Exchange Rate Populism*

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JEL Classification Codes: D72, E32, F31

Keywords: Election cycle, real exchange rate, preferences signaling

September 2015

Empirical findings have shown that East Asian and Latin American economies present opposite exchange rate electoral cycles: exchange rates tend to be more depreciated before and appreciated after elections among East Asian countries, and the opposite is true in Latin America. This paper proposes a theoretical model that explains the opposite exchange rate electoral cycle in these two regions. In a setup where policy-makers differ in their preference bias towards non-tradable and tradable sector citizens, the RER is used a noisy signal of the incumbent's type in an uncertain economic environment. The mechanism behind the cycle is engendered by the incumbent trying to signal he is median voter's type, biasing his policy in favor of the majority of the population before elections. The driving forces of the opposite exchange rate populism in these two regions is the RER distributive effects and the difference of the relative size of tradable and non-tradable sectors in these two regions.

*We would like to thank participants at 2014 American Economic Association Annual Meeting, the 62nd Annual Meeting of the French Economics Association and 12th Journées d'Economie Publique Louis-André Gérard-Varet for their comments and discussion. The usual disclaimer applies.

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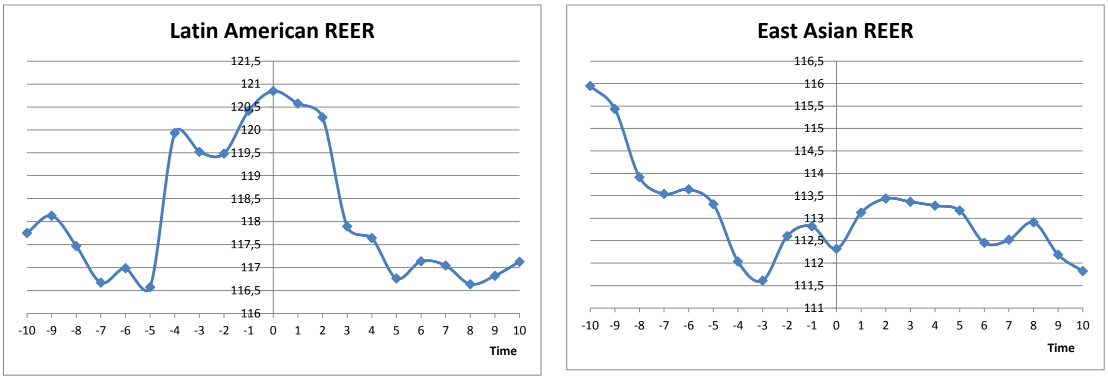
1 Introduction

Empirical studies on the political economy of exchange rate policy in Latin America have identified an electoral cycle of exchange rate: the real exchange rate (RER) is more appreciated than average before elections and more depreciated after elections (Bonomo Terra [1999], Frieden Stein [2001] and Pascó-Font Ghezzi [2000]). In a more recent study, Ryou [2008] identified for Korea the opposite electoral cycle to that in Latin America, that is, more depreciated RERs before elections and appreciated after. Huang Terra [2012], on their turn, perform a broad comparison between the Latin American and the East Asian experiences, and they find that RERs in these two regions do exhibit opposite election cycles. Figure 1 displays the average real effective exchange rates for Latin America and East Asia in a 20-month-window centered in the election month. The figure shows that the real effective exchange rate appreciates in the run-up to elections and depreciates after elections in Latin America; while it depreciates before and appreciates after elections in East Asia.

There are basically two competing explanations for the RER electoral cycles in Latin America. Stein Streb [2004] and Stein, Streb Ghezzi [2005] suggest that exchange rate cycles are generated by politicians who signal their competence by temporarily slowing the rate of currency depreciation below its sustainable level before elections, thus generating the exchange rate electoral cycles observed in the region. Alternatively, Bonomo Terra [2005] emphasize the distributive impact of RER as the main ingredient leading to exchange rate policy cycles. More specifically, a RER depreciation favors exporters and import competing domestic industries, to the detriment of non-tradable sector workers. Policymakers' preferences, which are biased towards different groups in society. RER electoral cycles is then the result of the incumbent's attempt to emulate a preference bias towards the median voter, who is a non-tradable citizen, and thereby increase his re-election probability.

The two alternative explanations for the RER electoral cycles, in a nutshell, compe-

Figure 1: Real exchange rate around election: Latin America and East Asia



Monthly CPI-based REER from BIS and IFS, from 01/1980 to 12/2009. Higher values of the index mean a RER appreciation. Latin American economies: Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, Uruguay, and Venezuela. East Asian economies: Indonesia, Korea, Malaysia, Philippines and Taiwan.

tence or preferences signaling, were equally capable of explaining the Latin American experience. The recent empirical findings of RER electoral cycles in opposite direction among Asian economies can help to disentangle the two explanations. While the competence signaling could not generate such cycles, we show in this paper that preferences signaling can encompass both types of cycles.

East Asian countries are relatively more open to trade compared to countries in Latin America. In East Asian export-oriented economies, the majority of the population works in the tradable sector, whereas in Latin America it is the non-tradable sector that attracts the highest share of workers. As a result, while an appreciated currency are in general more "popular" in Latin America, the majority of East Asian citizens should prefer a more depreciated exchange rate. The exchange rate populism goes then in opposite directions in these two regions: in Latin America, a RER appreciation pleases the median voter, whereas a depreciation is more popular in East Asia.

We generalize the theoretical model in Bonomo Terra [2005] to develop a dynamic, multidimensional signaling game between incumbent and forward-looking rational voters that generate the observed RER election cycles. Policymakers differ in their preferences bias towards citizens in tradable and in non-tradable sectors, and this difference is concealed from the public with the help of an unstable macroeconomic environment. Government policy affects the level of the RER which, in turn, have a distributive impact: depreciated RER favors tradable sector citizens in detriment to non-tradable sector citizens.

Voters, who would like to elect the politician that attributes more weight to her own welfare, infer the incumbent's type from the observed RER level. Intuitively, a more depreciated exchange rate has a higher probability to be the result of economic policy from a government that favors the tradable sector. Hence, the incumbent has an incentive tilt economic policy in favor of the median voter to increase his probability of re-election. This behavior generates policy cycles around elections, and a corresponding RER cycle. Moreover, the direction of the RER cycle depends on the median voter's type. In economies where the median voter is a tradable sector citizen, the RER will be on average more depreciated before and appreciated after elections, as observed in East Asian economies. With a median voter from the non-tradable sector, the opposite election cycle should be observed, as the one in Latin America.

The paper is organized as follows. Section 2 compares Latin American and East Asian economies, with supporting evidence of our hypothesis that generates the opposite exchange rate populism in these two regions. Section 3 describes the model's setup, whereas the equilibrium is presented in section 4. In section 5 we show how the model generates the opposite RER election cycles. Section 6 concludes.

2 Opposite Exchange Rate Populism: Latin America and East Asia

Bonomo Terra [2005] highlight the distributive impact of RER as the center piece of the electoral RER cycles in Latin America. More specifically, a RER appreciation favors the citizens in non-tradable sector, to the detriment of tradable sector citizens. Hence, if the majority of the population works in non-tradable sector, appreciation is more popular, and policy-makers use policies that appreciate the RER to increase their chances of getting reelected. However, if most of the population is in the tradable sector it is depreciation that is more popular, and policies that depreciate the currency are the ones that should increase re-election probability. In this section we present evidence that suggests that the median voter in these two regions are in different sectors, which, we argue, is the driving force of the opposite electoral RER cycle.

Table 1: Exports-To-GDP Ratio

Country		1960 - 2012		1980 - 2012	
		(1)	(2)	(3)	(4)
Latin America	Brazil	9.35%	20.65%	10.80%	23.44%
	Chile	25.50%		31.25%	
	Colombia	15.30%		16.10%	
	Cost Rica	34.23%		38.60%	
	Ecuador	19.75%		23.05%	
	Mexico	16.72%		21.84%	
	Peru	18.01%		18.42%	
	Uruguay	19.80%		22.75%	
	Venezuela	27.17%		28.17%	
East Asia	Indonesia	24.18%	38.08%	28.90%	46.74%
	Korea	29.11 %		36.95%	
	Malaysia	69.94%		86.05%	
	Philippine	29.08%		35.05%	

Source: World Bank.

The development strategy adopted by East Asian economies was based on export-oriented policies, whereas policies in Latin America have been more import-substituting (see, for instance, Bourguignon, Ferreira Lustig [2005] and Haggard Kaufman [2008]). The average ratio of export to GDP, presented in Table 1 for selected countries from these two regions, is relatively higher in East Asia compared to Latin America. The exports-to-GDP ratio ranges from 24.18% to 69.94% over the period from 1960 to 2012 in East Asia, with an average of 38.08%. While in Latin America, the average exports-to-GDP ratio is 20.65%, that is, 17.43% smaller compared to the average in East Asia. We also report in columns (3) and

(4) the average exports-to-GDP ratio for these countries from 1980 to 2012, period in which all the countries in our sample have elections. The average ratio of export to GDP of 46.74% in East Asia for that period is almost twice as large as that in Latin America, 23.44%.[1]

Table 2: GDP in Tradable Sector (% of GDP)

Country		1960 - 2012 (1)	1960 - 2012 (2)	1980 - 2012 (3)	1980 - 2012 (4)
Latin America	Brazil	48.36%	52.13%	44.55%	50.89%
	Chile	51.68%		50.47%	
	Colombia	51.56%		49.22%	
	Cost Rica	44.73%		44.73%	
	Ecuador	52.53%		51.73%	
	Mexico	44.35%		43.49%	
	Peru	53.60%		50.23%	
	Uruguay	53.38%		53.38%	
	Venezuela	61.22%		62.72%	
East Asia	Indonesia	72.56%	61.14%	71.36%	59.18%
	Korea	52.03%		49.14%	
	Malaysia	58.70%		57.90%	
	Philippine	61.29%		58.33%	

Source:World Bank. The tradable sector is comprised of: agriculture, industry, and the service sector multiplied by its trade as a share of GDP.

To illustrate the relative importance of tradable sector in the national economy, Table 2 compares tradable sector production as a ratio of GDP between these two regions. The tradable sector accounts, on average, for 52.13% of total production in Latin America, compared to 61.14% in East Asia for the period 1960-2012. For the more recent period from 1980 to 2012, the numbers drop slightly to 50.89% in Latin America and 59.18% in East Asia.

Finally, Table 3 presents the percentage of employment in the tradable sector. In Latin American countries the average share of employment in the tradable sectors is 45.30 %, while in East Asia it is 58.34%. Hence, on average, the majority of

[1] The countries displayed are the ones whose elections are at fixed dates, so that the timing is exogenous to economic variables

Table 3: Employment in Tradable Sector (% of Total Employment)

Country		1980 - 2012 (1)	(2)
Latin America	Brazil	47.77%	45.30 %
	Chile	46.08%	
	Colombia	37.25%	
	Cost Rica	47.63%	
	Ecuador	44.40%	
	Mexico	50.53%	
	Peru	40.15%	
	Uruguay	47.38%	
	Venezuela	46.55%	
East Asia	Indonesia	73.28%	58.34%
	Korea	47.60%	
	Malaysia	53.16%	
	Philippine	59.33%	

Source:World Bank. The tradable sector is comprised of: agriculture, industry, and the service sector multiplied by its trade as a share of GDP.

workers are in the tradable sector in East Asia, but not in Latin America.

All in all, we have seen that exports and tradables production represent a larger share of GDP in East Asian economies compared to Latin American ones, and that the majority workers are in the non-tradable sector in Latin America, whereas they are in the tradable sector in East Asia. As a result of these comparisons, it is fair to say that an appreciated currency is more popular in Latin America, whereas the majority of East Asian citizens should prefer a more depreciated exchange rate.

3 The Model

We propose a theoretical model in which RER election cycles are generated through a signaling game where policy-maker uses exchange rate policy to increase his re-election probability. This model is based on Bonomo Terra [2005], which explains the RER electoral cycle observed in Latin America with the assumption that the majority of the population prefers an appreciated RER. Therefore, the RER electoral cycle generated by their model is an appreciated RER before elections, and depreciated after elections. In sum, our model differs from Bonomo Terra [2005] in four main aspects: (i) we let the median voter to be either a tradable or non-tradable citizen; (ii) we introduce uncertainty in the non-tradable sector endowment; (iii) taxes are levied on all citizens (not only those from tradables sector); (iv) government policy choice is the share of expenditures on non-tradables, instead of overall expenditure level.

3.1 Model Set Up

There are two non-storable goods in this model economy, a tradable good (T) and a non-tradable one (N). We take the non-tradable good as numeraire, and the relative price of tradables e we define as the real exchange rate. Citizens derive utility from the consumption of both types of goods, with Cobb-Douglas preferences,[2] according to which they spend a share α, $\alpha \in (0, 1)$, of their income on the consumption of non-tradable goods, and a share $(1 - \alpha)$ on tradables. Preferences, both of government and of common citizens, are additively separable in time with a discount factor. We assume that there are no financial markets, hence each period's consumption expenditures must equal disposable income. This assumption will simplify intertemporal relations by making the consumers' problem time separable.

We consider an endowment economy, where each citizen receives each period an endowment y^J of the good J, for $J = T$, N. There is, however, uncertainty with respect to the amount of goods each citizen receives. More specifically, we assume that the endowment of a citizen in sector J is a log-normally distributed random variable with support $[0, \infty)$, that is, the probability density of y^J is given

[2] We use Cobb-Douglas preferences for simplicity, to have closed form solutions. We would have the same qualitative results with any increase, concave and continuous utility function.

by:[3]

$$f_J(y^J) = \frac{\exp\left\{-\frac{\left(lny^J-\mu^J\right)^2}{2(\sigma^J)^2}\right\}}{y^J\sigma^J\sqrt{2\pi}}, \text{ for } J = N, T \tag{1}$$

where μ^J and σ^J are parameters representing, respectively, the average and standard deviation of endowment in sector J.

Non-tradable sector citizens

A non-tradable citizen receives each period an endowment y^N and pays as taxes a share τ of her income. With a disposable income of $(1-\tau)y^N$, she consumes tradable and non-tradable goods, according to the following demand functions:

$$C_a^N\left(e,\, y^N\right) = \alpha(1-\tau)y^N \text{ and } C_a^T\left(e, y^N\right) = \frac{(1-\alpha)}{e}(1-\tau)y^N, \tag{2}$$

where the subscript a indicates to non-tradable citizens variables, referring to the fact that they prefer an *appreciated* RER.

Demand functions (2) yield the following indirect utility function for non-tradable sector citizens:

$$V^a\left(e, y^N\right) = \overline{h}y^N e^{-(1-\alpha)} \tag{3}$$

where $\overline{h} \equiv \alpha^\alpha(1-\alpha)^{1-\alpha}(1-\tau)$. Note that this is a decreasing function of e, that is, non-tradable sector citizens prefer an appreciated RER.

Tradable sector citizens

Similarly, a tradable sector consumer has a disposable income of $e(1-\tau)y^T$, and demand function represented by:

$$C_d^N\left(e, y^T\right) = \alpha(1-\tau)ey^T \text{ and } C_d^T\left(e, y^T\right) = (1-\alpha)(1-\tau)y^T \tag{4}$$

[3] To simplify notation, we omit time subscripts whenever it is not confusing to do so.

which yield the following indirect utility function:

$$V^d\left(e, y^T\right) = \overline{h} y^T e^\alpha \tag{5}$$

This indirect utility function is an increasing function of e, which means the tradable sector citizens are better off with more depreciated RERs. Subscript d indicates tradable sector citizens, who prefer a *depreciated* RER.

Policymakers' preferences

We assume that policy-makers derive utility not only from the welfare of society, as a benevolent policy-maker would do, but also from the fact of being in office. That is, policy-makers receive additional *ego rents* χ, with $\chi = C > 0$ per period in office, and $\chi = 0$ when not elected. Hence, the policy-maker's per period utility function can be represented by:

$$\widetilde{V}^i\left(e, y^N, y^T\right) = W\left(V^a\right) + \theta^i W\left(V^d\right) + \chi, \text{ for } i = a, d \tag{6}$$

where θ^i is the relative weight attributed to tradable citizens by policy-maker i, and $W(\cdot)$ is thus an increasing and concave function in citizens' utility: $W'(\cdot) > 0$ and $W''(\cdot) < 0$. Notice that, with the concave function $W(\cdot)$, we assume that policy-makers are not only concerned about citizens' utility level, but also about the disparity between two groups' utility. The concern about the disparity may be motivated by the fact that the inequality between two groups can lead to social unrest. [4]

As in Bonomo Terra [2005], we assume that policy-makers may differ in their preferences. The idea is that tradable sector lobbying may bias policy-maker preferences towards the tradable sector, as proposed by Bonomo Terra [2010]. As a result, policy-makers may differ in the relative weight θ^i they attribute to the

[4] This formulation is similar to that in Rogoff [1990], in which the policy-maker's per period utility is a concave function of citizen's consumption and public investment goods, plus the ego rents.

welfare of tradable citizens. The result of the lobbying activity is uncertain, and the public cannot observe directly whether the policy-maker has been captured by the tradable sector lobbying.

More specifically, we assume that there are two types of policy-makers: d and a. Policymakers of type d give relatively more weight to tradables utility, thus choosing economic policy that generates more depreciated exchange rates on average. Type a policy-makers, on their turn, give relatively less weight to tradables utility, delivering more appreciated RERs. This difference in captured by the parameter θ^i in the politician's utility function (6), with $0 < \theta^a < \theta^d$.

We do not model the lobbying activity in this paper, but the mechanism we have in mind is the one proposed by Bonomo Terra [2010]. As a shortcut, we assume that politicians are randomly assigned a type, θ^a or θ^d, so that with probability p^m the politician is of the median voter type.

Government finances its expenditures by taxing the endowments of each citizen, and spending it in both tradable and non-tradable goods. Given our assumption that there are no financial markets, the government must have a balanced budget at all periods, that is:

$$G = G^N + G^T = n\tau y^N + (1-n)\tau e y^T, \tag{7}$$

where G is total expenditure per capita, G^N and G^T represent government spending per capita on non-tradable goods and tradable goods, respectively. n is the share of the population in non-tradable sector.

We take the tax rate τ as exogenous. Typically, changing tax rates takes time since it usually has to be approved by congress. Therefore, it cannot be used as short term economic policy, which is the focus of this paper on electoral cycles. Hence, the policy-makers' policy choice is how to distribute government expenditures between tradable and non-tradable goods. We denote s as the share of government expenditure used to buy non-tradable goods, so that $G^N = sG$ and $G^T = (1-s)G$.

As we will see in the next session, government spending allocation s affects the equilibrium RER e, which, in turn, impacts citizens' utility according to equations (3) and (5). Since we want to focus on the incentives for the government to use economic policy to manipulate the RER, we will abstract from the direct impact of policy choice on citizens' utility. That is, we assume that expenditure allocation across sectors does not have a direct impact on the utility of individuals.[5]

Equilibrium RER

Since there are no financial markets and there is only one type of tradable good, the market equilibrium conditions for this economy are the same as those of a closed economy.[6] Equilibrium RER is the one that assures equilibrium in the markets for tradable and non-tradable goods, that is, the relative price that makes demand equal supply in each sector, as in:

$$sG + nC_a^N\left(e,\ y^N\right) + (1-n)\,C_d^N\left(e,\ y^T\right) = ny^N, \text{ and} \tag{8}$$

$$(1-s)\,\frac{G}{e} + nC_a^T\left(e,\ y^N\right) + (1-n)\,C_d^T\left(e,\ y^T\right) = (1-n)\,y^T, \tag{9}$$

where the demand functions $C_i^J\left(e, y^J\right)$, $J = N, T$, are in equations (2) for non-tradable sector citizens $i = a$, and in equations (4) for those in the tradable sector $i = d$.

Solving either one of the market equilibrium equations (8) or (9), and using the gov-

[5]This assumption is captured by the fact that government expenditures do not appear in the demand functions (2) and (4). Our results would not change if we had included total expenditure per capita G in the utility function, either multiplicative (so it would also appear on demand function) or additively. The important assumption is that the two types of citizens do not differ with respect to their preferences for consuming government expenditures as tradable or non-tradable goods.

[6]It is important to note that the driving force of RER election cycle is the distributive impact of the RER, that is, the relative price of tradable and non-tradable goods, on different citizens' utility. It is, thus, not related to intertemporal effects.

ernment's budget constraint in equation (7), we obtain the equilibrium RER:

$$e\left(s,\, y^N,\, y^T\right) \;=\; \eta H\left(s\right)\left(\frac{y^N}{y^T}\right), \tag{10}$$

where $\eta \equiv \dfrac{n}{1-n}$, and $H(s) \equiv \dfrac{1 - s\tau - \alpha(1-\tau)}{s\tau + \alpha(1-\tau)}$.

According to equation (10), the equilibrium RER is a function of the share of government expenditures on non-tradable goods s. More specifically, since $H(s)$ is a decreasing function of s, the more the government spends on non-tradable goods, the more appreciated is the equilibrium RER. Equilibrium RER depends also on the relative endowments in the two sectors: a lower relative endowment of non-tradables results in a more appreciated equilibrium RER. Hence, a more appreciated RER may be the result of either more government spending on non-tradable goods or a lower relative endowment in that sector.

3.2 Events around Elections

Elections are held every other period, with two candidates: the incumbent and the opponent. The citizens in each sector are assumed to be identical, so their voting preferences are the same. Let m be the sector to which the median voter belongs, and $\overline{m}$ be the other sector, so that:

$$m = \begin{cases} N & \text{if } n > {}^1\!/\!{}_2 : \;\; \text{median voter is a notradable sector citizen } a \\ T & \text{if } n < {}^1\!/\!{}_2 : \;\; \text{median voter is a tradable sector citizen } d \end{cases}$$

$$\overline{m} = \begin{cases} N & \text{if } m = T \\ T & \text{if } m = N \end{cases}$$

The election cycle occurs in a two-periods setup, with an election between the periods. We first describe the events in the pre-election period $\bar{t}$. The politicians' preferences are randomly assigned, and, after observing his own type, the incumbent chooses economic policy, which is the share of government spending on non-tradable goods, s. The endowments in two sectors, y^N, y^T are then distributed, determining, with the chosen policy s, the equilibrium RER, $e_{\bar{t}} = e\left(s_{\bar{t}}, y_{\bar{t}}^N, y_{\bar{t}}^T\right)$, as established in equation (10). The median voter knows neither the politicians' type i nor the policy chosen s, nor the endowment in the other sector $y_{\bar{t}}^{\bar{m}}$. She makes her vote decision according to the information she has, which are the endowment in her sector $y_{\bar{t}}^m$, and the observed RER $e_{\bar{t}}$.

In the post-election period $\bar{t}+1$, the election winner sets new policy $s_{\bar{t}+1}$ and the equilibrium RER is determined once the endowments in two sectors are realized, $e_{\bar{t}+1} = e\left(s_{\bar{t}+1},\, y_{\bar{t}+1}^N,\, y_{\bar{t}+1}^T\right)$.

Notice that we assume that there is persistence of the policy-maker's preferences before and after elections, which is essential for the election cycle to be generated. Voter only care about the policy-maker type if they believe his type will not change completely after election. We use the simplifying assumption that the type does not change at all around elections.

We argue, however, that preferences may change in between elections. In the preparation process for elections, new alliances are made, government's composition may change, and the result may affect the politicians' preference bias towards the two sectors in the economy. To capture this change, we assume that preferences are randomly assigned to politicians in the period prior to elections.

4 Equilibrium

Substituting the equilibrium RER from equation (10) into the citizen's indirect utility functions (3) and (5), the indirect utility function of non-tradable and tradable sector citizens become:

$$V^a\left(s, y^N, y^T\right) = hH\left(s\right)^{-(1-\alpha)} \tag{11}$$

$$V^d\left(s, y^N, y^T\right) = hH\left(s\right)^{\alpha} \tag{12}$$

where $h \equiv \bar{h}\eta^{\alpha-1}\left(y^N\right)^{\alpha}\left(y^T\right)^{1-\alpha}$ and $H(s) \equiv \dfrac{1-s\tau-\alpha(1-\tau)}{s\tau+\alpha(1-\tau)}$.

Since $H(s)$ decreases in s and $0<\alpha<1$, the non-tradable citizen's utility V^a increases in s, while for the tradable citizen V^d is a negative function of s. In other words, a higher expenditure share on non-tradable goods favors non-tradable sector citizens' interests, to the detriment of tradable sector citizens. Substituting equations (11) and (12) into equation (6), the incumbent's per-period utility function can be written as:

$$\widehat{V}^i\left(s,y^N,y^T\right) = W\left[hH(s)^{-(1-\alpha)}\right]+\theta^i W\left[hH(s)^{\alpha}\right]+\chi \tag{13}$$

where $\chi = \begin{cases} C & \text{if in office} \\ 0 & \text{otherwise} \end{cases}$, with $C>0$.

The incumbent chooses government expenditure allocation before observing endowments, so he relies on expected value of his utility, which can be obtained from taking expectations of equation (13) with respect to the endowment shocks. We can therefore get the incumbent's expected utility in a period is a function of s:

$$\begin{aligned} F^i(s) &\equiv E\left[\widehat{V}^i\left(s,\,y^N,\,y^T\right)\right] \\ &= \int_0^{\infty}\int_0^{\infty} W\left(V^a\left(s,\,y^N,\,y^T\right)\right) f_N\left(y^N\right) f_T\left(y^T\right) dy^N dy^T \\ &\quad +\theta^i \int_0^{\infty}\int_0^{\infty} W\left(V^d\left(s,\,y^N,\,y^T\right)\right) f_N\left(y^N\right) f_T\left(y^T\right) dy^N dy^T + C \\ &\equiv E\left[W\left(V^a(s)\right)\right]+\theta^i E\left[W\left(V^d(s)\right)\right]+C \end{aligned} \tag{14}$$

We now solve the dynamic game between the incumbent and the median voter. With our assumptions of no financial markets, non-storable goods, time separable utility functions, and the politician's preferences independently assigned every two periods, we are able to break our problem into a sequence of identical two-period stage games. This implies that the equilibria strategies of each player are the same in every stage game.

In a stage game, the median voter's strategy is her vote choice in the pre-election period $\bar{t}$, based on the information she has, which is the observed RER and the endowment in her sector.

The incumbent's strategy is the expenditure allocation chosen in the pre-election and the post-election periods. The strategy can be represented by $s^* = \{s^{a*}, s^{a*}_{+1}, s^{d*}, s^{d*}_{+1}\}$, where s^{i*} is the expenditure share on non-tradable goods chosen by the incumbent of type i before election, $i = a$ or d, and s^{i*}_{+1} is the one chosen by the election winner in the after-election period.

The road-map for finding equilibrium is as follows. Solving by backward induction, we start by finding the optimal policy choice after election. Then, we solve for the optimal strategies of the incumbent and of voters in the pre-election period.

4.1 After Election Policies

In the post-election period, there is no signaling issue in policy choice. New preferences will be assigned to all politicians before the next elections, so that the policies chosen in a period following elections have no influence on the re-election probability in the next stage game. Hence, there is no point in trying to signal being of one type or another at that moment. Even though there is still asymmetric information, the incumbent has no strategic considerations in the period following elections, so that he chooses the policy to maximize his expected per-period utility function presented by equation (14). Thus, s^{i*}_{+1} is chosen so as to maximize his expected utility $F^i(s)$ in equation (14), that is:

$$s^{i*}_{+1} = \arg\max F^i\left(s\right). \tag{15}$$

As shown in appendix A.1, we have that $s^{a*}_{+1} > s^{d*}_{+1}$, that is, the non-tradable type of policy-maker chooses a relatively higher government expenditure share on non-tradable goods than the tradable type. Since the RER is a decreasing function of s, as established in equation (10), s^{a*}_{+1} yields more appreciated RERs, preferred by non-tradable citizens a, while s^{d*}_{+1} generates more depreciated RERs, satisfying tradable citizens d. Hence, citizens always prefer politicians of their own type.

4.2 Before Election Problem

Let us now analyze the incumbent's and voters' strategies in the period preceding elections. The median voter may be either a non-tradable or a tradable citizen. We then define s^{i*}_{m} as expenditure share on non-tradable goods chosen in equilibrium by an incumbent of type i, $i = a, d$, in the pre-election period, when the median voter belong to sector m, $m = N, T$.

We start by solving the voter's problem, and then calculating the incumbents re-election probability, which depends on the equilibrium expenditure share chosen by the incumbent, and then we look at the policy-maker's problem.

The Median Voter's Problem

We have seen that $s^{a*}_{+1} > s^{d*}_{+1}$, that is, after election, the policy-maker that favors the non-tradable sector spends relatively more on non-tradables. This generates more appreciated RERs, which are preferred to non-tradable citizens. Hence, they would like to elect a policy-maker of type a. Analogously, a tradable citizen would like to elect a type d policy-maker. Hence, the median voter would like to vote for the policy-maker of her own type. However, under asymmetric information, the median voter cannot observe policy-makers' type. She knows the probability distribution according to which politicians types are assigned, that is, with probability p^m a politician is of median voter's type.

For the opponent candidate, that is all the information the median voter has. As for the incumbent, she uses the information she has on the economic activity to try to infer his type. In particular she uses the observed RER, which results form the combination of economic policy and the endowment size in both sectors. We denote ρ^m the updated probability the incumbent is of the median voter's type. If it is larger than or equal to p^m, it means the incumbent is more likely to be of median voter's type than the opponent, and the median voter will vote for the incumbent; otherwise she votes for the opponent. Therefore, the vote function can be rewritten as:

$$vo_m(\widehat{e}, y^m) = \begin{cases} inc & \text{if } \rho^m(\widehat{e}, y^m) \geq p^m \\ opp & \text{otherwise} \end{cases} \tag{16}$$

The observed RER is a function of the policy chosen and the endowment level in both sectors: $\widehat{e}\left(s,\, y^N,\, y^T\right)$. Since the voter has information only on the endowment level in her own sector, she is not able to infer precisely the policy chosen by observing the RER level. She knows, however, the probability distribution for the other sector' endowment, which she uses to form her belief about the incumbent's type using Bayes' rule. The median voter's updated probability is:

$$\begin{aligned} \rho^m &= Pr\left(i = m \mid e = \widehat{e}\right) \\ &= \frac{p^m \times g\left(e = \widehat{e} \mid i = m\right)}{p^m \times g\left(e = \widehat{e} \mid i = m\right) + \left(1 - p^m\right) \times g\left(e = \widehat{e} \mid i = \overline{m}\right)} \end{aligned} \tag{17}$$

where i denotes the incumbent's type,[7] $\widehat{e}$ is the observed RER, and $g(\cdot \mid \cdot)$ represents the conditional density function of RER given the incumbent's type. From equation (17), $\rho^m \geq p^m$, the condition that the median voter votes for the incumbent in equation (16), is equivalent to:

$$g\left(e = \widehat{e} \mid i = m\right) \quad \geq \quad g\left(e = \widehat{e} \mid i = \overline{m}\right) \tag{18}$$

According to equation (18), the median voter votes for the incumbent if, and only if, the observed exchange rate is more likely generated by the incumbent of her own type, which is quite intuitive.

[7] With some abuse of notation, we means that $i = a$ when $m = N$ and $i = d$ when $m = T$.

Reelection probability

The re-election probability, π, is the probability that the median voter votes for the incumbent. Referring to the median voter's voting function equation (16), π equals to the probability of $\rho^m \geq p^m$, which holds if, and only if, $g\left(e=\widehat{e} \mid i=m\right) \quad \geq \quad g\left(e=\widehat{e} \mid i=\overline{m}\right)$.

The median voter can observe the endowment in her own sector y^m and the RER $\widehat{e}$, but she does not observe the endowment in the other sector $y^{\overline{m}}$ nor the policy chosen s. Since the RER depends on the policy chosen s and the realized endowments in both sectors, $\widehat{e} = e\left(s, y^N, y^T\right)$, she can compute the endowment level in the other sector $y^{\overline{m}}$ that would generate the observed RER $\widehat{e}$, given the policy chosen in equilibrium by a policy-maker of type i, s_m^{i*}. Hence, the conditional density function of $\widehat{e}$, given the incumbent's type, $g\left(e=\widehat{e} \mid i\right)$, is equal to the density function of that endowment $y^{\overline{m}}$ that would generate $\widehat{e}$. That is:

$$g\left(e=\widehat{e} \mid i\right) \quad = \quad f_{\overline{m}}\left(y^{\overline{m}} \mid e\left(s_m^{i*}, y^N, y^T\right) = \widehat{e}, y^m\right) \tag{19}$$

The median voter compares the density function of the other sector's endowment that generates the observed RER for the equilibrium policies from two types of policy-makers: s_m^{a*} and s_m^{d*}, where the subscript m stands for the sector to which belongs the median voter.[8] Then, given equation (19), the condition for re-election in inequality (18) becomes:

$$f_{\overline{m}}\left(y^{\overline{m}} \mid e\left(s_m^{m*}, y^N, y^T\right) = \widehat{e}, y^m\right) \geq f_{\overline{m}}\left(y^{\overline{m}} \mid e\left(s_m^{\overline{m}*}, y^N, y^T\right) = \widehat{e}, y^m\right) \tag{20}$$

where $e(\cdot)$ is defined by equation (10).

Figure 2 represents this re-election condition. The horizontal axis measures the observed RER and the vertical axis is the probability density function of the endowment shock non observed by the median voter $y^{\overline{m}}$, which would yield the observed

[8]Notice that, while the optimal post-election policy choice does not depend on the identity of the median voter, the same is not true for the pre-election policy. Before elections, the policy chosen by each type of policy-makers depends on which sector the median voter belongs to: tradable or non-tradable.

RER $\widehat{e}$ for a given expenditure policy s and the given endowment in the median voter's sector y^m, that is, $f_{\overline{m}}\left(y^{\overline{m}} \mid e\left(s, y^N, y^T\right) = \widehat{e}, y^m\right)$. Since RER decreases in s, the curve more to the right corresponds to a lower level of s. Hence $s > s'$, that is, the solid curve in Figure 2 corresponds the a larger expenditure share on non-tradable goods s, and the dotted curve for the smaller one s'.

The conditional density of the endowment shock in the $\overline{m}$-sector is distinct for different expenditure policies. For instance, in Figure 2 the solid curve is higher than dotted one when $e = \check{e}$, which means that RER $\check{e}$ is more likely to be generated by the larger s.

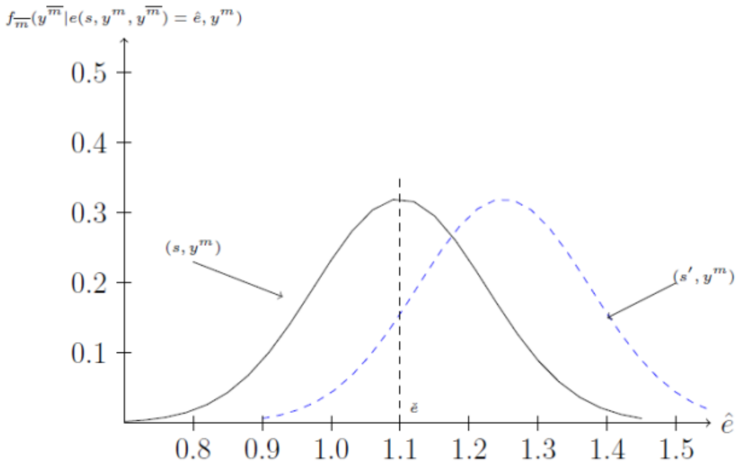


Figure 2: Re-election Condition

By comparing the two conditional density functions at the observed RER level, the median voter makes her vote decision: she votes for the incumbent if the conditional density function for the policy chosen by an incumbent of her own type s_m^{m*} is higher than for the policy from the other type of policy-maker $s_m^{\overline{m}*}$. She votes for the opponent otherwise. The median voter's problem can thereby be written as follows:

$$vo_m\left(\widehat{e}, y^m\right) = \begin{cases} inc & \text{if} \quad f_{\overline{m}}\left(y^{\overline{m}} \mid e\left(s_m^{m*}, y^N, y^T\right) = \widehat{e}, y^m\right) \\ & \qquad \geq f_{\overline{m}}\left(y^{\overline{m}} \mid e\left(s_m^{\overline{m}*}, y^N, y^T\right) = \widehat{e}, y^m\right) \\ opp & \text{otherwise} \end{cases} \tag{21}$$

It is worth noting that an equilibrium in which both types of policy-makers choose the same policy level cannot exist. If actions chosen by the two types of policy-makers were the same, for every exchange rate level compatible with equilibrium, the median voter would attribute probability $\rho^m = p^m$ that the incumbent is of her own type. According to the voting function in equation (16), the median voter would reelect the incumbent for any observed value of the RER. Since the observed RER would not affect his re-election probability in this case, the incumbent would have an incentive to deviate and choose the policy that maximizes his expected utility (14), that is, the same policy s_{+1}^{m*} chosen in the post-election period. We have seen that $s_{+1}^{a*} > s_{+1}^{d*}$, which means that policy-makers of different types would choose different policies. Therefore, a pooling equilibrium does not exist.

In the equilibria with different policies, there is a cutoff level of RER, $\tilde{e}_m$ for which inequality (20) is satisfied with equality, which is the point where the two curves cross in Figure 2. Put in other words, at the RER cutoff level, the probabilities of this RER being generated by either type of incumbent are the same. As shown in Appendix A.2, the RER cutoff levels are:

$$\begin{cases} \tilde{e}_N = \eta\sqrt{H\left(s_N^{a*}\right) H\left(s_N^{d*}\right)}\dfrac{y^N}{\exp\left(\mu^T - \left(\sigma^T\right)^2\right)} \\ \\ \tilde{e}_T = \eta\sqrt{H\left(s_T^{a*}\right) H\left(s_T^{d*}\right)}\dfrac{\exp\left(\mu^N - \left(\sigma^N\right)^2\right)}{y^T} \end{cases} \tag{22}$$

where $\eta \equiv \dfrac{n}{1-n}$ and n is the share of the population in the non-tradable sector. The median voter is in the non-tradable sector when $\eta > 1$, and in that case the cutoff RER is given by $\tilde{e}_N$. For a tradable sector median voter, we have that $\eta < 1$

and the cutoff RER is $\tilde{e}_T$.

The median voter makes her voting decision by comparing the observed RER with its cutoff level, as illustrated in Figure 3. Figure 3(a) represents the voting decision for a median voter from the non-tradable sector while Figure 3(b) when the median voter is a tradable citizen. In both figures, we have that $s_m^{a*} > s_m^{d*}$,[9] where the left solid curve corresponds to the conditional density function for the higher value of s, s_m^{a*}, while the right dotted one for the lower value s_m^{d*}. The intersection of the curves determines the RER cutoff level, $\widetilde{e}_m$.

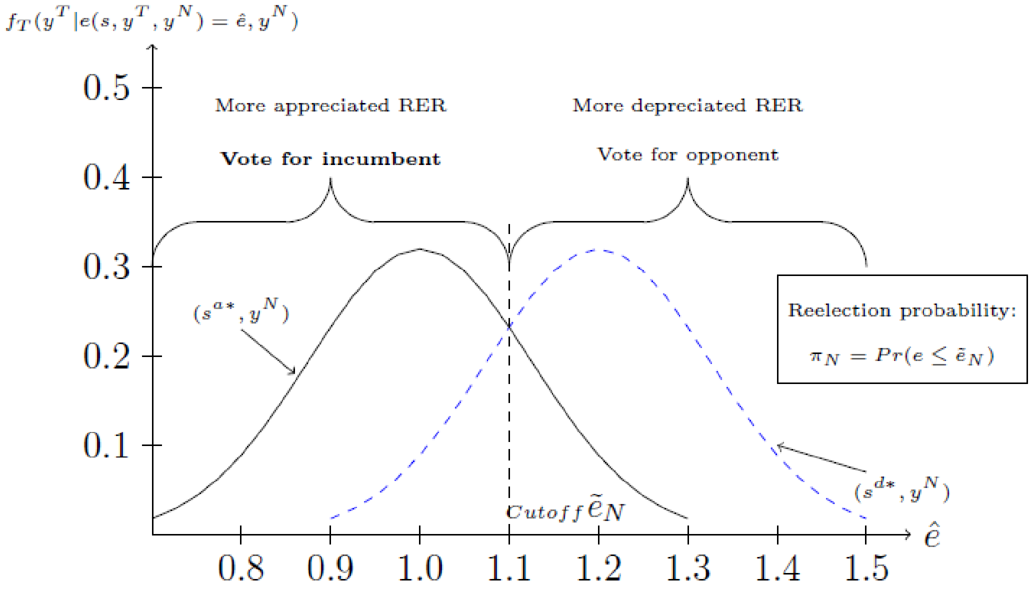
A median voter from the non-tradable sector, $m = N$, would like to reelect a policy-maker of type a. She will then vote for the incumbent whenever the observed RER is more appreciated, that is, lower that the cutoff level $\widetilde{e}_N$, since those RER values are more likely to be generated by the policy set by a type a incumbent, s_N^{a*}. Conversely, for more depreciated RERs $\hat{e} > \widetilde{e}_N$, the median voter votes for the opponent. Figure 3(a) indicates this voting strategy for the median voter, when she is a citizen from the non-tradable sector.

The median voter from the tradable sector, $m = T$, on her turn, would like to re-elect a type d, policy-maker, who will generate more depreciated RERs on average after election. As shown in Figure 3(b), an exchange rate $\widehat{e}$ more depreciated that is, higher than $\widetilde{e}_T$ is more likely to be generated by policy s_T^{d*}, chosen by incumbent of type d. Hence, the median voter votes for the incumbent if she observes RER is more depreciated than $\widetilde{e}_T$, otherwise votes for the opponent.

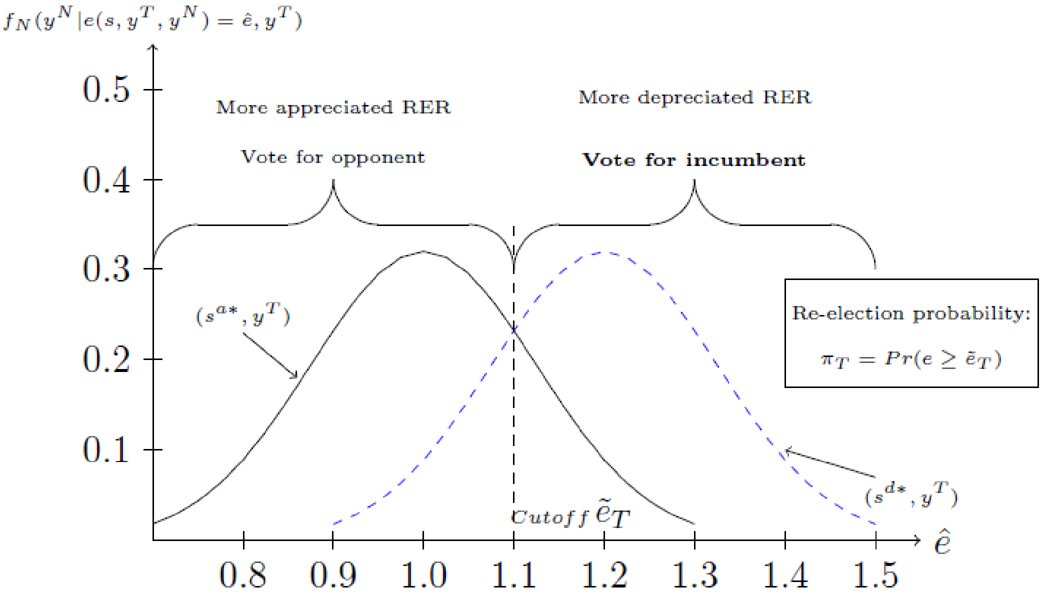
Proposition 1 formalizes the median voter's voting decision.

Proposition 1 (Median voter's voting decision) *If the median voter is a non-tradable sector citizen, she votes for the incumbent once she observes a real exchange rate more appreciated than the corresponding cutoff real exchange rate, and she votes for the opponent otherwise. A median voter from the tradable sector, in its turn, votes for the incumbent if the observed real exchange rate is more depreciated than the corresponding cutoff real exchange rate, and for the opponent*

[9] In Proposition 3 we show that, indeed, $s_m^{a*} > s_m^{d*}$ in equilibrium.



(a) Voting Rule: Nontradable median voter



(b) Voting Rule: Tradable median voter

Figure 3: Voting Rule of Median Voter

otherwise. In sum, the median voter's voting decision is represented by:

$$
\begin{aligned}
vo_N(\widehat{e}) &= \begin{cases} inc & \text{if } \widehat{e} \leq \widetilde{e}_N \\ opp & otherwise \end{cases} \\
vo_T(\widehat{e}) &= \begin{cases} inc & \text{if } \widehat{e} \geq \widetilde{e}_T \\ opp & otherwise \end{cases}
\end{aligned} \tag{23}
$$

where the cutoff levels $\tilde{e}_N$ and $\tilde{e}_T$ are defined in equation (22).

Proof. Given the voting rule in equation (21) and the results from Appendix A.2, the result is straighforward. ■

Now we can compute the re-election probability, which is the probability of having an endowment level for the non-median voter that generates a RER in the range where the median voter votes for the incumbent. In other words, the voting decision establishes a corresponding cutoff level for the endowment of the non-median voter, which is obtained by equalizing the observed RER defined by equation (10) to its cutoff RER in equation (22). The cutoff levels of endowments $\widetilde{y}^T$, for $m = N$, and $\widetilde{y}^N$, for $m = T$, are given by:

$$\widetilde{y}^T\left(s_N^i, s_N^{a*}, s_N^{d*}\right) = \frac{H\left(s_N^i\right)}{\sqrt{H\left(s_N^{a*}\right) H\left(s_N^{d*}\right)}} \exp\left(\mu^T - \left(\sigma^T\right)^2\right), \text{ for } m = N \tag{24}$$

$$\widetilde{y}^N(s_T^i, s_T^{a*}, s_T^{d*}) = \frac{\sqrt{H\left(s_T^{a*}\right) H\left(s_T^{d*}\right)}}{H\left(s_T^i\right)} \exp\left(\mu^N - \left(\sigma^N\right)^2\right), \text{ for } m = T \tag{25}$$

where $H(s)$ is defined in equation (10), s_m^i is the policy chosen by the incumbent of type i while s_m^{a*} and s_m^{d*} are the optimal policies chosen in equilibrium by the two types of incumbent, when the median voter is of type m.

Given that the exchange rate is a decreasing function of the tradable sector endowment y^T and an increasing function of the non-tradable sector endowment y^N (see equation (10)), the median voter's voting decision described in Proposition 1 is equivalent to:

$$vo_N\left(\widehat{e}, y^N\right) = \begin{cases} inc & \text{if } y^T \geq \widetilde{y}^T \\ opp & \text{otherwise} \end{cases} \tag{26}$$

$$vo_T\left(\widehat{e}, y^T\right) = \begin{cases} inc & \text{if } y^N \geq \widetilde{y}^N \\ opp & \text{otherwise} \end{cases} \tag{27}$$

The incumbent is re-elected once the realized endowment is larger than the cutoff level. The re-election probability, which is the probability that the re-election condition occurs, is then $\pi = Pr(y^{\bar{m}} \geq \tilde{y}^{\bar{m}})$. The following proposition formalizes the re-election probability.

Proposition 2 (The re-election probability) *When the incumbent chooses policy s before election, his re-election probability is given by:*

$$\pi_m\left(s, s_m^{a*},\ s_m^{d*}\right) = \int_{\widetilde{y}^{\overline{m}}}^{\infty} f_{\overline{m}}\left(y^{\overline{m}}\right) dy^{\overline{m}},\ for\ m = N, T \tag{28}$$

where $\widetilde{y}^{\overline{m}}$ are given by equations (24) *and* (25)*, for $\overline{m} = T, N$.*

Proof. See Appendix A.3 ■

How does the policy choice s affects the re-election probability? Taking the derivative of the re-election probability in equation (28) with respect to s, we get:

$$\frac{\partial \pi_m\left(s, s_m^{a*}, s_m^{d*}\right)}{\partial s} = -\underbrace{f_{\bar{m}}\left(\widetilde{y}^{\bar{m}}\right)}_{\oplus} \times \underbrace{\frac{\partial \widetilde{y}^{\bar{m}}\left(s, s_m^{a*}, s_m^{d*}\right)}{\partial H(s)}}_{\oplus \text{if } m=N;\, \ominus \text{if } m=T} \times \underbrace{\frac{\partial H(s)}{\partial s}}_{\ominus}$$

In the formulation above, the first term $f_{\bar{m}}\left(\widetilde{y}^{\bar{m}}\right)$ is positive and the last term $\dfrac{\partial H(s)}{\partial s}$ is negative. The sign of the second term $\dfrac{\partial \widetilde{y}^{\bar{m}}\left(s, s_m^{a*}, s_m^{d*}\right)}{\partial H(s)}$ depends on the type of the median voter: it is positive when the median voter is a non-tradable sector citizen, and negative if the median voter is from the tradable sector. Therefore, if the median voter is a non-tradable sector citizen, the re-election probability increases in the government expenditure share on non-tradable goods. Conversely, the re-election probability is a negative function of the government expenditure share on non-tradable goods if the majority of the population is from the tradable sector. In sum, we have that:

$$\frac{\partial \pi_N\left(s, s_N^{a*}, s_N^{d*}\right)}{\partial s} > 0, \text{ and}$$
$$\frac{\partial \pi_T\left(s, s_T^{a*}, s_T^{d*}\right)}{\partial s} < 0.$$

The Incumbent

From Proposition 2, it is clear that the policy chosen by the incumbent in the pre-election period affects not only his contemporaneous utility, but also the probability of re-election, and hence his next period's expected gains. The policymaker chooses pre-election policy so as to maximize an intertemporal utility function, as in:

$$\max_s U_m^i(s) = \left\{ \begin{array}{l} F^i(s) \\ +\beta\pi_m\left(s, s_m^{a*}, s_m^{d*}\right) F^i\left(s_{+1}^{i*}\right) \\ +\beta\left[1-\pi_m\left(s, s_m^{a*}, s_m^{d*}\right)\right] p^i\left(F^i\left(s_{+1}^{i*}\right)-C\right) \\ +\beta\left[1-\pi_m\left(s, s_m^{a*}, s_m^{d*}\right)\right]\left(1-p^i\right)\left(F^i\left(s_{+1}^{j*}\right)-C\right) \end{array} \right\} \tag{29}$$
$$\text{s.t. } 0 \leq s \leq 1$$

where β is the incumbent's intertemporal discount rate. The first term, $F^i(\cdot)$, is the contemporaneous expected utility of the incumbent, defined in equation (14). The sum of the other terms represents the incumbent's expected utility for the following period: (i) The incumbent will be re-elected with probability $\pi_m\left(s, s_m^{a*}, s_m^{d*}\right)$, and the corresponding expected utility is $F^i\left(s_{+1}^{i*}\right)$. (ii) With probability $\left[1-\pi_m\left(s_m, s_m^{a*}, s_m^{d*}\right)\right] p^i$ he loses election and an opponent with the same type wins the election and $F^i\left(s_{+1}^{i*}\right) - C$ is the corresponding expected utility. Although in both cases the expenditure policy in the next period is s_{+1}^{i*}, the expected utility for the politician is not the same since he does not have the "ego rent" when away from the power. (iii) With probability $\left[1-\pi_m\left(s, s_m^{a*}, s_m^{d*}\right)\right]\left(1-p^i\right)$ an opponent of the other type wins the election, in which case the utility of incumbent is denoted as $F^i\left(s_{+1}^{j*}\right)-C$.

Rearranging, problem (29) can be rewritten as:

$$\max_s U_m^i(s)=\left\{\begin{array}{l} F^i(s) \\ +\beta\pi_m\left(s, s_m^{a*}, s_m^{d*}\right)\left\{\left(1-p^i\right)\left[F^i\left(s_{+1}^{i*}\right)-F^i\left(s_{+1}^{j*}\right)\right]\right\} \\ +\beta\left[p^i F^i\left(s_{+1}^{i*}\right)+\left(1-p^i\right)F^i\left(s_{+1}^{j*}\right)\right]-\beta\left(1-\pi_m\right)C \end{array}\right\} \tag{30}$$
$$\text{s.t. } 0\leq s\leq 1$$

The solution is a fixed point where the optimal policy choice for a type a incumbent is s_m^{a*}, and s_m^{d*} for a type d incumbent.

Proposition 3 *Under asymmetric information about the policy-maker's type, the policy-maker of non-tradable type chooses in equilibrium a higher expenditure share on non-tradable goods than policy-maker of tradable type in the run-up to the election, that is, $s_m^{a*}>s_m^{d*}$, for $m=N,T$.*

Proof. see Appendix A.4 ■

The following proposition formalizes the equilibrium and its existence.

Proposition 4 (Equilibrium under asymmetric information) *There is a perfect Bayesian equilibrium in pure strategies. In any perfect Bayesian equilibrium, the incumbents' strategies prescribe as following: (1) in the pre-election period, the incumbent of type i will chose the policy s_m^{i*} such that $s_m^{i*}\in s_m^i\left(s_m^{a*}, s_m^{d*}\right)$, where $s_m^i(\cdot,\cdot)$ is the solution to problem* (30). *(2) In the post-election period, the incumbent of type i will choose policy s_{+1}^{i*} defined in equation* (15). *The non-tradable sector citizen votes for the incumbent if the observed exchange rate is not greater than $\widetilde{e}_N$; while the tradable sector citizen votes for the incumbent if she observes exchange rate is not smaller than $\widetilde{e}_T$, where $\widetilde{e}_m$, for $m=N,T$, is defined by equation* (22). *(3) The re-election probability $\pi_m\left(s, s_m^{a*}, s_m^{d*}\right)$ is given by equation* (28).

Proof. See Appendix A.5. ■

5 RER Election Cycle

5.1 Conditional Electoral Cycle

Proposition 5 (Conditional electoral cycle of expenditure policy) *In equilibrium, pre-election policies are biased towards the median voter's preferences, compared to post-election policies, that is, incumbents of both types spend relatively more on nontradable goods before elections when the median voter is of the non-tradable type, while they spend less on non-tradable goods if the median voter is a tradable sector citizen. In sum, we have that* $s_N^{i*} > s_{+1}^{i*} > s_T^{i*}$.

Proof. See Appendix A.6. ■

Corollary 6 (Conditional electoral cycle of RER) *In equilibrium, when the election winner is of the same type as the incumbent (including re-election), the real exchange rate is on average more appreciated before than after election if the median voter is a non-tradable sector citizen. Conversely, on average, a more depreciated RER is observed before than after elections if the median voter is a tradable sector citizen. That is:*

$$\begin{cases} \overline{e}^i < \overline{e}_{+1}^i & \textit{if } m = N \\ \overline{e}^i > \overline{e}_{+1}^i & \textit{if } m = T \end{cases}$$

where $\overline{e}^i$ *and* e_{+1}^i *are the average exchange rate before and after elections, respectively, when the incumebent is of type* i.

Proof. From Proposition 5, we have that $s_N^{i*} > s_{+1}^{i*} > s_T^{i*}$. Given the exchange rate is decreasing in s, the result follows. ■

5.2 Unconditional Electoral Cycle of RER

The exchange rate dynamics depend on the policy-maker type before and after election, and the transition probabilities are summarized in the following Markov transition matrix:

$$\begin{aligned}
P_m &= \begin{pmatrix} P_m^{d,d} & P_m^{d,a} \\ P_m^{a,d} & P_m^{a,a} \end{pmatrix} \\
&= \begin{pmatrix} \pi_m^d + \left(1-\pi_m^d\right) p^d & \left(1-\pi_m^d\right) p^a \\ \left(1-\pi_m^a\right) p^d & \pi_m^a + \left(1-\pi_m^a\right) p^a \end{pmatrix} \\
&= \begin{pmatrix} P_m^d \\ P_m^a \end{pmatrix}
\end{aligned}$$

where $P_m^{i,j}$ represents the vector of transition probabilities for an incumbent of type i to be replaced by an election winner of type j, when the median voter is a m-sector citizen.

The matrix $\triangle E_m$ displays the average RER depreciation around elections when the median voter is of type m, $m = N, T$:

$$\begin{aligned}
\triangle E_m &= \begin{pmatrix} \bar{e}_{+1}^d - \bar{e}_m^d & \bar{e}_{+1}^a - \bar{e}_m^d \\ \bar{e}_{+1}^d - \bar{e}_m^a & \bar{e}_{+1}^a - \bar{e}_m^a \end{pmatrix} \\
&= \begin{pmatrix} \triangle E_m^d \\ \triangle E_m^a \end{pmatrix},
\end{aligned}$$

where each row$\triangle E_m^i$ is a vector of the average RER depreciation around elections when the incumbent is of tradable type i, and he is replaced by politicians of types a or d.

For an incumbent of the tradable type, the average RER depreciation is then given by:

$$\Delta \bar{e}_m^d = P_m^d \triangle E_m^{d'},$$

while, for a non-tradable type incumbent, it equals:

$$\Delta \bar{e}_m^a = P_m^a \triangle E_m^{a'}.$$

Thus, the unconditional average RER depreciation after elections can then be represented by:

$$\Delta\bar{e}_m = p^d \Delta\bar{e}_m^d + p^a \Delta\bar{e}_m^a \tag{31}$$

Numerial simulations

In order to illustrate the election cycle of RER, we evaluate the RER depreciation around elections with a set of parameter values,[10] using two different values for n: $n = 0.6$, for the median voter from the non-tradable sector; and $n = 0.4$, for a median voter belonging to the tradable sector.

Median voter from the non-tradable sector

The first two columns of Table 4 present the simulation results when the median voter is a non-tradable sector citizen. Comparing the first two lines, we see that incumbents of both types choose higher expenditure share on non-tradable goods before elections in order to signal they favors the median voter's interests, as expected. Thus, a more appreciated RER is generated on average in the pre-election period, as indicated in the third and fourth lines. More specifically, when a non-tradable incumbent is re-elected the RER will depreciate by 0.091 on average (first column of line (5)), and RER depreciates by 0.076 on average when tradable type of incumbent is re-elected (second column of line (6)). There will be a larger RER depreciation of 0.591 if the non-tradable incumbent is replaced by the tradable politician (first column of line (5)). It is interesting to note that the RER appreciates on average when an incumbent of tradable type is replaced by one of non-tradable type, as shown by the negative number in the second column of line (5).

The re-election probability of the non-tradable type of incumbent is 87.6%, which

[10] For the simulation, we assume $W(X) = -\dfrac{1}{X}$ for the function $W(.)$ in the politicians preferences established in equation (6). We take the following value for the parameter: $\alpha = 0.5$, $\tau = 0.3$, $\mu^T = 2$, μ^N=2, σ^T=1, σ^N=1, $p_N = 0.5$, $C = 0.2$. For $m = N$: $n = 0.6$, $\theta^d = 2$, $\theta^a = 1.5$. For $m = T$: $n = 0.4$, $\theta^d = 1$, $\theta^a = 0.5$.

is higher than the one for the tradable type, 80.0%, as shown in the first two columns of line (7). As indicated in line (10), there is an expected exchange rate depreciation of 0.1218, conditioned to the incumbent being of non-tradable type. The reasoning is the following. The RER depreciates by 0.091 when the non-tradable type of incumbent is succeeded by a politician of the same type, which happens with probability 93.81% (first column of line (8)). With probability 6.19% (second column of line (8)) the incumbent of non-tradable type is replaced by one of tradable type and the corresponding RER depreciation is 0.591. These numbers yield an overall average RER depreciation of 0.1218.

For an incumbent of tradable type, RER depreciates by 0.076 if the winner of election is of his own type (second column of line (6)), which happens with probability 90.04% (second column of line (9)). The RER will appreciate by 0.424 if he is replaced by an opponent of non-tradable type (second column of line (5)). Due to the small value of probability (9.96%) for the latter case (line (8), second column), the RER still depreciate by 0.0255 on average conditioned to a tradable type of incumbent (second column of line (10).

Combining the results from the two types of incumbent, we use equation (31) to find an average depreciation of 0.0737 of the RER after elections when the median voter is from non-tradable sector, as indicated in line (11).

Median voter from the tradable sector

The opposite RER election cycle is generated when the median voter is a tradable sector citizen, which can be seen from the simulation results in the last two columns of Table 4. The results in the first two lines indicate that each type of incumbent chooses a smaller expenditure share on non-tradable goods in the pre-election periods, thus favoring the median voter in order to increase his re-election probability. Now it is the tradable type of incumbent has a higher re-election probability, 90.22%, than the one of non-tradable type, 75.97%, as shown in the last two columns of line (7). There is a RER appreciation of 0.096 after elections when an incumbent of non-tradable type is replaced by a politician of his own type (third column of line (5)), which happens with probability 87.99% (third column of line (8)). If he is replaced by a politician of tradable type, the RER depreciates by 0.4036 (third column of line (6)), which happens with probability 12.01% (line (9), third column). There is then an average RER appreciation of 0.036 after election conditioned to having an incumbent of non-tradable type (third column of line (10)).

If the incumbent is of tradable type, the probability that he will be replaced by a different type of policymaker is 4.89% (last column of line (8)), and it generates a RER appreciation of 0.5746 (line (5), last column). With probability 95.11% he is replaced by a tradable-type politician (line(9), last column), in which case the RER appreciates by 0.0746 (line (6), last column), resulting in a RER post-election appreciation of 0.0990 (line (10).

Overall, there is an average RER appreciation after election, unconditional to the incumbent's type, equal to 0.067 when the median voter is from a tradable sector (last column of line (11)).

6 Conclusion

Empirical literature suggests that politicians in Latin America have a bias towards appreciating their currencies before elections and depreciating after elections. The two alternative explanations for the RER electoral cycles, in a nutshell, competence or preference signaling, were equally capable of explaining the empirical findings in Latin America. This literature did not consider the East Asian experience, which turns out to present an opposite RER electoral cycle compared the one found in Latin America. In East Asian economies, the RER tends to be more depreciated before than after elections. Actually, an appreciated currency seems to be popular in Latin America, but not in East Asia. In East Asia, the majority population seems to prefer an depreciated currency, for most a larger share of GDP comes from the tradable sector and the majority of the population also works in that

Table 4: Numerical Example

Median voter	Non-tradable sector $m = N$		Tradable sector $m = T$	
Incumbent's type	Non-tradable $i = a$	Tradable $i = d$	Non-tradable $i = a$	Tradable $i = d$
(1) Policy before election s_m^{i*}	0.5520	0.2933	0.5928	0.1095
(2) Policy after election s_{+1}^{i*}	0.5000	0.2619	0.7381	0.1667
(3) Average pre-election RER $\bar{e}_m^i$	1.409	1.924	0.5963	1.0746
(4) Average post-election RER $\bar{e}_{+1}^i$	1.500	2.000	0.5000	1.000
(5) Conditional RER change $\bar{e}_{+1}^a - \bar{e}_m^i$	0.091	-0.424	-0.0963	-0.5746
(6) Conditional RER change $\bar{e}_{+1}^d - \bar{e}_m^i$	0.591	0.076	0.4036	-0.0746
(7) Re-election Probability π_m^i	87.6%	80.0%	75.97 %	90.22 %
(8) Transition probability p^{ia}	93.81%	9.96 %	87.99%	4.89%
(9) Transition probability p^{id}	6.19%	90.04%	12.01%	95.11 %
(10) Average conditional depreciation $\Delta\bar{e}_m^i$	0.1218	0.0255	-0.0362	-0.0990
(11) Average unconditional depreciation $\Delta\bar{e}_m$	0.0737		-0.0676	

sector.

Competence signaling models can not generate the RER electoral cycle found in East Asia, but we show in this paper that preference signaling model could generate both types of cycles. We develop a preference signaling model, where cycles occur in a dynamic, multidimensional signaling game between the incumbent and forward-looking rational median voters. Our results show that RER tends to be more appreciated than average before elections and more depreciated than average after elections if the median voter is a citizen from the non-tradable sector, while the opposite cycle occurs if the median voter is a tradable sector citizen.

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A APPENDIX

A.1 After election policies

Given equation (14), the expect utility function for the policy-makers of type a and d can be written as:

$$\begin{aligned} F^d(s) &= EW\left(V^a\left(s\right)\right) + \theta^d EW\left(V^d\left(s\right)\right) + C \\ &= \underbrace{EW\left(V^a\left(s\right)\right) + \theta^a EW\left(V^d\left(s\right)\right) + C}_{F^a(s)} + \left(\theta^d - \theta^a\right) EW\left(V^d\left(s\right)\right) \\ &= F^a(s) + (\theta^d - \theta^a) EW\left(V^d\left(s\right)\right) \end{aligned}$$

Let s_{+1}^{a*} and s_{+1}^{d*} be the solutions that maximize $F^a(s)$ and $F^d(s)$, respectively. We then have that:

$$\frac{\partial F^d\left(s_{+1}^{d*}\right)}{\partial s} = 0 \Leftrightarrow \frac{\partial F^a\left(s_{+1}^{d*}\right)}{\partial s} + \left(\theta^d - \theta^a\right) \frac{\partial EW\left[V^d\left(s_{+1}^{d*}\right)\right]}{\partial s} = 0$$

Since we know that $\dfrac{\partial EW\left[V^d\left(s_{+1}^{d*}\right)\right]}{\partial s} < 0$, we have that:

$$\frac{\partial F^a\left(s_{+1}^{d*}\right)}{\partial s} = -\left(\theta^d - \theta^a\right) \frac{\partial EW\left[V^d\left(s_{+1}^{d*}\right)\right]}{\partial s} > 0$$

Also, given that $\dfrac{\partial F^a\left(s_{+1}^{a*}\right)}{\partial s} = 0$, we get:

$$\frac{\partial F^a\left(s_{+1}^{d*}\right)}{\partial s} > \frac{\partial F^a\left(s_{+1}^{a*}\right)}{\partial s} \tag{32}$$

Since policy-maker's expected utility is assumed to be concave in s, that is, $\dfrac{\partial^2 F^a\left(s\right)}{\partial s^2} < 0$, inequality (32) is true if, and only if, $s_{+1}^{a*} > s_{+1}^{d*}$.

A.2 RER cutoff point

A.2.1 Median voter is non-tradable: $m = N$

Using the RER definition in equation (10), we compute the endowment shock in tradable sector y^T that would generate the observed RER $\widehat{e}$ for the different equilibrium policy choices, s_N^{a*} and s_N^{d*}, given that $s_N^{a*} > s_N^{d*}$:

$$w(\widehat{e}) \equiv y^T\left(\widehat{e}; s_N^{a*}, y^N\right) = \eta H\left(s_N^{a*}\right)\frac{y^N}{\hat{e}} < \eta H\left(s_N^{d*}\right)\frac{y^N}{\hat{e}} = y^T\left(\widehat{e}; s_N^{d*}, y^N\right) \equiv v(\widehat{e}).$$

Therefore, $w(\widehat{e})$ is the tradable sector endowment that would yield the observed RER if the incumbent were of type a, whereas for a d-type incumbent, the endowment in tradable sector would have to be equal to $v(\widehat{e})$. Notice that $w(\widehat{e})$ and $v(\widehat{e})$ are strictly decreasing functions of $\widehat{e}$.

The density function of endowment shock has a unique maximum point since it log-normally distributed. We will denote the unique maximum point as z. There are two straightforward cases:

$$\begin{aligned} \text{Case I:} \quad & w(\widehat{e}) < v(\widehat{e}) \leq z \Rightarrow f_T(w(\widehat{e})) < f_T(v(\widehat{e})), \text{ and} \\ \text{Case II:} \quad & z \leq w(\widehat{e}) < v(\widehat{e}) \Rightarrow f_T(w(\widehat{e})) > f_T(v(\widehat{e})) \end{aligned}$$

In case I the observed RER is more likely to have been generated by a d-type incumbent, hence the non-tradable median voter vots for the opponent. The reverse is true in Case II.

Finally, there is a third case that needs some analysis: when z is between w and v:

$$\text{Case III:} \quad w(\widehat{e}) < z < v(\widehat{e})$$

We define a function: $\mathcal{H}_T(\widehat{e}) \equiv f_T(w(\widehat{e})) - f_T(v(\widehat{e}))$. $\mathcal{H}_T(\widehat{e})$ is a continuous function, and it is strictly decreasing in the observed RER, since:

$$\begin{aligned}\frac{d\mathcal{H}_T(\widehat{e}))}{d\widehat{e}} &= \frac{df_T}{dw}\frac{dw}{d\widehat{e}} - \frac{df_T}{dv}\frac{dv}{d\widehat{e}} \\ &= \oplus \times \ominus - \ominus \times \ominus \\ &< 0\end{aligned} \tag{33}$$

From Case I, we have that for a high enough RER value $\lim_{v(\widehat{e})\downarrow z} \mathcal{H}_T(\widehat{e}) < 0$; whereas, according to Case II, for a sufficiently low RER we have that $\lim_{w(\widehat{e})\uparrow z} \mathcal{H}_T(\widehat{e}) > 0$. Hence, there must be a RER value $\widetilde{e} \in \left(w^{-1}(z), v^{-1}(z)\right)$ for which the function $\mathcal{H}_T(\widetilde{e}_N) = 0$. For all $\widehat{e} > \widetilde{e}_N$, we have that $\mathcal{H}_T(\widetilde{e}_N) < 0$, whereas $\mathcal{H}_T(\widetilde{e}_N) > 0$ for $\widehat{e} < \widetilde{e}_N$.

In sum, we have that:

$$\begin{aligned}f_T(w(\widehat{e})) &< f_T(v(\widehat{e}))\forall\widehat{e} > \widetilde{e}_T \\ f_T(w(\widehat{e})) &> f_T(v(\widehat{e}))\forall\widehat{e} < \widetilde{e}_T,\end{aligned}$$

where $\widetilde{e}_N = \mathcal{H}_T^{-1}(0) = \eta_N\sqrt{H(s_N^{a*})H(s_N^{d*})}\dfrac{y^N}{\exp(\mu^T - (\sigma^T)^2)}$, given the log-normal distribution of endowments as defined by equation (1).

A.2.2 Median voter is tradable: $m = T$

In an analogous way to what we did for the case of a non-tradable median voter, we use the RER definition in equation (10), using $s_T^{a*} > s_T^{d*}$, to compute the endowment shock in non-tradable sector y^N that would generate the observed RER for the different equilibrium policy choices.

$$\phi(\widehat{e}) \equiv y^N\left(\widehat{e}, s_T^{d*}, y^T\right) = \frac{\hat{e}y^T}{\eta H\left(s_T^{d*}\right)} < \frac{\hat{e}y^T}{\eta H\left(s_T^{a*}\right)} = y^N\left(\widehat{e}, s_T^{a*}, y^T\right) \equiv \psi(\widehat{e}).$$

$\phi(\widehat{e})$ is the non-tradable endowment compatible with a d-type policy-maker, given the observed RER, while $\psi(\widehat{e})$ is the non-tradable endowment that yields $\widehat{e}$ when the policy maker is of type a. Notice that now the functions $\phi(\widehat{e})$ and $\psi(\widehat{e})$ are strictly increasing in $\widehat{e}$.

The endowment in non-tradable sector is a log-normal distribution, thus with a unique maximum point, denoted as φ. Again, there are two simple cases:

$$\begin{aligned}\text{Case I:} \quad & \phi(\widehat{e}) < \psi(\widehat{e}) \leq \varphi \Rightarrow f_N(\phi) < f_N(\psi), \text{ and} \\ \text{Case II:} \quad & \varphi \leq \phi(\widehat{e}) < \psi(\widehat{e}) \Rightarrow f_N(\phi) > f_N(\psi)\end{aligned}$$

In case I, median voter, who is a tradable-sector citizen here, votes for the opponent; while in case II, she votes for the incumbent.

In the third case, φ is between ϕ and ψ:

$$\text{Case III:} \quad \phi(\widehat{e}) < \varphi < \psi(\widehat{e})$$

We define a function: $\mathcal{H}_N(\widehat{e}) \equiv f_N(\phi(\widehat{e})) - f_N(\psi(\widehat{e}))$. $\mathcal{H}_N(\widehat{e})$ is an increasing function of the observed RER:

$$\begin{aligned}\frac{d\mathcal{H}_N(\widehat{e})}{d\widehat{e}} &= \frac{df_N}{d\phi}\frac{d\phi}{d\widehat{e}} - \frac{df_N}{d\psi}\frac{d\psi}{d\widehat{e}} \\ &= \oplus \times \oplus - \ominus \times \oplus \\ &> 0\end{aligned} \tag{34}$$

From Case I, we have that for a low enough RER value $\lim_{\psi(\widehat{e})\downarrow z} \mathcal{H}_N(\widehat{e}) < 0$; whereas, according to Case II, for a sufficiently high RER we have that $\lim_{\phi(\widehat{e})\uparrow z} \mathcal{H}_N(\widehat{e}) > 0$. Hence, there must be a RER value $\widetilde{e}_T \in \left(\psi^{-1}(z), \phi^{-1}(z)\right)$ for which the function $\mathcal{H}_N(\widetilde{e}_T) = 0$. For all $\widehat{e} < \widetilde{e}_T$, we have that $\mathcal{H}_N(\widetilde{e}_T) < 0$, whereas $\mathcal{H}_N(\widetilde{e}_T) > 0$ for $\widehat{e} > \widetilde{e}_T$.

In sum, we have that:

$$\begin{aligned}& f_N(\phi(\widehat{e})) < f_N(\psi(\widehat{e})) \forall \widehat{e} < \widetilde{e}_T \\ & f_N(\phi(\widehat{e})) > f_N(\psi(\widehat{e})) \forall \widehat{e} > \widetilde{e}_T,\end{aligned}$$

where $\widetilde{e}_T = \mathcal{H}_N^{-1}(0) = \eta_T \sqrt{H\left(s_T^{a*}\right) H\left(s_T^{d*}\right)} \frac{\exp\left(\mu^N - \left(\sigma^N\right)^2\right)}{y^T}$, using the log-normal distribution of endowments defined in equation (1).

A.3 Proof of Proposition 2: Re-election Probability

A.3.1 Median voter is non-tradable sector citizen: $m = N$

According to equation (10), RER is a negative function of the endowment in tradable sector: $\frac{de}{dy^T} < 0$.

$$
\begin{aligned}
\Rightarrow Pr(re-election) &= Pr\left[f_T\left(w\left(\widehat{e}\right)\right) - f_T\left(v\left(\widehat{e}\right)\right) \geq 0\right] \\
&= Pr\left[f_T\left(w\left(\widehat{e}\right)\right) - f_T\left(v\left(\widehat{e}\right)\right) \geq \mathcal{H}_T\left(\widetilde{e}_N\right)\right] \\
&= Pr\left[\mathcal{H}_T\left(\widehat{e}\right) \geq \mathcal{H}_T\left(\widetilde{e}_N\right)\right] \\
&= Pr\left[\widehat{e} \leq \widetilde{e}_N\right] \text{ (since } \frac{d\mathcal{H}_T\left(\widehat{e}\right)}{de} < 0) \\
&= Pr\left[y^T \geq \widetilde{y}^T\right] \text{ (since } \frac{de}{dy^T} < 0)
\end{aligned}
$$

where we have used $\mathcal{H}_T(e) = f_T(w(e)) - f_T(v(e))$, $\mathcal{H}_T(\widetilde{e}_N) = 0$, and inequality (33).

Thus,

$$\pi_N\left(s, s_N^{a*}, s_N^{d*}\right) = \int_{\widetilde{y}^T}^{\infty} f_T(y^T) dy^T$$

A.3.2 Median voter is tradable sector citizen: $m = T$

From equation (10), the equilibrium RER is a positive function of the endowment in non-tradable sector: $\dfrac{de}{dy^N} > 0$.

$$\begin{aligned}
\Rightarrow Pr(re-election) &= Pr\left[f_N\left(\phi\left(\widehat{e}\right)\right) - f_N\left(\psi\left(\widehat{e}\right)\right) \geq 0\right] \\
&= Pr\left[f_N\left(\phi\left(\widehat{e}\right)\right) - f_N\left(\psi\left(\widehat{e}\right)\right) \geq \mathcal{H}_N\left(\widetilde{e}_T\right)\right] \\
&= Pr\left[\mathcal{H}_N\left(\widehat{e}\right) \geq \mathcal{H}_N\left(\widetilde{e}_T\right)\right] \\
&= Pr\left[\widehat{e} \geq \widetilde{e}_T\right] \text{ (since } \frac{d\mathcal{H}_N\left(\widehat{e}\right)}{de} > 0) \\
&= Pr\left[y^N \geq \widetilde{y}^N\right] \text{ (since } \frac{de}{dy^N} > 0)
\end{aligned}$$

where we have used that $\mathcal{H}_N(e) = f_N(\phi(e)) - f_N(\psi(e))$, $\mathcal{H}_N(\widetilde{e}_T) = 0$, and inequality (34).

As a result, we have that:

$$\pi_T\left(s, s_T^{a*}, s_T^{d*}\right) = \int_{\widetilde{y}^N}^{\infty} f_N\left(y^N\right) dy^N$$

A.4 Proof of Proposition 3

s_m^{i*} is the policy level that maximizes the policy-maker's utility function (30) before election. Thus, s_m^{a*} is such that $\dfrac{dU_m^a(s)}{ds} = 0$, and s_m^{d*} is the policy level that satisfies $\dfrac{dU_m^d(s)}{ds} = 0$. That is:

$$s_m^{a*} : \frac{dU_m^a\left(s_m^{a*}\right)}{ds} = \frac{dF^a\left(s_m^{a*}\right)}{ds} + \beta\left[\left(1-p^a\right)\left(F^{a,a} - F^{a,d}\right) + C\right]\frac{d\pi_m\left(s_m^{a*}\right)}{ds} = 0 \quad (35)$$

$$s_m^{d*} : \frac{dU_m^d\left(s_m^{d*}\right)}{ds} = \frac{dF^d\left(s_m^{d*}\right)}{ds} + \beta\left[\left(1-p^d\right)\left(F^{d,d} - F^{d,a}\right) + C\right]\frac{d\pi_m(s_m^{d*})}{ds} = 0, \quad (36)$$

where we define $F^{i,j} \equiv F^i\left(s_{+1}^{j*}\right) - C$

Using $F^i(s) = E\left[W\left(V^a\right)\right] + \theta^i E\left[W\left(V^d\right)\right] + C$, we can get:

$$\begin{aligned}
\frac{dU_m^d(s)}{ds} &= \frac{dF^d(s)}{ds} + \beta\left[\left(1-p^d\right)\left(F^{d,d} - F^{d,a}\right) + C\right]\frac{d\pi_m(s)}{ds} \\
&= \frac{dF^d(s)}{ds} + B^d\frac{d\pi_m(s)}{ds} \\
&= \frac{dF^a(s)}{ds} + B^a\frac{d\pi_m(s)}{ds} + \left(\theta^d - \theta^a\right)\frac{\partial EW}{\partial V}\frac{\partial V^d(s)}{\partial s} + \left(B^d - B^a\right)\frac{d\pi_m(s)}{ds} \\
&= \frac{dU_m^a(s)}{ds} + \left(\theta^d - \theta^a\right)\frac{\partial EW}{\partial V}\frac{\partial V^d(s)}{\partial s} + \left(B^d - B^a\right)\frac{d\pi_m(s)}{ds},
\end{aligned}$$

where $B^i \equiv \beta\left[\left(1-p^i\right)\left(F^{i,i} - F^{i,j}\right) + C\right]$.

The second term on the right hand side is negative, since $\theta^d - \theta^a > 0, \frac{\partial EW}{\partial V} > 0, \frac{\partial V^d(s)}{\partial s} < 0$. As for the third term, we know that $\frac{d\pi_N(s)}{ds} > 0$ and $\frac{d\pi_T(s)}{ds} < 0$, and that $B^i > 0$ for $i = a, d$. The sign of the difference $B^d - B^a$, on its turn, can be either positive or negative. However, notice that B^i correspond to the loss for an policymaker for being replaced by politician of a different type. Although the model does not assure a perfect symmetry in this respect, it seems reasonable that the value of this loss should not differ much for the two different types of policymakers. If the absolute value of the third term is not larger than the absolute value of the second term, we would have that:

$$\begin{aligned}
\frac{dU_m^d(s)}{ds} &= \frac{dU_m^a(s)}{ds} + \left(\theta^d - \theta^a\right)\frac{\partial EW}{\partial V}\frac{\partial V^d(s)}{\partial s} + \left(B^d - B^a\right)\frac{d\pi_m(s)}{ds} \\
&= \frac{dU_m^a(s)}{ds} + \text{negative term}
\end{aligned}$$

Hence,

$$\begin{gathered}
\frac{dU_m^d(s)}{ds} < \frac{dU_m^a(s)}{ds} \\
\Rightarrow \frac{dU_m^d\left(s_m^{a*}\right)}{ds} < \frac{dU_m^a\left(s_m^{a*}\right)}{ds} \\
\Rightarrow \frac{dU_m^d\left(s_m^{a*}\right)}{ds} < 0 = \frac{dU_m^d\left(s_m^{d*}\right)}{ds}
\end{gathered}$$

Given that $U_m^d(s)$ is a strictly concave function in s, we can deduce that $s_m^{a*} > s_m^{d*}$. Our numerical simulations of the model confirm this result.

A.5 Proof of Proposition 4

The set of solutions to Problem (30) is denoted as $s_m^i\left(s_m^{a*}, s_m^{d*}\right)$, which is an upper hemi-continuous correspondence, since it is the solution set for maximizing of a continuous function over a compact set. We can apply Kakutani's fixed-point theorem to the hemi-continuous correspondence vector:

$$s_m^* = \begin{pmatrix} s_m^a\left(s_m^{a*}, s_m^{d*}\right) \\ s_m^d\left(s_m^{a*}, s_m^{d*}\right) \end{pmatrix}, \tag{37}$$

which guaratees the existence of equilibrium.

A.6 Proof of Proposition 5

The optimal policy choice after election is the one that satisfies the following equation: $\frac{dF^i\left(s_{+1}^{i*}\right)}{ds} = 0$, for $i = a, d$. As for the pre-election policies, the first order conditions for the optimal policies are given by equations (35), for an incumbent of non-tradable type, and (36) for a tradable-type incumbent. It is easy to check that $F^i\left(s_f^{i*}\right) - F^i\left(s_f^{j*}\right) + C$ is positive. When the median voter is a non-tradable sector citizen, the re-election probability $\pi_N(\cdot)$ is strictly increasing in s, so that the second term in the first order conditions (35) and (36) is positive. Hence, to have $\frac{dU_N^i\left(s_N^{i*}\right)}{ds} = 0$, it must be the case that $\frac{dF^i\left(s_N^{i*}\right)}{ds} < 0 = \frac{dF^i\left(s_{+1}^{i*}\right)}{ds}$. Given the strict concavity of $F^i\left(.\right)$, we have that $s_N^{i*} > s_{+1}^{i*}$. For a median voter of tradable type, we have that $\pi_T(\cdot)$ is strictly decreasing in s. By an analogous argument, we have that $\frac{dF^i\left(s_T^{i*}\right)}{ds} > 0 = \frac{dF^i\left(s_{+1}^{i*}\right)}{ds}$, which implies $s_T^{i*} < s_{+1}^{i*}$.