 shows that the Laffer curve is higher for all regional groups compared to the OECD benchmark. It is worth pointing out too that most emerging economies extract higher taxes on labour, another influence of imperfect governance on fiscal policy. Although all emerging economies are to the left-hand side of the maximum tax rate, the effective tax revenue from labour is significantly higher than the regional median, which means that labour is over-taxed. Indeed, there are many emerging economies that appear to set their long-run tax rates past beyond their Laffer-based maximum rate. This is not exclusive to emerging economies, as many countries in the OECD sample also appear to set their taxes beyond the maximum point as well.

15 The stylised facts discussed above offer the empirical basis for choices made in formulating our model. We have shown that although many emerging economies have introduced sound fiscal management policies, pro-cyclicality remains a hallmark of fiscal policy in emerging economies. Government expenditure is not significantly different in its persistent over time between emerging and developed economies. Taxes exhibit a stronger distortionary effect in the former, as shown by the two Laffer curves built for labour and capital taxes, as well as their respective revenues. These results put an emphasis on imperfect governance as a rationale for governments in emerging economies to engage in pro-cyclical fiscal policies. The distortions introduced by the tax structure are amplified due to the endogenous preferences of the public sector. In addition, the strategic interactions between public and private goods raise price stickiness, and may therefore account for high and persistent inflation in emerging economies.

2.3 Price stickiness and empirical evidence of strategic interactions

The previous sub-sections have laid out the empirical evidence of procyclical fiscal policies in most emerging economies. In addition to those properties, emerging economies also exhibit higher levels of inflation compared to developed countries. The reasons behind it are multifarious, as reported in Agénor & Montiel (2015). Although the literature appears to focus on the inflation tax as a main channel for inflation-induced fiscal policy, we turn our attention instead to strategic interactions between private and public sectors, and the effects public goods have on private prices.

We first start by comparing the dynamics of inflation, measured with the GDP deflator across the regional groups of our country sample. We interpret their respective properties with respect to the OECD benchmark group. The figure below depicts median GDP deflator inflation in all six regional groups compared against OECD.

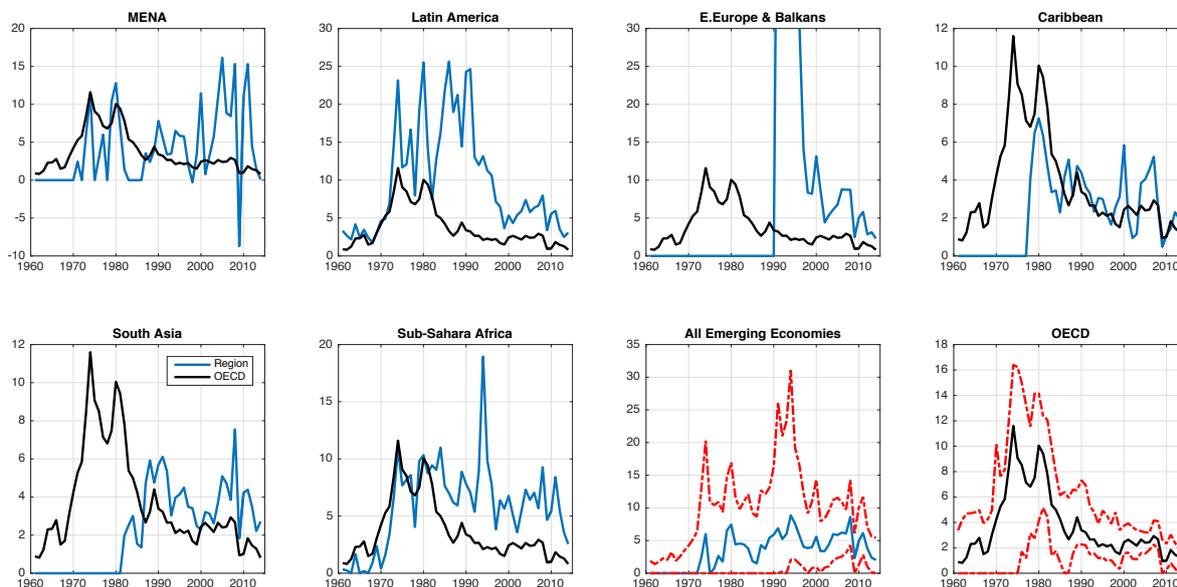


Figure 8: Median GDP deflator, 1961-2014. Median regional group (blue) versus OECD median (black). Dashed red lines represent the 25th and 75th percentiles for EME and OECD regional groups.

Figure 8 above shows that there has been a great deal of convergence in inflation rates among the OECD regional group, as shown by the tightening distance between the 25th and 75 percentiles, particularly with the mid-to-late 1980s, when the great moderation sets in. One can observe the twin effects of a downward trend in the median OECD inflation as well as a convergence of country-level inflation around the regional median. This convergence is not observed among all emerging economies however, even if median inflation remains relatively stable around 5% *per annum*.

Latin America, Sub-Sahara Africa and MENA regional groups all share higher inflation levels compared to the OECD benchmark. There are significant differences as to each regional median persistence: inflation in Latin American economies is quite persistent when compared against MENA and Sub-Sahara Africa, as the graph shows

for the period 1970-1990. MENA regional group exhibits a great deal of volatility during the early 2000s, a testament to the sensitivity of oil-producing countries in the regional sample to commodities global prices. South Asia and the Caribbean tend to exhibit comparatively lower levels of median inflation, and are closer to mirror the downward trend in OECD median inflation. Finally, countries in Eastern Europe and the Balkans experienced high levels of inflation during the early 1990s after the collapse of the Eastern Bloc. The median deflator quickly converges to OECD levels by the late 1990s to early 2000.

Overall, each regional group in the emerging economies sub-sample experienced its own specific episodes of high, persistent or volatile inflation. The highly heterogenous properties of GDP deflator inflation across regional groups suggest that there are no clear patterns upon which stylised facts can be gathered and described. Nonetheless, staying away from time- and country-specific historical episodes and focusing on statistical moments allows us to sort out common and specific stylised facts in emerging economies, compared against developed ones. In particular, we look at the persistence of GDP deflator inflation, using the autocorrelation function (ACF) as we did in the previous sub-section. Figure 9 below reports the ACF boxplots for each regional group.

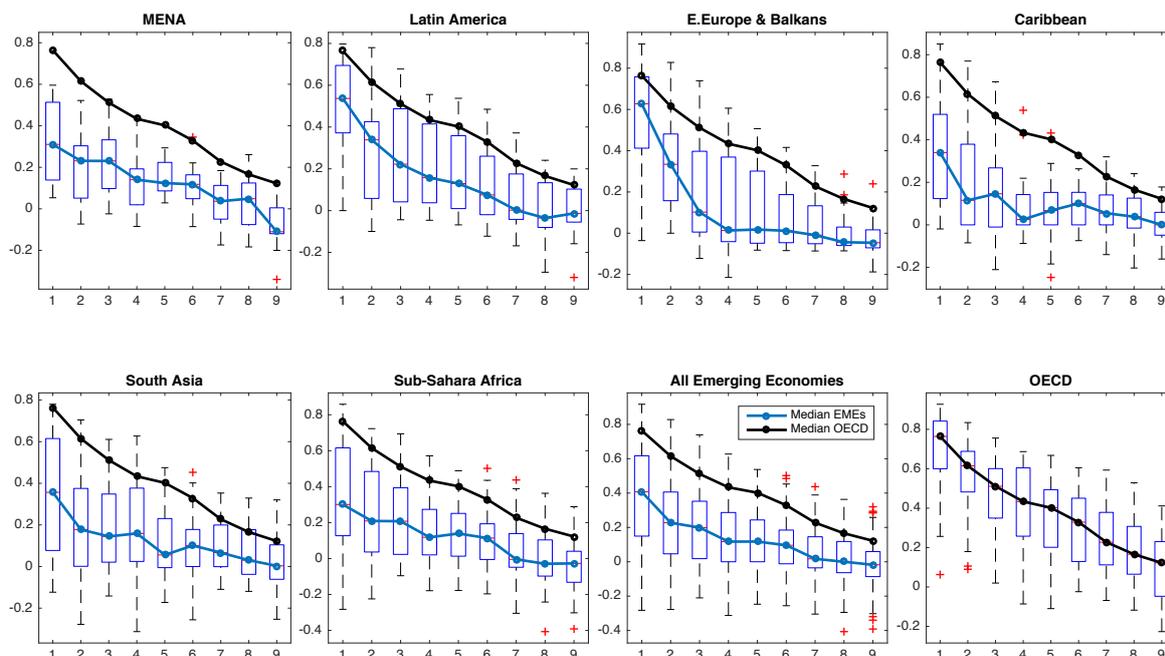


Figure 9: Median GDP deflator autocorrelation functions - 1961-2014. Median regional group (blue) versus OECD median (black).

The graph shows that inflation is most persistent among the OECD regional group, when first compared against the whole EME sub-sample, and against regional groups. It starts off at a comparatively higher level of first-order autocorrelation of .764, and then slowly declines to .227 by the seventh period. By contrast, the median EME at the first order is at .407, and reaches a similar level of .227 by the second period, thus showing that inflation is significantly less persistent in emerging economies compared to developed ones.

Differences in persistence can also be reported for regional groups: in Latin America, inflation ACF declines at more or less the same rate as the OECD benchmark. First-order autocorrelation starts at .536 and then declines to .222 by the third period. In comparison, inflation in Eastern Europe & the Balkans exhibits strong first-order autocorrelation at .627, closer than all other emerging economies to the OECD autocorrelation level, by then quickly declines to zero by the third period. The Caribbean, South Asia and Sub-Sahara Africa all share low levels of autocorrelation at the first order, and a quick convergence to zero. One can therefore conclude that prices are significantly less persistent in emerging economies than developed ones, with prices marginally more persistent in Latin America and Eastern Europe & Balkans. The rest of emerging economies exhibit low correlation levels, and inflation converges to zero fairly quickly, usually by the third or fourth period.

Persistence in the GDP deflator inflation rate does not mean that prices are stickier in the OECD benchmark regional group than in emerging economies. We reprise the definition given by [Blinder \(1994\)](#), where price stickiness is defined by the absence of equiproportionate and immediate price adjustment following an exogenous change in money supply. [Gali \(2008\)](#) concurs by stating that money non-neutrality is indeed a consequence of nominal rigidities. In other words, if prices do not adjust one-to-one with changes in the nominal interest rate, then money is not neutral, and prices are sticky.

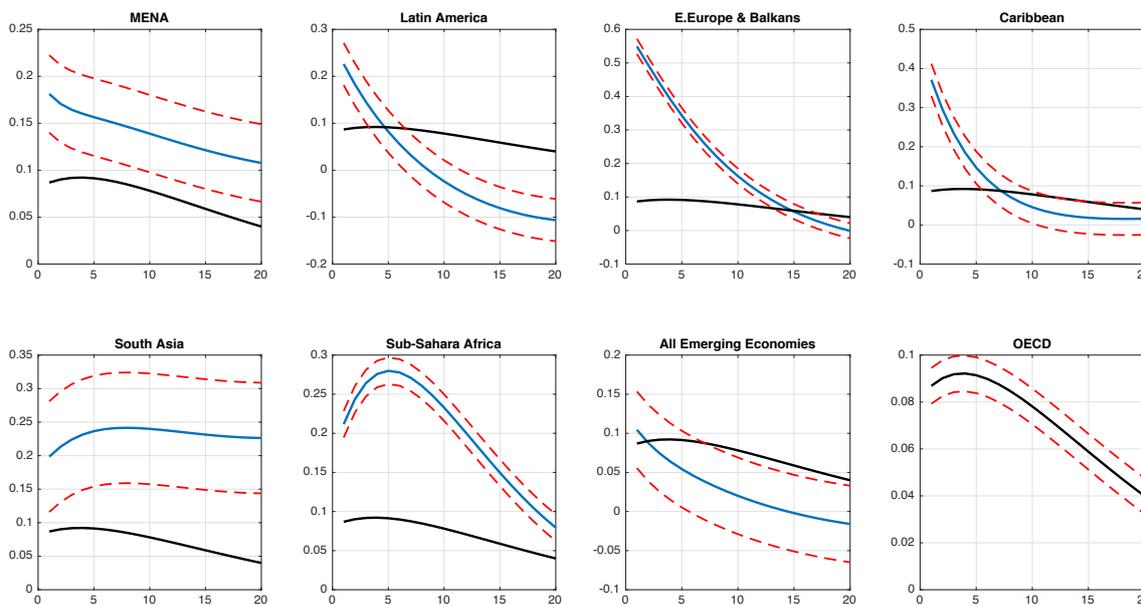


Figure 10: Inflation IRF to temporary increase in monetary multiplier. Average regional group (blue) versus OECD median (black). Dashed red lines represent the 95% confidence band for error average.

In order to check on the existence of price stickiness, we use monthly data from the Global Economic Monitor database, compiled by the World Bank. The data runs from March 1996 to November 2017, and encompasses a smaller sample of 113 countries, consolidated into regional groups. A VAR model is built with monthly inflation rate, monetary mass relative to foreign reserves, foreign reserves in terms of import months

and crude oil WTI prices. Figure 10 above reports the average impulse response function (IRF) for inflation relative to a temporary increase in the monetary multiplier - an increase in monetary mass relative to foreign reserves. The VAR specification is parsimonious in order to make the most of the country sample as well as available data. We control for the foreign reserves effect by looking at the monetary multiplier instead of monetary mass, and for energy prices on inflation by incorporating the WTI crude price. The purpose of this VAR estimation is to check whether inflation reacts one-to-one to an unexpected increase in the monetary multiplier, *i.e.* a sudden expansion in the M2 monetary aggregate relative to foreign reserves.

Figure 10 reports the average monthly inflation IRF to an expanding monetary policy shock, proxied by an increasing monetary base multiplier. Most emerging economies exhibit a higher sensitivity to inflation compared against the OECD average response. Nevertheless, there is clear evidence of price stickiness, as the response is neither equiproportionate, nor immediate. There are differences across regions, such that the average EME response is not significantly different from the OECD average response. Most emerging economies exhibit significant responses to a monetary shock, as exhibit by regional groups like the Caribbean, Sub-Sahara Africa and Eastern Europe & Balkans. By contrast, countries in MENA and Latin America quickly catch up with the OECD average, or converge fairly quickly to zero, as the impact of the monetary shock on inflation fades away.

In addition to the impulse response computed for each regional group, we also look at price stickiness through non-neutral money through variance decomposition and the relative contribution of monetary shocks in price variance. To that effect, we compute the average forecast error variance decomposition (FEVD) for each regional group, and compare it against the OECD average. Figure 11 below reports the average FEVD for each regional group, and compares it against the OECD benchmark:

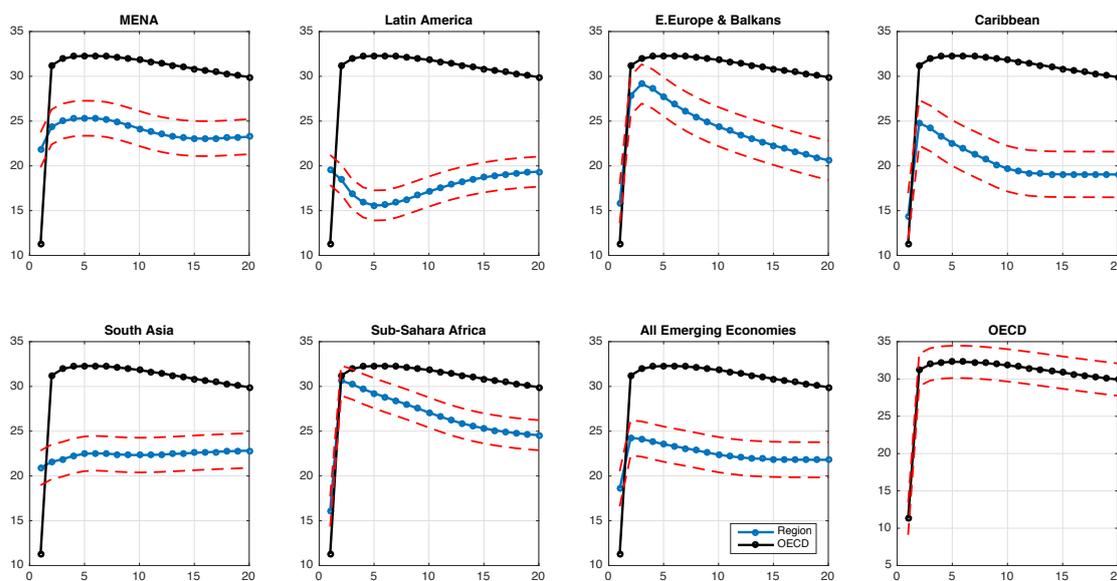


Figure 11: Average FEVD for a monetary shock on inflation. Average regional group (blue) versus OECD median (black). Dashed red lines represent the 95% confidence band for error average.

In the long run, monetary shocks contribute on average 30% of forecast variance error for the OECD regional group, which is systematically higher than the average variance contribution for emerging economies. The monetary contribution to price forecast variance is significantly lower for emerging economies, as it is established between 25 and 20%. This sub-sample average is representative of each region's moments, where the long run forecast variance decomposition puts values as high as 25% for MENA, Sub-Sahara Africa and South Asia, as as low as 20% for Latin America, the Caribbean and Eastern Europe & Balkans. Overall, the criterion of price stickiness using money non-neutrality shows that prices are indeed stickier in emerging economies than they are in developed economies, because inflation variance is less sensitive to monetary shocks.

We next argue that price stickiness is due to strategic interactions between public and private goods prices. To that effect, we use the Penn World Table (PWT) and its estimates of consumer and government expenditures price levels for 175 countries, from 1950 to 2014, or any available time periods within. We build a small-scale VAR model by incorporating exports, imports, productivity and investment price level, and compute the impulse response function of consumer price level to a temporary shock in government expenditure price level. The same argument of tractability applies to this model, so as to keep the largest set possible of countries in their respective regional groups. Exports and imports filter out the exogenous shocks from global trade and capital flows, whereas the proposed TFP estimate captures the productivity effect on prices. Finally, investment prices are incorporated to test for the robustness of consumer prices' impulse response to government expenditure prices.

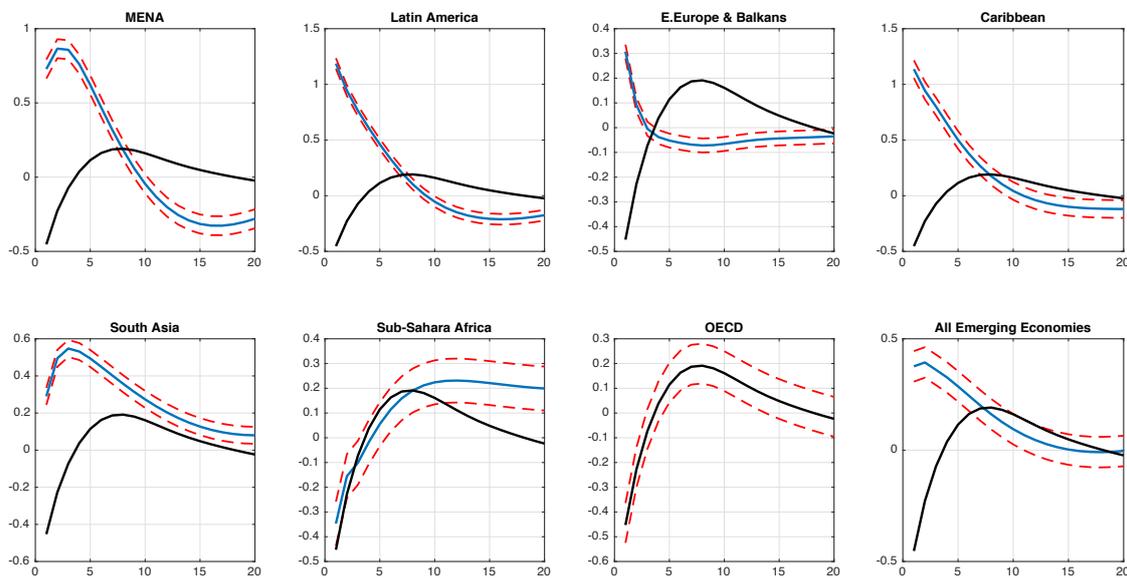


Figure 12: Consumer price IRF relative to a temporary shock in government price level. Average regional group (blue) versus OECD median (black). Dashed red lines represent the 95% confidence band for error average.

Figure 12 shows that for all emerging economies, there is a significant and positive response of consumer prices to a government price shock. By contrast, there is a negative IRF for consumer goods in the OECD regional benchmark group when a

government price shock occurs. The empirical evidence for all regional groups except Sub-Saharan Africa is statistically significant, and buttresses the assumption of a strategic interaction effect central to our model. Differences in the shape of impulse responses suggests that each regional group deals with government price shocks in different ways, with the hump-shaped response a sign of inter-temporal tradeoffs. Overall, a 1% temporary increase in government expenditure price level results in a .38% increase in consumer price level in all emerging economies, on average. This positive impulse response contrasts with the negative response observed for the OECD regional group, where a 1% temporary increase in price government expenditure results in an initial .45% decline in consumer price level. These differences underline the strategic interaction argument behind pro-cyclical fiscal policy in emerging economies. Indeed, we can observe that except Sub-Saharan Africa, all regional groups for emerging economies exhibit the positive impact of increasing government expenditure price level: countries in MENA, Latin American and the Caribbean all exhibit impulse responses close to or slightly above unity, with initial responses at .73%, 1.19% and 1.14% respectively.

Other emerging economies exhibit a far less pronounced reaction to a government price shock, even though its effects remain positive and relatively persistent. The government price shock is quite persistent and positive in South Asia, where the consumer price level increases to .55%. By comparison, the government price shock effect in Eastern Europe & Balkans is more muted, with a positive impulse response at .31% in the first period, and then a fairly rapid convergence to zero afterwards. The Sub-Saharan Africa regional group is a significant outlier in the emerging economies sub-sample. Its average impulse response replicates very closely that of the OECD regional group. It is worth pointing out that after the consumer price level declines by .35% in the first period, it reverses the effects of the government price shock, and remains persistently positive at about .20%, whereas the OECD regional group average IRF becomes statistically insignificant by the 15th period.

Overall, the proxies selected for public and private prices perform well with statistically robust results. Estimated results for most emerging economies show that the strategic interaction effect between private and public goods' prices is positive and significant. These results highlight this effect's viability as a candidate to account for price stickiness in those economies. We extend the same VAR analysis carried out earlier by computing the forecast variance decomposition for consumer prices relative to government expenditure prices. If strategic interactions play such a significant role in private prices, then their variance will be quite sensitive to changes in government prices. We carry out a variance decomposition analysis, and the FEVD estimates are reported on figure 13 below.

Figure 13 reports government prices' contribution to the forecast error variance decomposition for consumer prices for each regional group, and compares their averages against the OECD benchmark. Results are broadly in line with those describe above, with consumer prices being more sensitive to changes in government prices in emerging economies than in developed ones. On average, changes in government prices account for 23% of forecast variance for consumer prices in emerging economies, against a little under 20% for the OECD regional group.

Contrary to the IRF analysis conducted above, there is more heterogeneity among emerging economies. Regional groups, such as Eastern Europe & Balkans, as well

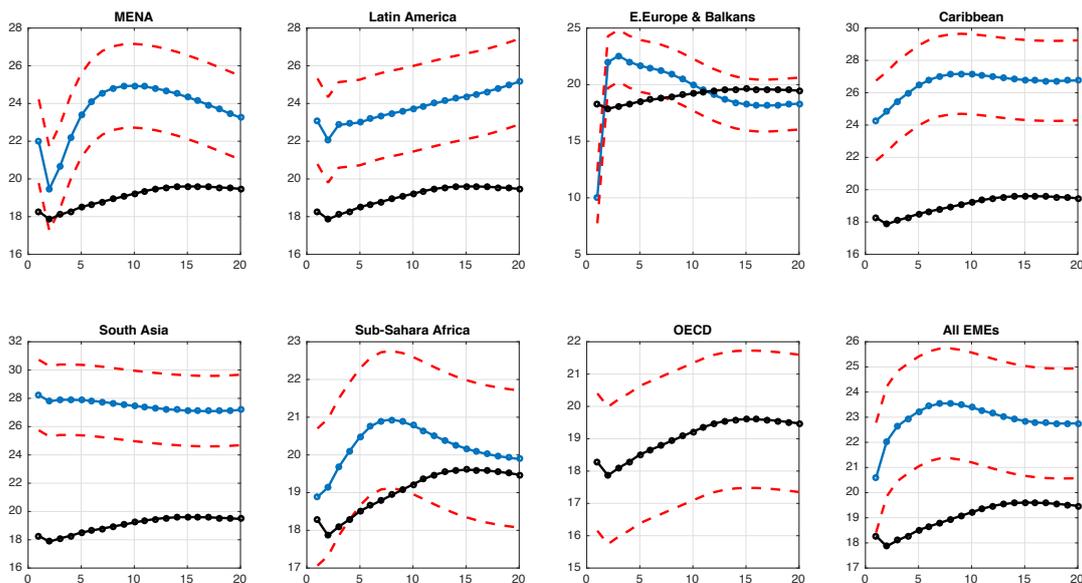


Figure 13: FEVD Consumer price relative to a temporary shock in government price level. Average regional group (blue) versus OECD median (black). Dashed red lines represent the 95% confidence band for error average.

as Sub-Sahara Africa appear to exhibit similar contributions of government prices in consumer prices' variance. By contrast, regions, such as MENA, Latin America, the Caribbean and South Asia exhibit clear differences in variance contribution with respect to the OECD regional benchmark. These emerging economies exhibit comparatively high levels of variance contribution at 28% for South Asia, 27% for the Caribbean, and 24% for MENA. Latin America appears to exhibit an even higher sensitivity in its variance decomposition, as shown in the upward trend in the second top panel to the left on figure 13.

3 The Model

10 We expand the framework proposed by [Trabandt & Uhlig \(2013\)](#) of monopolistic competition by assuming that consumers value public goods in their utility function. We assume that public goods can be consolidated into a Dixit-Stiglitz index, and each intermediate public firm exerts market power over its pricing schedule. The combination of these two aspects means that intermediate public goods act as strategic complements to private goods. The resulting strategic interaction raises the private prices stickiness. In addition, we depart from the literature by assuming that the government forms endogenous preferences over its provision of public goods. These preferences generate an agency interaction with consumers who act as principals, and whose expected level of public goods is above that supplied by the public sector.

20 The previous section has provided an exhaustive overview of stylised facts in emerging and developed economies. Data analysis has shown that pro-cyclical fiscal policy is quite common in emerging economies, but that is was not the only fiscal regime their finances exhibit. The data has also shown that most regional groups for emerging economies exhibit strong signs of pro-cyclical fiscal policy, using the measure adopted

by Alésina & al. (2008). After empirical validation of signs of fiscal pro-cyclicality, we moved to the tax structure, and showed that overall emerging economies exhibit a lower optimum for their tax rates, and that there are significant imbalances in taxing labour and capital which are not observed in developed economies. The two pieces of evidence of pro-cyclical fiscal policy and sub-optimal Laffer extrema suggest that the political economy factor is significant to account for institutional failure in emerging economies. We then put to the test the assumption that institutional imperfections arise from strategic interactions between public and private goods. To that effect, we show that price stickiness, measured as the sluggish price response to a monetary shock, is more significant in emerging economies when compared against the OECD benchmark. We then show that price stickiness arises from the positive response of the consumer price level to a government price shock, a feature common to all emerging country groups except Sub-Saharan Africa. Further analysis also shows that consumer price variance in emerging economies is more sensitive to government price than it is the case in developed economies.

3.1 The Public sector

In this model, the government acts as an agent for the representative consumer. The household acts as a principal who delegates the provision of public goods to the government, and subsequently an agency problem arises from differences in preferences between the consumer-principal and the public sector-agent. In particular, the government expects to exert the lowest possible effort denoted (e) subject to its resources constraints, as well as expected future benefits from supplying the public good. For households, there is a welfare loss associated with any effort lower than the maximum, denoted \bar{e} .

We first start by specifying the pricing rule for public goods. The government provides individual public goods, denoted $G_t(i)$ priced at $P_t^g(i)$. It incurs costs for supplying these goods, which are broken down into two categories: the first cost component is related to physical elements, *i.e.* inputs needed to produce and supply $G_t(i)$. The second cost component is linked to quality, and the level of effort exerted in order to produce the public good. We formalise the public agent's payoff function, denoted $\Pi_t^g(g, e)$ as follows:

$$\Pi_t^g(g, e) = P_t^g G(e_t) e_t - C^g(e_t) \quad (10)$$

Where $C^g(e_t(i))$ denotes the total cost associated to produce public good i . The flexible price-setting framework determines that the government supplies its public good at the following price:

$$P_t^g = \frac{\bar{e}}{1 + \bar{e}} \frac{MC(G_t)}{e_t} \quad (11)$$

The price is increasing in the physical marginal cost of production, denoted $MC(G)$, and decreasing in the level of effort put by the government. Equation (11) reports the price-setting rule of public goods as a function of the agency dynamic between the government and her voters/consumers.

More generally, the payoff function can be extended to an infinite time horizon. We use the q-theory framework pioneered by Hayashi (1982) to formulate a specification for

the payoff function of the public sector. The government seeks to maximise it subject to effort and budget constraints. The payoff value maximisation programme writes:

$$\max \mathbb{V}^g = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [P_t^g G(e_t) e_t - C^g(e_t)] \quad (12)$$

$$\text{s.t. } G(e_t) + (1 + r_t)B(e_{t-1}) \leq (\tau_t^c C_t + \tau_t^w W_t N_t + \tau_t^k r_t K_{t-1}) + B(e_t) \quad (13)$$

Where τ^i (for $i \in \{c, w, k\}$) are taxes levied on consumption, wages and capital, respectively. The government funds its expenditure G using distortionary taxes τ^i and by issuing debt $B(e)$ which is a decreasing function in the effort to provide public goods. We deviate from the framework developed by [Alésina & al. \(2008\)](#) in that debt is used as a complement to tax instruments, and the higher the exerted effort, the less reliant the government is on issuing debt. In essence, we shift the focus to the shadow value of the exerted effort, which becomes the political rent. In this setting, neutral governance implies that the government prices its public goods at their physical marginal cost. However, as reported in [Atkinson & Stiglitz \(2015\)](#) public goods provision does not necessarily follow market pricing, and the literature frequently uses Ramsey-Boiteux as a means to model a benevolent social planner, and [Dierker \(1991\)](#) argues that the resulting Ramsey rule delivers a second-best welfare outcome.

The assumption of a socially benevolent government is in contradiction with the results derived for emerging economies in the previous section. That is why we deviate from the Ramsey rule, and instead formulate a framework where the government will always provide fewer public goods than expected by the consumer/voter, with adverse effects on the latter's welfare. This agency issue has significant repercussions on how consumers formulate their demand for intermediate private goods, as well as private firms' pricing schedule.

Solving the optimisation programme in equation 12 for exerted effort e_t yields a more general expression for equation 11. We solve the social planner's Lagrangian expression, which writes:

$$\mathfrak{L} : \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [\Pi_t^g(g, e) - \psi_t (G(e_t) + (1 + r_t)B(e_{t-1}) - (\tau_t^c C_t + \tau_t^w W_t N_t + \tau_t^k r_t K_{t-1}) + B(e_t))] \quad (14)$$

First order conditions with respect to exerted effort e_t yield a general expression for pricing the public good, which writes:

$$P_t^g = \frac{\bar{e}}{1 + \bar{e}} \frac{MC(G_t)}{e_t} + \psi_t \frac{\bar{e}}{e_t} - \frac{|\varphi_b|}{e_t} \frac{B(e_t)}{G(e_t)} (\beta \mathbb{E} \psi_{t+1} (1 + \mathbb{E} r_{t+1}) - \psi_t) \quad (15)$$

Where \bar{e} denotes the positive elasticity of government goods to exerted effort, and coincides with its maximum value. Parameter φ_b denotes debt issuance elasticity to the exerted effort, and it is negative. Variable ψ_t denotes the shadow marginal value of exerted value to the government. It can thus be considered to be a proxy for the political rent similar to the concept put forward in [Alésina & al. \(2008\)](#). The first component of equation (15) is common with equation 11, which reflects the contemporaneous pricing schedule for the public good. The second prices in ψ_t relative to the level of exerted effort. In other words, the second component expresses the political rent extracted

by the government relative to the exerted effort in order to supply the public good. The third component expresses the expected net benefit from the future political rent weighted by the share of issued debt relative to public good. The third component takes into account the social planner's expectations in future political payoffs weighted
 5 by its present debt issuance policy.

The pricing rule can be interpreted as follows: the price of public goods is increasing in its physical marginal cost $MC(G)$, and decreasing in its exerted effort e . The first component refers to the flexible pricing regime described in equation (11) and expresses the marginal cost in efficiency terms. The second component also establishes
 10 a positive relationship between public good pricing and the contemporaneous political rent, though the latter is also expressed in terms relative to exerted effort e . The third component introduces an inter-temporal benefit tradeoff from supplying public goods for the government, and its sensitivity to public finances. The difference between the effort's present shadow value and its future, expected discounted value describes the
 15 public agent's expected net benefit from a marginal effort in the present. This expected benefit is weighted by the share of issued public bonds relative to public expenditure. In other words, the benefit extracted from the political rent is weighted by how reliant the government is on debt issuance to finance its provision of public goods.

Finally, the future net benefit enters as a negative argument in the pricing rule
 20 thanks to debt elasticity to effort φ_b . This is the case because a positive net future benefit pushes the public agent to exert more effort. As a result, higher exerted effort by the government acts as a downward pressure on public good pricing, *ceteris paribus*.

Theses pricing schedules affect the quantity of public goods provided by the government, which in turns influences private consumers' own decision-making, because
 25 they value public goods in their utility function. This results in a strategic interaction for firms between pricing in public and private goods. We now turn to consumers and their preferences for public goods, and the impact it has on the demand they formulate for intermediate public and private goods.

3.2 Aggregate private and public consumption

30 We assume that consumers value both private and public goods in an aggregate consumption index *à la* Dixit & Stiglitz (1977) and the index writes:

$$C_t = \left[\int_0^1 \frac{C_t(i)^{\frac{\theta_t - 1}{\alpha}} G_t(i)^{1-\alpha} di}{\alpha} \right]^{\frac{\theta_t}{\theta_t - 1}} \quad (16)$$

Where $C_t(i)$, $G_t(i)$ refer respectively to individual private and public goods. θ_t is the time-varying elasticity of substitution between private goods $C_t(i)$ and α the share allocated to those in households' consumption schedule.

35 Intermediate demand for private good $C(i)$ is computed from the consumers' minimisation programme between the aggregated individual prices for intermediate goods,

and the nominal cost of the aggregate consumption index. The intermediate demand writes:

$$C_t(i) = \left[\left(\frac{P_t(i)}{P_t} \right)^{-\theta_t} C_t G_t(i)^{(1-\alpha)\theta_t} \right]^{1/(\theta_t - \alpha(\theta_t - 1))} \quad (17)$$

Notice that when $\alpha = 1$ the consumer does not value intermediate public goods, and equation (17) collapses to the standard expression where the intermediate good $C(i)$ is function of the elasticity of substitution θ and the deviation of its price $P(i)$ relative to the aggregate price index P . In addition, the government supplies its final public good with the same Dixit-Stiglitz aggregative function. Public good G and the resulting intermediate demand for public good $G(i)$ write:

$$G_t = \left[G_t(i) \quad \gamma \quad \text{di} \right]^{\frac{\gamma}{\gamma - 1}} \quad (18)$$

$$G_t(i) = \left(\frac{P_t^g(i)}{P_t^g} \right)^{-\gamma} G_t \quad (19)$$

Where $P^g(i)$ and P^g refer respectively to prices of i -specific public good and the aggregate public goods price index. When equations (17) and (19) are collapsed together, we obtain an expression for intermediate demand for private good $C(i)$ as a function of its price as well as the public good complement $P^g(i)$. The expression writes:

$$C_t(i) = \left[\left(\frac{P_t(i)}{P_t} \right)^{-\theta_t} \left(\frac{P_t^g(i)}{P_t^g} \right)^{-\theta_t \gamma (1-\alpha)} G_t^{(1-\alpha)\theta_t} C_t \right]^{1/(\theta_t - \alpha(\theta_t - 1))} \quad (20)$$

Equation (20) establishes a direct link between public and private goods' prices. In using the Dixit-Stiglitz framework to depict the aggregate consumption index, we include public goods as complements to intermediate private ones. The intermediate demand for private goods is rewritten so as to show the influence of its public good complement. When plugged in firm i 's profit-making schedule, the private good's pricing will depend upon its public complement's price - thus ushering in strategic interactions between public and private goods.

3.3 Firms - Strategic interactions

In a flexible price setting, the private firm sets its prices as a function of its markup and marginal cost. In this setting, the firm also takes into account the pricing of its public good complement. In other words, the profit function writes:

$$\max_{P_t(i)} \pi(P(i), P^g(i)) = P_t(i) C_t(P_t^g(i)) - TC_t(i) \quad (21)$$

Where $TC(i)$ denotes the firm's total cost. Profit maximisation yields the private firm's pricing schedule, which writes:

$$P_t(i) = \frac{\theta_t}{\alpha(\theta_t - 1) + \xi_t(i)\theta_t\gamma(1 - \alpha)} MC_t(i) \quad (22)$$

In addition to α , the share of private goods in households' consumption index, the private markup is function of $\xi_t(i)$. It denotes the strategic interaction in private pricing with respect to public goods. If there are no strategic interactions, then $\xi(g, p) = 0$ and the pricing expression in equation (22) collapses to the following:

$$P_t(i) = \frac{\theta_t}{\alpha(\theta_t - 1)} MC_t(i) \quad (23)$$

5 which is similar to the pricing rule with a markup, except for α which captures the complementarity effect in the aggregate consumption index. The strategic interaction between private and public goods affects the former's stickiness, as it divorces it from changes in the marginal cost, as the firm becomes more reliant on the dynamics of public good pricing. In fact, it can be shown that private firms' pricing is going to
 10 be higher compared to that of standard monopolistic competition, where strategic complements depend only on imperfect elasticity of substitution. Higher private prices imply the following inequalities:

$$\alpha(\theta_t - 1) + \xi_t(i)\theta_t\gamma(1 - \alpha) \leq (\theta_t - 1) \quad (24)$$

$$|\xi_t(i)| \leq \frac{\theta_t - 1}{\gamma\theta_t} \quad (25)$$

Which means that the absolute value of the strategic interactions effect dominates the markup implied by imperfect elasticity of substitution. The set of figures below
 15 describe two cases where the strategic interaction $\xi(i)$ is positive or negative, and their respective economic implications.

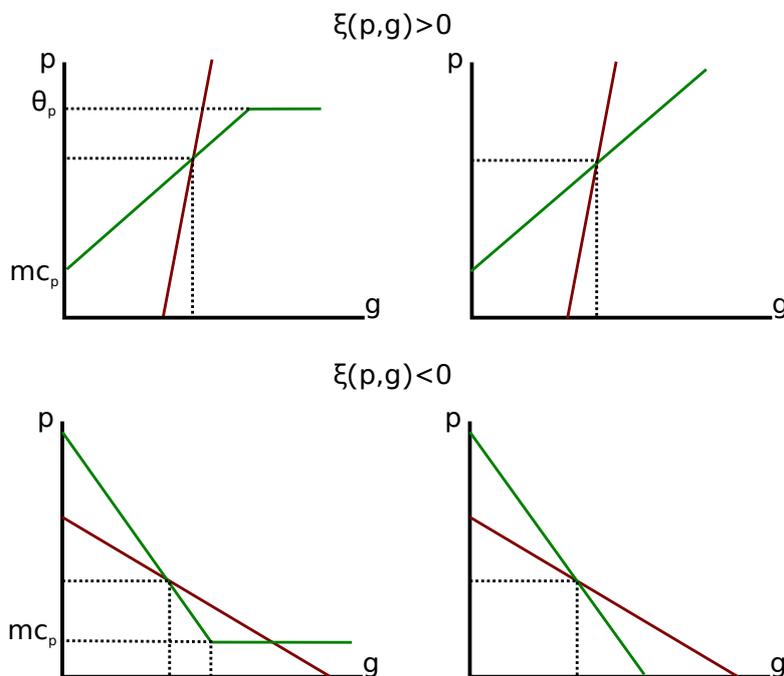


Figure 14: Strategic interaction pricing between public (red) and private (green) goods.

Figure 14 plots private and public goods best response pricing strategy against each other. There are two cases where a shift in one sector's best response elicits a

shift in the same or opposite direction. In addition, we also look at constraints private firms face in their best responses, such as their marginal cost as a floor price, and the pricing schedule in a flexible price regime with no strategic interactions. The first bottom figures assume that there is a negative correlation in pricing between private and public goods. It represents the standard Cournot-Nash equilibrium, with the intersection of private and public best responses' to each other. The slope coefficient for the private good provider is the strategic interaction variable $\xi(i)$ and assumes that there is a negative relationship between private and public goods.

The second set of top figures depicts the opposite set of interactions between private and public goods. Both prices are increasing in each other, and the intersection of their respective best responses generates another set of equilibrium prices. The slope coefficient for private goods' best response curve is $\xi(i) > 0$ which means that private firms index their price on that of the public good provider, thus describing another case of strategic interactions between the two sectors. The figures to the left offer two specific examples where the response curves are bound in the bottom by the private marginal cost - meaning that there are limits to the strategic interaction with public goods, whereas the same private good best response curve is bound upward by its markup.

Figure 14 depicts strategic interactions between private and public goods where both interact with each other, for the time being. Recall from equation (11) that strategic interactions go only one way, *i.e.* from public to private goods. Public goods pricing schedule is only function of the provider's exerted effort, whereas private firms take into account public firms' prices to set their own. This affords us the opportunity disentangle the impact of increased effort level on behalf of the public sector, and the strategic interaction generated by the pricing schedule of private firms, as specified in equation (22). As a result, strategic interaction dynamics are mainly driven by private firms' best response to an otherwise vertical line for public goods, as shown on the figure 15 below. The figure reports three cases that result in decreasing private prices: improved governance (increasing effort on behalf of the public good provider), improved productivity (and thus lower marginal cost) and a combination of both.

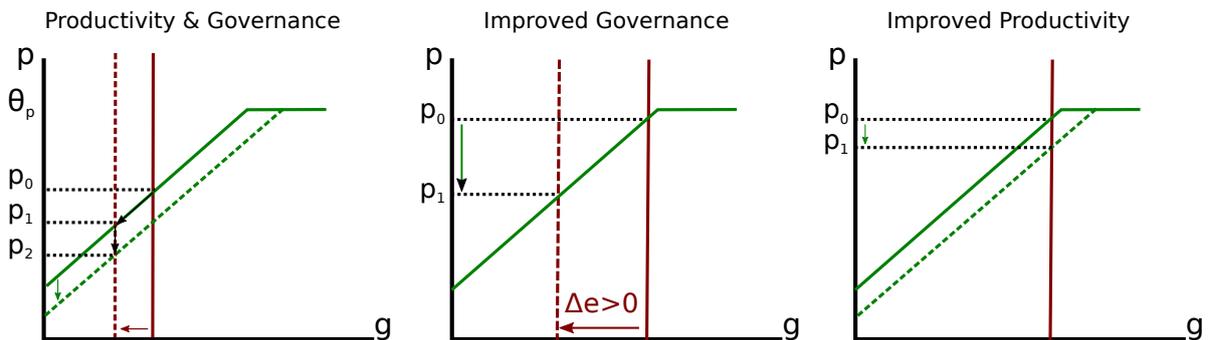


Figure 15: Three cases: improved governance (effort) in public goods (red) improved productivity for private (green) goods. Combination of both.

The first figure to the right reports the effects of improved productivity in the form of a fall in the firm's marginal cost. In this case, the private firm replicates this decline on its best response curve, thus the downward shift to the new minimum marginal

cost, as shown on the right-hand side figure. *Ceteris paribus* the new equilibrium private price will be lower as a result. A similar outcome is observed in the middle figure: improved governance means that the public good price decreases, as predicted in equation 11. The rightward shift in the public good pricing curve ensures that the new equilibrium private price will also be lower, thanks to the upward slope of its best response function. The figure to the left combines the two effects, and describes the disinflationary effect of declining marginal costs thanks to productivity, as well as improved governance thanks to a higher level of effort put by the social planner in providing its public goods. Notice that the fall in private prices is not instantaneous as it is the case in the figure to the right. The price first adjusts to a temporary equilibrium, moving along the private good's best response curve from p_0 to p_1 . From then on the decline in marginal cost takes over, and brings the private price further down from p_1 to p_2 .

Although an increase in exerted effort generates a disinflationary effect on private prices, changes in strategic interactions may blunt or neutralise the exert effort effect. Similarly, increased strategic interaction may dilute the effects of increased productivity for private firms. Indeed, increased strategic interactions between private and public goods detach price setting rules from changes in the marginal cost, even when these are brought about by productivity shocks. In fact, private pricing is more sensitive to changes in absolute value from its strategic component $\xi_t(i)$ than its marginal cost $MC_t(i)$. We show indeed that:

$$\frac{\partial P}{\partial MC} \frac{MC}{P} = \frac{\alpha(\theta_t - 1) + \xi_t(i)\gamma(1 - \alpha)}{\theta_t} \leq 1 \quad (26)$$

$$\left| \frac{\partial P}{\partial \xi} \frac{\xi}{P} \right| = \frac{\theta_t^2 \gamma (1 - \alpha)}{(\alpha(\theta_t - 1) + \xi_t(i)\theta_t \gamma (1 - \alpha))^2} > 1 \quad (27)$$

This means that the firm replicates only a fraction of its falling marginal cost on its price, a behaviour that can be readily illustrated by the way firms pass on changing in VAT or other taxes on their customers. In this case, a productivity effect will be matched by less than one-to-one decrease in private prices. By contrast, private firms are disproportionately sensitive to changes in their strategic interactions to public pricing. This means that rising productivity and/or improved governance may be blunted by private firms' increased sensitiveness to public goods pricing schedule. Figure 16 below reports cases of improved governance and increasing sensitiveness of private firms to public goods.

Figure 16 shows two cases where improved governance yields different levels of price fall. The first case to the left replicate the result discussed earlier: a decline in the marginal cost brought about by improved productivity accelerates the decline in private prices generated by improved governance. To the opposite side on the right, there is an increase in strategic interaction sensitivity in the private firm's best response curve, meaning $\Delta\xi(i) > 0$. The private firm becomes more reliant on changes in the level of effort in provision of public goods. As a result, the expected decline in private prices is somewhat dampened by increased strategic interactions.

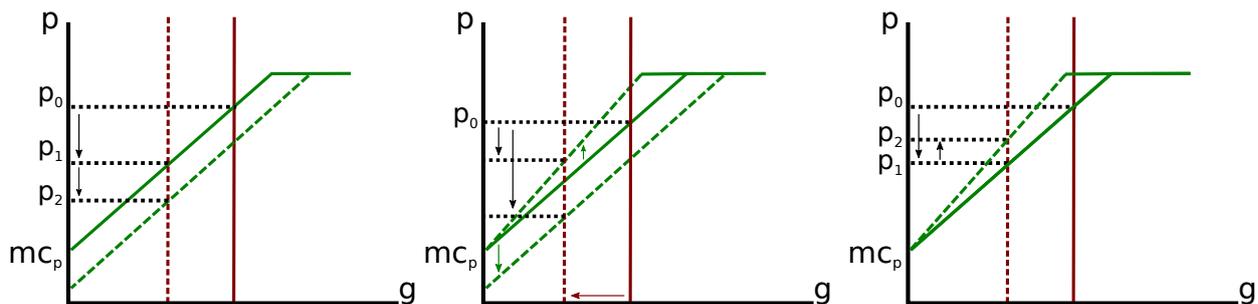


Figure 16: Three cases: improved governance (effort) in public goods (red) and improved productivity for private (green) goods. Improved governance and increasing sensitivity in private goods to strategic interactions. Combination of both.

3.4 Public-private strategic interactions and the New Keynesian Phillips Curve

Recall from the previous sub-section that private firms' pricing schedule is sensitive to price changes in public goods, as these act as strategic complement to the former. We have introduced $\xi_t(i)$ as a measure of this strategic interaction, and write:

$$\xi_t(i) = \frac{\partial P_t(i)}{\partial P_t^g(i)} \frac{P_t^g(i)}{P_t(i)} \quad (28)$$

Assuming private firms adopt the Rotemberg cost of adjustment pricing mechanism, we build an alternative specification to the New Keynesian Phillips Curve (NKPC) with a strategic interactions components. To that effect, we assume that the private firm seeks to minimise a lifetime penalty stemming from two components. The first is a penalty from deviations of its price from its optimal contemporaneous value, which is the flexible-prices regime value. The second component incorporates costs from adjusting prices over one period. The infinite-horizon penalty function writes:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{\phi_1}{2} (p_t - \bar{p}_t) + \frac{\phi_2}{2} (p_t - p_{t-1})^2 \right] \quad (29)$$

We drop the i indicator by means of symmetry, and write inflation as the rate of change prices, such $\pi_t = p_t - p_{t-1}$. The alternative NKPC writes:

$$\pi_t = \beta \mathbb{E} \pi_{t+1} + \frac{\phi_1}{\phi_2} \left[\tilde{\delta}_t - \theta_t \left(1 - \xi_t \gamma \frac{1 - \alpha}{\alpha} \right) \right] \quad (30)$$

Where $\tilde{\delta}$ refers to the output gap, θ_t is the elasticity of substitution, which is a proxy for the markup shock. In the absence of any strategic interaction from public goods, $\xi_t = 0$ and the NKPC expression in equation (30) reverts to its standard form, where inflation is written as a function of its discounted, future expected value, the output gap and an exogenous markup shock. The literature posits that markup is a supply shock, and thus exercises a negative impact on inflation. In our case, the markup becomes endogenous, and relies on strategic interactions as well as the exogenous elasticity of substitution common to the benchmark NKS model. Equation (30) shows that the elasticity of substitution, which is an essential component to the markup, is distorted

by the influence of public good prices. As a result, any downward pressure on inflation from the markup shock is dampened by strategic interaction due to the pricing schedule for public goods providers.

3.5 Model simulation: simple setting

5 This sub-section is devoted to the extension of the strategic interaction component to a simple new Keynesian model. We look in particular at its effects on price rigidity and inflation. The model uses a simplified version of the New Keynesian synthesis (NKS) framework provided by Ireland (2004) where the Phillips and forward-IS equations are micro-founded. The modified new Phillips curve is retrieved from equation (30) and the
 10 rest of the model equations are calibrated in order to match the stylised facts discussed in the previous section. In addition to the two NKS equations, we also add sources of exogenous shocks, namely productivity, demand, markup and strategic interactions, all modelled as AR(1) processes. Monetary policy is modelled after the Taylor (1993) rule with a lag component for smoothing interest rates.

15 In this stripped-down version, the main alterations are focused on markup dynamics. The literature treats it either as a fixed parameter, as in Gali (2008) or a time-varying source of exogenous shocks, as is the case for Ireland (2004). In this setting, the markup is endogenous in order to account for the strategic interactions between private and public goods. We report below the equations in our modified
 20 NKS framework:

$$\pi_t = \beta \mathbb{E} \pi_{t+1} + \phi [\tilde{o}_t - \theta_t (1 - \tau \xi_t)] \quad (31)$$

$$\tilde{o}_t = \mathbb{E} \tilde{o}_{t+1} - \frac{1}{\sigma} (i_t - \mathbb{E} \pi_{t+1} + \ln \beta) + \frac{1 - \rho_a}{\sigma} a_t - (1 - \rho_z) z_t \quad (32)$$

$$i_t = \rho_r i_{t-1} + \rho_\pi \pi_t + \rho_{\tilde{o}} \tilde{o}_t + \epsilon_t^r \quad (33)$$

$$z_t = \rho_z z_{t-1} + \epsilon_t^z \quad (34)$$

$$a_t = \rho_a a_{t-1} + \epsilon_t^a \quad (35)$$

$$\theta_t = \rho_\theta \theta_{t-1} + \epsilon_t^\theta \quad (36)$$

$$\xi_t = \rho_\xi \xi_{t-1} + \epsilon_t^\xi \quad (37)$$

In order to provide a comprehensive interpretation of the model's predictions, we run simulations for all 118 countries in our sample, and extract impulse responses from their approximated policy functions. This means that individual values for structural parameters need to be computed

25 3.5.1 Calibration: methods and values

Table 4 below reports all the structural parameters to our model. In the interest of compactness, we use a stripped-down version of the New Keynesian framework and this rely on the smallest possible set of parameters, in order to extended the country sample for which the model is calibrated.

Table 4: Structural parameters: regional averages and medians.

Par.	Economic Interpretation	Support	Computation	Source
α	Private good share in consumption	$]0, 1[$	Calibration	WDI
γ	Elasticity of substitution - public goods	> 1	<i>idem</i>	<i>idem</i>
τ	Weighting - strategic interactions	$\frac{\gamma(1-\alpha)}{\alpha}$	<i>idem</i>	PWT
β	Discount factor	< 1	<i>idem</i>	WDI
ϕ	NKPC slope	$\frac{\phi_1}{\phi_2}$	GMM	<i>idem</i>
σ	Elasticity of substitution	≥ 1	Calibration	<i>idem</i>
ρ_z	persistence - TFP	$] - 1, 1[$	ACF estimation	PWT
ρ_a	Persistence - demand	<i>idem</i>	<i>idem</i>	WDI
ρ_θ	Persistence - markup	<i>idem</i>	<i>idem</i>	<i>idem</i>
ρ_ξ	Persistence strategic - interaction	<i>idem</i>	VAR estimation	PWT
ρ_r	Lagged interest rate	<i>idem</i>	GMM	WDI
ρ_π	Weighting - inflation	<i>idem</i>	<i>idem</i>	<i>idem</i>
$\rho_{\bar{o}}$	Weighting - output gap	<i>idem</i>	<i>idem</i>	<i>idem</i>

Recall from previous sections that this paper's overarching aim is to formulate a tractable model such that it can be calibrated for the largest set of countries. To that effect, table 4 reports some parameters that have been conflated in order to preserve the sample set for the simulated responses to exogenous shocks. For instance, the GMM estimation for the Phillips curve does not provide separate estimates for ϕ_1 and ϕ_2 , and concentrates on single parameters ϕ which is the NKPC slope. This does not weaken the model or its predictions, and allows us to focus on the important results to interpret. In this case, we are interested in impulse response to exogenous shocks conditional on the existence of strategic interactions effects. Note also that the original 123-strong sample has been winnowed to 118 due to the lack of sufficient data points for five countries, nevertheless, the country sample size remains large enough to provide meaningful regional estimates for price rigidity as predicted by the model.

Structural parameters for each regional group are tested against the OECD benchmark group using ANOVA, in order to identify potentially significant differences in calibrated values. ANOVA regression results are reported in table 5. Table 5 shows that overall, there are no significant differences between the OECD regional benchmark and regional groups of emerging economies. The discount factor appears to be slightly lower for most emerging economies, but not in a statistically significant way. The OECD regional group points to an annual risk-free rate of 4.8%. The largest discrepancy in discount factor is attributed to Latin America, whose regional mean discount factor implies an annual interest rate of 11.7%. Even then, the differences are not large enough to generate a statistically significant result for this region or other EME regional groups.

Only a handful of parameters appear to exhibit statistically significant differences across the country sample. Persistence of demand shocks is derived from the ACF of residuals of the Euler equation. Countries in Latin America and Eastern Europe & Balkans exhibit differences in persistence, where one is weaker than the OECD regional

mean, and the other is stronger. A similar pattern is observed for persistence in strategic interaction shocks, parameter ρ_ξ appears to be statistically significant for Latin America compared to the OECD base benchmark, while other emerging economies do not differ significantly. Latin American economies experienced high levels of inflation brought about by discretionary government, following Agénor & Montiel (2015). The fact that private prices are more sensitive to public ones for this regional group provides an adequate explanation to the discrepancy between Latin America and the OECD. Lagged interest rate also appear to be smoother in Latin America and the Caribbean, while estimated Taylor rule coefficients suggest that central bankers in Latin America place a greater weight on the output gap in their monetary rule than the OECD regional group. Finally, persistence of markup shocks appears to be statistically significant across the board - all emerging economies except South Asia appear to exhibit weaker persistence than the OECD base benchmark. This result is not particularly surprising, given that the simple modified NKS framework we are using for simulation focuses on the effects of strategic interactions on firms' markup.

Table 5: ANOVA testing for differences in parameters between regional groups and OECD benchmark base.

Variable	MNA	LAT	EEB	CRB	ASE	SAF	OECD
β	.029	-.059	-.032	-.024	-.025	-.001	.954***
σ	-.642	-.912	-.614	-1.085	-1.042	-.904	3.501***
α	.014	.032	.011	.035	-.005	.034	.812***
γ	.632	-1.227	3.771	-1.105	-1.264	-2.543	4.134***
ϕ	.018	.012	-.047	.031	-.06	-.021	.512***
τ	2.561	-1.076	2.461	-1.366	1.515	-.185	2.135*
ρ_z	.014	.032	.011	.035	-.005	.034	.812***
ρ_a	-.045	-.077*	.074*	-.072	.003	-.039	.256***
ρ_θ	-.167**	-.161**	-.24***	-.258**	-.063	-.215***	.807***
ρ_ξ	.079	.189**	.082	.182	.089	.013	-.049
ρ_r	-.016	.271***	.061	.393**	.025	.017	1.164***
ρ_π	.007	.081	-.046	.04	-.064	.204	.141
$\rho_{\bar{o}}$	-.055	.725***	.264	.164	.059	.213	.188*

Note: Legend p-value: 10%* 5%** 1%***

3.5.2 Model performance and predictions

We look at the model's overall predictions with respect to inflation responses to productivity shocks. The standard New Keynesian model predicts that inflation decreases after a temporary increase in productivity, thanks to declining marginal costs. Inflation response to productivity is delayed because of market imperfections and price rigidities, but firms do pass on a fraction of their falling marginal costs. When markups are endogenous, price stickiness increases thanks to strategic interactions, where firms set their prices independently from changes in the marginal cost.

Figure 17 reports the output gap response to two shocks, strategic interactions and productivity, as well as a net effect of the difference between the two. In the first

subplot, output decline - thus generating a negative output gap after a temporary increase in the endogenous markup. This means that the strategic interactions effect results in declining production, which was discussed in the previous section. The second subplot reports increasing output, which is predicted in the standard NKS model. The third subplot to the right shows that the combined effect gives a significant advantage to the strategic interactions component, which means that changes in production costs no longer figure in private firms' pricing schedule price stickiness is driven by strategic interactions between private and public goods.

It is also worth pointing out that based on structural parameters calibrated for our country sample, output reaction to a productivity shock is highly concentrated around the median response. The graph shows that the 25th and 75th percentiles are close to the median, which suggests very little dispersion in countries' simulated responses. In a sense, the standard model prediction of increasing output is readily observed for a largest set of countries. This result should be against the wide differences between the median and the 75th percentile, where some countries exhibit dramatic responses to an exogenous strategic interactions shock when private firms' markup is endogenous to government prices. A highlight of these simulations is the wider distribution of impulse responses around the median. These can be explained by the significant heterogeneity in persistence in markup shocks, as reported in table 5 for ANOVA regression results. The more persistent the markup, the less likely it is to be influenced by strategic interactions with public goods' prices.

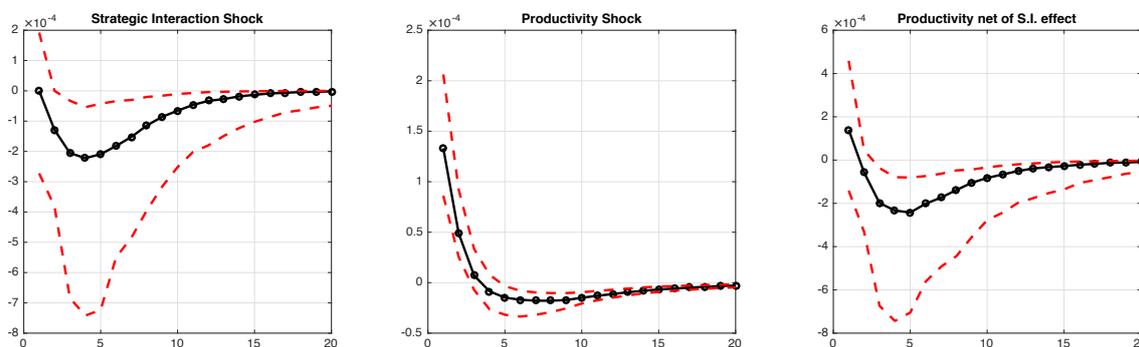


Figure 17: Median (**Black**) simulated Impulse Response Functions (IRFs): output gap to productivity and strategic interaction shocks. **Red** dashed lines refer to the 25th and 75th percentiles.

Figure 18 below reports the regional mean for each group of inflation IRF to a markup shock under two regimes. The first reports inflation IRF under strategic interaction, *i.e.* equation (31). The second reports the same IRF under the standard NKPC specification, *i.e.* when $\tau = 0$. The model is simulated for each country in the sample, and a regional mean is computed for the two regimes, in order to report regional average response to a markup shock under the two strategic interaction regimes.

The differences in inflation responses to a markup shock illustrates the importance of strategic interactions in muting deflationary shocks, and reversing their effects. There are no significant differences between regional groups as to the impact of a pure markup shock, or one that takes into account strategic interactions. Indeed, an endogenous markup with strategic interactions raises price rigidity to a level such

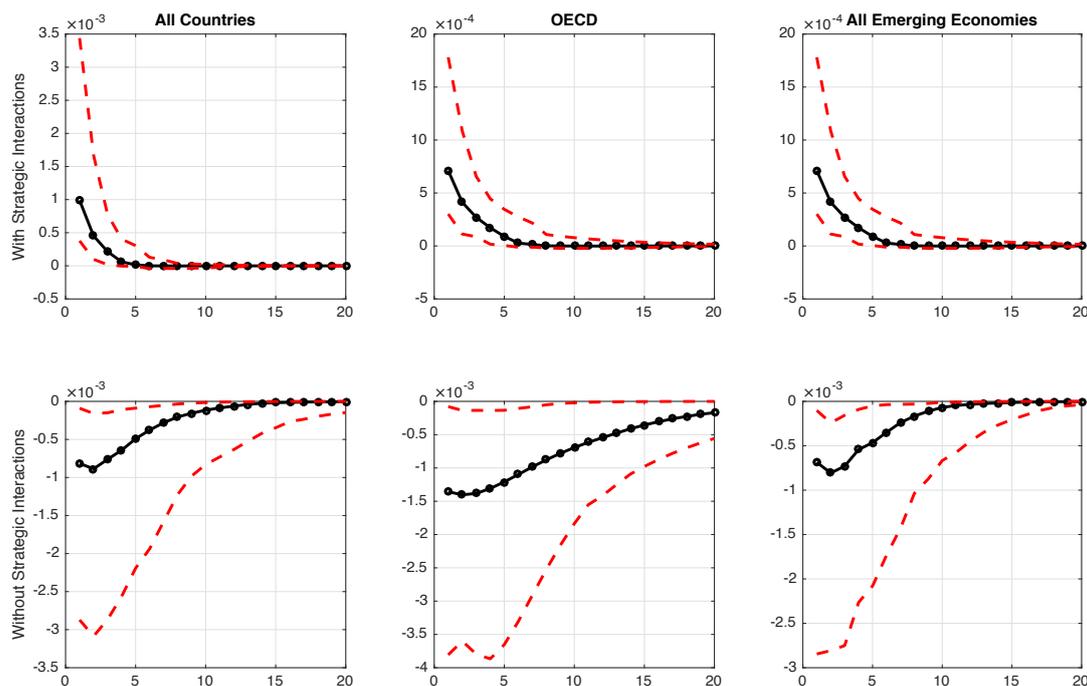


Figure 18: Simulated median inflation impulse response to a markup shock under strategic interactions (**top**) and standard NKS specification (**bottom**) Red dash lines refer to the 25th and 75th percentiles.

that a markup shock actually increases inflation. Given the simple setting of our NKS framework, the counter-intuitive impact can be accounted for by strategic interactions divorce the pricing schedule from changes in the marginal cost. In the standard model, a markup shock means that imperfect elasticity of substitution between intermediate goods increases, and intermediate firms' market power weakens, thus raising competitiveness. In this case, a markup shock is dominated by the strategic interactions effect embodied in equation (31). As a result, raising competitiveness in the economy actually increases prices, because all intermediate firms are locked in their best response strategies to public goods.

Figure 19 provides a more elaborate explanation to that offered by equation (25) and figures 14 and 14, namely that the strategic interactions effect dominates over the decline in marginal costs brought about by improved productivity. Although the model predicts increased price rigidities for all economies, the differences between strategic and non-strategic regimes are plain to see. Judging by the impulse response range for each regime, we can observe that the OECD regional group is more likely to fall into the non-strategic interaction regimes. Indeed, the calibrated values for ξ suggest that its effects are short-lived and considerably small compared with the more realistic case where there are no strategic interactions. In addition, while the standard case shows that inflation response to a markup shock is hump-shaped, it exhibits no similar reaction when strategic interactions are taken into account. This means that the model does not factor in inter-temporal substitution effects in a similar way to its standard specification. The model does not feature the hump-shaped response observed in figure 12 for regional groups, such as MENA and South Asia.

Overall, the model performs quite well for most emerging economies and their

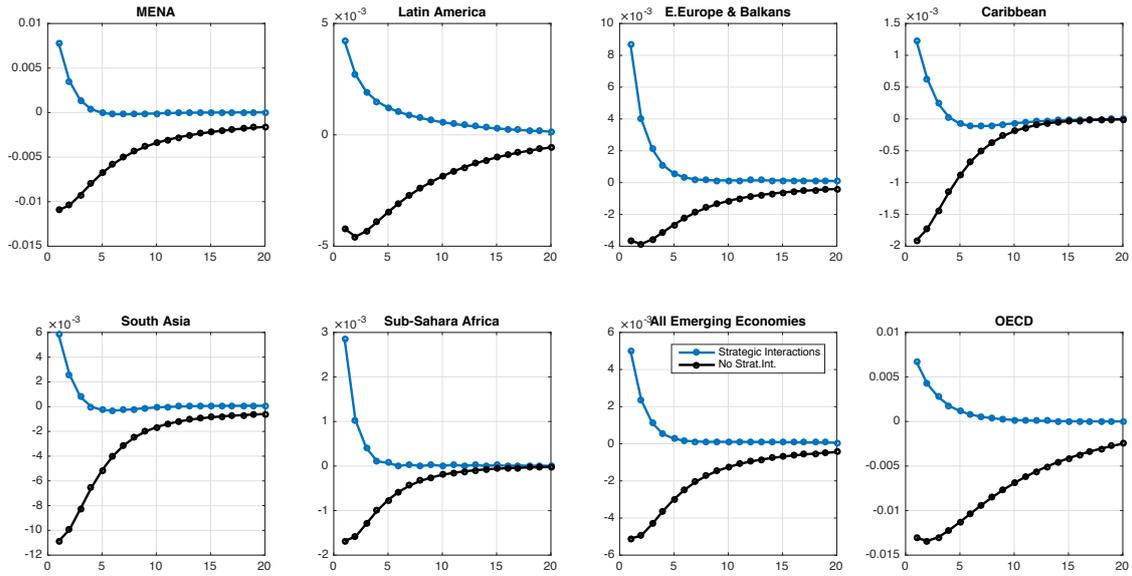


Figure 19: Simulated Impulse Response Functions (IRFs). Inflation to markup shock, under strategic interaction (blue) and standard NKS (black) (no strategic interactions)

respective regional groups, where the strategic interactions effects dominates over the standard case. This is not the case however for two regional groups: the model predicts that Sub-Saharan Africa falls in the standard case of strong strategic interaction effects, even as the data presented in the previous section states otherwise. Similarly, countries South Asia appear to exhibit a stronger effect of a non-strategic interactions regime, whereas the data discussed in the section above shows that the regional group falls in the standard EME case. Nevertheless, the stripped-down model version performs reasonably well in accounting for the effects of strategic interactions on price rigidities.

So far the model has assumed an exogenous government component in the form of strategic interaction shocks. It has provided satisfactory results for most emerging economies by showing that their new Phillips curves incorporate a strategic interactions component that dampens the effects of a markup shock on inflation. By contrast, the strategic interactions effect is weak in the OECD country group, which correlates well with the data presented in the previous section. Nevertheless, there are a couple of limitations to the mode that need to be addressed. For instance, we note that the simulated impulse response for inflation under the strategic interactions reported in figure 12 displays the same shape, even as some regional groups exhibit hump-shaped response. This is due to the fact that the exogenous shock intervenes only in the Phillips equation, and does not feature for instance in the forward-looking IS equation. Furthermore, there are no economic interpretations to how government expenditure and its inherent agency strategy interact with the output gap.

Table 6: Structural parameters: economic interpretation and calibration method.

Region	α	γ	τ	ϕ	β	σ	ρ_a	ρ_z	ρ_θ	ρ_ξ	ρ_r	ρ_π	$\rho_{\bar{o}}$
Sub-Saharan Africa	.318	1.853	3.188	.498	.972	2.633	.221	.849	.592	-.044	1.186	.35	.401
	(.205)	(2.315)	(9.368)	(.184)	(.032)	(1.664)	(.113)	(.073)	(.214)	(.265)	(.22)	(.986)	(.661)
	.261	1.218	.55	.503	.979	2.167	.202	.88	.667	.019	1.136	.099	.241
South Asia	.287	2.285	1.193	.467	.982	2.624	.233	.808	.709	.075	1.274	.094	.269
	(.138)	(2.426)	(1.583)	(.219)	(.016)	(3.106)	(.168)	(.09)	(.2)	(.093)	(.276)	(.105)	(.238)
	.247	1.443	.457	.503	.987	1.702	.203	.831	.774	.04	1.206	.064	.221
Caribbean	.395	2.975	1.641	.404	.986	3.102	.344	.872	.649	.079	1.227	.121	.222
	(.133)	(2.445)	(.825)	(.146)	(.004)	(1.46)	(.073)	(.021)	(.161)	(.172)	(.237)	(.116)	(.099)
	.434	2.064	1.511	.438	.987	2.956	.359	.874	.664	.031	1.181	.127	.224
E.Europe & Balkans	.394	8.248	4.554	.448	.973	2.782	.299	.843	.617	.059	1.254	.157	.515
	(.151)	(16.858)	(6.705)	(.162)	(.036)	(1.44)	(.126)	(.05)	(.295)	(.123)	(.262)	(.187)	(.573)
	.397	1.627	1.591	.519	.985	2.121	.326	.856	.653	.057	1.171	.114	.341
Latin America	.296	4.002	2.719	.554	.977	2.718	.182	.846	.637	.091	1.389	.183	.828
	(.165)	(5.356)	(4.31)	(.184)	(.021)	(2.512)	(.148)	(.076)	(.239)	(.245)	(.571)	(.207)	(1.011)
	.263	2.111	.67	.504	.984	2.053	.157	.872	.667	.062	1.171	.101	.582
MENA	.393	5.8	3.201	.507	.992	3.5	.247	.84	.758	.084	1.205	.158	.18
	(.187)	(13.382)	(5.553)	(.191)	(.005)	(2.63)	(.173)	(.072)	(.187)	(.244)	(.292)	(.163)	(.215)
	.317	1.284	1.002	.529	.992	2.888	.262	.855	.827	.146	1.082	.105	.072
OECD	.291	2.869	1.71	.527	.988	3.537	.253	.797	.803	-.07	1.147	.135	.195
	(.108)	(6.225)	(4.551)	(.262)	(.006)	(1.274)	(.139)	(.09)	(.164)	(.31)	(.162)	(.352)	(.144)
	.274	1.192	.573	.513	.989	3.777	.266	.82	.865	-.153	1.11	.043	.174
All EMEs	.335	3.512	2.843	.493	.977	2.749	.235	.838	.636	.037	1.254	.215	.456
	(.179)	(7.774)	(6.512)	(.184)	(.027)	(2.234)	(.141)	(.074)	(.229)	(.209)	(.329)	(.6)	(.661)
	.288	1.517	.718	.501	.985	2.088	.235	.87	.667	.054	1.161	.096	.25

3.6 Model setting with endogenous government expenditure

In this section, the model is augmented with endogenous government expenditure from equation(15). Recall that the public good provider pricing schedule is increasing in its marginal cost, and decreasing in exerted effort, as well as the shadow price of effort, or political rent extracted from its position as agent to households-principals. The government has also an inter-temporal tradeoff to take into account, namely the expected net benefit from future political rent flows. This pricing schedule generates a government expenditure gap, between what it should provide under maximum exerted effort and the actual amount of public goods it provides. As a result, both inflation and output are affected by inter-temporal tradeoffs for the public sector, and their impulse response to a productivity shocks is reported on figure 20 below:

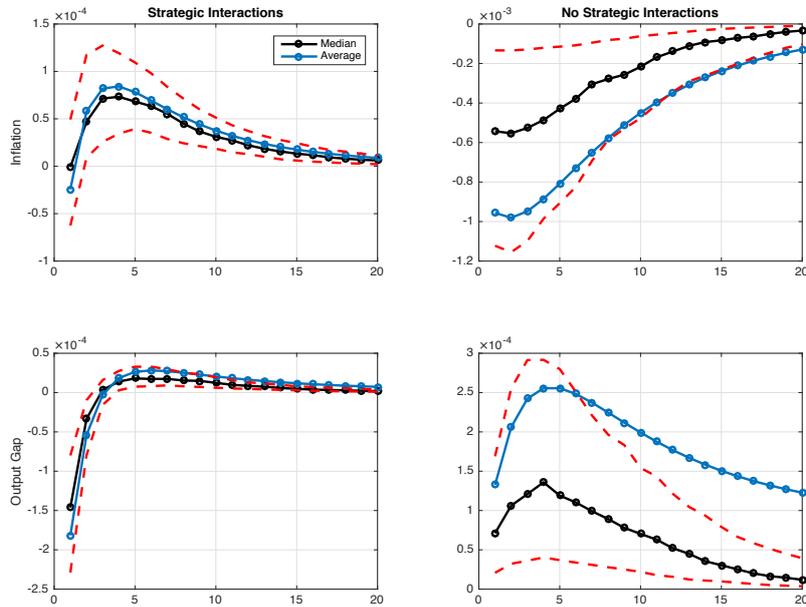


Figure 20: Simulated Impulse Response Functions (IRFs). Inflation, output gap to productivity shocks, under strategic interaction and standard NKS (no strategic interactions). Red dash lines refer to the 25th and 75th percentiles

An impulse response to productivity shocks usually entails a decline in inflation, and an increasing level of output, as reported on the figures to the right of the panel. By contrast, the effects of a temporary increase in productivity are reversed under strategic interactions. Inflation increases, as predicted in the simple setting model in the previous section, but this model provides a hump-shaped response that we argue captures more adequately the impact of strategic interactions on price stickiness. Indeed, we can see that the output gap expands after a productivity shock, which is due to the fact that strategic interactions negate the effects of declining costs. Firms prefer to set their prices following interactions between themselves and public goods, and so prices do not pass on the decline in marginal cost. To that effect, we run the model with endogenous government expenditure for the same country sample, and report median and average inflation impulse responses to markup shocks under two regimes: the first incorporates strategic interactions similar to the initial, stripped-down model version, and the second is the standard NKS prediction.

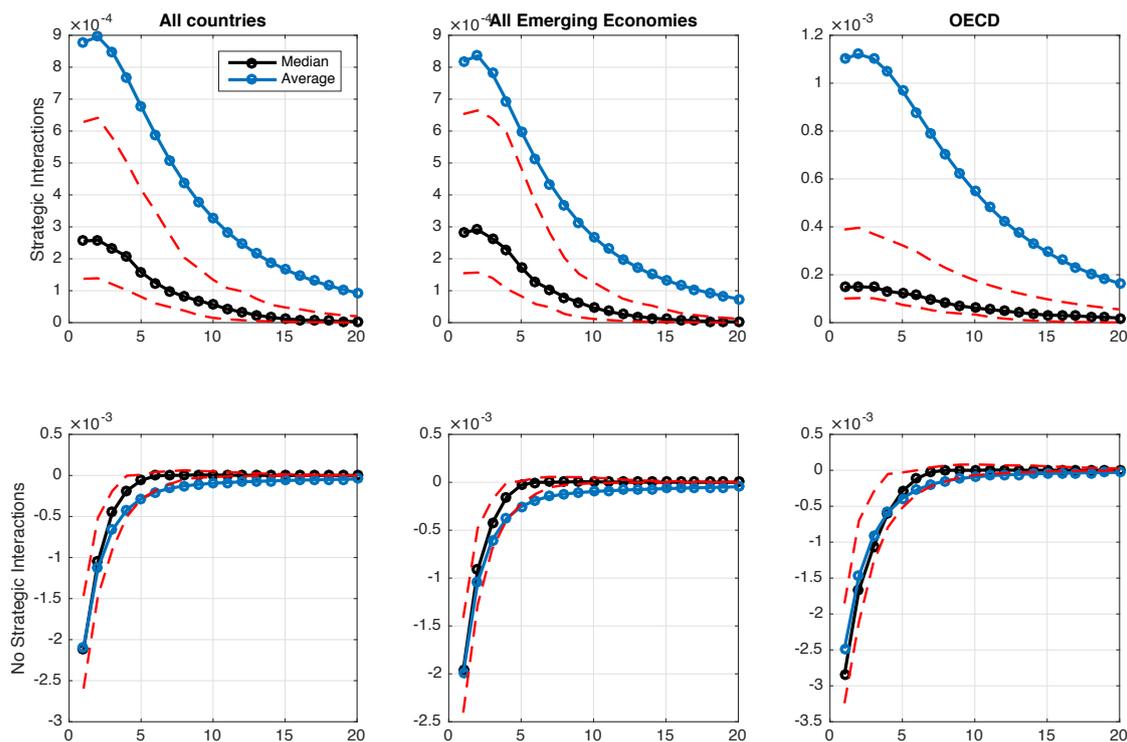


Figure 21: Simulated Impulse Response Functions (IRFs). Inflation to markup shocks, under strategic interaction (**top**) and standard NKS (no strategic interactions) (**bottom**). Red dash lines refer to the 25th and 75th percentiles

Figure 21 represents inflation impulse response to a markup shock under strategic interactions and standard NKS specification. The top panel row shows that emerging economies are significantly more responsive to a markup shock under strategic interactions than countries in the OECD benchmark group. Indeed, this new specification yields the same hump-shaped response reported in the previous section. This model therefore improves on the initial setting with its introduction of endogenous government expenditure. It also contradicts the literature’s modelling assumption of government as an exogenous component, especially when it comes to emerging economies. In this setting, endogenous government expenditure shows that inflation increases after a markup shock, thanks to strategic interactions between private and public goods. This is observed for emerging economies at a significant level, and less so for the OECD country sample. These results vindicate the underlying assumption of our model that the agency problem has an impact on the provision of public good, their pricing as well as private prices.

Consequently, the main differences between this model and the simple initial setting is that strategic interactions affect not only contemporaneous inflation, but also future, expected inflation through the output gap. The model computes output as the sum of household consumption and government expenditure, and thus is able to decompose output gap contribution between the two aggregates. Household consumption captures market imperfections generated by monopolistic competition and price stickiness, as well as a fraction of strategic interactions now that the markup is endogenous. Government expenditure on the other hand, captures institutional imperfections with

the agency problem of a public good provider with endogenous preferences for exerted effort.

In order to assess the model's performance with respect to its initial version, we report on figure 22 the average inflation impulse response to a markup shock under strategic interactions regime and in a standard NKS framework.

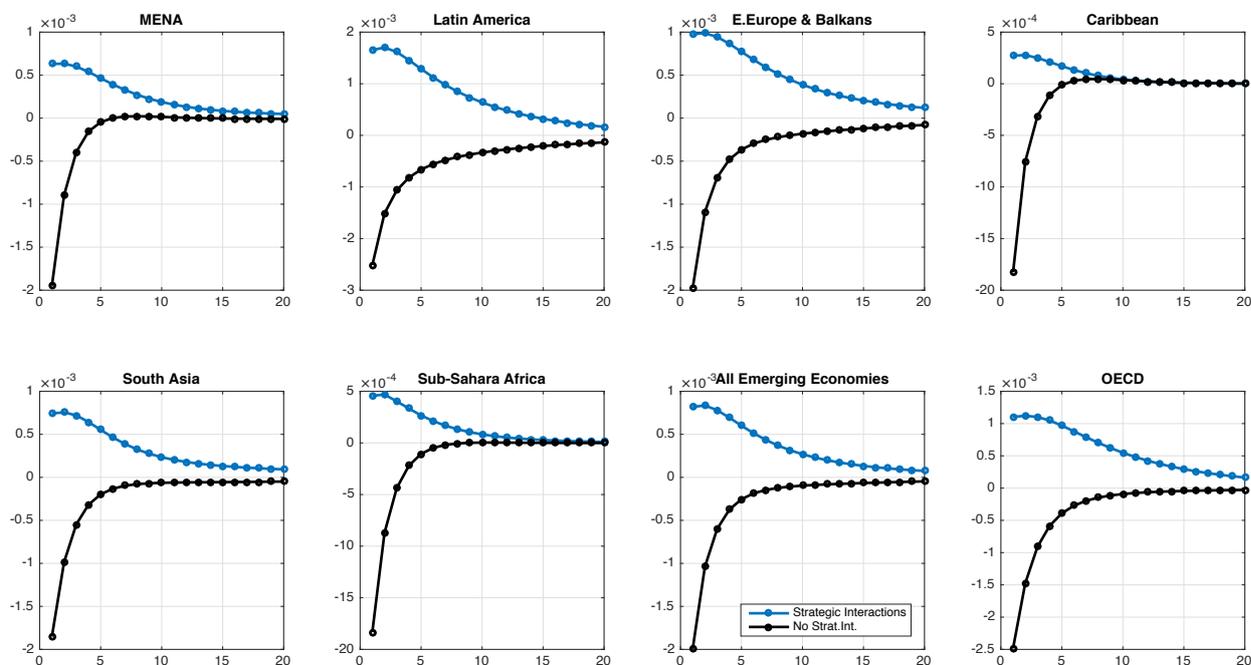


Figure 22: Simulated Impulse Response Functions (IRFs). Inflation to markup shocks, under strategic interaction (blue) and standard NKS (black)

As shown in figure 22, the model predicts a decline in inflation after a standard NKS markup shock, while the opposite is true under strategic interactions regime. Notice however that contrary to the earlier version, this model predicts a hump-shaped response, and a more sensitive inflation to the markup implied by endogenous government expenditure. We do observe for the whole emerging economies sub-sample a predicted hump-shaped response that was estimated and reported in figure 19. The model improves on its prediction of the strategic interactions effect for specific regional groups as well. For instance, private prices' sensitivity to government goods in MENA and South Asia are now adequately captured in comparison with the initial, simple setting. The model mimics adequately the impulse responses in the other emerging economies regional groups, except Sub-Sahara Africa, where the non-strategic interactions regime is more relevant to the empirical results exhibited in the previous section. The model also confirms that strategic interactions do not appear to play any meaningful role in the OECD benchmark group.

Overall, the model improves markedly on our ability to account for the strategic interactions effect on inflation in most emerging economies. The hump-shaped response shows that inflation dynamics are also sensitive to how the output gap is specified, and how important its aggregate components contribute to its response to exogenous shocks.

4 Conclusions

The stylised facts enumerated in the first section have shown that government dynamics are quite atypical in emerging economies, in the sense that pro-cyclical fiscal policy is more prevalent. Further investigation shows that it would be foolhardy to assume that government spending can be modelled as a stream of exogenous shocks. Indeed, following [Alésina, Campante & Tabellini \(2008\)](#) the political economy of these countries can be described with a social planner with endogenous preferences. The public good provider seeks to maximise its payoff function subject to resources constraints and its budget set. The pricing schedule for its public good is therefore inversely related to exerted effort and the amount of public goods offered to consumers.

These dynamics have vast repercussions on other economic agents: consumers suffer a welfare loss due to the agency strategic behaviour in which the public goods provider engages in with their principal-consumers. This reflects on their preferences in their utility function, and thus in their intermediate demand for private as well as public goods. On the supply side, private firms have to contend with the monopolistic competition in which they engage, as well as the strategic interactions implied by public goods as complements in consumers' utility function, and therefore shows in their intermediate private demand. As a result, private firms' pricing schedule has to take into account the strategic interactions effect. This provides a micro-founded theoretical framework where price stickiness is explained by two factors: first, the imperfect substitution effect in the standard monopolistic competition setup. Second, the strategic effect elasticity effect, which dominates any real changes implied by the marginal cost. In other words, productivity shocks are blunted in their effects by price stickiness exacerbated by strategic interactions between private and public goods. The model provides thus a tractable setting where contributions from market imperfections and policy failures are disentangled. It also shows that any fiscal policy designed to improve competitiveness in the economy will not deliver the expected results because of the strategic interactions effect. Any likely positive shock will be absorbed by a component directly linked to the imperfect governance implied by the agency of the public good provider.

Our model has departed from the literature by turning one of its key premises on its head: the paper does not posit that the government formulates the least distortionary tax structure in order to fund exogenous expenditure. On the contrary, we posit that the government seeks to extract a political rent through sub-optimal supply of public goods. The exerted effort, the political rent and the public good itself are then financed with taxes and debt issuance, all of whom have a distortionary effect on the economy. But the most important source of distortions on prices, output and other relevant macroeconomic aggregates is sure to be the agency behaviour of the public good provider, whose sub-optimal supply affects consumers in their utility function, and private firms in their pricing schedule.

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