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Abstract

Public-private partnerships (PPPs) are increasingly used to provide infrastructure services. Even though PPPs have the potential to increase efficiency and improve resource allocation, contract renegotiations have been pervasive.

We show that existing accounting standards allow governments to renegotiate PPP contracts and elude spending limits. Our model of renegotiations leads to observable predictions: (i) in a competitive market, firms lowball their offers, expecting to break even through renegotiation, (ii) renegotiations compensate lowballing and pay for additional expenditure, (iii) governments use renegotiation to increase spending and shift the burden of payments to future administrations, and (iv) there are significant renegotiations in the early stages of the contract, e.g. during construction. We use data on Chilean renegotiations of PPP contracts to examine these predictions and find that the evidence is consistent with the predictions of our model. Finally, we show that if PPP investments are counted as current government spending, the incentives to renegotiate contracts to increase spending disappear.

Keywords: Build-operate-and-transfer, concessions, lowballing.

JEL classification: 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 2nd 2009.

1 Introduction

Private participation in infrastructure provision has increased dramatically since the early 1990s via public-private partnerships (PPPs).[2,3] For example, the average annual value of 22.9 billion Euros for PPP projects signed in Europe between 2002 and 2006 was three times the annual average over the preceding decade.[4] In the United States, where until recently PPPs played a smaller role than in many European countries, financing of transportation infrastructure via PPPs increased almost tenfold, on an annual basis, between 2006-2008 and the preceding decade (1996-2005).[5] Similarly, investment in PPPs in developing countries grew at an average annual rate of 28.3% between 1990 and 1997, followed by a slowdown after the East-Asian crisis, and a new growth spurt beginning in 2003, reaching 114.3 billion dollars during 2006.[6]

One of the reasons for the popularity of PPPs is that governments can simultaneously attract private firms and claim that they are not privatizing. Independently of these po-

[2] A rich set of acronyms describe specific PPP arrangements, including BLT, BLTM, BOT, DBOT, DBFO, DBFO/M, JV and ROT. The B usually stands for build, the L for lease, the R for rehabilitate, the T for transfer, the O for operate, the D for design, the F for finance, and the M for manage. JV stands for "joint venture". See Grimsey and Lewis (2005) and chapter 1 in Guasch (2004).

[3] Infrastructure that has been provided via PPPs include roads, bridges, tunnels, railways, ports, airports, air traffic control systems, water and sanitation plants, hospitals, schools, prisons, and social housing.

[4] Several European countries have well established PPP programs that account for 20% of public investment between 2001 and 2006, see Blanc-Brude et al. (2007). One of these programs is the United Kingdom's Private Finance Initiative (PFI) mentioned above in the quote from the *Economist*.

[5] The projects (with financing in million dollars followed by the year of notice to proceed, in parenthesis) are the following: Pennsylvania Turnpike (12,300; 2008), Texas SH 130 (1,350; 2007), Indiana Toll Road (3,850; 2006), Virginia's Pocahontas Parkway (611; 2006), Chicago Skyway (1,830; 2005), California's SR 125 (773; 2003), Jamaica-JFK Airtrain (930; 1999), New Jersey's Trenton River Light Rail (604; 1999), Camino Colombia Bypass in Texas (85; 1999), JFK Terminal 4 (689; 1997) and New Jersey's Hudson-Bergen Light Rail (1674; 1996). Source: Public Work Financing, October 2007.

[6] Source: World Bank and PPIAF, PPI Project Database. These amounts do not correspond to the exact concept of public-private partnerships, but constitute a reasonable (and the best available) proxy for developing countries.

litical reasons, PPPs have the potential to increase efficiency and improve resource allocation.[7] Nevertheless, experience has revealed several pitfalls of PPPs.

One of the problems with PPPs is that renegotiations of contracts are pervasive. Guasch (2004) examined nearly 1,000 Latin American concession contracts awarded between the mid 1980s and 2000, and found that 30% of all contracts were renegotiated. The proportion reaches 54.4% in the transportation sector (roads, ports, tunnels and airports) and 74.4% in the water sector.[8] Guasch also finds that renegotiations often favor the concessionaire. For example, in 62% of the cases they led to tariff increases, in 38% to extensions of the concession term and in 62% to reductions in investment obligations. Renegotiations are also pervasive in developed countries, see Gómez Ibáñez and Meyer (1993).

What is the reason for frequent renegotiations? Industry participants claim that circumstances change over the life of a concession, which usually last many decades. According to this explanation, renegotiations are due to the long term, incomplete nature of PPP contracts. However, this explanation ignores that renegotiations often occur during the construction phase, shortly after contracts are awarded. For example, Guasch (2004, Table 6.4) reports an average of just 2.2 years between the concession award and the first renegotiation.

In this paper we show that renegotiations of PPP contracts can be used by governments to circumvent budgetary constraints. In our model an incumbent that spends more on infrastructure is more likely to be reelected. This creates a bias towards anticipating infrastructure spending relative to its welfare maximizing allocation over time. We assume that under conventional provision, i.e., when the government hires a construction company to build infrastructure but controls the project thereafter, caps on spending or on net fiscal debt are effective in controlling this bias. By contrast, we show that because of defective fiscal accounting standards, renegotiations of PPP contracts can be used to elude spending caps.

Essentially, because PPP arrangements bundle finance and construction, the firm can "lend" to the government by renegotiating the contract in return for payments made by future administrations. Under current fiscal accounting rules neither the additional investments that take place after renegotiations, nor the future obligations assumed by

[7] See, for example, Hart (2003), Bentz et al. (2005), Bennet and Iossa (2006), and Martimort and Pouyet (2008).

[8] It is worth noting that Guasch's data base underestimates the prevalence of renegotiations due to censoring. For example, his data includes several Chilean concessions which at the time had not yet been renegotiated, but which have been repeatedly renegotiated since 2000 (see section 3 below).

the government in a renegotiation are accounted for in the budget. This suggests that the solution to the spending bias is to ensure that PPP assets are counted as public investments at the moment they are built.

Our model has four observable implications: First, under competition for the contract, firms lowball their offers, expecting to get even in later renegotiations. Second, additional works are included in the renegotiation of the contract. Third, major renegotiations occur shortly after the award of the contract. Fourth, an important fraction of the costs of renegotiation are not borne by the current administration. We compile information on the 50 concessions awarded in Chile between 1993 and 2006 and show that it is consistent with these predictions.[9] Total investment increased via renegotiation from $8.4 billion to $11.3 billion, i.e., by nearly one-third. Most of the increase (83% of the total amount) was the result of 78 bilateral renegotiations, while the rest were decisions of arbitration panels.[10] For the $2.3 billion awarded in bilateral renegotiations, we find that only 35% of the additional cost was paid by the administration that renegotiated. Of that $2.3 billion, 84% corresponds to payments for additional works, while the remaining 16% correspond to additional payments for works included in the original contract. Of the total, 78% was awarded during the construction phase. Finally, we observe that even though specific provisions in the concessions law limit the amounts that can be renegotiated, these limits are routinely exceeded.[11]

Our paper adds to the evidence on renegotiations and PPPs; see Guasch (2004); Guasch and Straub (2006) and Guasch et al. (2006, 2007 and 2008). We also contribute to the literature on soft budgets.[12] In the standard mechanism, developed by Dewatripont and Maskin (1995), the "center" lends and sinks money into a firm in period 1. Because assets are sunk, in period 2 the center wants to bail out the firm. Thus, the dynamic inconsistency problem brought about by the inability to commit not to bail out the firm softens the budget. In our model, by contrast, there is no time inconsistency problem, as the government does not face a commitment problem, and wants to renegotiate. The budget constraint is soft because a renegotiation allows the incumbent to elude spend-

[9] The Chilean concession program is considered among a handful of well established PPP programs (Hemming, 2005), solidly based in the Law, with well specified conflict resolution procedures (IMF, 2005). Detailed data on concession contracts are available on the webpage of the Ministry of Public Works and the quality of fiscal accounting can be described at par with average OECD levels.

[10] According to the Chilean Concession Law, when the firm and regulator are unable to reach an agreement in a bilateral negotiation, the firm (and only the firm) can bring the case to an arbitration panel.

[11] This is noteworthy since international indicators (World Bank Governance Indicators and World Economic Forum Global Competitiveness Report) indicate that the quality of regulations in Chile are above the OECD average.

[12] See Kornai et al. (2003) for a synthesis of this literature.

ing limits.

The rest of the paper is organized as follows. Section 2 formalizes our argument and derives some observable implications. Section 3 presents evidence from the Chilean PPP program on these observable implications. This is followed by the conclusion and an appendix with an extension of the model.

2 A simple model of renegotiations

2.1 Model

There are two periods, each corresponding to the term of one administration. There is an election at the end of the first period. The discount rate is zero and social welfare is

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

where u is strictly increasing and strictly concave and I_t denotes the ability to provide infrastructure services in period t.[13] The construction industry and the PPP industry are competitive, infrastructure fully depreciates in one period and each unit of capacity costs \$1 and is costless to operate.

Infrastructure must be financed with an exogenous sequence of taxes T_i that satisfies

$$T_1 + T_2 = 1, \tag{2}$$

so that the budget constraint is

$$I_1 + I_2 = 1. \tag{3}$$

That is, over time infrastructure spending cannot exceed 1.[14] The following result follows immediately:

Result 1 *I_1^s characterized by $u'(I_1^s) = u'(1 - I_1^s)$ maximizes (1) subject to (3). It follows that socially optimal investment in periods 1 and 2 satisfies $I_1^s = I_2^s = \frac{1}{2}$. This investment*

[13] In addition to decreasing returns to infrastructure, there are other reasons for concavity of utility. For example, if there are no alternative suppliers to the firms already operating in the country (assuming that it is costly —e.g., takes too long— to invite additional international firms), increasing investment leads to more market power of the firms, so it is inefficient to bunch most investments in the first period. Alternatively, input (materials and specialized labor) costs go up when most investment takes place in the first period, again leading to higher prices.

[14] It is straightforward to extend the model to include user fee revenue, but this would add little to the analysis in this paper.

program is feasible.

Congress wants to maximize social welfare (1) and can impose a spending cap $\bar{I}_1$.[15] The government can issue debt in period 1, constrained by (2) and the spending cap imposed by Congress. The incumbent executive has a reelection concern: if p is the probability of reelection, her payoff is

$$\mathscr{G}(I_1, I_2) = u(I_1) + p(I_1)u(I_2), \tag{4}$$

where p 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.

What is the rationale for the incumbent's objective function (4)? The probability of reelection may increase with infrastructure spending because voters are irrational and prefer investments now, before the election.[16] An alternative interpretation comes from the political economy literature. Hillman (1982), suggests that governments choose policies by balancing the political benefits of support from industry (through campaign contributions) against the dissatisfaction of consumers from inefficient investments. Higher industry profits are exchanged in return for political contributions, which raises the probability of reelection, but also increases the welfare loss and, therefore, the dissatisfaction of voters. It is straightforward to see that in a neighborhood of $I_1^s = \frac{1}{2}$ the welfare loss to consumers will be second order while the benefit for the incumbent of increased political support is first order; it follows that I_1 will be larger than I_1^s in equilibrium.

2.1.1 Conventional provision vs. public-private partnerships

There are 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

[15] 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.

[16] Cadot et al. (2006) present a model of pork-barrel infrastructure spending where future voters are not represented in the current election

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 insight and result 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.[17] 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 for increases in future subsidies, or lower the quality standards the firm must comply with. In all these cases the incumbent is transferring resources, mainly from future administrations and users, to the firm, circumventing budgetary control.

Conventional provision As mentioned above, Congress grants an authorization to the government to spend at most $I_1^s = \frac{1}{2}$. Under conventional provision, the government then procures $I_1 = \frac{1}{2}$ in a competitive auction and the construction company builds the project. At the end of period 1 the government collects taxes T_1, issues debt $D = \frac{1}{2} - T_1$, and repays the construction company (see the left panel in Figure 1 for the time-line).[18] Note that in period 1, net borrowing D equals $\frac{1}{2} - T_1$. Hence, under existing budgetary

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

[18] In practice, construction companies finance their operation mainly with short-term bank loans, which they must repay when the works are completed.

practices Congress can also impose an effective limit by capping net borrowing at $\frac{1}{2} - T_1$.

Because (3) must hold, $I_2 = 1 - I_1$. Thus, in period 2 the government procures $I_2 = \frac{1}{2}$, collects taxes T_2, pays the construction company and repays debt D. Then the game ends.

Public-private partnerships Under this contractual relationship, the infrastructure is financed, built and operated by a private firm. Congress imposes the same spending cap as in the case of conventional provision, $\bar{I}_1 = I_1^s = \frac{1}{2}$, and the government allocates the PPP in a competitive auction where firms bid for the total payment B they demand in order to finance, build and operate the infrastructure $\bar{I}_1$. The lowest bidder becomes the concessionaire, with a contract $\{B; \frac{1}{2}\}$, which entitles him to receive B at the end of period 1. The expenditure limit interpretation for the spending cap implies that $B \leq \frac{1}{2}$.[19]

According to the time-line depicted in the right panel of Figure 1, after the PPP contract is signed, but before the infrastructure is built, the incumbent renegotiates and agrees on an amount ϵ in additional works in exchange for R in additional payments to the concessionaire. Part of these payments are made in period 2. Hence, they sign the new contract $\{B + R; \frac{1}{2} + \epsilon\}$ and the concessionaire builds $\frac{1}{2} + \epsilon$ units of infrastructure in period 1, for a total payment of $B + R$.

Below, we determine the equilibrium values for B, R and ϵ. Before doing so it is instructive to discuss how a renegotiation can be used to elude the spending cap imposed by Congress. The timing of payments is important. Denoting by P_1 the amount promised to the firm in period 1 according to the renegotiated contract, as long as $B \leq P_1 \leq \frac{1}{2}$, the spending cap is met and the government's net borrowing appears to be

$$D = P_1 - T_1.$$

Nevertheless, in addition to D the government assumes a contractual commitment to pay $(B + R) - P_1$ in period 2. Hence, the government's true net borrowing in period 1 is

$$[(B + R) - P_1] + D = (B + R) - T_1.$$

In period 2 the contractual obligation appears in the budget and is binding. Hence, the amount that can be allocated to construction is $I_2 = 1 - (B + R)$. At the end of the period,

[19] The initial contract auctioned by the government could be for more than $\frac{1}{2}$, since firms may bid less than their cost in the expectation of the profits they will make after the renegotiation. We consider this possibility later in this section.

the government collects taxes of T_2, pays $1-(B+R)$ to the construction company for the second period construction, pays $(B+R)-P_1$ to the concessionaire, and repays debt D.

It might appear that direct congressional oversight of PPPs can substitute for budgetary accounting, but this does not occur. PPP contracts tend to be renegotiated by the individual agencies that signed them, as they have the expertise to evaluate the costs and benefits of the modifications. The new obligations are normally ignored by the budget office because they are registered in complex bilateral contracts that are signed when the renegotiation occurs. Even when the budget office has oversight over the negotiation process, Congress may still be ill informed about the obligations. For example, referring to a related issue, Hemming et al. (2005) point out that in many countries it is very difficult to obtain information about minimum income guarantees provided in PPP contracts, which tend to be granted by individual ministries, and not by the government budget office.

2.2 Soft budgets, renegotiations and PPPs

We now show that an incumbent can exploit PPPs to anticipate 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 Two benchmarks

The unconstrained government Assume a government constrained only by (3). Then the incumbent sets I_1 to satisfy the necessary FOC

$$\frac{d\mathcal{G}(I_1,1-I_1)}{dI_1} = u'(I_1^*) - p(I_1^*)u'(1-I_1^*) + p'(I_1^*)u(1-I_1^*) = 0, \tag{5}$$

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 in-

frastructure 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 (see Alesina and Tabellini [1990]): the incumbent tends to anticipate spending because future infrastructure spending is discounted by more than the social discount factor.

We return to the first order condition (5) with p a function of I. 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 (5) we have

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

It follows that

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

Hence $p^{\text{eq}} < p(I_1^*)$ and $I_1^* > I_1^{p^*} > I_1^s$, where $I_1^{p^*}$ denotes optimal government expenditure for a government with constant p equal to $p(I_1^*)$ and we recall that $I_1^s = \frac{1}{2}$ denotes socially optimal government expenditure.

Thus, there are two reasons why the current government wants to anticipate spending. First, the coalition may not be in office in the future: $p < 1$ acts as a discount rate that discounts 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.

Conventional provision Result 1 implies that socially optimal expenditure in period 1 equals $\frac{1}{2}$. Under conventional provision Congress implements the optimal sequence of investments by setting a spending limit $\bar{I}_1 = I_1^s = \frac{1}{2}$. Since $I_1^* > \bar{I}_1$, this spending limit is binding.

2.2.2 Implementing the incumbent's optimum with a renegotiation

Assume that Congress sets a spending cap $\bar{I}_1 = \frac{1}{2}$ and that the incumbent auctions a PPP contract for $I_1 = \frac{1}{2}$. We now show that by renegotiating the PPP contract the government can anticipate spending and implement her optimum, I_1^*.

As noted before, if the incumbent and the concessionaire agree to ϵ in additional works against R in additional revenues, the concessionaire receives $B + R$ and spends $\frac{1}{2} + \epsilon$. The incumbent, in turn, is left with $1 - (B + R)$ to spend in period 2. Hence after renegotiation her utility increases to

$$u(\tfrac{1}{2} + \epsilon) + p(\tfrac{1}{2} + \epsilon)\, u(1 - B - R). \tag{6}$$

Now note that the concessionaire receives a rent $\mathscr{R} \equiv R - \epsilon$ when renegotiating. Rational expectations on the part of potential concessionaires implies that this rent will affect bids in the auction for the PPP contract—i.e. it will stimulate lowballing. Denoting the amount that is lowballed by $\phi \equiv I_1 - B = \frac{1}{2} - B$ we have that competition in the auction implies that the firm's total profit will equal zero. That is, competition eliminates rents and, therefore, the concessionaire's lowballing equals her expected gain in the renegotiation.

Result 2 *$B + R = I_1 + \epsilon = \frac{1}{2} + \epsilon$ and $\phi = \mathscr{R}$.*

Below, we show that the firm will renegotiate in order to circumvent the spending limit imposed by Congress, and in this way achieve its optimum. The main idea is as follows. The firm lowballs during the auction, in the expectation of recovering the deficit during the renegotiation stage. If the firm lowballs by too much, the maximum rent it can obtain in the renegotiation stage is insufficient for it to break even. By contrast, if the firm lowballs by too little, the government is willing to pay a large premium (larger than the amount lowballed) in order to have additional infrastructure. In turn, this excess in renegotiation rents attract more aggressive bids on the auction. In equilibrium, the firm lowballs in the auction by the exact amount it will obtain in renegotiation rents.

The interesting question is what enables the government to attain its bliss point. This is due to two facts: competition in the initial stage eliminates ex post rents, plus the assumption that bargaining is efficient. This last condition implies that, thanks to the renegotiation, the government's desired first period investment I_1^* is part of the bargaining frontier, and since the firm gets nothing overall, the government can achieve its desired first period investment.

To provide formal derivations, it is instructive to consider first the cases where one of the parties has all the bargaining power.

The firm has all the bargaining power

In this case, the firm maximizes its profits subject to maintaining the utility of the government at the level it would obtain if no renegotiation takes place. It therefore solves:

$$\max_{\epsilon,R} \quad R-\epsilon \tag{7}$$

$$\text{s.t.} \qquad u(\tfrac{1}{2}+\epsilon)+p(\tfrac{1}{2}+\epsilon)u(\tfrac{1}{2}+\phi-R)=u(\tfrac{1}{2})+p(\tfrac{1}{2})u(\tfrac{1}{2}+\phi). \tag{8}$$

Note that the renegotiation allows the incumbent to achieve a debt-like intertemporal transfer. Current infrastructure spending rises by ϵ, at the cost of R.

The first order conditions for the problem stated above and some straightforward algebra lead to the following condition for the additional infrastructure contracted during the renegotiation stage, ϵ^*:

$$u'(\tfrac{1}{2}+\epsilon^*)+p'(\tfrac{1}{2}+\epsilon^*)u(\tfrac{1}{2}+\phi-R)-p(\tfrac{1}{2}+\epsilon^*)u'(\tfrac{1}{2}+\phi-R)=0.$$

Rational lowballing on the part of the firm (Result 2) implies that $R=\phi+\epsilon^*$, so that

$$u'(\tfrac{1}{2}+\epsilon^*)+p'(\tfrac{1}{2}+\epsilon^*)u(\tfrac{1}{2}-\epsilon^*)-p(\tfrac{1}{2}+\epsilon^*)u'(\tfrac{1}{2}-\epsilon^*)=0.$$

This condition is equivalent to condition (5) that determines the government's optimal investment schedule. Therefore the government will contract for additional works to the amount $\epsilon^*=I_1^*-\frac{1}{2}$ during the renegotiation. We also have that the equilibrium amount of lowballing during the auction for I_1, ϕ^*, satisfies:

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

The firm lowballs by ϕ^* during the auction for $I_1=\frac{1}{2}$, anticipating that it will make ex

post rents equal to ϕ^* when it renegotiates the contract.

The government has all the bargaining power

In this case the government pays the firm at cost (i.e., without any rents) for any additional infrastructure contracted during the renegotiation, and therefore chooses ϵ to maximize:

$$u(\tfrac{1}{2}+\epsilon)+p(\tfrac{1}{2}+\epsilon)u(\tfrac{1}{2}+\phi-\epsilon),$$

where $\phi=\frac{1}{2}-B$ denotes the amount lowballed during the auction.

The optimal level of infrastructure contracted during renegotiation, ϵ^*, then satisfies

$$u'(\tfrac{1}{2}+\epsilon^*)+p'(\tfrac{1}{2}+\epsilon^*)u(\tfrac{1}{2}+\phi-\epsilon^*)-p(\tfrac{1}{2}+\epsilon^*)u'(\tfrac{1}{2}+\epsilon^*)=0. \tag{9}$$

From the zero profit condition (Result 2) we have that $\phi=0$ in (9). Comparing with (5) then shows that the government contracts $\epsilon^*=I_1^*-\frac{1}{2}$ during the renegotiation, thereby implementing its optimum.

The intuition is the following: when making its bid to build $I_1=\frac{1}{2}$, the firm is aware that it will have no bargaining power when renegotiating the contract, and therefore will not obtain rents that could allow it to recover from any lowballing. For this reason, it does not lowball and bids $B=\frac{1}{2}$. It follows that $\phi=0$.

General case

When considering the general case, where both the government and the firm 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 firm and government measure their utility in different units, and we present it in the appendix. Here we state the result.

Result 3 *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 ϕ^* that solves*

$$u(I_1^*)+p(I_1^*)u(1-I_1^*)=p(\tfrac{1}{2})+p(\tfrac{1}{2})u(\tfrac{1}{2}+\tfrac{\phi^*}{\alpha}), \tag{10}$$

where $\alpha\in[0,1]$ denotes the firm's share of surplus. It follows that ϕ^* is increasing in α with $\phi^*(0)=0$. 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 lowballing in the auction.

Proof See the Appendix. ∎

Note that the split 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 make rents overall, as any ex post rent is a remuneration for ex ante lowballing. This has an interesting implication: suppose Congress makes it a law that additional works must be awarded after a competitive auction that forces a competitive price ϵ^* for these additional works. This procedure does not prevent spending anticipation: 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 government during the renegotiation. Nevertheless, as shown above, the government can attain its optimum nonetheless, 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 $B = \frac{1}{2} - \phi^*$, at a net loss of ϕ^* for the firm, while the amount paid by the government in the renegotiation equals $\phi^* + \epsilon^*$, for infrastructure that is worth ϵ^*. 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 brought about endogenously, by initial 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 an effective means of anticipating 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.[20] The future administration has $\frac{1}{2} - \epsilon^*$ to spend in period 2 instead of the social optimal $\frac{1}{2}$.

We note that we assumed the infrastructure auctioned initially equals the spending limit imposed by Congress: $I_1 = \frac{1}{2}$. This is one of many auctions that lead, after renegoti-

[20] Observe the difference between this prediction and having additional spending by emitting bonds or borrowing in the market: in the case of PPPs, the lender is the firm and there is no clear supervision of the additional spending.

ation, 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 $\frac{1}{2}$.[21]

2.2.3 A suggested solution

Spending anticipation 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 in 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 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. The constraint limits the spending by the government (i.e., it sets I_1 to the optimal social value I_1^s) and implies that the incumbent must renegotiate the original contract in order to increase spending to $I_1^* > I_1^s$.

Nevertheless, 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.[22]

[21] Result 3 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 $\phi^*(I_1)$ in a manner analogous to what we did for $I_1 = \frac{1}{2}$, we have that as long as $I_1 - \phi^*(I_1) \leq \frac{1}{2}$ the spending limit for period 1 won't be exceeded and the renegotiation achieves the incumbent's optimum. The resulting function $\phi^*(I_1)$ 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.

[22] Engel et al. (2007) study the public finance of PPPs in a model where incentives play no role, and show that optimal budgetary accounting of PPPs requires that they appear as a deficit item upfront, indepen-

Including privately-financed assets in the public sector's balance sheet has been already proposed by Donaghue (2002, p. 9). Donaghue shows, however, that the conventional approach has been to classify assets as owned by the concessionaire during the term of the concession. One 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.[23]

2.3 Accounting of PPPs by government entities

According to Hemming et al. (2005), there is a hierarchy of government accounting standards. At the highest level there is the International Public Sector Accounting Standard (IPSAS). When there is no rule in the IPSAS covering an issue, government entities should comply with the International Financing Reporting Standards (IFRS) under the interpretation of the International Accounting Standards (IAS). The big issue concerning PPPs is how to incorporate them into the government accounts. Eurostat (2004) has made recommendations based on who bears the construction, availability and demand risks. If the private partner bears at least two of these three sources of risk, including among them the construction risk, Eurostat recommends that assets built by PPPs be classified as nongovernmental and therefore recorded off the balance sheet. This does not account for the fact that PPP contracts are assumed to assign risks to the party that can best manage them.

2.3.1 Revenue guarantees

Many PPP contracts include minimum revenue guarantees, i.e., a promise that the government will pay the difference between the user fee revenue generated by the project and a predetermined revenue flow. Accounting for revenue guarantees has proven difficult, and while there is a literature on the topic, there is no consensus on how to incorporate them into the public accounts.[24] Here we argue that guarantees can also be used to elude spending limits.

In Engel et al. (2007) we show that revenue guarantees correspond to (contingent) subsidies for the concessionaires. In addition to these issues, in many countries guarantees are poorly documented, as we have already mentioned. Moreover, since guarantees depend on the state of demand for the project, there is no consensus on how to deal

dent of whether the source of payments is the public budget or revenues generated by the project.

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

[24] See, for example, Hemming et al. (2005), Irwin (2007).

with the associated risk. Most importantly, as Hemming (2005, p. 40) notes, under current accounting standards for government entities, many future obligations will remain hidden. For example, under cash accounting for government entities, guarantees are apparent only when they are paid, in which case they appear as current expenditure. And under accrual accounting for government entities, a guarantee is recorded as a liability only if the government considers that the probability of making a payment is higher than 0.5 and can make a reasonable estimate of the amount to be paid. In that case the liability is formally recognized by creating a provision, but this is a financial management decision that is not covered by the IMF's Government Finance Statistics Manual.[25] Therefore, unless the government makes a provision and sets funds aside, guarantees are recorded only when they are called.

2.3.2 Guarantees and spending caps

The previous analysis shows that a guarantee G is equivalent to additional revenue for the concessionaire, which, if callable in period 2, can be used to elude the spending cap in period 1. Two implications follow. First, in terms of anticipating spending, revenue guarantees and renegotiations are almost perfect substitutes. It follows that reducing the scope of renegotiation may induce the government to offer larger guarantees so as to continue spending more than the cap, and conversely, that better accounting for guarantees will stimulate renegotiation. Second, the solution to avoid that guarantees be used to overspend is the same as the solution to the renegotiation problem discussed above: force the government to include as current spending all expenditures, both current and future, associated with PPP investment. Thus, in general, for budgetary accounting purposes, infrastructure investment under PPPs should be treated in the same way as investments under the conventional approach.

3 Evidence from the Chilean PPP program

3.1 Concession program

As mentioned in the Introduction, 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

[25] The *Government Finance Statistics Manual* (GFSM, see IMF, 2001) "integrates flows and stocks and shifts the emphasis toward accrual reporting and balance sheets", Hemming et al. (2005).

its Spanish acronym) and the quality of fiscal accounting can be described at par with average OECD levels.

Chilean PPPs were launched in 1993 with the El Melón tunnel concession. As shown in Table 1, 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. As shown in Table 2, however, roads are the main component of the PPP program, as they account for 89% of the $11.3 billion invested (column 6).[26,27]

3.2 Renegotiations

By 2007, there had been 148 renegotiations of PPP contracts, and therefore each concession had been renegotiated three times on average. Renegotiations led to an increase of $2.8 billion, or nearly one-third, in total investment, from $8.5 billion to $11.3 billion. As can be seen from Figure 2, however, there is substantial variation among different types of infrastructure. On average, the largest increases correspond to urban highways and to jails, with average increments of more than 50%.

The following two examples illustrate how the government has used renegotiations to circumvent Congressional approval for increased expenditures.

The rainwater collectors In 2001 there was flooding in Santiago, which led to political pressures on the government to invest in main collectors that would drain the rain waters from flood-prone areas. Since the government was unwilling to obtain the necessary resources from the budget or through increased indebtedness, it decided to renegotiate the contracts of the urban highways scheduled for construction so that they would build the drains. The sums involved were hundreds of millions of dollars and required changes to the contracts of three urban concessions during the construction phase. The initial 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 to the port that bypassed the city. There were three options

[26] Chile's GDP is currently about $160 billion, and at the time of completion of the main projects, these represented about 10% of GDP.

[27] A detailed description of the data base can be found in Engel et al. (2009).

to finance the project: i) to fund it with fiscal resources, ii) through an independent self-financed tolled concession or iii) as a non-tolled extension to the Route 78, 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. It is not clear whether the expected revenue from increased tolls corresponds to the value of the project.

3.3 How and what is renegotiated?

The Chilean concessions law allows for two possible channels to renegotiate concession contracts. In a *bilateral renegotiation* either MOP or the concessionaire can initiate the process and bargain until they reach an acceptable agreement. The agreement is then formalized via a publicly available annex to the original contract, which describes the aspects that were renegotiated, values additional investments, indicates the timing of additional payments and states the sources of funds that will be used to pay the amounts that were renegotiated.

Contracts can also be modified by the concessionaire appealing to a panel. These appeals usually occur if the government and the concessionaire cannot reach an agreement during the bilateral renegotiation. There is one panel per PPP, each with three members, one designated by MOP, another by the concessionaire and the third, who must be a lawyer, named by mutual agreement. In a first stage the panel attempts to conciliate the positions of both parties. If the conciliation stage fails, the panel arbitrates between the positions.[28] There are no appeals to the panel's decisions, except for procedural issues. Under the current Chilean concessions law, the government cannot present a dispute with the concessionaire to the panel.

Bilateral renegotiations are reviewed by other government agencies, in particular the Finance Ministry, but are not subject to independent review. By contrast, renegotiations before a panel are subject to the examination of outsiders (even though they are chosen by MOP and the concessionaire).

More detailed information is available for bilateral renegotiations than for renegotiations before a panel. In particular, a break up of the amount renegotiated into how much goes to pay for existing infrastructure and how much for additions is only available for

[28] Formally, the panels operate as conciliation panels in the first stage and as arbitration panels in the second stage of the process.

bilateral renegotiations.

As can be seen in Figure 3, there were 78 (out of 148) bilateral renegotiations, while the rest were appeals to the panel. Hence, bilateral renegotiations represent little more than 50% of all processes. Nevertheless, 83% of the renegotiated amounts, corresponding to $2.3 billion, were awarded in bilateral renegotiations. Of this amount, 84%, or $1.96 billion, were designated as additional investments, with the remaining $360 million, were designated as additional payments for originally contracted works.[29] According to the records, 66 of the 78 bilateral renegotiations were initiated by MOP.[30]

3.4 When do renegotiations occur?

As we pointed out in the Introduction, industry participants often defend renegotiations by arguing that PPPs are long-term, incomplete contracts, and that conditions change over the life of the concession. For example, traffic on a road may grow faster than expected, and this could warrant building additional lanes of a highway before the end of the concession. In contrast, in our model renegotiations occur during construction.

Figure 4 shows that 51 of 78 bilateral renegotiations, corresponding to 78% of the total amount renegotiated, took place during construction, which is evidence against the interpretation of renegotiations as the response to long-term, incomplete contracts. By contrast, less than half of the $490 million awarded by arbitration panels occurred during construction. Evidently, our data is censored, because most concessions have not completed their term. Nevertheless, the point is that renegotiations during construction are significant, a fact that is hard to rationalize under the long term incomplete contracts interpretation of renegotiation, whereas it is predicted by the model presented in this paper.

3.5 The timing of compensations

Our analysis implies that future administrations bear the cost of renegotiations by incumbents. Figure 5 shows that only 35% of the $2.3 billion that were awarded through bilateral renegotiations was paid by the incumbent administration. Most of the remaining amount will be borne by future administrations, and a final fraction by users, via higher tolls and contract extension.

[29] We were unable to determine the division into these two components in the case of arbitrations, given the available information.

[30] Industry insiders suggest that it is politically more acceptable if it looks as if MOP rather than the concessionaire starts the renegotiation process.

It is interesting to contrast bilateral renegotiations with arbitration panels. In that case, 61% of the awards were paid by the administration involved in the dispute.

3.6 Renegotiation caps

When a concession is auctioned in Chile, firms must submit an estimate of the cost of the project as part of their bid. The current Chilean concessions law states that additional investments added during the term of the concession cannot exceed 15% of this estimate, unless the concession contract specifies it explicitly. Of the 50 concession contracts, 39 established ad-hoc caps. During construction the caps range from 5% to 15%, and from 10% to 30% for the whole term of the concession. This is an attempt to limit renegotiations; it is interesting to examine the effectiveness of caps.

Table 3 shows data for those concession contracts that exceeded their cap. In each case, we compute the dollar value of the limit on renegotiations, and then compare the total limit over all the concessions with the total amount effectively renegotiated.

Column 1 indicates that 16 concessions exceeded their caps during construction, and 11 had exceeded their overall renegotiation caps by 2007. During construction, aggregate caps were $367 million; but renegotiations were $1.6 billion, i.e., 4.3 times the predefined limit. During the term of the concession total caps added up to $483 million; while the amounts renegotiated were $1.6 billion. We conclude that caps are ineffective tools to limit renegotiation.

3.7 Taking Stock

Combining bilateral and panel renegotiations, we have that 73% of the total amount was renegotiated shortly after the concession was auctioned, that is during the construction phase. This is consistent with the prediction of our model and inconsistent with the interpretation of renegotiations as the response to long-term, incomplete contracts. Furthermore, only 40% of the $2.8 billion that were awarded through renegotiations was paid by the incumbent administration, suggesting that renegotiations help governments increase expenditures by circumventing budgetary controls.

For those renegotiations where data is available, 84% of the sums contracted were designated as additional investments, with the remaining 16% designated as additional payments for works included in the original contract. This is consistent with lowballing by firms in the original auction, as suggested by our model.

Finally, it is noteworthy that the predictions of our model hold to a larger extent for

bilateral renegotiations than for panel renegotiations. We do not have information to account for the endogeneity of the choice of renegotiation and therefore leave possible explanations for this finding for future research.

4 Conclusions

We have shown that, from the point of view of incumbent governments, PPPs have the advantage of allowing them to exceed spending limits. This is because poor accounting standards allow governments to use renegotiations to increase spending without oversight. This feature of renegotiations leads to observable predictions, namely that (i) in a competitive market, firms lowball their offers, expecting to break even through renegotiation, (ii) renegotiations compensate lowballing and add additional expenditure, (iii) the government uses renegotiation to increase spending and shift the burden of payments to future administrations, (iv) there are significant renegotiations during construction. We use data on Chilean renegotiations of concessions to examine these predictions and find that the data are consistent with the results of our model.

We also show that a simple change to fiscal accounting could eliminate this problem, namely by including PPP investment, including renegotiations, as current expenditure. On the other hand, the data show that alternatives, such as contractual limits, are ineffective in that role.

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APPENDIX

Proof of Result 3.

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

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

$$\mathscr{S}(\epsilon, R; \phi) \equiv u(\tfrac{1}{2} + \epsilon) + p(\tfrac{1}{2} + \epsilon)\, u(\tfrac{1}{2} + \phi - R) - u(\tfrac{1}{2}) - p(\tfrac{1}{2})\, u(\tfrac{1}{2} + \phi).$$

The second period monetary equivalent of this gain, $M_2(\epsilon, R)$, is defined via:[31]

$$\mathscr{S}(\epsilon, R; \phi) = u(\tfrac{1}{2}) + p(\tfrac{1}{2})\, u(\tfrac{1}{2} + \phi + M_2) - u(\tfrac{1}{2}) - p(\tfrac{1}{2})\, u(\tfrac{1}{2} + \phi),$$

which leads to

$$u(\tfrac{1}{2} + \epsilon) - u(\tfrac{1}{2}) = p(\tfrac{1}{2})\, u(\tfrac{1}{2} + \phi + M_2) - p(\tfrac{1}{2} + \epsilon)\, u(\tfrac{1}{2} + \phi - R). \tag{11}$$

Implicit differentiation w.r.t. ϵ and R implies:

$$\begin{aligned} u'(\tfrac{1}{2} + \epsilon) &= p(\tfrac{1}{2})\, u'(\tfrac{1}{2} + \phi + M_2) \tfrac{\partial M_2}{\partial \epsilon} - p'(\tfrac{1}{2} + \epsilon)\, u(\tfrac{1}{2} + \phi - R), & (12) \\ 0 &= p(\tfrac{1}{2})\, u'(\tfrac{1}{2} + \phi + M_2) \tfrac{\partial M_2}{\partial R} + p(\tfrac{1}{2} + \epsilon)\, u'(\tfrac{1}{2} + \phi - R). & (13) \end{aligned}$$

Total surplus to be split during renegotiation equals:

$$[R - \epsilon] + M_2(\epsilon, R; \phi), \tag{14}$$

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. ϵ and R leads to the FOC:

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

Substituting these expressions in (12) y (13) and adding both expressions yields:

$$u'(\tfrac{1}{2} + \epsilon) + p'(\tfrac{1}{2} + \epsilon)\, u(\tfrac{1}{2} + \phi - R) - p(\tfrac{1}{2} + \epsilon)\, u'(\tfrac{1}{2} + \phi - R) = 0. \tag{15}$$

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

Imposing the zero profit condition we have $R = \phi + \epsilon$. Substituting this expression for R in (15) and comparing with (5) shows that the equilibrium value for infrastructure contracted during the renegotiation, ϵ^*, satisfies $\epsilon^* = I_1^* - \frac{1}{2}$. The government therefore attains its optimum.

We complete the proof by deriving (10). If the firm's surplus share is α, then

$$\phi^* = R - \epsilon^* = \alpha[R - \epsilon^* + M_2(\epsilon^*, R; \phi)] = \alpha[\phi^* + M_2(\epsilon^*, \phi^* + \epsilon^*; \phi^*)],$$

where the first and third equalities follow from Result 2. Therefore

$$\phi^* = \alpha[\phi^* + M_2^*], \tag{16}$$

with $M_2^* \equiv M_2^*(\epsilon^*, \phi^* + \epsilon^*; \phi^*)$. It follows from (11) that $\phi^* + M_2^*$ is determined from:

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

Using (16) to substitute ϕ^*/α for $\phi^* + M_2^*$ leads to (10) and completes the proof. ∎

Table 1
Chilean PPPs, 1993-2006[1]

Highways

Pan American Highway (Route 5)

1. Los Vilos-La Serena [1997, 25] [3, 0]
2. Santiago-Los Vilos [1996, 23] [3, 7]
3. Santiago-Talca [1998, 25] [5, 10]
4. Talca-Chillán [1996, 19] [5, 3]
5. Chillán-Collipulli [1997, 23] [3, 0]
6. Collipulli-Temuco [1998, 25] [4, 1]
7. Temuco-Río Bueno [1997, 25] [3, 1]
8. Río Bueno- Puerto Montt [1997, 25] [2, 2]

Interurban highways

9. Acceso Nor Oriente a Santiago [2003, 40] [0, 0]
10. Acceso Norte a Concepción [1995, 28] [0, 3]
11. Acceso aeropuerto AMB, Santiago [1996, 12] [1, 2]
12. Autopista Santiago-San Antonio [1995, 23] [4, 4]
13. Camino de la Madera [1994, 25] [1, 1]
14. Camino internacional Ruta 60 Ch. [2002, 32] [2, 1]
15. Santiago-Colina-Los Andes [1996, 28] [3, 2]
16. Nogales –Puchuncaví [1995, 22] [1, 2]
17. Santiago-Valparaíso-Viña [1998, 25] [6, 3]
18. Red vial Litoral Central [2000, 30] [1, 2]
19. Ruta interportuaria Talcahuano-Penco [2002, 42] [2, 1]
20. Túnel El Melón [1993, 23] [0, 3]
21. Variante Melipilla [2001, 30] [1, 1]

Urban highways

22. Vespucio-El Salto-Kennedy [2004, 30] [1, 0]
23. Américo Vespucio Nor Poniente [2002, 30] [2, 0]
24. Américo Vespucio Sur [2001, 38] [2, 0]
25. Sistema Norte-Sur [2000, 30] [4, 0]
26. Sistema Oriente-Poniente [2000, 30] [5, 0]

Other concessions

Airports

27. Arturo Merino Benítez, (Santiago) [1997, 15] [2, 9]
28. Carlos Ibáñez del Campo (Punta Arenas) [2000, 9] [1, 0]
29. Carriel Sur (Concepción) [1999, 16] [0, 1]
30. Cerro Moreno (Antofagasta) [1999, 10] [1, 1]
31. Chacalluta (Arica) [2004, 15] [1, 0]
32. Diego Aracena (Iquique) [1995, 12] [1, 0]
33. El Loa (Calama) [1997, 12] [1, 0]
34. El Tepual (Puerto Montt) [1995, 12] [2, 0]
35. La Florida (La Serena) [1998, 10] [0, 1]
36. Regional (Copiapó) [2002, 20] [0, 0]

Jails

37. Grupo 1 (Iquique-La Serena-Rancagua) [2002, 23] [0,2]
38. Grupo 2 (Concepción-Antofagasta)[2] [2002, 22] [0, 1]
39. Grupo 3 (Santiago1-Valdivia- Puerto Montt) [2004, 23] [1, 1]

Water reservoirss

40. Convento Viejo [2005, 25] [2, 0]
41. El Bato de Illapel[2] [2001, 30] [0, 3]

Urban public transportation

42. Conexión vial Suiza-Las Rejas [2005, 5] [1, 0]
43. Corredor Av. Santa Rosa [2006, 14] [0, 0]
44. Estación de intercambio La Cisterna [2004, 22] [0, 1]
45. Estación de intercambio Quinta Normal[2] [2004, 24] [1, 1]
46. Estaciones de trasbordo [2006, 15] [0, 0]

Others

47. Centro de Justicia de Santiago [2004, 23] [0, 0]
48. Estadio techado Parque O´Higgins [2004, 20] [1, 0]
49. Plaza de la Ciudadanía [2004, 30] [1, 0]
50. Landport (Los Andes) [2004, 20] [0, 0]

Notes: (1) In brackets: [*year of the original concession contract, term (years)*] [*number of bilateral renegotiations, number of conciliations and arbitrations*]. (2) The project was cancelled.

Table 2
Investment and renegotiations in Chilean PPPs
(in $ millions)

	(1) Number of projects & renegotiations[1]	(2) Average term (years)	(3) Original investment estimate[3]	(4) Renegotiated amounts[4]	(5) Total investment	(6) Share of total
Pan American Highway	8/28/24[2]	23.8	2,875.43	843.46	3,718.89	0.33
Interurban	13/22/25	26.9	2,118.06	425.63	2,543.68	0.23
Urban	5/12/0	31.6	2,420.86	1,331.56	3,752.42	0.33
Highways	**26/62/49**	**26.9**	7,414.35	2,600.64	10,014.99	**0.89**
Airports	10/9/12	13.2	383.94	48.08	432.02	0.04
Jails	3/1/4	22.5	221.40	113.41	334.82	0.03
Water reservoirs	2/2/3	27.5	120.00	24.45	144.45	0.01
Public transport	5/2/2	14.7	156.81	25.82	182.64	0.02
Others	4/2/0	23.2	168.72	0.97	169.69	0.02
Other concessions	**24/16/21**	**17.5**	1,050.87	212.73	1,263.61	**0.11**
Total or average	**50/78/70**	**22.4**	8,465.22	2,813.38	11,278.59	**1**

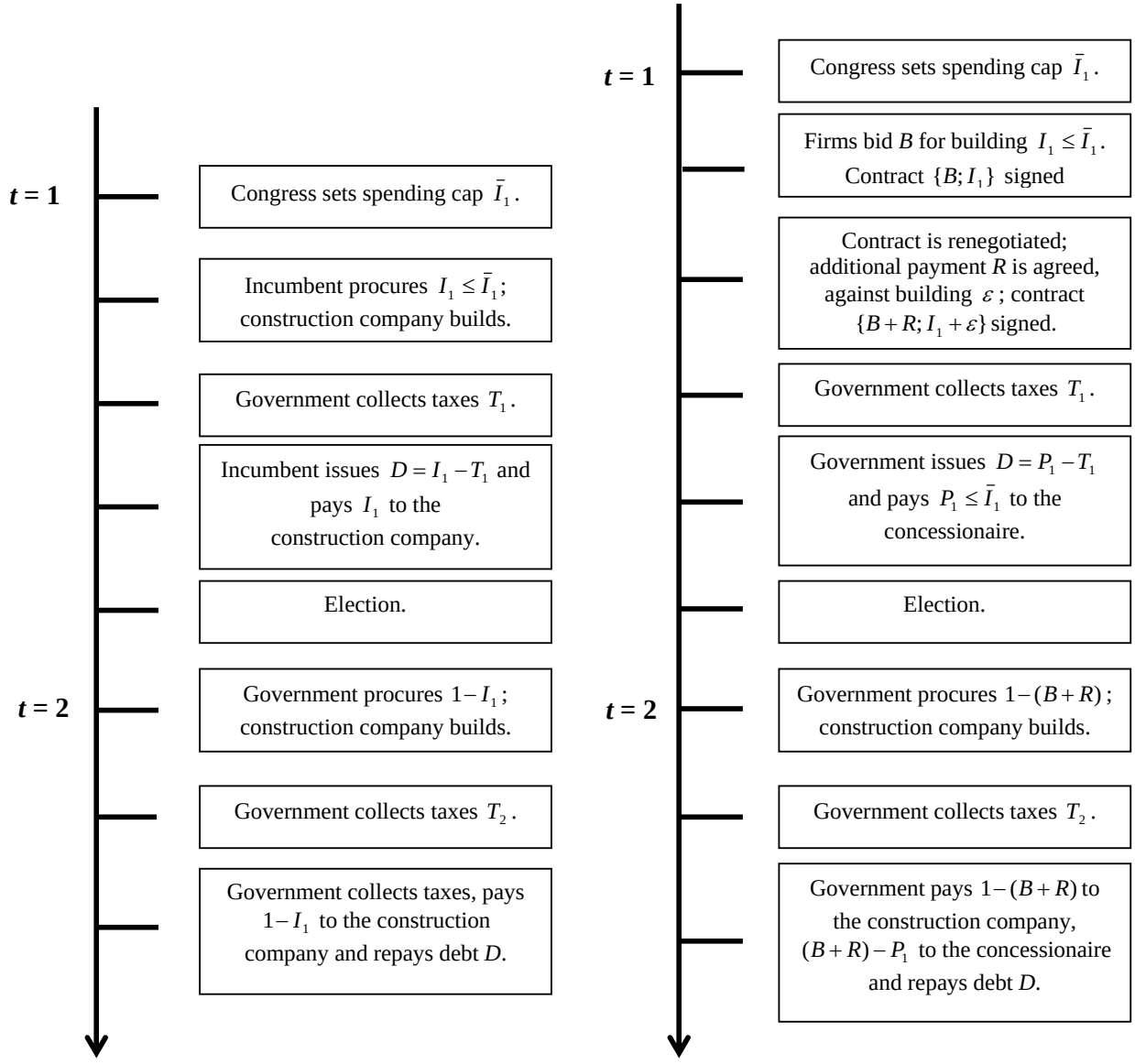
Notes: (1) Includes cancelled projects. (2) Projects/bilateral renegotiations/arbitration panel. (3) Excludes cancelled projects. (4) Includes the amounts which were paid to cancel three concessions.

Table 3
Renegotiation caps and bilateral renegotiations
(in $ millions)

	(1) Concessions that exceed the investment limit		(2) Allowed increase in investment[1]		(3) Actual increase[2]		(4) = (3a)/(2a)	(5) = (3b)/(2b)
	(a) During construction	(b) During the concession	(a) During construction	(b) During the concession	(a) During construction	(b) During the concession		
Pan American Highway	4	3	80.07	158.65	396.99	396.55	4.96	2.50
Interurban	5	2	69.90	34.81	163.36	45.33	2.34	1.30
Urban	5	5	190.49	285.74	980.52	1,132.41	5.15	3.96
Highways	**14**	**10**	**340.47**	**479.20**	**1,540.87**	**1,574.29**	**4.53**	**3.29**
Airports	1	1	18.40	3.93	20.19	4.88	1.10	1.24
Jails	0	0	0.00	0.00	0.00	0.00	-	-
Water reservoirs	1	0	8.40	0.00	10.29	0.00	1.23	-
Public transport	0	0	0.00	0.00	0.00	0.00	-	-
Others	0	0	0.00	0.00	0.00	0.00	-	-
Other concessions	**2**	**1**	**26.80**	**3.93**	**30.48**	**4.88**	**1.1**	**1.24**
Total	**16**	**11**	**367.27**	**483.13**	**1,571.35**	**1,579.18**	**4.3**	**3.3**

Notes: (1) We only count those concessions that surpassed investment caps. (2) Includes only those amounts added in bilateral renegotiations which add investments not included in the original contract.

Figure 1
Timing of the infrastructure process



(a) Conventional provision

(b) PPP provision

Figure 2
Increases in investment as a percentage of the original estimate

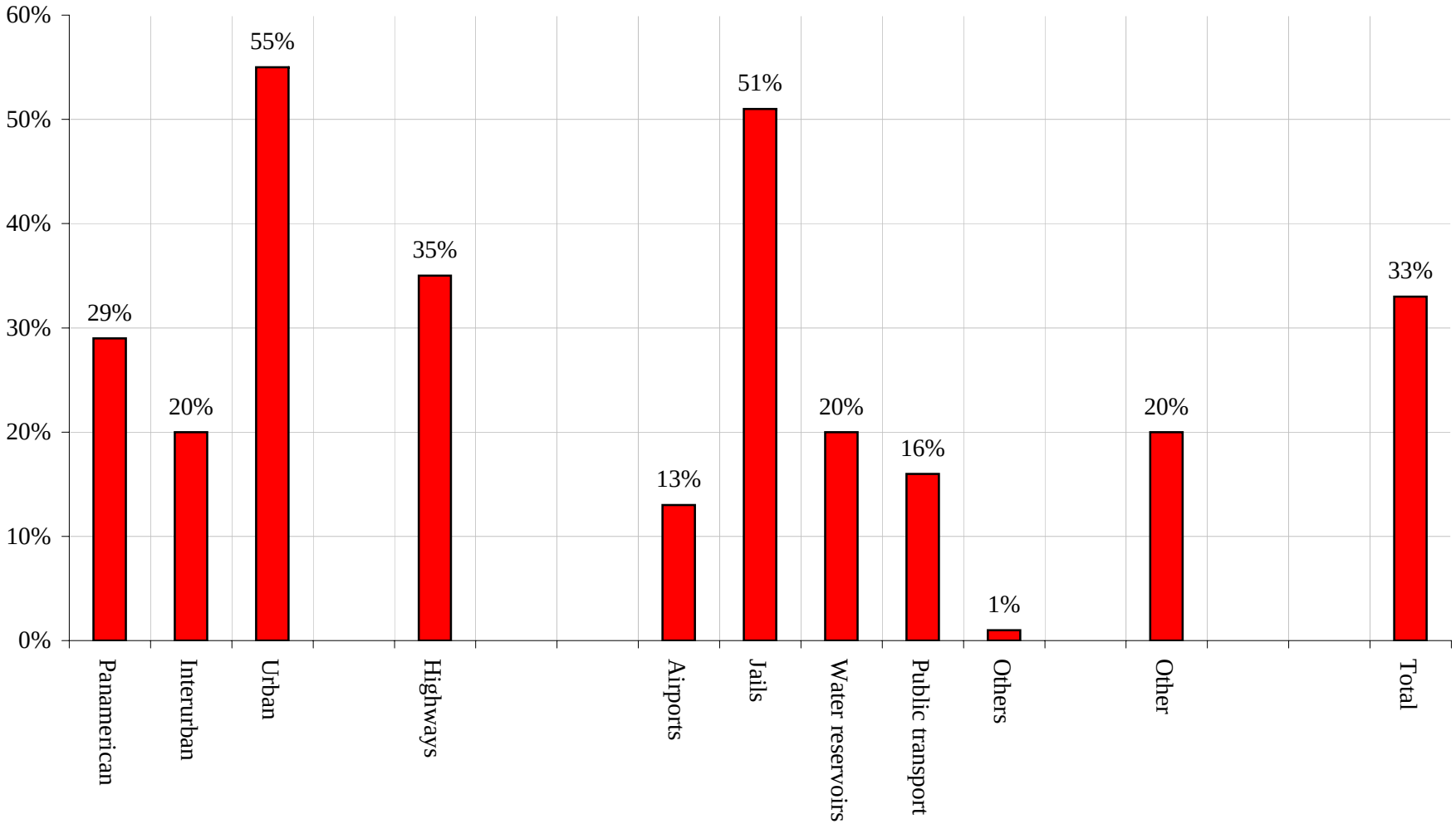


Figure 3
How and what is renegotiated

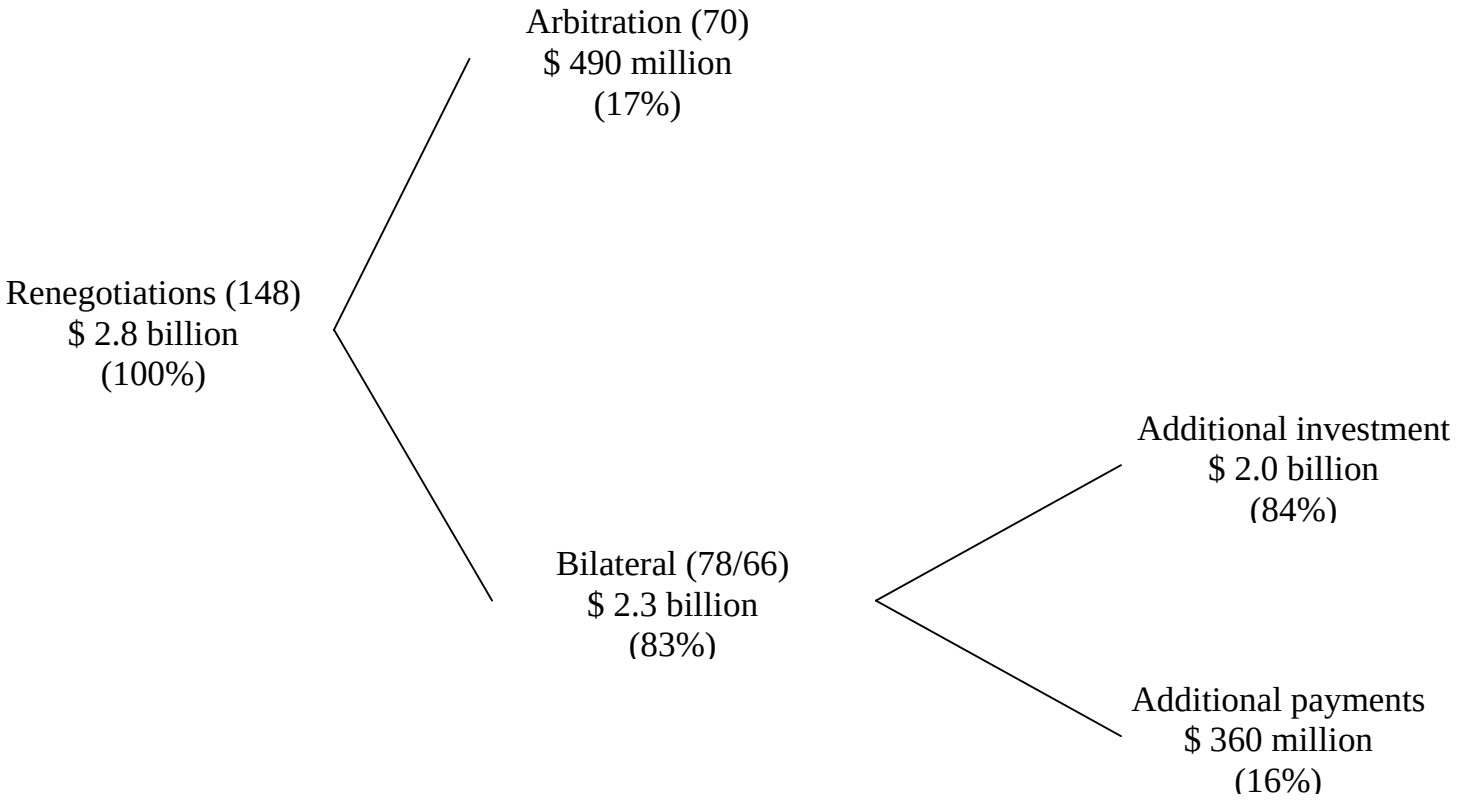


Figure 4
When are PPPs renegotiated?

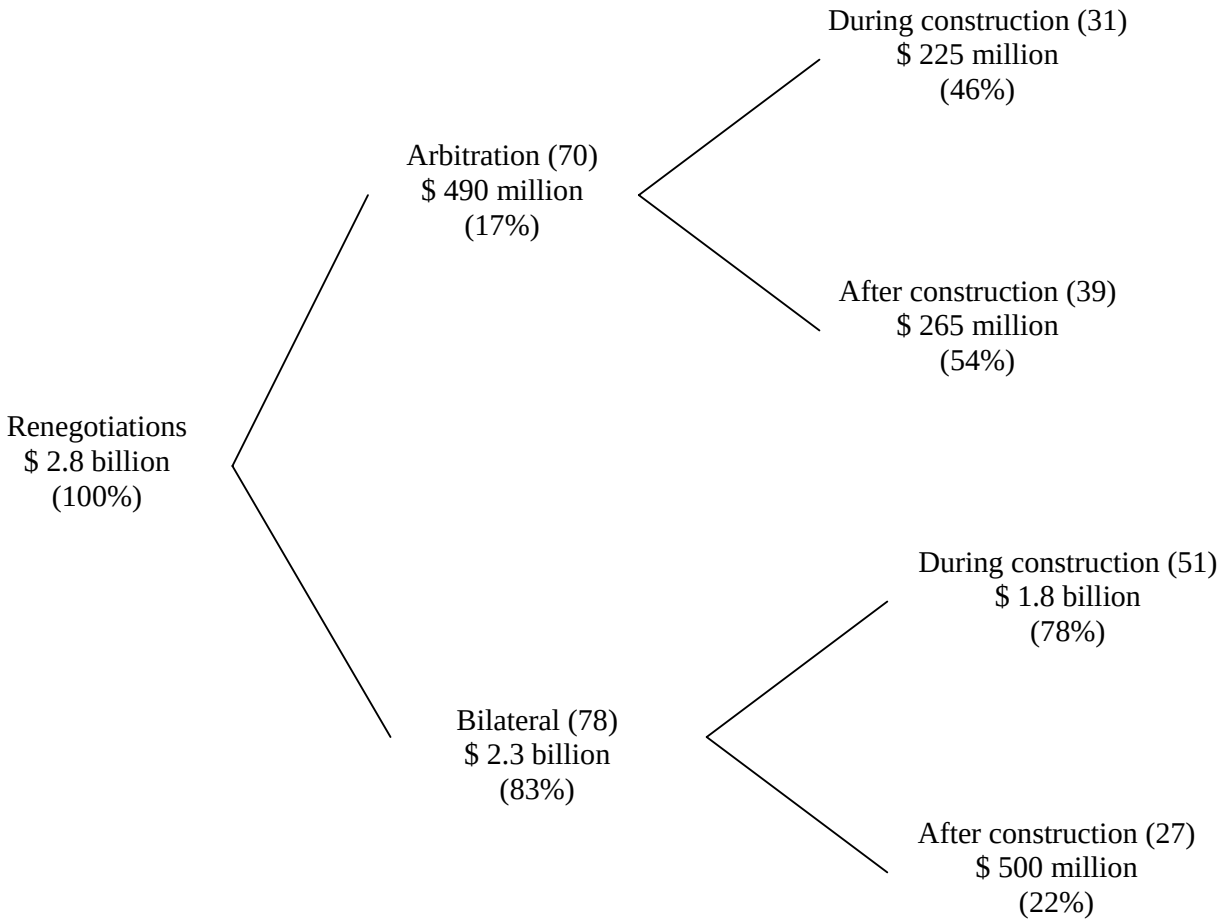


Figure 5
Who pays when PPPs are renegotiated?