The Length of PPP Tendering Periods: A Multi-Country Analysis

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Abstract

Substantial infrastructure deficits are a major challenge for countries around the world and PPPs continue to play an important role in addressing the challenge of delivering critical infrastructure. PPPs, however, are often characterised by lengthy tendering periods, defined as the difference between contract notice and financial close. Tendering periods are important because they account for a significant proportion of overall project delivery time. Slow tendering deters bidders and thus reduces competition for contracts. We source data on 1,295 PPP projects in eight countries and use a duration analysis model to empirically examine the factors that impact tendering period duration. Our findings show that there is significant variation across countries and sectors. When we control for other variables we find that Ireland and the United Kingdom stand out as the countries with the longest tendering periods. In sectoral terms the longest tendering periods were found in the health, housing, and defence sectors. However, PPPs in the defence sector are not associated with significantly longer tendering periods once the UK is excluded.

Keywords: Public-private partnerships, tendering period, procurement, duration analysis

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1. Introduction

Significant challenges around investing in physical infrastructure are faced by governments across the world. The sheer amount of investment required to meet the needs in different countries is enormous. At an aggregate level, the scale of investment required to keep pace with national income growth and meet investment requirements has been estimated in a number of studies. For example the *McKinsey Global Institute* (2013) estimates that at a global level required investment levels over the period 2013-2030 amount to US$57 trillion. The OECD (2015) estimates that US$71 trillion – about 3.5 per cent of annual World GDP from 2007 to 2030 – is required if total global infrastructure investment requirements are to be met in key sectors such as transport, electricity generation, transmission and distribution, water and telecommunications.

As the availability of public resources becomes increasingly constrained governments are turning more and more to increased private-sector participation in infrastructure project delivery via public-private partnerships (PPPs). PPPs are contracts between a public-sector project sponsor and a private partner that facilitate private participation in project design, construction, financing, operation and maintenance. Various PPP approaches, including concession contracts, design-build, build-operate-transfer, design-build-operate-maintain contracts, among many others, have been used to deliver key facilities such as highways, tunnels, airports, ports, hospitals and schools.

The justifications for use of PPPs are manifold. They commonly include the potential to improve the cost-efficiency of infrastructure investment (often referred to as the achievement of better value-for-money) and the scope for on-time and on-budget project delivery. Disenchantment with traditional procurement methods are well documented with some of the most persuasive evidence of inefficiencies provided by Flyvbjerg *et al.* (2002; 2003a; 2003b; 2004; 2011) who analysed data on 258 large-scale infrastructure projects. Those studies show that procurement via traditional methods was, in nine out of ten cases, characterised by cost overruns, benefit shortfalls and time delays.

Empirical evidence in favour of PPP as a more efficient procurement approach is provided by the National Audit Office (2003), Mott MacDonald (2002), and Lammam *et al.,* (2013).

These studies find that PPP achieves lower construction costs and shorter completion times compared to traditional procurement models. It is important to note that these studies focus on the ex-post contract period (that is, after contracts are signed). Findings in relation to shorter delivery times focus mainly on construction periods. In this sense these studies pay little if any attention to the tendering period, which is the interval between contract notice and contract award. This effectively omits one of the most important phases of the overall procurement process that can have considerable implications for the efficiency of public investment. In the UK, the National Audit Office (2007) notes that competition for contracts can be reduced where there is even the perception of lengthy tendering periods. In addition, HM Treasury (2010: 5) notes that projects that suffer from poorly delivered procurement are more likely to involve increasing costs and delays, raising the overall cost to the Exchequer and reducing the potential value for money gains. Moreover, protracted procurement periods impose social costs because citizen access to valuable infrastructure and/or services is delayed.

This paper analyses tendering periods and their determinants for PPP projects in eight countries with extensive records of PPP procurement. This analysis is based on a novel data set gathered on 1,295 projects from Australia, Brazil, Canada, France, Germany, Ireland, Spain and the UK. Our paper follows the empirical approach adopted in single-country studies by Reeves *et al*. (2015) which studied the case of Ireland and Reeves *et al.* (2016) which focused on the case of the UK. The only other empirical study of tendering period length that we are aware of was conducted by the National Audit Office in the UK and published in 2007. This UK-based study was based on ordinary least squares regression analysis. The approach adopted in this paper is to use a more robust statistical methodology. Specifically the paper examines how tendering periods are determined by the timing of contract notice, project size (measured by capital value), sector, and geography (location of PPP project) and the status of the procuring agency (national or sub-national) using a duration-analysis model. This helps explain variations in tendering periods while controlling for a number of relevant factors.

The paper is structured as follows. In the next section, we review the mechanics of the PPP procurement process in general as well as related theories. In section 3, we provide a broad

overview of the history of PPP procurement in our sample countries. In section 4 we describe the data underlying our analysis of tendering periods, as well as our empirical methods. We discuss our variable choice in section 5, and our estimates in section 6. Section 7 summarises and concludes.

2. PPP Procurement: Theory and Practice

The PPP label has been used to describe a range of different collaborative arrangements between the public and private sectors (Hodge and Greve, 2007). This paper focuses on PPP in the form of long-term infrastructure contracts where the private sector partner is responsible for the design, build, finance, operation and/or maintenance of the asset over the life of the contract. The key stages of the PPP project life cycle typically include a number of distinct stages which comprise: (i) option appraisal and project preparation; (ii) the tendering process (inviting bidders to submit and develop tenders, choosing a preferred bidder, negotiating a final agreement); (iii) construction; and (iv) service delivery (NAO, 2007). We focus explicitly in this paper on the second phase only – the tendering process.

Although the PPP approach to procuring infrastructure continues to appeal to policy makers around the globe, experience has shown that the *ex-ante* stage of the procurement process is often characterised by time overruns and significant costs incurred when organising contract competitions, crafting agreements and executing deals (HM Treasury, 2012; KPMG, 2010). Transaction cost economics (Williamson, 1975, 1985) illuminates the sources of such costs and how they impact PPP procurement efficiency.

Parties to PPP contracts can incur significant transaction costs prior to finalising agreements. These are the costs to the public and private sectors of using the market and include information, search, bargaining and contract conclusion costs (Obermann, 2007). In the case of PPP, the government incurs transaction costs related to the organisation of the tendering process, the assessment of bids and the negotiation of the final contract with the winning bidder. Private contractors also incur significant costs in assembling bids that may or may not be successful. At a theoretical level, the magnitude of transaction costs is determined by the characteristics of the transaction (Williamson, 1975, 1985). These characteristics include the degree of project asset specificity, uncertainty, complexity, *ex ante* supplier

market competitiveness, and the level of government contract management skills (Vining *et al*., 2005). PPP contracts for infrastructure are typically characterised by high degrees of uncertainty, complexity and uncertainty. They also involve investments in specific assets (with little or no alternative use) and relatively small numbers of bidders for contractors. As a relatively recent phenomenon the organisation of PPP contracts demands specific skills that are not readily available in the public sector. While government skills are improving in some countries they can frequently be poor (Boardman and Vining, 2012). Some governments are therefore susceptible to the problem of opportunistic behaviour whereby private parties seek to exercise unfair advantage.

The characteristics of PPP transactions for large infrastructure projects and opportunistic behaviour by contracting parties can increase tendering periods and the transactions costs incurred at the pre-contract award phase of PPP projects. The extant empirical evidence indicates that transaction costs under PPP are considerable.[1] Klein *et al.* (1996) suggest that transaction costs range between 3 and 5 percent of project costs in well-developed policy environments, while they may be 10 to 12 percent in pioneering projects. Dudkin and Välilä (2005) estimate the magnitude of transactions costs incurred by the public sector (using data on 55 contracts in the UK) and the private sector (using data on 32 projects in 4 countries). They find that "procurement phase transaction costs average well over 10 percent of the capital value of the sampled projects, with the cost to the public sector at 3.5 percent, cost to the winning bidder at 3.8 percent, and the cost to the failed bidders at about 5 percent" (Dudkin and Välilä, 2005, p. 14).

In addition, Henjewele *et al.* (2014) examined the impact of project attributes on the performance of PFI projects in the UK's transport and health sectors and found substantial variations in client requirements, time and cost before projects reached the financial close stage. The authors also found that iterations in client's requirements increased project procurement lengths and put both contractual and transactional costs at risk of overrun. These findings suggest that high transaction costs can have a considerable impact on the

[1] See Obermann (2007) for a detailed review.

overall efficiency of PPP and underline the importance of taking steps to improve the efficiency of the PPP procurement process and shortening tendering periods.

3. Background: PPP Procurement in the Sample Countries

There is a rich history of private sector investment in public infrastructure. Grimsey and Lewis (2004) provide a detailed set of illustrative examples including tolls on London Bridge that date back to 1268 and the first turnpikes in England and the USA that that opened in 1663 and 1794 respectively. Modern PPPs in the form of long-term infrastructure contracts have been extensively used in highly industrialised economies such as the UK and Canada since the early 1990s. In recent years, however, private investors are looking to emerging markets including Latin America, the Philippines and China. A useful classification of PPP markets is provided by KPMG (2015) which identifies mature stagnant PPP markets (e.g. the UK), mature growth markets (e.g. USA, Canada, Australia), high growth markets (e.g. Brazil, China), mature steady markets (e.g. Ireland, Spain, France) and small developing markets (some African countries including Namibia Tanzania, Angola).

For the purpose of this study we collected data on PPP procurement in eight countries included in the KPMG classification, namely the UK, Australia, Canada, Ireland, Spain, France, Germany and Brazil. The following section provides a brief description of the extent of PPP investment in each country and some relevant information about institutions and procurement practices.

Australia

Australia has a relatively long history of PPP procurement that has largely been driven by activity at a state rather than a federal level. The pace and scale of PPP investment has increased considerably in the past fifteen years with Victoria and New South Wales (NSW) the most active users of PPP for infrastructure investment. Hodge and Duffield (2010) estimate that by the end of 2009 there were 49 PPP projects worth an aggregate AUS$32.3 billion under way, with Victoria, NSW and Queensland accounting for 41 of these projects and AUS$28.8 billion of the total contracted value. Since 2009 PPP activity has continued to increase with a further 8 projects signed in Victoria worth approximately AUS$3 billion, and a further 19 projects signed in NSW. While projects in the transport sector (roads and rail)

account for the majority of PPP investment to date there is a wide variety of PPP infrastructure projects across other sectors such as water, health, education, and justice.

Brazil

It is difficult to provide a comprehensive overview of the history of PPP investment in Brazil as very little has been published on the Brazilian experience to date. Information on projects signed is also fragmented and generally only available in Portuguese from various state government and municipal websites. Notwithstanding these issues, it is clear from the sources that are available that Brazil has only recently turned to PPPs as a means of delivering infrastructure projects with the first PPP contract signed in 2006. Since then, however, the use of PPP has increased significantly with 58 PPP projects under way by the end of 2013 (Spanish Embassy in Brazil, 2013). The majority of this activity has occurred at the state (21 contracts spread across 10 states) and municipal (37 projects) levels with only one project procured at the federal level. Most of the PPP projects signed to date have been in the transport (roads) and water/wastewater sectors, as well as a number of stadiums, with a considerable number of projects signed as a result of the urgent need for infrastructure investment due to Brazil's hosting of the 2014 World Cup and 2016 Olympics. To date, half of Brazil's 26 states have established specialised PPP units to help promote and support the use of PPP investment, while at the federal level there are a number of planned PPP projects currently in the pipeline.

Canada

Over the past 20 years, the procurement of large-scale infrastructure projects through PPP agreements has become increasingly common across Canada. Figures provided by the Canadian Council for PPP show that 247 PPP projects worth CAD$119 billion have been procured since 1990. The vast majority of these have been procured since 2004, with much of this activity driven by provincial governments in Ontario, British Columbia, Alberta and Quebec where specialist PPP agencies or government departments have been established to help plan, procure and deliver PPP infrastructure projects. At the federal level PPP Canada was established in 2008 as a crown corporation to help encourage the use of PPPs for infrastructure investment and to manage a PPP fund created by the Canadian government to help incentivise greater use of PPP investment. To date, the majority of PPP investment

across Canada has been directed towards the healthcare and transport sectors and, in contrast to many other countries, only a small number of PPP projects have involved the transfer of demand/revenue risk to the private sector (Boardman and Vining, 2010; Siemiatycki, 2015).

France

While France has a centuries-long tradition of procuring infrastructure projects using concession arrangements, the introduction of long-term DBFM/DBFOM type PPP projects that have become common in many other countries occurred only relatively recently. The *contrat de partenariat* (CP) or partnership contract was introduced in 2004 and involves the bundling of the design, build, finance, operate and maintain elements of a project as part of a long-term contract backed by an ongoing public payment over the duration of the contract. Since 2004 the number of CP contracts signed has increased considerably at both the state and municipal/regional level. Figures as of October 2016 provided by MAPPP (the national PPP advisory agency) show that over 220 CP projects with an aggregate capital value exceeding €14 billion have reached financial close since 2004 with 162 of these signed at the municipal level. Most CP projects procured at a local level have been projects related to street lighting, ITC, waste/energy and sport/cultural activities whereas CP projects procured by the State have been predominantly in the health, education and transport sectors. CP projects in France have been mainly procured using the competitive dialogue procedure, although the negotiated procedure and restricted procedure have also been used in some instances. While all CP proposals have to be approved by MAPPP at their preliminary stage, thereafter it only provides support in terms of the preparation, negotiation and monitoring of CP projects. It is not a procurement agency for any contracts unlike dedicated government PPP units that have been established in other countries (EPEC, 2012).

Germany

Although Germany has been a relative latecomer to PPP procurement, PPP investment has surged since the first projects were signed in 2002. Between 2002 and 2009 a total of 145 projects were procured representing an aggregate investment of approximately €5.5 billion. While the pace of PPP investment has slowed since the crisis, by the end of 2015 total PPP

investment in Germany had reached approximately €9 billion across some 200 projects. An interesting feature of the German model of PPP procurement to date has been the use of *forfaitierung mit einredeverzicht* (a waiver of objections) in many of the projects procured. This involves the public sector agreeing to pay the financial institution(s) that provide the finance for a project regardless of the performance of the private company responsible for the delivery of the project. This waiver makes it easier for preferred tenderers to raise the necessary financing for a project and also leads to a lower cost of financing as any loan provided is effectively backed by the Government. The vast majority of PPP projects procured in Germany have adopted the negotiated procedure method of procurement, with no indication that there is any move towards the adoption of the competitive dialogue approach to date. Almost all PPP investment has occured at the *Länder* (State) level within Germany with only a small number of motorway projects procured at the federal level (in conjunction with *Länder*). In terms of institutional support, ÖPP Deutschland AG (Partnerschaften Deutschland) was founded in 2008 as a national PPP advisory/competency agency for all sectors and provides support to any public authority procuring PPP projects. For road transport projects there is a separate federal agency, VIFG, which provides support for all federal road/motorway related PPP projects. Aside from these federal consulting bodies almost all Länder have their own PPP taskforces generally housed within the Ministries responsible for finance or building/transport (Möpert and Mitz, 2014).

Ireland

The use of PPPs in Ireland dates back to 1999 and the launch of a pilot-programme of PPP projects. In the interim, PPPs have been used extensively to procure motorways, schools, environmental and other social infrastructure. By mid-2015, procurement was completed for 28 PPP contracts with contractual capital values exceeding €20 million. The aggregate contracted capital value of these projects amounted to over €6.8 billion with 13 motorway PPPs accounting for most (over €5 billion) of this total amount. Like other common law jurisdictions there is no set of specific PPP laws in Ireland. A number of public authorities have clear legal authority to procure PPPs. Several institutions have been developed to support PPP procurement including a central PPP agency (the National Development Finance Agency) which was established to advise state authorities on the financing of public investment projects by applying commercial standards in evaluating financial risks and costs.

The NDFA is also responsible for the procurement of PPP projects (outside the transport sector) and contract management in the case of the schools sector. With the exception of one project where the competitive dialogue approach was adopted, all other projects have been procured using the negotiated procedure.

Spain

Spain was an early adopter of PPPs when it began procuring motorways in the 1960s using BOT type contracts financed by user tolls. Since then it has procured projects in a number of other sectors such as healthcare, rail (high speed and light), prisons and water/wastewater. Ascertaining the exact extent of PPP activity in Spain in terms of value and volume is difficult given there is no central PPP unit at the national level monitoring activity and the fact that most PPP projects are procured at a regional rather than federal level. Data provided by Kappeler and Nemoz (2010) shows that approximately 130 PPP projects were procured in Spain between 1990 and 2009, with an aggregate project value of almost €29 billion making it one of the largest PPP markets outside of the UK.[2] Spanish PPP tendering periods for major concession projects are generally very rapid due to the use of the open procedure where bids can be submitted without prequalification and due to the provision of detailed information on output specifications, draft contracts, risk allocation, and the tariff regime thus reducing the need for any detailed negotiations. Furthermore, financial close does not need to occur at the contract award stage with the preferred bidder simply having to pay a bond worth 4% of total project investment to signal their commitment to the project when contracts are signed (OECD, 2008).

United Kingdom (UK)

The UK is recognised as the pioneer of modern PPP procurement using long-term infrastructure contracts. The initial form of procurement known as the private finance initiative (PFI) was launched in 1992 and after a thorough review was re-launched in 2012 as PF2. HM Treasury (2016) reports that as of March 2015, over 700 projects, using private sector investment of approximately £55 billion, reached financial close since 1992. The UK

[2] Spanish PPP investment over this period accounted for 10.1% of the number of projects signed across Europe and 11.4% of the related aggregate project value. If the UK is excluded, Spanish PPP investment accounts for approximately 30% of project signed and 24% of aggregate project value.

experience with PFI is well documented but details of relevance to this study include the centrality of the objective of using private capital to finance projects across a range of sectors including health, education, defence, transportation, energy and the environment. With regard to institutional features, the EIB (2011) notes that as England has a common law system there is no overarching PPP/PFI law. However, there is clear legal authority for public bodies to procure PPP projects and enter PPP contracts. PPP institutions have evolved over time and a number of measures have been taken to create a stable institutional framework including the standardisation of contracts and establishment of central agencies that the provide advice and oversight of PPP procurement (EIB, 2011). Since 2006 it has been government policy to use the competitive dialogue procedure for procuring PPP projects. The negotiated procedure which was used more widely before 2006 now has limited application.

4. Data Collection and Methodology

We compiled a unique data set including tendering periods and other relevant factors for eight different countries. Our data was obtained from various government and industry sources and includes projects in each country that had reached financial close by the end of 2015. Our dataset includes information on the tendering period, capital value, and sector for each project. For European countries the tendering period is measured as the number of months between the date of contract notice in the Official Journal of the European Union and the date of contract award/financial close. In Canada and Australia the tendering period is measured as the number of months between the date the RFQ/RFEI was issued and financial close. In Brazil the tendering period is measured as the number of months between tender notice and contract award. The breakdown of our project sample by country, capital value and procurement period is reported in Table 1. Table 2 provides a similar breakdown on a sectoral basis.

(Table 1 here)

(Table 2 here)

We utilise a Duration Analysis (DA) model to identify the factors impacting tendering period length. DA represents a class of analytical methods that are appropriate for modelling data that focus on an end-of-duration occurrence, given that the duration has lasted to some

specified time (Hensher and Mannering, 1994). This method has been used extensively in empirical studies across multiple disciplines including, for example, unemployment duration (Stancanelli, 1999), self-employment duration (Taylor, 1999; Cueto and Mato, 2006), the adoption of PPP enabling legislation within U.S. states (Geddes and Wagner, 2013), and in previous studies that have looked at tendering periods for Ireland (Reeves *et al*., 2015) and the UK (Reeves *et al*., 2016) respectively. Similar to these previous two studies, we use DA to analyse the time (in months) between a project contract notice and financial close.

We use the accelerated time failure (ATF) specification within DA to estimate our model.[3] The ATF model treats the logarithm of duration as the response variable and includes an error term that is assumed to follow a particular distribution (Swindell, 2009). Equation (1) below shows the log-linear representation of the ATF model for the *i*th individual, where logT_i is the log-transformed duration, $x_1 \ldots x_p$ are explanatory variables with coefficients $\beta_1 \ldots \beta_p$, ε_i represents residual or unexplained variation in the log-transformed survival times, while μ and σ are intercept and scale parameters, respectively

$$LogT_i = \mu + \beta_1 x_{1i} + \ldots . \beta_p x_{pi} + \sigma\varepsilon_i \qquad (1)$$

A first step in estimating an ATF model is determining which distribution should be specified for the duration times T_i. Under the ATF model parameterisation, the distribution chosen for T_i dictates the distribution of the error term ε_i. For instance, if survival times are modelled as a Weibull distribution, the error term is assumed to follow an extreme-value distribution. Likewise, if survival times are modelled using the log-logistic, log-normal or generalised gamma distribution, the ε_i are assumed to be logistic, normal or log gamma respectively (Swindell, 2009). Standard practice dictates that models are estimated using the exponential, Weibull, Gamma, log-logistic and log-normal distributions. Measures such as the Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) can then

[3] While the proportional hazards model (PHM) is more commonly used within DA, we considered the ATF specification to be more appropriate given the nature of the data used and research question at hand. Specifically, the assumption of proportionality in the PHM was seen as questionable. For clarification, the PHM was estimated and the proportionality assumption tested. The results indicated it is not appropriate with our data.

be used to select the most appropriate distribution. Based upon these criteria, the Gamma distribution was chosen for each of the models estimated in this study.

5. Choice of variables

The dependent variable in our DA model is the tendering period, i.e. the number of months from the date of contract notice to the date of financial close. Our independent variables include project capital values, a time period dummy variable, sectoral dummies, a dummy to indicate project procuring authority and country dummies dummy that captures country level fixed effects (see table 3). The choice of independent variables is informed by theoretical perspectives and the extant literature on procurement under PPP, as outlined below.

We included a 'country' dummy variable to account for country-specific characteristics including variation in institutional arrangements. It is commonly recognised that larger projects tend to be more complex in structure leading to higher bidding and development costs (Yescombe, 2007). To account for the potential role of complexity in influencing tendering periods we use project capital values. Transaction cost economics highlights how the precise features of transactions (or projects) impact on governance aspects such as procurement costs and times. The model therefore incudes dummy variables to account for differences across sectors (e.g. health, education, military), as well as a dummy variable to indicate the level of government (Central/Federal or otherwise) that acted as the relevant procuring authority for each project. A time period dummy variable is included to account for the fact that it can be expected that those engaged in PPP procurement climb a 'learning curve' so that procurement practices improve over time. In this context we expect tendering periods to decrease over time.

6. Empirical Results

Table 4 reports DA estimates for the overall tendering period using our full sample of 1,295 projects. For ease of interpretation they are presented in the form of time ratios. Our results show that tendering periods vary significantly across sectors. Compared to our base sector (education), projects in all sectors besides ICT and street lighting had significantly longer

tendering periods. Notably longer periods were found in the health (35 percent), housing (67 percent) and defence (28 per cent) sectors.

We also find evidence that project capital value has a significant impact on the time to complete the tendering process. The coefficient on capital value in table 4 demonstrates that higher capital values are associated with longer tendering periods. For a more intuitive explanation of the exact nature of this relationship we also estimated (but do not present in table 4) the elasticity of capital value in relation to tendering periods. This estimates that a 1 per cent increase in capital value increases tendering periods by about 1 month.

The coefficients on our time period dummy indicate that the tendering periods are not significantly different from pre- or post-2006, when controlling for other factors. However, we do estimate that projects procured at a Central/Federal, rather than State or Local Government level take ten percent longer to complete.

Our results also show substantial variation in tendering period length across countries after controlling for capital value, sector, time period advertised and procurement authority. Relative to the UK we find that every other country in our sample, with the exception of the Republic of Ireland, has shorter tendering periods. Specifically we find that Brazil, Canada, France, Germany and Spain have tendering periods close to half that of the UK, while tendering periods in Australia are over forty per cent shorter.

As seen in table 2, the UK makes up over half of our cross country sample. While this is expected, given the relatively long-standing and extensive adoption of PPPs in the UK, it is plausible that some of the sectoral and capital value effects seen above could be driven by variations relating solely to the UK. To explore this we next estimate two separate models, with the sample split between the non-UK countries and the UK respectively. Tables 5 and 6 present the DA results (again in the form of time ratios) for these respective samples. In comparing the size and significance of our coefficients across these two tables we find some consistencies. Capital value is positive and significant across both samples. Also with the sector dummies, both housing and health projects have significantly longer tendering periods, albeit with different coefficient sizes.

There are some important differences between the two samples that were not evident in table 4. For example, tendering periods within defence/military and emergency services projects are significantly longer relative to project within the education sector in the UK but this is not the case in our non-UK sample. Conversely, projects within the ICT and justice sectors are significantly longer than those in education in non-UK countries but not so in the UK. We also find that that projects procured at a Central/Federal, rather than State or Local Government level are thirty three per cent longer in the non-UK sample; this variable is not significant within the UK estimates. In relation to changes over time, we find that projects advertised post 2006 have tendering periods twelve per cent shorter relative to those advertised per 2006 in the UK; something not found with the pooled non-UK countries.

To further explore potential country level heterogeneity we extend the analysis of our results by considering the impact of capital value on tendering period as the country dummy variables are allowed to vary. The rationale for this is to investigate how sensitive the tendering period in the eight different countries in our sample is to variations in capital value. To provide such insight table 7 provides the estimated capital value elasticities for each country. This shows the unit change (as measured in months) in tendering period brought about from a one per cent increase in capital value. We note that these effects may vary at different points on the distribution of capital value. In other words, the impact on tendering periods of a percentage change in capital value for a low value project may differ from the impact of a percentage change in capital value for a high value project. To account for this, the elasticities are presented for the 10^{th}, 25^{th}, 75^{th} and 90^{th} percentile levels of capital value.

From table 7 we can see that the impact of capital value on tendering periods varies significantly. For countries such as Australia, Brazil and Ireland we find that capital value has no significant impact on tendering periods. For the other countries we find that capital value lengthens tendering periods, with a stronger effect at higher end of the project value distribution. Specifically, we find that PPP projects in France have a significant but relatively weak relationship between capital value and tendering periods, while in Spain this relationship is much more pronounced. Table 7 also shows that the UK and Canada have

very similar capital value elasticities across the distribution. Germany is also quite similar to these two countries for projects in the 10^{th}, 25^{th} and 75^{th} percentiles. However, we find that tendering periods for PPP projects in in Germany are particularly sensitive to changes to the scale of high value projects, in other words there is a very elastic response to changes in projects in the 90^{th} percentile of value.

7. Summary and Conclusions

As more and more countries opt to use PPPs in order to meet requirements to invest in infrastructure it is apparent that a number of challenges must be met if PPP is to deliver on its promises. It is commonly asserted that PPP projects are delivered faster and more cost effectively under PPP compared to traditional procurement approaches. Claims around faster delivery times however tend to focus on the construction period following contact award. It must however be noted that the tendering period between contract advertisement and contract award can be protracted. This is attributable to the relatively complex nature of PPP projects due to the bundling of functions into one contract and the inclusion of private finance as an integral part of the model adopted. There is evidence that the question of tendering periods has become a matter of concern for policy makers in some countries. As extended tendering periods have the potential to deter bidders for PPP contracts, authorities in Ireland and the UK have set specific targets in order to reduce tendering periods in order to enhance the prospects of improving efficiency and achieving better value for money.

This paper examines the question of tendering periods across a sample of countries where PPP has been extensively adopted. The analysis is based on an original data set that was carefully assembled using a variety of sources from eight countries. Our findings show that there is significant variation across countries and sectors. When we control for other variables we find that Ireland and the UK stand out as the countries with the longest tendering periods. This is surprising given the extensive experience with PPP procurement in both countries and is a question that deserves deeper analysis. In sectoral terms the longest tendering periods were found in the health, housing, and defence sectors. However, PPPs in the defence sector are not associated with significantly longer tendering periods when the UK is excluded from our analysis. We also find considerable variation in the impact the size

of a project may have; tendering periods in Spain and Germany are estimated to be more sensitive to changes in the value of the projects compared to the other countries in our sample.

Overall, our findings shed light on an important aspect of PPP practice that poses significant challenges for those responsible for their management and implementation. The main contribution of our paper is to provide the first robust empirical cross-country investigation of PPP tendering periods. However, it is important to acknowledge some limitations. Firstly, there may be institutional and behavioural factors that affect what is a complex process that are not captured by our study due to data constraints. Secondly, an interesting question is whether the negative impact of lengthy tendering periods is mitigated by shorter construction periods that may occur due to features of PPP such as risk transfer and the bundling of the finance, construction and operation elements of PPP projects. Thirdly, there appears to be grounds for deeper examination of the inter-sectoral differences we find. Whereas these issues are outside the scope of the analysis presented in this paper it should provide fertile grounds for future enquiry.

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Table 1: PPP projects by country, capital value and tendering period

Country	# projects	% of total	Project Value (US$m PPP)				Tendering Period (months)		
			Total	Average	Min	Max	Average	Min	Max
Australia	53	4.1%	26,550.3	500.9	23.1	3,488.7	22.1	9	56
Brazil	30	2.3%	22,554.2	751.8	43.5	2,800.0	17.1	4	37
Canada	146	11.3%	62,089.4	425.3	12.9	7,462.0	18.3	6	48
France	168	13.0%	26,255.1	155.4	0.6	9,238.0	17.1	5	52
Germany	149	11.5%	10,172.4	68.3	1.5	800.8	16.8	2	51
Ireland	29	2.2%	7,457.8	257.2	65.2	923.3	33.4	17	64
Spain	50	3.9%	18,492.4	369.9	18.7	1,452.2	19.3	5	66
UK	670	51.7%	81,244.6	121.3	2.3	4,129.5	34.8	8	127
Total	**1,295**	**100%**	**254,816.2**	**196.6**	**0.6**	**9,238.0**	**27.0**	**2**	**127**

Source: Authors' calculations from various sources as follows: (1) Australia: Infrastructure Australia, NSW Public Private Partnerships, Partnerships Victoria and Queensland Treasury; (2) Brazil: Ministério do Planejamiento, Orçamento e Gestão, Agència Nacional de Transportes Terrestres, Oficina Económica y Comercial de la Embajada de España en Brasilia, *InfraDeals* database; (3) Canada: The Canadian Council for Public-Private Partnerships; (4) France: Mission d'appui aux Partenariats Public-Privé (MAPPP); (5) Germany: Partnerschaften Deutschland ÖPP-Projektdatenbank, VIFG Verkehrsinfrastruktur-finanzierungsgesellschaft mbH; (6) Ireland: National Development Finance Agency, National Roads Authority, Comptroller & Auditor General, Central Statistics Office; (7) Spain: *InfraDeals* database and data kindly provided by Basilio Acerete (Universidad de Zaragoza); (8) UK: HM Treasury. Notes: (1) in all cases, extensive cross checking of project information was conducted. For European projects, data was crosschecked with contract notice and contract award information from the Official Journal of the European Union. For non-EU countries, data was crosschecked with project information contained on *InfraDeals* (http://www.infra-deals.com) and *InfraPPP World* (http://infrapppworld.com) as well as various other provincial and municipal sources; (2) Project values for each country were converted from national currency values to US$ in purchasing power parities (GDP) sourced from the OECD with the conversion based on the year of financial close for each project. The exception is Brazil where our capital value data was sourced from *InfraDeals* in nominal US$. In most cases the project value relates to the overall contract value at financial close, however in some countries such as Germany and France it relates to the capital/construction value only. While it was not possible to get directly comparable figures for project values across each country our data nonetheless provides an accurate proxy of the size of each project signed.

Table 2: PPP projects by sector, capital value and tendering period

Sector	# projects	% of total	Capital Value (US$m PPP)				Tendering Period (months)		
			Total	Average	Min	Max	Average	Min	Max
Culture/Leisure/Sport/Social	117	9.0%	9,224.7	78.8	1.5	958.2	21.8	4	55
Defence/Military	35	2.7%	12,018.8	343.4	7.7	4,129.4	39.2	16	99
Education	337	26.0%	25,011.9	74.2	3.2	610.6	24.9	3	91
Emergency Services	47	3.6%	1,939.7	41.2	2.3	185.6	30.6	10	86
Environment/Energy	84	6.6%	15,329.8	180.3	1.1	2,290.0	29.2	5	121
Government Services/Offices	63	4.9%	7,433.7	118.0	2.2	1,557.2	26.8	2	68
Health	236	18.2%	50,487.5	213.9	3.5	1,833.3	31.8	5	127
Housing	37	2.9%	4,282.2	115.7	2.7	595.6	47.5	10	80
ICT	28	2.2%	3,559.5	127.1	0.6	799.4	20.0	9	52
Justice	56	4.3%	9,136.3	163.1	8.0	792.0	25.3	13	59
Street Lighting	78	6.0%	2,543.3	32.6	0.6	192.0	21.0	5	57
Transport	177	13.7%	113,848.5	643.2	2.9	9,238.0	23.6	4	99
Total	**1,295**	**100%**	**254,816.2**	**196.6**	**0.6**	**9,238.0**	**27.0**	**2**	**127**

Source and notes: see table 1.

Table 3: Variable descriptions

Variable	Type	Description
Capital Value	Continuous	Amount in millions (US$ PPP) relating to the value of the project
Time Period 2006-	Indicator	1= Project tendered in or post 2006; 0 = Not tendered in or post 2006
Sector dummies	Indicator	12 sectoral dummies
Country level dummies	Indicator	8 Country dummies
Central Government Dummy	Indicator	1= Project had Central/Federal government as procuring authority, 0= Local or State government procuring authority

Table 4: DA results for overall tendering periods

Variable	Time Ratio	z
Capital Value	1.0002***	**5.55**
Time period dummy 2006-	1.01	**0.27**
Culture/Leisure/Sport/Social	1.09*	**1.86**
Defence/Military	1.28***	**2.88**
Emergency Services	1.15**	**2.09**
Environment/Energy	1.22***	**3.62**
Government Services/Offices	1.16**	**2.46**
Health	1.35***	**7.57**
Housing	1.67***	**6.75**
ITC	0.96	**-0.5**
Justice	1.18**	**2.51**
Street Lighting	0.96	**0.73**
Transport	1.12**	**2.27**
Australia	0.57***	**8.60**
Brazil	0.43***	**9.47**
Canada	0.48***	**15.38**
France	0.51***	**13.61**
Germany	0.52***	**15.14**
Ireland	0.93	**0.76**
Spain	0.50***	**9.46**
Central Government	1.10**	**2.33**
Observations: 1295		

Notes: (1) The dependent variable (*months*) is a count variable indicting the number of months from the time a PPP project was advertised to the date the contract was signed; (2) Absolute values of z statistics are presented in parentheses: (3) *** denotes significant at 1%, ** denotes significant at 5%, and * denotes significant at 10%; (4) The base category for the sector dummies is the education sector. (5) The base category for the country dummies is the United Kingdom.

Table 5: DA results for overall tendering periods for non-UK countries

Variable	Time Ratio	z
Capital Value	1.0001***	**4.09**
Time period dummy 2006-	1.05	**1.25**
Culture/Leisure/Sport/Social	1.18***	**2.58**
Defence/Military	1.34	**1.63**
Emergency Services	1.05	**0.32**
Environment/Energy	1.28***	**2.89**
Government Services/Offices	1.32***	**3.27**
Health	1.28***	**3.72**
Housing	1.47*	**1.75**
ITC	1.23*	**1.8**
Justice	1.23**	**2.43**
Street Lighting	0.85**	**1.86**
Transport	1.14**	**2.08**
Australia	1.21**	**2.41**
Brazil	0.87	**1.39**
Canada	1.02	**0.37**
Germany	1.06	**0.91**
Ireland	1.62***	**5.18**
Spain	1.06	**0.69**
Central Government	1.33***	**5.03**
Observations: 625		

Notes: (1) The dependent variable (*months*) is a count variable indicting the number of months from the time a PPP project was advertised to the date the contract was signed; (2) Absolute values of z statistics are presented in parentheses: (3) *** denotes significant at 1%, ** denotes significant at 5%, and * denotes significant at 10%; (4) The base category for the sector dummies is the education sector. (5) The base category for the country dummies is France.

Table 6: DA results for overall tendering periods for UK

Variable	Time Ratio	z
Capital Value	1.0003***	**4.33**
Time period dummy 2006-	0.88*	**1.9**
Culture/Leisure/Sport/Social	1.04	**0.55**
Defence/Military	1.28**	**2.4**
Emergency Services	1.19**	**2.28**
Environment/Energy	1.23***	**2.84**
Government Services/Offices	1.09	**1.04**
Health	1.34***	**6.04**
Housing	1.64***	**6.07**
ITC	0.69***	**2.67**
Justice	1.12	**1.12**
Street Lighting	1.18**	**2.07**
Transport	1.04	**0.51**
Central Government	0.98	**0.25**
Observations: 670		

Notes: (1) The dependent variable (*months*) is a count variable indicting the number of months from the time a PPP project was advertised to the date the contract was signed; (2) Absolute values of z statistics are presented in parentheses: (3) *** denotes significant at 1%, ** denotes significant at 5%, and * denotes significant at 10%; (4) The base category for the sector dummies is the education sector.

Table 7: Estimated Capital Value Elasticities (dy/ex) by Capital Value Percentile and Country

Time Period	Percentiles			
	10th	25th	75th	90th
Australia	0.07 (0.56)	0.14 (0.56)	0.60 (0.54)	1.2 (0.53)
Brazil	0.06 (0.65)	0.12 (0.64)	0.82 (0.61)	2.2 (0.57)
Canada	0.10** (2.48)	0.17** (2.48)	0.99** (2.35)	2.33** (2.2)
France	0.01*** (3.98)	0.02*** (3.91)	0.18*** (3.88)	0.51*** (3.8)
Germany	0.15*** (5.46)	0.29*** (5.4)	1.38*** (5.04)	4.03*** (4.44)
Ireland	1.06 (1.41)	1.62 (1.38)	5.87 (1.22)	8.33 (1.15)
Spain	0.56*** (2.65)	0.91** (2.59)	4.20** (2.18)	8.50** (1.89)
United Kingdom	0.13*** (3.84)	0.25*** (3.83)	1.01*** (3.73)	2.16*** (3.61)

Notes: (1) The coefficients can be interpreted as the unit increase (months) in a tendering period brought about from a % increase in the value of the project at different percentile levels for each country. (2) Absolute values of z statistics are presented in parentheses; (3) *** denotes significant at 1%, ** denotes significant at 5%, and * denotes significant at 10%.