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Nº 317 **SOFT BUDGETS AND RENEGOTIATIONS IN PUBLIC-PRIVATE PARTNERSHIPS: THEORY AND EVIDENCE**

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Soft Budgets and Renegotiations in Public-Private Partnerships: Theory and Evidence[☆,☆☆]

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Abstract

Most countries keep PPP investments off their balance sheet. We develop an equilibrium model where incumbents renegotiate contracts and use off-balance sheet finance to anticipate spending in transport infrastructure, which distorts intertemporal investment. We find that: (i) firms bid below costs ex ante ("lowballing"); (ii) renegotiations pay for lowballing, and for additional investment; (iii) renegotiations occur early in the contract; (iv) future administrations pay a large fraction of the additional spending; (v) neither ex ante spending controls nor ex post competitive bidding for renegotiated contracts stems spending anticipation.

We analyze 535 renegotiations of 59 highway PPPs in Colombia, Peru, and Chile. Renegotiations per concession/year average 9.5 percent of the initial investment in Colombia, 3.6 percent in Peru, and 1.3 percent in Chile. More than 45 percent of renegotiations (by dollar amount), occur during the construction phase. At least 60 percent of the renegotiated spending increase falls on future administrations.

Keywords: Build-operate-and-transfer, concessions, lowballing.,
JEL: H21, L51, L91

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"Cynics suspect that the government remains keen on PFI not because of the efficiencies it allegedly offers but because it allows ministers to perform a useful accounting trick."

The Economist, July 2, 2009.

1. Introduction

It has been known for some time that renegotiations of public-private partnerships (PPPs) are related to the political cycle. For example, in his seminal work on renegotiations Guasch (2004) found that incoming administrations tend to renegotiate the contracts signed by previous administrations to adjust policy priorities and avoid political costs (e.g. increasing tolls). More recently, Aguirre (2015) found that Peruvian transport PPPs are renegotiated with higher frequency during election years. This paper contributes to the literature by exploring the incentives that prompt governments to renegotiate PPPs in equilibrium. We show that a basic feature of the political cycle—the current government may be replaced by a different administration—, the long horizon of PPP contracts, which span several administrations, and the off-balance sheet treatment of PPPs combine to endogenously produce PPP renegotiations as an equilibrium outcome. Somewhat surprisingly, the current government (referred to as 'incumbent' in what follows) wants to bring forward infrastructure spending even when it does not affect the probability of reelection.

It is important to understand what drives renegotiations because in the last three decades PPPs have spread to become an accepted means to procure public infrastructure. For example, in Europe PPP investment rose from almost zero in 1990 to almost €30 bn in 2006 (before falling by one third in the aftermath of the financial crisis; see (Engel et al., 2014b)). Similarly, in low and middle income countries, PPP investments rose from less than $20 bn p.a. in the early 1990s to between $50 bn and $90 bn p.a. in recent years (see (Engel et al., 2014b)). As Engel et al. (2014a) show, nearly three quarters of PPP investment is spent in transport infrastructure— mostly highways, but also bridges, tunnels, railways, airports, and seaports.[1]

The promise of PPPs is that private firms will deliver better transport infrastructure faster and at lower cost than conventional provision. It is claimed that these efficiency gains stem from bundling the design, financing, construction and operation of transportation projects in long-term contracts.[2] With bundling, concessionaires optimize intertemporally over several decades to minimize life-cycle costs.[3] Indeed, in a recent paper, Valero (2015) shows that the ability of governments to pre commit to a long-term contract is necessary to ensure the realization of the efficiency gains that PPPs promise. In addition, when quality of service is contractible, as is the case of highways, a PPP will lead to better maintenance. Nevertheless, it is well known that PPPs tend to be routinely renegotiated and that renegotiations may dilute the incentives that prompt concessionaires to deliver better performance.[4]

Of course, occasional contractual adjustments are to be expected in any 20 or 30 year contract, as demand, network configuration and standards of service change.[5,6] However, renegotiations of PPP con-

[1] Governments also use PPPs to procure prisons, hospitals, schools, sanitation systems, sports arenas and convention centers.

[2] See Hart (2003), Bentz et al. (2005), Bennett and Iossa (2006), Martimort and Pouyet (2008), Valero (2015) and Danau and Vinella (2015).

[3] See Engel et al. (2014b).

[4] On incentives and renegotiations, see chapter 7 in Engel et al. (2014a)

[5] As revealed by the Petrobras-Odebrecht corruption scandal involving infrastructure projects in a dozen countries, there is scope for corruption in renegotiations of contracts, even when the renegotiation itself is justified. On renegotiations and corruption in concessions see Guasch (2004), Estache et al. (2009), Guasch and Straub (2009) and Campos et al. (2018).

[6] The tradeoff between the gains from flexibility to adapt a project to changed conditions and the risk of opportunistic rene-

tracts are very frequent and many occur even before projects are completed. An early and influential study by Guasch (2004), which examined over a thousand Latin American concessions, found that over 30% of contracts were renegotiated (54.4% in the case of roads), often favoring the private party.[7] Similarly, below we examine 59 highway PPPs in Colombia, Peru and Chile and find more than 500 renegotiations. The data shows that on average, 9.5 percent of the initial investment was renegotiated in Colombia every year, 3.6 percent in Peru, and 1.3 percent in Chile.[8] This suggests that renegotiations are not accidents, but an equilibrium outcome of the incentive structure in place.

In this paper we study the incentive structure that delivers protracted renegotiations. Our model builds from three well-known facts. One is that administrations are routinely replaced. Second, standard accounting conventions allow governments to keep most PPP investments agreed in renegotiations off-balance sheet. Last, concessionaires finance a PPP project under a long term contract that spans several administrations.

We show that these three facts interact to produce renegotiations in equilibrium. First, the possibility of being replaced increases the effective discount rate of the incumbent (see Alesina and Tabellini (1990)). Therefore, an incumbent values the future less than the social planner and wants to anticipate spending. Second, because fiscal accounting rules keep PPPs off balance sheet, the incumbent can renegotiate the PPP contract to increase current infrastructure spending. Last, the concessionaire is willing to renegotiate the contract because he is backed by a long-term contract which is binding on future administrations.

The mechanism we describe works independently from the way a PPP is funded. If the concessionaire receives availability payments (as is the case, for example, with many highways in Europe), renegotiated payments will be borne by future administrations and constrain their ability to spend. If, on the other hand, the infrastructure is funded with tolls, future governments will forego revenues (see Engel et al. (2013)). Whatever the funding source, the incumbent can exchange resources that would have been available to future administrations for current infrastructure spending by the concessionaire. In essence, therefore, in a renegotiation the concessionaire lends to the incumbent in exchange for payments by future administrations. The incumbent's commitment is credible because the concessionaire has a long-term contract with the government, not only with the incumbent administration.

Our model has four additional observable implications which are consistent with observed facts. First, under competitive bidding, firms bid below costs, in the expectation of renegotiating the contract (a behavior sometimes labeled "lowballing"). A common interpretation is that firms overbid because they are victims of the Winner's Curse.[9] However, Athias and Nunez (2008, 2009, 2015) show that the "curse" is larger under weaker institutional frameworks, where it is easier to renegotiate contracts. Our equilibrium analysis is consistent with this empirical regularity and suggests that lowballing is an endogenous means to compete for ex post rents obtained in renegotiations.[10]

Second, our model suggests that renegotiations will occur early in the concession contract, both because concessionaires want to renegotiate their low bids and because the incumbent wants to bring forward infrastructure spending. Indeed, in the data we examine the average time between the award of a concession and the first renegotiation was 0.9 years in Colombia, 1.4 years in Peru and 2.7 years in Chile, and more than 45% of the amounts were renegotiated during construction. Third, and related, in actual renegotiations, concessionaires get paid more for the original project and are often asked to add additional

gotiations is examined in Engel et al. (2003) and Athias and Saussier (2010).

[7] See Gómez-Ibañez and Meyer (1993) for an early reference noting that renegotiations are common.

[8] The data was developed by Bitrán et al. (2013). We are very grateful to them for kindly sharing their data.

[9] Cantarelli et al. (2010) analyze the causes of cost overruns.

[10] On endogenous lowballing in PPP auctions see also Oxera (2012) and Menezes and Ryan (2015). Also note that Campos et al. (2018) suggests that concessionaires anticipate the rents made in bilateral renegotiations and compete them away in the auction for the contract.

investments. Last, a large part of the renegotiated amounts will be disbursed by future administrations. Indeed, we find that in Colombia, Peru and Chile at least 60 percent of the renegotiated spending increase will be disbursed by future administrations.

Our model has implications that are useful to design transport PPP contracts and programs. One is that ex ante limits on PPP spending are ineffective to prevent the incumbent from bringing forward infrastructure spending, because incumbents can use renegotiations to elude them. Indeed, to make the point, in our model we assume that initial spending in PPPs must undergo the same scrutiny as regular government spending. Despite this extreme and rather unrealistic assumption, renegotiations are sufficient to elude ex ante spending limits.

Similarly, forcing competitive bidding for additional investments agreed in the renegotiation, a practice that some countries have adopted, might be desirable in and of itself, but is ineffective to stem the ability of the government to shift costs onto future administrations via renegotiations. Indeed, our analysis shows that when concessionaires compete ex ante for the PPP contract, any reduction in the ex post rent of the concessionaire wrought by competition only reduces lowballing in the ex-ante auction, but does not reduce the incumbent's total infrastructure spending.

Perhaps more important, our analysis shows that poor accounting is a weakness of PPPs relative to conventional infrastructure provision. Compared with PPPs, conventional provision is less vulnerable to incumbents brining forward infrastructure spending because transport infrastructure projects that are financed with budget appropriations must pass through the standard budgetary process. Moreover, to spend more in a project the incumbent must either reassign funds or go through the budgetary process. And in any case, the scope for an intertemporal transfer is more limited, because the contractual relationship between the builder and the government ends once the project is built.

At the same time, bringing forward spending is not inherent to PPPs, but an equilibrium outcome enabled by poor fiscal accounting. Indeed, conventional provision would have no advantage if PPP investments and all its associated obligations, including renegotiations, would be counted as current investment in the fiscal budget and subject to the same oversight as other budgetary items. For example, in the early 1980s the UK introduced the so-called Ryrie rules, which did exactly that (only to abandon them a decade later when the Maastricht agreements limited public investment).

We contribute to an extensive literature of renegotiation in PPP contracts. As we have already said, the first comprehensive empirical study of renegotiations of PPPs is Guasch (2004), who analyzed more than 1.000 concession contracts in Latin America and established several stylized facts. Several theoretical and empirical papers followed. Guasch et al. (2006) and Guasch and Straub (2006) developed a theory of the determinants of renegotiations. Guasch et al. (2007) and later Bitrán et al. (2013) applied the theory empirically to quantify the determinants of government-led renegotiations in Latin America. Guasch et al. (2008) empirically studied renegotiations in transport and water in Latin America.[11] We complement this literature by explaining why and how renegotiations emerge in equilibrium and by exploring several additional observable implications of this mechanics.

Our model stresses the importance of the political cycle in PPPs and shows that incumbent administrations want to spend even more and inefficiently if new infrastructure increases their probability of reelection. Indeed, as we already said, Aguirre (2015) found that Peruvian transport PPPs are renegotiated with higher frequency during election years. But we go beyond elections by showing that the mere fact that incumbent administrations exit power with positive probability and discount the future at higher rates than society is sufficient to prompt them to renegotiate and bring forward spending in infrastructure. Therefore, incumbent administrations will use renegotiations to bring forward infrastructure spending even if doing so does not increase the probability of reelection. Indeed, this is consistent with the models

[11] Guasch and Straub (2006), Andrés and Guasch (2008) and Andrés et al. (2008) are useful overviews of this line of research.

of government-led renegotiation where incumbent administrations also renegotiate in the aftermath of the election that brought them to power in Guasch et al. (2006), Guasch and Straub (2006) and Guasch et al. (2007).

Our paper is also related to the literature on the fiscal impact of PPPs and government spending limits. On the theoretical side, Maskin and Tirole (2008) study a model where a public official selects projects developed and operated by private contractors. The official's choice among projects is biased by ideology or pandering to special interests and spending limits moderate the inclination of the official to understate the cost of his pet projects. In our model, by contrast, the government uses PPP renegotiations to elude the spending limits normally imposed by the fiscal budget. In addition, on the policy side, we contribute to the literature that discusses how PPPs should be accounted for in the fiscal budget (see Hemming (2006); Hemming and Staff (2008) and Irwin (2007)). We add to this literature by showing that renegotiations in PPPs are an equilibrium outcome, allowed by the fact that PPP renegotiations are excluded from the fiscal budget.[12] While there is still no agreement on whether and how to count PPPs in the fiscal budget (see, for example, Heald (1997), Grimsey and Lewis (2002) and Donaghue (2002)), our conclusion is that renegotiated amounts should be counted as government investment.

Last, we also contribute and complement the literature that studies the drivers of renegotiations in PPPs. Engel et al. (2003) and Athias and Saussier (2010) study the tradeoff between commitment and flexibility, while Brux (2010) shows that renegotiations increase value when parties value their long-term relationships. Guasch and Straub (2009) analyze the link between corruption and renegotiations and Estache et al. (2009) show that multidimensional auctions are renegotiated more often.

The remainder of the paper is organized as follows. Section 2 describes the theoretical model and obtains the main results. Section 3 discusses the implications for fiscal accounting. Section 4 describes the evidence arising from a database of renegotiations of PPPs in Chile, Colombia and Peru which was compiled by Bitrán et al. (2013). Section 5 concludes.

2. A simple model of renegotiations

2.1. Basic set up

The model has two periods. At the end of the first period there is an election to change or keep the current administration. Social welfare depends on infrastructure services and the discount rate is zero so that social welfare is the sum of per period utility of a representative household:

$$\mathcal{U} = u(I_1) + u(I_2), \tag{1}$$

where I_t denotes infrastructure services in period t and u is strictly increasing and strictly concave. Infrastructure lasts for a single period, the cost of a unit of infrastructure is \$1 and there are no costs of operation. The construction industry and the PPP industry are competitive.

Taxes in period t are denoted T_t and are exogenous. The intertemporal budget must be balanced:

$$T_1 + T_2 = 1 = I_1 + I_2. \tag{2}$$

Maximizing social welfare subject to the budget constraint leads to the following result which shows that it is optimal to spend the same amount in both periods.

Result 1. *Socially optimal investment in periods 1 and 2, denoted I_1^s and I_2^s, maximizes (1) subject to (2). It follows that I_1^s is characterized by $u'(I_1^s) = u'(1 - I_1^s)$ and $I_1^s = I_2^s = \frac{1}{2}$.*

[12] Milesi-Ferrettii (2003) provides a theoretical model showing how the adoption of fiscal rules can encourage "creative accounting" such as the off-balance treatment of PPPs.

Congress wants to maximize social welfare (1) and can impose a spending cap $\bar{I}_1$.[13] The government can issue debt in period 1, constrained by (2) and the spending cap imposed by Congress. In addition, the incumbent executive has a reelection concern. Following Alesina and Tabellini (1990), we capture this concern by assuming that her payoff is

$$\mathcal{G}(I_1, I_2) = u(I_1) + p(I_1)u(I_2), \tag{3}$$

where p is the probability of reelection, which we assume is strictly increasing and strictly concave, and $u > 0$, so that $p(I_1)u(I_2)$ is increasing in I_1 for any fixed value of I_2. Note that the incumbent's preferences coincide with social welfare in period 1, but that she values period's 2 welfare only when in power.[14]

2.1.1. Conventional provision vs. public-private partnerships

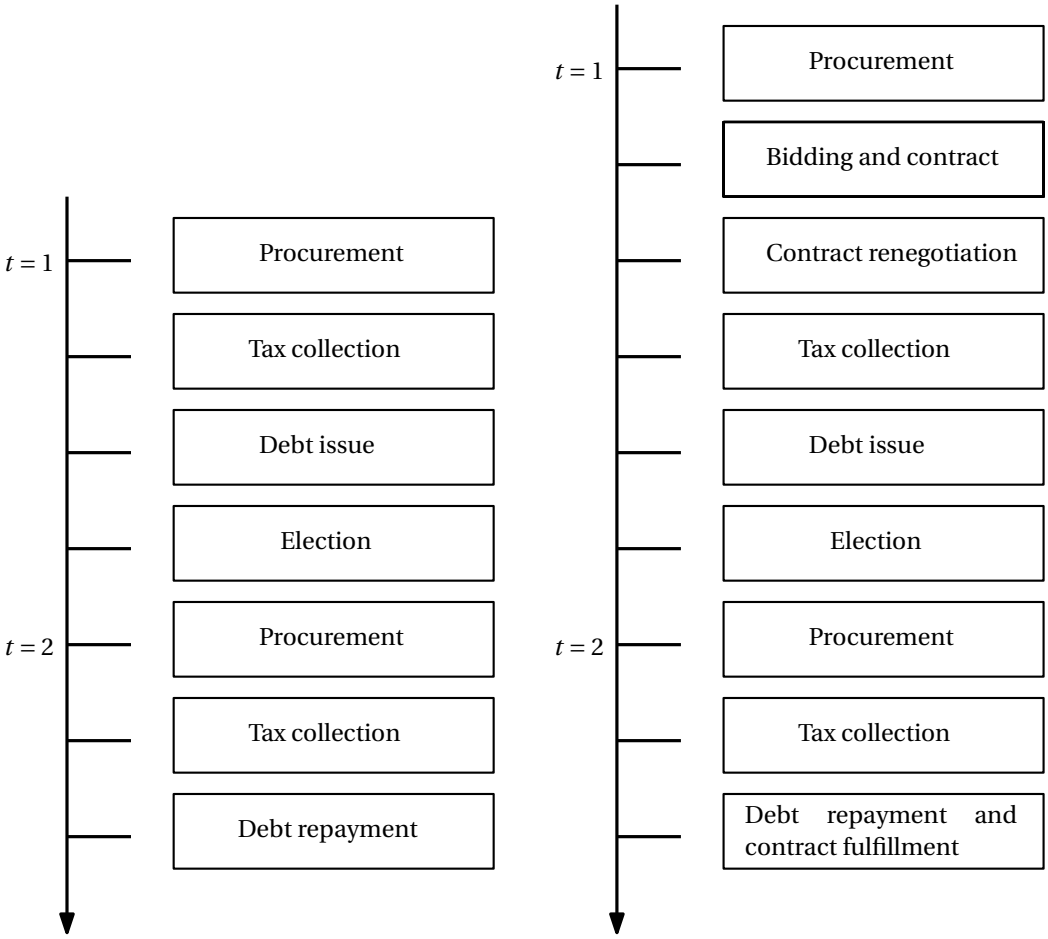

Figure 1: Timing of the two cases. Traditional procurement (left), PPP (right).

[13]The assumption that Congress' and society's interests coincide seems contrary to experience. It is based on the fact that in Congress there is an opposition party that reacts against increased (federal) spending with reelection purposes, whereas the executive has no corresponding opposition. The power of the purse is the main source of power of Congress in democratic societies, and it is active only in opposition to government. Our point is that Congress' oversight on electoral spending tends to reduce excesses, though it is probably still not optimal. In this sense, our simplification is analogous to assuming that the less risk averse party in a standard principal-agent problem is risk neutral.

[14]Voters responding to infrastructure spending may be sign of voter myopia.

The model considers two alternative ways of procuring infrastructure: conventional provision and public-private partnerships. In both cases Congress grants an authorization to the government to spend at most $\bar{I}_1 = I_1^s = \frac{1}{2}$ in period 1 (see Figure 1 for a time-line). This constraint can be interpreted in two ways. In the first interpretation, the services of infrastructure provided in period 1 cannot exceed $I_1 = \frac{1}{2}$, this is the "services limit" interpretation. In the second interpretation, actual expenditures on infrastructure in period 1 cannot exceed $\frac{1}{2}$, this is the "expenditure limit" interpretation. Both interpretations are not equivalent when the infrastructure contracted in period 1 is partly paid for in period 2, as will be the case under PPPs. Nevertheless the insights and results we derive below hold, with minor modifications, for both cases.

The specifics of expenditure oversight vary from country to country. In some countries infrastructure projects must pass a social cost-benefit evaluation. In other countries, PPP projects must pass a value-for-money test which compares costs with conventional provision.[15] In these cases the "services limit" interpretation for the spending cap is appropriate. Yet in other countries the public works authority faces spending limits imposed and enforced by the finance authority and the "expenditure limit" interpretation applies.

Following Maskin and Tirole (2008) we assume that PPPs make hidden intertemporal transfers possible. That is, because PPPs bundle finance with construction and operation, the government can make a credible promise to repay in the future for infrastructure that firms build in the present. Furthermore, these promises do not enter budgetary discussion until the period they are disbursed. By contrast, there is no mechanism available to backload payments under conventional provision.

Governments can backload payments under PPPs in a variety of ways other than the one considered in our model. For example, the government can extend the duration of the concession contract, raise future user fees, offer additional revenue guarantees, promise an increase in future subsidies, or lower the quality standards required for the project. In all these cases the incumbent transfers resources from future administrations and users to the concessionaire, and circumvents budgetary controls.

Conventional provision. As mentioned above, Congress allows the government an expenditure of at most $I_1^s = \frac{1}{2}$, a limit that cannot be exceeded, because there are no mechanisms to transfer resources intertemporally without congressional approval. There is procurement to an amount $I_1 = \frac{1}{2}$ from construction companies (here competition ensures that investment is comparable). If $\frac{1}{2} > T_1$, the government issues debt of an amount $D = \frac{1}{2} - T_1$. This means that $I_2 = T_2 - D$, since the intertemporal budget constraint always holds. Since period 2 spending in the optimal case is $I_2 = \frac{1}{2}$, we have that $T_2 = \frac{1}{2} + D$. This means that in this case there is no mechanism to shift spending between periods, and the government cannot achieve its desired spending pattern. Note also that an alternative way for Congress to control spending is by putting a limit of $\frac{1}{2} - T_1$ on the issuance of public debt in period 1.

Public-private partnerships. In this case, the concessionaire does not only builds the infrastructur, but also operates and finances the project. The firm makes a bid for a payment of B (over the two periods) in order to build infrastructure to the amount $\frac{1}{2}$, which is all that Congress allows. Given the expenditure limits enforced by Congress, $B \leq \frac{1}{2}$.

Assume now that the contract is renegotiated before period 2, in order to increase infrastructure investment by the amount W, in exchange for an additional amount R to be paid in period 2 to the concessionaire. The new contract specifies W in additional investment (to $\frac{1}{2} + W$) in exchange for increased payments, to be paid in the second period. Total payment is $B + R$. Thus, the agreement involves an intertemporal

[15] There is anecdotal evidence that frequently PPP units understate costs to meet the test.

obligation that has not been approved by Congress and that can be used to exceed the expenditure limits.[16] We show later how to determine the values of B, R and W in equilibrium.

2.2. Soft budgets and renegotiations

We now show that an incumbent can exploit PPPs to bring forward infrastructure spending. First we show that an unconstrained incumbent would like to spend more than what Congress allows under conventional provision. Next we show that the incumbent can use renegotiations to attain her optimum.

2.2.1. The unconstrained incumbent

Assume a government constrained only by (2). Then the incumbent sets I_1 to satisfy the necessary FOC

$$\frac{d\mathcal{G}(I_1, 1-I_1)}{dI_1} = u'(I_1^*) - p(I_1^*)u'(1-I_1^*) + p'(I_1^*)u(1-I_1^*) = 0, \tag{4}$$

with SOC

$$\frac{d^2\mathcal{G}}{dI_1^2} = u''(I_1^*) + p(I_1^*)u''(1-I_1^*) - 2p'(I_1^*)u'(1-I_1^*) + p''(I_1^*)u(1-I_1^*) < 0,$$

since u and p are concave and increasing, and $u > 0$.

We now show that $I_1^* > \frac{1}{2}$. To begin, assume that $p' = p'' = 0$, that is, there is a fixed probability of reelection $p \in [0,1]$. Denote the corresponding optimal investment in infrastructure during period 1 by I_1^p. The FOC simplifies to

$$u'(I_1^p) - pu'(1-I_1^p) = 0.$$

Result 1 corresponds to the case where $p = 1$. Implicit differentiation of the FOC shows that

$$\frac{dI_1^p}{dp} = \frac{u'(1-I_1^p)}{u''(I_1^p) + pu''(1-I_1^p)} < 0.$$

Hence, $I_1^p > I_1^s = \frac{1}{2}$ for $p < 1$. This result is well known (Alesina and Tabellini, 1990): the incumbent tends to bring forward infrastructure spending because it discounts future spending by more than the social discount factor.

We define p^{eq} as the fixed probability such that the incumbent would optimally choose to spend I_1^*, that is

$$u'(I_1^*) \equiv p^{\text{eq}}u'(1-I_1^*).$$

Now from the FOC (4) we have

$$u'(I_1^*) = p(I_1^*)u'(1-I_1^*) - p'(I_1^*)u(1-I_1^*).$$

It follows that

$$p^{\text{eq}} = p(I_1^*) - p'(I_1^*)\frac{u(1-I_1^*)}{u'(1-I_1^*)} < p(I_1^*).$$

Defining $I_1^{p^*}$ as optimal government expenditure for a government with constant p equal to $p(I_1^*)$ and recalling that $I_1^s = \frac{1}{2}$ denotes socially optimal government expenditure we then have $I_1^* > I_1^{p^*} > I_1^s = \frac{1}{2}$.

Thus, there are two reasons why the incumbent government wants to bring forward infrastructure spending. First, the coalition may not be in office in the future: $p < 1$ acts as a discount rate that dis-

[16] It is possible to control these underhand fiscal loans, but they require an overhaul of the fiscal accounts system, so that these hidden obligations are revealed.

counts future utility more than is socially desirable. Second, more spending today increases the probability of reelection. Hence, the government's expenditure not only depends on its probability of being re-elected, $p(I_1^*)$, but also on how responsive this probability is to changes in expenditures. A more responsive probability leads to higher expenditures, even when the actual probability of being re-elected remains unchanged.

2.2.2. Implementing the incumbent's optimum via renegotiation

We show that the incumbent is able to achieve its desired allocation of infrastructure investment by using renegotiations,. There are two things to consider here. First, the bargaining power of each party. Second, the degree of lowballing of the winning bidder. This subsection builds up to Result 2, where we show that, independently of the bargaining power of the parties, the incumbent can always obtain its chosen allocation.

The intuition for this is that as the concessionaire obtains more bargaining power, the competition to be the firm that builds the infrastructure project becomes more intense (in the expectation of profitable renegotiation), increasing the extent of lowballing. In turn, lowballing implies that there are period 1 ex post free funds that the government can use, apart from any reallocation due to the possibility of the PPP firm "lending" resources to the government to increase first period investment.

We assume that the government, following the spending cap set by congress, auctions a PPP contract with period 1 investment $I_1 = \frac{1}{2}$ and obtains a bid B for the contract. Nevertheless, renegotiation leads to additional spending W in period 1 and an additional payment R in period 2. Hence total investment in period 1 is $\frac{1}{2} + W$ and second period investment is $1 - (B + R)$. The utility of the incumbent then is:

$$u(\tfrac{1}{2} + W) + p(\tfrac{1}{2} + W)u(1 - (B + R)).$$

At the renegotiation the concessionaire obtains rent $R - W$ where the markup depends on its bargaining power. We assume that all firms have identical bargaining power. Then, an increase in the rent, due to reduced bargaining power by the incumbent, increases lowballing, because of competition among firms. Denote the extent of lowballing by $L = \frac{1}{2} - B$. By competition, we have that total spending commitments by government for period 1 investment, $B + R$, must equal total infrastructure provided that period, $\frac{1}{2} + W$:

$$B + R = \tfrac{1}{2} + W, \tag{5}$$

or equivalently

$$R = L + W. \tag{6}$$

Note that the effect is that in equilibrium with competition for the PPP, bidders lowball in period 1 by the extent they will gain in the renegotiation process in period 2.

The important point is that the lowballed amount is a free transfer to the incumbent, who can use it to increase its spending in the first period. Under the assumptions of efficient bargaining and competition, this is sufficient to achieve the desired first period investment by the incumbent.

We show next that even when the concessionaire has all the bargaining power, the incumbent can achieve its desired spending.

The concessionaire has all the bargaining power. Since in this case the government does not obtain any additional utility by renegotiation (because it is all appropriated by the concessionaire), renegotiations keep its pre-renegotiation utility constant. However, this utility includes the resources saved by lowballing, which means that there are free second period resources. The incumbent's utility of no renegotiation is $u(\frac{1}{2}) + p(\frac{1}{2})u(\frac{1}{2} + L)$, where the additional second period resources are due to the fact that the first period expenditure cost is less than $\frac{1}{2}$. Thus the problem for the winning bidder –after being awarded the contract

by lowballing $L-$ is to maximize its profits by renegotiation, under this constraint:

$$\begin{aligned} &\max_{\{W,R\}} R - W \\ &\quad \text{s.t. } u(\tfrac{1}{2}+W) + p(\tfrac{1}{2}+W)u(\tfrac{1}{2}+L-R) = u(\tfrac{1}{2}) + p(\tfrac{1}{2})u(\tfrac{1}{2}+L). \end{aligned} \tag{7}$$

We take the first order conditions of this problem and then impose the no rents constraint (5) to obtain

$$u'(\tfrac{1}{2}+W) - p(\tfrac{1}{2}+W)u'(\tfrac{1}{2}-W) + p'(\tfrac{1}{2}+W)u(\tfrac{1}{2}-W) = 0$$

which is identical to (4)! Thus, even when the firm has all the bargaining power, the incumbent can use renegotiations to achieve its desired allocation of infrastructure expenditure.

Note that in this setting we get cost overruns, because the concessionaire makes an offer that is below costs. Nevertheless, the cost overrun is not unexpected, but an endogenous outcome of the incentive structure. The renegotiated amount R to be paid in the second period includes an amount to compensate the firm for the lowballing implicit in its period 1 winning bid B.

The incumbent has all the bargaining power. When the incumbent has all the negotiating power, there is no lowballing, since firms know that they will not be able to raise their profits through renegotiation. In that case, renegotiation takes place, but the cost of the additional works W is equal to the repayment R and the incumbent attains its preferred allocation of infrastructure.

One way of giving all bargaining power to the incumbent is by awarding all additional works in an open auction. In this case, the concessionaire makes no profits in the renegotiation. There will be no lowballing, but the ability of the concessionaire to "lend" to the incumbent means that the incumbent is able to attain its desired allocation of investment.

General case. When considering the general case, where both the incumbent and the concessionaire have bargaining power during the renegotiation, the intuition is similar to what we discussed in the case where the firm has all the bargaining power. The firm lowballs in the expectation of recovering the first period deficit with the renegotiation rents. The proof of the result is complicated by the fact that the concessionaire and the incumbent measure their utility in different units, and we present it in the appendix. Here we state the result.

Result 2. *Assuming a competitive auction for $I_1 = \frac{1}{2}$ and efficient bargaining during the renegotiation that follows, in equilibrium the incumbent uses the renegotiation to implement her optimum, regardless of the distribution of bargaining power. The firm lowballs in the initial auction by L that solves*

$$u(I_1^*) + p(I_1^*)u(1-I_1^*) = u(\tfrac{1}{2}) + p(\tfrac{1}{2})u(\tfrac{1}{2}+\tfrac{L}{\alpha}), \tag{8}$$

where $\alpha \in [0,1]$ denotes the firm's share of surplus. It follows that L is increasing in α with $L(0) = 0$. As long as the firm has some bargaining power ($\alpha > 0$), additional spending contracted during the renegotiation is used both to pay for the new infrastructure and to compensate for lowballing in the auction.

Proof See Appendix A. □

2.2.3. Discussion

It follows from Result 2 that the division of the ex post surplus, and therefore, the ex post rent made by the concessionaire depends on his bargaining power, α. Nevertheless, our assumption of ex ante competition in the auction implies that the concessionaire will not earn rents overall, as any ex post rent compensates for ex ante lowballing.

This has an interesting implication: suppose Congress makes it a law that additional works must be awarded in a competitive auction, thus ensuring a competitive price W. This does not prevent the incumbent from brining forward infrastructure spending: its only effect is to prevent lowballing in the initial auction. By imposing no rents during the renegotiation, Congress shifts all bargaining power to the incumbent. Nevertheless, as shown above, the incumbent can still attain its preferred spending pattern, since the additional expenditure on infrastructure is paid for in period 2 and therefore is not subject to the spending constraint imposed by Congress in period 1.

Second, note that with PPP contracts the initial bid for the project is $B = \frac{1}{2} - L$, at a net loss of L for the firm, while the amount paid by the government in the renegotiation equals $L + W$, for infrastructure that is worth W. Thus, if $\alpha > 0$, the results of the renegotiation includes additional compensation for the works originally contracted as well as for additional works not contemplated in the original contract. In other words, "cost overruns," which are often cited in practice as the reason for renegotiating, are an endogenous outcome of lowballing.

Third, lowballing implies $B < \frac{1}{2}$ whenever $\alpha > 0$. Hence, the government is left with a first period surplus that can be used to pay for the results of renegotiation. Thus, some of the additional compensation of the concessionaire is paid from the current budget.

Fourth, observe that renegotiations are effective to bring forward spending only if a significant part of the amounts renegotiated are not paid by the current administration. This is the main prediction of the model.[17] The future administration has $\frac{1}{2} - W$ to spend in period 2 instead of the socially optimal $\frac{1}{2}$.

We note that we have assumed that the value of the infrastructure auctioned originally equals the spending limit imposed by Congress: $I_1 = \frac{1}{2}$. This is one of many possible auctions that lead, after renegotiation, to the incumbent's optimal infrastructure level I_1^*. For example, when the spending cap is interpreted as a limit on expenditures, it is feasible to have $I_1 > \frac{1}{2}$, coupled to a winning bid B that does not exceed the spending cap $\frac{1}{2}$.[18]

Summing up, the model developed in this section has various testable implications. First, anticipating future renegotiations, firms lowball in their bids for a PPP. Second, governments include additional works during the renegotiation process. Third, renegotiation can occur early on, even before construction is completed. Fourth, a significant part of the cost of renegotiation is passed onto future administrations (or users, in the case of user fee revenue).

3. Fiscal accounting for PPPs

Bringing forward spending is not inherent to PPPs. Indeed, conventional provision and PPPs share the same information structure, and have insignificant differences as far as delegation is concerned—both delegate infrastructure procurement to a government agency which reports directly to the executive, rather than to an independent supervisory body. The difference is due to defective accounting standards, which interact with two specific aspects of PPPs.

The first characteristic is that PPPs bundle finance, construction and operation into one contract, which allows the incumbent to renegotiate all dimensions of the contract with the concessionaire simultaneously. The second characteristic is that PPP laws and regulations impose constraints mainly (in many countries

[17] As we have mentioned before, there is a difference between this result and having additional first period spending by selling bonds or borrowing in the market: in the case of PPPs, the lender is the firm and there is no oversight of the additional spending.

[18] Result 2 applies to the case where $I_1 < \frac{1}{2}$ as well. In this case, the firm lowballs by including additional works (above $\frac{1}{2}$) initially, but charges less than $\frac{1}{2}$ for it. Defining $L(I_1)$ in a manner analogous to what we did for $I_1 = \frac{1}{2}$, we have that as long as $I_1 - L(I_1) \leq \frac{1}{2}$ the spending limit for period 1 won't be exceeded and the renegotiation achieves the incumbent's optimum. The resulting function $L(I_1)$ is decreasing in I_1. Thus, independent of how we interpret the spending cap imposed by Congress, the incumbent uses renegotiations to circumvent the spending caps and achieve her optimum.

only) on the original PPP contract. As we already mentioned, some countries may require that PPPs pass a social cost-benefit analysis; others require PPPs to pass a value-for-money test. These requirements are intended to limit spending by the government (i.e., they set I_1 to the optimal social value I_1^s), yet in practice the incumbent can renegotiate the original contract in order to increase spending to $I_1^* > I_1^s$, as described in our model.

This problem has a straightforward solution that can be implemented within existing budgetary practices: the government should count any infrastructure procured via PPPs as current investment.

To see why this solves the problem, we return to our model. Under the proposed solution, $B + R$ will be registered as government infrastructure spending in period 1, and the government's net borrowing will appear to be $B + R - T_1$. Thus a cap on total spending $B + R$, or on net borrowing equal to $I_1^s - T_1$ would lead to $B + R \leq I_1^s$. In other words, the reformulated cap forces the government to cut other investments if it wishes to renegotiate.[19]

The above digression is closely related to the issue of fiscal accounting of PPPs. Should the assets held by a PPP be classified as owned by the concessionaire or the government?

Eurostat (2016) distinguishes between PPPs funded primarily with user fees or tolls and PPPs funded mainly by government transfers. Toll funded PPPs are off-balance sheet as a general rule, unless government guarantees are deemed substantial. In contrast, the treatment of government funded PPPs seems to have been a compromise between the forces pushing for the exclusion of PPPs altogether form the government balance sheet, and those that found that it was an unsound fiscal policy, as events would show in the aftermath of the world financial crisis of 2008. In the latest version of these guidelines (see Eurostat (2016), the decision on whether to classify a particular government funded PPP project as belonging on or off balance sheet is based on the answer to 84 yes-no questions divided into 11 sections. For example, question 70 asks "does the (private) partner bear the construction risk and at least one of either the availability or the demand risks?". If the answer is 'no', the asset is classified on the government's balance sheet. If the answer is 'yes', additional conditions must be met for the asset to be kept off the government's balance sheet. In particular, there should be no mechanism, such as a government guarantee or early termination provisions, that transfers the risks back to government.

Summing up, Eurostat guidelines do little to avoid the use of PPPs to bring forward infrastructure spending via renegotiations, as their main focus is on risk sharing, not on their budgetary implications. Donaghue (2002, p. 9) shows that the conventional approach has been to classify assets as owned by the concessionaire during the term of the concession. Nonetheless there are some noteworthy exceptions. In the 1980s the so called 'Ryrie Rules' applied in the UK, requiring that private finance of public infrastructure could only be used if public expenditure was reduced by the same amount. Another exception is the auditor-general of New South Wales in Australia, who determined that the asset and liabilities of privately financed bulk-water treatment plants belonged to the public sector's balance sheet.[20]

A related important advance towards a sounder policy is the gradual incorporation of contingent obligations associated to PPPs into the fiscal accounts. Recently, Eurostat has established a separate set of accounts for contingent liabilities.[21] Some Latin American countries (Chile, Colombia) have gone beyond this by applying standard financial tools to put a value on these liabilities.

[19] Engel et al. (2013) show that optimal budgetary accounting of PPPs requires that they appear as a deficit item upfront, independent of whether the source of payments is the public budget or revenues generated by the project.

[20] Harris (1998), cited in Irwin (2007, p. 113)

[21] See "Supplement on contingent liabilities and potential obligations to the EDP related questionnaire", Eurostat, 22, July 2013.

4. Evidence from Chile, Colombia and Peru

In this section we report on the evidence for the hypothesis presented in this paper. We begin with examples that illustrate how the Chilean government has used renegotiations to circumvent Congressional limits to expenditures.

4.1. Two examples

The rainwater collectors. In 2001 there was flooding in Santiago, which led to political pressures on the government to invest in collectors that would drain the rain waters from flood-prone areas. The government ruled out financing through the budget and instead renegotiated the contracts of the urban highways scheduled for construction so that they would build the collectors. The sums involved were in the hundreds of millions of dollars and required changes to the contracts of three urban concessions. Payments for the additional works were scheduled to begin several years in the future.

The San Antonio Bypass. The main port of Chile was hampered by the fact that trucks had to go through the city of San Antonio to reach the port. The government decided to add a special access route that bypassed the city. There were three options to finance the project: i) to fund from the budget, ii) through an independent self-financed tolled concession or iii) as a non-tolled extension to the Route 78 PPP, from Santiago to San Antonio. The then President had promised the city, while a candidate, that he would not impose a toll on the proposed access. Even though the government had ample access to the international credit markets, it decided to renegotiate the contract, valuing the 8 km project at around US$ 45 million. The payment consisted in a substantial increase in tolls, and a further increase in 2012.

4.2. Renegotiations in Chile, Colombia and Peru

Chile. The Chilean concession program is considered among a handful of well established PPP programs (Hemming, 2005). Detailed data on concession contracts are available on the webpage of the Ministry of Public Works (MOP by its Spanish acronym) and the quality of fiscal accounting can be described as at par with average OECD levels.[22] Also, Chile probably was the first country to post all the information on renegotiations (in 2007). Most developed countries still do not make this information readily accessible.

Chilean PPPs were launched in 1993 with the El Melón tunnel concession. Between 1993 and 2006, MOP awarded 50 PPPs: 26 roads, 10 airports, three jails, two water reservoirs, five public transportation infrastructure projects and four other miscellaneous projects. At the time, roads represented 89% of the $11.3 billion invested in PPPs.[23]

By 2014 there were three major hospitals, plus seven additional roads under construction, in addition to other large infrastructure projects (part II of the underground urban highway Américo Vespucio Oriente in Santiago and the renewal of the Santiago Airport PPP) that were planned to be auctioned in the near future. Also, most Chilean seaports are managed under PPPs.

Colombia. In Colombia, PPPs in public infrastructure began in 1993. According to (World Bank Institute, 2012), by 2012, approximately 32% of its road network was under PPP contracts, the government had signed 48 PPP contracts in the transport sector. There were serious problems with the first PPPs however, leading to changes in the rules and new "generations" of PPPs. There have been several "generations" of PPPs altogether and by 2012 the legal environment for PPPs in Colombia was much improved (Bitrán et al., 2013).

[22] Significant improvements in fiscal accounting are possible in all OECD countries nonetheless. See Chapter 6.1 in Engel et al. (2014b).

[23] See Engel et al. (2009).

The first PPPs were not a success. The lack of road shows for international investors and the short preparation times meant that only local firms could participate. Moreover, seven of thirteen projects were awarded directly, without an auction. Among many problems there were no detailed designs of the roads, so it was difficult to plan eminent domain purchases, which caused long delays. The main public infrastructure PPPs are roads, of which 25 had been awarded up to December 2010, for a total contract value of USD 6.5 billion and 4,800 km (Bitrán et al., 2013). Currently, there are 48 extant PPP projects in roads (World Bank Institute, 2012).

Peru. Peru's PPP program in public infrastructure is more recent than those of Chile and Colombia. Though the initial legislation dates from 1991, only one road was concessioned during the 90's. That PPP was renegotiated several times during its 13 year duration. A new start in PPP began in 2001, with the concession of Lima's airport. Thus the program only really got going after that date. In 2008 a new law modernized and added flexibility to Peruvian PPPs in public infrastructure. The new law allowed contracts where concessionaires had no "skin in the game" (neither equity nor long term debt) so that the government assumed all the risk (construction, demand, etc.). By 2010 there were 15 road PPPs, with a total initial value of $2.3 billion, i.e., it was still a relatively small program in comparison to Chile and Colombia.

4.3. Data on renegotiations

Table 1 provides some basic information on road PPPs in the three countries. We first describe these facts and then contrast them with the implications of our model.

Rows 1-7 provide descriptive statistics for the highway concession programs in Chile, Colombia and Peru. Initial investments are similar, on average, with amount close to 200 million dollars (row 1). The main source of differences stems from Peru's concession program being much younger: the mean number of concession years elapsed is 3.8 for Peru compared with 12.7 for Chile and 9.0 for Colombia.

4.3.1. Extensive and intensive margins

Rows 8-13 provide statistics on the number of renegotiations. Renegotiations are pervasive in all countries under consideration. The fraction of concessions contract that have been renegotiated is 71% in Peru, 84% in Colombia and 85% in Chile (row 8). Most concession contracts have been renegotiated more than once (row 10): with an average of close to 3 renegotiations per concession in the case of Chile and Peru and close to 17 renegotiations in Colombia. A significant fraction of renegotiations take place during construction (row 11): 50 percent of concession contracts in Peru were renegotiated before becoming operational, 70 percent in Chile and 84 percent in Colombia. Many concession contracts were renegotiated on multiple occasions during the construction phase (row 13) with an remarkable 8.7 renegotiations on average in the case of Colombia.

Rows 14-21 provide statistics that are useful to gauge the magnitude of renegotiations (the intensive margin). The total amount renegotiated is equal to 13.7, 16.5 and 85.1 percent of initial investments for Peru, Chile and Colombia, respectively (row 15).

4.3.2. Standardized comparisons

The above numbers can be misleading when comparing the importance of renegotiations across countries, since they will be larger for countries with older concessions programs even if renegotiation rates are the same. For this reason we report the average amount renegotiated per year as a fraction of initial investment (row 18). The order changes and Peru renegotiates, on average, 3.6 percent of the initial investment on an annual basis compared with 1.3 percent for Chile. Colombia continues to lead with close to 10 percent. Colombia's lead in the magnitude of renegotiations looks even larger once we weigh concession years by the upfront investment (row 19) with annual renegotiations reaching 16.5 percent of initial investment, suggesting that larger projects are more prone to renegotiation. No such correlation is apparent for Chile or Peru.

Table 1: Characteristics of renegotiations in each country

		Chile	Colombia	Peru
Descriptive statistics on concession programs				
1	Number of road concessions[1]	20	25	14
2	Average initial investment (2009 MM USD)[2]	256.8	263.2	166.3
3	Mean length of highway (kms)	118.9	194.8	383.4
4	Average term length (years)	25.4	16.7	23.2
5	Mean concession years elapsed	12.7	9.0	3.8
6	Mean concession years elapsed during construction	4	3.4	3.0
7	Mean concession years elapsed during operation	8.7	5.6	0.8
Statistics on the number of renegotiations				
8	Number of concessions with renegotiations	17	21	10
9	Total number of renegotiations	58	430	47
10	Average number of renegotiations per concession	2.9	17.2	3.4
11	Number of concessions with renegotiations during construction	14	21	7
12	Total number of renegotiations during construction	31	218	33
13	Average number of renegotiations per concession during construction	1.6	8.7	2.4
Statistics on amounts renegotiated				
14	Average amount renegotiated (2009 MM USD)[3]	42.5	224.1	22.7
15	Average amount renegotiated/Average initial investment (%)	16.5	85.1	13.7
16	Avge. amount renegotiated per renegotiation (2009 MM USD)	14.7	13.0	6.8
17	Avge. amount renegotiated per renegotiation/Avge. initial inv. (%)	0.45	0.55	1.08
18	Avge. amount renegotiated/([avge. init. inv.]x[concession-yr]) (%)	1.3	9.5	3.6
19	Avge. fraction of inv. renegotiated per concession year, weighted (%)	1.4	16.5	3.6
20	Average time to first renegotiation (years from award)[4]	2.7	0.9	1.4
21	Average term increase due to renegotiations (yrs)	0.9	5.3	0.1
Statistics on amounts renegotiated during construction				
22	Average amount renegotiated during construction (2009 MM USD)	19.2	108.8	15.0
23	Avge. amount renegot. during constr./Avge. initial inv. (%)	7.5	41.3	9.0
24	Avge. reneg. during constr./([avge. init. inv.]x[concess.-constr.-yr]) (%)[5]	1.9	12.2	3.0
25	Avge. fract. init. inv. renegot. during constr. per yr., weighted (%)[5]	1.9	18.5	3.0
26	Avge. fract. init. inv. renegot. during operation per year, weighted (%)	1.1	14.9	5.8
27	Amount renegot. during constr./Total amount renegot. (%)	45.2	48.6	66.1

Source: Bitrán et al. (2013) and the corresponding database, which covers data from the 1993 to 2010.
[1]Only those with all data, leaves out one concession in Chile and one in Peru.
[2]Unless indicated otherwise, averages and sums consider all concessions, not only those with renegotiations.
[3]Considers only fiscal cost because of data limitations. Information on additional costs is available for Chile, leading to 59.0.
[4]Considers only concessions with renegotiations.
[5]Assumes 4 years for construction period, or less if reported length of concession is less.

The average time to the first renegotiation, among concessions that have been renegotiated, is inversely related to the average amount renegotiated (row 20): 0.9 years for Colombia, 1.4 years for Peru and 2.7 years for Chile. Row 21 shows that only renegotiations in Colombia involve, on average, an important increase in the concession term (5.3 years). The corresponding figures for Chile and Peru are less than a year.

4.3.3. Renegotiations during construction

If we only consider renegotiations during the construction phase, the relative ordering remains. As a fraction of initial investment, Colombia is most prone to renegotiations, followed by Peru and then by Chile (row 23). The rate and average magnitude of renegotiations may differ between the construction and operation phases of a concession. Rows 22-27 help assess this difference. For example, a comparison of rows 18 and 24 (or 19 and 25) shows that renegotiation rates differ between the construction and operation phases of a concession, being larger during construction for Chile and Colombia. The converse holds for Peru, yet the number of concessions in the operational phase is small in this case and the difference is not significant.

4.4. Testing the predictions

This section describes the tests of the predictions of the model, using the results from Section 4.3, Bitrán et al. (2013) and Engel et al. (2009).

Type of renegotiation. A first thing to notice is that most renegotiations are by mutual (or bilateral) agreement, so there is no conflict among the parties. In Chile 83 percent of renegotiations lead to these agreements and it is also true for 98 percent of the cases in Colombia and in all cases in Peru. The remaining cases go to arbitration, which are the result of an inability to reach an agreement.

In Chile and Peru, most renegotiations are led by the government, and to a lesser extent in Colombia, with 40 percent, but there jointly led agreements represent another 40 percent of cases. This seems to indicate a political economy reason for renegotiations. This option transfers more of the fiscal costs to future governments than arbitration (Engel et al., 2009), and may be one of the reasons why incumbents prefer this type of renegotiation.

When do they occur. In the standard interpretation of renegotiations, there should be more of them as time passes as more events that were uncertain initially come to pass. In the three countries, however, more than 45 percent of the renegotiations, as measured by value, took place during the construction phase, that is, within the first four years of the contract.[24] Moreover, as mentioned above, the time between when the concession is awarded and the first renegotiation is short: 2.7 years in Chile, 1 year in Colombia and 1.4 years in Peru. The difference remains when we compare the differences, by value, of renegotiations during the construction and operation phases for Chile and Colombia (rows 25 and 26 in Table 1). As mentioned earlier, the small number of concessions that have reached the operational phase render this comparison non significant for Peru.

There are three interpretations for these observations. One is that projects were not carefully designed and require modifications. This can be described as the incompetence (or moral hazard) interpretation of renegotiation. The second interpretation is that government wants to add additional works without going through the normal budgetary process and may also want to take advantage of the equipment already at the site. Third, the firm may want to recoup from lowballing its offer. The last two interpretations work together in our model.[25]

[24] Engel et al. (2009) consider a database with 50 PPPs, the 26 highways considered by Bitrán et al. (2013) as well as 24 non-highway PPPs and find that 72 percent of renegotiations, in value, occur during the construction phase.

[25] Another possibility is that unexpected problems developed that the concessionaire could not have reasonably anticipated, such as unusually hard or unstable strata during tunneling. We thank a referee for pointing this out.

When does the cost of renegotiations come due?. A large chunk of the cost of renegotiations falls on future governments, as predicted by the model. According to Bitrán et al. (2013) in Peru, only 14 percent of renegotiations have fiscal costs for the incumbent. In Chile, ninety percent of renegotiations have costs falling on future governments, by a combination of project term extensions, raises in future tolls, and by the government assuming additional risks. In Colombia, 6 percent of renegotiations involve future costs, yet these account for 60 percent of all fiscal transfers. The database in Bitrán et al. (2013) does not allow for more precise statistics on how the burden of renegotiations is distributed between current and future administrations. By contrast, Engel et al. (2009) do make this distinction. They find that, in the case of Chile, 60.5 percent of fiscal costs associated with renegotiations are passed on to future administrations.

Extending the term of the concession is one way of transferring costs to future administrations. When the concession ends, the incumbent receives a valuable asset that it can either operate, obtaining toll revenue, or auction, in exchange for additional works and revenues. Chile and Peru have used term extensions, but they have added less than a year to the typical concession. In the case of Colombia, on the other hand, the average concession has been lengthened by 5.3 years (row 21 in Table 1). However, this was the case of the 15 early concessions whose lengths were extended by an average of 70 percent. More recent PPPs have variable duration, depending on accumulated revenues, and term extensions have been avoided.

What do they pay for?. Engel et al. (2009) show that in the case of Chile, for those renegotiations where data is available, 84 percent of the sums renegotiated were designated as additional investments, with the remaining 16 percent designated as additional payments for works included in the original contract. The latter is consistent with lowballing by firms in the original auction, as suggested by our model.

In Colombia, only 5 percent of renegotiations involved road extensions, but these accounted for a third of the total renegotiated value. As Bitrán et al. (2013) mention, concession projects have been used to achieve objectives for which they were neither intended nor designed. These authors add that the costs of these additional stretches of road may be higher than registered in the data, because these extension projects are also renegotiated, and the added costs are no longer included as part of the original renegotiation. In Colombia there was one case of extreme lowballing that eventually led to the cancelation of the contract.

5. Conclusion

In this paper we have shown that governments find PPPs attractive because they are useful to avoid spending limits. This was the case in England, where the PFI program was, in general, not included in the fiscal balance sheet, given the Eurostat rules.[26] This can lead to choosing a PPP when public provision is socially optimal. For example, Chile's government is considering adding via PPP a much needed seventh line to the publicly owned and managed metro network in Santiago. Using a PPP keeps public spending below the limit imposed by the fiscal rule, even though it is likely that public provision is better, given the non trivial coordination problems that will arise between the existing network and the new metro line. Similarly, the UK's Office of Budget Responsibility, in its Fiscal Risks Report of July 2017, note that "some have argued that the structuring of Network Rail and the pursuit of PFI deals were influenced by the fiscal rules in place at the time. It is not for us to comment on the motivation behind these decisions, but it is possible to see why people might believe that their statistical treatment may have played a part."

In this paper we also note that renegotiations provide a further advantage to PPPs from the point of view of incumbent governments. We showed that, because PPP renegotiations do not lie under the purview of Congressional budgetary oversight they can be used to increase government spending. This

[26] In Engel et al. (2013) we provide a normative argument for why PPPs should count as public investment on fiscal accounts.

leads to a set of predictions: i) competitive firms can make lossmaking offers, expecting to recoup their losses though renegotiation., ii) these renegotiations can also be used to increase government expenditure, iii) governments will shift part of the payments onto future governments and iv) we will observe renegotiations during the construction stage of the PPP. We describe data on renegotiations of highway concessions in Chile, Colombia and Peru that are are broadly consistent with the results of our model, while showing significant differences among countries in the extent of renegotiations.

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Appendix

Proof of Result 2.

Assume the firm bids B for building infrastructure $\frac{1}{2}$, so that it lowballs by $L = \frac{1}{2} - B$, To determine the equilibrium value of L we analyze the renegotiation, conditional on L.

The incumbent's utility gain from contracting infrastructure W at a cost R during the renegotiation equals

$$\mathcal{S}(W, R; L) \equiv u(\tfrac{1}{2} + W) + p(\tfrac{1}{2} + W)u(\tfrac{1}{2} + L - R) - u(\tfrac{1}{2}) - p(\tfrac{1}{2})u(\tfrac{1}{2} + L).$$

The second period monetary equivalent of this gain, $M_2(W, R)$, is defined via:[27]

$$\mathcal{S}(W, R; L) = u(\tfrac{1}{2}) + p(\tfrac{1}{2})u(\tfrac{1}{2} + L + M_2) - u(\tfrac{1}{2}) - p(\tfrac{1}{2})u(\tfrac{1}{2} + L),$$

which leads to

$$u(\tfrac{1}{2} + W) - u(\tfrac{1}{2}) = p(\tfrac{1}{2})u(\tfrac{1}{2} + L + M_2) - p(\tfrac{1}{2} + W)u(\tfrac{1}{2} + L - R). \tag{.1}$$

Implicit differentiation w.r.t. W and R yields:

$$\begin{aligned} u'(\tfrac{1}{2} + W) &= p(\tfrac{1}{2})u'(\tfrac{1}{2} + L + M_2)\tfrac{\partial M_2}{\partial W} - p'(\tfrac{1}{2} + W)u(\tfrac{1}{2} + L - R), & (.2)\\ 0 &= p(\tfrac{1}{2})u'(\tfrac{1}{2} + L + M_2)\tfrac{\partial M_2}{\partial R} + p(\tfrac{1}{2} + W)u'(\tfrac{1}{2} + L - R). & (.3) \end{aligned}$$

Total surplus to be split during renegotiation equals:

$$[R - W] + M_2(W, R; L), \tag{.4}$$

where the term in square brackets represents the firm's profit while the second term corresponds to the government's monetary gain. Maximizing total surplus w.r.t. W and R leads to the FOC:

$$\begin{aligned} \frac{\partial M_2}{\partial W} &= 1,\\ \frac{\partial M_2}{\partial R} &= -1. \end{aligned}$$

Substituting these expressions in (.2) and (.3) and adding both expressions yields:

$$u'(\tfrac{1}{2} + W) + p'(\tfrac{1}{2} + W)u(\tfrac{1}{2} + L - R) - p(\tfrac{1}{2} + W)u'(\tfrac{1}{2} + L - R) = 0. \tag{.5}$$

Imposing the zero profit condition we have $R = L + W$. Substituting this expression for R in (.5) and comparing with (4) shows that the equilibrium value for infrastructure contracted during the renegotiation, W, satisfies $W = I_1^* - \frac{1}{2}$. The government therefore attains its optimum.

We complete the proof by deriving (8). If the firm's surplus share is α, then

$$L = R - W = \alpha[R - W + M_2(W, R; L)] = \alpha[L + M_2(W, L + W; L)],$$

where we used (6) in the first and third equalities. Therefore

$$L = \alpha[L + M_2^*], \tag{.6}$$

[27] A similar proof holds if we work with the first period monetary equivalent.

with $M_2^* \equiv M_2^*(L, L+W; L)$. It follows from (.1) that $L + M_2$ is determined from:

$$u(I_1^*) - u(\tfrac{1}{2}) = p(\tfrac{1}{2})u(\tfrac{1}{2} + L + M_2) - p(I_1^*)u(1 - I_1^*).$$

Using (.6) to substitute L/α for $L + M_2$ leads to (8) and completes the proof. □

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