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Can the market value state-owned enterprises without privatizing them? An application to natural resources companies☆

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ABSTRACT

State-owned enterprises may be strategic for many countries. For political or practical reasons some of these enterprises may remain *wholly* state-owned (WSOE), like PEMEX in Mexico or CODELCO in Chile. For this group, the lack of traded equity now prevents a market-based valuation. A market price would help provide an estimate of the WSOE's contribution to future fiscal income. It may also help keep managers more accountable and signal changes in the behavior of entrenched groups. Finally, a market valuation would also help valuing discoveries as well as research and development projects that are slow to yield profits. This paper presents a novel mechanism to create a market value for WSOEs, but without privatization. The method relies on independent parties trading a synthetic security. The security *replicates* the future cash flow that the WSOE pays to the government. It gives replicated cash-flow rights but no control rights of the WSOE. The document discusses methods to implement this principle and its potential challenges. Preliminary calculations show that issuing 3–10% pseudo-shares of some salient WSOEs could generate a meaningful valuation. This, without compromising state ownership of assets and decisions.

1. Market value for wholly-State-Owned Enterprises

Around the world, many of the State-Owned Enterprises (SOEs) that existed 40 years ago are already privatized. Some were fully privatized, while others were partially traded in stock markets. However, certain Sovereigns seem likely to keep some SOEs under 100% state ownership, for a variety of political and strategic reasons (Megginson and Netter, 2001; Lazzarini and Musacchio, 2014; Bortolotti and Faccio, 2009; Ganbold and Ali, 2017). For instance, salient natural resources companies like PEMEX in Mexico and CODELCO in Chile are *wholly* state-owned enterprises (WSOE).[1] The Panama Canal Authority (ACP) belongs to this group. Also, various banks in developed and less developed economies are wholly state-owned (World Bank, 2014; Musacchio et al., 2015).

The decision to keep 100% state ownership has advantages and disadvantages that need to be traded-off against each other (e.g. Che, 2009; Vining and Moore, 2017). In that tension, one known limitation of keeping a company as wholly state-owned is that it has no market-based valuation of its equity. This is unfortunate, because a market price for these SOEs may be useful information for managers, owners,

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[1] Saudi Arabia's oil WSOE is currently planning an Initial Public Offering (IPO) for its stock. This move by Saudi Aramco has generated global expectations. It would make it the largest company in the world, as measured by market capitalization. Larger than Microsoft and Google together. Given the IPO news, Aramco seems less politically constrained to privatization than PEMEX or CODELCO. Importantly, though, while many WSOEs issue bonds in global markets as companies, Aramco does not issue bonds. Bonds are issued directly by the Saudi Treasury, which then may transfer resources to the company. So, Aramco does not reveal company level information to market regulators like the SEC. This makes it relatively less relevant for the method in this paper. This may change, however, if Aramco issues $2 billion in long term bonds, as suggested by Bloomberg (March 21, 2017).

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or stakeholders. This external and potentially disciplining assessment for the company may mitigate some current problems of WSOE management and investment.[2]

In that context, this paper presents a novel mechanism to create a market value for SOEs that cannot be privatized. The innovation is based on the idea that parties, potentially independent from the SOE, can trade financial claims that mimic the future cash flow that the SOE pays to the government. This is different from privatization, which gives both residual cash-flow rights and residual control rights to equity holders (seats on the company's board). In contrast, the proposed pseudo-equity instrument would only give cash-flow. Let's note this security may be worth less than the company's stock, if it were traded. This bias could be due to the lack of control and, maybe, the lack of rights at liquidation. Nonetheless, the synthetic security proposed here may still co-move with the true value of the firm. Its fluctuations can be a thermometer of the SOE's expected performance.

To be clear, this paper does not take any stand on whether it would be optimal to privatize an SOE or not.[3] Our point, in contrast, is that keeping the firm 100% state-owned does not immediately imply the absence of market-based valuation. The proposed alternative may be politically tolerated because it does not give up government assets.

As a practical example, the constitutional laws of Panama and Chile argue that assets of flagship SOEs like the Panama Canal or CODELCO are government owned. But at the same time, there are fewer restrictions to the uses of the cash-flow generated by these firms. This is a crucial difference that could enable the mechanism proposed in the paper. Even if there were restrictions on the cash flow, there is no restriction on two independent parties trading a synthetic security that *replicates* the dividends paid by the SOE to the government. In many cases, this transfer is publicly disclosed information.

It is worth emphasizing that the mechanism proposed in this paper is not for any SOE. There are some pre-requisites. For example, the company should be large enough. This allows that a relatively small fraction of the firm traded in this security could have enough value. Otherwise, the security would not attract enough traders and financial analysts that follow the company. This would make prices too noisy vis-à-vis the expectations of future value (see Hong et al., 2000). Additionally, the firm should ideally be profit-oriented, as opposed to having a mostly social goal, like a utility or a subway. If it were non-profit oriented, investors in the synthetic security would fear that the government may siphon profits out of the company, in the form of unrecorded cross-subsidies. Firms like CODELCO, Panama Canal or the upstream portions of PEMEX are the types of canonical "for-profit" SOEs we have in mind to explore this method. The remainder of the paper develops these and additional points.

2. Making the case for SOE market values

2.1. What are the benefits of a market value?

In theory, equity prices represent the forward-looking value of the future stream of profits of a company. So, share prices tend to rise when circumstances or decisions improve, and vice versa. This feedback is useful for managers unless they overreact to the market price (Albagli et al., 2011).

A market value may impact WSOE stakeholders in different margins. First is the national Treasury that gets an additional estimate of future income from the SOE. This is especially important for countries with large WSOEs and if the Treasury follows modern fiscal rules (e.g. Frankel, 2011). In those regimes, the government should spend a fraction of its expected long-run income rather than just a share of its current income. Therefore, they would benefit more from a market valuation of future earnings. A second group is SOE's managers and owners – the citizens – who could observe market reactions to their actions. For example, a sequence of poor managerial decisions could be reflected in a lower stock price. That market reaction could make managers accountable, or induce them to react and correct past mistakes. Today, there is no such feedback coming from a market valuation of WSOEs. While current profitability is measured in the existing financial accounts, the long-term profitability is not measured. In that context, governments and managers may take decisions that may appear to be good, because they improve current accounting figures, even though they could be destroying long-run value for the company. Underinvesting in maintenance is one example of such behaviors. Also, the lack of a measure for long-run value amplifies the problem of "fiscal extraction" of the SOE by the government (Musacchio et al., 2015). The third point is that citizens may want to reduce the potential capture of SOEs by unions and entrenched groups. In this scenario, monitoring the market value of the company could be a useful disciplining device. For example, massive strikes of SOE employees could impact the value of the company. News about the lost value could make the SOE more accountable to the public. Also, massive declines in value after a large non-competitive bidding for procurement may be a market signal for perceived corruption. A fourth point is the valuation of other projects that are slow to yield cash flow, like research and development (R&D) and mining exploration. A market price may discipline internal estimates of the value of the project, and contrast them to what the market thinks the innovations are worth. This is usually done by looking at market prices before and after the announcement of these innovations. In addition, having a market-based valuation could improve the quantification of contingent liabilities of some of these firms (e.g. provisions for retirement plans, mine closure costs, etc.). Overall, a market price may mitigate limitations for the efficiency of SOEs.

2.2. What are the alternatives to a market valuation?

A market valuation is neither necessary nor sufficient to overcome the information problems we describe, but it may help to complement existing practices. The current toolbox to improve the management of SOEs (see World Bank, 2014; Musacchio et al., 2015) includes various methods. SOEs can, for example, use current ratios of efficiency to evaluate their performance. The SOE can also bring internal or external consultants to value the company and provide various types of benchmarking. But these alternatives may suffer from both information and incentive problems. Therefore, these estimates should be seen more as a complement rather than a true substitute for a market-based valuation.[4]

[2] For example, when SOE managers anticipate that their losses will be bailed out by the Sovereign, they may be bad at keeping financial discipline. This is known as "soft budget constraint" (Kornai et al., 1986; Lin and Tan, 1999; Maskin, 1999). Sometimes managers distort investment decisions to favor some politically connected groups, de facto expropriating the true SOE owner – the citizens – and being used as tools for political patronage or rent-seeking (e.g. see Carvalho, 2014; Micco et al., 2007). Yet another problem is the so-called "fiscal extraction" problem, in which the treasury extracts too much cash from the firm. This underinvestment limits R&D projects and maintenance of the SOEs' assets, reducing the long run value of the company. But since nobody is measuring that long run value, the current government may extract too much during its limited political timeframe. See Boubakri et al. (2011); Ben-Nasr et al. (2012); Borisova et al. (2015); Jones et al. (1999) for governance and valuation of political dimensions in SOEs.

[3] This, in contrast to other papers that aim to provide evidence of the benefits from privatization, like La Porta and Lopez de Silanes (1999); or papers showing some of the costs of privatization (e.g. Haber, 2005). Belloc (2014) summarizes various reasons why state ownership *per se* does not necessarily mean a reduction in efficiency.

[4] There are reasonable grounds for a shareholder to be cautious about the projections made by internal experts of firms. Burton et al. (1999) show that after the announcement of a new investment project, the change in the stock market valuation does not necessarily reflect the additional valuation suggested

On a different front, SOEs can also improve their corporate governance. This is also complementary to a market valuation. Certainly, the most controversial tool in the current toolbox has been privatization. But the restrictions to privatization are not relevant everywhere. In fact, many Chinese SOEs have been partially privatized without that much controversy. In several countries, however, a few "strategic" SOEs might be too politically sensitive, as the case of PEMEX (Huizar, 2015).

To clarify, the restrictions to privatization of SOEs do not mean they are currently disconnected from financial markets. In fact, in 2014 WSOEs issued $300 billion in bonds, representing around a tenth of the global corporate bond issuances that year (Wagner et al., 2018). But the price of these bonds has two important limitations as a measure of expected performance. On the one hand, bond prices change only if the company is expected to be under relevant stress, because bonds value only the company's downside, unlike equity prices that value the company's upside. The second and deepest problem is that bondholders expect to be bailed out by the government in case the WSOE performs poorly. Even credit rating agencies recognize it, boosting credit ratings when SOEs are wholly owned by the government (Wagner et al., 2018). Therefore, bond valuations may not be sensitive enough to changes in firms' fundamentals, reacting more to the financial soundness of the fiscal authority. This hardly helps to recover firm-specific information about the WSOE's future performance.[5]

Summing up, existing tools fall short to replace for the information aggregated in a market price, suggesting there is a space for an innovation.

2.3. Who may use the Innovation: some magnitudes

Without further restrictions, the potential market for these pseudo-equity contracts are all WSOEs around the world. But this synthetic security needs to be frequently traded with good information.[6] Therefore, we focus initially on WSOEs that are currently bond issuers in global markets. Table 1 summarizes 195 WSOEs that fulfill that condition. Of special interest are firms in commodity sectors like mining or oil, as well as state-owned banks; marked with a (*). For the subgroup of 76 WSOEs that belong to these sectors and report financial statements to the regulator, Table 2 displays their geographic distribution. Four of these companies are in Africa. There are 31 in Asia/Pacific, 16 in Latin America and 25 in high-income countries & European Union. Looking at the sum of past bond issuances, the Latin American region has the highest average per firm, with a skewed distribution. These are not many firms but tend to be large and systemically important.[7]

3. The basic moving parts of the mechanism

The simplest example of the mechanism is as follows. A buyer buys a financial instrument from an issuer. This issuer promises to pay the buyer an amount of z dollars for each dollar that the WSOE pays to the Treasury in the future. Note that this means replicating the cash flow of the WSOE. These are not the same dollars that the WSOE pays to the government, but it is a proportional *amount*. If some conditions hold, the market price of the security will be a proportion z of the valuation of the WSOE. More specifically, when investors are neutral to risk then a security's price is

$$P = \boldsymbol{E}\left[\sum_{t=0} \frac{CF_t}{(1+r)^t}\right]$$

; where $\boldsymbol{E}$ is the expectation over all future scenarios. The stream of cash CF_t is uncertain, and future flow is discounted more heavily. That is why in each period t there is a discount factor $1/(1+r)^t$; with r being the discount rate. As well known in Finance, sometimes r may reflect risk tolerance, correlation with reference market, liquidity and other features of the security (e.g. Cochrane, 2009). The innovation in this paper is to make CF_t proportional to the payments of the WSOE. This is called pseudo-equity, and gives the owner replicated cash-flow rights, but no control. Based on the publicly available information of a dividend D_t paid by the WSOE to the Treasury and making $F_t = z\,D_t$; the synthetic security's price is $P^{SS} = E\sum_{t=0} \frac{zD_t}{(1+r)^t}$. But, absent premiums for corporate control, the market price of the WSOE had it been traded would be $P^{WSOE} = E\sum_{t=0} \frac{D_t}{(1+r)^t}$.

Combining these expressions, we get that $P^{WSOE} = P^{SS}/z$. For example, if $z = 1/10^6$ and the security is priced at $P^{SS} = \$1{,}000$; then $P^{WSOE} = \$1$ billion. For this proportionality to hold one needs the same perception about the future stream of D_t, and the same discount rate r_t, as if WSOE shares were traded. This assumption has practical considerations that we now discuss.

3.1. Counterparty credibility

If the buyer of the security is concerned that the issuer would not fulfill its future payment, then the market would perceive a lower stream of zD_t or discount it with a larger r. This generates a market price with too little information about the WSOE. Therefore, for this security price to co-move with the counterfactual WSOE stock price, which is not directly observed, one needs an issuer likely to pay in the future (a.k.a. with low "counterparty risk"). In practice, this means either an issuer perceived to have excellent access to finance in the foreseeable future; or an issuer that is naturally hedged against its liabilities ZD_t rising in the future. This hedging could be achieved, for example, if the issuer also owns shares of commodity companies similar to the WSOE. Decreasing the issuer's mismatch between its future assets

(*footnote continued*)
by the firm. Ferguson and Scott (2011) show how presentations to boutique resource investors in Australia generate an abnormal return in the market valuation of these firms. In the long run, however, they are unable to see that this effect persists. Titman et al. (2004) show that firms that have large investment expenditures tend later to underperform. All these concerns about projections made by firms naturally suggest that ministers of finance and citizens should be pragmatic but vigilant about the actual value of the new discoveries. Having an independent market valuation could be a step forward in that process, although not a perfect one.

[5] Currently there are other financial innovations, different from fixed incomebonds, but they do not focus on valuing the expectations of SOEs upside. For example, the Mexican government is issuing some synthetic securities to finance PEMEX and the Electricity Company CFE. These are the so called FIBRAS-E. But they are meant to monetize a secure asset of WSOES that obtain a stable stream of profits and/or have some type of guarantee over the asset. For example, it allows the WSOE to get cash for a fixed asset such as a pipeline or electricity infrastructure. They are different from the pseudo-equity discussed in this paper. These are closer to what in the United States is known as a master limited partner (MLP). Currently, there are other efforts to issue sovereign securities that are indexed to economic activity. For instance, Benford et al. (2018) simulate sovereign bonds that pay more when GDP growth is higher in the country. Caballero (2002) advocates the issuance of sovereign debt with coupon payments that grow with the country's main export commodity. For example, copper-linked bonds issued by Chile.

[6] Any financial instrument that pays on the underlying profitability of the company (i.e., stocks, B-shares without voting rights, or any of the synthetic assets suggested in this paper), need to have enough trading magnitude as to attract analyst coverage and liquidity, to create a meaningful price. Without that liquidity the market price for the synthetic security would not reflect the underlying fundamentals of the SOE that we aim to price.

[7] This analysis does not include the hundreds of firms that could use this application in a second stage but that are currently not disclosing their information to global financial markets, although they do so in domestic markets. For a description of the relevance of WSOEs that issue bonds, see Wagner et al. (2018). For the interested reader, Table A1 in the Appendix A describe the public markets in which bonds are traded.

Table 1
Descriptive statistics of the SOEs that issue bonds in international markets.

Industry classification	Frequency of firms	Percent of firms	Sum of bond issued 1990–2012 [billion USD current]
National agency	17	8.72	976.00
Public administration	17	8.72	348.00
Regional agency	18	9.23	336.00
Other financials	20	10.26	262.00
Oil and gas	7	3.59	175.00
Banks	34	17.44	164.00
Credit institutions	9	4.62	111.00
Transportation and Infrastructure	13	6.67	81.9
Regional government	1	0.51	53.7
Not Classified	12	6.15	38.9
Power	11	5.64	34.3
Metals and mining	3	1.54	20.2
Diversified financials	1	0.51	16.9
Professional services	6	3.08	11.4
Petrochemicals	1	0.51	7.83
Building/construction & Engin.	6	3.08	5.97
Legal services	1	0.51	5.27
Educational services	1	0.51	4.55
Machinery	1	0.51	3.77
Real Estate Mngnt & Devel	2	1.03	2.93
Water & Waste Management	5	2.56	2.00
Gov-Sponsored Enterprises	1	0.51	1.89
Other real estate	3	1.54	1.27
Asset management	1	0.51	1.16
insurance	1	0.51	0.65
Agriculture and livestock	1	0.51	0.26
City agency	1	0.51	0.22
Brokerage	1	0.51	0.01
Total	**195**	**100**	**2670**

Notes: This table describes the SOEs that are bond issuers in international markets according to Thomson Eikon database. They are classified by industry classification. The first numerical column described the count of different firms, while the second shows the size of each bin as a percentage. Industries are sorted according to the third numerical column, which is the sum of the total amount issued between 1991 and 2012 by these companies, measured in billions of current US dollars (10^9 USD). The database includes all "Agencies" with bonds outstanding in international markets. According to the author, sectors with a (*) may seem ex-ante more likely, as a group, to be a potential source of demand for the innovation because their goal seems more likely to be profit maximization, with some constraints or adjustments for externalities or strategic services. This is only an exploratory classification and should not be used for other purposes.

and liabilities (ZD_t) lowers its counterparty risk and improves valuations.[8]

3.2. Analyst coverage and liquidity

Markets can be a good mechanism to price assets if they get useful information and have good incentives to accumulate and aggregate that information. Otherwise, prices could suffer from systematic mispricing or excessive noise (i.e. "garbage in, garbage out"). To avoid this problem one needs appropriate trading liquidity and analyst coverage.

In financial markets, independent analysts look for information about the expected performance of firms, issuing reports. A single analyst may have idiosyncratic valuations, but a population of many analysts can collectively unveil a more precise valuation of the company. These analysts *purposefully* accumulate information about the scenarios that are more important to traders. But this means that the specific information raised by analysts would depend on the types of securities currently traded, as in a chicken-and-egg situation. Today many WSOEs have *bonds* traded in global *bond* markets, so the analysis provided is about the company's downside and potential default of bonds. In contrast, the proposed equity-like markets will demand more and different information. Especially important would be the information about the good scenarios for the company (the upside of the business), which are much less relevant for current bond traders (see Dang et al., 2013). As mentioned, to increase coverage by analysts, the amount traded of an SOE pseudo-equity would need to be large enough. Otherwise, there would not be enough opportunities to profit from trading the synthetic asset. If the future $E[ZD_t]$ is too small, then analysts and traders would acquire little information.

A related feature is that we need frequently updated prices that have some precision. If there is too little trading, there would not only be limited updating of prices, but there would also be a wide spread between bid and ask prices, creating excessive noise about the WSOEs value. To achieve a liquid security, which is frequently traded and with a narrow bid-ask spread, one also needs a minimum issuance size (see Section 5). [9]

3.3. Incentives for the owner

The previous point pushed for having large issuances of the synthetic security. But other forces push towards avoiding extremely large issuances, beyond political salience. One potential concern with the

Table 2
SOEs of selected industries that issue bonds in global markets, by region.

World region	Frequency of firms	Percent of firms	Sum bond issued 1990–2012 [billions USD current]
Africa	4	5.26	6.46
Asia / Pacific	31	40.79	185.00
EU and High Income	25	32.89	318.00
Latin America and Caribbean	16	21.05	248.00
Total	**76**	**100**	**757.00**

Notes: This table describes the SOEs that are bond issuers in international markets according to Thomson Eikon database and that belong to one of the following industries: other financials; oil and gas; banks; credit institutions; metals and mining; diversified financials; petrochemicals; asset management as classified in Thomson Eikon. The first numerical column described the count of different firms, while the second shows the size of each bin as a percentage. The third column is the sum of the total amount issued between 1991 and 2012 by these companies, measured in billions of current US dollars (10^9 USD). The database includes all "agencies" with bonds outstanding in international markets that belong to the abovementioned industries.

[8] In financial jargon, these issuers are called to have a "long position" on the WSOE future cash flow, because they benefit when the value of the WSOE rises and D rises. This is the opposite of a "short" position, when the agent benefits from a drop in the value of the company. A party unconnected to the WSOE that must pay a liability ZD is "short" on the WSOE. As clarification, here we use uppercase Z as the sum of all the shares issued ($Z = \sum z = Nz$). So, for example, if each synthetic share is a millionth of the SOE's dividends ($z = 1/10^6$), and there is an original issuance of the synthetic security totaling of 5% of the WSOE's value, then $Z = 5\%$, so there are $N = 50{,}000$ pseudo-shares of the company and $Z = \sum_1^{50{,}000} z = 50{,}000 \quad /10^6 = 5\%$.

[9] One potential synergy of issuing an equity-like security is that there could be more incentives to gather information about the company in general (Boot and Thakor, 1993), even for bonds. If this is the case, then there could be an additional benefit because also the bonds issued by these companies may become less volatile and could even have lower yields, decreasing the companies' cost of funding.

innovation would be if the Treasury has incentives to misreport the WSOEs financial information, to avoid paying excessive "replicated dividends" ZD_t. For example, let's consider the case that Z is close to one and the issuer only gets a share $(1 - Z)$. Thus, Z may act as a "tax" that the Treasury needs to pay, inducing various types of "creative accounting" behaviors and lowering the quality of reporting. A first suggestion would be to avoid extremely large issuances relative to the company's size. A Z below 10% of the company seems less likely to generate the mentioned problems, because the owner will have a net positive position on the cash flow of the company. Note that the synthetic security does not need to be issued by the Treasury. In that case, the misreporting problems may be less relevant.

3.4. Legal restrictions

There could be legal constraints in the design of these synthetic securities. For example, as a device to limit lobbying by special interest groups, many countries have specific laws against "earmarking" some types of fiscal revenues to specific types of expenditures (Bös, 2000). This might become a constraint in some countries if the judiciary interprets that replicating the cash flow of an SOE is a kind of earmarked expenditure, prohibited by law. In contrast, the judiciary may interpret this is a variable debt payment, which may not be constrained by law. Another key aspect is to have a report by a constitutional scholar in the country, remarking that replicating cash flow is not limited by the legal or constitutional restrictions to privatize the WSOE's assets. Of course, these aspects may be more salient if the synthetic instrument is issued by the Government, but not if it is issued by an independent party. In any case, legal certainty should be checked on a case-by-case basis, since the ultimate payments and therefore the valuation would depend on it.

3.5. Time horizon and lobby by investors holding the synthetic security

Yet another potential concern is that investors holding the synthetic security may lobby the government to pay more dividends today at the expense of the future value. This would happen if they are too impatient. This problem would mean replacing the fiscal extraction problem – in which governments extract too much from the SOE, destroying its long-run value – by a related "third party's extraction problem". But this concern does not need to be the case if the buyer of the synthetic security has ownership of cash-flow rights over multiple future periods, so the investor has a long-term interest instead of being myopic. In that case, lobby and monitoring from these investors may mitigate the fiscal extraction problem, although a dispersed ownership of the security could limit their coordination to do so. In any case, a lobby of investors in favor of SOE profits could also be useful in counteracting the potentially powerful lobby of unions, managers, or some entrenched groups.[10,11] These may have incentives to inflate the SOEs costs, like the payroll, at the expense of profits. In that sense, investors may lobby in favor of the Treasury's position as a shareholder.

After reviewing the main mechanism and its trade-offs, we now describe specific ways of implementing these principles.

4. Implementing the principles

4.1. Types of securities to implement

There are various ways to implement the principle of replicating contingent cash flow paid by the SOE to the government.[12]

The first approach is the explicit use of a pseudo-equity contract by an independent issuer, different from the Treasury. This type of issuer, usually international, seems more protected from national political interferences against trading this security, as in the current case of Credit Default Swaps (CDS).[13] The challenge of these independent issuers is the potential future mismatch between assets and liabilities, which may compromise its future ability to pay the stream of ZD_t. But there are ways to hedge part of this risk.[14] Also, since the price information revealed by this pseudo-equity would be a public good, the role of independent issuer could alternatively be supported by international organizations or foundations interested in the long performance of SOEs and natural resources extraction. Organizations interested in financial stability could also organize a similar market for pseudo-equity of state-owned banks, to gather market feedback on the quality of investments and financial risks involved.

A second methodology would be to set up a series of financial swap contracts. These are agreements between two parties that commit to exchange a sequence of cash payments in the future. This means one contract is made contingent on D_t, another contract for D_{t+1}, and so on and so forth. In a swap, one party would pay the other the *difference* between the dividend yield of the SOE and a benchmark interest rate (e.g., LIBOR). The advantage is that trading parties have liabilities on the net difference they owe to each other, rather than on the gross amounts of the security. This reduces opportunism by both parties and, therefore, enhances the perception that the issuer pays in the future; improving the valuation.[15]

[10] It can counteract lobbying in one direction with lobbying in the opposite direction, as in the political economy model of Becker (1983). Some countries currently have earmarking rules for expenditures that are connected to SOEs. For example, Chile's "*Ley Reservada del Cobre*" gives 10% of the export revenues of CODELCO to the military. Beyond issues of fairness and social priority, there is an additional problem of the schemes in which someone receives a share of the sales, as opposed to a share of the SOE's profits. The difference is that the armed forces do not have incentives to lobby for improving the cost-efficiency of CODELCO. This is a relevant difference with the proposal in this paper.

[11] Recent corruption scandals in privatized SOEs, like PETROBRAS, confirm that privatization alone is not enough to avoid SOEs' capture (Shaheer et al., 2017). While the method suggested in this paper is no guarantee against corruption either, it can hardly add to corruption, having the potential to complement the existing toolbox.

[12] Of course, all applications must ensure appropriate corrections in the contracts, made to reflect the repurchase of shares, equity injections by the Treasury and other contingencies, like future privatizations. These real-world wrinkles of the calculations are left out of the current paper, for expositional ease. Since many WSOEs have "special taxes" that in practice are way to pay out dividends to the Treasury, in all subsequent securities we assume the accounting figures for WSOEs provide information to back out the counterfactual profits. Meaning the after-tax profits that the WSOE would have gotten, had the company lack those special taxes (i.e. as if it were a standard corporation, unrelated to the government).

[13] One concrete example of existing contracts that are traded between two independent parties are the Credit Default Swaps (CDSs). This is an insurance against the default of a Corporate or a Sovereign Bond. They tend to be widely traded, with many daily updates. The issuers of these securities are not the underlying corporations or Sovereigns, but other third parties. Some of the buyers of these CDSs could be investors, but also other people could buy them. The crucial point for this paper is that the issuer does need to own the company. In fact - on a daily basis - global markets have estimate the probability of fiscal default for many countries, based on CDS, and even if the rulers of these countries may not like it.

[14] As suggested, this potential mismatch could be mitigated if the issuer holds a portfolio that is naturally hedged against fluctuations of the WSOE, even in the very long run. For example, by holding stocks of similar mining companies (see Section 3). The issuer of a pseudo-equity security may have trouble paying, for example, if the price of the commodity produced by the WSOE massively increases. In the medium run, let's say 1–5 years, the issuer could hedge that risk through instruments like financial options. For the long run, however, these instruments tend to be much more expensive or less available. Therefore, one possibility is that the issuer also holds stock of similar commodity companies, which positively covary with the WSOE's price. This mitigates the problems of ability to pay.

[15] As noted in Section 3.5, one concern is that when influential investors care

A third way to implement this principle is when the Treasury issues securities contingent on the SOE's profits or dividends. Like in other cases in which owners issue pseudo-equity,[16] this reduces counterparty risk. Since the Treasury is naturally hedged against the SOE rising in value, it is less likely that the issuer defaults on its payments *ZD*. This generates certainty for the buyers of the security. The Treasury could issue at least two types of instruments. One is to have true pseudo-equity, which replicates a fraction of the cash flow coming from the SOE. Another possibility are non-voting shares of the company (a.k.a. "B-shares"). The latter is a better-known instrument, that could help achieve liquidity. The difference between the two methods might be more legal than financial in nature. While B-shares give an actual portion of the company's profits, pseudo-equity pays *a replica* of this amount, which may have less of a privatization flavor. The relative benefits of one or the other should be weighted, depending on the legal and political constraints of each country.

A fourth way is having the SOE issue pseudo-equity to people like employees at retirement, and then allow them to trade this security in a secondary market, to get a market price. This method has the additional benefit of potentially aligning the incentives of SOE workers with those of the Treasury. This special pension plan of WSOEs is akin to how some Silicon Valley startups pay some early employees, even before the initial public offering of the company. Virtual marketplaces like SecondMarket.com, now Nasdaq Private Market, are specialized in trading these special securities.

While the synthetic security is meant to be used without privatization, it could still approximate the company's value, to subsequently time the issuance of SOE's common stock. This may reduce "rushed privatizations", which tend to raise little fiscal revenue (Hagemejer et al., 2018).

4.2. Description of the methods step by step

The flow-diagram of Fig. 1 describes the steps for implementation. In Stage 1, the WSOE commits in some credible way to report future audited accounting statements to a market or regulator (e.g., SEC). This is satisfied, for example, by issuing 20-year bonds in a reputable financial jurisdiction. Stage 2 is the organization of the market, developed by stakeholders, managers, or any interested party, even if unrelated to the ownership (e.g. International Agency). The market does not need to be organized by the sovereign or the SOE, but it may help if it participates in the process. The subsequent stages follow some periodic timing. Stage 3 describes the reporting process. In every period (e.g. quarter), the SOE would report financials and any other type of market-relevant information to regulators and analysts. In Stage 4 parties trade a financial security contingent on the SOE dividends paid to the government. Here one may need a so-called market-maker. That is a party that acts both as buyer and as a seller of the synthetic security, facilitating the liquidity of transactions. This role could be partially subsidized if it does not happen naturally, at least initially. Stage 5 follows a series of mathematical formulas to back out the implied SOE market price from the price of the synthetic security. In the case of pseudo-equity, the calculation derives from the formulas in Section 2.

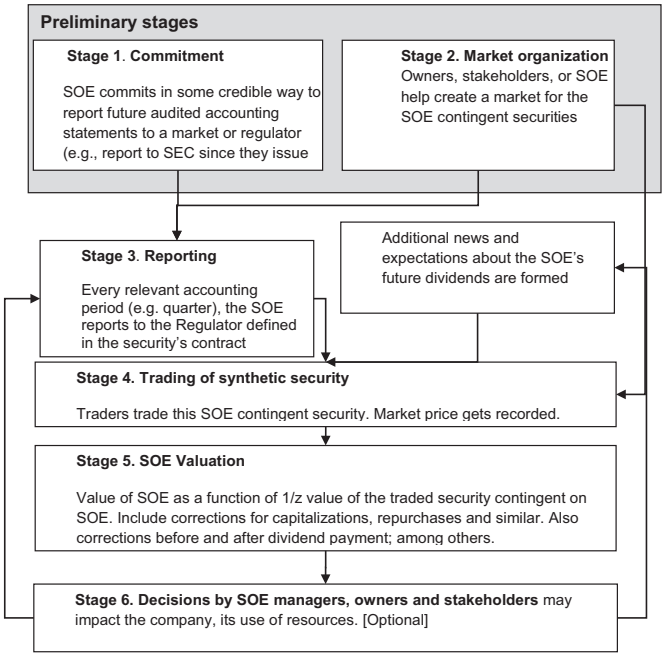

Fig. 1. Process-flow diagram.

Finally, as the market valuation is posted, managers and stakeholders of the SOE are expected to adapt their decisions — if pertinent — to improve the company. This is the basic plan which can be adapted for the specifics of each circumstance. Fig. 2 focuses on the special case when the Treasury issues the security. Fig. 3 details an example of the settlement of payments for each period (e.g., quarter).

5. Opportunity and applications

This section explores the size of a synthetic security for salient WSOEs in Latin America. The exercise does not aim to be a complete business plan but attempts to understand the orders of magnitude involved.

As noted in Section 3, it is important to issue pseudo-equity in relevant amounts, to get liquidity and analyst coverage. Also, one should aim to issue small percentages of the company, to avoid political controversy, as well as concerns over issuer credibility or reporting incentives. For the case of the copper company CODELCO, the estimations made jointly with Sanchez (2016) provide a starting point for an expected company valuation of US$20 billion, coming from at least three methods. This is not meant to be an exact valuation of CODELCO, but rather an estimate for our exercise to simulate the number of analysts that this company can get.

The relation between analysts and size of the company is in Fig. 4. The vertical axis shows the analyst coverage for publicly traded copper companies, going from zero to 35 analysts. The size of the company available for trading is on the horizontal axis. Size is measured as "*free float market capitalization*" to exclude the portion of the company that is closely held by insiders or the Government.[17] From a visual exploration of the graph, it is apparent that companies between US$2 and US$5 of floating market cap get around 20 analysts. More formally, when

(*footnote continued*)
only about swaps between today and a couple of years. Then they might act myopically about the long run value of the company. If that is the case, they may lobby for amplifying the fiscal extraction problem, instead of mitigating it. For that reason, it might be advisable to pack together a long sequence swaps, for example lasting 15 years or more. This aligns incentives, as if investors were true equity-holders.

[16] High impact technological entrepreneurs sometimes issue pseudo-equity in their early stages. It is used when the founder is cash constrained and wants to pay early employees with securities of the company, but at the same time, the entrepreneur wants to avoid the veto power of these early employees in the company's board.

[17] Market capitalization is simply the price of the shares multiplied by the number of shares of the company. But for some companies many shares are not available for trading in the market. To measure the shares available, it is useful to exclude the shares of locked-in stock held by promoters, company officers, controlling-interest investors or the government, as in our case. The remainder is called 'free float market capitalization' and it is a better measure of the magnitude of the securities that at some point could trade.

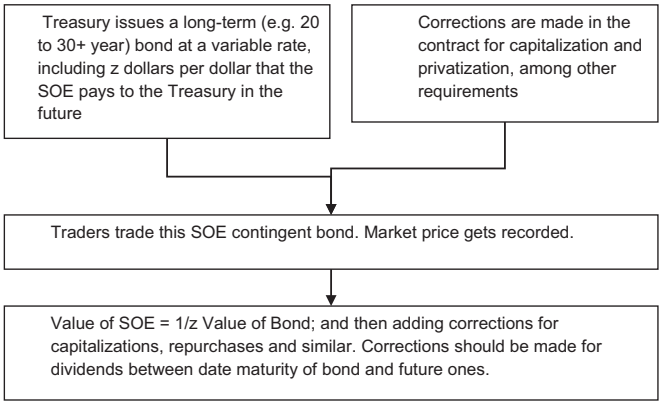

Fig. 2. Special Case when the Issuer of the SOE contingent security is the treasury of the government that owns the SOE, or any holder of future dividends of the SOE.

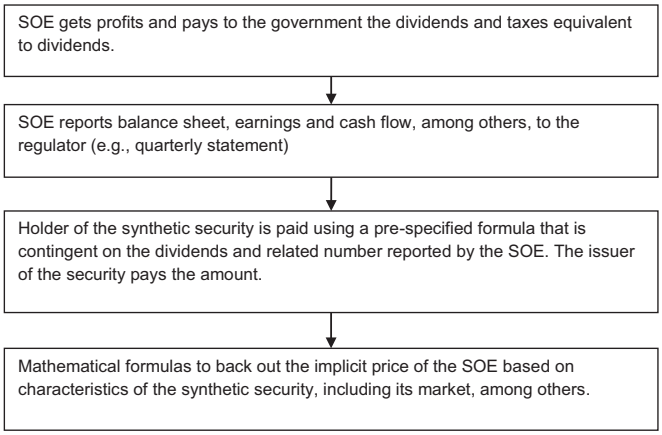

Fig. 3. Diagram with an example of payments and settlement in each period.

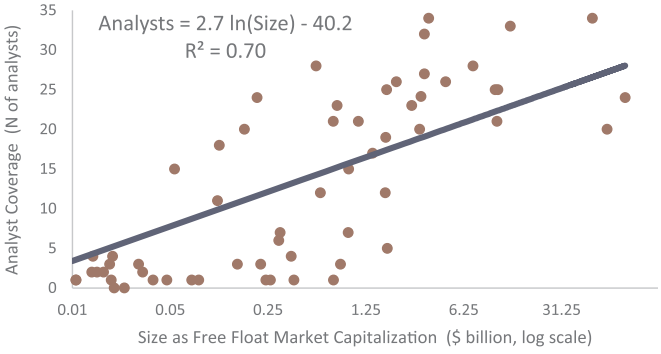

Fig. 4. Analyst Coverage for publicly traded copper miners, by size of the security. **Note:** Author's calculations using data compiled in Sanchez's dissertation (2016), using data from Bloomberg on *Analyst Coverage*. The plot shows on the vertical axis the analyst coverage for publicly traded copper companies. On the horizontal axis, the plot shows the value of the free-floating market capitalization for these companies. This is obtained by multiplying the percent of free-floating shares potentially traded times the market capitalization, which is the share price multiplied by the number of shares outstanding. Most companies are in the range between US$0 and US$15 billion. The three companies of the right-hand side are BHP Billiton PLC with $89 *billion*, Rio Tinto PLC with $52 *billion* and Rio Tinto LTD with US$66 billion on the horizontal axis. Additional multivariate regressions are available in Sanchez (2016).

inputting the assumed valuation of CODELCO of US$ 20 billion, times the assumed 10% pseudo-shares floating in the market, one gets a point estimate close to 21 analysts. Other multivariate regression models for CODELCO yield a similar order of magnitude.[18] Overall, we can say that having $Z = 10\%$ of CODELCO's cash-flow could in principle be enough to attract significant analyst coverage. It would have as much coverage as a medium-sized copper miner listed in the UK or Canada.

Similar calculations could be performed for other commodity companies like PEMEX. In that case, one would prefer the analyst curve for oil companies instead of copper companies, but a preliminary estimation showed a curve like the one in Fig. 4. The main difference comes from the fact that PEMEX is much larger than CODELCO. As a result, with a smaller share of PEMEX, around 3%, one can have a US$2 to US $5 billion floating market capitalization.

One challenge is the timing of issuance. With the fluctuations in commodities in the last decade, the implicit value of companies like CODELCO and PEMEX changed massively. It would be advisable to jumpstart these synthetic securities when commodity prices are not at the bottom. Especially because - as mentioned - with higher valuations one needs a smaller share Z to attract analysts and traders, which is particularly important at the beginning.

It is illustrative to see also a rough calculation for ACP, the Panama Canal Authority. It is a WSOE with annual profits around US$1 billion per year. Discounting these profits at 7%, as used in some internationals ports, yields a valuation for assets around US$14 billion, assuming no growth. In such a simplistic scenario, that does not correct for many of the real-world complications—including debt and taxes — a 5% of ACP in the synthetic security would be worth around $700 million. As benchmark, that amount corresponds to one and a half times the public shares of Eurotunnel (*Groupe Eurotunnel SE,* code GTP.PA). This is the company operating the submarine tunnel between France and the United Kingdom, which currently has some seven active analysts following the stock and it is reasonably liquid. This rough approximation does not mean this issuance is necessarily a good project for Panama, but it is not unreasonable to make a more serious evaluation. It could be issued as bonds contingent on the profits of the Canal, or B-shares without voting rights or any of the other possibilities of pseudo-equity discussed in this paper. These alternatives may be less politically controversial than partially privatizing ACP.

A cautionary note for nationalistic views is that issuances do not need to happen in the WSOE's domestic stock market. One may prefer a global location with liquidity and many specialized analysts for the WSOE's industry (e.g. a Chicago or London-based exchange for commodity companies).

6. Concluding remarks

Wholly state-owned enterprises (WSOEs) need new tools to keep them accountable and efficient, especially in extractive industries and state-owned banks. This paper offers a mechanism to create a market value for WSOEs that cannot be privatized, neither partially nor totally. The fluctuation of this value would be a signal for improving managerial decisions. It may also reduce rent extraction by entrenched groups. The method relies on trading a synthetic security, which replicates the future cash flow that the WSOE pays to the Treasury. This

[18] Another variable that is significant in predicting analyst coverage in copper (regressions available upon request) is the market in which the shares are traded. For copper, shares traded on the London Metal Exchange have, everything else constant, eight additional analysts vis-à-vis those traded in benchmark countries. This is still three more analysts than for issuances traded in North America. One implication of this result is that to get more analyst coverage, it is pseudo-shares may not be traded in the domestic market where the SOE is located, but rather in a stock market that understands its industry and has more coverage of specialized analysts. Although not conclusive, this is a first warning on the nationalistic view that SOE's should be traded domestically. One should note that simply counting analysts is not a perfect measure either, because in Emerging Markets they tend to provide less firm-specific information (Chan and Hameed, 2006), leading – on average – to lower quality of the prices.

principle can be implemented in many ways. For example, issuance by independent parties, as in sovereign default insurance (CDS). Alternatively, it can also be issued by the Treasury in various formats. This may even diversify the Treasury's portfolio, which is normally overexposed to the risks of the SOE.

Preliminary calculations show that issuing 10% of CODELCO in this synthetic instrument may trigger enough market traction. This, assuming investors perceive it as equivalent to being a small shareholder in a mid-sized copper mine. For the much larger Mexican PEMEX, one may need an even smaller share of the company. For the Panama Canal Authority, 5% of the company may achieve reasonable coverage and liquidity.

This paper argued for more market feedback in WSOEs, but without necessarily compromising state ownership of assets and decisions. Since this mechanism could work with a small fraction of these companies traded as synthetic security, the WSOE's owners would still have a large net positive position in its cash flow. This is useful for incentives and it may help rally more political support. Future research may explore additional implementation challenges. It could also explore how earmarking the revenues of this instrument to some specific public uses - like children's education or public R&D - may boost even more the support for this innovation.

Appendix A

See Table A1

Table A1
Listing markets for WSOE bonds traded in global markets.

Listing market for bonds	Frequency (# of bonds)	Percent of bonds	Cumulative Percent
Frankfurt	1100	44.64	44.64
Luxembourg	436	17.69	62.34
Singapore	157	6.37	68.71
London	109	4.42	73.13
Euronext.liffe Paris	99	4.02	77.15
Euronext.liffe Amsterdam	81	3.29	80.44
Mexico	49	1.99	82.43
Dusseldorf	48	1.95	84.38
Japan OTC	43	1.75	86.12
Cairo	38	1.54	87.66
Johannesburg	28	1.14	88.8
Berlin	22	0.89	89.69
Gretai Securities	20	0.81	90.5
Vienna Stock Exchange	18	0.73	91.23
Munich	17	0.69	91.92
Bond Exchange South Africa (BESA)	16	0.65	92.57
Hong Kong	16	0.65	93.22
Stockholm	15	0.61	93.83
Mercado Deuda Publica	13	0.53	94.36
Stuttgart	13	0.53	94.89
Euronext.liffe Lisbon	11	0.45	95.33
Dublin	10	0.41	95.74
New York Stock Exchange (NYSE)	10	0.41	96.14
Other	95	3.86	100.00
Total	2464		100.00

Note. This table describes the listing market for the bonds issued by SOEs. It includes all industries according to Thomson Eikon database. The first numerical column described the count of different bonds issued in each market between 1991 and 2012, while the second shows the size of each bin as a percentage. The third is the cumulative percentage. The total number of different SOE firms is 195. The listing markets for bonds in the last residual category called “Others” includes: Tokyo Stock Exchange, Milan, Toronto, Barcelona, Kuala Lumpur, Swiss Stock Exchange, Athens, New Zealand, Buenos Aires, Cordoba, Euro MTF, Helsinki, Warsaw, Madrid, Budapest Stock Exchange, Copenhagen Stock Exchange, Euro TLX, Casablanca, CeTO Regulated, Korea Stock Exchange, NASDAQ and Taiwan.

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