Winners and Losers in Toll Motorway Renegotiations

An empirical evaluation of the Spanish pioneers

Daniel Albalate & Paula Bel-Piñana*

Universitat de Barcelona

(GIM-IREA)

Universitat de Barcelona, Departament de Política Econòmica i Estructura Econòmica Mundial. Av. Diagonal 690, 08034 Barcelona, Spain
E-mail addresses: paulabel@ub.edu (P. Bel-Piñana), albalate@ub.edu (D. Albalate).

*Corresponding author: Paula Bel

ABSTRACT

This paper measures the impact on welfare of a toll motorway concession renegotiation agreed in the late 90s in Spain involving one of the pioneer private toll motorways in Europe (AP-7). By comparing the renegotiation – based on toll reductions of 30.37% on the Tarragona-Valencia section and 27.92% on the Valencia-Alicante section and a 13-year extension of the contract – with a simulated counterfactual, we are able to measure the welfare change to road users, the private concessionaire and the government. Our results indicate that road users were the main losers in this policy (12.74% welfare loss), while the actors involved in the negotiation – government and private concessionaire – benefited from the renegotiation. In fact, we estimate that the reduction in tolls would have had to have been in the order of 65% to leave road users, private concessionaire and social welfare indifferent. The agreement signed between the government and the private concessionaire is not a Pareto-optimal solution, although myopic road users might consider the reduction in tolls linked to the extension of the contract a benefit. We show that in the long term road users suffer if the toll reduction does not reach a minimum of 65%.

KEY WORDS: Concessions, Renegotiations, Motorways, Tolls.

JEL CODES: H43, L91.

1. INTRODUCTION

Financial and budget constraints are leading many governments to seek funding for strategic projects in the field of transportation infrastructure in the private sector. In recent decades, the presence of private interests in various joint undertakings with the public sector has increased throughout the world. Under such agreements, private partners have been involved in the design, construction, management and funding of many transportation projects. The growth of such public-private partnerships (PPPs) in this area is today, therefore, well documented but their presence is particularly notable in the toll road sector, above all in Latin America, Southern Europe and recently in the United States.[1]

The standard model for contracting and working with the private sector in infrastructure projects has been given the name of BOT (i.e., build, operate and transfer) and is characterized by a contract in which the State awards the project through a competitive auction (or bilateral negotiation) to a private company. The concessionaire then finances and builds the infrastructure and, subsequently, operates it for a stipulated time period charging fees to users. Once the concession ends, operation is transferred to the State. In this way, construction and operational risks under a BOT contract are transferred to the private partner or shared through the use of public guarantees (Kerf et al., 1998). However, recent experience shows that this model generates frequent renegotiations, in particular in the transportation sector, due above all to construction and demand risks and the traditional awarding mechanism based on fixed contract duration (Guasch, 2004; Guasch et al., 2008; and Engel et al., 2009a, 2009b).

Indeed, based on an analysis of over a thousand concession contracts in Latin America, Guasch (2004) reports that 30% of them were renegotiated, 54.4% of these being in the transport sector (roads, ports, tunnels and airports). Similarly, Engel et al. (2009) analyzed fifty concession contracts in Chile and found that each concession had undergone an average of three renegotiations, roads being the most frequent infrastructure involved with an average of 4.3 renegotiations. Moreover, it seems to be the case that road concessions are usually renegotiated before the infrastructure enters into service. By way of illustration, Guasch (2004) reports that 78.4% of road concessions in Latin America underwent early renegotiations of this type. Likewise, among European pioneers, such as Spain, 44% of concessions are renegotiated within the first five years of their being awarded (Baeza and Vasallo, 2008).

There are several explanations as to why concessions are subject to frequent and early renegotiations: first, the poor design of BOT contracts (Kerf et al., 1998), which are inherently incomplete; second, the use of deficient traffic prediction models, which are undermined by poor

---

[1] Good illustrations of the total traded volume of concession contracts under PPPs can be found in Guasch (2004) and Engel et al. (2009a, 2009b). The growth in interest in the US for toll motorways is described in Engel et al. (2006).

long-term forecasts and the uncertainty of traffic demand (Bain, 2009); and, third, the fixed duration of contracts (Engel et al. 1997; Engel et al., 2009) and the possible strategic behavior of companies in the bidding process anticipating the opportunity to renegotiate after being awarded the concession. In this regard, Athias and Nuñez (2008) note that bidders submit more aggressive bids when there is competition in the auction (adhering to the effect of the *winner's curse*)[2], but these bids are more strategic in institutional frameworks in which the renegotiation is easier.

Spain is one of the most experienced countries in the world as regards private participation in the toll motorway industry through the use of BOT contracts. This model was introduced in the late 60s – during the dictatorship – and was developed in the years that followed with the purpose of obtaining funding for strategic investments. Today, the country's toll motorway network exceeds 3,000 km in length and more than 70% of tolled kilometers have undergone at least one renegotiation. In fact, all concessions awarded during the dictatorship have been renegotiated at least once, while some of them have been the subject of several renegotiations.

Most of these renegotiations have been the result of contractual incompleteness and the fixed-term nature of the concession agreement, inaccurate forecasting (Baeza and Vasallo, 2008) or economic crises that have affected both costs and demand. However, some renegotiations have been motivated by other causes. In 1997, the Spanish government approved a new strategy to fight inflation in its efforts to comply with the conditions of the Maastricht Treaty. This involved the renegotiation of several toll motorway concessions, granting contractual extensions in return for lower tolls that could both transfer and reduce logistical costs. These agreements resulted in a significant increase in demand, and meant that many concessions that were due to be terminated in the early 2000s remain in private hands despite public discontent, especially in areas where toll roads concentrate.[3]

In this paper we evaluate the welfare effects of one of these renegotiations on various toll motorway concessions (included within a 1997 renegotiation package) by conducting a cost-benefit analysis of each renegotiation with respect to the status quo (i.e., no renegotiation) situation. This empirical strategy allows us to estimate the changes in welfare for motorway users, private concessionaires and governments and so to shed light on the impact of a policy that favors lower tolls but which extends contractual length.

The contributions of this paper are twofold. First, this is – as far as we know – the first paper to identify and measure the effect of welfare changes provided by a toll motorway

---

[2] The company that places the highest bid is the one that has the most optimistic traffic demand prediction and is the company that will win the auction. If after winning the award, traffic demand is lower than expected, the concessionaire incurs a high loss.

[3] Spain operates a mixed funding model for its motorways. About 80% of its motorways are publicly funded while 20% are financed with user fees (tolls). See Bel and Fageda (2005) and Albalate (2011) for further details.

renegotiation on concessionaires, users and governments. Indeed, this paper seeks to identify the winners and losers in this toll motorway renegotiation involving the reduction of tolls and the extension of contracts. Second, we build an empirical model that can be implemented when considering the effects of renegotiation on users, private operators and public agencies for any infrastructure contract or PPP agreement. Thus, we provide a valuable tool that can help in the welfare analysis of transportation policy.

Our results show that private concessionaries and governments – who bilaterally renegotiate the contract – benefit from these renegotiations, while users suffer a loss of welfare compared to an alternative scenario in which renegotiation is avoided, even when a reduction in tolls has been renegotiated. Total welfare changes only slightly. However, the main winner appears to be the government, who in most of our evaluations secures a considerable welfare gain thanks to the renegotiation. This gain is attributable to the fact that the government can now collect taxes for a longer period of time and make savings thanks to its avoidance of operation and maintenance costs. We also estimate the price reduction that would make users – who typically are worse off following the renegotiation – indifferent to a renegotiation of the concession. Our preliminary results indicate that prices would have to have been reduced by at least 65% to compensate road users given a 13-year contract extension. The actual reduction was only 30%.

The remainder of this paper is organized as follows. In the next section, we briefly review the history of the toll road industry and toll concessions in Spain. This is followed in section 3 by a description of the motorways and an evaluation of the concessions affected by renegotiation. Section 4 reviews the agents involved in our cost-benefit analysis and describes the methodology that we apply. The fifth section presents our main results. The paper concludes with some final remarks and conclusions.

2. TOLL MOTORWAY CONCESSIONS AND RENEGOTIATIONS IN SPAIN

After the approval of the 1959 Stability Plan, the Spanish economy grew vigorously during the 60s. Notable growth increased the need for high capacity transport infrastructure to satisfy the rise in demand and to avoid bottlenecks in the existing road network. Yet, the weak fiscal system operated by the dictatorship was unable to provide for such an investment effort. It was decided therefore to attract private capital and so a traditional BOT concession model was adopted to build the first high capacity roads along Spain's busiest corridors.

The initial concessions were made under the Spanish National Motorways Program (*Programa de Autopistas Nacionales Españolas*) in 1967. This program envisaged the building of 3,160 kilometers of toll highways. The plan was subsequently amended in 1972 due to the success of private involvement in the first package of concessions with additional motorways planned to

constitute an overall network of 6,340 km. Between 1967 and 1975, 2.040 kilometers of toll roads were awarded to private companies by the Spanish Ministry of Development. However, by 1976 the plan had been paralyzed. The economic crisis, the dramatic increase in construction and energy costs, together with political changes, were to have a marked impact on the industry. As Matas and Raymond (1999) and Bel and Fageda (2005) both note, the economic recession changed the profitability-related expectations of the construction and exploitation of these motorways while the growth in demand slowed because the main traffic routes had been awarded during the first wave of concessions.

After the democratic transition and with the Socialist Party (*Partido Socialista Obrero Español*) in power, toll road policy was reversed. The left-wing government was opposed to user fees and the private management of transport infrastructure, and so ushered in a period during which toll-free motorways were built from public funds. However, the government preserved the toll concessions for those roads already in private hands. It was this decision that formed the basis for the unique mixed funding model presented by Spain's motorway network today (Bel, 1999). This mixed model was further complicated with a second wave of privatizations and toll favoring policies introduced in 1996 by the Conservative Government of the People's Party (*Partido Popular*), which awarded concessions for new roads and renegotiated several existing contracts. While in office (until 2004), the length of most concession contracts awarded during the dictatorial regime were extended and 900 kilometers of new toll motorways were awarded to private concessionaires, including five radial motorways providing access to the political capital, Madrid. As Bel (1999) notes, extending the term of concession to 75 years, as provided for under the Budgetary Regulations Law of 1997, left the door open for these extension agreements, and was indicative of the policy that favored private participation in toll motorways.

In practice, the contracts for the earliest concessions have been renegotiated two, three or even four times. The most recent renegotiations (i.e., those agreed in the late 90s) involved either fee reductions, the extension of certain road sections or the postponement of contract termination dates. The earliest renegotiations, by contrast, were linked to the crisis experienced by the sector in the second half of the 70s and the early 80s. The current ruinous financial situation faced by the radial motorways giving access to Madrid (characterized by huge debt burdens, rising expropriation costs and lower than expected demand as they compete with free parallel motorways) is being reviewed and renegotiations, or even nationalization, may be the solution presented by the government in 2012 and 2013.

Table 1 lists all the toll motorways being operated today in Spain, the name of their private concessionaire and the date the concession was awarded. We also include the date when the concession was initially supposed to terminate, together with information about renegotiations that have modified the length of the contract. As can be seen, renegotiations are a recurrent phenomenon in Spain.

Table 1. Descriptive information on toll motorway concessions in Spain

CONCESSIONAIRE	ROAD	KM	AWARDED	FINAL DATE AWARDED	Nº YEARS	Nº RENEGs.	FINAL DATE	TOTAL Nº YEARS
ACESA	Barcelona-La Junquera (1)	150	06/02/1967	06/02/2004	37			54
	Mongat-Mataró (1)	15	06/02/1967	06/02/2004	37			54
	Barcelona-Tarragona	100	29/01/1968	29/01/2005	37	3	31/08/2021	53
	Zargaoza-Mediterráneo	215	25/06/1973	25/06/1998	25			48
	Montmeló-El Papiol	27	15/05/1974	15/05/1995	21			47
IBERPISTAS	Villalba-Villacastín (2)	39	29/01/1968	29/01/2018	50	1	19/11/2031-36	63-68
	Villacastín-Adanero (2)	31	30/09/1972	29/01/2018	46			59-64
EUROPISTAS	Bilbao-Behovia (3)	115	23/03/1968	05/06/2003	35	-	-	35
	Burgos-Málzaga	84	26/06/1974	26/06/1994	20	4	31/11/2018	44
AUMAR	Sevilla-Cádiz	94	30/07/1969	30/07/1993	24			50
	Tarragona-Valencia	225	08/09/1971	08/09/1998	27	3	31/12/2019	48
	Valencia-Alicante	149	22/12/1972	22/12/1999	27			47
AUDASA	El Ferrol-Frontera Portuguesa	219	18/08/1973	19/08/2012	39	3	18/08/2048	75
AVASA	Bilbao-Zaragoza	294	10/11/1973	10/11/1995	22	3	10/11/2006	33
AUCALSA	Léon-Campomanes	78	17/10/1975	17/10/2021	46	1	17/10/2050	75
AUSOL	Málaga-Estepona	83	15/03/1996	15/03/20 46	50			50
	Estepona-Guadiaro	22	01/07/1999	01/07/2051	52			52
AUSUR	Alicante-Cartagena	77	01/08/1998	01/08/2048	50			50
AM	R-3 Madrid-Arganda	34	06/10/1999	06/10/2049	50			50
	R-5 Madrid-Navalcarnero	28	06/10/1999	06/10/2049	50	-	-	50
ACEGA	Santiago-A.S.Domingo	57	12/11/1999	12/11/2074	75			75
CASTELLANA DE AUTOPISTAS	Ávila-Villacastín	23	18/11/1999	19/11/2031-36	32-37			32-37
	Segovia-San Rafael	28	18/11/1999	19/11/2031-36	32-37			32-37
AULESA	Léon-Astorga	38	10/03/2000	10/03/2055	55			55
HENARSA	R-2 Madrid-Guadalajara	81	04/11/2000	04/11/2024	24	1	25/03/2039	39
AUTOPISTA MADRID SUR	R-4 Madrid-Ocaña	88	30/12/2000	30/12/2065	65			65
EJE AEROPUERTO	Eje Aeropuerto	9	26/11/2002	26/11/2027-28	25-26			25-26
AUTOPISTA COSTA CÁLIDA	Cartagena-Vera	77	14/02/2004	14/02/2040-44	36-40			36-40
AUTOPISTA MADRID-LEVANTE	Ocaña-La Roda	118	21/02/2004	21/02/2040-44	36-40	-	-	36-40
AUTOPISTA MADRID-TOLEDO	Madrid-Toledo	60	21/02/2004	21/02/2040-44	36-40			36-40
CIRALSA	Circunvalación de Alicante	33	21/02/2004	21/02/2040-44	36-40			36-40
AUTOPISTA DEL GUADALMEDINA	Alto de las Pedrizas-Málaga	25	27/09/2006	27/09/2042-45	36-39	1	27/02/2044-47	38-41

Note 1: The table shows the original name that the concession had at the time that the State granted the concession.

Note 2: Currently Abertis (Spain's leading private management firm in transport and communications infrastructure) directly manages ACESA, IBERPISTAS, AUMAR, AVASA, CASTELLANA DE AUTOPISTAS and AULESA. It also participates in AM, HENARSA and CIRALSA.

(1) Since 30/06/1995 by RD 912/1995 the road section Mongat-Malgrat and Barcelona-Montmeló were segregated from the state road network. By RD 902/1995 the ownership of these roads was transferred to the Generalitat of Catalonia.

(2) The road sections Villalba-Villacastín and Villacastín-Adanero, currently known as Villalba-Adanero. As of 30 January 2018, the Villalba-Adanero section will be operated and maintained by the concessionaire CASTELLANA DE AUTOPISTAS.

(3) Since 01/01/2000 by RD 1883/1999 the road section Bilbao-Behobia was segregated from the state road network. By RD 1837/1999 the ownership of this road was transferred to the Autonomous Community of País Vasco.

According to Baeza and Vasallo (2008), errors in the demand forecasts might account for the earliest renegotiations. Likewise, the economic crisis of the 70s and early 80s and unforeseen developments in demand and operating costs might explain some of these agreements. Yet, others have also been initiated by the government. Thus, as discussed above, the renegotiations of the late 90s formed part of government plans to boost economic efficiency and fight inflation in the context of the Maastricht Treaty. In contrast with earlier renegotiations, these deals saw a reduction in tolls, while the concessionaires obtained contract extensions, given that any change in prices in a fixed-term agreement impacted negatively on their break-even point.

To date, none of these renegotiations has been evaluated in terms of welfare gains and welfare distribution. Indeed, our understanding of how these renegotiations have affected the long-run welfare of users and the profitability of companies is limited. This analysis, however, is not restricted solely to examining the positions of the winners and losers in these renegotiations, but it also employs methods for the ex-ante evaluation of their impact on the agents involved so as to enhance transparency and the process of deliberation.

Our paper focuses specifically on the renegotiation of the terms of concession contracts awarded to Aumar, one of the oldest toll motorway concessionaires in Spain. An evaluation of a 1997 renegotiation serves to develop a methodology for analyzing the distributional effects of a toll motorway renegotiation. Below, we describe AUMAR and the concessions it has been awarded.

THE CASE OF AUMAR: CONCESSIONS AND RENEGOTIATIONS

Autopistas del Mare Nostrum S.A. (hereinafter AUMAR) was created in 1971 to build and operate the Tarragona-Valencia toll motorway (AP-7).[4] In 1972 it was further awarded the southern section between Valencia and Alicante.[5] In 1986, it absorbed *Bética de Autopistas*, concessionaire of the Sevilla-Cádiz toll motorway (AP-2), awarded in 1969.[6] Today AUMAR forms part of *Abertis Infraestructuras* (a world leader in toll motorway concessions), following a merger with ACESA in 2003.[7]

AUMAR has experienced three renegotiations of its concession contracts. The first took place in the late 70s and early 80s.[8] The 1977-renegotiation affected the Sevilla-Cádiz motorway which was motivated by the fact that the projected "container" seaport in Puerto Real (Cádiz) was

---

[4] See Decree 2052/1971 of the 23rd July (BOE 08/09/1971).
[5] See Decree 3477/1972 of the 21st December (BOE 22/12/1972).
[6] See Decree 1636/1969, of the 17th July (BOE 30/07/1969).
[7] In April 2003 *Acesa Infraestructuras* merged with *Aurea Concessiones de Infraestructuras*, a concessionaire founded in 1971 as *Autopistas del Mare Nostrum*, to form *Abertis*. Today, *Abertis Infraestructuras*, S.A. operates 6,713 kilometers of motorway and more than a dozen airports in cities that include London, Stockholm and Orlando.
[8] See Royal Decrees 965/1977, 1284/1981 and 2715/1982.

never built. The shelving of this project in 1973 had a considerable impact on demand forecasts for the AP-2. Thus, *Bética* sought compensation from the State in 1977, based on the lower demand expectations over the life of the concession; it was awarded a six-year extension of its concession. The 1981 and 1982 renegotiations affected the Tarragona-Valencia and Valencia-Alicante sections, respectively, and were motivated by the increase in road works that had to be undertaken. Six- and five-year extensions of the concession were agreed, respectively.

The second wave of renegotiations was linked to the merger between AUMAR and *Bética de Autopistas*, in 1986.[9] The motivation behind the merger and the resulting renegotiation was the need to restructure a sector that had been in crisis since 1982. The main bases for the renegotiation were the unification and integration of the Tarragona-Valencia, Valencia-Alicante and Sevilla-Cádiz motorways under one single concession. The outcome was a seven-year extension of the concession for the Sevilla-Cádiz section and a two-year extension for the other two.

The final renegotiation took place in 1997 and was initiated by the government in its package of toll motorway renegotiations for that and the following year.[10] According to government sources, this round of renegotiations was aimed at stimulating a greater use of motorways in the areas served by the routes managed by AUMAR, given that they are located in corridors of high economic activity and the areas' roads absorb high volumes of traffic. The main modification involved a 30.37% reduction in tolls on the Tarragona-Valencia section, 27.92% in those between Valencia and Alicante section and 15.81% in the case of Sevilla-Cádiz. The renegotiations also included an investment commitment of 5,000 million pesetas (30 million euro) between 1998 and 2000 in flexible road safety barriers in the median strip of the motorway, new road links and improved access and information systems for users. In return, the concessionaire was granted an extension of the concession up to 2019 (an additional thirteen years).

To date, no study has evaluated the impact of these renegotiations in terms of welfare for road users, concessionaires and governments. The last renegotiation meant a reduction in tolls for users and, hence, a reduction in the concessionaire's revenue per user, but also included contract extensions for the current concessionaire. We have only a limited understanding of the desirability of the package of renegotiations agreed to in the late 90s in Spain and its consequences for the welfare of the various agents affected by the renegotiation. The following sections therefore are devoted to an explanation of the methodology proposed for evaluating toll motorway renegotiations (including toll reductions and contractual extensions) such as those experienced in Spain in the late 90s.

---

[9] See Royal Decree 1132/1986.

[10] Royal Decree 1674/1997 of the 31st October (BOE 01/11/1997).

4. METHODOLOGY FOR THE COST-BENEFIT ANALYSIS

The aim of this paper is to evaluate the impact of the renegotiations that took place in 1997 between the concessionaire AUMAR and the State, by examining the welfare changes experienced by road users, the private concessionaire and the public administration.

Our empirical strategy is based on a comparison of the real situation (status quo with renegotiation), resulting from the 1997 renegotiation, with the alternative situation (no renegotiation), which would have meant the termination of the concession in 2006 and the consequent transfer of the infrastructure to the State. We first assume that the State no longer collects tolls after recovering the motorway from the private company.[11] After this first analysis, we then relax this assumption and introduce an extended model in which the government charges cost-based tolls to users.

4.1. Alternatives and actors

The cost-benefit analysis (CBA) is carried out over a time horizon of 23 years (1997-2019), a period during which the concessionaire operates and maintains the AP-7 motorway sections (Tarragona-Valencia and Valencia-Alicante) under the renegotiated conditions of 1997. The two scenarios compared in our cost-benefit analysis, therefore, are:

- **Option A** (status quo): Current situation in which the last renegotiation between the State and the concessionaire for the AP-7 Tarragona-Valencia and Valencia-Alicante motorways took place on 31st October 1997 as provided for under Royal Decree 1674/1997 (BOE 01/11/1997) and the concession terminates on 31st December 2019.

- **Option B**: Alternative scenario in which the 1997 renegotiation is assumed not to have taken place and the concession terminates on 31st December 2006 as provided for under Royal Decree 1132/1986 (BOE 14/06/1986). From this point in time (01/01/2007), the two toll motorway sections are transferred and fall under State ownership. Tolls are lifted and the motorway is funded from the public budget.

The data for the time horizon under **option A** (status quo) are based on information available for the period 1997-2010 and thereafter (until 2019) on estimates for several key variables, as explained below. For the counterfactual, **option B**, data are based entirely on estimates for the period 1998-2019, although we use the real data of 1997 when constructing the counterfactual starting in 1998.

There are three actors involved in our cost-benefit analysis:

---

[11] Note that most of the motorway network in Spain is toll free (80% of total kilometers of High Capacity Roads).

(1) *Road Users*: Those using the motorway (AP-7) and those using the free alternative conventional road (N-340).

(2) *Private concessionaire*: AUMAR

(3) *Public Administration.* Given that the motorway forms part of the central government's road network, we can identify central government as the Public Administration.[12]

4.2. Methodology

This subsection describes the methodology used in quantifying the welfare effects of the renegotiation under consideration, examining primarily the welfare differences between Option A (status quo) and Option B (no renegotiation). As such, we calculate the impact of the renegotiation on welfare as the difference between Option A and Option B, i.e., we compare the net present value of welfare with renegotiation (NPV^A) and the net present value of welfare of no renegotiation (NPV^B). Both net present values are calculated in 1997 terms, the year in which the renegotiation took place.[13]

$$\Delta NPV = NPV^A - NPV^B \qquad (1)$$

In addition, the present study evaluates both the aggregate impact of the renegotiation and the disaggregated impact, by assessing the distribution of this welfare change among road users, the private concessionaire and government. Thus, we are interested not only in measuring the desirability of the renegotiation at an aggregate level, but also in identifying the winners and losers of this policy. As a consequence, equation (1) is applied for each of the agents involved in the renegotiation. Aggregate welfare change is, therefore, defined as the sum of all welfare changes weighted equally according to the following equations.[14]

4.2.1 Estimating welfare differences: CBA base without public tolls.

a) **Users: Net present value of the change in users' welfare.**

$$\Delta \text{NPV}_U = \left[\sum_{1997}^{2019} \frac{C_p + C_{t\_toll} + C_{t\_N340}}{(1+r)^t}\right] - \left[\left(\sum_{1997}^{2006} \frac{C_p}{(1+r)^t}\right) + \left(\sum_{1997}^{2019} \frac{C_{t\_toll} + C_{t\_N340}}{(1+r)^t}\right)\right] \qquad (2)$$

where,

C_p: Costs resulting from toll payments.

C_{t_toll}: Annual time costs resulting from traveling on the toll motorway (AP-7).

C_{t_N340}: Annual time costs resulting from traveling on alternative conventional road (N-340).

---

[12] Although central government collects VAT payments from commercial and professional transactions, part of these revenues are transferred to regional governments in adherence with a partly decentralized fiscal model.

[13] Cost and benefit flows in both options occur over different time spans; therefore, we need to consider them in terms of 1997 values.

[14] Applying different weights by actor is possible, but here we opt for equal weights for the sake of simplicity.

r: social discount rate.

t: years.

As observed, the C_{toll} in Option B (no renegotiation) is only deemed necessary from 1st November 1997 to 31st December 2006 (recall we assume that since 2007 the motorway has been in the hands of the State and is toll free). By contrast, C_{toll} covers the whole period through to 2019 in Option A (status quo). Note that the number of users of the toll motorway increases in 2007 under Option B because the motorway becomes free with its transfer to the State. This shift in the number of users is estimated using the price elasticity of demand. As a result, more kilometres are driven on the motorway and fewer on the lower quality alternative, the N-340. This affects the travelling time on both routes, and therefore the time costs for users.

b) Concessionaire: Net present value of the change in the private concessionaire's welfare.

$$\Delta\text{NPV}_\text{C}= [(\sum_{1997}^{2019} \frac{NR}{(1+r)^t})(\sum_{1997}^{2019} \frac{MC_{toll}}{(1+r)^t}) - (\sum_{1998}^{2000} \frac{IC_{toll}}{(1+r)^t})] - [(\sum_{1997}^{2006} \frac{NR}{(1+r)^t}) - (\sum_{1997}^{2006} \frac{MC_{toll}}{(1+r)^t})] \text{ (3)}$$

where,

NR: Revenue collected by the concessionaire after discounting Value Added Tax.

MC_{toll}: Annual maintenance costs for the toll motorway incurred by the concessionaire.

IC_{toll}: Annual investment costs in the toll motorway incurred by the concessionaire.

r: social discount rate.

t: years.

All the variables associated with the private concessionaire, including net revenues (NR), maintenance and investment costs are taken into account in both Options A and B. However, in Option B, NR and maintenance costs are considered from 1st November 1997 to 31st December 2006. From that date on, under this scenario, the motorway is transferred and managed and maintained by the Government. Moreover, the toll is lifted. In contrast, these variables apply to whole period under Option A. Investment levels were agreed in the renegotiation and had to be executed over the following three years. For this reason, investment is split annually between 1998 and 2000 in Option A. In contrast, in Option B, given the absence of any renegotiation, we assume no investment is made until the end of the concession in 2006. After this date, the government is responsible for any necessary investment.

c) Government: Net present value of change in government's welfare.

$$\Delta\text{NPV}_\text{G}=[(\sum_{1997}^{2019} \frac{VAT+CT}{(1+r)^t}) - (\sum_{1997}^{2019} \frac{GMC_{N340}}{(1+r)^t})] - [(\sum_{1997}^{2006} \frac{VAT+CT}{(1+r)^t}) - (\sum_{1997}^{2019} \frac{GMC_{N340}}{(1+r)^t}) - (\sum_{2007}^{2009} \frac{GIC_{free}}{(1+r)^t}) -$$

$$(\sum_{2007}^{2019} \frac{GMC_{free}}{(1+r)^t})] \tag{4}$$

where,

VAT : Value Added Tax.

CT : Corporation Tax.

GMC_{N340}: Government's annual maintenance costs for the alternative conventional road N-340.

GMC_{free}: Government's annual maintenance costs for the AP-7 motorway, once it has been transferred from the private sector and the toll lifted.

GIC_{free}: Government's annual investment costs for the AP-7 motorway, once it has been transferred from the private sector and the toll lifted.

r: social discount rate.

t: years.

VAT and Corporate Income Tax are the government's sources of revenue. This fact is particularly significant in the case of the differences between the two scenarios (Options A and B). Note that these tax revenues are only available during the private operation of the motorway, that is until 2006 in Option B. In this scenario, the government no longer obtains these revenues as the tolls have been lifted and the road is funded from the public budget. However, when we extend the model by introducing public tolls the government receives direct revenues from users.

As for costs, the government is responsible for maintaining the alternative conventional road in both scenarios, but in Option B it is also responsible for the management and maintenance of the motorways after 2007. As no renegotiated agreements have been settled in Option B, no investment is made by the private company. Thus, we assume that this investment is made by the government once it takes responsibility for the motorway and that it is realized in the three years between 2007 and 2009 according to the same schedule as that described above under Option A.

The main variables are presented and described in **Table 2** together with the main data source. We also provide the base values used for the most relevant assumptions made when constructing our key variables (**Table 3)**.

Finally, in order to obtain the social discount rate (SDR), we adhered to the approximation of the Social Time Preference Rate (STPR). We take as our starting point the 5.5% rate in line with the estimates obtained by Souto (2001) for Spain. Despite having made this choice, we then increase this value in our sensitivity analysis to check the robustness of our model with respect to other discounting rates.

Table 2. Variables and sources.

Variables	Description	Data Sources	Assumptions
C_p	Toll payments obtained from toll fares per km, distance driven in km and Average Daily Traffic (ADT) on AP-7. Prices are updated annually in line with the CPI. Note that from 2006 the motorway was managed by the Public Administration with tolls in the extended CBA, toll payments being calculated as annual estimated maintenance costs for the Public Administration on the AP-7 motorway plus the investment costs incurred by the Government (Option B).	Spanish Ministry of Transport.	In option A, 2011-2019 ADT on AP-7 grows at the average increase in ADT between 1990 and 1997. In option B, 1998-2006 ADT on AP-7 grows at the average increase in ADT between 1990 and 1997. For 2007 we use the elasticity price computed by Matas and Raimond (2003) and for 2008-2019 we apply the average increase between 1990 and 1997. The toll price in scenario A between 2011-2019 and in scenario B between 1998-2006 grows at the average increase in CPI between 1994 and 1997.
C_{t_toll}	Time costs obtained from average gross wages per hour effectively worked in the Provinces crossed by AP7 motorway and estimated annual time in hours traveled on the motorway.	National Statistical Institute (INE) and own estimations based on km and time provided by Google Maps software.	In both scenarios the hours effectively worked at weekend are estimated at 1/3 of average gross wage. From 2012 to 2019 the average gross wage per hour effectively worked grows at the average increase in CPI between 1994 and 1997.
C_{t_N340}	Time costs obtained from average gross wages per hour effectively worked in the Provinces crossed by N340 road and estimated annual time in hours traveled on N340 conventional road alternative sections.	National Statistical Institute (INE) and own estimations based on km and time provided by Google Maps software.	In both scenarios the hours effectively worked at weekend are estimated at 1/3 of average gross wage. From 2012 to 2019 the average gross wage per hour effectively worked grows at the average increase in CPI between 1994 and 1997.
NR_{toll}	Net revenues for the private concessionaire.	Own estimates.	Calculated as toll payments obtained from toll fares on AP-7 minus the Value Added Tax and Corporation Tax in both scenarios.
MC_{toll}	Ordinary and extraordinary maintenance costs.	Spanish Ministry of Transport and own estimates.	Maintenance costs grow at the same rate for simulated years as for real years.
IC_{toll}	Investment cost agreed in the renegotiation of 1997.	Royal Decree 1674/1997	Proportion of the investment cost that the concessionaire has to invest in both road sections fractioned in 3 years.
VAT	Value Added Tax Income collected by the Central Government from the AP-7 sections considered. Note that from 2006 the motorway is managed by the Public Administration in the extended model.	Own estimates given toll payments obtained from toll fares.	Between 2011 and 2019 in Option A, VAT is the same as in 2010.
CT	Corporation Tax collected by the Central Government from the AP-7 sections considered.	Own estimates given toll payments obtained from toll fares minus Value Added Tax.	Between 2011 and 2019 in Option A, CT is the same as in 2010.
GMC_{N340}	Estimated annual maintenance and investment cost borne by the Public Administration in the N-340, according to maintenance and investment per vehicle and km, Average Daily Traffic and Distance.	Provincial Delegations of the Spanish Ministry of Transport and Google Maps software for road distance. We only have real data between 2001-2008.	We assume that in scenario B the ADT on AP-7 in 2007 decreases, which reduces GMC.
GMC_{free}	Estimated annual maintenance cost borne by the Public Administration in the AP-7 motorway. Note that since 2006 the motorway is managed by the Public Administration without collecting tolls in the standard CBA and with collecting tolls in extended CBA.	Own estimates based on ordinary and extraordinary maintenance costs in the concessionaire in scenario B.	We assume that in scenario B the ADT on AP-7 in 2007 does increase.
GIC_{free}	Investment costs incurred by the Government in Option B. This is the investment agreed in 1997 and which was executed by the Private Concessionaire in Option A.	Royal Decree 1674/1997	Proportion of the investment cost that the concessionaire has to invest in both road sections fractioned in 3 years plus the CPI from 2007 to 2009.

Table 3. Base values for self-constructed variables and sensitivity analysis intervals per road section.

Variables	Base value Tarragona-Valencia	Base value Valencia-Alicante	Sensitivity Analysis
CPI 1994-2010	2.87	2.90	2 – 4%
ADT growth in AP7 Motorway 1990-1997	1.82	2.95	1.4 – 3.4%
ADT growth in N340 motorway 1990-1997	2.15	6.23	1.5 – 3.5% and 5.5 – 7.5%
Elasticity	-0.5	-0.5	-0.3 – 1.3%
Km driven N340 compared to AP7	100%	100%	10 – 100%
SDR	5.5	5.5	3 – 8%

4.2.2 Estimating welfare changes: CBA extended with public tolls.
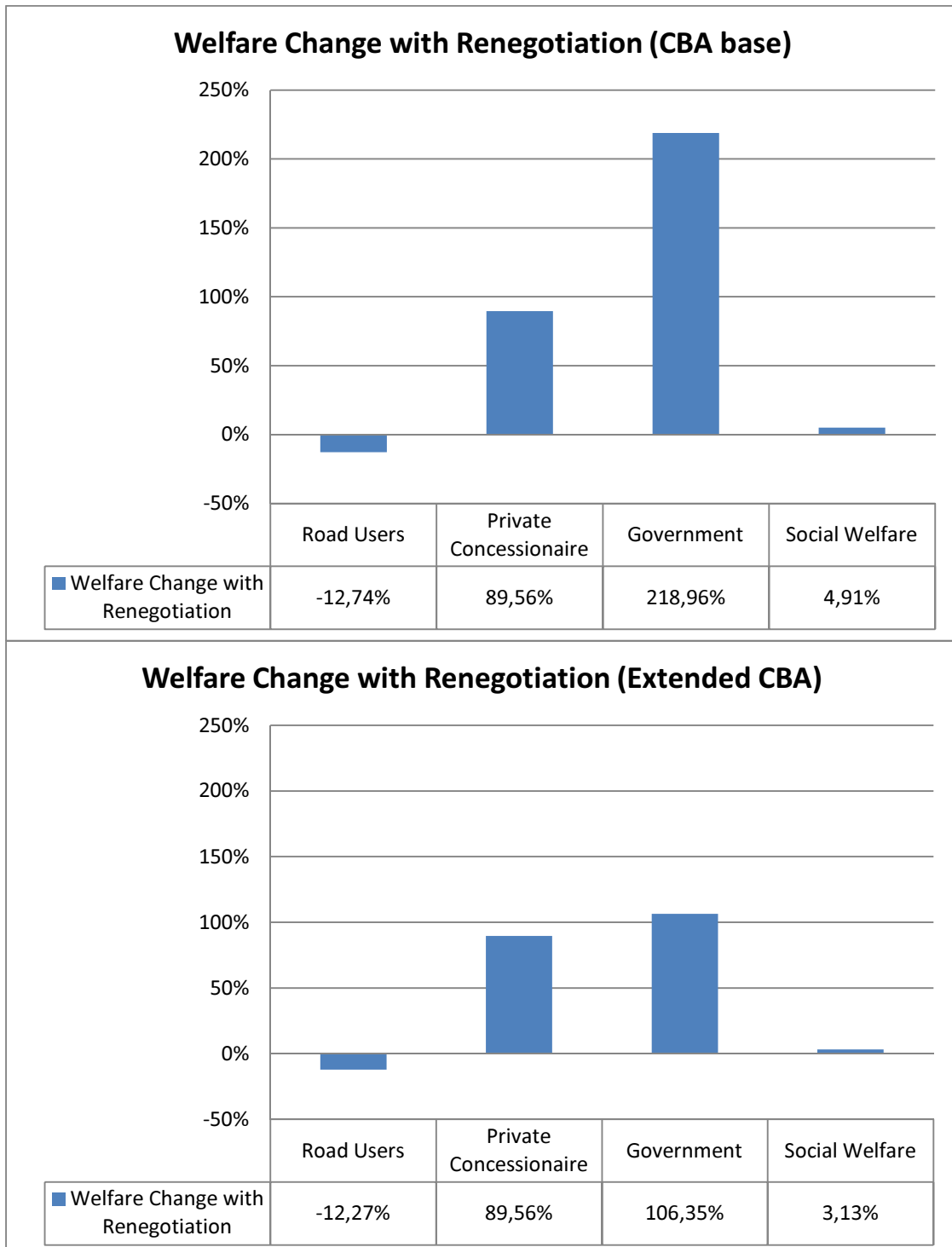
As discussed above, the CBA base assumes that the government lifts all tolls once the motorways have been transferred from private to public hands. However, the government could equally impose a toll via a public firm once it has recovered the management of the motorway. In this setting, we assume that the non-profit government establishes a toll to cover the maintenance costs of the motorway under Option B (no renegotiation). Now, in the extended CBA the users' costs (C_p) are considered from 1st November 1997 to 31st December 2019 in both Options A and B. The main difference is the price charged (Note that the VAT collected by the government can now be computed for 23 years in both options). In Option A (1997-2019) the toll collection is the responsibility of the private concessionaire, who then transfers these tax revenues to the government, whereas under Option B between 2007 and 2019 the government receives both the toll payment and the VAT directly.[15] In order to estimate the price charged to users we consider the maintenance cost by vehicle-km, the investment needed in the motorway and the additional VAT that needs to be applied.

---

[15] We do not consider the personal costs incurred by the government in operating the motorways. This is a highly capital intense activity and, we believe, these costs do not change our results significantly.

5. RESULTS

In **Figure 1** we present the main results of the net present value of the change in welfare disaggregated by the different actors considered: users, the private concessionaire and government in both models, the base CBA and the extended CBA. The figure shows the welfare gain or loss associated with the renegotiation compared to the counterfactual (i.e., no renegotiation).

Figure 1. Net Present Value of Change in Welfare in 1997 values.

Welfare Change with Renegotiation (CBA base)	Road Users	Private Concessionaire	Government	Social Welfare
■ Welfare Change with Renegotiation	-12,74%	89,56%	218,96%	4,91%

| Welfare Change with Renegotiation (Extended CBA)	Road Users	Private Concessionaire	Government	Social Welfare
■ Welfare Change with Renegotiation	-12,27%	89,56%	106,35%	3,13%

The aggregate NPV of the change in welfare is positive but very small. In fact, the social welfare reported under renegotiation is 4.91% lower in the base CBA and 3.13% lower in the extended model than in the case of no renegotiation. However, we need to take into account the fact that aggregate welfare is constructed as an equally weighted sum of all the actors' welfare. For this reason, it is of greater interest to analyze how renegotiation affected the welfare of each of the agents individually.

(1) *Users*: Road users are worse off after renegotiation despite the reduction in tolls and the time savings associated with using the high capacity road instead of the conventional road following the reduction in tolls. The extension of the concession seems to offset these effects and results in a negative net present value of change in welfare for users in both models. Avoiding renegotiation would have given a better result for road users in 1997 terms. According to our estimates, the renegotiation undermines road user welfare by more than 12%.

(2) *Private Concessionaire:* According to our estimates, changing the terms of the concession in the 1997 renegotiation improved the welfare of the private company by more than 50% in both models. The contractual extension and the increase in the number of users given the reduction in tolls seem to account for this result.

(3) *Government*: The public administration appears to be the agent to benefit most from the 1997 renegotiation. In the base CBA it is 219% better off with renegotiation than without. In the extended CBA – with public tolls – it is about 106% better off. On the one hand, it obtains taxes (VAT and Corporate Income Tax) throughout the whole period and avoids having to pay any management and investment costs, which are incurred by the private concessionaire. Without renegotiation, government costs increase and tax revenues fall significantly.

Thus, we find that the agents that agreed the terms of the renegotiated concession (the Government and AUMAR) benefited most from the policy change, while the actor not involved in the renegotiation (the road user) loses welfare.

In a final exercise that involves simulating results in relation to toll changes, we are able to estimate the percentage toll reduction that would leave road users and social welfare indifferent. **Figure 2** displays these results, which can be compared with the actual reductions implemented: a 30.37% real reduction on the Tarragona-Valencia section and a 27.92% reduction on the Valencia-Alicante section.

Figure 2. Simulation of a continuum of toll decreases on welfare change.
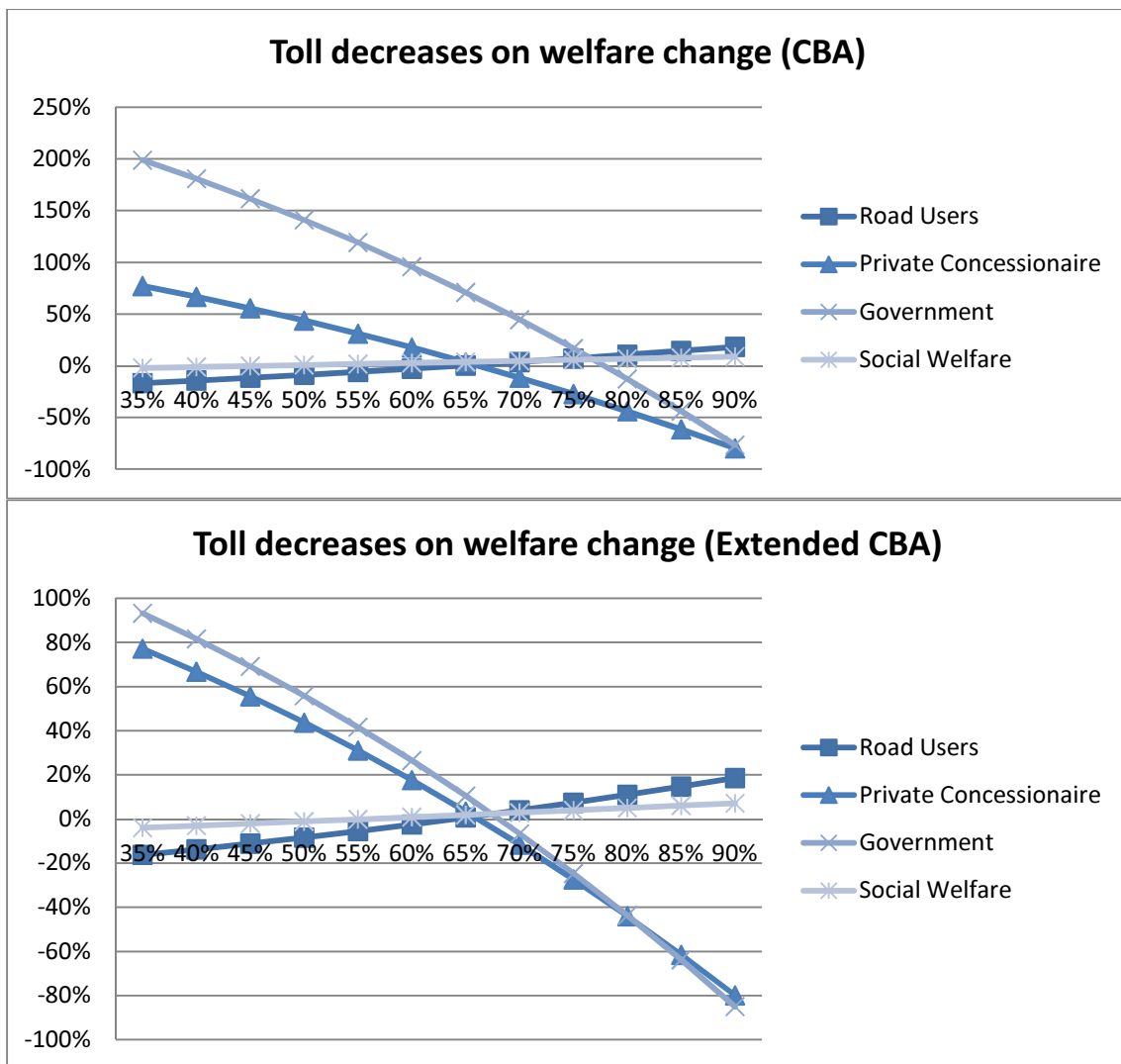
By simulating different toll reductions produced by renegotiation – and maintaining the rest of the variables fixed – we find that in order to keep road users and aggregate welfare (with equal weights per agent) indifferent to either renegotiation or no renegotiation, the toll reduction would have had to have been of the magnitude of 65%.[16] This agreement would have left users and private concessionaire virtually indifferent, while the government would have enjoyed an adequate welfare gain.

Our results were subjected to sensitivity analysis, which demonstrated the robustness of our main outcomes. **Table 3** presents the main values used and the intervals simulated. It shows that even when changing the values of our main key variables, our results remain largely stable.[17]

---

[16] Note that lower fares imply greater average daily traffic in the first few years. This is considered in our simulation.

[17] These results are available upon request.

6. CONCLUSIONS

Spain has been a pioneer in the use of PPPs in the transportation sector and provides a long standing framework in which to analyze and evaluate their performance, particularly in the motorway sector. As reported in many studies discussing concessions and BOT contracts, Spain has experienced many renegotiations in its toll motorway PPPs. Yet, no study to date has been undertaken to evaluate their impact or desirability. The most common outcomes of such renegotiations are a change in the toll charged to users and a modification of the contractual length. Most of the mature motorway concessions have been extended in order to compensate the private concessionaire for a reduction in tolls or the cost of new investment, but the public are unaware of the effects of such decisions on the welfare of road users, the private concessionaire and the government.

This study shows that the two agents involved in renegotiating the concession for one of the oldest and densest toll motorways (Aumar AP7) in Spain have benefited from the changes in the conditions of the contract made in 1997. Thus, the private concessionaire, but more specifically the government, has obtained the greatest welfare gain in terms of the rate of change. Reducing tolls but extending the length of the contract, however, resulted in a welfare loss for road users in the corridor. This outcome for the users could have been avoided by a larger discount in tolls.

Therefore, the agreement signed between the government and the private concessionaire is not a Pareto-optimal solution given that road users seem to be the ones providing for the gains from their own losses. The general inability of citizens to organize themselves and to be better informed about the impact of such agreements plays against their long-term interests. Although myopic road users might consider the decrease in tolls linked to the extension of the contract as a benefit, we show that in the long term they suffer.

It seems hardly surprising, therefore, that governments have an interest in extending toll motorway contracts so as to avoid the public expenditure associated with the management of these roads and the fall in tax revenues from toll charges. This might explain why only one concession has ever been transferred back to the State in Spain while all others have been the subject of renegotiations. Likewise, political economy motivations should not be ignored, given that incumbents have incentives to lower the regulated price of toll motorways taking advantage of the myopic behavior of current users who can experience a welfare gain in the short run.

Finally, it is perhaps worth noting that as governments are better off as a result of renegotiations, this in turn implies a better financial health for public finances, which may result in lower taxes generally or higher expenditure befitting citizens. In some way, there is probably a transfer from motorway users to the rest of the taxpayers in terms of welfare.

REFERENCES

Albalate, D. Bel, G. and Fageda, X. (2009). Privatization and Regulation Reforms of Toll Motorways in Europe. *Governance: An International Journal of Policy, Administration, and Institutions* 22 (2), 295–318.

Albalate, D. and Bel, G. (2009). Regulating concessions of toll motorways: An empirical study on fixed vs. variable term contracts. *Transportation Research Part A*, 43, 219-229.

Albalate, D. (2011) "Shifting death to their alternatives: The case of Toll Motorways", *Journal of Transport Economics and Policy* 45 (3), 453-479.

Athias, L. and Nuñez, A. (2009). Winner's curse in toll road concessions. *Economic Letters* 101, 172-174.

Baeza, M. (2008). Planificación económico-financiera de las concesiones de autopistas de peaje. Un estudio empírico del caso español. PhD Thesis, Universidad de Granada, Spain.

Baeza, M. and Vassallo, J. (2008). Renegociaciones de los contratos de concesión de autopistas de peaje en España y su influencia sobre los incentivos en la licitación. Mimeo Universidad de Granada y Universidad Politécnica de Madrid.

Baeza, M. and Vassallo, M. (2010). Private concession contracts for toll roads in Spain: analysis and recommendations. *Public Money & Management*, 30 (5), 299-304.

Bain, R. (2009). Error and optimism bias in toll road traffic forecasts. *Transportation* 36, 469-482.

Bel, G. (1999). Financiación de infraestructuras viarias. La economía política de los peajes. *Papeles de Economía Española* 82,123-139.

Bel, G. and Fageda, X. (2005). Is a Mixed Funding Model for the Highway Network Sustainable over Time? The Spanish case. In: Ragazzi, G. and Rothengatter, W. (Eds.), Procurement and Financing of Motorways in Europe. Elsevier, 95-211.

Bel, G. and Foote, J. (2009). Tolls, Terms, and Public Interest in Road Concessions Privatization: A Comparative Analysis of Recent Transaction in the USA and France. *Transport Reviews* 29 (3), 397-413.

Carpintero, S. (2002). Las concesiones de carreteras en los países en vías de desarrollo. El caso de Argentina y de México. *Revista de obras públicas* 3425, 113-118.

Castellanos, A; & López-Casasnovas, G. (2005). El uso del análisis coste-beneficio en la estimación de la posibilidad de rescate de las autopistas. *Ekonomiaz 60*, Vol. I.

De Rus, G. Betancor, O. and Campos, J. (2006). Manual de evaluación económica de proyectos de transporte. *Banco Internacional de Desarrollo*, Washington D.C.

De Rus, G. and Nombela, G. (2004). Flexible-term contracts for road franchising. *Transportation Research Part A* 38, 163–179.

Engel, E. Fischer, R. and Galetovic, A. (2006a) "Privatizing highways in the United States", *Review of Industrial Organization*, 29 (1), 23-57.

Engel, E. Fischer, R. and Galetovic, A. (2006b). Renegotiation without holdup: Anticipating spending and infrastructure concessions. *NBER Working Paper 12399*.

Engel, E. Fischer, R. Galetovic, A. and Hermosilla, M. (2009). Renegociación de concesiones en Chile. *Estudios Públicos* 113, 151-205.

Engel, E. Fischer, R. Galetovic, A. and Hermosilla, M. (2009). Public-private partnerships: when and how. Stanford Center for International Development; Working Paper.

Guasch, J. (2004). Granting and Renegotiating Infrastructure Concessions: Doing it Right. *The World Bank Institute Development Studies*, Washington DC.

Guasch, J. Laffont, J. and Straub, S. (2008). Renegotiation of concession contracts in Latin America. Evidence from the water and transport sector. *International Journal of Industrial Organization* 26, 421-442.

Holguín-Veras, J. Cetin, M. and Xie, S. (2006). A comparative analysis of US toll policy. *Transportation Research Part A* 40, 852–871.

Kerf, M. Garay, R. Irwin, T. Levesque, C. and Taylor, R. (1998). Concessions for infrastructure. A guide to their design and award. *World Bank Technical paper* 399.

Matas, A., and Raymond, J. (2003). Demand elasticity on tolled motorways. *Journal of Transportation and Statistics 6, 2/3*, 91-108.

Ruiz, A. (2009). La supresión de peajes en España: un análisis empírico sobre el excedente del consumidor. *Documento de Investigación del Programa de Doctorado de Economía Aplicada*, Mimeo Universidad Autónoma de Barcelona.

Souto, G. (2001), Trabajo y capital en la evaluación pública de proyectos, Madrid: Instituto de Estudios Fiscales, Serie Investigaciones VI.

Vickers, J. and Yarrow, G. (1991). Economic Perspectives on Privatization. *Journal of Economic Perspectives* 5 (2), 111–132.

Williamson, O. (1976). Franchise Bidding for Natural Monopolies - in General and with Respect to CATV. *Bell Journal of Economics*, 7(1), 73-104.

Williamson, O. (1985). The Economic Institutions of Capitalism: Firms, markets, relational contracting. London and NY: *The Free Press*.

Yarrow, G. (1999). A Theory of Privatization, or Why Bureaucrats Are Still in Business. *World Development* 27 (1), 157–168.