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REGULATING SOVEREIGN WEALTH FUNDS OPERATING OVERSEAS THROUGH AN EXTERNAL FUND MANAGER

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Abstract

This article looks at the relationship between SWFs and their recipient countries, with a focus on the impact it may have depending on the nature of the objectives pursued by the SWF from the perspective of a principal-agent framework. In particular, when the SWF has multiple objectives, there is a risk that signals are misinterpreted and lead to misguided reactions by authorities in the recipient country. Thus, hard to interpret signals do not provide a sufficient case for imposing constraints on the SWF. However, we will show that requiring the SWF to invest through intermediary asset managers may foster cooperation, especially when the objectives of the SWF and of the authorities are closely aligned. SWFs may also alleviate the concerns in recipient countries by acting as an investor (and accepting the funds) of other SWF and non-SWF investors.

[1] Ecole Polytechnique and Ecole Normale Supérieure de Cachan, the Office in Europe of the IMF, and the Middle East and Central Asia Department of the IMF, respectively. We have benefited from comments from E. Barot, M. El-Gamal, A. Ferrière, J. Pihlman, and H. van der Hoorn. The views expressed in this article are those of the authors and do not necessarily represent those of the IMF or IMF policy.

I. INTRODUCTION

Only a little while ago, sovereign wealth funds (SWFs) were seen by many as the newest malignant instrument of state-sponsored capitalism on the global financial stage. SWFs, with large assets that were projected to rise rapidly on the back of rising commodity prices and widening global imbalances, were expected to invade and occupy financial markets and take them hostage for the unfriendly objectives of their mother governments. There is not much empirical evidence to support these concerns and, in fact, thus far, SWFs have generally behaved in a non-controversial way. In international fora where these issues are being debated, many are not surprised by this and expressed serious doubts when others feared that SWFs would pursue an objective function that would be vastly at odds with the objectives of other economic actors operating in the host country, and in particular that profit maximization would not be at the core of their strategy.[2] Yet, the concerns were sufficiently strong to have led to calls from many quarters for more regulation of SWF operations through a number of means.[3]

Fortunately, with improved information, persistent communication efforts by SWFs to explain their own activities, the preparation of a voluntary set of best practices (known as the Santiago Principles),[4] and efforts by various international organizations (principally the IMF and the OECD) to clarify the rules and regulations governing SWFs' investments, tempers have cooled. Perhaps more importantly, with the global financial crisis unfolding, other issues have taken center stage. Also, SWFs have lost some of their portfolio value due to the global asset price decline, and many have turned inward in an attempt to save their domestic economies through increased support for local banks or purchases of domestic assets.

So, was the debate about SWFs all about nothing? We do not think so. Although many of the fears about sovereign funds have been exaggerated, SWFs do pose important issues for regulation, certainly as foreign investors and as key players in the economies where they operate, and also, more simply and irrespective of the location of their activities, as players whose characteristics are not fully known to other economic actors. That many SWFs have turned inward during the crisis is certainly not an argument against looking more deeply in these issues. Besides, the recent crisis has heightened global concerns about risk management of all financial institutions, especially systemic ones. There are indications that at least some SWFs have already started to make their comeback and, as the crisis recedes, their operations in foreign markets are likely to quickly accelerate. This will likely revive concerns and misgivings in recipient countries.

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[2] Others have also argued that, far from being very sophisticated, SWF managers were actually not aware of their potential impact or reluctant, for reasons of "image," to activate all the leverages that are at their disposal.

[3] See, for example, Kimmit (2008).

[4] See International Working Group on Sovereign Wealth Funds (2008).

Before we move further, let us detail some of the key issues surrounding SWFs operations.[5] Concerns in *recipient countries* about SWFs have generally been about their ownership by foreign sovereigns (which may have non-commercial, perhaps strategic, motives for investment and generally raise the role of governments in economic activity and its distortionary impact on business decisions); their size (which may unduly affect asset prices and financial stability in host countries); and the transparency of their operations. Notwithstanding the recent and temporary decline in foreign-based operations, it is clear that the issue of governance in countries receiving SWF investments will remain relevant for a long time, would it be only because some key operations are locked-in.

SWFs have also raised important issues in their *home countries* although these concerns are quite different in nature. The reason is that, irrespective of their location, SWFs can serve one or a combination of the following functions: stabilization funds, savings funds, reserve management corporations, developments funds, or contingent pension reserve funds (see IMF, 2008, p. 5). Accordingly, it is clear that, even when they operate at home, SWFs raise a number of key concerns for their sovereign owners.[6] Unfortunately, the principal-agent model is not very well suited to this scenario and, while there may be some lessons to be drawn, we will not focus on them in this article..

We will rather focus on the concern that SWFs' operations may (but need not) distort the decision-making process and governance of the firms they invest in (even though it is not unique to them), thereby harming the national interest of the recipient country—even leaving security-related concerns aside. At the root of this concern is the lack of trust among all parties in the objectives (the utility function) pursued by the others. This implies that perceptions and the difficulty in interpreting the actions of one party will affect the interactions between the SWF and the recipient country. This may lead to a lack of trust that is not necessarily justified. To illustrate this, this article looks in detail at the possibility that the SWF invests in the recipient country with legitimate (i.e., not related to strategic or "unfriendly" motives) objectives that are hard to interpret because they are not necessarily associated with short-term profit maximization. For example, the SWF could invest in order to learn more about a certain business. In that case, it is difficult for authorities in the recipient country to accurately interpret the signals sent by the SWF through its actions.

[5] Das et al. discuss this and many other concerns raised by SWFs' operations. They also elaborate on the rationale for the Santiago Principles and how they seek to allay those concerns.

[6] First, as a public investor, they must properly invest public funds and secure adequate risk-adjusted returns. Second, SWFs need to make sure their investments are immune from undue domestic political interference. Third, because of their size, their activities need to be well coordinated with the county's overall macroeconomic policies, in particular with the activities of other actors tasked with the implementation of macroeconomic objectives (e.g., the central bank). And fourth, just as we mentioned in the case of the SWF operating overseas, there is the possibility that some of the multiple objectives pursued by the manager of the SWF may not be compatible with those of the other domestic economic actors. For example, the finance minister of a centralized economy may have misgivings about the profit-maximizing instincts of the SWF manager. As we have already mentioned, these issues have become more relevant in recent times as SWFs have been asked by their governments to shift some of their focus to their domestic economies.

The article is organized as follows Section II discusses the foreign operations of SWFs that may create the need for regulation through an external fund manager. Section III provides the outlines of an analytical framework. Section IV discusses the scope for regulation under different assumptions about the information set of the agents involved. Section V complicates the basic model from Section III by introducing agents with multiple objectives, thus increasing the risks that signals are misinterpreted by recipient countries. Section VI concludes.

II. REGULATING THE SWF OPERATING OVERSEAS THROUGH AN EXTERNAL FUND MANAGER

For a variety of reasons, countries regulate domestic financial companies. By becoming active in a foreign country, some or all of the activities of a SWF also become subject to regulations imposed by the recipient government. While generally encouraging foreign investment, many recipient countries tend to be more suspicious of SWF activities than they are of domestic firms, as they fear that the SWF may somehow find a way to circumvent the regulatory process, if it is not actively trying to avoid scrutiny.

Hence, various propositions have been made to regulate SWFs, including through imposing upper limits on ownership and/or voting rights; prohibitions on SWFs investments in "sensitive" areas, and subjecting their operations to a specific set of procedures. There is a clear trade-off for the recipient country, however. If a SWF brings economic benefits to the recipient country (as most have argued), limiting its room for maneuver through more regulations than is typically applied to domestic firms engaged in similar activities may not be wise: beside the extra cost to the regulatory authorities (and the compliance costs to the SWF), the SWF will face additional constraints (some arguably not necessary) and, if there are too many, it could even forego the opportunity of operating in that country altogether.

A more subtle idea that has received support is to ask a SWF wanting to invest not to do so directly but, instead, to go through a fund manager in the recipient country.[7] By introducing an additional layer between the SWF and the company or companies where the money will be invested, the hope is that the probability of detrimental activities would be reduced for two main reasons: the scope for collusion between the SWF and the target company or undue influence by the SWF on that company would be more limited; and investment funds tend to be more tightly regulated than other commercial activities. Another approach for allaying the concerns of recipient countries about the possible non-commercial motivations of SWFs has been recently initiated by Temasek of Singapore. Temasek has taken steps to set up a more general fund which would also take investments from other SWFs and non-SWF investors. Through this approach Temasek and its partners could in effect signal to recipient countries that their investments involve resources from diverse investors with different political

[7] See Gibson and Milhaupt (2008).

interests, thus allaying concerns about non-commercial objectives of their investments, and clearly greater focus on commercial objectives.[8]

In the next two sub-sections, we look at the proposal to use an external manager by considering the case of an intermediary local fund.[9] We use principal-agent theory for this. In such a context, and broadly speaking (this important aspect of the model is discussed in detail in the next section), both the regulatory authorities (or a trusted domestic investor) and the SWF become the principals of the local fund (the agent). As is standard in game theory, the strategy of each principal is to induce the agent to act in such a way that the resulting output maximizes the principal's utility. In doing so, the principals interact with and learn more about each other. In other words, the principals compete in trying to influence the actions of the agent in a way that could protect (as is hoped by those putting forward the proposal) the interest of the recipient country (for the principal associated to the regulatory authority or a domestic investor) and of the sovereign owner (for the principal associated with the SWF). We demonstrate that a key consideration in determining whether the approach is likely to have the desired results is the extent to which the objectives of the domestic regulator and the SWFs can be accurately interpreted and, if they can, whether they are complementary or antagonistic.

III. A SIMPLE MODEL

A. Theoretical considerations

We now turn to a simple description of the model we intend to use as a tool to develop our ideas and develop the policy arguments. The model, inspired by Martimort (2006), will not be solved here, but some references are provided for the interested reader. The framework presented is a simple way to sketch the case of one agent being supervised by several principals (and we limit the model to two principals) and is very much in line with the typical model used in the field.

Let us assume that two principals (P_i, i=1,2) have an objective function $S_i(q)$, where $q=q(q_1,q_2)$ is the output of the agent. In return, each principal makes a transfer t_i to the agent. The utility V_i of each principal is given by:

$$V_i = S_i(q) - t_i; \qquad (i = 1,2).$$

The utility, U, of the agent is given by the transfers received from both principals minus the effort it makes to produce q. It is further assumed that the agent is more or less efficient with an intensity θ, so that the cost C(q) of producing q affects his utility as follows:

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[8] See "Temasek to Launch $4bn Investment Division," *Financial Times*, February 10, 2010.

[9] In the rest of the text, we will indifferently use "domestic" or "local" to refer to the recipient country.

$U = t_1 + t_2 - \theta C(q)$;

where the term $\theta C(q)$ can be interpreted as the opportunity cost to the agent of producing q or in managing a company F on behalf of its principals in such a way that F produces q. θ can be interpreted as the agent's type (e.g., efficient or not) and this parameter may or may not be known to the principals. As detailed below, we can then respectively refer to a case of perfect or imperfect information. The model is sketched in Figure 1 (where company F has not been included).

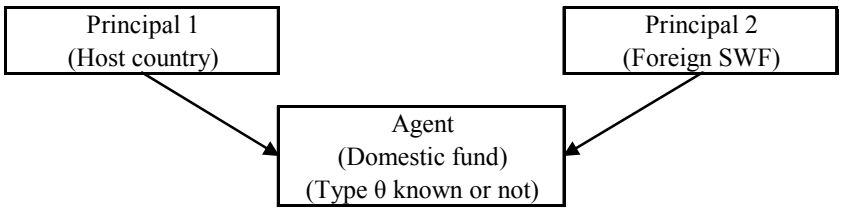

Figure 1: The SWF invests in a domestic fund

It is important to note that the way we formulate the utility function of the agent is very general. In fact, we allow for the possibility that each principal i enters into a contract with the agent on a specific component of the output that matters to him. We call this quantity q_i (i = 1, 2) with $q=q(q_1,q_2)$. If we further assume that principal i can only observe q_i and is not able to observe q_j, the output going to the other principal, we have the case of a *private agency*. If the contract is on the whole output $q=q(q_1, q_2)$, we have the case of a *public agency*. In both cases, as we discuss in the next subsection, the principals interact with each other via the contracts that they offer to their common agent. We show that the ability of the regulatory body (or the domestic fund) to constrain the SWF depends on whether the agency is private or public. For the cost function, this distinction is not necessary because the agent is assumed to have full information about it. Yet, C(q) can play a role in the results as we discuss later.

B. Some considerations on the basic assumptions

We now discuss the main elements of the model relevant for our purpose:

- **First, who are the principals?** Because the P-A model with two principals assumes a transfer to the agent, we cannot, technically, associate the regulatory authority to a principal. Instead, we should assume that the "domestic" principal is a local financial institution in which the authorities have full trust while the other principal is the SWF. Note that this simplification could affect the results. The reason is that between the regulatory authority (which would become an additional, main principal as shown in Figure 2) and the domestic fund (the domestic principal), there would also exist a

P-A relationship where the domestic fund is in fact an agent of the regulatory authority. Similarly, there would be a P-A relationship between the domestic fund (the agent in Figure 1) and the domestic company F where money is ultimately invested. Just as in the other case, the domestic fund, agent of principals 1 and 2, would itself become one of the principals of company F. Yet another (realistic) complication would be to take into account the P-A relationship that necessarily exists between the SWF and its sovereign owner (not included in Figure 2). Unfortunately, we cannot include these complex features in the model because cascade P-A relationships have not been studied in the theoretical literature (although Mookherjee (2006) provides a qualitative discussion of such models). Hence, we associate the domestic principal to the "government" or to the "domestic fund" as the case may be. We also neglect firm F, the domestic company, as a player. The simple situation presented in Figure 1 would then become as sketched in Figure 2:[10]

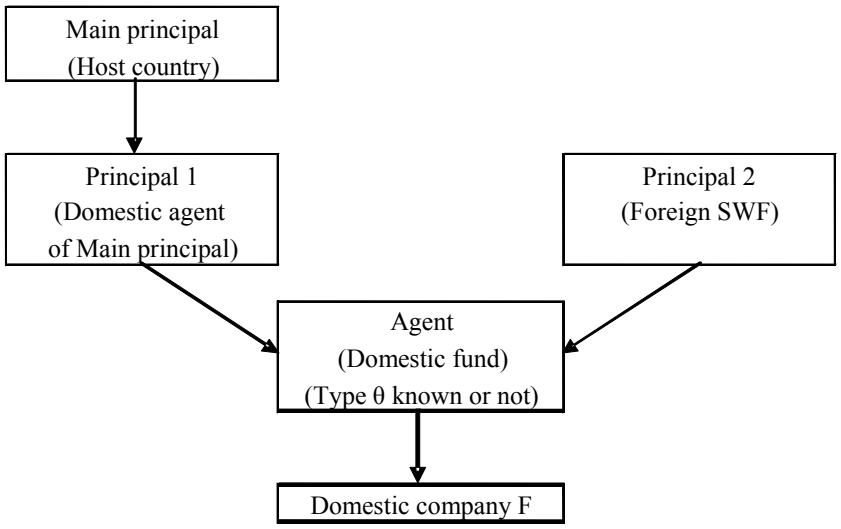

Figure 2: The SWF invests in F through a domestic fund

- **Second, who knows what?** With complete information (section IV, A), the parameter θ is known to both principals (see Figures 1 and 2). Intuitively, this corresponds to a situation where the regulatory authority feels confident that, through the domestic financial institution acting as "domestic principal," it knows the characteristics of the agent or is in a position to monitor it sufficiently closely to be well informed about its behavior. This may not always be the case because the relationship between the regulatory authority and the domestic principal is not as

[10] Note that there are several other P-A relationships that we neglect in this brief description and some can be very important, such as the relation between the foreign authorities as a principal and the SWF as its agent. [The example in the footnote (last part of the sentence) is a repetition of the main text.]

straightforward as we have assumed (as discussed in the previous bullet) or because there is less than perfect information (as we discuss in the next bullet). More importantly, and that is certainly a limitation of the simple assumption of perfect information, it is unlikely that the SWF will know an agent unilaterally selected by the regulatory authority as well as the economic actors of the recipient country, which implies an asymmetry between principals and this, to our knowledge, has not been studied in the literature. On the other hand, it could be realistic to assume that the SWF were allowed to choose an agent from a list of candidates deemed "acceptable" by the regulatory authority of the recipient country (perhaps a fund with ties to the sovereign country) and that would restore some balance in terms of information between the two principals. If the agent is sufficiently well known, we associate that case into that where our assumption of perfect information holds. In addition, there is an aspect of information that involves sending messages to and properly reading the intentions of the other players (and these can be interpreted wrongly or rightly). We discuss this in detail in section V;

- **Third, some issues in situations of imperfect information**.[11] In that case (section IV, B), the agent is not well known to either principals and will therefore retain some advantage in terms of its ability to extract surplus from both of them as they compete for its services. Once again, the idea is that, by inference, the regulatory authority will also face more uncertainty about the characteristics of the SWF. Intuitively, this appears to be a more realistic assumption than having θ known. For example, since θ is an aggregate measure, it is reasonable to assume that the Principal may be fully aware of some characteristics of the agent and ignore others, making its aggregate perception imperfect. In addition, as we will show, this model allows us to explore somewhat different issues, in particular the extent to which antagonistic or complementary utility functions by the principals can affect the outcome. This is important as a key consideration in the debates on SWFs is precisely the extent to which their objectives conflict with those of domestic actors. It is also important because an agent could be very good at certain tasks and less good at others while the global output $q=q(q_1,q_2)$ received by the Principal is a combination of these tasks;

- **Fourth, the interpretation of q should not be restricted to the notion of quantity.** In fact, q should be considered as an "output" which, in the context of SWFs' operations could correspond to a portfolio that the principals ask the agent to manage on their behalf. This has been done in some papers (see for example Martimort, 2006). An ambitious approach (not used in this article) would be to move away from the SWF as the Principal to consider that the Sovereign breaks up its SWF in a number of Agents, each with a comparative advantage in dealing with various aspects of portfolio management, in order to maximize its overall utility with the combination of their outputs (just as an investor strikes a balance between risks and returns). If it

[11] In the model we consider, imperfect information corresponds to the case of adverse selection. We could also have looked at other variations of the model but, in the context of this article, the analysis would not yield substantially different conclusions.

can be done, such a model would provide a useful intuition into the optimal architecture of any organization, one obvious example being to determine the share of foreign reserves that the SWF would be allowed to manage while the central bank would retain responsibility over the rest. We briefly discuss this later in the article but do not model the issue;

- **Fifth, we restrict ourselves to the case where the agent has an obligation to work for both principals simultaneously.** In the P-A literature, this is a special case because most models allow the agent to reject one contract and accept the other. However, doing so would not make much sense in this context. Indeed, we have ruled out the possibility that the SWF could be operating independently in the recipient country. Thus, if the agent rejects the possibility of working with the SWF (or the other way round), the SWF would simply not be allowed to operate; and

- **Finally, the welfare aspects of multi-principal models are generally not well defined because the objectives of each principal may overlap.** Indeed, this implies that utilities cannot easily be added up and the theoretical literature has therefore neglected welfare analysis to instead focus on various notions of economic efficiency. We do not discuss these in the context of this article.

IV. RESULTS, INTUITION, AND POLICY IMPLICATIONS

A. Perfect information

With perfect information, both principals know the characteristics of the common agent. In this model, it means that the parameter θ is known to them. Let us first consider the case where the common agent operates as a private agency (i.e., deals with each principal i individually and negotiates on the specific output q_i that only the parties involved can observe). Because the principals know θ, each of them is able to reduce its transfer to the point where the agent is indifferent between undertaking the task and rejecting the offer (an option we do not allow here as discussed earlier). Each principal behaves in the same way, and an equilibrium is reached when none of them wants to deviate.

Even in this simple case, both principals interact with each other when they negotiate with the agent. The reason is that, during the negotiations, each principle can offer a contract in the form of a set of options to the agent. Most of these options will not materialize but they are nevertheless very important because they act as strategic signals to the other principal.[12] With both principals acting that way, the result may be inefficient outcomes, a somewhat unexpected result since there is otherwise perfect information in the game.

[12] Parlour and Rajan (2001) provide a model of private agency where the principals lend money to a common agent who may default. In that case, however, the signaling between the principals is made via that possibility of default. This may also lead to inefficient equilibria.

In the case of a private agency, and from the point of view of the regulatory authority, the ability to monitor the activities of the SWF is limited by the fact that each principal negotiates directly with the agent and that the interactions between the principals are limited to sending signals to each other through a set of contracting options. Even with perfect information (and a private agency), it is therefore difficult to see how forcing a SWF to go through an agency with which it would be able to contract on its specific output would limit the scope for undesirable behavior. In fact, while it is possible that the signals sent by the other principal somehow affect (in a socially positive manner) the SWF, it is also equally likely that the signals sent by the SWF to the other principal have less desirable impact (if indeed the SWF has undesirable objectives). We argue below and in the subsection devoted to the case of imperfect information that this is indeed a risk for the recipient country.

When the agent is public (i.e., both principals can negotiate on the whole output), there is clearly more scope for interaction between the two principals (through the agent). However, although these interactions can lead to more coordination (and that is presumably what the regulatory authority would like to see), there is also potentially more room for failing to coordinate properly (a situation the regulatory authorities would like to avoid). The latter is especially likely to happen when the SWF has objectives that diverge substantially from those of the recipient country. This is precisely the situation where the recipient country would want to increase its control over the activities of the SWF, and the model suggests that the ensuing lack of coordination leads to inefficient equilibria. If, on the other hand, the SWF has objectives that are broadly compatible with those of the recipient country, then using a common fund as a public agency is indeed likely to strengthen collaboration and therefore yield efficient equilibria. *Overall, if the room for coordination is limited, a common agency is unlikely to help. If scope for coordination exists, a common agency may help reinforce it.*

Although we explore this issue in more detail (section V), it is worth noting that, in this game where signaling plays an important role, the signals sent by one principal (e.g., the SWF) could be misread by the other principal (e.g., the regulatory authority). This is likely to happen when two intrinsically different principals use their investments through their common agent as a tool to learn about each other. As we discuss in the next section, it seems that if (unfortunately) signals are misread, the outcome is likely to be inefficient. *Once again, a common agency may help, but will be a more efficient instrument once some common ground has been established.*

B. Imperfect information

In the previous subsection, we assumed that the principals operate with perfect information about the agent's type (θ). Intuitively, this means that the recipient country feels confident enough about the behavior of the local fund to put it in charge of handling the SWF's activities. That the SWF also knows the agent perfectly is clearly a restriction but the theoretical models typically do not consider the case of asymmetry of information between principals. In spite of its limitations, however, our analysis helps to get an insight into the communication channels between both principals, even when the agent is "transparent."

Yet, we must also consider the case when the agent retains some informational advantage. Intuitively, it may be reasonable to assume that the authorities in the recipient country do not

really know the agent very well. For example, the recent crisis has revealed that regulatory authorities, in spite of the time and resources spent, may at times be taken by surprise at the type of financial products developed (and their valuation) by the most trusted names they were supervising, even those operating domestically.

There is also another interpretation: the risk for existing principals that the agent changes its type when a new and unknown principal—the SWF—enters. Such an argument is often made in clubs: the new member of a club could alter the nature of the club. A similar argument has also been used by some observers to argue that the inclusion of China in the WTO would not only affect China's approach to trade, but that it could also fundamentally change the way the WTO operates.

One of the results obtained in multi-principal models with imperfect information is that the agent can strategically use his informational advantage to play one principal against the other, especially when they have conflicting objectives (see Laffont and Pouyet, 2004, for a formal approach). This is not surprising because this result was already obtained in perfect information, but the effect is indeed amplified when the agent retains private information.
As the principals do not have full information, they have an incentive to monitor the agent in order to minimize his rent-seeking behavior. However, by monitoring the agent, each principal will (involuntarily) interact with the other principal and will therefore send strategic messages. Khalil et al. (2004) study that framework in the case of principals asking a common fund (the agent) to manage their investments. As with full information, the results depend on whether the agent is private or public (yet, even when the agent is private, the principals still interact with each other by performing some monitoring). The reason is that the monitoring may reveal to the other principal some information about the characteristics of the agent. When the agent is public, each principal (say A) may want to use monitoring in order to convince the other principal (say B) that the agent is not really good for B's purpose. In that sense, although θ is a one-dimensional parameter not designed to capture the multi-dimensional aspects of the agent's skills, it also serves as a blurring device that prevents principals to correctly assess these skills (assumed given) in the different areas that each cares about. If B does the same, there may be (socially) too much monitoring. The opposite holds when the agent is private.

Intuitively, this is an interesting conclusion for SWFs' operations. The idea that there can be excessive monitoring is not always easily accepted (much like the idea that there can be excessive availability of information), and a local fund may indeed resent becoming the object of increased scrutiny by the domestic regulators and possibly by the SWF. The lesson is, therefore, that while some monitoring is beneficial, the regulatory authority may quickly fall into the trap of excessive monitoring. That this may also occur with a public agency where the principals have more opportunities to collaborate and also to compete with each other, suggesting that forcing a public agency approach would not be without pitfalls. Excessive monitoring could also be seen by SWF home countries as a protectionist step by the recipient country, creating demands in those countries for retaliatory steps against all foreign investment.

After having explored how imperfect information can affect the results already obtained with perfect information, we use the model to briefly look into other areas that could be relevant to the activities of SWFs. To keep the argument simple, we assume a private agency model where the principals are concerned by two different aspects of the activities of the common agent.

From the social point of view, a key consideration is the extent to which the outputs q_1 and q_2 are complementary or substitutes. Let us look at the private agency model again. Intuitively, the agent is tasked by both principals to produce the output that is relevant to each of them (q_1 for P_1 and q_2 for P_2). For example, the common agent could be asked by one principal to invest in a stock with certain return/variance characteristics, while the other principal would rather favor another stock, with different characteristics. In that situation, the principals compete with each other (when their respective outputs are substitutes) and they support each other (when their outputs are complementary) for the agent's time and to capture the output. Technically, the activities are complements when $C_{12} <0$, and substitutes when $C_{12} >0$, where C_{ij} denotes the cross derivatives of the cost function introduced in section III. It is easy to show that an increase in activity q_1 triggers a decline in activity q_2 when goods are substitutes, while the reverse holds when they are complements. Complementarity could be interpreted as a situation where the SWF has "friendly" objectives that do not conflict with those of the recipient country.

There is one general lesson that can be drawn from such imperfect information models. Principal i always tries to induce the agent to do more for it (of q_i) and less for the other principal (j). This is done by offering to the agent signals and incentives aimed at convincing principal j that the agent is not good at performing the task that j cares for (q_j). When outputs are substitutes (or compete with each other), this behavior leads to output distortions as both play the same game and successfully manage to reduce the output for the other. When outputs are complementary, the game does not lead to a substantial loss in overall output.

Intuitively, the extent to which the objectives of the regulatory authority and the SWF conflict (substitutes) or reinforce (complement) each other is, therefore, an important consideration as already noted in the introduction. Not surprisingly, there will be fewer distortions with complements and the recipient country is therefore right to feel more comfortable with the arrival on its territory of a SWF with objectives that do not conflict with the domestic ones. Once again, however, all these results depend on how each player interprets (rightly or wrongly) the signals sent by the others. We now show, using one example, how even good intentions can be misinterpreted, and lead to a loss of efficiency.

V. PRINCIPAL-AGENT PLAYERS WITH MULTIPLE OBJECTIVES

While formally assuming that players maximize some general form of utility function, principal-agent models are often limited to profit maximization, as we have already indicated. Yet, some of the key issues emerging from the debates on SWF activities suggest that there are suspicions (authorities in recipient countries, think tanks, and even sovereign authorities) about the motives of SWFs, even though achieving some level of profits must clearly be an important component of a more complex utility function. Mostly, the discussion

in this section will be relevant to the SWF operating in a recipient country, although some of the issues would also be relevant to the SWF operating domestically, as we just discussed.

In reviewing the various objectives that a SWF could pursue, it appears that some of them could be characterized as involving what we could coin as a "learning by investing" process. The idea is that by investing in a line of business, the SWF will learn about its activities and can in turn report to its sovereign and provide it with useful information (irrespective of whether such learning is aimed at strategic commercial, security, or simply developmental purposes). This "learning by investing" is in contrast to the well researched field of "learning by doing" where costs keep decreasing with the cumulative quantity of goods produced (see, for example, Dasgupta and Stiglitz (1980) or Tirole (1988). If one of the players (be it a principal or an agent) is pursuing multiple objectives in the short run, these would probably not be compatible with short-term financial objectives, but could well be compatible, in the long run, with standard (although enlarged) financial objectives. In other words, the agent is "investing" in the short run for a long run payoff that the host country may find difficult to define or even understand at the time of the investment. In such a framework, the signals received by the other players (i.e., information on their action) will be hard to interpret. When signals are not read correctly, any move could lead to suboptimal reactions by other players and therefore to suboptimal outcomes from the point of view of the other players (including the agent and the principal). There is clearly a possibility that such situations could occur when SWFs operate in a host country (but this can also arise in the case of a SWF operating domestically as mentioned in the previous section). We have touched on this issue in the context of a model with two principals and one agent. Yet, for tractability, we will restrict the model in this section to one principal and one agent in the first instance, before briefly moving to the case of several principals.

A. The case of one principal

In order to illustrate how such learning by investing can take place, we introduce a simple example. We assume that a SWF acts as a principal who wishes to invest in each period (time is discrete) in one of two funds, denoted by j, with $j = A, B$. The financial returns from investing in either fund are stochastic and denoted by R_j, $j = A, B$. We also assume that the principal can acquire some private additional benefit T_j from investing in any of these funds (e.g., control or acquisition of information). Again, this information can be directly related to the profitability of the fund or to more general benefits that the principal wishes to acquire. We further assume that the principal is facing uncertainty and the benefit T_j is therefore modeled as a latent variable (not observable directly by the principal) which can take two values normalized to 0 or 1, without loss of generality. The possible realizations of T_j are denoted by $t_j = 0$ (referred to as "bad outcome") or $t_j = 1$ (referred to as "good outcome"). The words "good" and "bad" are arbitrary. We assume that the underlying process generating the good and bad outcomes is stationary and unknown.

We assume that the principal is facing uncertainty, as it does not know the probabilities of occurrence of the good and bad outcomes. However, he can reduce this uncertainty, but at a cost. We denote by p_j, the probability that the outcome is unfavorable $\text{Prob}\{t_j = 0\} = p_j$ with $f_P(p_j)$, the prior belief, in other words the probability distribution for parameter p_j. Without any extra (prior) information, it is reasonable to assume the simplest possible prior, i.e., that

the distribution is uniform ($f_P(p_j)$=1). One extreme case occurs when the random variables R_j and t_j are perfectly correlated; the other extreme case is when the random variable R_j and t_j are independent, so that a large or a low return on investment j tells nothing about the value of t.

If there is perfect correlation (between financial benefits and the extra benefits), acquisition of information by the principal is required in order to maximize long-term objectives. If there is independence, acquisition of information and profit maximization correspond to two different objectives faced by the principal in a multi-criteria problem.

We have assumed that the investment occurs in a discrete time framework and, in each period, the principal decides where to allocate his funds (the choice is discrete, i.e., either fund A or fund B is chosen). The proposed model is dynamic and captures the time lag associated with the concept of "learning by investing." It works as follows: after each period, the principal observes a realization of the random variable T_j, and adjusts his priors accordingly. Note that the observation of fund j is costly since the principal has to invest in this fund in order to be allowed to have access to a realization of t_j. After n observations of the realization of T_j, the distribution of prior has changed and is determined by the observed number of good and bad outcomes; this provides a sufficient statistics for making the next decision. This problem is difficult and has no closed form solution, but rigorous numerical solutions exist. We provide some of the computations related to this problem in Appendix 2.

Investing in a fund can therefore play a dual role for the SWF: first, it gets some financial return together with some private benefit; second, it gets access to information about the quality of the fund (the value of p). Some simple cases are easy to solve.

Assume, for example, that returns and private information are perfectly correlated. To fix ideas, assume that the value of p_A for fund A is known, we then have a "one armed bandit problem." It can be shown that in this case, the best strategy is either: (a) the principal always invests in fund A and never changes; (b) the principal invests in fund B, and if there are too many bad outcomes, it stops and switches to fund A forever; (c) the principal invests in fund B and never switches. Case (b) is the most interesting one, and illustrates what is meant by "learning by investing." The choice of fund B can be interpreted as follows: the principal is ready to lose possibly some money to find out if fund B will be a good source of private information. After exploring that possibility for some time, he decides (in case (b)) that this is probably not the case and switches to another fund (he may be wrong ex-post, but this is nevertheless the best decision, ex ante). Stopping rules must be designed and computed on the basis of past observations so that the principal knows when he should switch; although they are quite complex (they are known as the Gittins Indexes after Gittins (1979) and (1989)), they can be computed analytically.[13] In more complex cases, the quality of the private information for both funds is unknown. When that happens, shifts by the SWF from

[13] Note that this problem, known as the "bandit problem" already evoked at the beginning of this section, has been treated in the literature only for risk neutral players (with one exception by Chancelier, De Lara and de Palma (2009) who consider the case of players who are risk-averse).

fund A to fund B (and vice versa) can always occur because a sufficiently long series of bad outcomes can discourage the principal from continuing to invest in the fund originally selected.

B. The case of several principals

In the previous subsection, we have considered the case of a single principal. When there are several principals willing to invest in the same funds, the situation is far more complex. The principals will observe each other, and the rational SWF behaving the way we have just described sends a signal to the other principals when he decides to switch from one fund to another. Although these signals are hard to interpret, they cannot be ignored. Since all these signals convey some information, they should (and will) be interpreted by the other investors. However, the solution is not easy to compute—a point we have made earlier--since the acquisition of some share of a fund could be explained by several considerations that are hard to disentangle: a principal could select a fund in the short run investment stage to acquire knowledge about the potential private information conveyed by this fund. Or he may just be interested in the return on this investment. Moreover, the correlation between the private information that two principals could extract also matters in the discussion.

So far, we have assumed that the domestic fund manager (the agent) is not acting strategically. Things are more complicated when the agent ceases to be a passive player who ignores that its choices convey some information to the principals. We have also seen in section IV.A that, even with perfect information, the agent may be in a position to play one principal against the other. Assuming a passive agent may be realistic in situations where the number of principals is large, but it will generally not be the case when there are only a few. In addition, if the principals are in small number, they will be aware that their actions are observed and, in turn, may benefit from acting strategically. This is usually true (as discussed in Martimort (2006)), and we have already seen that signals outside equilibrium can play a critical role in the game with single objectives. This discussion suggests that, with multiple objectives, the signals sent by any player (one of the principals or the agent) can be significantly blurred and the ability of the other players to interpret them will therefore be reduced.

Clearly, the fees charged by the agent will depend on the value of its private information, which we have called θ in the rest of the article. As is usually assumed, this parameter will remain unknown to the principals, but while the value of the information (T_j) gathered by the principals is unknown to the agent, the latter can learn from their investment behavior (via some market study, for example). This problem is very complex and has not been addressed in the literature. However, in simple cases, it can be shown that, when principals have multi-criteria objectives, the agent may be able to extract a positive rent (even under full information) that it would not be able to extract otherwise (a result similar to that obtained in Martimort (2006) with single objective). This is worrying from the policy standpoint since the outcome of forcing a SWF to operate through a local fund (when it is suspected that the preferences of the SWF depart strongly from those of the regulatory authority), could be to increase the profits of the common agency and make it move to an inefficient outcome. Once

again, channeling the investment activities of the SWF through a domestic agency may not always increase efficiency.

VI. CONCLUSIONS

[Can one say that the external fund manager strategy works least when it is needed most?]
Some observers have suggested that SWFs could partly allay the concerns about possible political motivations behind their activities by investing through fund managers located in the recipient countries. We examine the usefulness of this proposal by using agency theory. The results show that, under reasonable assumptions, the use of fund managers may not necessarily address these concerns. This result holds in a situation when an SWF pursues only its profit maximization motives, but also more when it pursues multiple objectives, including "learning by investing." These results indicate that recipient countries may try to address their concerns through more direct regulation, which may add to the protectionist trends we observe in many countries. To avoid this, SWFs and recipient countries need to work toward greater organizational and operational transparency. The recent creation by Temasek of a new investment division that hopes to seek backing from institutional investors (and possibly the general public, down the road) may prove to be a useful example of innovations that would help allay the concerns of recipient countries.

Appendix 1

A simple model of one principal with two agents can be formalized as follows:

Let y be the output, x_i the effort made by each agent and $a_i.y$ the compensation paid by the principal to each agent, the utility of each agent is given by:

$U_i(a_i, x_i, y) = a_i y - (x_i)^2/2 \qquad (i = 1,2).$

The utility of the principal is given by:

$U(a_1, a_2, y) = y - a_1 y - a_2 y.$

The production function is given by:

$Y = x_1 m_1 + x_2 m_2$

when the efforts of each agent towards the overall objective are complementary. And,

$Y = (m_1 + m_2).x_1^{(m1/(m1+m2))}.x_2^{(m2/(m1+m2))}$

when the contributions to production are substitutes. In all cases, the social welfare is given by:

$V(x_1, x_2, m_1, m_2) = y - x_1^2/2 - x_2^2/2.$

Appendix 2

Denote by N_b, the number of periods a bad realization ($t_j = 0$) is observed. Then, the a priori distribution of t, conditional on the observation of $k=N_b$ bad realizations for j over n observations of j, can be computed according to Bayes' rule. Some standard computations show that:
$f_{P/k}(p; N_b = k) = (n+1)C_k^n p^k (1-p)^{n-k}$.

The expectation of the probability t_j conditional of $N_b = k$ is:

$$E(p_j; N_b = k) = \frac{k+1}{n+1}.$$

Note that, as expected, this converges to k/n, as k and n tend to infinity.

Denote the benefit conditional (on the realization t_j) of the principal, during one period by: $B_j(t_j) = U(r_j + \theta_j ; t_j)$, where $U(.,.)$ the utility function of the principal is based on the return

of fund *j* (j=A or B) and on the private information provided by this fund. For example, if the principal is risk neutral, and if there is a constant tradeoff in the two criteria, then its utility is linear, and $B_j(t_j) = r_j + \theta\ t_j$. If the principal is risk averse, the utility function will have a non-linear specification, such as constant relative risk aversion or constant absolute risk aversion. With risk neutral principals, the unconditional benefit of the principal, after n investment periods (observations) is then:

$$B_j(n) = \int_0^1 [pB(0) + (1-p)B(1)] f_{P/k}(p; N_b = k) dp$$

This expression is linear in the probability. It can therefore be simplified as follows:

$$B = E(p_j; N_b = k)B(0) + [1 - E(p_j; N_b = k)]B(1).$$

The principal should then maximize the discounted value of the flows of benefits over the total investment period.

Note that if the principal has some perception biases of the unknown probabilities, the expression will be non-linear in the probability:

$$B'_j(n) = \int_0^1 [v(p)B(0) + w(1-p)B(1)] f_{P/k}(p; N_b = k) dp,$$

where v(.) and w(.) denote the probability weighting functions. With no perception biases, v(.) and w(.) reduce to the identity. When v(.) and w(.) are non-linear, a closed-form solution for B(n), does not necessarily exist. However, numerical computations could still determine the switching points in the investment strategies.

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