



**Do Private Water Utilities Operators Care
about Regulatory Agencies in Developing Countries ?**

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Abstract

This paper shows that the creation of an independent regulatory agency (IRA) is often not a necessary or sufficient condition to help countries attract private participation in the operation and financing of the water and sanitation sector of developing countries. The odds of an impact are, however, significantly higher for Latin American and Caribbean countries and to a lesser extent Eastern European countries, than for any other region. Higher income levels and higher prices are also correlated with a higher effectiveness of IRAs in attracting private sector financing. The analysis of the impact on the various types of PPP contracts shows that, at the margin, IRAs are irrelevant in general, to the contract choice, except for greenfield projects for which IRAs may be counterproductive at the margin.

Keywords: Regulation, Regulatory Agencies, Water utilities, Privatization, Public-Private Partnerships,

JEL Codes: L33, L38, L43, L51, L95, L97

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1. Introduction

The extent to which the creation of an independent regulatory agency (IRA) is needed to attract the large scale private operators into the water sector of developing countries has been a recurring topic of discussion among analysts and policymakers for over 25 years now. This concern is part of a broader set of concerns linked to the desire to come up with an ideal design of the regulatory governance of the water sector. The goals of regulation are possibly the only point of convergence between all analysts of the sector: (i) making sure that the needs of all users are met with decent quality standards and (ii) providing with the right incentives to public and private providers, small or large, to deliver water in a cost-effective way and treat wastewater to minimize costs and/or make the right investments. And although there is a broad consensus that regulation (in a broad sense) does matter, there is much less agreement on the institutional design needed to implement regulation and make sure its goals are achieved.

And yet it started from a common global vision which has long dragged a somewhat excessively broad view of what should work. For the last 25 years, the core of this view has been that the private actors should take over the investment financing requirements as well as the management of the sector and these private actors should be supervised by an IRA. The case was not too hard to make, at least in the beginning. During the previous 25 years, the public sector had not been able to get public enterprises to raise funds on their own. Until the early 1990s, in many countries, investment in networked water supply had, indeed, failed to catch up with population growth and efforts to improve sanitation were close to catastrophic. This is largely what made the initial case for private sector participation relatively easy politically. Something new had to be tried.

After 25 years of trials with a somewhat standardized approach to public private partnerships (PPP) in the sector, once again, there is a feeling that something new must be tried out. A major difference is that, now, we have enough diversified experiences to be able to draw pragmatic lessons on the basic components of the regulatory governance of the sector. This includes the effectiveness of IRAs and how relevant they are to the various types of standard contracts, the main focus of this paper.

The original case for IRAs has not changed much since the early 1990s. The creation of an autonomous independent regulator offers an option to minimize the risks of firms capturing the regulatory process by trying to influence the Government, Ministries or other public actors to get them to bias regulatory decisions in their favor. Somehow, Governments were not too concerned about this when firms were public and de facto, firms were often self-regulating or instrumentalized by the Government to create jobs or maintain public services prices below costs. Once firms became operated by private operators, the concern for capture exploded and that is when an IRA was being considered as desirable to make sure the key regulatory decisions on prices, quantities, quality, and cost efficiency were being assessed without political interference or without the control of the operators.

The implementation of this institutional change in the developing world started in Argentina (in the early 1990s) and moved on to be tested most notably in Latin America and sub-Saharan Africa (SSA) and to a lesser extent, so far, in Asia and Eastern Europe. North America had a long experience of agency based water utilities regulation at the state level but many of these agencies were, and are still, far from being independent from political interference since members of regulatory commissions are usually political appointees. In Europe, the leader was the UK but there was a wide support for the idea from political scientists (e.g. Majone (1997) or Thatcher (2002, 2011)), even if in the water sector it did actually not lead very far.

For developing countries, political scientists were not alone in voicing their support for these agencies. The case for IRAs also came from solid theoretical academics concerned with the institutional weaknesses linking the multiple sources of conflicts of interests characterizing public sector institutions (e.g. Laffont (2005)). The emerging academic message was simple: unbundling the regulatory function from other public sector responsibilities would increase the transparency of

political interferences and/or of incompetence and hence improve accountability. The ultimate purpose was to make it easier for regulation to be a technical rather than a political decision. This, in turn, would make it easier to attract private sector investment concerned with the risks of expropriations in sectors demanding high investments levels with slow amortization periods. But if the private sector was not to be interested, it would still be a useful idea to improve the accountability of the managers of the public enterprises. Indeed, the regulators would at least provide a solid independent audit of the management of these enterprises that would go beyond the traditional accounting review delivered by national public auditors.

The approach was eased by the growing popularity of contract based mandates to public and private operators. Management contracts, licenses, concession contracts or any other types of more targeted contracts (Build-Operate and Transfer, Build-Operator and Own, ...) became an increasingly popular way of spelling out regulatory expectations. The outcome was a hybrid model combining contract based regulation with some discretionary power for new autonomous regulators. International organizations and other policy analysts have been vocal supporters of these agencies, echoing recommendations from the economic, legal and political literature.

Over 25 years later, and with the insights of many failed experiences, some academics and practitioners have become somewhat cynical of the possibility of achieving independence from political interference in the regulation of the sector. The doubts also characterize the preferences of private actors. Indeed, if private firms are still interested in very targeted projects, the stylized facts reviewed below seem to suggest that creating a separate regulatory agency to regulate water utilities is not needed to attract private financing for these projects and that the creation of these agencies does not guarantee private financing of much needed projects and operations.

The doubts about IRA's impact probably reflect the challenges linked to the implementation of the concept. The ideal of independence has seldom, or then only temporarily, been adopted. In almost all countries, political interference with the nomination of regulators, the design of their budget, the investment in the technical skills of their staff, with the design of processes and with their validation is the norm rather than the exception.² Ministers, or more broadly politicians, have a hard time giving up on their ability to turn regulation into a political instrument when it is convenient (Gerlach and Fraceys, 2010).

This interference usually eventually matters to the financing and operational performance of the sector, although not as dramatically as sometimes argued in political speeches. But the growing image of their irrelevance in conflict situations may be why many countries have decided not to rely on IRAs as shown by recent OECD reports on the water sector governance (2015, 2016). The fact that they are less than unanimous endorsed around the world calls for an assessment of the extent to which they actually make a difference as an institutional design choice and whether the specific contract forms make a difference.

The main purpose of this paper is to provide analytical rather than anecdotal evidence on the evidence on how much the creation of an IRA and of the choice of a specific contractual form for a PPP explain the supply of PPPs. Section 2 reviews the literature. Section 3 provides a brief overview of the main relevant institutional preferences for agencies and contracts around the world. Section 4 discusses the main data sources for the key variables we work with and then explains how we estimated the relevance of IRAs for PPP in developing countries. Section 5 concludes.

² Argentina, the poster child of regulatory agencies, did not manage to survive the desire of the first Kirchner administration to turn regulation into a political instrument. But this is not a developing or emerging economy characteristic. Similar cases characterize the nomination of members of regulatory commissions in continental Europe where holding a party card is a common requirement to be eligible to sit at the board of a regulatory agency (or at the board of regulated firm for that matter).

2. Brief survey of the literature

The relevant economic literature can be divided into roughly three broad categories. The first provides insight on the impact of regulatory agencies across regulated industries, emphasizing the evidence on the water sector. The second looks at the evidence on their impact of contract choices. The third emphasizes the difficulty of achieving actual independence from political interference in practice and is largely developed by political scientists. The main message from the evidence, mostly from partial regional samples (Latin America and sub-Saharan Africa) is that the likelihood of finding an impact of the introduction of a regulatory agency on performance in general should be relatively low. This is particularly true of their impact on investment incentives. A secondary message is that the impact may be linked to overall governance characteristics as well as to the specific contractual design adopted. In sum, the a-priori in favor of IRAs may be positive thanks to the main insights from theory, but the practice seems to be quite different. A final insight is that, although their impact on total investment has been looked at formally, the specific impact on the odds of attracting PPP on average or at the margin has not really been addressed empirically to our knowledge. The details are as follows.

The evidence of the payoffs to the institutional unbundling of regulation is quite skewed towards the energy and telecoms sectors and the general message is that the creation of these agencies tends to have the desirable effects that theory has been claiming, at least on efficiency and financing options. For developed economies, a notable exception covering all regulated infrastructure sectors is provided by Cambini and Rondi (2012). In addition to energy and telecoms operators, they include water and transport operators. More specifically, they rely on a panel of 80 publicly traded EU utilities (including 12 water utilities) over the 1994-2004 period to essentially validate the main theoretical insights. They already point to the fact that water is different when it comes to an impact of IRAs on investment, whether the firm is private or public. The telecoms and the energy sectors benefit a lot more from the existence of an IRA than the water sector, even if, for the sample, the positive impact is also observed for the water sector, on average. Although they already imply that having a separate IRA may not be a guarantee of impact as they find that political interference with formally independent regulators hurts investment.

For developing countries, Andres et al (2013), Bel et al (2010), Carvalho et al. (2012), Estache et Wren-Lewis (2010) or Gassner and Pushak (2014) suggest that, in general, IRAs do not guarantee a major improvement in investment, access rates or efficiency in the water and sanitation sector. For this group of countries, this is largely due to the fact that institutional weaknesses render these agencies significantly less independent and competent than they should be to have the expected impact. This research also suggests that the type of contract (i.e. divestiture, greenfield, brownfield or management) may matter and that a good matching of the contract type and of the institutional capacity makes it easier to a regulatory agency to be effective. It also implies that IRAs may be good at ensuring that some basic equity concerns are addressed through the specific design of tariffs and the sharing of efficiency gains between users and producers. But these insights do not apply equally well across regions. In a very detailed study of the sub-Saharan African experience, Mande Bafua (2015) finds that performance is not influenced by the existence or absence of an independent regulator. In that region, the creation of an IRA was, instead, on average associated with loss in technical efficiency under all ownership and contractual models, as a result of an unclear mandate and a monitoring and enforcement capacity constraint for these regulators. For his large African sample, he also found, however, that contract designs may matter to the operators' performance. Similar conclusions have been reached for other cases studies. For instance Barbosa, Costa Carvalho and Menezes Bezerra Campiao (2015) for Brazil blame regulatory standardization and weak implementation capacity or willingness for efficiency underperformance.

Political scientists provide complementary insights to those provided by economists when they focus on the factors determining formal independence (e.g. Gilardi (2008)). They emphasize the role of IRA as a tool to improve the credibility of policy commitments and hence reduce investment risks. They

also point out that the overall institutional configuration matters and that IRAs do not function in a vacuum. IRAs can sometimes be seen as a substitute to checks and balances of normal policy and political processes when these do not function well enough (e.g., Estache and Martimort (2000), Jordana and Levi-Faur (2006), Maggetti 2007; Maggetti et al (2013), Majone (1997), Thatcher (2011)). When this happens, IRAs can be quite effective in improving performance. In the rest of this paper, we ignore these process related matters and focus on the simple payoff to the creation of a separate regulatory agency. We recognize that the degree of independence of the agency is an important dimension but it goes beyond the scope of this paper.

3. How many water IRAs are there in the world?

To be able to assess the impact of IRAs on PPP, two sets of data at least are needed: data on the existence of IRAs and comparable data on PPPs. PPPs data is available from the World Bank, but global information on IRAs is not available, at least publicly. This is why this paper started with a data collection effort on the existence of national water and sanitation IRAs. The main output of this effort is reported in Table 1. We managed to collect data for 177 countries in 2015.³ The detailed country specific coding is reported in Annex 2.⁴ The data is recorded as a dummy variable, i.e. if the country has an IRA, it is coded as 1 and otherwise as 0. The information has been collected from a systematic search of the official web site of the countries' government, United Nations agencies and Multilateral Development Banks' project documents. In the process, we also documented the extent to which the country had any access to some significant water or sanitation delivery contract with the private sector. The country is considered to have some form of public private partnership (PPP) in 2015 if during that year there is an ongoing divestiture, greenfield or brownfield PPP in the water sector of the country other than management or lease contract (since these do not involved any private investment), or if these investment contracts had been closed and concluded within the previous 10 years. We also ran robustness checks changing this time limit to 5 and 2 years. This information is collected from the World Bank PPP database and is also coded as a dummy variable with a value of 1 when a PPP has been awarded. The detailed country specific coding used in this paper is also reported in Annex 1.

The way we have decided to account for these PPP implies that the IRA may have been put in place after the adoption of a PPP in the sector which imposes some limit on any causal interpretation of the results. In other words, we can only hope for a sense of correlation or of odds of a correlation as discussed in more detail later. We do not correct for the size of the deals with the private sector (i.e. large and small projects both count as a PPP in the same way). While the main focus of the paper is the experience of developing countries, we collected the basic institutional information also on the developed economies. This allows us to identify any significant core difference between the two country groups. As discussed next, however, the stylized facts suggest that the differences in the distribution of basic governance characteristics are actually not very significant across country groups.

³ 123 developing countries and 54 developed countries.

⁴ Updates will be available on the Bernard Vanommeslaghe Chair website

http://ecares.ulb.ac.be/index.php?option=com_content&task=view&id=168&Itemid=367

Table 1: Summary of data set						
	Countries with an autonomous water regulatory agency	Countries with PPP	Countries with both an autonomous regulator and PPP	Countries with PPP but no autonomous regulatory agency	Countries with an autonomous regulatory agency but no PPP	Countries with no autonomous regulatory agency and no PPP
Full Sample (177 countries)						
Number	80	157	69	89	11	8
Share (in %)	45.2	88.7	39.0	50.3	6.2	4.5
Developing country sample (123 countries)						
Number	55	108	48	60	7	8
Share (in %)	44.7	87.8	39.0	48.8	5.7	6.5
Developed country sample (54 countries)						
Number	25	49	21	29	4	0
Share (in %)	46.3	90.7	38.9	53.7	7.4	0.0

Source: Based on data collection by the authors

The table shows that, while 88.7% of the countries of this very large sample have some type of PPP, only 45.2% rely on the existence of a sector regulator. The proportions are roughly similar across country groups at this very high level of aggregation. When matching the existence of any PPP and the existence of an IRA, the shares drop to less than 40% and once more there is not much difference between the two country groups. Very roughly, one out of two countries with a PPP has no IRA. As expected somehow given the differences in risks levels to investors, it seems somewhat easier for developed countries to attract PPPs without IRAs. There are also a number of countries in which the sector has not relied in any PPP but have adopted the IRA model, less than 6% for developed economies and less than 8% for developing ones. The differences are somewhat stronger for the groups of countries with PPP but no agencies. Finally, in our sample of 54 developed economies, there is no instance of countries without IRA and without PPP jointly.

This very basic data analysis already points to the uncertainty of the size and sign of the correlation between the existence of an IRA and any experience with PPP. But there are clearly other factors that will drive the outcome and the extent to which an IRA may help or not access to PPP. These differences may actually be quite important in the context of developing countries since the initial condition on core water market characteristics are likely to differ. Coverage is indeed not yet universal for the water sector and even less so for sanitation. The ability to pay also varies across countries, reflecting wide differences in income per capita. Institutional differences are also likely to influence the supply of PPP since it drives the levels of risks for investors.

The initial conditions of the sector are approximated by the access rates available from the World Bank Development Indicators database and the quality of the governance of the sector. Institutional quality is approximated by three types of indicators: a regulatory quality indicator, a rule of law indicator and the control of corruption approximated by the ratings provided by the World Bank Governance indicators. These indicators are running from -2.5 to 2.5, with higher values corresponding to better governance for each country. We also consider the possible relevance of the extent to which water regulation is decentralized based on a survey produced by the OECD (2016). Because we are interested in the supply of private capital, it seems reasonable to include a price variable. We approximate this driver of supply by the inflation rate. Finally, we considered the possibility of patterns of differences across regions in their ability to attract PPP since the World Bank PPP data base clearly points to a very strong comparative advantage of Latin America and Asia in the ability to do so. This is included as a regional dummy variable in the model discussed later. Finally, we account for the income per capita in the country since it provides a sense of the extent to which the ability to pay may influence the potential market for the PPP operators. This data is

collected from the World Bank Economic indicators. A specific definition of all the data and of their sources is provided in the appendix.

Unfortunately, the detailed information on the contracts types is only available for 70 of the 123 developing countries for which we have collected the data related to IRAs. Table 2 provides with the distribution of these 70 sub-sample countries across regions. Note that all the 6 countries in East Asia have private participation in their water and sanitation sectors, while the 2 countries in South Asia lack an IRA in their respective sectors.

(1) East Asia	(2) Europe and Central Asia	(3) Latin America and the Caribbean	(4) Middle East and North Africa	(5) South Asia	(6) sub-Saharan Africa
6	16	16	8	2	22

Table 3 summarizes the basic statistics on each of these variables for the developing countries sub-sample we ended up working with in our assessment of the drivers of the supply of PPP in developing countries. The sample size is the same for all variables except decentralization. It shows that the sample is quite heterogeneous in some of the key control variables such as water and sanitation and access rates since the relatively high mean is matched by a high standard deviation. The same observation applied to the variables used to approximate the quality of governance.

	Observations	Mean	Std. dev.	Min	Max
<i>ppp_i</i>	70	0.46	0.50	0	1
<i>decentralization_i</i>	51	0.55	0.50	0	1
<i>IRA</i>	70	0.50	0.50	0	1
<i>gdp_pc_i</i>	70	9586.09	6638.74	581.14	25311.91
<i>water_access_i</i>	70	87.08	14.49	49.0	100
<i>sanitation_access_i</i>	70	67.63	28.60	10.90	100
<i>inflation_i</i>	70	2.77	8.50	-29.69	38.40
<i>control_corruption_i</i>	70	-0.46	0.57	-1.40	1.30
<i>reg_qual_i</i>	70	-0.24	0.62	-1.69	1.35
<i>rule_law_i</i>	70	-0.42	0.56	-1.72	1.33

Table 4 provides a first sense of the partial correlations between these country specific variables and the main variables specific to the water and sanitation sector. With respect to the core interest of this paper, the partial correlation between PPP and IRA is the most interesting one. It suggests that these two policy options are not statistically significantly related. The second clear observation is that all the key control variables, except for decentralization, are positively correlated with PPP. The existence of an IRA is only correlated with inflation and regulatory quality, and only at a 10% level of significance. In other words, basic indicators of institutional quality seem to be much more important to the chances of attracting PPP than IRA, assuming that these correlations can be used to try to anticipate the likely outcome of the econometric analysis. The non-significance of a very basic modeling of decentralization as a dummy variable is also interesting since it also raises questions on the effectiveness of this common political option of the sector.

	ppp	decentralization	IRA	water access	sanitation access
Ppp	1.00				
Decentralization	0.17	1.00			
IRA	-0.00	0.09	1.00		
Water access	0.47 ***	0.17	-0.03	1.00	
Sanitation access	0.37 ***	0.00	0.03	0.74 ***	1.00
GDP_per capita	0.42 ***	-0.01	0.01	0.63 ***	0.67 ***
Inflation	0.25 **	0.31 **	0.23 *	0.13	0.07
control_corruption	0.25 **	-0.08	0.17	0.46 ***	0.33 ***
Regulatory quality	0.30 **	0.03	0.23 *	0.44 ***	0.41 ***
Rule of law	0.29 **	0.09	0.15	0.45 ***	0.33 ***

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

4. Modeling the interactions between PPP and IRAs

This section describes the methodology followed, as well as the results obtained. We give a general specification of the estimated logit model to analyze the determinants of the source of financing being private and analyze the results. We ran three different sets of regressions. First, we proceeded with a sample which does not include the decentralization variable, for which we only have 51 observations. The results are reported in Table 5. Second, we included the decentralization in the same regressions but the decentralization variable was never significant and the overall results did not change. Therefore, we did not report the results. Finally, we performed a multinomial logit regression to analyze the effects on each type of PPP contract separately. These results are reported in Table 6.

4.1. Logit model specification and results⁵

Since the dependent variable, PPP, is dichotomous and equals 1 if there is private participation in the financing of the water and sanitation sector of a specific developing country (i.e. if there is at least some private investment), our model specification is given by

$$Prob(ppp_i = 1) = \Lambda(\alpha + x_i' \beta_i)$$

where Λ is the standard logistic distribution (i.e., logit model); x_i' is a vector of country specific explanatory variables; and α and β_i are the parameters to be estimated. Note that SSA is the default region in the model and South Asia has been dropped as a regional dummy since neither of the two South Asian countries of our sample has a national IRA. East Asia has also been dropped as a regional dummy because all 6 countries in the sample have a PPP. The other regional dummies crossed with IRA inform of the differences across regions as compared to the impact of IRAs in SSA. Table 5 reports the estimation results.

⁵ We obtained very similar results when estimating a probit model.

Table 5: Empirical results for logit model

Dependent Variable: PPP						
	(1)	(2)	(3)	(4)	(5)	(6)
IRA	-2.56E-17 (0.4798)	0.0019 (0.5296)	-0.3003 (0.5154)	-0.4825 (0.5933)	-3.2418** (1.3472)	-2.5139* (1.4044)
GDP per capita		0.0001*** (0.00005)		0.0002*** (0.00005)		0.0001** (0.00005)
Inflation			0.0796* (0.0418)	0.1133** (0.0521)	0.1473** (0.0651)	0.1617** (0.0690)
2.Europe and C. Asia and IRA					2.8261* (1.4684)	1.7713 (1.1375)
3.Lat. Am. And Carib. and IRA.					3.7601*** (1.4181)	2.5250* (1.5264)
4.Mid. East and N. Africa, and IRA.					3.0673 (2.0422)	2.5494 (2.2595)
Constant	-0.1719 (0.3393)	-1.5873*** (0.5700)	-0.2563 (0.3509)	-1.8891*** (0.6148)	-0.3636 (0.3746)	-1.6562** (0.6610)
Observations	70	70	70	70	68	68
Pseudo R ²	0	0.1372	0.0522	0.2127	0.1873	0.2621
Log Likelihood	-48.26	-41.64	-45.74	-37.99	-37.92	-34.43
LR χ^2	0	13.24	5.04	20.53	17.48	24.46
Prob < χ^2	1	0.0013	0.0804	0.0001	0.0037	0.0004

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

South Asia is dropped as all observations lack an autonomous regulator; East Asia is dropped as all 6 observations have PPP; sub-Saharan Africa is omitted variable

The goodness-of-fit results show that the Pseudo R² increases when controlling for income per capita and for regional interaction terms and the model reaches a relatively good fit (considered to be between 0.2 and 0.4 according to McFadden (1998)). This better fit is also seen in the log-likelihood, which is maximized when controlling for all variables (i.e. model 6). Finally, the probability of obtaining the χ^2 statistic if there is no effect of the independent variables (Prob < χ^2) is lowest when controlling all variables as well (model 6).

The interpretation of the table is somewhat subtle since the coefficients reported on each independent variable need to be transformed into the odds of having PPP depending on the value taken by the independent variables. A negative coefficient implies that the odds ratio will be smaller than 1. When this ratio is less than 1, it means the odds of having PPP (i.e. PPP=1) when there is an IRA (i.e. IRA=1) are actually lower than when there is no IRA (i.e. IRA=0). If the odds ratio is above 1, the odds of having PPP when there is an IRA are higher than the odds of having PPP without a regulator. The specific measure of these odds is obtained by exponentiation of the coefficient on the IRA.

If models (5) and (6) respectively are considered to be the most complete, the odds that a country with an autonomous regulator has private participation in the water and sanitation sector are between $\exp^{(-3.2418)} = 0.04$ and $\exp^{(-2.5139)} = 0.08$ times higher than a country without a regulator. The impact is however stronger in Latin America; more precisely, the odds that a Latin American country with a regulator has private financing in the water sector are $\exp^{(-3.2418+3.7601)} = 1.68$ times higher than a Latin American country lacking such a regulator. In terms of Europe and Central Asia, where results are only slightly significant and the impact only appears when income per capita is not controlled for, the odds that a European or Central Asian country has PPP are $\exp^{(-3.2418+2.8261)} = 0.66$ times higher when the country has a regulator than when it does not. Note that in the Middle East, the results

also suggest that the odds that an IRA makes a difference to the chances of getting a PPP deal are not statistically different from 0.

When everything else is held constant, the odds that a European or Central Asian country with a regulator has private participation are $\exp^{(2.8251)} = 16.88$ times higher than a country in sub-Saharan Africa that also has a water sector IRA. In terms of a country in Latin America and the Caribbean such odds are between $\exp^{(2.520)} = 12.49$ and $\exp^{(3.7601)} = 42.95$ times higher than a country in SSA with an autonomous regulator, everything else held constant.

It is useful to also note that for income and inflation, the results are significant and positive for both variables. In terms of odds, however, holding IRA constant, the odds of PPP increase by at least 0.01% for a one-unit increase in the level of income (i.e. model 2). Likewise, when inflation increases by 1%, it increases by at least 7.96% the odds of PPP (i.e. model 3). The odds are higher on average when accounting for regional differences (models 4 and 5).

4.2. Multinomial Logit

The extent to which the creation of these agencies may have a more subtle impact on the possibility of getting access to PPP is linked to the specific type of contract that countries can rely on to conclude these PPPs. To be able to assess the impact of IRAs on the supply of PPPs, we switch to a multinomial logit and in this case, the dependent variable is defined by the various types of contracts distributed across the main categories: management and lease, greenfield, brownfield or divestiture contracts. Once again, the model allows us to establish the impact of the adoption of an IRA on the odds of adopting a specific type of contract relatively to the odds not having a PPP contract at all. The specific characterization of each type of contract can be summarized as follows:

- a. **Management and lease contracts:** take-over the management of a public asset by a private firm for a fixed duration (the ownership and investment decisions remain with the public sector).
- b. **Greenfield projects:** construction and operation of a new facility by a private operator or a partnership between private and public actors for a duration specified in the project contract.
- c. **Brownfield projects:** take-over of the operations, improvement, expansion and/or rehabilitation of an existing asset by a private firm or a public-private partnership.
- d. **Divestitures:** full or partial transfer of ownership of a public asset to a private firm through a direct sale or a public offering.

The specific model tested to assess the impact of IRA on the adoption of each type of contract controls for GDP per capita and inflation.⁶ The analysis is carried out for a subset of 60 developing countries since these are the only one for which we have all the data needed. Indeed, less data is available on the type of contract than on whether there is a contract at all. The results are presented in Table 6. In this case, we do not provide the estimated coefficients and then interpret the results in terms of odds as in sub-section 4.1, but we provide the marginal effects at the mean of each regressor. As such, the interpretation is as follows: for the IRA variable, the coefficient tells how greater is the probability of observing a specific type of PPP when we consider a country that has a regulator (IRA = 1) compared to a country that does not have such a regulator (IRA = 0).

⁶ Decentralization, Regional dummy, and governance variables did not provide any significant results and did not change the impacts estimated or the explanatory power of the models. This is why we do not report the fuller models which take them into considerations.

Table 6: Empirical results for Multinomial Logit Model explaining PPP (dependent variable)		
	(1)	(2)
1. Management and lease contracts		
IRA	0.0403 (0.1110)	0.0819 (0.1159)
GDP per capita		-0.00003*** (0.00001)
Inflation	-0.0114 (0.0089)	-0.0189** (0.0089)
2. Greenfield contracts		
IRA	-0.1547* (0.0865)	-0.2112* (0.1104)
GDP per capita		8.44e-06 (8.67e-06)
Inflation	0.0082 (0.0054)	0.0142* (0.0079)
3. Brownfield contracts		
IRA	0.0869 (0.1316)	0.0304 (0.1579)
GDP per capita		0.00005*** (0.00001)
Inflation	0.0144 (0.0095)	0.0269** (0.0130)
4. Divestiture contracts		
IRA	0.0033 (0.0524)	-0.0035 (0.0398)
GDP per capita		5.34e-06 (3.97e-06)
Inflation	0.0007 (0.0035)	0.0018 (0.0032)
Basic Statistics and Tests		
Observations	60	60
<i>Pseudo R</i> ²	0.0512	0.1885
Log Likelihood	-81.9	-70.05
LR χ^2	8.84	32.55
Prob < χ^2	0.3561	0.0011

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

The model estimated shows goodness-of-fit as suggested by the *Pseudo R*². The model is a better fit when income per capita is controlled for (0.19 vs. 0.05), but remains just outside the good fit interval (0.2 to 0.4). This is one of the reasons why Model (2) is our preferred model. In addition, the log likelihood is maximized when controlling for income per capita (model 2), and the probability of obtaining the χ^2 statistic if there is in fact no effect of the independent variables, is also lowest for this model (0.001). The analysis of the coefficients allows the following conclusions.

First, the relation between the type of PPP contract in the water and sanitation sector and the existence or not of an IRA is only significant when the contract is a greenfield project.

Second, in the only contract type for which an IRA matters, the impact is actually negative. Investors seem not to be keen on being regulated by an independent agent, potentially with discretionary powers. Indeed, we find that having an IRA decreases the probability of having a greenfield project

rather no private participation in the financing of the sector. This may be because these types of contracts can be designed as detailed regulatory instruments which are better implemented by a monitoring and enforcement unit within a ministry rather than an agency with margin to interpret, complement or modify the contract.

Third, a higher income level slightly but significantly decreases the probability of having a management and lease contract and increases the probability of having a brownfield contract instead of no contract at all.

Fourth, prices matter to all types of contracts except the divestiture. A higher annual percentage change of inflation slightly but significantly decreases the probability of having a management and lease contract, but increases the probability of having a brownfield or a greenfield project contract, instead of no contract at all.

To sum up, we find that the only significant effect of IRA is for greenfield projects, i.e. projects entailing new investments. And in that case, an IRA has been counterproductive in the water and sanitation sector.

5. Concluding comments

Next time someone asks the reader whether creating an IRA is a *necessary* condition to be able to attract private sector participation in the water and sanitation sector, (s)he will now have a much better way of saying that *the answer is no*. The stylized facts show that there are countries with PPP and no IRA and the statistical analysis suggests that the supply of PPP seems to be hardly correlated to the existence of an IRA.

Next time someone asks the reader whether creating an IRA is a *sufficient* condition to be able to attract PPP, (s)he will once again be able to argue that *the answer is probably no, on average*, because the results reported here show that the odds of having a PPP are only 0.04 to 0.08 times higher when a country has an IRA, which is considerably low (below 1) and close to zero. These are also the best estimates of the odds for SSA. However, the odds vary across regions. They are significantly better in Latin America than in the other regions (almost twice as large for a Latin country with an IRA as compared to a Latin country without an IRA). The odds are also higher in Europe and Central Asia but much lower than in Latin America for a similar comparison (0.66) when the income per capita is not accounted for. Note that in the Middle East, the results also suggest that, so far, the creation of an IRA have made no statistically significant difference to the chances of getting a PPP. The tests cannot be applied to the Asian countries since all East Asian countries have a PPP and none of the South Asian countries of the sample have a national IRA.

Next time someone asks the reader whether *the lessons from one region are relevant to another region*, the *answer will once more be no*, at least at the very broad level. When everything else is held constant, the odds that a European or Central Asian country with an IRA has private participation are about 17 times higher than for a SSA country with a comparable institutional regulatory governance. The odds in Latin America could be as much as 43 times higher than in SSA. Extrapolating somewhat, this also means that key aspects of the success stories from Europe, Canada, Australia so often used to convince policymakers in developing countries need to be analyzed with much more caution. Cross country and cross regional differences influence the effectiveness of some of the institutional changes considered as potentially useful in theory.

Finally, next time someone asks whether the effectiveness of adopting an IRA helps in attracting PPP at the margin depends on the *contract type*, the *answer is yes, but not as expected*. To be more precise, the adoption of an IRA has in general no impact at the margin (other things matter more and notably price prospects and income per capita). Worse yet, in the case of greenfield projects, an IRA has a negative impact at the margin. This may simply mean that a good contract with clear rules

of the game seems to be preferred to a contract that can be subject to discretionary changes by a regulator.

Despite their attractive relative simplicity, these answers have some limitations because the dataset and the modeling approach are not able to address a number of very real and important dimensions. First, as repeatedly pointed out by political scientists in their research, there is a lot of heterogeneity in the quality of IRAs, in their governance, actual independence and accountability (e.g. OECD (2016)). This heterogeneity cannot be picked up at the level of aggregation of the data used here. And there is also a lot of heterogeneity in the quality of the incumbent administrations, including the possibility that some ministries are totally capable of taking on the regulatory activities in very professional ways. This heterogeneity is not picked up either by the very simple characterization adopted here. Second, there are also differences in the absolute and relative importance of PPP for the countries which has been ignored by the modeling of PPP as dummy. Finally, there is the possible relevance of the sequencing of PPP and IRA which may also matter but which cannot be addressed by our single year data set.

These limitations are important, but they are not sufficient to reject the doubts raised on the too common assumption that an IRA is needed as part of the institutional reforms to be adopted to attract PPP. The evidence is imperfect but robust enough to make the case for more detailed public sector diagnostics before trying to force a standard regulatory governance model onto countries. Many developing and emerging economies will not need IRAs to attract PPP and many countries with an IRA will not be able to attract PPP. Details and context matter to the effectiveness of ideas extracted from theory and practice in successful developed economies. And these details abound in water and sanitation regulatory governance as recently shown by the OECD (2015). These data as well as additional data on the timing and sequencing of IRAs would provide even more insights on the relevance of these institutions for PPP. Further also linking these institutional options to the volume of investments achieved through PPP would further refine these insights. But without an effort to collect this data, no new research will be possible.

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Annex 1: Definition of variables and sources

Variable	Definition	Source
ppp	Dummy equal 1 if there is a divestiture, greenfield or brownfield PPP in the water sector of country other than management or lease contract, and 0 if there is a management or lease contract, or no PPP.	PPI Database (World Bank)
ppp_type	Polychotomous variable equal 0 if country has no PPP contract in water sector, equal 1 if PPP is management or lease contract, and equal 2 if PPP is divestiture, greenfield or brownfield contract.	
Regional dummies	Dummies equal to 1 if the country belongs to a specific region, and 0 otherwise. Regions are: (1) East Asia, (2) Europe and Central Asia, (3) Latin America and the Caribbean, (4) Middle East and North Africa, (5) South Asia, and (6) sub-Saharan Africa.	
decentralization	Dummy equal 1 if regulation of water sector is carried out at a subnational level, equal 0 if carried out at a national level or there is no regulation.	OECD (The governance of water regulators) and regulatory bodies websites
auto_reg	Dummy equal 1 if there is an autonomous regulator in the water sector, and 0 if there is no regulator, or regulator lacks autonomy.	
gdp_pc	GDP per capita, PPP (constant 2011 international \$)	World Development Indicators (World Bank)
water_access	Improved water source (% of population with access)	
sanitation_access	Improved sanitation facilities (% of population with access)	
Inflation	Inflation, GDP deflator (annual %)	Worldwide Governance Indicators (World Bank)
control_corruption	Indicators running from -2.5 to 2.5, with higher values corresponding to a better governance for each country. The quality of governance is represented by control of corruption, government efficiency, political stability, regulatory quality, rule of law, and voice and accountability.	
reg_qual		
rule_law		

Annex 2: Main Dataset Produced as part of this paper

	IRA	PPP with investment	Any PPP	Type of PPP *
Developing countries - Subset 70 countries				
Albania	1	0	1	0
Algeria	0	1	1	2
Angola	0	0	0	0
Argentina	1	1	1	3
Armenia	1	0	1	1
Azerbaijan	0	0	0	0
Belize	1	1	1	0
Benin	0	1	1	-
Bolivia	0	0	1	0
Bosnia and Herzegovina	1	0	0	0
Botswana	0	0	0	0
Brazil	1	1	1	3
Bulgaria	1	1	1	3
Burundi	1	0	0	0
Cameroon	0	0	1	1
Central African Republic	0	0	1	0
Chad	0	0	0	0
Chile	1	1	1	3
China	0	1	1	3
Colombia	1	1	1	3
Congo, Republic	1	0	1	1
Côte d'Ivoire	0	0	1	1
Ecuador	1	0	1	-
Egypt	1	1	1	2
Georgia	1	1	1	4
Ghana	1	1	1	2
Guatemala	0	1	1	3
Guyana, CR	1	0	1	-
Haiti	0	0	1	1
Honduras	1	1	1	-
India	0	1	1	3
Indonesia	0	1	1	3
Iraq	0	0	0	0
Jordan	0	1	1	3
Kazakhstan	0	1	1	4
Kenya	1	0	0	0
Kyrgyz Republic	0	0	1	1
Lebanon	0	0	1	-
Malaysia	1	1	1	3
Mauritius	0	0	1	1
Mexico	1	1	1	3
Moldova	1	0	0	0
Montenegro	0	0	0	0
Morocco	0	1	1	2
Mozambique	1	0	1	1
Namibia	1	0	1	1
Nepal	0	0	1	1
Niger	1	0	1	1
Panama	1	0	1	1
Peru	1	1	1	3
Philippines	1	1	1	3
Romania	1	1	1	3
Russia	0	1	1	3
Rwanda	1	0	0	0
Salvador, El	0	0	0	0
Senegal	0	0	1	1
Serbia	0	1	1	2
Sierra Leone	1	0	0	0
South Africa	0	1	1	3
Tanzania	1	0	1	-
Thailand	0	1	1	3
Tunisia	0	1	1	2
Turkey	0	1	1	2

Uganda	0	0	0	0
Ukraine	1	1	1	3
Uruguay	1	0	1	-
Uzbekistan	0	0	1	-
Vietnam	0	1	1	2
West Bank and Gaza	1	0	1	-
Zambia	1	0	1	-
Other developing countries				
Bangladesh	0	-	1	-
Belarus	0	-	1	-
Bhutan	1	-	1	-
Burkina Faso	0	-	1	-
Cambodia	0	-	1	-
Cape Verde	1	-	1	-
Congo, Democratic Republic	1	-	1	-
Costa Rica	1	-	1	-
Cuba	0	1	1	3
Djibouti	0	-	1	-
Dominican Republic	0	-	1	-
Equatorial Guinea	0	-	1	-
Eritrea	0	-	1	-
Ethiopia	0	-	1	-
Fiji	0	-	1	-
Gabon	1	-	1	-
Gambia, The	1	-	1	-
Guinea	1	-	1	-
Guinea-Bissau	0	-	1	-
Iran, Islamic Rep.	0	-	1	-
Jamaica	1	-	1	-
Kiribati	0	-	1	-
Kosovo	1	0	0	0
Lao PDR	0	-	1	-
Lesotho	1	-	1	-
Liberia	1	-	1	-
Libya	1	-	1	-
Macedonia FYR	0	-	1	-
Madagascar	1	-	1	-
Malawi	0	-	1	-
Maldives	0	-	1	-
Mali	1	-	1	-
Mauritania	1	-	1	-
Mongolia	0	-	1	-
Myanmar	0	-	1	-
Nicaragua	1	-	1	-
Nigeria	0	-	1	-
Pakistan	1	-	1	-
Paraguay	1	-	1	-
Somalia	0	-	1	-
South Sudan	0	-	1	-
Sri Lanka	0	-	1	-
Sudan	0	1	1	2
Suriname	0	-	1	-
Swaziland	0	-	1	-
Syrian Arab Republic	0	-	1	-
Tajikistan	0	-	1	-
Togo	1	-	1	-
Turkmenistan	0	-	1	-
Vanuatu	1	-	1	-
Venezuela	0	1	1	2
Yemen, Rep.	0	-	1	-
Zimbabwe	0	-	1	-
Developed Countries				
Antigua and Barbuda	1	-	1	-
Australia	1	-	1	-
Austria	0	-	1	-
Bahamas, The	0	-	1	-
Bahrain	0	-	1	-

Barbados	1	-	0	-
Belgium	0	-	1	-
Brunei Darussalam	0	-	1	-
Canada	1	-	1	-
Croatia	1	-	1	-
Cyprus	0	-	1	-
Czech Republic	0	-	1	-
Denmark	1	-	1	-
England and Wales	1	-	1	-
Estonia	1	-	1	-
Finland	0	-	1	-
France	0	-	1	-
Germany	0	-	1	-
Greece	0	-	1	-
Hungary	1	-	1	-
Iceland	0	-	1	-
Ireland	1	-	1	-
Israel	0	-	1	-
Italy	1	-	1	-
Japan	0	-	1	-
Korea, Rep.	0	-	1	-
Kuwait	0	-	1	-
Latvia	1	-	0	-
Lithuania	1	-	1	-
Luxembourg	0	-	1	-
Macao SAR, China	0	-	1	-
Malta	1	-	1	-
Netherlands	0	-	1	-
New Zealand	1	-	1	-
Northern Ireland	1	-	0	-
Norway	0	-	1	-
Oman	1	-	1	-
Poland	1	-	1	-
Portugal	1	-	1	-
Puerto Rico	1	-	1	-
Qatar	0	-	1	-
Saudi Arabia	0	-	1	-
Scotland	1	-	1	-
Seychelles	0	-	1	-
Singapore	0	-	1	-
Slovak Republic	1	-	1	-
Slovenia	0	-	1	-
Spain	0	-	1	-
Sweden	0	-	1	-
Switzerland	0	-	1	-
Taiwan, China	0	-	1	-
Trinidad and Tobago	1	-	0	-
United Arab Emirates	1	-	1	-
United States	1	-	1	-

Note: * 0 = No PPP contract, 1 = Management and lease contracts, 2 = Greenfield contracts, 3 = Brownfield contracts, 4 = Divestiture contracts.