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## Pension reserve fund, political budget cycles and fiscal illusion

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## ABSTRACT

We model political manipulations of pension reserve funds in a modified Shi and Svensson (2006) political budget cycle (PBC) model. Assuming that a share of voters suffers from fiscal illusion the incumbent can increase her re-election chances by prematurely spending parts of the reserve fund. We also obtain results that are counterintuitive, but only at first sight. First, it can be shown that the incumbent wants to *reduce* the manipulation when her ego rent increases. Second, the optimal magnitude of manipulation does not necessarily go up when the share of voters suffering from fiscal illusion rises.

## 1. Introduction

Many countries have a demographic problem which implies increased financial needs for future pension payments.<sup>1</sup> The problem is more serious in countries which largely rely on pay-as-you-go (PAYG) pension schemes because a smaller number of employees has to directly finance the pensions for the growing older generation (Selén and Ståhlberg, 2007). To alleviate the problem pension reserve funds have been established in many countries (Yermo, 2008; Mulder et al., 2009; Clark and Monk, 2011). Their purpose is to accumulate assets now and release them later. However, during recessionary periods it is difficult to save for the future. Between 2007 and 2010, for instance, it was expected that social expenditures in EU countries would increase by 3.3% of GDP (Natali, 2011). At the same time, there was pressure to abide by the deficit and debt rules of the Stability and Growth Pact. As a consequence, several countries used the funds prematurely or intervened in their operations during the Great Recession of the late 2000s. Casey (2014) discusses three examples. The French Pension Reserve Fund was used to cover increased deficits. In Ireland, 60% of the pension reserve fund had been diverted to bailing out and recapitalising the banking sector by spring 2011. In Poland, 50% of the pension reserve fund was used to help the country satisfy the Maastricht requirements.<sup>2,3</sup>

Pension reserve funds are classified as sovereign wealth funds by the IMF (2007). Like any trust fund, they accumulate resources which can potentially be freed up at any time, not only during recessionary periods. In fact, they are always threatened by political intervention (Yermo, 2008). According to Clark and Monk (2011) “former Federal Reserve Board Chairman Alan Greenspan famously

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<sup>1</sup> The positive effect of ageing on the size of the welfare state has been questioned by Razin et al. (2002). They offer a theoretical explanation for the negative correlation between the dependency ratio and the size of the welfare state. Disney (2007) does, however, reach the opposite conclusion and suggests that the social security design may affect the effect of ageing on the size of the welfare state. This suggestion has been analysed and confirmed in Galasso and Profeta's (2007) theoretical model.

<sup>2</sup> Portugal and Spain are additional examples. Spain used its Social Security Reserve Fund for the intended purpose, but decades too early. Since 2012, the Spanish government has tapped into it at least twice a year to pay for current pension benefits. Moss (2016) predicts that it will run out of funds by the end of 2017. Even more strikingly, the Portuguese Social Security Financial Stabilisation Fund invested nearly all of its funds in Portuguese public debt in 2013 (Geddie, 2013).

<sup>3</sup> Academic research about modifications of investment strategies for pension reserve funds emerged after the 2007–2009 crisis. To our knowledge, all papers are empirical; there is not a single analytical model that could explain the change in strategy.

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said in 1999, ‘Even with Herculean efforts, I doubt if it would be feasible to insulate, over the long run, the trust funds from political pressures ...’.”

This paper focuses on the political threats to pension reserve funds irrespective of there being a recession or not. Tapping into a pension reserve fund means that the government can dissolve part or all of it without the obligation of subsequent replenishment. Our paper and its results could also be interpreted in the more general context of trust funds. We embed a pension reserve fund in a modified [Shi and Svensson \(2006\)](#) political budget cycle (PBC) model. While separating voters into fiscal realists and persons suffering from fiscal illusion (henceforth FISPs, i.e. fiscal illusion suffering persons), we investigate how voters perceive policies and the competence of politicians. Will politicians try to manipulate voters’ perception in order to increase their re-election chances by prematurely spending parts of the pension reserve fund?

Our research is based on [Shi and Svensson’s \(2006\)](#) model, but with two modifications which, taken together, allow us to study the essence of political manipulations of pension reserve funds. First, instead of the increase in debt, the politician’s instrument becomes the reduction of an existing pension reserve fund. Different from pension funds, the beneficial owners of pension *reserve* funds are institutions or governments, not individuals. This feature leads to the aforementioned possibility that reserve funds can be raided by the government for political purposes. Second, we assume that voters can be fiscal realists or FISPs (fiscal illusion suffering persons). Fiscal illusion refers to a misperception of fiscal parameters.<sup>4</sup> Fiscal realists can adequately perceive the cost of public spending, but FISPs lack this ability or are unwilling to do so.<sup>5</sup> This paper posits that FISPs underestimate the amount of fund reduction (costs) required for benefitting from public goods spending. The typical result from fiscal illusion (based on underestimated costs) is overspending. In our model, it manifests itself in political budget cycles.

Overall, we obtain three results. First, we find that the premature spending of parts of the reserve fund allows the incumbent to increase her re-election chances, but with limitations. Dissolving parts of the pension reserve fund allows the incumbent to increase the provision of public goods which is beneficial per se and *may* help increase political support. However, the optimal degree of dissolution of the pension reserve fund exceeds the degree which would lead to the largest winning probability. Politicians are willing to overmanipulate at the expense of vote shares in order to achieve a higher provision of public goods. In fact, there is a trade-off between economic gains (the public goods provision) and re-election chances at the equilibrium.

Overmanipulation with respect to optimal re-election chances also explains the second result. At the equilibrium, the level of manipulation *decreases* when the ego rent goes up. This seems counterintuitive at first glance, but not any more when we think in terms of overmanipulation at the equilibrium. A larger ego rent increases the incentive to stay in power. Hence the policymaker would like to reduce the manipulation in order to raise re-election chances. The re-election motive dominates the public goods provision motive in the trade-off between the two at the equilibrium. This means that politicians with stronger self-serving inclinations (with higher ego rents) may actually not be an additional threat for existing pension reserve funds. As a third result, we can show that an increase in the share of FISPs does not necessarily increase the optimal degree of manipulation, i.e. the degree of dissolution of the pension reserve fund.<sup>6</sup> Thus societies with lots of voters suffering from fiscal illusion do not necessarily have to worry more about the depletion of their pension reserve funds.

The paper is structured as follows. In Section 2 and 3, we present our core PBC model with pension reserve fund manipulations and its general solution. Several propositions are discussed in Section 4. There, we also widen our discussion to, for instance, an extended model with both types of manipulation (deficit and pension reserve fund). We summarise the results and show that our findings from the core model are confirmed. Details on both, the core model and the extended model, are presented in the [appendix](#). Section 5 concludes.

## 2. Core model

The model presented here is in the [Shi and Svensson \(2006\)](#) tradition. The election takes place every other period. Both incumbent and challenger are opportunistic and try to get elected and receive an ego rent. The electorate votes for the party of the candidate who promises higher utility after the election. All agents, voters and politicians, maximise utility which is derived from two economic components (private consumption good  $c$  and public goods provision  $g$ ) and one political component. Voter  $i$ ’s utility function is:

$$U_t^i = \sum_{s=t}^{\infty} (\beta^i)^{s-t} E_s [u(c_s) + g_s + \phi \theta^i z_s], \quad i = 1, \dots, n; \quad (1)$$

where  $\beta^i$  is a subjective discount factor;  $u(c_s)$  is a concave function which represent the utility from private consumption;  $g_s$  is a public good; and  $\theta^i z_s$  is the political component with relative weight parameter  $\phi$ . Preference over private and public goods consumption are the same for all individuals. However, voters have different political preferences,  $\theta^i$ , which are derived from the politicians’

<sup>4</sup> [Oates \(1985\)](#) points out that imperfect information is a necessary, but not a sufficient condition for fiscal illusion. To be more specific, imperfect information might induce a random pattern of over- and underestimation, but fiscal illusion refers to a systematic misperception of key fiscal parameters by the electorate and may thus produce electoral manipulation by the incumbent.

<sup>5</sup> [Downs \(1957\)](#) argues that it is irrational for a voter to spend too much effort on obtaining, analyzing and learning political information for voting purposes: “Hence ignorance of politics is not a result of unpatriotic apathy; rather it is a highly rational response to the facts of political life in a large democracy”.

<sup>6</sup> Again, this is unintuitive since one would have expected that having more manipulable agents should evoke more manipulation. However, [Bohn \(2016\)](#) argues that this is not necessarily so since changing the manipulation also affects the *marginal* winning chances which depend on the competence distribution of policymakers. He can show that an unambiguous result (more voters that can be manipulated lead to more manipulation) will only be found in high variance distributions which may be more characteristic of developing countries or new democracies (rather than established OECD democracies).

non-economic characteristics like trustworthiness or good looks. The parameter  $\theta^i$  is uniformly distributed in the interval  $[-1, 1]$ ; it is in the left half of the interval,  $[-1, 0]$ , if voter  $i$  is in favour of party  $a$ , or in  $(0, +1]$ , if party  $b$  is preferred. Variable  $z_t$  represents the party in power. When  $a$  is elected, the value of  $z_t$  is  $-1/2$ , otherwise  $+1/2$ . Together,  $\theta^i z_t$  give voter  $i$  positive utility when her favourite politician is elected, and negative utility when the opponent is in power.

Both politicians, the incumbent (henceforth referred to with superscript  $a$  without limiting the general validity of the analysis) and challenger (hereinafter  $b$ ), also derive utility from private consumption and public goods. Different from voters though, the political component is a political rent,  $X_s > 0$ , which is received, if the politician is in power in period  $t$ . This so-called ego rent could be either political income (Barro, 1973) or good reputation. Politician  $j$ 's utility is:

$$V_t^j = \sum_{s=t}^{\infty} (\beta^j)^{s-t} E_s[u(c_s) + g_s + \mathbf{I}_s X_s], \quad j = a, b; \quad (2)$$

$$\mathbf{I}_s = \begin{cases} 1 & \text{if in power in period } s; \\ 0 & \text{otherwise.} \end{cases}$$

In each period, all agents face a budget constraint in expectations:

$$E_t^k[c_t] = E_t^k[(1 - \tau)y_t], \quad k = i, j. \quad (3)$$

To focus on government manipulation, private consumption is assumed to be determined by two exogenous components, tax rate  $\tau$  and income  $y_t$ . The government provision of public goods,  $g_t$ , is financed by tax revenue  $\tau y_t$ , but also depends on government competence,  $\eta_t^j$ , which could be interpreted as the ability to provide public goods efficiently – as described in equation (4). Additionally (and thereby ignoring the possibility of incurring a deficit), the government can tap into the pension reserve fund  $R_t$  which is regarded as free-use resource (the no-replenishment assumption is given up in the “Discussion on Extensions” (page 17) in Section 4).

$$g_t = \tau y_t + \eta_t^j + \delta_t R_t; \quad 0 \leq \delta \leq 1.$$

By increasing the public goods provision the incumbent can improve her performance and enhance the probability of re-election.  $\delta_t$  is thus the incumbent's instrument which determines the percentage of the dissolution of the pension reserve fund  $R_t$  that exists at the beginning of the period. It seems it would be optimal for the government to break up the pension reserve fund completely. The optimal reduction of the pension reserve fund does, however, depend on the perception of FISPs (fiscal illusion suffering persons) – as shown further down.

Politicians' competence  $\eta_t^j$  follows an MA(1) process, i.e. it is determined by skills shocks  $\mu$  for the current and previous periods:

$$\eta_t^j = \mu_t^j + \mu_{t-1}^j, \quad j = a, b; \quad (4)$$

where  $\mu_t$  is an i.i.d. random variable with mean 0, distribution function  $F[\mu_t^j]$  and density function  $f[\mu_t^j]$  with  $f(0) > 0$ . We assume that only past skills shocks are common knowledge and neither current nor future shocks are known to any agent. The current skills shock for the incumbent government can, however, be deduced by realistic voters (share  $(1 - \psi)$ ); and by politicians once the public goods provision has materialised. FISPs (share  $(\psi)$ ) have a distorted perception of the reserve fund reduction and, therefore, a distorted perception of the incumbent's skills.

Oates (1985) argues that “Fiscal illusion ... can only operate over a limited range”. It cannot persist over the threshold. So we also assume that FISPs have the awareness of depletion of the pension reserve fund. In our model, FISPs underestimate the fund reduction  $\delta_t R_t$  as  $\alpha(\delta_t) R_t$ . They hardly perceive the fund reduction when  $\delta$  is small, but, with an increasing percentage of dissolved pension reserve funds, they become more and more aware of the amount of funds made available by the government for financing the current budget. We postulate the following simplifying properties for the function  $\alpha(\delta_t)$  for  $0 \leq \delta_t \leq 1$ :  $0 \leq \alpha(\delta_t) \leq \delta_t \leq 1$ ,  $\alpha'(0) = 0$ , and  $\alpha''(\delta_t) > 0$ . If the reserve fund were used up completely in the election year, we assume that FISPs would perceive this without mistake, i.e.  $\alpha(1) = 1$ .<sup>7</sup>

As the Fig. 1 shows, the difference between  $\delta_t$  and  $\alpha(\delta_t)$  captures the underestimation of the fund reduction. As the fund reduction increases, this underestimation increases at first, and reaches a maximum at  $\delta_t^W$ . Beyond this point, the underestimation decreases.

Furthermore, we assume that voters learn from the underestimation of the previous period. If the government were to use the pension reserve fund in the off-election year, she could not use it again in the election year. Mathematically, if  $\delta_{t-1} > 0$ , then  $\alpha(\delta_t) = \delta_t$ . This is so because FISPs have a learning ability which also follows an MA(1) process similar to the politicians' competence. Politicians are assumed to understand this and therefore manipulate voters by using the reserve fund only in the election year. If the incumbent used part of the reserve fund,  $\delta_{t-1} R_{t-1}$ , in the off-election year,  $t - 1$ , then FISPs would perceive the incumbent's competence correctly in the election year, even if the incumbent tried to manipulate. Taking the reserve fund as a policy instrument which could improve the probability of winning the election, the politicians will only use it in the election year. Otherwise, this instrument would be ineffective.

<sup>7</sup> This implies that no group of voters would suffer from fiscal illusion and any government manipulation would no longer affect the probability of winning the election. The assumption facilitates the derivation of the solution as it guarantees an interior solution, but any other maximum value for  $\alpha(1)$  would also be feasible.

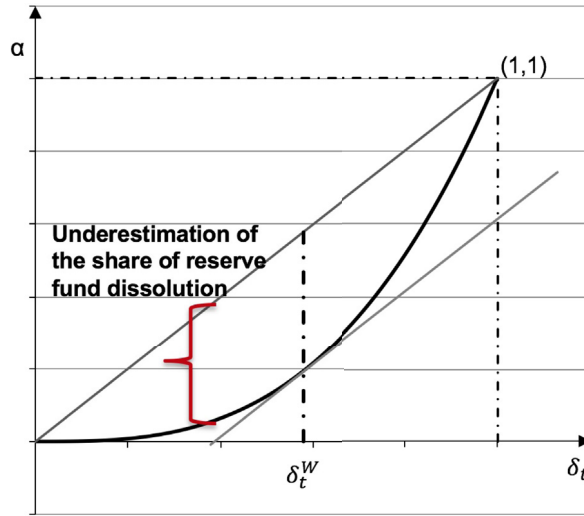


Fig. 1. Perception of the fund reduction by voters with fiscal illusion.

The timing of events is as follows. In the beginning of election period  $t$ , the incumbent  $a$  chooses a percentage of fund reduction  $\delta_t$  and uses the additional resources for financing public goods. Past skills shock  $\mu_{t-1}^a$  and the level of public goods provision can be observed by all agents. The current skills shock occurs during period  $t$  and is unknown to all agents. All voters have expectations of the current skills shock, but only realistic voters can deduce it correctly. The perception of the skills shock by FISPs is influenced by  $\delta_t$ . At the end of period  $t$ , an election takes place. Based on their different beliefs, voters vote for whoever they think has better skills and can, therefore, provide a higher level of utility next period. The winner of the election receives an ego rent in period  $t + 1$ . Since there is no election in period  $t + 1$ , the incumbent has no incentive to use the fund for manipulation. Under the assumptions that elections take place every other period and both the competence of the politicians and the learning ability of voters follow an MA(1) process, the problem can be divided into two-period maximization problems.

### 3. Model solution

The model can be solved in three steps. First, we can infer the probability of voter  $i$  to vote for incumbent  $a$ . Voter  $i$  will vote for incumbent  $a$  if the expected utility derives from the incumbent  $a$  is higher than  $b$ .

$$\underbrace{E_t^i[u(c_{t+1}^a) + g_{t+1}^a + \phi\theta^i(-\frac{1}{2})]}_{\text{utility when } a \text{ in power}} > \underbrace{E_t^i[u(c_{t+1}^b) + g_{t+1}^b + \phi\theta^i(+\frac{1}{2})]}_{\text{utility when } b \text{ in power}}. \quad (5)$$

Given that the competence of the challenger ( $\eta_{t+1}^b = \mu_t^b + \mu_{t+1}^b$ ) is unknown, and expected to be 0. Then a voter would vote for the incumbent if and only if

$$E_t^i[\mu_t^a] > \phi\theta^i. \quad (6)$$

A voter would vote for the incumbent either she favors the incumbent ( $\theta^i$  is relatively small) or she expects sufficient competence of the incumbent ( $E_t[\mu_t^a]$  is large).

And the probability of voting for the incumbent  $a$  is

$$\text{Prob} \left\{ E_t^i[\mu_t^a] - \phi\theta^i \geq 0 \right\} = \frac{E_t^i[\mu_t^a]}{2\phi} + \frac{1}{2}. \quad (7)$$

Second, the incumbent could be elected if she obtained at least 50% of the votes. The incumbent's probability of winning is

$$\text{Prob}^{win} = \left\{ (1 - \psi) \left[ \frac{E_t^{REAL}[\mu_t^a]}{2\phi} + \frac{1}{2} \right] + \psi \left[ \frac{E_t^{FISP}[\mu_t^a]}{2\phi} + \frac{1}{2} \right] \geq \frac{1}{2} \right\}. \quad (8)$$

This probability depends on voters' expectation, both fiscal realists and FISPs (fiscal illusion suffering persons), on the incumbent's current skills shock ( $E_t[\mu_t^a]$ ). Fiscal realists (share  $(1 - \psi)$ ) perceive the composition of public goods production rationally and deduce  $\mu_t^a$  from the budget constraint equation in period  $t$ ,

$$E_t^{REAL}[\mu_t^a] = \mu_t^a = g_t - \tau y_t - \mu_{t-1}^a - \delta_t R_t. \quad (9)$$

However, FISPs underestimate the amount of fund reduction required for benefitting for public goods spending. FISPs' expectations,  $E_t^{FISP}[\mu_t^a]$  depends on their perception of the fund reduction,  $\alpha(\delta_t)R_t$ ,

$$E_t^{FISP}[\mu_t^a] = \widehat{\mu}_t^a = \mu_t^a + (\delta_t - \alpha(\delta_t))R_t. \quad (10)$$

As the aforementioned,  $\alpha(\delta_t)$  is smaller than  $\delta_t$ . Then obviously the incumbent's competence is overestimated by FISPs by  $(\delta_t - \alpha(\delta_t))R_t$ . Based on this, we can derive:

$$\text{Prob} \{ \mu_t^a \geq \psi(\alpha(\delta_t) - \delta_t)R_t \} \quad (11)$$

$$= 1 - F[ \psi(\alpha(\delta_t) - \delta_t)R_t ]. \quad (12)$$

Where  $F[\cdot]$  is the distribution function of the skills shock. It can be seen that the raid on the reserve fund could increase public goods production, individuals' utility, and thus increase the incumbent's competence as perceived by FISPs.

Third, we can derive the maximization of the incumbent's expected utilities over 2 periods. That equals to utility in period  $t$  plus utility in period  $t + 1$  if the incumbent is elected times the probability of winning plus the utility in period  $t + 1$  if the incumbent loses times the probability of losing. For simplicity, we assumed that  $\beta^l = 1$ .

$$\begin{aligned} \max_{\delta_t} V &= \max_{\delta_t} V_t^a + V_{t+1}^a \\ &\times \max_{\delta_t} E_t \{ u(c_t) + g_t^a + X_t \} \\ &+ E_t \{ [1 - F[\psi(\alpha(\delta_t) - \delta_t)R_t]] [u(c_{t+1}) + g_{t+1}^a + X_{t+1}] \} \\ &+ E_t \{ F[\psi(\alpha(\delta_t) - \delta_t)R_t] [u(c_{t+1}) + g_{t+1}^b] \} \end{aligned} \quad (13)$$

It could be re-written as follows:

$$\max_{\delta_t} u(c_t) + \tau y_t + \mu_{t-1}^a + \delta_t R_t + X_t + u(c_{t+1}) + \tau y_{t+1} + X_{t+1} [1 - F[\psi(\alpha(\delta_t) - \delta_t)R_t]]. \quad (14)$$

Since the second-order condition holds the incumbent's optimal percentage of fund dissolution,  $\delta_t^*$ , can be fully characterised by the first-order condition:

$$V_{\delta_t} = R_t - \psi R_t F'[\cdot] (\alpha'(\delta_t^*) - 1) X_{t+1} = 0. \quad (15)$$

The first term captures the marginal gain of increased public goods consumption by using the reserve fund in period  $t$ . The second term depicts the negative ( $\alpha'(\delta_t) > 1$ ) marginal effect on the expected ego rent, which is the enhanced chance of re-election times the marginal gain of the fund reduction times the share of FISPs times the ego rent.

**Lemma 1.** - Overmanipulation.

*It is optimal for the incumbent to overmanipulate.*

$$\alpha'(\delta_t^*) > 1 \quad (16)$$

**Proof.** Appendix C.

In order to increase the winning probability, the incumbent uses part of the reserve fund to raise the public goods consumption in period  $t$ . However, Fig. 2 shows that the optimal value of  $\delta_t^*$  is higher than the value which could maximize the winning probability. In other words, the incumbent is willing to sacrifice some votes while benefitting from a higher public goods consumption. That the optimal value goes beyond the value for the maximal winning probability we call overmanipulation.

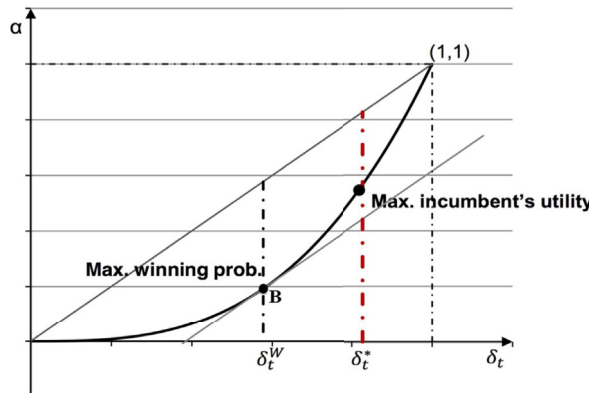


Fig. 2. Maximization problem.

#### 4. Propositions and discussion

**Proposition 1.** - Re-election Chances.

*Manipulations by the incumbent could increase her re-election chances, but with limitations.*

**Proof.** See equation (11) and Appendix B.

The incumbent is able to improve her re-election chances by manipulating. When  $\alpha'(\delta_t^W) = 1$  the probability of winning is the largest. Considering the inverse function,  $\delta := \delta_t^W = \delta(1)$ , it would be easier to interpret. As Fig. 2 shows, at first the likelihood of winning increases with manipulations increases. At point B, the degree of underestimation,  $\alpha(\delta_t^W) - \delta_t^W$ , reaches its maximum value. That is when the incumbent uses  $\delta_t^W$  percent of the pension reserve fund, which is smaller than the optimal value ( $\delta_t^*$ ), her winning probability is maximized. The correlation between probability of winning and the level of manipulation becomes negative when  $\delta_t$  is larger than  $\delta_t^W$ . There may be no other theoretical literature manifesting that politicians could increase their vote share by using the reserve fund. However, plenty of research, both theoretical and empirical, find that the incumbents could enhance their re-election prospects by engaging in expansionary fiscal policies (Akhmedov and Zhuravskaya, 2004; Bohn, 2016).

**Proposition 2.** - Ego Rent.

*As ego rent increases, the incumbent becomes more eager to win. The reserve fund reduction will decrease:*

$$\frac{d\delta_t^*}{dX_{t+1}} < 0. \quad (17)$$

**Proof.** Appendix D.

This result seems contrary to Shi and Svensson's (2006) finding. Research on PBCs typically suggests that the manipulation will be increased with an increase in the ego rent. Nonetheless, the mechanisms are the same actually, as the ego rent increases, politicians adjust manipulations to improve their winning chances. What leads to the deviation from previous findings lies in the different relationship between voters' perception and the magnitude of manipulations. In other models, uninformed voters' perception of the incumbent's competence increases with the level of manipulations. The probability of winning is positively correlated to manipulations. An important assumption in our model is that the degree of fiscal illusion is not always positively correlated to manipulations. As Proposition 1 states, the probability of winning is the largest if and only if  $\alpha'(\delta_t) = 1$ . Since by doing manipulations, the incumbent's public goods consumption will also be increased in period  $t$ . To maximize her utility, the incumbent will sacrifice a small shares of votes and then to choose a higher level of manipulations. The optimal value of manipulations,  $\delta_t^*$ , is satisfied with  $\alpha'(\delta_t) > 1$ . When the ego rent is getting larger, the incumbent is more eager to win the election. The public goods provision that they forego could also be interpreted as a cost of rent seeking. To improve her re-election chances, the incumbent will use a lower percentage of the reserve fund, namely,  $\delta_t^*$  goes down.

**Proposition 3.** - The share of FISPs (fiscal illusion suffering persons).

*At the equilibrium, the budget cycle will not always be enlarged along with the share of FISPs increasing. The budget cycle being enlarged or shrunk depends on the trade-off between economic gains (public goods provision) and winning chances.*

A. *If and only if the incumbent values the chances of winning more (competence density function is compressed), manipulations decrease along with an increase in the share of FISPs.*

$$\frac{d\delta_t^*}{d\psi} < 0 \quad (18)$$

B. *If and only if the incumbent values the provision of public goods more (competence density function is dispersed), manipulations increases along with an increase in the share of FISPs.*

$$\frac{d\delta_t^*}{d\psi} > 0 \quad (19)$$

**Proof.** Appendix D.

At the equilibrium, the immediate effect of having a larger share of FISPs is that more voters are affected by the manipulation; hence the incumbent's re-election chances go up. How could the incumbent respond? The incumbent could decrease manipulations to reach an even higher probability of winning, but could also raise manipulations to increase economic gains (the provision of public goods). The trade-off between public goods provision and winning chances determines the size of the budget cycle. And the politicians' competence distribution determines which effect is greater. This result is similar to the finding of Bohn (2016).

To be concrete, a sufficient condition for part A of Proposition 3, equation (18), is:

$$F'[\cdot] + \psi F''[\cdot](\alpha(\delta_t^*) - \delta_t^*)R_t > 0, \quad (20)$$

which suggests that when the competence density function is relatively elastic (a small change in the skills shock has a relatively large impact on the competence distribution function and winning probability), the manipulation is more effective, and winning chances are more important. Thus the incumbent intends to decrease the manipulation (the [red] arrow labelled as A in Fig. 3 and in Fig. 4). The mechanism is the same as described in Proposition 2, which is that decreasing the manipulation leads to an increase in winning chances at the equilibrium. Besides, when the competence distribution is more compressed, the effects of changes in

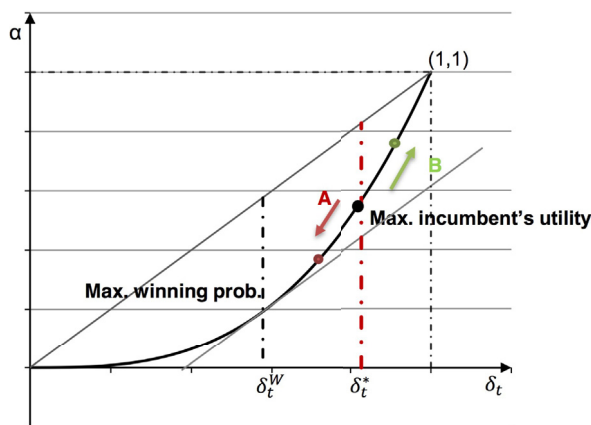


Fig. 3. A trade-off between winning probability and public goods provision.

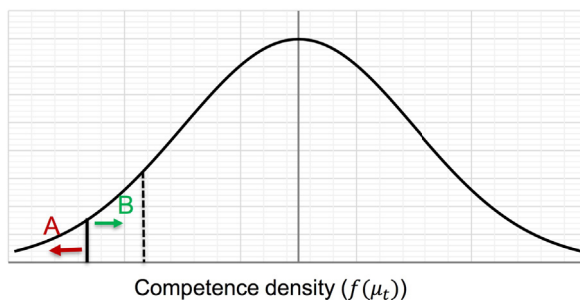


Fig. 4. Competence density function.

manipulations are significant (see Fig. 4).

Part B of Proposition 3 is obtained when the following inequality holds.

$$F'[\cdot] + \psi F''[\cdot](\alpha(\delta_t^*) - \delta_t^*)R_t < 0. \tag{21}$$

Part B of Proposition 3 depicts what could be considered the intuitive response. Manipulations increase with a larger share of FISPs (the [green] arrow labelled as B in Fig. 3 and in Fig. 4) because the incumbent prefers the economic gains from a fund reduction. Part B applies when the competence density function is relatively inelastic (a small change in the skill shock has a relatively small impact on the competence distribution function and winning probability). At the equilibrium, the increasing share of FISPs improves the incumbent's re-election chances. The incumbent could also decrease the manipulation to achieve even higher winning probabilities. However, due to the relatively flat competence density function, the effects of a change in manipulation are relatively small at the equilibrium. In other words, due to a dispersed competence distribution, both increasing and decreasing manipulations are less effective. Comparing with the small changes of winning probability, incumbents prefer the economic gains from a fund reduction. Therefore, the incumbent is willing to use more funds to increase the public goods provision in  $t$ , even though they have to endure the decreasing winning probability.

According to Bohn (2016), the competence distribution is more dispersed in developing and newly democratic countries, and more compressed in advanced OECD countries. Applied to our paper, this suggests that the intuitive response to an increase in the share of FISPs in a given country (Part B above) should be expected in developing countries and new democracies. Raising the share of FISPs in such a country should lead to more manipulation. Compare this with OECD countries. Increasing the share of FISPs in such a country, the manipulation should go up by less or even be reduced (Part A above).<sup>8</sup>

#### 4.1. Discussion of extensions

Our model thus far captures the political economy mechanism when an opportunistic government can make premature use of a pension reserve fund which it does not have to repay. This is a parsimonious and simplified setting which delivers new results.

<sup>8</sup> Note that the comparison made here is a within country comparison. The effect of changing the share of FISPs is different in different countries because of different country characteristics, i.e. that the competence distribution is different. – Another country characteristic is the degree of fiscal illusion which is also different across countries according to Mourao (2008). All results in this paper apply to any country given the characteristics of that country.



However, it can be criticised from several angles. First, one could argue that a government should take into account that dissolving part of the pension reserve fund now reduces the resources available for manipulation during the following elections, if the government should still be in power. Hence the government may optimally want to reduce the share of the pension reserve fund it wants to dissolve now<sup>9</sup> so that the overmanipulation result obtained in Lemma 1 would be reduced or even eliminated. There are two reasons why the government may not necessarily want to reduce the volume of the fund reduction: (i) it may fear to lose the elections and worry about the fund being available for the challenger (such a strategic argument in the context of tax revenues is made in Cukierman et al. (1989)); (ii) the re-election prospect may shorten the incumbent's time horizon as suggested by Raveh and Tsur (2017). The overmanipulation result could also be preserved in a model with (mandatory) replenishment of the pension reserve fund in off-election periods, if the subjective discount rate of the incumbent is larger than the interest rate obtained for the pension reserve fund.

Second, in a more realistic scenario, one would have to consider deficit as an alternative way of manipulation in an election year. In Appendix E we present a summary of such model. The main outcome is that both deficit and the depletion of the pension reserve fund are used. Both types of manipulation (deficit and pension reserve fund) increase the incumbent's re-election chances. However, under reasonable assumptions, in particular that interest rates on the pension reserve fund are lower than those on deficit when debt levels are already high, the result of overmanipulation of the pension reserve fund remains. At the equilibrium, as the ego rent marginally increases, the depletion of the pension reserve fund will decrease, but the level of manipulation of deficit will increase. However, the overall budget cycle will be enlarged along with an increasing share of FISPs. Politicians from a country with a compressed competence density function value the re-election chances higher than economic gains (the public goods provision). They will use less pension reserve fund but more deficit in order to raise the winning probability. Politicians from a country with a dispersed competence density function prefer the public goods provision to re-election chances and will increase pension reserve fund manipulations and decrease deficit manipulations.

## 5. Conclusion

This paper studies the threat of using pension reserve funds prematurely. We argue that voters who are suffering from fiscal illusion underestimate the depletion of the pension reserve fund. The model illustrates how these voters overestimate the incumbent's competence, and how politicians take advantage of fiscal illusion to obtain higher winning chances and a higher public goods provision. It is shown that the special nature of pension reserve funds (for instance, no replenishment obligation in case of premature use) may lead to manipulation beyond what one would expect from the political budget cycle literature. Overmanipulation, i.e. the depletion of a pension reserve fund beyond the point of maximal re-election chances, is a real possibility, if the additional resources can be used for the provision of public goods. In the core model, this is so because the incumbent can enjoy the public goods without having to replenish the pension reserve fund. But even with partial or full replenishment obligations, overmanipulation will occur, if the incumbent is either myopic and/or if deficit repayment is preferred to fund replenishment.

Overmanipulation has significant implications for re-election chances and effects of changes in the ego rent and changes in the FISPs (fiscal illusion suffering persons). First, the winning probability reaches a maximum when the degree of fiscal illusion is maximized. However, the incumbent is intend to spend more in order to receive a higher utility from the public goods provision. In other words, she is willing to sacrifice some votes for the economic gains from the fund reduction. Second, at the equilibrium, the manipulations decrease when the ego rent gets larger. As the ego rent increases, the incumbent is willing to give up the additional public goods for increasing her winning probability. More opportunistic policymakers may actually be better for the preservation of pension reserve funds. Third, the relationship between the share of FISPs and the degree of manipulation depends on the competence distribution of policymakers in a given country. Hence it is not clear whether more fiscal illusion in the population makes the problem worse or better. To an increase in the share of FISPs – as with an increase in the ego rent – less manipulation may be the optimal (and economically viable) response because policymakers adjust their manipulation strategies to maximise their utility.

It is interesting that seemingly similar scenarios for manipulation in election years, deficit spending on the one hand and pension reserve fund depletion on the other hand, may lead to different qualitative results due to overmanipulation (of the pension reserve fund). Policy recommendations are, therefore, complex, and the task of protecting pension reserve funds is not an easy one.

## Appendix and indications for the referees

### Appendix A. Step 1: Probability of voter votes for the incumbent

A voter, both the fiscal realists and FISPs (fiscal illusion suffering persons), votes for the incumbent if and only if,

$$\underbrace{E_t^i[u(c_{t+1}^a) + g_{t+1}^a + \phi\theta^i(-\frac{1}{2})]}_{\text{utility when } a \text{ in power}} > \underbrace{E_t^i[u(c_{t+1}^b) + g_{t+1}^b + \phi\theta^i(+\frac{1}{2})]}_{\text{utility when } b \text{ in power}}. \quad (\text{A.1})$$

<sup>9</sup> Shi and Svensson (2006) posit full deficit repayment, but mention in Footnote 22, p. 1377, the possibility that reduced repayment, thereby producing a rising debt trend, might be optimal. Here, we start out from the maximal use of the pension reserve fund (overmanipulation) and now discuss that it might be optimal to reduce the use of the pension reserve fund.

Politicians are opportunistic, share the same policy preferences and will implement the same policies. The only difference between the incumbent and the challenger is their competence. Specifically, the incumbent and challenger implement the same tax policy. The disposable income for individuals and tax revenue for the government are same, no matter which party is in power. Thus individuals' private good consumption which is constrained by disposable income  $((1 - \tau)y_t)$  are same.

$$E_t^i[u(c_{t+1}^a)] = E_t^i[u(c_{t+1}^b)] = E_t^i[u((1 - \tau)y_t)]. \quad (A.2)$$

However, the provision of public goods consumption depends on politicians' competence and individuals' expectations about it. Politicians' competence follow MA(1) process. Politicians' competence in period  $t + 1$  are determined by skills shocks in period  $t$  and period  $t + 1$ . Voters have no idea about skills shocks of the challenger in both period  $t$  and  $t + 1$ . The incumbent's skills shock in period  $t + 1$  is also unknown. Thus expect 0. However, voters could deduce the skills shock of the incumbent in period  $t$ .

$$E_t^i[g_{t+1}^a] = E_t^i[\tau y_{t+1}] + E_t^i[\mu_t^a]; \quad (A.3)$$

$$E_t^i[g_{t+1}^b] = E_t^i[\tau y_{t+1}]. \quad (A.4)$$

Combining equations (A.1) to (A.4) we can derive the following condition:

$$E_t^i[\mu_t^a] > \phi \theta^i. \quad (A.5)$$

Since  $\theta^i$  is uniformly distributed, we can obtain the probability of a voter votes for incumbent  $a$ :

$$\Pr[E_t^i[\mu_t^a] - \phi \theta^i \geq 0] = \frac{E_t^i[\mu_t^a] - (-\phi)}{\phi - (-\phi)} = \frac{E_t^i[\mu_t^a]}{2\phi} + \frac{1}{2}. \quad (A.6)$$

#### Appendix B. Step 2: The incumbent's probability of winning

In step 2, we can obtain the incumbent's winning probability. The incumbent will win the election if and only if she received more than 50% votes. The probability is the share of fiscal realists times the probability of fiscal realist votes plus the share of FISPs (fiscal illusion suffering persons) times the probability of FISPs votes:

$$\text{Prob} \left\{ \underbrace{(1 - \psi) \left[ \frac{E_t^{REAL}[\mu_t^a]}{2\phi} + \frac{1}{2} \right]}_{\text{Fiscal Realists}} + \underbrace{\psi \left[ \frac{E_t^{FISP}[\mu_t^a]}{2\phi} + \frac{1}{2} \right]}_{\text{FISPs}} \geq \frac{1}{2} \right\}. \quad (B.1)$$

From step 1, we know that voters deduce the incumbent's current skills shock from the government budget constraint for period  $t$ .

$$g_t = \tau y_t + \mu_{t-1}^a + \mu_t^a + \delta_t R_t. \quad (B.2)$$

Equation (B.2) could be rewritten as:

$$\eta_t^a = \mu_{t-1}^a + \mu_t^a = g_t - \tau y_t - \delta_t R_t. \quad (B.3)$$

The expectation about the current skills shock by fiscal realists is:

$$E_t^{REAL}[\mu_t^a] = \mu_t^a = g_t - \tau y_t - \delta_t R_t - \mu_{t-1}^a. \quad (B.4)$$

However, FISPs underestimate the pension reserve fund reduction. This faulty perception leads FISPs to overestimate the skills shock of the incumbent. They attribute part of the higher provision of public goods to the incumbent's competence.

$$\begin{aligned} E_t^{FISP}[\mu_t^a] &= \widehat{\mu}_t^a = g_t - \tau y_t - \alpha(\delta_t)R_t - \mu_{t-1}^a \\ &= g_t - \tau y_t - \delta_t R_t - \mu_{t-1}^a - (\alpha(\delta_t) - \delta_t)R_t \\ &= \mu_t^a + (\delta_t - \alpha(\delta_t))R_t. \end{aligned} \quad (B.5)$$

Combining equations (B.1) to (B.5), we can obtain:

$$\begin{aligned} \text{Prob}^{win} &= \text{Prob} \left\{ (1 - \psi) \left[ \frac{E_t^{REAL}[\mu_t^a]}{2\phi} + \frac{1}{2} \right] + \psi \left[ \frac{E_t^{FISP}[\mu_t^a]}{2\phi} + \frac{1}{2} \right] \geq \frac{1}{2} \right\} \\ &= \text{Prob} \left\{ \mu_t^a \geq \psi(\alpha(\delta_t) - \delta_t)R_t \right\} \end{aligned} \quad (B.6)$$

$$= 1 - F[\psi(\alpha(\delta_t) - \delta_t)R_t], \quad (B.7)$$

where  $F[\cdot]$  is the distribution function of the skills shock. It can be seen that the maximum winning probability can be obtained when  $F[\cdot]$  is minimized. As aforementioned, FISPs underestimate the degree of dissolution of the pension reserve fund, which means

$\alpha(\delta_t) < \delta_t$ . So to minimise the monotonous function  $F[\cdot]$ , we need to minimise  $(\alpha(\delta_t) - \delta_t)$ . Combined with the curve of FISPs' perception, that is when  $\alpha'(\delta_t) = 1$ .

*Appendix C. Step 3: The incumbent's maximisation problem*

All agents are utility maximizer. The incumbent's purpose is to maximize her utility over two-periods. The expected utility equals the utility in period  $t$  plus the expected utility in period  $t + 1$  if she wins the election times the winning probability plus the expected utility if she loses the election times the probability of losing.

$$\begin{aligned} \max_{\delta_t} V^a &= \max_{\delta_t} V_t^a + V_{t+1}^a \\ &= \max_{\delta_t} E_t^a \{ u((1 - \tau)y_t) + g_t + X_t \} \\ &\quad + E_t^a \{ \underbrace{[1 - F[\psi(\alpha(\delta_t) - \delta_t)R_t]]}_{\text{Prob .wins}} [u((1 - \tau)y_{t+1}) + g_{t+1}^a + X_{t+1}] \} \\ &\quad + E_t^a \{ \underbrace{F[\psi(\alpha(\delta_t) - \delta_t)R_t]}_{\text{Prob .loses}} [u((1 - \tau)y_{t+1}) + g_{t+1}^b] \} \end{aligned} \tag{C.1}$$

$$\begin{aligned} &= \max_{\delta_t} u((1 - \tau)y_t) + \tau y_t + \mu_{t-1}^a + \delta_t R_t + X_t \\ &\quad + u((1 - \tau)y_{t+1}) + \tau y_{t+1} \\ &\quad + X_{t+1} [1 - F[\psi(\alpha(\delta_t) - \delta_t)R_t]] \end{aligned} \tag{C.2}$$

The first order condition (FOC) is:

$$R_t - \psi R_t F'[\cdot](\alpha'(\delta_t) - 1)X_{t+1} = 0. \tag{C.3}$$

It can be seen that equation (C.3) holds if and only if  $(\alpha'(\delta_t) - 1)$  is positive.

As we discussed, the curve of fiscal illusion perception is convex. In other words,  $\alpha''(\delta_t)$  is positive. With this condition, the second order condition is negative.

$$-\psi R_t X_{t+1} [F''[\cdot]\psi(\alpha'(\delta_t) - 1)^2 R_t + F'[\cdot]\alpha''(\delta_t)] < 0. \tag{C.4}$$

Then the optimal percent of using the pension reserve fund,  $\delta_t^*$ , is determined. And we can derive the Lemma 1.

$$\alpha'(\delta_t^*) > 1. \tag{C.5}$$

As we have discussed at the end of Appendix B, the winning probability is maximized when  $\alpha'(\delta_t) = 1$ . What the Lemma suggested is that the incumbent will always overmanipulate, which means the optimal value of  $\delta_t$  goes beyond the value of winning probability maximization.

*Appendix D. Perturbation results for the propositions*

Based on the Implicit Function Theorem, the following perturbation results obtained.

For Proposition 2: A higher ego rent increases the budget cycle at the equilibrium.

$$V_{\delta_t X_{t+1}} = -\psi R_t F'[\cdot](\alpha' - 1) < 0 \tag{D.1}$$

$$\frac{d\delta_t^*}{dX_{t+1}} = -\frac{V_{\delta_t X_{t+1}}}{V_{\delta_t \delta_t}} < 0 \tag{D.2}$$

For Proposition 3: A larger share of FISPs (fiscal illusion suffering persons) will not always induce a larger budget cycle. The incumbents' manipulations depend on the trade-off between re-election chances and the provision of public goods.

$$V_{\delta_t \psi} = -X_{t+1}(\alpha' - 1)R_t [F'[\cdot] + \psi F''[\cdot](\alpha - \delta_t)R_t] \tag{D.3}$$

1. Winning chances effect: At the equilibrium, the incumbent will use a smaller percentage of the pension reserve fund when the share of FISPs is larger. This situation always happened in the country with an elastic politicians' competence density function.

$$\frac{d\delta_t^*}{d\psi} = -\frac{V_{\delta_t \psi}}{V_{\delta_t \delta_t}} < 0 \tag{D.4}$$

2. Public Goods Provision effect: At the equilibrium, the incumbent will increase manipulations when the share of FISPs is larger. Public goods provision is favored in the country with a inelastic competence density function.

$$\frac{d\delta_t^*}{d\psi} = -\frac{V_{\delta_t \psi}}{V_{\delta_t \delta_t}} > 0 \tag{D.5}$$

Apparently, in equation (D.3), the first term is positive and the second term negative. With the assumption that  $\alpha(\delta_t^*) \leq \delta_t^*$ , the second term is always non-positive and vanishes when  $F''[\cdot] = 0$  or  $\alpha(\delta_t^*) = \delta_t^*$ . In the first case, namely, the skills shocks uniformly distributed. The second term equals 0 and condition holds. In another case,  $\alpha(\delta_t^*) = \delta_t^*$ , which means that every voter could perceive fund reduction correctly without underestimation of it and without overestimation of the incumbent’s competence. In other words, according to characters of the function of  $\alpha$ , the government has raid the whole reserve fund for manipulation. This case would be impossible since that running out of the reserve fund could not increase the probability of being re-elected.

Appendix E. Extension

We extend the model to include two types of manipulation (deficit and pension reserve fund). We add the following assumptions to our core model:

1. The incumbent could incur a deficit to finance government spending. We can define  $\zeta_t$  to depict the ratio of deficit to pension reserve fund. Without restriction on  $\zeta_t$ , deficit  $D_t$  can be chosen to be larger or smaller than the pension reserve fund  $R_t$ :  $D_t = \zeta_t R_t$ .
2. The interest rate on deficit is higher than the interest rate on the pension reserve fund,  $r_D > r_R$ . This assumption is not unrealistic in countries with high debt-to-GDP ratios.
3. The incumbent has to replenish part or all of the reduction of the pension reserve fund in the off-election year.  $\lambda$  is the share of replenishment. With the interest on deficit being higher, the government will always repay the newly incurred deficit first.<sup>10</sup>
4. The FISPs (fiscal illusion suffering persons) underestimate the fund reduction  $\delta_t R_t$  as  $\alpha(\delta_t) R_t$ , and the deficit  $\zeta_t R_t$  as  $\sigma(\zeta_t) R_t$ . The properties for the function  $\alpha(\delta_t)$  are the same as the benchmark model. Analogously, we postulate the following simplifying properties for the function  $\sigma(\zeta_t)$  for  $\zeta_t \geq 0$ :  $0 \leq \sigma(\zeta_t) \leq \zeta_t$ ,  $\sigma'(0) = 0$  and  $\sigma''(\zeta_t) > 0$ . Compare to the deficit, we assume that the depletion of the pension reserve fund is more visible. Hence  $\sigma(\zeta_t) < \alpha(\delta_t)$  for any  $\zeta_t = \delta_t$ . See Fig. E.5.

The aforementioned assumptions imply that the budget constraints change:

$$g_t = \tau y_t + \eta_t^i + \delta_t R_t + D_t, \tag{E.1}$$

$$g_{t+1} = \tau y_{t+1} + \eta_{t+1}^i - \lambda(1 + r_R)\delta_t R_t - (1 + r_D)D_t. \tag{E.2}$$

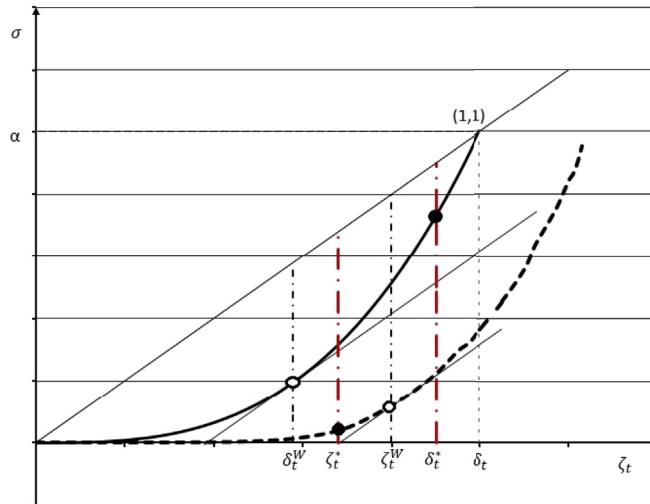


Fig. E.5. Perception of the fund reduction and deficit by voters with fiscal illusion.

<sup>10</sup> In fact, several countries have even used their sovereign wealth funds (SWFs) to finance domestic banks or corporations (which is beyond the original mandate of these SWFs) during the global financial crisis (Petrova et al., 2011), but without replenishing the SWFs in the following years. Another example is the Irish exchequer which used the pension reserve fund without replenishment. As of 2006, the National Pension Reserve Fund (NPRF) had assets equivalent to USD 29 billion (Blundell-Wignall et al., 2008). In 2014, the NPRF was converted into the Ireland Strategic Investment Fund, which is a sovereign development fund. The remaining volume was Euro 8.0 billion (Ireland Strategic Investment Fund, 2016).

With these changes, the model can be solved as before, albeit with two instruments for the government. From the re-election chances perspective, the incumbent's re-election chances are maximized when the underestimation is the largest, that is when  $\alpha'(\delta_t) = 1$  (at  $\delta_t^W$ ) and  $\sigma'(\zeta_t) = 1$  (at  $\sigma_t^W$ ) hold. But from the utilities maximisation perspective (which includes utility from the public goods provision), we find that as long as the share of replenishment of the pension reserve fund is smaller than the discount factor,  $\lambda < 1/(1 + r_R)$ , the incumbent will overmanipulate with the pension reserve fund and undermanipulate with the deficit,  $\alpha'(\delta_t^*) > 1$  and  $\sigma'(\zeta_t^*) < 1$ .<sup>11</sup>

The propositions also go through. Manipulations with the pension reserve fund and deficit increase the incumbent's winning probability. As the ego rent increases, the incumbent is more eager to win. At the equilibrium, higher re-election chances can be obtained by reducing manipulations with the pension reserve fund and by increasing manipulations with deficit. A larger share of FISPs increases the winning probability at the equilibrium. How the incumbent adjusts the magnitude of manipulation depends on her competence density function. For countries with a compressed competence density function, the incumbent would like to reduce manipulations with the pension reserve fund and increase manipulations with deficit, which could deliver a even higher winning probability. In contrast, for countries with dispersed competence distribution, the incumbent would like to increase manipulations with the pension reserve fund and reduce manipulations with deficit. It is better to reduce the manipulations with deficit which is costly, and use more pension reserve fund to increase public goods provision in period  $t$ .

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<sup>11</sup> Overmanipulation can also occur with full replenishment,  $\lambda = 1$ . In the core model, we assumed that the subjective discount factor of the incumbent  $\beta^j = 1$ . Raveh and Tsur (2017) argue that reelection prospects shorten incumbents' time horizons, more precisely, incumbents' subjective discount rate becomes larger relative to the interest rate at which they can borrow. We also modelled that the incumbent has to fully repay both the pension reserve fund and deficit under the assumption that  $\beta^j < 1/(1 + r_D) < 1/(1 + r_R)$ . The outcome shows that it is optimal for the incumbent to overmanipulate both with respect to the pension reserve fund and the deficit. Political myopia distorts incumbents' perception and leads them to underestimate the cost of manipulation. But political myopia also leads incumbents to overmanipulate at the cost of being re-elected.