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Tome La Siguiente Salida (Take the Next Exit)

A Case Study of Road Investments Gone Wrong
Spain, 1998-2018

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Executive Summary

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Asset owners and managers are typically limited to making private infrastructure investments one deal at a time. Building a well-diversified portfolio, when it is possible, can take a decade. Thus, individual infrastructure investment case studies can usefully complement quantitative studies and improve investors' knowledge and understanding of risk, including the nature and effect of political and regulatory shocks.

In this case study, we examine a disastrous series of private infrastructure equity and debt investments: ten Spanish toll roads procured between 1998 and 2004. Despite these projects being procured with the discipline of non-recourse project financing and the presence of a blanket government guarantee, within a few years of their becoming operational, nine out of ten roads were bankrupt, their equity investors wiped out and their lenders booking losses of 90 cents on the dollar.

What happened?

Bad procurement increases systematic risk

Based on detailed financial data on each of the concession companies as well as in-depth interviews with individuals representing the public and private sector and directly involved in the collapsed projects, this paper shows that governments can procure privately financed infrastructure projects in ways that not only magnify moral hazard, but can also create systematic risk for investors.

The simultaneous procurement of numerous large projects in a single national market not only tends to inflate construction prices and limit competition, which is bad for individual project economics, but can also create sufficiently large contingent public-sector liabilities to make it rational for a government –- in certain *very* bad states of the world –- to delay the payment of public sector guarantees for as long as possible.

Long enough for investors to give up and eat their losses.

This paper describes how, the procurement choices made by Spain led to the extremely aggressive financial structuring of most public-private toll road companies on the back of the *Responsabilidad Patrimonial de la Administración* (RPA). Combined with the *primera hipoteca* (the equivalent of a share pledge) provided by developers, the RPA gave lenders the apparent certainty of recovering their investment in the case of failure.

After the private road sector in Spain was crippled by exploding land expropriation rights and a recession which took away what overestimated traffic volumes were left, all but one of the concession companies filed for bankruptcy, hoping to claim the public sector guarantee. This happened after a recently re-elected conservative government (which had put the roads to tender a decade before) scrapped plans

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to subsidise the projects in a previous attempt to keep them from failing. By then, the government's job included bailing out the entire banking sector and saving road concessions had become a second-order problem.

This case study was motivated by the study of exit costs in the event of financial restructuring in project finance. In the most common cases, exit costs for lenders are high and credit events leads to a restructuring or 'work out' between sponsors and creditors in order to maximise the expected value of both senior debt and equity.

In this case however, the workout value of almost every project was not high enough to justify restructuring the firms and their debt. Instead, lenders acknowledged that the projects they had financed could no longer be considered viable and instead chose to claim the public guarantee provided by the government.

It could be argued that the RPA created moral hazard: the presence of a government guarantee led creditors to make very risky bets with the financial structuring of merchant toll roads, when they would otherwise not have supported such projects or at least have required a much deeper equity commitment from sponsors.

In a series of short models based on simple Game Theory, we show that as the cost of supporting the projects becomes higher, it becomes rational for the public sector to let them fail, knowing that lenders will also fail (or not prefer) to achieve a private sector debt workout, as long as the public sector is also willing to engage in a 'war of attrition' with the same lenders.

There were no bad guys, just rational actors

The war of attrition model provides an insightful framework to understand this phenomenon: in some cases, it is in the best interests of both parties (their best rational move) to engage in a seemingly absurd (zero net benefit) conflict that can last for a long time. A number of military doctrines have been developed in response to this phenomenon, many of which are variants of the 'overwhelming force' approach, by which an opponent chooses to exit the fight immediately when faced with a credible commitment to engage vast resources into a confrontation.

In this war of attrition, there are no bad guys: the government is not unfairly reneging on its commitments, and the private sector is not shamelessly exploiting the moral hazard created by procurement design. It is simply rational for all involved to wait for as long as it takes, because giving up means a large cost now and waiting (which is also costly but only by increment) means that the other side might give up first.

Following the game theory literature, the paper argues that most wars of attrition never start because one side can credibly commit to wait for 'as long as it takes' and the other thus immediately gives

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up. Hence, most public sector guarantees, whether they create moral hazard or not, are honoured immediately (The Tube Lines Bond guarantee by the UK Treasury is a typical example).

However, in certain circumstances, which investors would do well to understand and perhaps try to anticipate, war is the best option for all. In the end, losses for both can be enormous.

The inability of creditors to organise and make a credible commitment to wait for 'as long as it takes' to claim the RPA made it possible for the Spanish government to successfully push creditors to exit the game and sell their claims to a second group of investors, while substantially reducing the size of the liability in the process.

In wars of attrition, it can be difficult to declare a winner. In Spain, lenders eventually gave up and sold their debt in the secondary market with 60-90% haircuts, a world away from the usual 80-100% recovery rates typically expected in project finance. The government still owes the guarantee to the new debtors (even though the amount has been significantly reduced in the process) and also faces the added financial and political cost of having to re-tender the projects.

Amongst the warning signs, the fact that the projects were originally tendered in the middle of a debt-fuelled real estate bubble and were themselves highly leveraged suggested higher risk than individual project specifications might have revealed. By the time all road projects were procured, the total amount owed under the public guarantee represented 6% of the Spanish budget deficit or more than half of all public infrastructure expenditure.

While Spain could always afford to pay such sums, the liabilities created by each concession were significant because by design they were very likely to be triggered together: for a real toll road to fail entirely, the country must be in the middle of a very deep recession, which means that *all* toll roads fail at the same time. Other warning signs included the very structuring choices made by the lenders, which included bullet repayments, creating significant refinancing risk.

Game theory can help you

This paper shows that rational choice and game theory can provide investors with a powerful set of tools to model and predict what is often labelled as 'political risk' i.e. determine what the best moves of public and private actors would be conditional on certain states of the world e.g. a recession requiring the government to bail out the entire banking system, and what this implies for creditors who hold claims on the same government at the same point in time.

Game theory analyses also hold lessons for the design of guarantees and the dynamics they create at the procurement stage.

1. Introduction

1. Introduction

In this case study, we review the procurement, evolution, restructuring and eventual collapse of the Spanish toll road sector over the 1998-2018 period.

Ten new toll roads were procured in Spain in the late 1990s and early 2000s in a context of strong economic and credit growth. These projects then experienced significant cost overruns followed by a near collapse of traffic levels, in the wake of the recession that began in 2008. By 2013-14, the vast majority of these concessions has gone bankrupt after the government decided to stop paying subsidies extended in the initial aftermath of the recession. Equity investors were wiped-out and the commercial banks that had lent several billions of Euros to finance these projects had suffered 90% losses, despite the fact that the projects were protected by the "Responsabilidad Patrimonial de la Administración" or RPA, an unconditional government guarantee.

Our analysis of the concession companies involved is based on the in-depth study of their accounts, field interviews with a range of public and private sector individuals involved (conducted in 2017), as well as the detailed review of local and international media reporting on these events.

This case study provides the reader with an understanding of **the mechanisms at play between procuring authority, project sponsors and project finance creditors when infrastructure projects are simultaneously impacted by large exogenous shocks**. Understanding the decision by the government on whether or not to subsidise infrastructure projects that have been affected by a financial shock cannot be isolated from the ability of private investors and creditors to either 'work out' defaulted projects, or let equity investors be wiped out. Likewise, in the presence of a government guarantee, the decisions on whether or not to subsidise private infrastructure, but also those on structuring projects more or less aggressively, are related to the size of the guarantee relative to the size of the required subsidy.

For example, smaller subsidies, which tend to be preferred in isolation, are the more likely to be rejected by the government in the knowledge that creditors and sponsors can successfully restructure the firm and take a small loss; in turn, this can incentivise lenders to over-leverage project, making workouts less likely, as long as a large guarantee or subsidy can be claimed. Beyond this specific example, this case study applies an analytical framework that can be used to analyse political risk and, more generally, the public-private interaction and strategic bargaining in infrastructure investments.

Section 2 presents a detailed account of the events and ensuing negotiations that led to the collapse and eventual 'exit' of the various parties involved. Section 3 proposes an analysis of the strategic bargaining that took place between the different players using a simple game theoretic framework. Section 4 concludes.

2. The Story: Risky Road Bets

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This chapter tells the story of the ten toll roads that were procured and built in Spain, mostly at the beginning of the century. These concessions suffered simultaneous shocks that led to their eventual bankruptcies and very high losses for original equity and debt investors, despite multiple attempts to rescue them by the Spanish government, proposals to restructure the projects privately and the existence of an unconditional government guarantee in case of early termination.

In section 2.1, we describe the projects, their legal and financial structures, and the public sector guarantee extended by the Spanish government. Section 2.2 focuses on the twin shocks of development cost overruns and traffic collapse that subsequently affected the concessionaires.

Section 2.3 discusses the aftermath of the shocks in three stages: first the attempt by the government to save the concessions through a series of subsidy measures, then the attempt to restructure the project companies by lenders and project owners, and finally the negotiations between lenders and the public sector with respect to the payment of the guarantee.

Section 2.4 presents the eventual outcome of the case in 2018 and suggests analytical directions that we explore in the next chapter.

2.1 Ten New Toll Roads

From 1998 to 2004, ten new toll roads were built around Madrid and the south east Mediterranean coast of Spain, as shown on figure 1.

In 1997, a plan to build "radial" roads to de-congest the access to the capital city, Madrid, was declared "urgent and of special social interest" by the Spanish Ministry of Works (Albalate et al., 2015). Existing access roads (the A2, A3, A4 and A5) suffered from heavy congestion and the outer region of the city was expected to experience significant population growth.

Plans to build seven new toll roads (Radial 2, Radial 3, Radial 4, Radial 5, M-12 Eje Aeropuerto, AP-41 Madrid–Toledo, AP-36 Ocaña-La Roda) and a new toll-free ring-road (M-50) were put forward. The seven toll roads were to be built and operated under long-term concession agreements with private concessionaires who would finance the projects.

The toll-free M-50 was divided into three sections, each of which was bundled with a tolled concession. These three concessionaires also had to raise construction financing and fund future M-50 operations on the basis of the toll income generated by the relevant radials roads. [1]

At the same time, another priority national project entailed the construction of three toll roads along the south east Mediterranean coast, from Alicante to Almería, a region with increasing tourism activity

1 - Initial project cost estimates by the concessionaires (see table 10) suggest that M-50 construction costs represented a large proportion of total project costs.

2. The Story: Risky Road Bets

Figure 1: New Spanish Toll Roads Projects in 1998-2004

(A-70 Circunvalación de Alicante, AP-7 Alicante-Cartagena, AP-7 Cartagena–Vera). This project was an extension of the existing Mediterranean toll road AP-7 which connected La Junquera, in the north of Cataluña, with Alicante, a city with a population of around 300,000 and one of the most touristic provincial capitals along the Mediterranean Coast.

2.1.1 The Choice of the Concession Model

All ten toll roads were procured using a concession model often referred to as a 'public-private partnership' (PPP), by which private companies build, finance, maintain and operate the roads for a pre-defined period of time. The ten road projects were developed as nine concession contracts awarded to as many concession companies or Special Purpose Vehicles (SPVs). Table 1 lists the nine SPVs and the ten corresponding toll roads.

As in most other European countries, public-private concession contracts had been used to procure a limited number of public infrastructure projects in Spain since the nineteenth century, and had become more widely adopted in the mid 1960s, at least in part to alleviate the public sector budget constraint (Bel, 2011).

However, a wave of bankruptcies of private toll roads in Spain in the late 1970s had forced the government to nationalise three projects in the north of the country in 1984 (Autopista del Atlántico, Autopista León-Campomanes and Autopista de Navarra) (Acerete et al., 2009), and by the time the Socialist party came to power in 1982, the PPP model had rather fallen out of favour as a means to procure new infrastructure.

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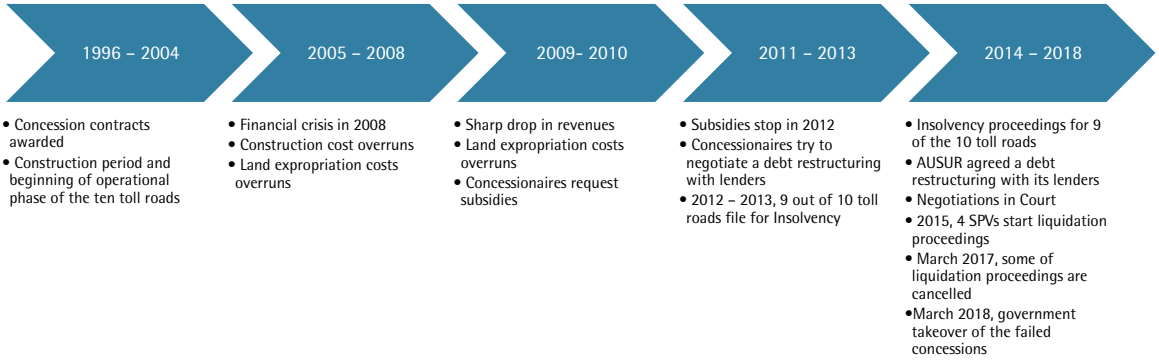
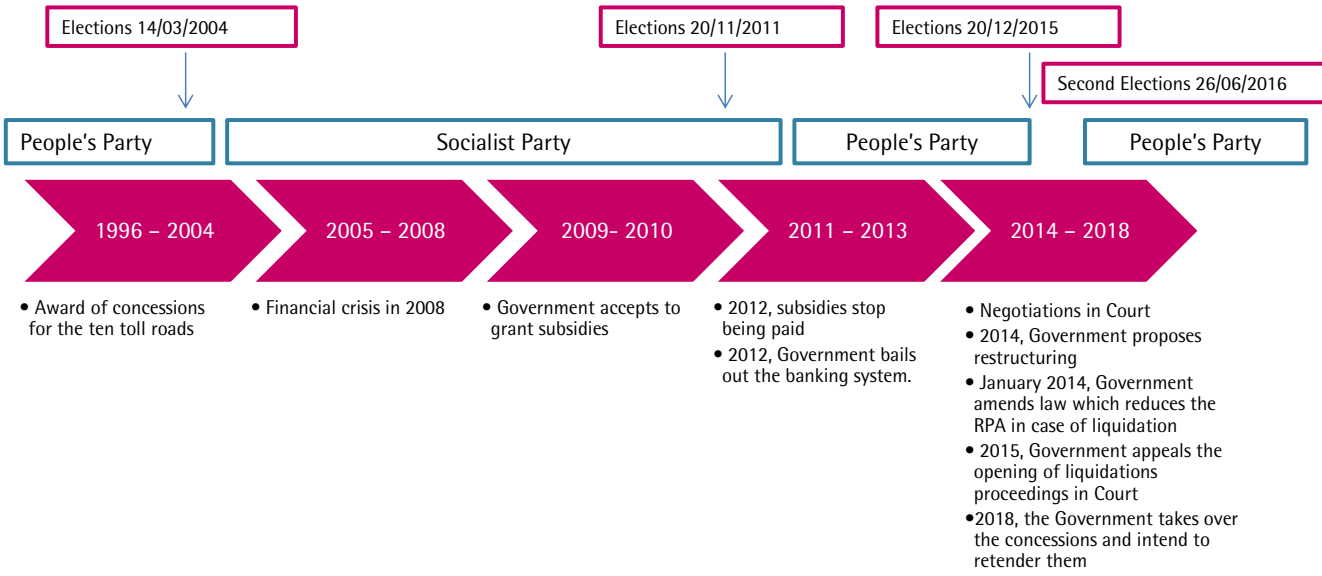
Figure 2: Timelines: Summary of Major Events

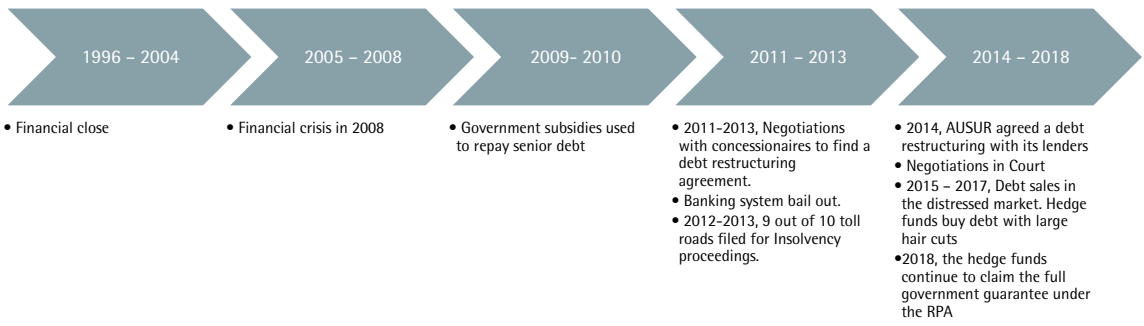
(a) Concessionaires' Timeline



(b) Government Timeline



(c) Lenders' Timeline



2. The Story: Risky Road Bets

Table 1: Concessionaires and Toll Road Names

	Concession Company	Corresponding Toll Road(s)
1	Henarsa	Radial 2
2	Autopista Madrid – Sur C.E.S.A.	Radial 4
3	Autopista Madrid Toledo C.E.A.S.A.	AP-41
4	Autopista Madrid Levante	AP-36
5	Ciralsa S.A.C.E.	Circunvalación Alicante
6	Aucosta	AP-7 Cartagena - Vera
7	Accesos de Madrid Concesionaria Española S.A.	Radial 3 and Radial 5
8	Autopista Eje Aeropuerto Concesionaria Española	M-12 Eje aeropuerto
9	Ausur	AP-7 Alicante - Cartagena

Source: authors

For a few years, the government stopped promoting private concessions to finance motorways and focused on widening and upgrading the most important roads, turning them into faster dual-carriageways (Autovías). These projects were entirely financed by the public sector.

After Spain joined the European Economic Community (EEC) in 1986, the concession model was used again to build new transport infrastructure. Joining the EEC gave the country access to new funds to develop its infrastructure (so-called accession funding), but also gradually created a more stringent budget constraint with European rules designed to preserve European fiscal stability, especially after the signature of the Maastricht treaty in 1992.

A conservative government returned to power in Spain in 1996 under the People's Party, and the use of concessions to procure new infrastructure was further extended to help comply with the European public deficit rule, the enforcement of which would become a precondition to joining the future European Monetary Union in 1999 ((Ortega et al., 2016)).

2.1.2 Financial Structuring

Two aspects of the financial structuring of these projects stand out: the financing was rather aggressive and it was backed by a public guarantee in the event of default.

Aggressive Financing Structures

Table 11 in Appendix B shows the financial structuring of each project at financial close. This data was computed by the authors using detailed financial accounts for each project. It can be seen from the table that these projects were at the high end of the levels of senior leverage typically found in "merchant" project financing, often approaching and in one case exceeding 90%, a level more commonly found in project financing structures that receive a pre-defined 'contracted' income stream instead of being exposed to commercial risk.

Moreover, several projects feature loans with so-called bullet repayment structures (i.e. the loan principal is expected to be repaid in one single instalment at maturity).

2. The Story: Risky Road Bets

This is not the most common structure found in infrastructure project financing, where fully-amortising loan repayment tends to be the norm. Indeed, in order to repay a bullet loan, an infrastructure project, which is a standalone business, would need to accumulate large amounts of cash over time in a reserve account, which can put it at odds with its business model.

While it is likely that the lenders involved in the financing of the roads expected these loans to be refinanced long before they reached maturity, it also suggests, in combination with the leverage ratios described above, that the amount of debt was maximised for a given business case.

While increasing leverage can optimise the financial structure of the firm in low risk businesses, in the case of green-field real toll roads, this decision may also have been driven by the existence of a blanket public-sector guarantee under Spanish procurement rules known as the "RPA".

The Public Guarantee

PPPs often include public-sector termination guarantees. In the Spanish case, the termination guarantee is called the "Responsabilidad Patrimonial de la Administración" or RPA.

By law, each concession contract must feature an RPA clause, indicating the maximum amount payable to the concessionaire by the public sector. This amount is set at the time of contract signature on the basis of an amount submitted in the winning bid.

The original intention behind such a guarantee is to protect the private sector against any "unfair" enrichment of the state in the event of contract termination (i.e. expropriation).

At the financing stage, project lenders could thus demand pledges on the RPA so that the senior debt of each concession company would be protected against default. When providing financing, lenders would look at the maximum RPA amount and size the financing, in part, on the basis of that amount (Anonymous Interview, 2017d).

In Appendix A, we cover the origins and mechanism of the RPA in more detail.

At financial close, the concessionaires would also mortgage the concession (*primera hipoteca de concesión*) in favour of senior lenders. These mortgages are not on the hard assets themselves (which remain in the public domain as is the case with most PPPs), but on the ownership of the concession rights. In the event of default, these mortgages would create control rights for the lenders over the concession.

Thus, through this mechanism, lenders to the nine concession companies held the equivalent of a 'share pledge' by the sponsors, by which a breach of covenant (including a default) can allow lenders to take control of the project company.

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The combination of the *hipoteca* and of the RPA gave lenders the quasi-certainty of recovering their investment in case of failure of the toll roads.

2.2 Synchronised Shocks

Having been procured over a relatively short period of time, the nine concessions were still going through the early years of their life-cycle when they were all hit by two, mostly unrelated, but simultaneous shocks: a dramatic fall in traffic revenues and the rapid escalation of their development costs due to legal issues around land use rights.

While infrastructure projects such as toll roads can experience shocks, these are mostly idiosyncratic and uncorrelated. But the nine concessions were bound by their original design, and these shocks would forge a common if tragic destiny for all of them.

2.2.1 Traffic Collapse

After joining the European Economic Community in 1986, Spain had experienced steady economic growth: between 1995 and 2007, Spain had a higher GDP growth than most other European countries.

Following years of growth but also public and private debt accumulation, the economic recession of 2008 had a very negative effect on the Spanish economy.

GDP growth fell dramatically in 2009, 2011, 2012 and 2013. By then, unemployment exceeded 26% in Spain, against 10.8% in the European Union (28 countries).

The recession had particularly severe consequences on the economic performance of toll road concessions. Traffic levels declined sharply after 2008 as shown in figure 3a, 4a and 5a. Likewise, figures 3b, 4b and 5b show traffic growth for each toll road.

The impact of the recession was particularly negative for the toll roads built in the metropolitan area of Madrid.[2]

Furthermore, initial traffic forecasts, which were made by the public sector and concessionaires, proved to have been characteristically over-optimistic (Flyvbjerg et al., 2003), and some studies ((Muñoz and Vassallo Magro, 2012)) have shown that average daily traffic estimates were below the actual traffic levels even before the 2008 recession.

Figures 6a and 6b show the deviation between the forecast and actual average daily traffic in the toll roads Radial 3 and Radial 5 in Madrid. The largest deviation from base case traffic was -79% for the R-3, and -85% for the R-5 in 2014.

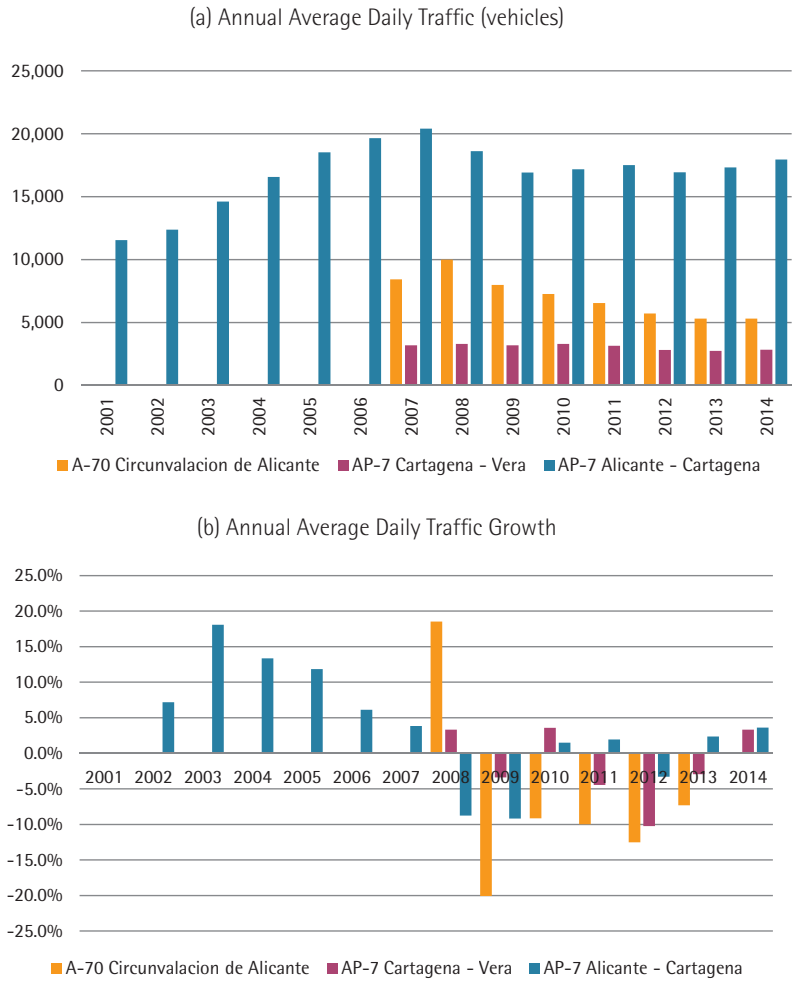
2.2.2 Spiralling Land Expropriation Costs

In addition to low and declining traffic levels, from 2008 onwards, concessionaires had to cope with significant land expropriation cost overruns.

2 - The radial roads were meant to alleviate traffic congestion on free roads at peak hours, but connections between the different roads was poorly designed. Additionally, the toll roads in the Madrid metropolitan area were the first toll roads build within a city in Spain, which made it difficult to anticipate user response and traffic patterns (Anonymous Interview, 2017a).

2. The Story: Risky Road Bets

Figure 3: Realised Traffic on the A-70 and AP-7 (Cartagena-Vera and Alicente-Cartagena)



Source: Ministerio de Fomento.

In Spain, the process by which the public sector can expropriate land owners is fast-tracked if a project is considered to be of public interest, and the administration can expropriate land owners and set compensation at a level deemed fair by the public sector.

Moreover, under the Spanish legal framework for concessions, the public sector delegates the right to expropriate the relevant land from its existing owners to the concessionaires. Concessionaires thus bought the land needed to build the project at an estimated initial price, which had been put forward by the public sector at the time of bidding.

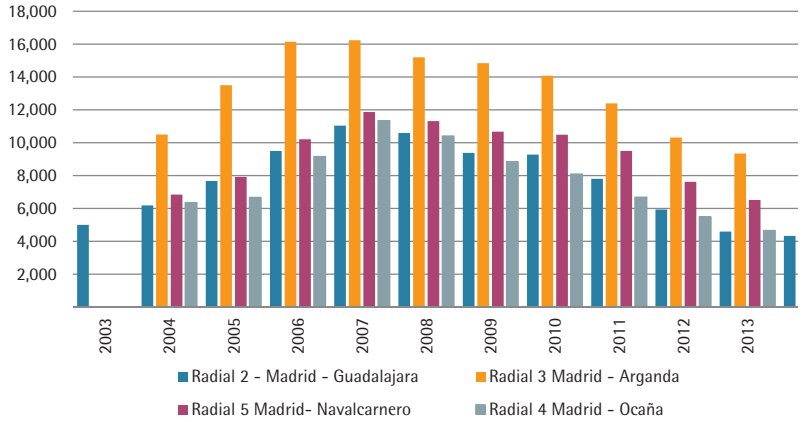
At that time, three categories of land were recognised in the law: urban land, "urbanisable" land and rural land. Initial cost estimates were based on rural land valuation (Fernández Magariño, 2012).

Land owners can appeal the compensation set by the government in court and the

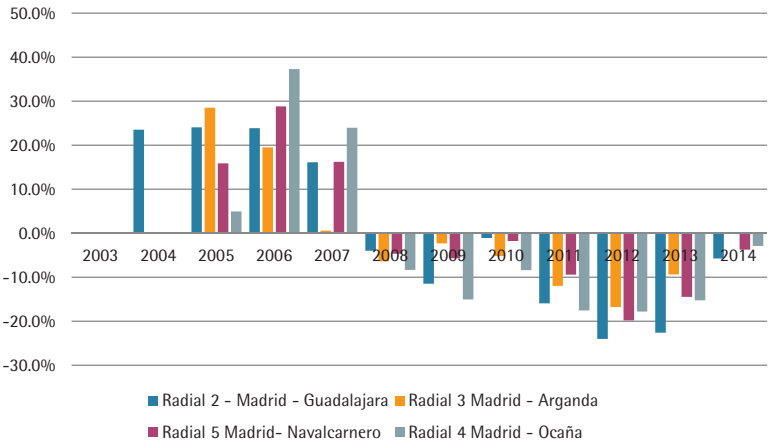
2. The Story: Risky Road Bets

Figure 4: Realised Traffic on the Madrid Radials

(a) Annual Average Daily Traffic (vehicles)



(b) Annual Average Daily Traffic Growth



Source: Ministerio de Fomento.

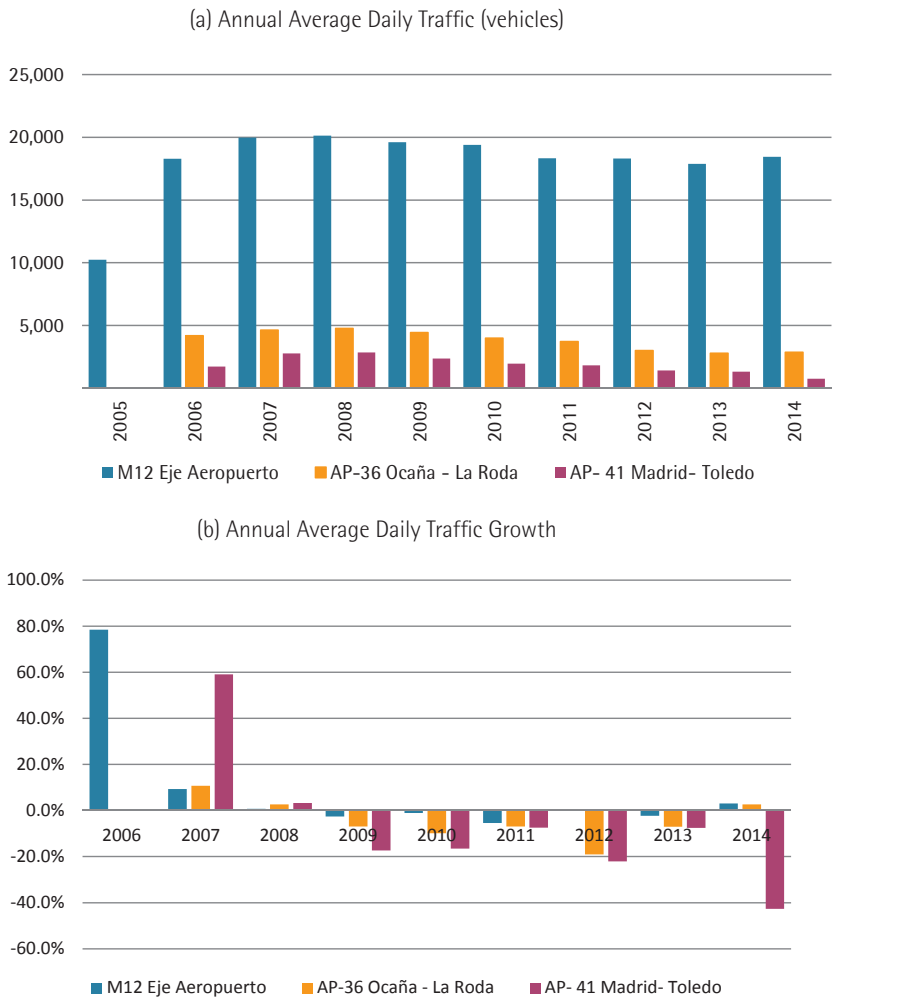
final decision on the fair value of the expropriated land rests with the courts. On 21 July 2008, the Supreme Court ruled that land expropriation costs close to urban areas would contribute to urban development and therefore should be valued higher as "urbanisable" land (Vassallo Magro and Baeza Muñoz, 2011). As the parcels became recategorised as *urbanisable* expropriation costs dramatically increased. [3]

Expropriations claims by land owners were processed in court from 2008 to 2015. When the compensation claims and the final land acquisition costs were determined, concessionaires were ordered by the courts to pay back the difference with initial valuations and accrued interest. However, the valuations put on urbanisable land proved to be controversial and allegedly too high (Anonymous Interview, 2017d) (Anonymous Interview, 2017a). For toll roads inside the Madrid metropolitan area, this issue was compounded by the rapid increase of land valuations until the crisis, within a context of real estate price bubble (Burriel, 2011).

3 - In 2008, the law was amended, reducing the number of land categories to two: urban and rural (Fernández Magariño, 2012) in order to avoid an escalation of land expropriation costs in future projects

2. The Story: Risky Road Bets

Figure 5: Realised Traffic on M12, AP-36 and AP-41



Source: Ministerio de Fomento.

According to data provided by SEOPAN (Asociación de Empresas Constructoras y Concesionarias de infraestructuras), the Construction Companies and Concessionaires Association, total land costs forecast for the development of the nine toll roads initially amounted to 387 million Euros (concessionaires estimates). However by 2015, when the claims initiated by land owners were resolved, total land costs had increased to 2.19 billion Euros. In March 2015, 991 million Euros had been paid and 1.2 billion Euros remained due to land owners (Méndez, 2015). [4].

Table 2 shows the project cost estimates of 3 of the Madrid projects, while table 3 shows the outturn costs actually incurred as per the last financial report available. Table 4 shows the extent of cost overruns incurred by the three concessionaires.

While detailed land expropriation cost data is only available for the Madrid concessions, the other projects suffered similar issues and

4 - Further compensation of land owners was also owed by the government in cases where the initial expropriation process was voided by the Supreme Court: in order to shorten the bidding time, the official business case of Madrid toll roads (R-2, R-3, R-4 and R-5) was not made public by the government, which was sufficient to void the original expropriation process.These damages were set at 25% of the total land price (Méndez, 2015)

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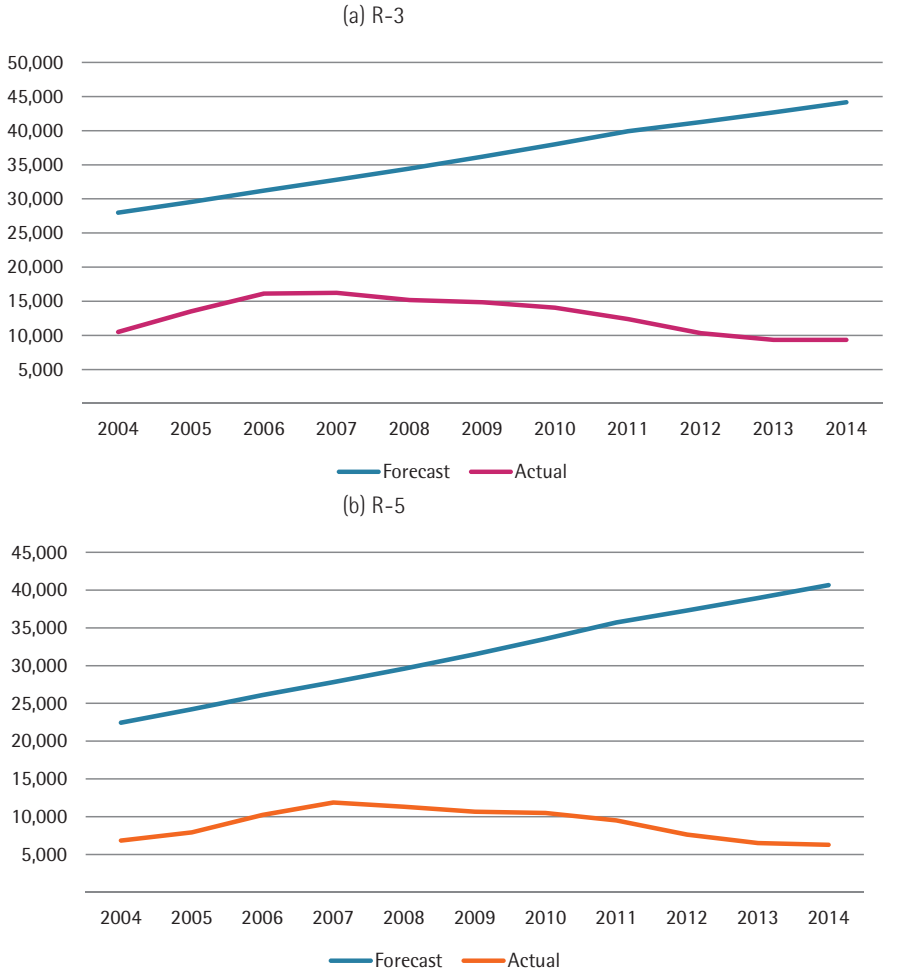
Figure 6: Annual Average Daily Traffic Estimates versus Actual



Source: actual data from Ministerio de Fomento and concessionaire's estimates.

Table 2: Project Cost Estimates in million Euros, Madrid Radials

Concessionaire	Const. Cost Forecasts	Land Cost Forecasts	Total Cost Forecasts
Henarsa - (R2 and part of M50)	395.4	73.5	468.9
A. Madrid Sur - (R4 and part of M50)	622.1	72.8	694.9
Accesos de Madrid - (R3, R5 and part of M50)	679.6	39	718.6

Source: concessionaires estimates, initial business case.

Table 3: Outturn Project Cost in million Euros, Madrid Radials

Concessionaire	Outturn Const. Costs	Outturn Land Costs	Total Outturn Costs
Henarsa - (R2 and part of M50)	490.2	378.5	868.7
A. Madrid Sur - (R4 and part of M50)	773.8	547.9	1321.7
Accesos de Madrid - (R3, R5 and part of M50)	1006.9	252.3	1259.2

Source: last audited accounts available in 2012, 2014 and 2014, repsectfully

2. The Story: Risky Road Bets

Table 4: Project Costs Increase with Respect to Initial Estimates, Madrid Radials

Concessionaire	Const. Costs Overruns	Land Cost Overruns	Total Cost Overruns
Henarsa - (R2 and part of M50)	24%	415%	85%
A. Madrid Sur - (R4 and part of M50)	24%	653%	90%
Accesos de Madrid - (R3, R5 and part of M50)	48%	547%	75%

Source: authors' calculations.

cost overruns, albeit not on the same scale as land prices were not as high in the south of Spain as they were in the capital.

2.3 Aftermath

From 2008, as a result of the revenue and costs shocks described in the preceding sections, the nine toll road concessionaires started experiencing significant financial difficulties. The cost estimates of their original business case were beginning to look increasingly unrealistic and, at the same time, their revenues started to collapse.

The story of the nine concessions then unfolded in several key moments: first, the government tried to save the projects but eventually decided not to (section 2.3.1), then ensued a period of private debt restructuring attempts which culminated with private lenders trying to obtain the payment of the RPA public sector guarantee (section 2.3.2). Finally, the public sector and lenders engaged in a lengthy negotiation about the payment of the guarantee or the possibility of a new debt restructuring (section 2.3.3).

2.3.1 Subsidy

Faced with increasing financial stress, in 2009 the concessionaires started requesting support from the government to restore the financial balance of the projects, and almost immediately the government approved a set of measures to mitigate the effects of the recession and of the large cost overruns (Vassallo Magro and Baeza Muñoz, 2011).

These measures took various forms, from direct subsidies, to debt injection and revenue support.

Direct subsidies

Construction cost overruns had impacted several of the concessionaires over and above the matter of land expropriation costs.

As shown in table 4, the Madrid concessions had also experienced higher construction costs due to the changes in project specification that were not initially included in the financial plan and were requested by the government.

In some cases and under certain conditions, the government agreed to compensate the firms for these cost overruns, sometimes with a direct subsidy and sometimes with an extension of the concession period and/or

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the increase of toll fees. See tables 5 and 6 for details. [5]

Subordinated public participation loans

Another measure adopted by the government in 2009 was the award of "subordinated public participation loans" to the concessionaires as a way of compensating them for the increase in land expropriation costs.

These loans were granted under the condition that total expropriation costs be more than 175% of the initial total costs envisaged in the business plan. The loan tenor equalled the remaining years of the concession and the government would receive the remuneration that was the greater of the two options: a fixed interest rate of 1.75% or the ratio of the outstanding loan face value at year-end to total investment (see table 7 for details).

Such loans were considered a financial investment in public accounts and thus did not impact official public debt levels.

Clearing accounts

In 2010, the government established an additional measure called "Cuenta de compensación" or *clearing account* introduced by the law 43/2010.

A clearing account would allow the government to compensate concession companies that had experienced levels of traffic below those estimated when the concession agreement was signed, alleviating operating cash flow problems for the adversely affected concessionaires, thus helping maintain the short-term economic stability of the firms.

With this measure, the government guaranteed the difference between the 80% of the revenues originally expected and actual revenues. This compensation became effective in January 2011 for an initial period of three years.

This revenue shortfall was recorded in each concession's account. The yearly compensation for each concessionaire was limited according to a level of revenues. Additionally, the government also capped the total amount of compensation paid by creating a specific public budget to be determined and agreed each year. While this measure existed in 2011 and 2012, this cap was set to 80 million Euros.

This revenue support was also supposed to be paid back to the government once a concession company started to have higher revenues than those estimated in the initial financial plan. Each year, concessionaires would pay the 50% of such "exceptional" revenues into the same account, gradually offsetting the public support received.

The clearing accounting compensation was paid in 2011 to all the concessionaires in financial difficulties except to AUSUR, which the government refused to include in the program probably due to its better financial health, despite the firm requesting to be included. Table 17 in Appendix C shows the effect of this subsidy on their

5 - The concessionaire A. M12 Eje Aeropuerto had also claimed a compensation of 140.7 million Euros from the government in 2005 and 2006. The government only acknowledged 42.6 million Euros in 2010. The company continued claiming but no extra compensation was paid.

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Table 5: Construction Costs Overruns Compensation, in million Euros

Concessionaire	Costs Overruns	Subsidy	Year
Henersa - R2	61.5	Contract extension (15 years) + 1.95% annual tariff increase since extension	2010
A. Madrid Sur - R4	110.7	Tariff increase of 1.95% annually as of 2012%	2011
Accesos de Madrid - R3 and R5	199.1	Tariff increase of 1.95% annually as of 2011	2010
A. M12 Eje Aeropuerto	140.7	No compensation given	

Source: concessionnaires' financial accounts, relevant years.

Table 6: Other Direct Subsidies

Concessionaire	Amount	Reason	Year
A. Madrid Toledo - AP-41	4.1M Euros	Changes in project scope	2012
AUSUR - AP-7	Tariff increase of 3.21%	Improvement of parallel free road	2012

Source: concessionnaires' financial accounts, relevant years.

Table 7: State Loans Compensating for Land Expropriation Cost Overruns, in million Euros

Concessionaire	Facility limit	Amount received	Year
HERNASA - R2	354	279	2011
ACCESOS DE MADRID - R3 and R5	570	168.5	2011
AUSUR - AP-7	30.6	30.6	2010

Source: concessionnaires' financial accounts, relevant years.

net income. In the vast majority of cases, the clearing account acted as intended and turns negative income growth into a positive figure.

In December 2012, Royal Decree 43/2010 was modified to extend the terms of the clearing account to 2018. This was enacted by the People's Party in its first year in government.

But soon after, the same newly elected government stopped paying these subsidies to the concessionaires, as it became apparent that the probability of the projects defaulting was still very high.

Indeed, despite this set of measures, the financial health of the concessionaires did not improve and eight out of the nine toll road companies went into hard default in the following years (from 2012 to 2013).

2.3.2 Restructuring

In November 2011, general elections were held in Spain and the conservative People's Party was declared the winner with an absolute majority of seats. [6]

From 2012 onwards, the different subsidies and support mechanisms described above were suspended by the new government.

The subordinated loans that had been granted to some concessionaires could not be drawn, and the payment of the clearing account compensation was suspended and was not included in the 2013 budget.

6 - General elections in Spain are held to choose representatives of the Cortes Generales or Congress. The Congress is composed of 350 members directly elected by universal suffrage for a four-year term of office. Each of Spain's 50 provinces is a constituency entitled to an initial minimum of two seats. The remaining 248 seats are allocated among the 50 provinces in proportion to their populations. The candidates are presented by parties. Electors do not choose individual candidates. In order to participate in the allocation of seats, a list must receive at least three percent of all valid votes cast in the constituency. Absolute majority of votes is considered when a party wins more than half of the seats (at least 176 seats). In the general elections of 2011, the PP party obtained 186 of the seats.

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It is likely that the new government saw the failure and eventual default of the concessionaires as unavoidable (Anonymous Interview, 2017c).

Moreover, by 2012, bailing out toll road projects that had been granted concessions by the previous government had become a second-order problem, in a context where the Spanish government now had to play the role of lender of last resort for the entire economy.

Since 2008, the Spanish banking system had already undergone significant restructuring through a combination of bank consolidation and public bailouts. By 2012, many of the *Cajas*, regional semi-public savings banks, had to be rescued by the government.

But in May 2012, the impending failure of much larger, national lenders took the Spanish credit crisis to a new level. On 9 May, Bankia, formerly Caja Madrid, a lender to and shareholder of several of the toll roads, and one of the country's largest mortgage lenders, was nationalised. On 25 May 2012, it was announced that Bankia would require a bailout of 23.5 billion Euros to cover losses from failed mortgages and other credits. In a dire financial situation itself, on 9 June, the Spanish government had to accept a loan of 100 billion Euros from the European Union to support the bailout of the national banking system.

In this context, protecting road concessionaires from default amounted to bailing out the lenders (the majority of which were Spanish) at the project level rather than at the more adequate level of the banking system as a whole.

As we discuss below, international lenders would find themselves caught short by this logic. It is estimated that in 2014, Spanish banks held 68% of the total debt outstanding, or about 2.7 billion Euros, and that foreign banks held the remaining 32%, or 1.3 billion Euros (EconomiaDigital, 2014).[7]

When subsidies and revenue support stopped, the concessionaires began judicial proceedings against the government but were now on an unavoidable path to hard default.

As hard defaults became inevitable, the concessionaires now had to negotiate with their respective lenders to try and achieve a viable restructuring and avoid insolvency proceedings, in which case their equity would be wiped out.

However, private debt restructuring was eventually considered viable in only one of the nine concession companies.

The AUSUR AP-7 Alicante-Cartagena concession was a more sound project that benefited from more resilient traffic flows even after the recession.

As a result, AUSUR is the only concession that could reach a debt restructuring agreement with its lenders, which was agreed in 2014.[8] All other concessions had

7 - Tables 19 and 20 in the appendix include the list of Spanish and foreign banks involved in the 10 road projects at the time of financial close.

8 - When this project was refinanced, its lenders demanded new pledges on AUSUR shares and an additional equity injection.

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defaulted and filed for insolvency between 2012 and 2013.

Insolvency and the RPA

These eight firms may have been declared insolvent because of their very limited business prospects, or because their lenders took the view that the RPA public guarantee offered them a better outcome (i.e. a higher expected recovery rate than a "work-out"). We discuss this point in rational-choice setting in the next chapter.

Once insolvency proceedings were initiated, the next logical step was the liquidation of the concession companies, at which point the RPA clause could be activated, since the concession contracts are terminated earlier than stipulated in the contract.

Under this clause, the government has to bear all non-depreciated capital costs. As we argued above, multiple bankruptcies in the toll road sector, effectively triggering a bailout of all project lenders, had to be considered in the context of the first-order problem at the time: bail-out the Spanish banking sector as a whole.

Furthermore, the synchronised nature of the bankruptcies means that the cost to the public sector, at a time of significant fiscal stress, was also large.

Table (8) shows the values of the maximum RPA amount stated in each concession contract, the amount of debt that was raised at financial close, and the senior debt outstanding as per the last balance sheet available.

For the eight concessions facing bankruptcy, in 2015, the cumulative RPA payable by the government could reach a maximum of 3.34 billion Euros.

At that time, Spanish GDP was about 1 trillion Euros and the public sector budget deficit reached 55.7 billion Euros, or 5.15% of GDP (OECD, 2016). Hence, an additional 3.34 billion Euros of RPA would have pushed the budget deficit by 30 basis points, to 5.46% of GDP.

The maximum amount owed under the RPA also represented 55% of the total annual infrastructure public budget or 6.05 billion Euros (OECD, 2016).

Thus, while the Spanish state could afford to pay the RPA, even in the aftermath of the biggest recession in recent history, the size of this liability was undeniably large and is likely to have made the search for alternatives appealing.

Moreover, in the context of the European Union's fiscal rules, Spain had already largely surpassed the 3% budget deficit threshold allowed, and a 6% increase of the budget deficit was also unwelcome for this reason, especially as the country had just accepted the terms of a large rescue loan with the EU.

2.3.3 Calling the Guarantee

At this stage, creditors of the eight projects had already concluded that they

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Table 8: RPA Established in Concession Contracts, Debt Granted at Financial Close and Senior Debt Outstanding as per Last Balance Sheet Available (in million Euros)

Failing Concessions	Max RPA	Senior Debt (Fin. Close)	Outstand. Debt (2012-13)	RPA/Outs. Debt
Accesos de Madrid - R3 and R5	677	831.5	720.4	94%
A. Madrid Sur - R4	559.7	610.7	606.2	92%
Aucosta - AP-7 Cartg.-Vera	526.8	632	473.1	111%
A. Madrid Levante - AP-36	487.2	577	549.2	89%
Ciralsa - A-70	398.6	299.1	286.2	139%
A. Madrid Toledo - AP-41	348.9	424.8	387.5	90%
A. M12 Eje Aeropuerto	305.5	315.6	269.7	113%
Henarsa - R2	40.7	473	475.8	8.5%
Total	3,344	4,164	3,768	89%

Source: Official Bulletin, audited accounts for relevant years; Authors' calculations.

would rather "exit" the deal and call the government guarantee rather restructure the project debt with the sponsors, in which case they would have followed the path of the AUSUR project and not started the insolvency proceedings that were expected to lead to the firm's liquidation.

If all eight concession companies were liquidated, the government would have to face what can reasonably be described as "high costs."

As a result, in October 2013, to avoid the activation of the RPA clause, the Spanish government began negotiations with the projects' creditors to try and find an alternative restructuring solution.

Public Workout Proposal

The government proposed the creation of a new state-owned company that would manage and operate the toll roads that were in default.

Under this proposal, made jointly to all creditors, a 50% haircut would be agreed, representing a private loss of about 1.75 billion Euros,[9] and the remaining 50% of outstanding debt would be converted into a 30-year bond issued by the state-owned company SEITTSA, the existing Public highway company.[10]

This new bond would bear a fixed 1% interest rate plus an additional margin linked to the traffic evolution of the toll roads. Shareholders would surrender 100% of the roads' equity, seeing their investment completely wiped out and confirming that they had, by then, lost all bargaining power in these negotiations.

For the public sector, this solution presented the advantage of being budget-neutral, even though it would impact the official level of public debt.

Crucially, this deal would preclude having to pay the RPA guarantee.

The public sector's rationale was thus to replace the lump-sum payment of the RPA with a instrument paying stream of future

9 - Total outstanding debt in 2012-13, for the concessions that would have to be restructured, was 3.7bn Euros

10 - SEITTSA was created to absorb the first generation of private road concessions after they failed in the late 1970s following another exogenous shock: the twin oil crises of 1974 and 1979.

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cash flows with a share of the future upside (Anonymous Interview, 2017a).

To be implemented, however, this solution had to be accepted in the context of each individual insolvency proceeding, which required pooling all assets and applying the same valuation formula to all remaining senior debt instruments, even though some roads allegedly had better prospects than others.

In March 2014, Spanish banks, which held the majority of the debt, stated publicly that although they were willing to accept the size of the haircut, they did not agree to the proposed interest rate formula. They argued that it was too risky to link the bond remuneration to future traffic (Alba, 2014).

Instead, they asked that the new bond interest rate be no less than 4.25% fixed (i.e. the 30 years public bond interest at that time). At the time, Spanish banks argued that the combination of revised traffic forecast with the interest rate formula proposed by the public sector would imply actual haircuts in the 60-80% range, which they were not willing to accept.

Moreover, the government's offer did not include any kind of debt guarantee, implying that more debt relief could occur in the future. Hence, creditors also demanded a government debt guarantee as a condition to agree to the proposed restructuring.

In July 2014, the government was reportedly willing to increase the fixed interest rate of the new bond to 2.5%, but lenders still refused (Marco and Navas, 2014).

Importantly, while national lenders were more willing to negotiate the new debt restructuring proposed by the government, foreign banks reportedly refused to engage in such negotiations and continued to demand the liquidation of the toll roads and the payment of the RPA (Sainz, 2014).

In the end, it seemed unlikely that the proposal would ever succeed.

Spanish bankruptcy law requires that the different proposals made during the insolvency proceedings must be first examined by the appointed administrator and later approved by the appointed judge.

But the different versions of this public workout proposal were considered invalid and void by commercial courts. Indeed, the government's proposal was considered to have important legal defects: it did not treat all the creditors equally and it infringed bankruptcy law on several counts (Anonymous Interview, 2017c), (Anonymous Interview, 2017e), (Agencias, 2015).

Today, it remains difficult to ascertain whether or not the government was aware of these defects and was only trying to gain time, or if it genuinely expected and thought it possible to restructure a new deal.

Computation of the RPA

The government made the proposal to restructure the toll roads' debt described

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above *after* private debt restructuring had been rejected by the lenders. Hence the chances of success of any new workout proposal made by the government at this stage might have seemed rather low, especially since the alternative (receiving the RPA guarantee) represented the majority, if not all, of the debt that creditors were trying to recover, and remains – by law – the responsibility of the public sector.

However, while the public sector could not credibly walk away from its obligation to pay the guarantee, it could make the size and the timing of that payment more or less uncertain for creditors.

For instance, while insolvency proceedings are going on, from a legal standpoint the road infrastructure at stake continues to depreciate. Hence, the longer insolvency proceedings last, the more the guaranteed amount under the RPA would be reduced. It follows that blocking liquidation by engaging into lengthy restructuring discussions with Spanish banks (sometimes without involving the foreign ones) **has value** for the public sector, whether or not these restructuring negotiations can be reasonably expected to succeed.

Furthermore, in January 2014, Royal Decree Law 1/2014 was approved and introduced regulatory changes which affected the State's liability in the event of the termination of a concession contract. There was a modification of Law 8/1972 which governs the construction, maintenance and operation of motorways under concession contracts.

The new version of the law includes a cap on the public liability for land expropriation costs in case the concessionaire goes bankrupt and fails to pay land owners. Crucially, it states that if the state does become liable for the claims of the expropriated beneficiaries, it could *offset this liability by deducting the amount payable from the RPA due to the concessionaire* (Lasa and Pérez-Marsá, 2015).

As discussed in section 2.3.1, the government had granted several state loans to cover expropriation cost overruns, the total amount of which (approx. 450 million Euros) could now be deducted from the RPA.

Additionally, since concessionaires had declared insolvency in 2012 and 2013, the Supreme Court ruled that the government was liable to pay any remaining unpaid land expropriation cost overruns of the concessionaires to land owners, as well as any claims yet to be resolved. As previously mentioned, this amounted to approximately 1.2 billion Euros.

The Royal Decree became effective as of 26 January 2014, with retroactive effect.

This regulation has important implications for creditors: it entails a potentially large reduction of the final RPA to be paid, as previous and future public liabilities with respect to land expropriation cost overruns

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will be discounted from the termination guarantee.

Still, according to legal experts interviewed for this case study, this change could be considered unconstitutional and lenders could claim in Court the discount made to the RPA amount once effective (Anonymous Interview, 2017d). However, this would mean additional costly litigation, making the final outcome and payment even more uncertain for lenders.

2.3.4 Game over?

Thus far, we have described a period of government support (section 2.3.1), followed by the withdrawal of this support, financial collapse and a period of mostly failed private debt restructuring attempts (section 2.3.2) and finally a third period during which creditors and the public sector guarantor considered the possibility of yet another restructuring or the payment of the termination guarantee (section 2.3.3).

In 2015, the culmination of 2 to 3 years of negotiations seemed to be in sight. The public sector could be expected to pay the RPA, even though the amount was now likely reduced following the new 2014 law. However, this is not what happened.

Liquidations begin

Between early 2015 and mid-2016, commercial courts began opening liquidation proceedings due the impossibility of reaching a new restructuring agreement between the government and the lenders.

Again, the liquidation phase would trigger each concession's termination and the legal obligation for the government to pay the termination guarantee. Beginning the liquidation proceedings also froze the amount used for the computation of asset depreciation, which factors into the RPA calculation.

Hence, the liquidation start date was critical for creditors, who would expect the payment of the guarantee to go towards the repayment of outstanding senior debt first, with any additional funds being made available to shareholders.

The following four firms entered their liquidation phase:

- AP-36 Ocaña- La Roda (Autopista Madrid Levante) on 26 February 2015.
- Road M- 12 Eje Aeropuerto (concessionaire Autopista Eje Aeropuerto Concesionaria Española) on 13 October 2015.
- A-70 Circunvalación de Alicante (Ciralsa) on 3 May 2016.
- Radial-3 and Radial-5 (Accesos de Madrid Concesionaria Española) on 9 May 2016.

Timing uncertainty

On 20 December 2015, a new general election was held but no single party could secure a majority of the votes and ensuing negotiations failed to produce a government coalition.

In the absence of a government, a new general election had to take place six month later, on 26 June 2016. At this stage, a

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so-called provisional government, constituted by the incumbent People's Party (PP) remained in power.

The new government first appealed against the courts' resolution, thus delaying the payment of the RPA even though liquidation proceedings had started.

Until the second election was decided, no decision with respect to the RPA could be made. At the time of the election, the PP had the highest support in the polls at 28%, followed by the Socialist Party with 22% of the vote. However, a new left wing populist party, Podemos, had a large proportion of support at 20%, which could result in a new left-wing government were a coalition with the socialist party to be formed.

Additionally, the shareholders of the concessionaires in liquidation proceedings also appealed the courts' resolution in order to have their own restructuring proposal accepted by the judge (Morán, 2017). Shareholders were interested, as were the government, in reaching a restructuring agreement to avoid being completely wiped out.

Creditors Exit

By the time the second election took place, a number of Spanish lenders had sold their stake in the toll roads' senior debt to distressed debt buyers.

In April 2016, it transpired from government-released data, that 20% of the debt held in the toll roads had been sold in the distressed debt market in the previous months with a haircut of 90% (Navas, 2016).

In June 2016, Caixabank, which held 100 million Euros of debt in Ciralsa (AP-7 Circunvalación de Alicante) and Accesos de Madrid (R – 3 ad R- 5), announced the sale of this debt to the hedge fund *Taconic* with a haircut of 90% (Marco, 2016a).

Soon after, Ibercaja, a Spanish bank holding around 40 million Euros on Ciralsa (AP-7 Circunvalación de Alicante), Accesos de Madrid (R-3 and R-5), Autopista del Henares (R-2) and Autopista Madrid Sur (R-4) debt, confirmed the sale to the same hedge fund with a haircut in excess of 90%, at a price of 3.8 million Euros (Marco, 2016b).

In September 2016, it was reported that Sabadell, another Spanish bank, had sold 240 million Euros of its debt to Taconic in previous months, also with a haircut of 90% (Ugalde, 2016).

While the discussions between lenders and distressed debt buyers must have been going on in the background even before the first round of the elections, this new delay, along with the uncertainty created by an indecisive electorate, was enough to tip the balance in favour of a distressed sale for the project creditors.

It is also possible that the Spanish banks (which would have already and completely written-off these loans in their books under their recent bailout conditions) were keen to

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exit first and quickly, effectively booking a (small) profit in that year.

At the same time, the government confirmed in a letter to the commercial court its commitment to take over the toll roads already in undergoing liquidation proceedings and potentially other toll roads in default, but requested an additional period of nine months to determine the RPA amount to be paid out (EuropaPress, 2016).

The extension was requested to provide time for a new government to be formed with the intention of ensuring an orderly transfer of the roads from the concession companies to a state-owed entity. [11]

11 - A new government had to be formed by December 2016, otherwise new elections would be held.

On the 1 October 2016, the Court accepted the government request and extended the liquidation period until July 2017.

The toll roads would remain open to traffic and the concessionaires would operate them until July 2017, when the government would take over.

In November 2016, it transpired that some of the international banks involved in the deals had also sold at least one third the debt they held in the Madrid Radial toll roads to New York Venture Capital funds, Blue Mountain Capital and Neuberger Berman (Monzón and García, 2016).

New Government, New Negotiations

A new government, still led by the People's Party, was finally formed on 3 November 2016.

Almost immediately, the new Public Works Minister announced that the government intended to continue negotiations with the lenders towards a debt restructuring agreement.

In the beginning of 2017, it was reported that distressed debt hedge funds were increasing the price they were offering for the remaining debt held by international banks. ING and BNPP sold their stock of debt (around 100 million Euros and 60 million Euros, respectively) with a haircut of 50-60% (Ugalde, 2017b,a).

Unicaja, one of last Spanish banks still involved, also announced the sale of its debt (around 70 million Euros) in January 2017 (Marco, 2017).

According to SEOPAN (Construction Companies and Concessionaires Association), 70% of all project debt had been sold to distressed debt funds in the first quarter of 2017.

In March 2017, the provincial courts stopped the liquidation proceedings of Radials 3 and 5 (Accesos de Madrid Concesionaria) and the concessionaire Ciralsa, because the courts accepted the appeal by the concessionaires against liquidation proceedings (Agencias, 2017): the two concessionaires returned to insolvency

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proceedings and a restructuring agreement was still possible. Hence, depreciation was again being counted which will further reduce any RPA if these SPVs are eventually liquidated (Anonymous Interview, 2017c).

Now, the Spanish government faced creditors, the majority of which were not the initial lenders but who instead paid between 10 and 50 cents on the dollar for the debt of the toll roads. It has been reported that the current creditors did not intend to accept any new restructuring proposal from the Government (Martínez, 2017b).

In July 2017, despite the fact that negotiations were still 'open', the government announced the take over of the projects with the intention of absorbing the projects through SEITTSA and at a later stage, re-tendering them in the market through concessions packages.

Liquidation proceedings for all failed toll roads had indeed been opened by October 2017. (Martínez, 2017a) and the government would now have to pay the guarantee owed under RPA rules. The Public Works Minister announced that the actual payment of the guarantee would not take place before the end of 2018, and that the Government plans to recover part of the amount through the tendering of new concession (Martínez, 2017b).

In February 2018, The R-4 was the first concession to be taken over by the government. The rest were transferred in March 2018 to the publicly-owned company SEITTSA. The AP-41 from Madrid to Toledo would be transferred later in the year, following delays in the liquidation proceedings.

Six months after the assets were transferred to the public sector, the amount owed under the RPA must be have been determined by the Ministry of Public Works. An amount of 2 billion Euros has been earmarked in the 2018 budget submitted to the European Commission (Magariño, 2018; García, 2017). The government plans to re-tender the road projects as early as the summer of 2018 under new 25-year concession contracts and reportedly hopes to raise between 700 million and 1 billion Euros, partly offsetting the cost of paying the guarantee. [12]

2.4 Conclusion

Withdrawing support to the ailing concessions in 2012 was almost certainly going to push them into default, and would, in all likelihood, lead private creditors to claim the termination guarantee under the RPA.

But since then, the Spanish government managed to delay and substantially reduce the liability created by the RPA, and this provided an incentive for the original creditors to sell their claim in the distressed debt market.

Equity holders had an interest in stopping the liquidation proceedings and forcing private creditors back to a private work-out, thus avoiding being wiped-out. But their

12 - In March 2018, the hedge funds holding most of the debt were reportedly planning to take legal action against the government and claim as much as 4.5 billion Euros. However, the Spanish banks that still hold some of the projects' debt (Bankia and Instituto Oficial de Credito) have declated that they would not seek any further compensation, as they have been bailed out by the government in 2012.

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bargaining power was never strong enough to achieve this outcome.

Clearly, the economics of the projects envisaged before the 2008 crisis were not credible, including if creditors were to receive a share of the future traffic upside, as the public sector suggested in its first restructuring proposal.

As a result, commercial banks, which had agreed to finance the concessions because the RPA provided them with a state-guarantee against default and bankruptcy, could never agree to a private sector workout, with the notable exception of the AUSUR concession.

It is possible that when the first debt restructuring proposal was made in 2013, the government was still in denial about the absence of economic viability of the projects, and thus expected lenders and sponsors to 'work things out'.

Later on, it is also possible that the public sector always knew that the debt restructuring it proposed to lenders would not succeed, but instead was just trying to buy time, and managed to use restructuring proposals and the Spanish electoral cycle to exhaust the patience of the creditors who had bet on the RPA being a sufficient security.

As the expected value of recovery under an RPA scenario continued to shrink and to be further delayed, the choice to exit and sell remaining positions in the distressed debt market gradually became the expected value maximising one, first for Spanish banks and then for international ones.

In the next chapter, we return to this conclusion and propose an analysis and generalisation of this case study using ideas from the game theory literature. In some settings, the game culminates towards a sub-game called a "war of attrition".

3. Analysis & Discussion

3. Analysis & Discussion

In this section, we discuss the sequence of events described in chapter 2 and attempt several generalisations mostly using ideas and concepts borrowed from Game theory (i.e. the theory of strategic bargaining). We do not present a fully-fledged game-theoretic model because 1) the casual discussion of the concepts and mechanisms at play are sufficient to interpret the case of the Spanish toll road sector in a broader context and 2) from a pure game theoretic perspective, the results obtained would be trivial or already known.

We propose to interpret the events of the Spanish toll road case in the context of three 'sub-games' representing the three main stages of negotiations occurring after the infrastructure projects have become financially impaired.

These three sub-games are: 1) a 'subsidy' game in which equity investors in public-private partnerships aim to obtain a financial bailout from the public sector following a shock; 2) a 'workout' game in which project lenders and equity investors negotiate the opportunity and the terms of restructuring the debt of an infrastructure project following a shock; and 3) a 'guarantee' game in which lenders aim to claim a public sector guarantee of a public-private project, which they have taken control of following a shock.

These three cases of strategic bargaining can be examined in isolation, or considered to be sub-games of a larger set of strategic relationships, in which case optimal decisions for each player may differ from those taken in individual sub-games.

This approach allows key mechanisms in the strategic relationship between players to be characterised and isolated. It can be useful *post mortem*, as is the case here, to evaluate the rationality of the different players in the Spanish road case or calibrate the game's parameters assuming players were indeed rational.

In a broader context, it can also be useful *ex ante* to anticipate the strategic behaviour of specific actors in certain scenarios, in particular that of the less easily tractable behaviour of the public sector. In other words, **game theoretic models can be a powerful way to model political risk for investors in infrastructure**. We return to this idea in the concluding chapter.

The rest of this chapter is structured as follows: in section 3.1 we describe the game theoretic framework we will use for our discussion. We then discuss the first (section 3.2), second (section 3.3) and third (section 3.4) games with reference to the Spanish toll road case.

Finally, in section 3.5, we examine strategic interactions if the three sub-games are taken together and discusses possible interpretations of the Spanish toll roads case.

This discussion uses and develops the more formal game theoretic frameworks put forward in the literature to describe renegotiation and financial restructuring in public-

3. Analysis & Discussion

private partnerships, most notably Ho (2010) and Hasan and Blanc-Brude (2017).

3.1 Setup

We set the scene as follows:

- A long-term concession contract has been awarded to private sponsors;
- A special project vehicle or SPV has been created by the sponsors for the sole purpose of entering into this contract and meeting its obligations. The sponsors are the sole owners of the new firm's equity;
- The same firm has raised financing on a non-recourse basis from a group of creditors following a standard project financing template, including step-in rights for lenders in the event of default;
- The public sector and concession guarantor also provided an *unconditional* termination guarantee, which, if it was called, would be used first and foremost to repay senior creditors;
- Finally, after a few years, the concession is now in a situation of financial distress following a shock of some kind [13] and a number of decisions now have to be taken by the three protagonists: the firm's owners, its creditors and the government.

While this description fits the facts of the Spanish toll roads case discussed in section 2, it is also quite generic and matches numerous other cases.

For instance, most so-called public-private partnerships are required to award a long-term concession contract to private sponsors, and are subsequently structured and financed using a non-recourse model that creates significant control-rights for creditors.

It is also frequent for the public sector to provide termination guarantees either directly or indirectly to project creditors. While such guarantees typically cover termination events initiated by the public sector only, it is also possible to have *unconditional* termination guarantees provided by the public sector to creditors, such as the one covering the GBP 4bn bond issue for the financing of the two London Underground PPP contracts in 2001. [14] Alternatively the guarantor of the project debt could be an insurance company. [15]

In this multi-stage game (the "Game"), a series of sub-games are played by a pair of the three protagonists at different points in time, conditional on actions taken in previous sub-games. As shown in table 9, only two of the three players are involved in any sub-game.

The three sub-games follow a common pattern by which two players are faced with a binary choice in each round: **they can either *negotiate* (i.e. engage with the other player to change the terms of their existing relationship) or *exit* (i.e. exercise their option to walk away from the relationship.)** Either choice is more or less costly and players aim to maximise their *net* expected payoffs.

13 - This shock can be a macroeconomic event or regulatory change or the slow-motion shock of reality impacting fanciful projects based on characteristically unrealistic assumptions.

14 - One of which subsequently went in administration and triggered the guarantee.

15 - So-called monoline insurers have provided guarantees to numerous project finance bond issues.

3. Analysis & Discussion

Table 9: Players Active in Each Sub-Game

	Sponsors	Creditors	Government
Game 1: Subsidy	Active	Silent	Active
Game 2: Restructuring	Active	Active	Silent
Game 3: Guarantee	Silent	Active	Active

Next, we remind the reader of some of the standard terminology used in game theory. Readers familiar with game theory can skip to section 3.2.

A game involves *players* that can chose between sets of *moves* at different junctures. These moves can be made simultaneously or sequentially – in which case we talk of *dynamic* games – in the knowledge of what other players can do or have done (with full-information) or not.

Players' moves are motivated by *payoffs*. All players are assumed to be rational and to aim to maximise their expected payoff from the game. In a full information game, all players also know the value of each other's payoffs and the form of each other's payoff functions.

The combination of moves made by a player during a game is called a *strategy*. Games have a *Nash Equilibrium* if its players can have *Pareto-optimal* strategies, that is, strategies which maximises their payoff given the optimal strategies of other players. In equilibrium, rational players always play their optimal strategy, as long as it exists.

Optimal strategies can be described as choices between discrete moves (A or B) in which case the equilibrium is known as a pure strategy Nash equilibrium or PSNE. Optimal strategies can also consist of playing probability distributions of moves (in the case of a binary choice, A with probability p, B with probability $1 - p$), leading to mixed strategies Nash equilibria or MSNE.

An important aspect of each player's choice of strategy is the *credibility* of other players' intention to make a given move. For example, whether a player can credibly commit to play a certain move given other players' choices, or keep playing a game beyond a certain cost or time threshold.

3.2 The Subsidy Game

3.2.1 The Game

In the first game ("Subsidy"), following a shock that destabilises the firm, the sponsors and public sector negotiate a subsidy that can return the SPV to financial equilibrium.

Here, senior creditors do not play a role and there is no termination guarantee provided by the government (i.e. we consider this sub-game in isolation).

The subsidy could take various forms; the choice opened to the public sector

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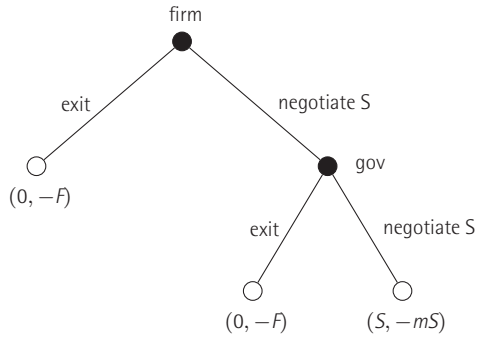
Figure 7: Subsidy Game Decision Tree – Extensive Form



is between ensuring the survival of the concession or letting the firm default and go bankrupt.

We assume that the materiality of the shock is not in doubt and that without support the firm will indeed default, leading its owners to exercise their limited liability and file for bankruptcy.

Since the public sector is the guarantor of the continuity of service, the second choice involves the possibility of costly re-tendering to find another sponsor or taking the project under public management, which may also bear political costs.

This game loosely follows Ho (2010), who describes a similar case.

The firm and government move sequentially. The owners of the firm moves first and decide whether to request the subsidy ('negotiate') or default and declare bankruptcy ('exit').

Next, the government decides to either grant a subsidy ('negotiate') or not support the firm ('exit').

If the owners choose to exit and the firm goes bankrupt, the equity payoff is negative but also small since the market value of the firm without the subsidy can be assumed to be close to zero (whatever losses were created by the shock would have been booked in the previous period, such sunk cost would not change preferences at this stage). Project bankruptcy is, however, costly for the government which, as the guarantor of the continuity of public service, now needs to take over the firm and possibly re-tender the contract.

Hence the payoffs for the firm and the government in the event of bankruptcy are $(0, -F)$, where F is the aggregate cost of having to deal with failing public-private concession contracts for the public sector. [16]

If the firm chooses to request a subsidy, the government makes its move and can either choose to negotiate the required level of

16 - Contrary to Ho (2010), we are not interested here by the subsidy negotiation itself, hence we represent the net cost of government exit with the aggregate variable F for 'failure'.

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subsidy S with the firm, or reject the request and exit the game.

If the government negotiates a subsidy the payoffs are $(S, -mS)$, where S is the monetary value of the subsidy and $m \in [1, +\infty]$ captures the additional political cost of having to bail out the firm for the public sector.

Figure 7 shows the extensive form decision tree and the relevant payoffs. For the government, if the payoff from negotiating the subsidy is greater than that from exiting (so that $-mS > -F$), it will choose to negotiate support, since it is less costly for the government to support the project than not.

If this is the case, assuming full information, the firm's owners always choose to negotiate a subsidy at the first step.

For now, we assume that the negotiated amount S will be set at a level that is sufficient to restore the financial equilibrium of the concession: the amount S that will restore the concession to financial health is known to all and not in dispute.

It can be shown that a single pure strategy Nash equilibrium (PSNE) exists in this setting: either $mS \leq F$ and the subsidy will always be negotiated, or the reverse is true and the firm owners will choose to exit at the first step, never asking for a subsidy they know the government will never agree to pay.

Thus, in this simple setting, the equilibrium path is dependent on a single metric (the cost/benefit ratio of the government or F/mS) which determines the best moves available to both players.

3.2.2 The Spanish Case

Reality is never as simple as the game presented above, but this framework is helpful to summarise the real case.

When the Spanish toll road concession companies found themselves facing bankruptcy in 2009, they turned to the government for help. The left-wing government at the time initially tried to save the firms from failing through various means of support as documented in section 2.3.1.

Assuming that the Spanish government was acting rationally, it must then have perceived the cost of failed PPPs to be higher than the required bailout. However, we also know that this bailout turned out to have been insufficient to fully restore the PPPs' financial health, unlike the level of subsidy S provided in the stylised game above, which is assumed to be sufficient.

In other words, the government could have wrongly estimated the actual cost of bailing out the PPPs, providing $\bar{s} < S$.

Alternatively, both the firm and the government could have known that available subsidies were insufficient to restore the PPPs' financial health for good. In this case, the game still has a unique

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PSNE in which the firm requests the subsidy and the government grants it as long as $\bar{s} < F$, making this equilibrium a case of 'kicking the can down the road' as both players simply agree to delay the inevitable.

For the firm, any positive payoff is better than zero so it would always ask for the subsidy if it thinks the government will grant it. In the case of the government, avoiding the high political cost of failing infrastructure PPPs even if they will probably fail later can be the best move if elections are planned in a not too distant future. A costly scandal is averted and the next government will be left to decide whether to bear the full cost of a bailout of the PPPs.

In the case of Spain in 2009, multiple subsidies were provided at a time when the next elections were still two years away. It is possible that both sides of the game did not foresee that the economic situation of the toll roads would continue to deteriorate for several more years, nor that the banking system would collapse nationwide creating an entirely new dynamic for the government.

When the People's Party, which had procured the projects ten years earlier, returned to power in 2011, the expected net benefit of granting the subsidies quickly turned negative. Bearing the political cost of failed toll roads quickly became a second-order question as the nation's various savings banks needed to be rescued from bankruptcy in mid-2012.

Faced with a wider crisis, the government's preferred move in this game was now to exit (i.e. F was now such that $mS > F$). Indeed, as the crisis continued to unfold, project sponsors did not continue to ask for new subsidies. They also chose to 'exit' at their node in the game tree.

Thus, in the Spanish case, over time the equilibrium for this sub-game has shifted from $< (negotiate, negotiate) >$ to $< (exit, exit) >$, as default had become more and more unavoidable.

Next, we describe the second sub-game between the firm's owners and its senior creditors.

3.3 The Workout Game

3.3.1 The Game

In Ho (2010), project creditors do not play a specific role and are only mentioned in passing; their interests are presented as similar to those of the firm's owners.

However, creditors have extensive control rights in non-recourse project finance and, in the event of default, can effectively take control of the firm, which the *hipotecas* allowed lenders to do in the Spanish case. These "step-in rights", which exist precisely because creditors have no recourse to the sponsors to secure their investment, create an *option* for creditors to try and maximise their recovery rate given a credit event.

This mechanism is described and modelled using a game-theoretic approach in Hasan

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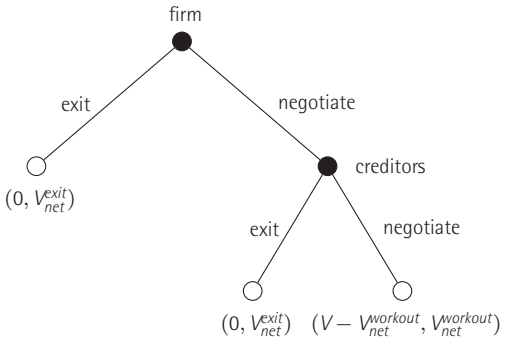
Figure 8: Workout Game Decision Tree – Extensive Form



and Blanc-Brude (2017). In this section, we summarise their approach to describe the "workout" game.

As before, a concession company experiences a large exogenous shock. If negotiating a subsidy with the public sector was an option, we assume that the government chose not to negotiate. The firm is now in default [17] vis-a-vis its senior creditors, and the "workout" game begins.

Once the firm is in default, its owners move first: they can choose either to exercise their limited liability, *exit* the game and receive of payoff of 0; or to negotiate the financial restructuring of the firm with senior creditors, who will otherwise take it over as the security against their investment.

If the firm's owners chose to *negotiate* with its creditors, the latter then make their move and either agree to negotiate a 'workout' or choose to *exit* (i.e. 'wipe out' the owners and take control of the firm's assets).

If creditors choose to exit the game, they will have several options, including finding new equity investors, selling the firm or its debt, as well as appealing to the government. These options are laid out in the next game in section 3.2.

Structurally, this game is very similar to the subsidy game. As above, the equilibrium path in this game rests on a single metric: the creditors' *exit costs*. In Hasan and Blanc-Brude (2017), after a hard default the creditors can chose to *exit* and claim the firm's value *V*, but doing so is costly. [18]

Exit costs are determined by the nature of the concession company and the environment in which it went into default: depending on the jurisdiction, market conditions, reputation effects or the value of the existing relationship between creditors and the firm's owners (e.g. if the main creditor is a commercial bank with an existing relationship with the sponsor, a large construction firm), choosing to walk away from the project's current owners' offer to negotiate a workout can be more or less costly for the lenders. For simplicity,

17 - For simplicity, we limit our framework to cases of hard default (i.e. default of payment). Integrating so-called soft defaults would be a straightforward extension of this game.

18 - In Hasan and Blanc-Brude (2017) lenders can also 'waive' defaults if the cost of restructuring the firm renders this option less valuable than doing nothing. We ignore this case here for simplicity.

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we ignore the role of restructuring costs described in Hasan and Blanc-Brude (2017) because it does not change the fundamental game dynamics.

The creditors' *exit* payoff is written

$$V_{net}^{exit} = V^{exit} - X$$

where V^{exit} is the exit value of the firm and X represents exist costs. As suggested above, at a given point in time and space, the value of X is given and therefore the *exit* payoff is essentially a function of V^{exit} for this firm.

Hasan and Blanc-Brude (2017) show that the firm's owners bargaining power is an decreasing function of V_{net}^{exit}. If V_{net}^{exit} is low enough, they can trigger a workout and still have positive equity after a hard default, as opposed to receiving 0 for sure if they exit.

Intuitively, if the value of the firm after a workout can be at least as high as its *net* exit value today, then creditors prefer a workout as long as they at least get their net exit value (which, in equilibrium, is what they get) while the firm's owners can get the remaining value as their new equity. Additionally, equity owners can offer/agree to increase their equity investment by δ in order to ensure that $V^{workout}$ is high enough to make creditors indifferent to negotiate while they get $V - V^{workout} > \delta$.

Hence the bargaining power of the firm's owners after a default is substantial when exit costs are material and the firm's exit value V^{exit} is high: creditors will not get more by choosing the exit route, and in equilibrium, equity owners get the payoff $V - V_{net}^{exit}$.

Conversely, if the value of the firm after a workout cannot be at least as high as the net exit value today, creditors choose to exit, in which case equity holders get 0.

Hasan and Blanc-Brude (2017) spell out the three conditions that must hold for lenders to choose renegotiating as the equilibrium path:

1. Both players can gain at least as much from the negotiating as from exit;
2. A least one player can get more from negotiating;
3. Creditors never get less than the firm's owners as they effectively have control.

Thus, in equilibrium, creditors always get V_{net}^{exit}, as long as it is lower than the current value of the firm V, and greater than half of its value (3^{rd} equilibrium condition).

As in the Subsidy game, there is only one PSNE in the Workout game: with full information, the lenders either agree to negotiate a workout and, knowing this the firm owners negotiate one, or they would not, and equity investors simply walk away from the firm as soon as it defaults, in the knowledge that creditors would choose to exit as well.

As before, depending on the parameters, the equilibrium is either $<(negotiate, negotiate)>$ or $<(exit, exit)>$.

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The extensive form for this game is shown in figure 8.

3.3.2 The Spanish Case

In the case of the Spanish road concessions, the evidence fits the model very well. By the time the government had withdrawn its support to the concessionaires in 2012, the Spanish economy was in the midst of a long recession and traffic had continued to decline. This vote of no-confidence in the new government must have been enough to challenge the belief, amongst sponsors and lenders alike, that the concessions could return to financial equilibrium in the near future. As a result, sponsors and lenders both chose to exit in all cases but one, the AUSUR concession.

AUSUR had always had better economics than the other eight concessionaires, which is why the government had originally excluded it from the so-called clearing account subsidy scheme. With enough traffic and better prospects than the other projects, lenders and equity owners were better off picking the PSNE: $< (negotiate, negotiate) >$ in this case.

The AUSUR restructuring was complete by 2014 and creditors were indeed better off than if they had chosen to exit the relationship (even with a public guarantee). We will return to this case in the section 3.5, when we compare the value of the restructured debt to the public sector guarantee in AUSUR. In this case, sponsors were also made to increase their equity by 10 million Euros in 2014, making the workout value for the lenders high enough to justify staying involved and not wipe out the equity owners (who still had 148.7 million Euros of equity book value in 2014.)

The decision by all other lenders to exit the Workout game for the other eight concessions can be understood within this subgame as the result of $V_{net}^{exit} > V^{workout}$. But another consideration explains their decision: the existence of a back-stop to their exit decision in the form of the RPA.

Next, we introduce a third game between creditors and the government, if the former chose to exit the Workout game in the presence of a guarantee.

3.4 The Guarantee Game

3.4.1 The Game

At the beginning of this game, creditors move first. They are in control of a concession firm that has defaulted on its senior debt obligations and which would not be more valuable if they had 'worked things out' with the firm's owners. As a result, they have claimed control over the firm and must decide their next move.

When the project was financed, the government (or another insurance provider) extended an unconditional termination guarantee, by which, if the firm had to be liquidated, it would pay a lump sum $\overline{G}$ to its owners, according to a pre-agreed formula.

While the Workout game obviously took place beforehand, in this section we only

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consider the strategic choices of the players for this particular sub-game, and will consider strategic interactions between the three sub-games in section 3.5. Indeed, the claimants at the beginning of this game are not necessarily the original creditors, but may have purchased the debt from a previous set of creditors in the distressed debt market.

Since creditors had the option to take control of the firm in the event of default, the guarantee $\overline{G}$ was also a form of senior creditor security. Note however that $\overline{G}$ is not the same thing as the net exit value V_{net}^{exit} defined in section 3.3.

Here, as before, V_{net}^{exit} is the net exit value if the guarantee is not claimed and the lenders exit the Guarantee game.

Hence, when choosing their preferred strategy creditors can choose as their first move either to *negotiate* (i.e. claim the payment of the termination guarantee with the public sector), or *exit* the game, and either sell the debt in the distressed debt market, or find a new project sponsor to negotiate a new debt restructuring with.

If creditors sell the project debt, they get V_{net}^{exit} and the new creditors can again decide whether or not to *exit* or *negotiate* in a new round of the Guarantee game. If creditors *exit* because they found a new set of equity investors and can restructure the firm privately, they would never claim the guarantee, but instead go back to the Workout game.

If $\overline{G} > V_{net}^{exit}$, creditors always choose to *negotiate* and claim the guarantee.

3.4.2 Strategic Space

Prima facie, this is not a game since the guarantor has no apparent choice but to pay the guarantee by law. For clarity, this obligation is considered enforceable in the relevant courts and therefore not in doubt. Thus, any strategic moves available to the government are not self-evident.

An important difference between the previous two sub-games and the Guarantee game is the role of time in determining the value of each player's payoffs and preferred moves.

In both the Subsidy and the Workout games, time is irrelevant: players are not forced to make any particular move other than the ones that maximise their respective payoffs, and the unique PSNE is such that the first player only chooses to negotiate if it is also in the best interest of the other player to do so.

In the Guarantee game, while the government is bound to *in fine* pay the guarantee (i.e. *exit*), the fact that creditors may also have an *exit* option can create some 'strategic space' for the public sector to try and force creditors to exit the game first.

Of course, if creditors exit and sell the debt in the distressed debt market, this does not extinguish the guarantee but merely transfers it to new creditors, and

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the Guarantee game starts again. Still, this outcome can have value for the guarantor if, for instance, it can be expected to reduce the face value of the guarantee, either because it is indexed on the passage of time or because the new creditors, having purchased the debt at a discount, will be more willing to negotiate a settlement to save their own costly time.

Negotiating can also have value for the government if delaying the payment of the guarantee leads to passing the responsibility for making the payment to the next government.

To create strategic space, the public sector may choose not to pay (or *exit*) immediately but instead to *negotiate* and delay the payment of the guarantee, including by **creating a second exit option for creditors that can void the guarantee (i.e. a new workout)**, this time between creditors and the public sector. Hence, as negotiations begin, the government proposes a new exit value of $\underline{G} < \overline{G}$.

In this setting, because negotiating time is costly, the longer creditors have to wait, the lower their expected net payoff. If the expected waiting time to receive $\overline{G}$ is τ, then is it possible that the expected value of $\overline{G}_\tau$ is lower than $\underline{G}$ today.

That is, if at time t,

$$E_t(\underline{G}_t) > E_t(\overline{G}_\tau) > E_t(V_{net}^{exit})$$

with $\tau - t$ the waiting time, creditors would always prefer to settle and agree to the new public workout rather than requiring the full payment of the guarantee.

If negotiating $\underline{G}$ is also going to take some time and require waiting until time $\kappa < \tau$, then it is also possible that waiting is never preferred if at time t

$$E_t(V_{net}^{exit}) > E_t(\underline{G}_\kappa) > E_t(\overline{G}_\tau)$$

. In this case, creditors would simply prefer to exit at the beginning of the game.

Other creditors, with a lower cost of time may then see value in buying the debt from the original lenders.

For the government, the preferred outcome is always to settle and pay $\underline{G}$, which extinguishes the guarantee, followed by creditor exit, which merely pushes the payment into the future (while this cannot last eternally, it has positive value for the government especially at the beginning of the negotiation), followed by their least preferred outcome: to exit and pay $\overline{G}$ immediately. The preferences of creditors are exactly the reverse.

Thus, while the guarantee payment is owed to the creditors by law, under certain conditions, the Guarantee game may actually take place.

3.4.3 A War of Attrition

As long as the delay in paying $\overline{G}$ can be justified for some time, the Guarantee game is a kind of "staring contest", also known as a "war of attrition" game (see for example Hendricks et al., 1988).

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War of attrition models aim to explain why costly confrontations take place and continue over time, possibly a long time. Such models do not focus so much on why one side ends up winning (which can be a matter of assumptions about the cost of fighting for example).

Say the government will make the guarantee payment at some time t, within a certain period of time indexed between 0 and 1, by the end of which it has to pay the guarantee by law.

Until the government decides to pay or *exit*, it is *negotiating* a settlement $\underline{G}$ (or simply delaying payment). During the same time period, creditors may choose to *exit* and not claim the guarantee if they can maximise their expected payout this way, either by going to the secondary market or agreeing to settle with government.

The two players must decide to make a single move – *exit* – over that period of time, and their payoffs are determined by who moves first and when.

Any player's payoff is lower if they *exit* first. In other words, they both have an incentive to wait for the other player to move first and continue negotiating. However, each player's payoff function is also strictly decreasing in t (i.e. negotiation time is costly).

For player i, winning (player j exists first) is strictly preferred to delaying, which is strictly preferred to exit.

In war of attrition models, players compete for a unique 'prize' the value of which may differ for each player. In our case, the prize is simply the difference between what each player would get if they concede first or the other player concedes first.

Here, the government will either pay $\overline{G}$ or $\underline{G}$ and the creditors will either loose $D - \overline{G}$ or $D - \underline{G}$, with D the value of the firm's outstanding debt. Thus, the value of the prize – the difference between the two outcomes of the game – is the lesser loss incurred by each player if they *exit* last, and it has the same absolute *face value* for both players.

We call the prize $p = \overline{G} - \underline{G}$ and can reduce the game payoffs to each player getting either p or 0. [19]

Ignoring simultaneous moves for simplicity, the payoff or utility functions of player i for pair of strategies t_i and t_j are written:

$$\begin{aligned} U_i(t_i, t_j) &= 0 - c_i(t_i) \qquad \text{if } t_i < t_j \\ &= p - c_i(t_j) \qquad \text{if } t_i > t_j \end{aligned} \tag{3.1}$$

where $c_i(t_i)$ is the cost of continuing to negotiate until time t_i for player i in the case when player i exists first. $c_i(t_j)$ is the cost of continuing to negotiate until time t_j for player i in the case when player j exits first. Both are strictly increasing in t and the government is forced to *exit* at $t = 1$.

In such a game, a *pure strategy* for any player i consists of choosing or bidding on a time $t_i \in [0, 1]$ by which they intend to

19 - $p = \overline{G} - \underline{G} = D - \underline{G} - (D - \overline{G})$

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move, conditional on the other player not having moved yet. As soon as one player has moved, the other moves as well, irrespective of their initial intention, since players can observe each other's moves.

A *mixed strategy* consists of player i playing a distribution of exit times by which they may concede with probability λ at time t.

The question of interest is to determine under what circumstances the government would decide to *negotiate* instead of just paying the guarantee immediately (that is, play *exit* at $t = 0$) since both players know that it will have to pay the guarantee by $t = 1$ and negotiation time is costly.

Pure strategy

When playing pure strategies, both players simply bid on a time t_i until which they are willing to continue playing, conditional on the other player still being in the game.

Replacing i and j by c for creditors or g for the government, if creditors can credibly play $t_c = 1$, the government's preferred move must be $t_g = 0$ since it is has to pay by $t = 1$, it would prefer to pay now and not incur the negotiation costs.

If the creditors' threat to play $t_c = 1$ is *not credible*, the government could play $1 \geq t_g > 0$ but, with full information, players know that the government can always outlast creditors by a small amount of time while creditors will always exit before $t = 1$, hence creditors must exit immediately to minimise costs.

Hence, a PSNE is possible depending on the following: (i) the credibility of creditors' threat to wait until $t = 1$; (ii) one player always exiting at $t = 0$; negotiations ever occurring; and (iv) no negotiation costs being incurred.

Either the creditors' threat to play $t_c = 1$ is credible and the government has no choice but to pay the full guarantee; or this threat is empty, and the creditors exit immediately. These PSNEs are called *degenerate* equilibria and are of little strategic interest: nothing happens and either the guarantee is paid as promised originally or it is never claimed.

Instant exits from wars of attrition models are very common and well-documented in the literature (see Myatt, 2005, for a discussion) both in nature or business.

For instance, when the UK Treasury guarantee of the London Underground PPP bonds mentioned earlier was called following the project's demise, the credibility of the threat to wait until $t = 1$ (i.e. as long as necessary), was not in doubt and the Treasury's best move was to pay the guarantee immediately, which it did.

In other cases, if the waiting time was known to be very long or waiting costs known to be very high, creditors would exit immediately, knowing that they cannot credibly commit to wait.

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Mixed strategies

As long as the creditors' threat to play $t_c = 1$ is *not credible*, a mixed strategy equilibria, by which players play a probability distribution of moves, is also possible.

In effect, an actual war of attrition between players i and j is *only* possible because there exists an MSNE by which both players are better off staying locked into mutually offsetting positions, and it is indeed their best move to do so. In other words, if each player plays a strategy such that the other player is indifferent between staying in the game or losing (player i's strategy is such that player j's expected utility at time t is always zero), the game can continue for a long time.

Several versions of the war of attrition model exist in the literature (see for example Fudenberg and Tirole, 1984).

Standard models let players bid probability distributions of waiting times or *exit rates*. In expectation, the gross payoff of player i is the value of the prize times the probability that player j exits at time t, or $p \times \lambda_j(t)$, and the net payoff or utility is $U_i(t) = p \times \lambda_j(t) - c_i$.

In equilibrium, player j picks a strictly positive exit rate $0 < \lambda_j(t) < 1$ that makes player i indifferent so that:

$$U_i(t) = p \times \lambda_j(t) - c_i(t) = 0$$
$$\rightarrow \lambda_j(t) = \frac{c_i(t)}{p} \qquad (3.2)$$

Hence, player i is indifferent between the choice to *exit* or *negotiate* when the cost/benefit ratio, $c_i(t)/p$ equals the probability of player j, $\lambda_j(t)$ exiting at that time. Simple numerical examples can show that in this case the probability-weighted payoff is always equal to the cost of staying in the game, hence players are indifferent to keep spending resources in the confrontation for p.

The simple models can have counter intuitive results, including, as numerous papers note, the fact that in the mixed strategy equilibrium (i.e. for the confrontation to take place), the player with the lowest cost has to have the higher probability of exiting, short of which the higher cost player cannot be made indifferent and they would either exit or up their bid.

Hence, if the benefit from continuing negotiations is small and the cost of negotiating is significant for player i, player j has to be more likely to exit sooner for an equilibrium to exist, otherwise player i should exit immediately. Conversely, if the cost of continuing negotiations is low and/or the prize is highly valued by player i (i.e. i has a low cost/benefit ratio), then player j has to play a low exit rate in equilibrium.

If there are significant asymmetries between the two players in terms of cost or valuation, the MSNE only exists if they play very different exit rates.

More sophisticated war of attrition models exist (see for example Agastya and McAfee,

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2006) but while these refinements are valuable, our objective here is not to develop a full model but to describe mechanisms that can be helpful in our analysis of the case study.

Again, war of attrition models focus on the possibility of protracted, long-lasting conflicts, but do not attempt to explain why these conflicts come to an end. Players may run out of resources or, relaxing the full information assumption, they may fail to estimate the other player's cost or valuation of the prize, or ability to commit resources to the negotiation.

3.4.4 The Spanish Case

In the Spanish toll road case, a war of attrition did take place. Banks, especially foreign ones, expected a prompt payment of the guarantee owed under the RPA; instead, the government made a counter-offer and started negotiations (delay) and the banks' perceived best move at the time was to keep asking for what they were owed under the RPA.

Any decision to exit in 2013 and either agree pay the guarantee in the case of the government, or go to the secondary market, or even accept the government's settlement deal for the lenders was perceived as less preferable than to just keep negotiating.

The Spanish government may well have taken the view that the creditors' threat to wait for as long as was necessary to receive the RPA was not credible. All the banks involved had their own problems in the midst of the financial crisis that was gripping Spain and Europe at the time. Local banks were under public sector bailout so the government could assume that it could exert pressure to force a settlement. Foreign banks were suffering in most business lines and were under pressure to consolidate their balance sheets and 'move on'.

By delaying the payment of the guarantee on multiple occasions, including because of the electoral cycle, the Spanish government eventually led the vast majority of creditors to sell the concessions' debt in the distressed asset market, accepting very high losses in the process (typically 60-90%).

This is striking considering that most of these lenders were owed enough money under the RPA (i.e. Spanish law), to achieve recovery rates close to 100%.

If creditors choose instead to sell the concessions' debt for 10 cents on the dollar, assuming they acted rationally, it must be because their expected value of the guarantee was now lower (or no higher) than that of the distress sale. In other words, the costs of playing the Guarantee game turned out to be very high.

Even though Spanish banks were at the time being bailed out by the same government from whom they were asking the guarantee payment, it took several years for them to accept an exit and while they did agree in principle to a new public sector workout, they never agreed to the proposed terms. Meanwhile foreign banks never agreed to

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settle and played the Guarantee game in the expectation of receiving the full RPA payment.

It should be noted that for the government, the size of the prize in the Guarantee game was very large, much larger than for creditors, who were claiming the RPA for individual concessions, whereas the government was negotiating the principle and application of a deal that would have to apply to eight concessions companies, and cost a substantial amount in terms of its impact on the budget deficit, as described in the previous chapter. In this context, the cost of waiting for a more advantageous settlement was low relative to the size of the game prize.

Clearly the creditors' threat to wait for as long as was necessary to get the RPA clauses triggered and the guarantee paid was not credible enough for the Government to exit the game immediately.

With low costs and a high valuation of the payoff, one interpretation of the simple war of attrition model above can be that the government would have been indifferent to playing the game *even if* the lenders' probability of exit was very low. Its expected utility would only be negative if the probability of creditor exit was even lower than its cost/benefit ratio, which, in this case, would have been very low indeed.

Conversely, with higher waiting costs and a lower value of the payoff, creditors' indifference levels implied a high probability of exit of the government, below which their expected utility turned negative.

This possible equilibrium, while consistent, highlights how **far from the equilibrium the Guarantee game actually took place** in the case of the RPA, and in hindsight, how much more likely creditors were to exit the game first.

Why did creditors decide to play nonetheless?

Clearly, creditors did not prefer to play the Guarantee game but instead wanted immediate payment of the guarantee under the RPA. When the government responded with a counter-offer to restructure the concessions debt, effectively starting the war of attrition, creditors could have exited immediately and gone to the secondary debt market. It is possible that creditors miscalculated the size of the prize for the Government, failing to see the sector-wide picture, or anticipated higher political costs. Faced with a sector-wide collapse, creditors also had to coordinate their response, which was not always easy, especially since local and international lenders had very different incentives and perspectives. Creditors may also have underestimated the cost of delaying payment for the Government, because the impact of the electoral cycle was unpredictable. As it happened, multiple elections provided a long series of excuses to delay the process further.

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3.5 The Full Game

In this section, we consider the full Game (i.e. the combination of the three sub-games described above).

The same three players are now involved in a game, but only get to play at certain times. However, the strategic interactions between all payers are now influencing the preferred strategies of individual players in each sub-game. The extensive form game tree is visible in figure 9.

3.5.1 The Government

In the first sub-game, the decision to provide a subsidy to a failing public-private project was determined by the cost/benefit ratio of agreeing to help the firm or not. Considering the full game tree, this decision also depends on the likelihood of the SPV being successfully restructured by its creditors if the government were to refuse the subsidy, as well as the expected cost of having to pay the termination guarantee if the workout turned out to be unsuccessful.

In particular, if the size of the required subsidy *S* is not very high, in the full game, the government can reasonably expect project sponsors and creditors to take a haircut and 'work things out'. Hence, while a low required subsidy (relative the political and re-tendering costs *F*) was more likely to lead the government to agree to support the project in the sub-game taken in isolation, the trade-off between paying a subsidy now for sure or paying zero as long as a successful outcome of the Workout game can be expected must now factor into the government's calculation.

In effect, when it decided not to give AUSUR access to the 'clearing account' subsidy in 2010, the Spanish government took precisely this view: that the business case for this concession was still strong enough to lead to a successful private workout, thereby removing the cost of exiting the Subsidy game for the government.

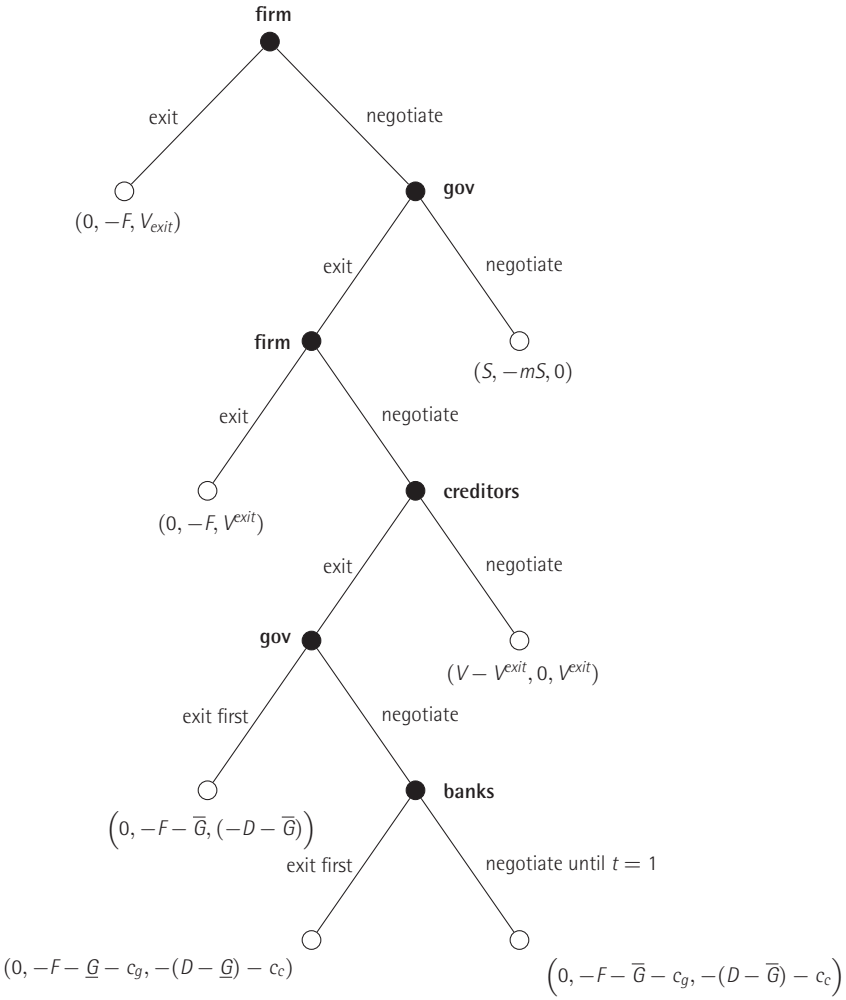
Conversely, if the government had decided to exit the Subsidy game, while being uncertain of the possibility of a successful workout, which it eventually did in 2012, it would have had to do so in the knowledge that it would have had to pay the guarantee if creditors chose to exit the Workout game. Hence, the decision to exit the Subsidy game implied the possibility of playing the Guarantee or War of Attrition game described above.

In the case of Spain, by providing the subsidy the government was also indirectly bailing out the lenders, most of which were lenders that, by 2015, had to be bailed out by the government anyway. Hence, it may have seemed unnecessary to protect creditors from losses at the concession level, when much larger bank losses had to be absorbed by the Spanish government at the entire banking sector level.

Still, when the Spanish Government decided to stop subsidies to the toll roads in 2012, while presumably expecting the Workout game to lead to a creditor exit (with the

3. Analysis & Discussion

Figure 9: Full Game Decision Tree – Extensive Form



exception of AUSUR) it was either expecting to certainly pay the guarantee under the RPA or to enter into protracted negotiations with lenders over the guarantee, whichever was lower. **As long as paying the RPA in full was costlier than maintaining the subsidies, the decision to remove them implied that of choosing to play the War of Attrition game.**

Note that in both cases, the government is also expecting to pay the sunk cost $-F$ of having failed concessions that need to be either nationalised or re-tendered.

Thus, in the multi-stage setting, several dimensions have changed from the point of view of the government. In particular, providing a subsidy S to the concessionaires may not be optimal any more since:

1. A workout between lenders and sponsors may be sufficient to restore the concession's financial balance at no

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cost to the public sector, especially if the expected subsidy is low;
2. Conversely if workouts are expected to fail, paying the guarantee $\overline{G}$ *as well as the costs of having failed projects* F may be less costly than paying the necessary subsidy;
3. If the public sector can expect to win the Guarantee game, the expected cost —F—$\underline{G}$ may be even lower.

Hence, if the government feels that it can win the Guarantee game, as long as the sum of the expected (renegotiated) guarantee payout $\underline{G}$ *and the cost of PPP failure* F is lower than the required subsidy to support the concessions, it should always exit the Subsidy Game, knowing that lenders and sponsors will either take the loss if a workout is possible or the government will pay less than what it would pay through direct subsidy.

The size of F plays an important role in the government decision to remove the subsidy despite the possibility of creditor exit from the Workout game, which may lead to a claim of the guarantee. If F is always high and higher than mS, then having to pay $F + \overline{G}$ or even $F + \underline{G}$ is never preferred to paying mS.

But F is highly state-dependent: the size of the political cost of failed road concessions depends on the current state of affairs. In normal times, most governments would have to weigh the *marginal* cost of a negative story like failed PPP concessions. However, in a period of deep economic and political crisis, as was the case in Spain at the time, it can be assumed that the marginal cost of additional bad news was much lower then than it would have normally been.

Hence, in a crisis situation where F is low, removing subsidies to failing PPPs and expecting to pay $F+\overline{G}$ can be the best move. Moreover, if the Guarantee game can be played (if creditors cannot credibly commit to wait for as long as it takes), the expected cost for the government can be even lower $F + \underline{G}$.

This characterisation may seem unlikely in numerous countries or times; indeed, as we suggested above, most wars of attrition never take place or end immediately with one party exiting the battlefield.

Still, in the Spanish case in 2013, it may not be far from an accurate calibration of the game: the initial total guarantee owed under the RPA was about 3bn Euros. However, we know that the government paid close to 450m Euros in loan subsidies to the companies related to land use costs, and still owes another 1.2bn Euros to landowners. Furthermore, the 'clearing account', which was meant to keep the concessions afloat until at lest 2018, was going to cost roughly 600m Euros over that period and in all likelihood would have to have been extended. Finally, we know that the guarantee depreciates over time. While the exact computation formula is not known today and remains a matter of discussion, it is only a matter of time before the cost of paying the depreciated

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guarantee or indeed the proposed alternative public sector debt restructuring, can be expected to be lower than paying the subsidies for the government. [20]

20 - One may assume that since the subsidies are certain, their present value should be discounted at the risk-free rate, while the guarantee payments are uncertain and therefore would be discounted at a higher rate.

Thus it can be argued that cancelling the subsidies in 2012 was indeed the government's best move. It avoided paying costly subsidies immediately, and while it failed to privatise the losses immediately through sponsor/lenders workouts, it delayed and reduced the size of the guarantee owed to creditors.

3.5.2 The Creditors

From the point of view of the creditors, the Workout game takes place because they have agreed to finance the concessions projects with the expectation of achieving a sufficiently high recovery rate in the event of failure. [21]

21 - The banks involved in infrastructure project financing are regulated commercial banks and can be considered risk averse (e.g. the toll roads were not financed because creditors wanted to make a high risk bet).

In the Workout game, taken in isolation, creditors would choose to finance only these projects that have a high probability of being successfully restructured upon default without the need for any public subsidies or guarantee to recoup their investment (i.e. so-called bankable projects).

But in the full game, lenders can expect the government to provide subsidies to failing projects and to pay a guarantee in the event of project failure. Here, they should always agree to finance projects as long as the probability of the government either paying subsidies in the event of a shock instantly exiting the Guarantee game is high.

AUSUR turned out to be the only bankable project that was worth more than the RPA guarantee. The 2014 workout between creditors and sponsors led to an increase in the stake of lenders in the project, who agreed to new senior loans of 126m Euros and convertible loans of 70m Euros. In 2014, the AUSUR balance sheet showed a total senior debt face value of 187m Euros. By chance, this was the exact amount of the maximum RPA guarantee agreed at the original contract signature. In this case, the workout value was higher for creditors than to exit and play the Guarantee game.

In the presence of the guarantee, lenders structured the less bankable projects more aggressively, further lowering the chances of successful workouts in the event of a shock or credit event.

Making projects harder to restructure and the Workout game more likely to lead to creditor exit can, if the guarantee is large and creditors expect the government to pay it, force the government into agreeing to pay subsidies in the event of a shock, since any workout would be expected to fail and the government would owe a large payout under the guarantee.

Hence, the guarantee increases the likelihood that projects be harder to rescue after a shock and that subsidies will have to be paid, as long as creditors expect it to be paid if called.

However, when creditors observe the government choosing to exit the subsidy

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Game, while also expecting the concessions to fail following this decision, it could be because paying $-F - \overline{G}$ is less costly than $-mS$, or it could be because the government intends to negotiate the guarantee owed under the RPA because it finds the the bank's ability to commit to wait not credible enough.

If the creditors know that the government does not believe they can wait for long enough, then they also know that the Guarantee game must take place; in other words, while the government can credibly commit to paying the guarantee at $t = 1$, it cannot credibly commit not to engage in war of attrition if the ability of creditors to wait for a 'as long as it takes' is not credible.

One could argue that the creditors should have known that, in the event of a serious crisis, the likes of which would require them to call the guarantee, their credibility to wait for long enough would be limited and therefore that the Guarantee game would take place.

If the lenders should have expected the Guarantee game to take place, at least from 2012, could they have hoped to win? Apart from exhausting all available resources, the only way to make one of the players leave the war of attrition is to change the other player's perceived commitment not to exit, which returns the game equilibrium to a PSNE in which one player has to exit immediately.

The creditors could have created a binding commitment to wait until the government had not choice but to pay, but they were also faced with a classic collective action problem. From the moment that some of the original lenders started selling the concession debt to secondary market buyers the collective bargaining power of the creditors was unlikely to improve, even thought it was never very good as Spanish and foreign banks were not very good at cooperating and exchanging information. Had all creditors formed a well-organised block, perhaps in the recognition that this was indeed a war of attrition and that holding out was of the essence, they might have changed the course of the negotiations with the government and secured a prompter payment of the guarantee or a better second workout with the government.

There appear to have been two events that triggered creditor exits in 2016: for local creditors, the second Spanish election was the key moment; after the elections and the forming of a government in December 2016, the decision by the commercial court to grant extra time to the government before the guarantee amount to be paid was computed coincided well with the exit of most foreign banks.

3.5.3 The Sponsors

Sponsors' interests change depending on the actions taken in the different subgames. In the first game, sponsors always prefer to receive a positive subsidy and not declare bankruptcy, and as long as

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the the government prefers not paying the guarantee, they also have an interest in over-leveraging the project companies since their lower chances of achieving a private workout will force the government to pay a subsidy after a shock.

However, if the government forces a default and creditors choose to exit the workout game to claim the guarantee, sponsors would prefer the government to delay the guarantee to try and force the creditors back to the negotiation table and avoid being wiped out themselves.

This would require the concessions to have decent business prospects and therefore long-term value, which the creditors and sponsors would share in a workout, if claiming the guarantee turned out to be too costly. In the case of the eight failing toll road concessions in Spain, the bargaining power of the sponsors was always very limited due to the lack of profitability of the projects in the foreseeable future.

3.5.4 Endgame

In this section, we summarise the best moves and potential equilibria of the full game. We can distinguish two cases depending on whether the war of attrition over the payment of the guarantee can be expected to take place or not (i.e. whether creditors can credibly commit to waiting for 'as long as it takes' to receive the payment).

Without war

The payoffs of the three players are (by increasing value):

1. since the guarantee is always paid when claimed, the government can either the pay the guarantee and the cost of failed PPPs ($-\overline{G}-F$), pay the subsidy ($-mS$), or pay nothing if there is a private workout;
2. likewise, creditors either lose the difference between the debt face value and the guarantee ($\overline{G}-D$), the value of the workout/exit ($V_{exit}-D$), or they make zero loss if the subsidy is paid;
3. sponsors either get nothing if creditors prefer claiming the guarantee to a workout, keep a share of the firm $V-V_{exit}-\delta$ in the event of a successful workout, with δ any additional equity injection required, or stay in business thanks to the subsidy and receive S.

If the concession requires a lot of financial support (perhaps it is not 'bankable'), then $-mS$ is large:

1. the government prefers paying $-\overline{G}-F$, especially if, in times of crisis, $-F$ is small;
2. the creditor haircut required by a workout is high ($V_{exit}-D<\overline{G}$) and creditors thus prefer claiming the guarantee or selling the project debt in the secondary market, whichever is higher;
3. sponsors have no bargaining power so they get nothing.

Thus, unsurprisingly, projects that are not commercially viable either at the onset or following a large demand shock, inevitably lead creditors to claim the guarantee. The presence of a guarantee at the financing stage or the possibility of subsidies do not

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save the concessions from eventual failure and social losses.

If the concession is fundamentally sound but only going through a momentary phase of financial distress (i.e. $-mS$ is small):

1. either $\overline{G}$ is also small, and both the government and creditors prefer a private workout, the government's loss is zero, creditors lose $V_{exit} - D$ (which may be a positive value) and sponsors get $V - V_{exit} - \delta > 0$;
2. or $\overline{G}$ is large and because creditors would prefer an exit to a workout, the government always prefers paying the subsidy $-mS < \overline{G}$, in which case sponsors receive $S > 0$ and creditors lose nothing.

Thus, depending on the ratio of mS to $\overline{G} + F$ and of V_{exit} to $\overline{G}$, there can be different paths to equilibrium.

With a war of attrition

At the moment of the shock that impacts the concessions and triggers the first stage of the Game, the creditors' ability to make a credible commitment to claim the guarantee for long enough (i.e. whether there is going to be a war of attrition of not) should be known to all players.

With full information, given what credible threats can be made and each side's cost/benefit ratio, the outcome of the Guarantee game is predictable and playing the full Game amounts to a simple recalibration of the game with no war, with a lower expected guarantee payout $\underline{G} - c_c(t) < \overline{G}$.

If the eventual guarantee payout is smaller, creditors are more likely to prefer a workout, and the government is less likely to agree to provide subsidies. If the projects are not viable after the shock, with a lower guarantee, creditors are more likely to prefer a direct exit in the secondary market and sponsors are more likely to get nothing. Conversely, if the projects are still sound, the prospect of a costly war of attrition over the guarantee payment should make a workout more attractive for both creditors and sponsors.

The costs and uncertainty created by the Guarantee game, thus partly reverse the moral hazard found in insurance policies (including public sector guarantees), since it makes claiming the policy more difficult and creates a greater tolerance for private losses (a deductible) on the side of the claimant.

4. Conclusions

4. Conclusions

In this case study, we have reviewed the procurement, evolution, restructuring and collapse of the Spanish toll road sector over the 1998-2018 period.

Our analysis of the concession companies was based on the study of their financial accounts, field interviews with a range public and private sector individuals involved (conducted in 2017), as well as the review of local and international media reporting on these projects.

This case study was motivated by the study of exit costs in the event of financial restructuring in project finance. In the most common cases, exit costs for lenders are high and credit events leads to a restructuring or 'work out' between sponsors and creditors in order to maximise the expected value of both senior debt and equity.

In this case however, the workout value of almost every project was not high enough to justify restructuring the firms and their debt. Instead, lenders acknowledged that the projects they had financed could no longer be considered viable and instead chose to claim the public guarantee provided by the government.

It could be argued that the RPA created moral hazard: the presence of a government guarantee led creditors to make very risky bets with the financial structuring of merchant toll roads, when they would otherwise not have supported such projects or at least have required a much deeper equity commitment from sponsors.

Beyond this question, the fact that the same lenders eventually chose to take 90% haircuts on loans that had 100% of their face value backed by a state guarantee is striking. While the combined cost of the guarantees was large, the Spanish government's ability to pay was never in doubt. Moreover, similar cases of credit guarantees extended by sovereigns to the creditors of infrastructure projects have tended to be uncontroversial, as the London Underground example illustrates.

The war of attrition model provides an insightful framework to understand this phenomenon: in some cases, it is in the best interests of both parties (their best rational move) to engage in a seemingly absurd (zero net benefit) conflict that can last for a long time. A number of military doctrines have been developed in response to this phenomenon, many of which are variants of the 'overwhelming force' approach, by which an opponent chooses to exit the fight immediately when faced with a credible commitment to engage vast resources into a confrontation.

The inability of creditors to organise and make a credible commitment to wait for 'as long as it takes' to claim the RPA made it possible for the Spanish government to successfully push creditors to exit the game and sell their claims to a second group of investors, while substantially reducing the size of the liability in the process.

Thus, the bets made by creditors in this case were indeed high-risk: **in the event where**

4. Conclusions

the macro-economic conditions would have deteriorated enough to justify calling the guarantee, it was unlikely that it could easily be claimed.

Still, it would be unfair to say that the government 'won' the Guarantee game against the original creditors. Instead, both sides played their best moves at the time. In the end, both sides paid a high price.

This case also highlights the importance for infrastructure investors to take into account the potential dynamic of the relevant sector as a whole before engaging in individual projects. They should consider the contingent nature of creditor and government responses to shocks, which can create state-dependent correlations between projects.

While infrastructure projects can be expected to exhibit very idiosyncratic features (including in terms of the risks they represent), infrastructure projects can also be linked by certain mechanisms at the national level.

In particular, if a government decides to procure a series of new projects within a short time-frame, these projects are more likely to be impacted in a synchronised manner by exogenous shocks, since they will all be at the same stage in their lifecycle when the shock occurs. Government support or the payment of a guarantee may be uncontroversial in the case of a single project, but creates large contingent liabilities if the whole sector can fail simultaneously.

Likewise, the bargaining power of creditors is impacted by the occurrence of 'bad states of the world' lowering their ability to bear the cost of negotiations, whether it be because lenders suffer losses across their entire balance sheet at that time, or because they themselves need to be bailed out.

While game theory can only provide a stylised and often highly simplified framework for understanding such cases, it can provide investors with powerful insights *ex post* as is the case here, but also help model important aspects of the risks taken in infrastructure projects, including *systematic* aspects of the infrastructure sectors in which they wish to invest.

This is particularly relevant when it comes to modelling political and regulatory (or other event-driven) risks: simple games of strategic bargaining over different 'moves' can help understand, anticipate and even mitigate risk.

For the public sector, such models can also help design and calibrate guarantee mechanisms that minimise moral hazard, while allowing insurance mechanisms to play a role in attracting private capital to the infrastructure sector.

4.1 Sector Evolutions

The Spanish government intends to re-tender the failed concessions very

4. Conclusions

quickly after taking over them in 2018 (Magariño, 2018). It should be noted that the procurement of road concessions has evolved in ways that should avoid the repetition of the story presented in this case study.

The law regulating toll road concessions in Spain dates back to 1972. At the time, to attract private funding, the government granted tax breaks, loan guarantees and exchange rate insurance for loans provided by foreign banks until 1975 (Ortega et al. (2016)). With the mid-70s oil crisis, such guarantees became too costly. At the time, high oil prices had also caused a sharp decline in traffic and a series of concession bankruptcies, followed by nationalisations.

PPP contracts are not negotiated; instead, the government provides a standard concession contract, the main features of which have changed little over time.

In 2003, just as the last of the ten toll roads in our study was being procured, a new private concessions business model was being introduced, requiring less demand risk to be borne by private parties. This new framework allowed the creation of the "shadow tolling" model (different levels of contractual payments are made by the government on the basis of actual road usage) and the "availability payments" model (a periodic payment is made by the government as long as the infrastructure is available to use, at a pre-agreed level of performance).

In 2007, a new PPP law was approved, to transpose a European directive, specifying the obligation to do a detailed cost-benefit analysis for every new contract signed. Under previous rules, governments usually used impact studies, which included very limited CBAs (Engel et al., 2015).

In 2011, a new public contract law was passed and included new regulations about the funding sources for concessions agreements, such as the possibility of issuing securities, the possibility of mortgaging concessions as a guarantee for the lenders, and the implementation of subordinated loans.

These evolutions can be expected to improve the outcome of PPP procurement and avoid the kind of synchronised shocks that led to the series of events described in this study.

A. Appendix: The RPA

A. Appendix: The RPA

The Responsabilidad Patrimonial de la Administración or RPA states that "Individuals are entitled to a compensation from the government for any injury or damage caused to any of their property or rights, except in cases of force majeure, if the injury is a result of normal or abnormal functioning of public services".

In the current Spanish legislative framework, the RPA has been regulated by the Decree of April 26, 1957, in Chapter II of Title IV, "Compensation for other damages" that developed the law of December 16, 1954 about Expropriation. The procedure to claim the RPA is regulated by the Law 30/1992. In order to claim the RPA, the affected party must initiate the claim against the concerned administration. In any case, the alleged damage must be effective, economically assessable and individualised in relation to a person or group of people. The Council of Ministers fixes the amount of compensation to be paid after the declaration by the Constitutional Court of the existence of an injury or damage caused by the administration.

Examples of applications of the RPA are:

- Liability arising from an accident in the street due to the poor condition of public roads or sidewalks;
- Liability arising from a medical error or medical negligence in the case the doctor or medical equipment is hired by a public hospital.

In concession contracts, the legal concept of the RPA, which is regulated by the Public Procurement Law, must be included as a clause in the concession contract. This clause has been included in public infrastructure concessions sine 1965 and should specify the maximum amount of RPA applicable for the concession. This maximum amount is established by the bidder when bidding in the tender process.

However, to this day there is no precedent of RPA payment following the failure of a public concession contract. In any case, the calculation of any amount owed to concessionaires under the RPA can only be made by the government, which determines the level of depreciation to be applied and the final amount to be paid (Anonymous Interview, 2017e).

Much of this case revolves around the RPA: from the decision to finance the projects to that of selling the project debt to distressed debt investors and wiping out equity holders.

As discussed earlier, the point of the RPA is to avoid an unfair enrichment of the government in case the concession contract is terminated. The rationale partly springs from Spain's recent history and the role played by the state in expropriating private property.

But the fact that the RPA also applies if the projects is declared bankrupt (i.e. when contract termination is not caused by the

A. Appendix: The RPA

government) can be considered to create moral hazard.

Hence, the suppression or modification of the RPA in public concessions has been on the public agenda in recent years for obvious reasons.

Consequently, and as part of a transposition of two European Directives (Directive 2014/24/UE of public contracts and Directive 2014/23 of public concessions), in October 2015 the Spanish Parliament approved amendments to the Public Procurement Law by modifying the Royal Decree 3/2011 on Spanish Public Sector Contracts. These amendments introduced modifications to the RPA applied to public concessions. [22]

22 - This law is still being discussed in the Spanish Parliament and it can be subjected to further modifications (Anonymous Interview, 2017b)

The new regime introduces a distinction between early termination of a contract due to causes attributable to the administration and due to causes not imputable to the administration.

If the cause of termination can be attributed to the administration, the existing RPA mechanism and calculation are maintained.

Conversely, in cases where causes are not attributable to the administration, which include the declaration of insolvency proceedings by the concessionaire, RPA calculations have been changed as follows:

- **Calculation of the RPA amount**: The RPA to be paid by the government in case the concessionaire is declared bankrupt will no longer be calculated on the basis of construction costs minus depreciation. Instead, it will take into account the market price of the firm: an initial value of the RPA will be calculated using estimated cash flows for the remaining concession period, discounted at the 10-year government bond interest rate plus a 3% margin;
- **Auction process**: Following a bankruptcy, the government may award the contract to a new sponsor. The first price of the auction will be the amount calculated according to the formula described above. If this auction is not successful, a second auction will be organised, but the opening price shall be 50% of the price of the first auction. The project will be free from any bank debt. The new investor buying the project will have to pay within two months after the auction and this payment will be used by the government to pay the RPA to the previous owners.

B. Appendix: Project Costs and Financial Structure

B. Appendix: Project Costs and Financial Structure

Table 10: Construction Costs Estimates breakdown between M50 and the Radials (in million Euros) for the Madrid Concessions

	Total Project costs	M-50 costs	M-50 costs as a % of project costs
R-3 and R-5	719	279	39%
R-2	469	139	30%
R-4	695	405	58%

Table 11: Financial Structuring of the 9 Concession Companies

Project	Leverage	Fin Close	Loan info	Mat. date	Repayment profile	Credit spread	Comments
AP-7 Alicante - Cartagenae	92%	11/11/2004	Senior Syndicated loan 214 (3 tranches) + VAT facility 27 mill	31/12/2013	Bullet	EURIBOR (3m) + 105	
Ciralsa - Cirv. Alicante	89%	15/8/2005	Senior Syndicated Loan 269 mill + VAT facility 30.1 mill + Government subordinated loan 101 mill	30/6/2033	Starts as of 2012	EURIBOR (6m) + (115 to 140)	Government loan matures on 22/02/2040
Radial 2 Madrid - Guadalajara	87%	23/4/2002	Senior Syndicated loan (2 tranches) 440 mill + VAT facility 33 mill	31/10/2021	Starts as of 2008. Semi-annual	EURIBOR (6m) + 158	If DSCR > 1.5, then spread = 135
AP- 36 Ocaña - La Roda	85%	27/7/2004	Senior Syndicated Loan 522 mill (3 tranches) +VAT facility 55 mill	31/12/2012	Bullet repayment	EURIBOR (6m) + 110	
AP-7 Cartagena - Vera	85%	7/7/2005	Senior syndicated loan 450 mill, subordinated loan 100 mill and VAT facility 82 mill	15/12/2012	Bullet repayment	EURIBOR (6m) + 130	Credit spread of subordinated loan EURIBOR + 250
AP- 41 Madrid - Toledo	81%	21/12/2004	Senior Syndicated Loan of 379.8 mill + VAT facility 45 mill	31/12/2031	Starts when the loan has been drawn down in full. As of 2011 in 42 semi annual instalments.	EURIBOR (6m) + 140	DSCR is <1.3, EURIBOR + 140; DSCR is between 1.30 and 1.35, EURIBOR + 130; DSCR is between 1.35 and 1.45, EURIBOR + 120; DSCR is between 1.45 and 1.55, EURIBOR + 110; DSCR> 1.55, EURIBOR + 100
Radial 3 - Radial 5	81%	18/7/2003	Senior Syndicated loan 455.5 mill, EIB loan 300 mill + VAT facility 76 mill	15/3/2010	Bullet repayment	EURIBOR (6m) + 140	EIB loan is guaranteed by the banks of syndicated loan. Maturity date: 15/03/2033. Repayment starts on 27/03/2017. Interest rate is EIB rate (3 months based)
M12 Eje Aeropuerto	78%	31/12/2003	Senior Syndicated loan 281.6 mill + VAT facility 34 mill	31/12/2023	Repayment as of 2007, in semi-anual increasing instalments.	EURIBOR (6m) + 150	
Radial 4 Madrid - Ocaña	74%	27/1/2003	Senior Syndicated Loan of 196.6 mill + EIB loan 360 mill. VAT facility 54.14 mill	27/1/2009	Bullet repayment of senior loan	EURIBOR (6m) + 130	EIB loan is guaranteed by the banks of syndicated loan. It has 2 tranches (Tranche A: 46.14 euros available as of 31/01/2003 which will be amortized from 15/07/2010 to 15/12/2032; Tranche B can be drawn any time and will be amortized from 10 years to 30 year after being drawn. EURIBOR + 12

Source: audited account, relevant years, authors computations.

C. Appendix: Project Financials

C. Appendix: Project Financials

C.1 Projects Financials

This section proposes a summary of the projects financials. SPV names and initial shareholders are disclosed in table (18).

Table (14) shows the proportion of debt to the total assets value (indebtedness). In 2012, in many projects the total debt is significantly higher than the assets value.

Table (15) shows the annual change in revenues of the 10 toll roads since the onset of the financial crisis. It shows a large drop in turnover in year 2008, driven by a decline in traffic in all the toll roads. The revenues continue decreasing in the following years.

Table (16) shows the Annual Change in Net Income of the 10 toll roads since the onset of the financial crisis. The net profit has been calculated including an adjustment to eliminate the effect of the impairment of fixed assets accounted in the P&L statements. If the impairment of fixed assets is considered, the net profit annual change will decrease substantially.

Net income dropped sharply in most of the projects in 2008 and 2009, and continued decreasing in the following years. In 2011, a significant positive change can be seen in 9 projects. This positive change is explained by the compensation received from the Government as "clearing account compensation" which in all cases was accounted as a direct subsidy (extraordinary revenue in the P&L) instead of as subordinated debt. The reason for this is that the companies considered that the conditions set to be able to pay back the compensation would never be met. For the same reason, the accrued financial expenses related to the clearing account compensations were never accounted (data from financial statements). Table (17) shows the Clearing account compensation received by the companies in 2011 and the annual change in Net Income that the companies would have experienced if the compensation had not been received.

Table 12: Assets Value (in million eur)

Project	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
A-70 Circunvalación de Alicante				76	163	235	566	441	456	497	488	391		
AP-7 Alicante - Cartagena	281	272	278	302	344	356	399	417	428	381	385	379	359	352
AP-7 Cartagena - Vera				109	354	703	779	777	795	685	530	515	500	
AP- 36 Ocaña - La Roda				92	368	540	526	541	540	545	558	467	464	
AP- 41 Madrid - Toledo				98	263	424	423	521	528	498	517	582		
Radial 2 Madrid - Guadalajara	148	303	555	564	587	636	668	663	684	733	956	954		
Radial 3 - Radial 5	171	412	793	1085	1115	1136	1166	1168	1225	1283	1449	1444	1422	1405
Radial 4 Madrid - Ocaña					674	678	746	1156	1199	1216	1272	1092	1104	
M12 Eje Aeropuerto					674	678	746	1156	1199	1216	1272	1092	1104	

Source: audited accounts, relevant years.

Table 13: Total Debt (in million eur)

Project	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
A-70 Circunvalación de Alicante				26	112	185	517	363	389	444	453	483		
AP-7 Alicante - Cartagena	257	250	258	259	289	289	291	299	308	296	334	335	322	317
AP-7 Cartagena - Vera				70	286	603	677	687	720	735	748	768	773	
AP- 36 Ocaña - La Roda				65	323	477	483	506	516	534	552	611	630	
AP- 41 Madrid - Toledo				10	175	336	327	436	444	420	455	529		
Radial 2 Madrid - Guadalajara	84	235	478	479	501	547	562	585	618	683	918	945		
Radial 3 - Radial 5	30	271	603	892	915	931	965	975	1041	1108	1275	1291	1291	1297
Radial 4 Madrid - Ocaña					536	564	642	1005	1051	1068	1136	1240	1273	
M12 Eje Aeropuerto			153	290	346	350	362	365	391	404	413	449	508	521

Source: audited accounts, relevant years.

C. Appendix: Project Financials

Table 14: Leverage over Time

Project	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
A-70 Circunvalación de Alicante				34%	69%	79%	91%	82%	85%	89%	93%	**123%**		
AP-7 Alicante - Cartagena	91%	92%	93%	86%	84%	81%	73%	72%	72%	77%	87%	88%	90%	90%
AP-7 Cartagena - Vera				64%	81%	86%	87%	88%	90%	**107%**	**141%**	**149%**	**155%**	
AP- 36 Ocaña - La Roda				71%	88%	88%	92%	94%	96%	98%	99%	**131%**	**136%**	
AP- 41 Madrid - Toledo				10%	67%	79%	77%	84%	84%	84%	88%	91%		
Radial 2 Madrid - Guadalajara	57%	78%	86%	85%	85%	86%	84%	88%	90%	93%	96%	99%		
Radial 3 - Radial 5	18%	66%	76%	82%	82%	82%	83%	83%	85%	86%	88%	89%	91%	92%
Radial 4 Madrid - Ocaña					80%	83%	86%	87%	88%	88%	89%	**113%**	**115%**	
M12 Eje Aeropuerto			83%	80%	79%	82%	86%	100%	**104%**	**107%**	**111%**	**115%**	**127%**	**133%**

Source: audited accounts, relevant years, authors' calculations, figures above 100% indicate negative book equity.

Table 15: Annual Change in Turnover

Project	2007	2008	2009	2010	2011	2012	2013	2014
A-70 Circunvalación de Alicante		-37%	-18%	-11%	-97%	-52%		
AP-7 Alicante - Cartagena	9%	-17%	-14%	-11%	-6%	-8%	2%	5%
AP-7 Cartagena - Vera		35%	-11%	-5%	-5%	-11%	-1%	
AP- 36 Ocaña - La Roda	54%	-3%	-3%	-12%	-5%	-13%		
AP- 41 Madrid - Toledo		44%	-18%	-12%	-19%	-61%		
Radial 2 Madrid - Guadalajara	21%	-2%	-9%	-1%	-15%	-21%		
Radial 3 - Radial 5	10%	-26%	-6%	-1%	-0%	-12%		
Radial 4 Madrid - Ocaña	32%	-4%	-12%	-9%	-15%	-12%	-11%	
M12 Eje Aeropuerto	7%	-6%	-9%	-6%	-7%	-2%	22%	8%

Source: audited accounts, relevant years, authors' calculations.

Table 16: Annual Change in Net Income

Project	2007	2008	2009	2010	2011	2012	2013	2014
A-70 Circunvalación de Alicante		-265%	-70%	6%	47%	-440%		
AP-7 Alicante - Cartagena	21%	-230%	-222%	-47%	336%	181%	0%	-81%
AP-7 Cartagena - Vera		8%	-1%	-164%	61%	-84%	-11%	
AP- 36 Ocaña - La Roda	-15%	44%	4%	-19%	26%	-488%		
AP- 41 Madrid - Toledo		-8%	-254%	70%	-224%	52%		
Radial 2 Madrid - Guadalajara	83%	-209%	-221%	-7%	67%	-507%		
Radial 3 - Radial 5	-233%	-183%	-57%	-25%	87%	-1337%		
Radial 4 Madrid - Ocaña	16%	33%	-17%	2%	11%	-18%	-43%	
M12 Eje Aeropuerto	-1%	5%	19%	-2%	21%	-73%	-171%	57%

Source: audited accounts, relevant years, authors' calculations.

Table 17: Impact of the Clearing Account compensation on Annual Change in Net Income in 2011

Project	Actual Net Income annual change	Clearing Acc comp (in EUR)	Net Income annual change (w/o comp)
A-70 Circunvalación de Alicante	47%	6,843,246	-30%
AP-7 Alicante - Cartagena	336%	0	336%
AP-7 Cartagena - Vera	61%	8,281,529	28%
AP- 36 Ocaña - La Roda	26%	8,579,906	-25%
AP- 41 Madrid - Toledo	-224%	3,574,990	-287%
Radial 2 Madrid - Guadalajara	67%	16,183,806	-48%
Radial 3 - Radial 5	87%	17,838,310	-77%
Radial 4 Madrid - Ocaña	11%	14,003,955	-81%
M12 Eje Aeropuerto	21%	4,802,338	-17%

Source: audited accounts, relevant years, authors' calculations.

C. Appendix: Project Financials

Table 18: SPV and Sponsors

SPV	Project	Shareholders
Ciralsa SACE	A-70 Circunvalación de Alicante	Desarrollo de Concesiones Viarias Uno SL (ACS) (25%), Autopistas Aumar (Abertis) (25%), Global Via Infrastructuras (Corp Fin Caja Madrid) (50%)
Autopista del Sureste Concesionaria Española	AP-7 Alicante-Cartagena	Pralesa Concesiones (41.44%), Caja Mar Caja Rural (22.79%), Grupo Corpoprativo Fuertes SL (20.67%), Unicaja Banco SA (15.10%)
Autopista de la Costa Cálida	AP-7 Cartagena- Vera	Autopista del Sureste Concesionaria Española de Autopistas SA (35.75%) Global Via infraestructuras SA (35.75%), Banco Sabadell SA (4.5%), Cajas rurales Unidad (4.5%), Unicaja Banco (4.5%), Ploder Concesiones (15%)
Autopista Madrid Levante	AP-36 Ocaña-La Roda	Cintra Infraestructuras (51.84%), Sacyr Concesiones (48.16%)
Autopista Madrid Toledo	AP-41 Madrid - Toledo	Comsa Concesiones (25.5%), Grupo Isolux Corsan (25.5%), Cointer, Concesiones Intercontinentales (17%), Sando Concesiones (17%), ESConcessoes (Banco Espirito Santo) (15%)
Autopista del Henares SACE	Radial 2 Madrid-Guadalajara	Desarrollo de Concesiones Viarias Uno SL (ACS) (35%), Acciona SA (22.5%), Autopista Vasco Aragonesa (15%), Iberpistas (15%), Global Via Infraestructuras (10%), (Corporación financiera de Caja Madrid, now Bankia), Acciona Infraestructuras SA (2.5%)
Accesos de Madrid Concesionaria Española SA	Radial 3 Madrid - Arganda, Radial 5 Madrid- Navalcarnero	Iberpistas (Abertis) (35%), Sacyr SA (25%), Bankia (Caja Madrid) (20%), Desarrollo de Concesiones Viarias Uno S.L. (ACS) (20%)
Autopista Madrid-Sur CESA	Radial 4 Madrid - Ocaña	Cintra Infraestructuras (55%), Sacyr Concesiones (35%), Inversiones Corporativas (10%)
Autopista Eje Aeropuerto Concesioaria Española SA	M12 Eje Aeropuerto	OHL Concesiones SA (100%)

Source: SABI

C. Appendix: Project Financials

Table 19: Spanish Lenders

Ahorro Corporacion Financiera SA
Banco Cooperativo Español SA
Banco de Sabadell
Banco de Valencia
Banco Español de Crédito SA
Banco Popular Español
Banco Santander
Banco Zaragozano
Banesto
Bankinter SA
BBVA
Bilbao Bizkaia Kutxa
Caixa d'Estalvis de Catalunya
Caixa d'Estalvis i Pensions de Barcelona
Caixa Geral de Depositos SA
Caixa Sabadell
Caixanova
Caja Badajoz
Caja de Ahorros Castilla La Mancha
Caja de Ahorros de Murcia
Caja de Ahorros de Navarra
Caja de Ahorros del Mediterraneo – CAM
Caja de Ahorros Provincial San Fernando de Sevilla y Jerez
Caja de Badajoz
Caja de Burgos
Caja de Castilla-La Mancha
Caja de Guadalajara
Caja de Madrid
Caja de Segovia
Caja del Circulo Catolico de Obreros de Burgos
Caja Duero
Caja España
Caja General de Granada
Caja Insular de Canarias
Caja Vital Kutxa
Cajamar
Cajasur
Ibercaja
Instituto de Credito Oficial - ICO
La Caixa
Monte de Piedad y Caja de Ahorros de Ronda Cadiz Almeria Malaga
Unicaja

Source: Dealogic

Table 20: Non-Spanish Lenders

AIB Capital Markets Ltd
Banca OPI SpA
Banco Comercial Portugues
Banco Espirito Santo de Investimento SA
Banco Espirito Santo SA
Bank Nederlandse Gemeenten NV
Bank of Ireland
Barclays Bank
BCPA - Banco de Investimento SA
BNP Paribas SA
Commerzbank AG
Crédit Agricole
DePfa-Deutsche Pfandbrief AG
Dexia
DVB Bank AG
Espirito Santo Investment
Fortis Bank SA
Helaba Bank
HSBC Holdings
HSH Nordbank AG
ING Bank
Kreditanstalt fuer Wiederaufbau - KfW
Landesbank Hessen-Thueringen Girozentrale - Helaba
Lloyds Bank
Mizuho Corporate Bank
Natixis
Norddeutsche Landesbank Girozentrale - NORD/LB
Royal Bank of Scotland
Société Générale
Sumitomo Mitsui Banking Corp

Source: Dealogic

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About EDHEC Infrastructure Institute-Singapore

About EDHEC Infrastructure Institute-Singapore

EDHEC*infra* addresses the profound knowledge gap faced by infrastructure investors by collecting and standardising private investment and cash-flow data and running state-of-the-art asset pricing and risk models to create the performance benchmarks that are needed for asset allocation, prudential regulation, and the design of new infrastructure investment solutions.

Origins

In 2012, EDHEC-Risk Institute created a thematic research program on infrastructure investment and established two Research Chairs dedicated to long-term investment in infrastructure equity and debt, respectively, with the active support of the private sector.

Since then, infrastructure investment research at EDHEC has led to more than 20 academic publications and as many trade press articles, a book on infrastructure asset valuation, more than 30 industry and academic presentations, more than 200 mentions in the press, and the creation of an executive course on infrastructure investment and benchmarking.

A testament to the quality of its contributions to this debate, EDHEC*infra*'s research team has been regularly invited to contribute to high-level fora on the subject, including G20 meetings.

Likewise, active contributions were made to the regulatory debate, in particular directly supporting the adaptation of the Solvency-II framework to long-term investments in infrastructure.

This work has contributed to growing the limited stock of investment knowledge in the infrastructure space.

A Profound Knowledge Gap

Institutional investors have set their sights on private investment in infrastructure equity and debt as a potential avenue toward better diversification, improved liability-hedging, and reduced drawdown risk.

Capturing these benefits, however, requires answering some difficult questions:

1. **Risk-adjusted performance measures** are needed to inform strategic asset allocation decisions and monitor performance;
2. **Duration- and inflation-hedging properties** are required to understand the liability-friendliness of infrastructure assets;
3. **Extreme risk measures** are in demand from prudential regulators, among others.

Today none of these metrics is documented in a robust manner, if at all, for investors in privately held infrastructure equity or debt. This has left investors frustrated by an apparent lack of adequate investment solutions in infrastructure. At the same time, policy-makers have begun calling for a widespread effort to channel long-term savings into capital projects that could support long-term growth.

To fill this knowledge gap, EDHEC has launched a new research platform, EDHEC*infra*, to collect, standardise, and produce investment performance data for infrastructure equity and debt investors.

Mission Statement

Our objective is the creation of a global repository of financial knowledge and investment benchmarks about infrastructure equity and debt investment, with a focus on delivering useful applied research in finance for investors in infrastructure.

We aim to deliver the best available estimates of financial performance and risks of reference portfolios of privately held infrastructure investments and to provide

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investors with valuable insights about their strategic asset allocation choices in infrastructure, as well as to support the adequate calibration of the relevant prudential frameworks.

We are developing unparalleled access to the financial data of infrastructure projects and firms, especially private data that is either unavailable to market participants or cumbersome and difficult to collect and aggregate.

We also bring advanced asset pricing and risk-measurement technology designed to answer investors' information needs about long-term investment in privately held infrastructure, from asset allocation to prudential regulation and performance attribution and monitoring.

What We Do

The EDHEC*infra* team is focused on three key tasks:

1. **Data collection and analysis**: we collect, clean, and analyse the private infrastructure investment data of the project's data contributors as well as from other sources, and input it into EDHEC*infra*'s unique database of infrastructure equity and debt investments and cash flows. We also develop data collection and reporting standards that can be used to make data collection more efficient and more transparently reported. This database already covers 15 years of data and hundreds of investments and, as such, is already the largest dedicated database of infrastructure investment information available.

2. **Cash- flow and discount-rate models**: Using this extensive and growing database, we implement and continue to develop the technology developed at EDHEC-Risk Institute to model the cash flow and discount-rate dynamics of private infrastructure equity and debt investments and derive a series of risk and performance measures that can actually help answer the questions that matter for investors.

3. **Building reference portfolios of infrastructure investments**: Using the performance results from our asset pricing and risk models, we can report the portfolio-level performance of groups of infrastructure equity or debt investments using categorisations (e.g., greenfield vs. brownfield) that are most relevant for investment decisions.

Partners of EDHEC*infra*

Monetary Authority of Singapore

In October 2015, Deputy Prime Minister of Singapore Tharman Shanmugaratnam announced officially at the World Bank Infrastructure Summit that EDHEC would work in Singapore to create "usable benchmarks for infrastructure investors."

The Monetary Authority of Singapore is supporting the work of the EDHEC Singapore Infrastructure Investment Institute (EDHEC*infra*) with a five-year research development grant.

Sponsored Research Chairs

Since 2012, private-sector sponsors have been supporting research on infrastructure investment at EDHEC with several Research Chairs that are now under the EDHEC Infrastructure Investment Institute:

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1. The EDHEC/NATIXIS Research Chair on the Investment and Governance Characteristics of Infrastructure Debt Instruments, 2012-2015
2. The EDHEC/Meridiam/Campbell-Lutyens Research Chair on Infrastructure Equity Investment Management and Benchmarking, 2013-2016
3. The EDHEC/NATIXIS Research Chair on Infrastructure Debt Benchmarking, 2015-2018
4. The EDHEC / Long-Term Infrastructure Investor Association Research Chair on Infrastructure Equity Benchmarking, 2016-2019
5. The EDHEC/Global Infrastructure Hub Survey of Infrastructure Investors' Perceptions and Expectations, 2016

Partner Organisations

As well as our Research Chair Sponsors, numerous organisations have already recognised the value of this project and have joined or are committed to joining the data collection effort. They include:

- The Global Infrastructure Hub;
- The European Investment Bank;
- The World Bank Group;
- The European Bank for Reconstruction and Development;
- The members of the Long-Term Infrastructure Investor Association;
- Over 20 other North American, European, and Australasian investors and infrastructure managers.

EDHEC*infra* is also :

- A member of the Advisory Council of the World Bank's Global Infrastructure Facility
- An honorary member of the Long-term Infrastructure Investor Association

EDHEC Infrastructure Institute Publications

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- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker. "Private Infrastructure Equity Indices: Benchmarking European Private Infrastructure Equity 2000-2016" (June 2017).
- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker. "Private Infrastructure Debt Indices: Benchmarking European Private Infrastructure Debt 2000-2016" (June 2017).
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