Enforcing Public-Private Partnership Contract: Role of Incentive Contract and Fiscal Institution*

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Abstract

This paper estimates the hazard model to examine key factors for enforcing public-private partnership contracts. The bargaining model predicts conditions how contractual disputes will be triggered under two payment schemes, highlighting the role of public financial management (PFM). Empirical analysis shows that contracts transferring larger financial risk to private parties faced more disputes for fuel cost-overruns in recent years. For the success of user-pay contracts, the quality of PFM is critical to ensure the financial viability in project appraisal. Involving multilateral partners in contracts provides an insurance to reduce dispute risk, while issuing sovereign guarantees without proper assessment of the fiscal cost increases the risk of the government-led dispute by accumulating contingent liabilities. This highlights the importance of fiscal prudence in developing PPPs in infrastructure investments. (*JEL Code: F21, H54, O10, O19*)

Keywords: Public investment, Incentive contract, Fiscal institutions, Guarantees

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I Introduction

Public investment is a main driver of economic growth by accumulating physical capital and increasing productivity, while private capital could augment the efficiency of investment in infrastructure. In recent years, fiscal consolidation reinforced a declining trend of public capital stock (in percent of GDP) in advanced economies, and low efficiency in public spending also created a declining trend in capital stock in emerging market economies and low-income countries (IMF 2014b,c). Reducing inefficiencies in public spending would help close the infrastracture gap in many developing countries. In this context, a large number of papers have looked at the role the public-private partnership (PPP)[1] could play in attracting private capital in infrastructure construction and to improve the efficiency of public investment to reverse the downward trend of capital stocks.

Despite higher expectation on the role that PPPs could play in complementing public resources, one need to assess conditions where policy makers can expect larger efficiency gains (more precisely, *value for money* (VfM)[2]) from PPPs as its success would be contingent on the contract design and the country's institutional environment. Since the early 1980s, there has been a large increase in private sector participations in infrastructure which reflects a shift in the role of the public and private sectors in the provision of electricity, water and sanitation, telecommunication, and public transportation. However, the use of PPPs could only marginally offset the decline in public capital stock (IMF 2014c). The PPPs also witnessed elevated tensions between the contractual parties which forced the contracts to be renegotiated or terminated. Often, the government behaves opportunistically and takes ex-post regulatory actions or expropriates the assets. In recent years, indirect expropriations and breach of contract have become one of the biggest concerns for foreign investors, compared to outright

[1]PPP is defined as "a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance" (World Bank, 2014).

[2]The value for money means the cost-effectiveness in the provision of a public service (better quality of outputs for the public with same or lower cost) by implementing PPPs compared with values expected in the conventional public procurement (World Bank, 2014).

expropriations which were widespread in the 1970s and 1980s (World Bank, 2012; Nose, 2014). The cost of breach of contract will be large as it would discourage private investments in the first place, as well as requiring higher risk premium in the PPP contract and disrupting public utility services for domestic users.

Previous papers have discussed the wide variety of factors as the determinants of breach of contract which range from micro factors (i.e., contract type) to macro factors (such as external shocks, political institutions, and level of development). Recent literature on FDI focuses on macro factors, especially host country's governing institutions, claiming the importance of democratic and more cohesive economic and political institutions.[3] Some scholars put a particular focus on the effects of natural resources, arguing that governments in natural resource dependent economies are less sensitive to reputation costs from reneging on contracts, leading to higher probability of expropriation and contract disputes (Jensen and Johnston, 2011), especially during a commodity price boom (Frankel, 2012). More recently, the probability of contract breach is found to be related to the level of state fragility, inclusiveness of political institutions, and natural resource dependency (Besley and Persson 2009, 2010). The literature on micro factors has mainly focused on the optimal design of incomplete contracts under uncertain state of the world (Tirole, 1999) and theoretical studies analyzing the efficiency of the public-private partnership contract (Hart, 2003; Iossa and Martimort, 2015; Valero, 2015), but the empirical studies are only a few (such as Guasch, Laffont, and Straub (2007)).

This paper fills in this gap by examining contract types and an institutional framework needed to help the governments succeed in enforcing PPP contracts to maximize its return on public capital stock and growth using a comprehensive contract-level dataset (covering a universe of dispute events for both greenfield and concession contracts signed in emerging and developing countries). It first establishes predictions from a bargaining model under a limited

[3]Multinational corporations are more likely to enjoy higher investment security in democratic countries (Jensen 2008), in countries with stronger property rights and constraints of the legislature on the executive (Li and Resnick, 2003; Li, 2009; Humphreys and Bates, 2005), and in more stable political environment with less frequent political turnovers.

commitment framework in honoring contracts. Then, it looks at the differences in contractual hazards by risk allocation scheme (private's risk taking in initial investment, market demand risk, contingent guarantee clause, and safety-nets provided by international organizations) and by country's quality of institutions. As for the institution, it pays closer attention to the channel how better fiscal institution can help success in PPPs besides revisiting the importance of political institutions which alter the government's cost by reneging contract ex-post.

There are three key empirical findings. First, incentive contracts (in greenfield and concession contracts) which transfer larger financial obligations to private parties without sovereign guarantees or government's direct subsidies faced higher risk of contractual disputes due to fuel cost-overruns in recent years. For the success of user-pay contracts, the quality of public financial management (PFM) system is critical to ensure the financial viability in project appraisal. Second, involving multilateral partners in PPP contracts provides an insurance to reduce the dispute risk, while issuing guarantees without proper assessment of contingent fiscal cost rather increases the risk of the government-led disputes as the government bears larger risk from the accumulation of contingent liabilities. This highlights the importance of fiscal prudence in designing PPPs to boost private investments in infrastructure, and thereby promote growth as similarly discussed in Basu (2014). Finally, this paper also supports empirical evidence found in the past literature which highlights the importance of democratic regime in enforcing contracts (Eden, Kraay and Qian, 2012; World Bank, 2012) and significance of adverse shocks (such as business cycle and commodity price shock) which needs to be absorbed by drafting more flexible contracts.

The paper is structured as follows. Section II explains the context, section III provides theoretical predictions, and section IV explains the data. Sections V and VI carry out empirical analyses on the triggers of breach of contract. Section VII concludes.

II Background

A Countries Prone to the Risk of Breach of Contract

As Figure 1 shows, contractual disputes seemed to be clustered in the post-communist and Latin American countries. In recent years, the risk of breach of contract was peaked during the 2000-05 although the risk continued to rise in the Latin America and Caribbean (LAC) and the Europe and Central Asia (ECA) regions (Figure 2). As political economy theories suggest, the insecurity of contract enforcement might be correlated with the level of economic and political development (Besley and Persson, 2009; Acemoglu and Robinson, 2005).

Contrary to our expectation, Figures 3 characterizes a puzzling fact showing higher incidence of dispute events in relatively wealthier nations especially in the upper-middle income level, which includes Argentina, Brazil, Malaysia, Mexico, and Turkey. This may imply that wealthier countries have more resources and opportunities for coercive government to be extractive.

What would be the key triggers of the breach of contract? Nose (2014) identifies exogenous shocks such as economic and commodity price shocks as well as natural disasters as triggers of disputes. This is consistent with anecdotal evidence and the pattern found in the pre-claim data of the breach of contract (covering events during 2006-12) collected by the political risk insurance agencies.[4] In many cases, economic crisis or political regime changes exposed PPP projects to financial stress and/or inconsistent economic policy, which drove private investors to renegotiate terms of contract (such as adjusting tariff, subsidy) (MIGA, 2013). This paper

[4]Using the PPI dataset, World Bank (2004) examined factors which could trigger contractual renegotiations on infrastructure concessions in Latin America, showing country-level institutions (regulations) and the concession award criteria as more critical determinants of renegotiations than macroeconomic factors. Woodhouse (2006) used same data and offered case studies which highlight the importance of micro-level contractual factors in affecting the bargaining power between the host government and international investors and in the success of PPP projects. Jensen et al (2013) used a different contract-level data from the Overseas Private Investment Cooperation (OPIC) and addressed how external factors can drive governments to breach contracts. It found that the government has less incentive to expropriate firms during the period of economic crisis and when it has external financial relationship with donors (through foreign aid or IMF agreement) to avoid reputational cost by breaching contracts.

investigates further the role of institutional quality in altering the riskiness of disputes, and contractual design which could mitigate the risk.

[insert Figure 1-3]

B Contract Design and Institutions

PPPs are expected to have efficiency gains compared to conventional public procurement while it can also create significant financial and contingent fiscal risk to the host country and to the investor. The success in PPPs will depend on how contract can absorb unforeseeable risk during the contractual period and on the quality of institutions for better implementation of the complex PPP projects.

PPPs embrace a range of structures, which involves different risk sharing arrangements between the private partner and the government, which accompanies sovereign guarantees [5] and the government's direct subsidies[6] in some cases. It usually defines long-term contractual bond between private operator and a public authority although the duration of contract differs substantially. In Section IV, we consider how the differences in contractual design can affect the riskiness of the contractual disputes.

This paper pays closer attention to two types of institutions: PFM system and political regime. In particular, PPPs require strong fiscal and legal basis to have efficiency gains as initially expected. PPPs have not always performed better than public procurement as they are often used to circumvent budget constraints and to postpone recording the fiscal costs of investments rather than for efficiency reasons. The PPP's value for money depends on the

[5]The sovereign guarantee can take different forms such as the minimum payment guarantee for covering loss in demand of the infrastracture project, the debt guarantee for covering the insolvency risk, the revenue guarantee for securing minimum revenues for private parties, the exchange rate guarantee for covering the currency risk, and the construction cost guarantee for potential cost overruns (World Bank, 2014).

[6]The government often has payment commitment under PPP contracts such as a capital subsidy for covering initial construction cost and availability payments, the multi-year payment commitment, for providing a regular subsidy over the life-cycle of the PPP projects (World Bank, 2014).

rate of return of the selected projects, which underscores the need for careful selection and appraisal, competitive procurement process, sound contract design, and strict quality and safety standards in the maintenance stage (Sabol and Puentes, 2014). Besides, it requires transparent disclosure of fiscal risk in the medium-term budgetary frameworks to avoid excessive financial commitment (IMF, 2006). Non-transparent PFM system can amplify fiscal risk as well as the risk of renegotiation or termination of PPP contracts, or could lead to corruption in contracting as commonly observed in the post-communist countries.[7]

Besides the quality of the PFM system, the contractual risk may be clustered in countries with authoritarian political regime and poor political institutions. For example, in Latin America, many disputes occurred after the 2002 financial crisis as some countries with authoritarian political regime (such as Argentina and Bolivia) refused to honor payment obligations due to their financing problems. In a recent history, political changes also created dispute cases, mainly in the energy sector. An example includes denial of tariff adjustments for a power project in Guatemala where there was a change in minister of mines in 2004. The change in domestic politics often caused reviews of privatization programs or the revision of existing contracts signed by the previous regime, leading to disputes in some development countries (such as the Democratic Republic of the Congo, Moldova, and Ecuador).

III The Model

To derive theoretical predictions, this section lays out a bargaining model of PPPs in a limited commitment framework following Danau and Vinella (2015). In the model, the builder and the operator are represented by a single private firm, and work with the government for an infrastructure project following the two-stage game:

1. *Construction stage:* The government offers a contract to the firm, and the firm accepts

[7]In Peru, contracts in the oil sector are regularly published on-line to improve transparency and to avoid corruption in contracting (http://www.perupetro.com.pe/wps/wcm/connect/perupetro/site-en/importantinformation/).

or refuses the offered contract. If the firm accepts, the firm makes investment I, financed by either equity or loan, and construction starts.

2. *Operation stage:* The firm operates the project and transfers the asset back to the government when the contract terminates at time T.

A Design of Incentive Contracts

Although the PPP contract refers to a broad range of deal structures and asset types, it can be represented by either the build-operate-transfer (BOT) contract or concession contract. Both types involve private participations in infrastructure with different degree of profit sharing between the host government and private parties.

PPPs are alternative forms of procurement in a sharp contrast to conventional public procurement in terms of ownership structure and financial obligations during the contractual period (see Table 2). The most common type is the BOT contract in which the firm makes upfront investment, builds, operates, and maintains an asset. It can take two types: (i) *user-pay contract* (the firm collects user-fees directly, make capital investment, and operation and maintenance spending) and (ii) *availability-based payment* (the government collects use-fee, makes a recurring direct transfer $\bar{\alpha}$ to the firm (independent of actual performance of private parties), and the firm make capital and operational investments). In the user-pay contract, the firm takes demand risk while the government is responsible for demand risk in the availability-pay contract. PPP projects can also be a concession contract in which the government incurs investment cost and owns the asset (however, the firm is responsible for user-fee collection and incur the operation and maintenance cost of the project).

[insert Table 2]

The stylized model is built based on an incomplete PPP contractual framework assuming

the BOT arrangement where renegotiation is possible ex-post (Tirole, 1999).[8] At the beginning of construction stage, the government makes take-it-or-leave-it offer to the firm with contractual term: $\psi = (p, I, \lambda, \bar{\alpha})$ where p is the end-user price and I is the total amount of investment. λ is equal to one in case of the user-pay contract, and zero for the availability-based payment contract.

The market demand q depends on the price and other uncertain factors. To mitigate market demand risk, the government may choose to provide the minimum revenue guarantee (ensuring minimum revenue threshold at $\underline{pq}$). The actual user-fee collection be lower than the threshold level ($pq < \underline{pq}$) with probability $1 - \beta$.

The firm decides to agree a loan contract in amount of C with a creditor, and the rest will be financed by own equity M to make total investment (i.e., $I = C + M$). The firm accepts the contract ψ or refuse/renegotiate it under the following participation constraint (PC).

$$\text{(PC)} \quad \pi = -M + \int_0^T [\lambda(p - c_1(z,\chi))q - d]e^{-rx}dx + (1-\lambda)\int_0^T [\bar{\alpha} - c_1(z,\chi)q]e^{-rx}dx \geq 0$$

where the firm's reservation utility is normalized to zero and the BOT contract is assumed to be completed by $t = T$. d is the amount of loan repayment and z is the input price which is unknown to the government and the firm ex-ante. c_1 is the firm's operational cost in running a PPP project. (PC) holds with probability β. Both c_1 and β will be affected by the country's efficiency in implementing the PPP project (i.e., the quality of PFM) χ. As the PFM quality improves, the private cost will decline while the probability of success in PPP increases: $\frac{\partial c_1}{\partial \chi} < 0, \frac{\partial \beta}{\partial \chi} > 0$. If $pq < \underline{pq}$ (with probability $1 - \beta$), the government pays a guarantee to ensure the minimum user-fee revenue. Then the participation constraint (PC') is modified as follows:

$$\text{(PC')} \quad \pi^{'} = -M + \int_0^T [\lambda(\underline{pq} - c_1(z,\chi)q) - d]e^{-rx}dx + (1-\lambda)\int_0^T [\bar{\alpha} - c_1(z,\chi)q]e^{-rx}dx \geq 0$$

[8]The BOT and BOO are the major forms of PPP contracts, which respectively represents 27% and 17% of all contracts covered in the sample. The model can be easily modified to concession contract.

From (PC) and (PC'), the firm's participation decision is expressed as follows:

$$\lambda[\beta(\chi)pq + (1-\beta(\chi))\underline{pq} - c_1(z,\chi)q] + (1-\lambda)[\bar{\alpha} - c_1(z,\chi)q] - d \geq \frac{rM}{1-e^{-rT}} \tag{1}$$

B Government's Decision

The government knows the firm's profit function except two uncertain parameters: (q, z). The successful BOT contract will yield welfare W_H to the government as defined below:

$$\begin{aligned} W_H &= Ie^{-(1-\delta)T} - \lambda \int_0^T (1-\beta(\chi))G(p,q)e^{-rx}dx + (1-\lambda)\int_0^T [pq - \bar{\alpha}]e^{-rx}dx \\ &+ \int_0^T [\lambda pq + (1-\lambda)\bar{\alpha} - c_1(z,\chi)q - d]e^{-rx}dx \end{aligned} \tag{2}$$

The first term of Eq. (2) denotes the residual value of the asset when transferred back to the government upon the completion of the contract. The second term captures the fiscal cost related to the guarantee payment to the firm under the user-pay contract ($\lambda = 1$), the third term captures the government's utility by collecting the user-fee under availability-based payment contract ($\lambda = 0$), and the fourth term represents the net present value of firm's profit depending on two types of the BOT contract.

The minimum guarantee arrangement creates fiscal cost defined as $G(p,q) = \underline{pq} - pq$.[9] The government may choose to renege the contract ψ by incurring the reputation cost R if it yields higher utility than W_H. If the government chooses to renege the contract, the welfare is expressed as follows:

$$\begin{aligned} W_{NH} &= Ie^{-(1-\delta)\tau} - \lambda \int_0^\tau (1-\beta(\chi))G(p,q)e^{-rx}dx + (1-\lambda)\int_0^T [pq - \bar{\alpha}]e^{-rx}dx \\ &+ \int_0^\tau [\lambda pq + (1-\lambda)\bar{\alpha} - c_1(z,\chi)q - d]e^{-rx}dx + \int_\tau^T [p - c_2]qe^{-rx}dx - R(\sigma) \end{aligned} \tag{3}$$

[9]Similar theoretical predications can be obtained for another form of guarantee (the off-shore purchase agreement in which the government buys the service from the firm and removes demand risk from the firm by ensuring minimum demand $\underline{q}$. In this case, the guarantee can be alternatively defined as follows: $G(p,q) = p(\underline{q} - q)$. This is typically the case in public utility sector (such as energy, and water and sanitation)).

The renegotiation is assumed to occur at time τ after which the government runs the contract from time τ until the completion at time T. c_2 is the government's operational cost in running the project. The reputation cost of breaching contract is higher if the government faces stronger political constraint (captured by σ): $R^{'}(\sigma) > 0$. The government renege the contract when $W_{NH} > W_H$.

C Case of User-pay Contract ($\lambda = 1$)

From Eq. (1), the firm's (PC) is written as follows for the user-pay contract which implies that the firm's participation in the contract depends on the project's financial viability as demand risk is fully taken by private parties.

$$\beta(\chi)pq + (1 - \beta(\chi))\underline{pq} - c_1(z, \chi)q - d \geq \frac{rM}{1 - e^{-rT}} \tag{4}$$

From Eq. (2)-(3) and assuming $1 - \delta = r$, the condition for contract breach is expressed as follows:

$$\begin{aligned} \Omega &= W_{NH} - W_H \geq 0 \\ &\Leftrightarrow rI + (1 - \beta(\chi))(\underline{pq} - pq) - \underbrace{[c_2 - c_1(z, \chi)]}_{\text{Value for money}} q + d \geq [\frac{e^{-r\tau} - e^{-rT}}{r}]^{-1} R(\sigma) \end{aligned} \tag{5}$$

In general, as the firm is more cost efficient than the government, $c_2 - c_1(z, \chi) > 0$. This term captures the value for money which is larger when PPPs are more cost-effective.

D Case of Availability-pay Contract ($\lambda = 0$)

Under the availability-based payment contract, the government collects user-fee and makes fixed amount of fiscal transfer to the firm. The firm's (PC) in Eq. (1) can be simplified as follows which implies that the firm will remain in the contract as long as the transfer is sufficiently large to recover the capital and operational costs. As demand risk is taken by the

government, demand risk no longer binds the (PC).

$$\bar{\alpha} - c_1(z, \chi) - d \geq \frac{rM}{1 - e^{-rT}} \tag{6}$$

For the government, Eq. (5) can be modified as follows.

$$rI - [c_2 - c_1(z, \chi)]q + d \geq [\frac{e^{-r\tau} - e^{-rT}}{r}]^{-1} R(\sigma) \tag{7}$$

From Eq. (7), the government-led disputes is no longer related to demand risk (as there is no sovereign guarantee) but depends on the value for money of PPPs. As the private cost c_1 gets higher (for example, due to poor PFM system), the PPP's value for money decreases, increasing the government-led dispute. Eq. (6) suggests that the firm-led dispute is less of a concern as the government takes the demand risk by providing transfer payment to cover the firm's operational cost.

E Theoretical Predictions

Eqs. (4)-(7) provide the following theoretical predictions.

(I.) *Effect of input price shock:* higher input price binds the firm's participation constraint more in Eq. (1) and increases the firm-led dispute. It also increases the government-led dispute as it reduces the value for money: $\frac{\partial \Omega}{\partial z} = \frac{e^{-r\tau} - e^{-rT}}{r} c_1'(z, \chi) q > 0$.

(II.) *Effect of political institutions (reputation cost):* higher reputation cost in face of stronger political constraint σ reduces the government-led dispute: $\frac{\partial \Omega}{\partial R(\sigma)} > 0$ (in consistent with sovereign theft proposed by Tomz and Wright (2010)).[10]

[10]The political constraint is stronger if the country has tighter relationship with international organizations (see Jensen et al, 2013), the political regime is democratic and incumbent government is stable (Arezki and Gylfason, 2011), or the state capacity is greater (Besley and Ghatak, 2010). Some papers found that the government in natural resource dependent economies face weaker reputation cost especially during the commodity price boom (Jensen and Johnston, 2011; Frankel, 2012), leading to higher risk of contractual disputes.

(III.) *Effect of guarantee provision:* greater provision of sovereign guarantee makes the firm's participation constraint less binding in Eq. (1), while it increases the government-led dispute for an accumulation of contingent liability: $\frac{\partial \Omega}{\partial \underline{pq}} = \frac{e^{-r\tau}-e^{-rT}}{r}(1-\beta(\chi)) \geq 0$.

(IV.) *Effect of improving the quality of PFM:* better PFM institution reduces the firm-led dispute by reducing the contingent fiscal risk under the user-pay contract: $\frac{\partial \Omega}{\partial \chi} = \frac{e^{-r\tau}-e^{-rT}}{r}[-\beta'(\chi)(\underline{pq}-pq) + c_1'(z,\chi)q] \leq 0$.

(V.) *Duration of contract:* the firm's (PC) gets less binding as duration T gets longer in Eq. (1), while it increases the government-led dispute in consistent with the *obsolescing bargain hypothesis* (Woodhouse, 2006): $\frac{\partial \Omega}{\partial T} > 0$. [11]

IV Data

This paper gathers contractual dispute information from the World Bank's Private Participation in Infrastructure (PPI) Database and the United Nations Conference on Trade and Development (UNCTAD)'s dispute data. Compared with Guasch, Laffont, and Straub (2007) which used the same PPI dataset but examined the risk of renegotiation only for a particular contract type (concession contracts) in a particular region (Latin America), this paper covers a universe of the PPP projects signed in emerging and developing countries.

The PPI dataset has details on contractual arrangements used for each project. The dataset covers 4,277 public-private infrastructure projects (greenfield projects or concession contracts) from 1984 to 2012 for 146 countries (see Appendix 1 for country list). The dataset includes information including investing country, sponsors' originating country, project status (e.g., completed, under construction, cancelled, in distress), financial closure year (when contracts were agreed), contractual period, sectoral affiliation, procurement type, and supports of

[11] Woodhouse (2006) discusses the obsolescing bargaining power of foreign investors and describes the situation where an investor holds the upper hand in negotiations with a host government ex ante but it loses the bargaining power as the contract ages since exiting from a committed investment becomes costly due to high sunk costs, providing host governments with stronger leverage to break contracts (Vernon, 1971).

international financial institutions. The majority of the PPP projects (93%) were conducted in lower or upper middle-income countries.

To record whether each contract experienced contractual disputes or not, additional data collection efforts were made through reviews of the public sources (such as Factiva, websites of multilateral agencies and sponsors) and data requests to project entities.[12] Contracts are classified as "dispute" case if contracts were in distress, renegotiated or cancelled due to contractual conflicts between the host government and private parties. In the dataset, the contractual disputes were recorded to be triggered by various factors including adverse macroeconomic shocks (financial crisis, currency devaluation, commodity price fluctuations) and sponsor's financial and technical problems in completing the project. Even if contracts were in distress or cancelled, they are classified as "non-dispute" cases if project renegotiations were caused by the sponsor's unilateral actions (e.g., change in business strategy) or uninsurable external events beyond the control of the parties (such as was or civil disturbance). Data on the exact timing of disputes were also collected through a comprehensive review of project documents.

Table 2 shows the distribution of four types of PPP contracts: greenfield, divestiture (privatization), concession, and management and lease contracts. This paper looks at greenfield projects (PPPs involving new infrastructure asset), which is represented by two types of private sector participation (build-operation-transfer (BOT) and build-own-operation (BOO) contracts), and concession contracts (PPPs managing existing infrastructure asset).

V Empirical Strategies

Contract breach is a rare event, taking place in only 8% of all contracts in the sample, which could be determined by micro-level contractual terms as well as macro-level factors (governing institutions and economic and political cycles). As the direct implication from Hypothesis V,

[12]The author thanks researchers in the World Bank's Public Private Partnership Group (the PPI database unit) for the intensive data collection of the dispute information for each contract.

the hazard model is used to estimate the probability of contractual disputes conditional on the age of each contract. The duration of the contract A_i is the number of years a project survives before it ends either due to contract breach or termination of the investment period as defined in Eq. (8).

$$A_i = t_1 - t_0 \tag{8}$$

where t_0 is the year when the contract was signed, and t_1 is the year when the dispute occurred. The data are right-censored if the project is still ongoing in 2012 (the censoring time is denoted as c which is the same for all contracts). The observed duration A_i is defined as follows.

$$A_i = \min(A_i^*, c) \tag{9}$$

If the duration is not censored, the density of A_i is simply $f(A_i|x_i;\theta)$. The probability of A_i is censored if $P(A_i^* \geq c|x_i)$, and therefore the MLE of θ can be obtained by maximizing the following log-likelihood function.

$$L = \sum_{i=1}^{N} \Big\{ d_i \log[f(A_i|x_i;\theta)] + (1-d_i)\log[P(A_i^* \geq c|x_i)] \Big\} \tag{10}$$

where d_i is a censoring indicator. $x_i = [X_{1,i}, X_{2,c}, \kappa, D_j]$ are covariates for project i in sector j, country c. $X_{1,i}$ is project-specific characteristics per contract which includes procurement type (competitive bidding or negotiated contract), the share of private investment in the contract, and the supports from international financial institutions. The majority of contracts in the sample involve a significant share of private sponsorship, but only 13% of them involved multilateral institutions.

$X_{2,c}$ includes macro shock variables which triggers the contractual disputes, such as change in real per capita GDP growth during the contractual period $t \in [t_0, t_1]$ defined as $\Delta g = g_{t_1} - g_{t_0}$. It measures improvement in the economic situation which is likely to create buffers

to reduce the dispute risk.

As a part of $X_{2,c}$, two types of country-level measure of the quality of institutions are included in the regression. First, to test Hypothesis III, it includes dummy variables on democratic regime (against autocratic regime) and ideology of the incumbent government (right wing or left wing regime) just before the outbreak of disputes. Regimes are democratic if their Polity IV score is positive and autocratic if it is non-positive as similarly defined by Besley and Kudamatsu (2008).[13] As the government-led disputes tend to be triggered by the change in nation's leader, we also consider how the duration of leaders (capturing leadership competition) affect the hazard of contractual disputes. Second, to test Hypothesis IV, we include proxy variables on the quality of PFM system measured by the public investment management index (PIMI).

As the omission of sectoral and regional affiliations will bias my point estimates for these variables, regional fixed effects κ and a vector of dummies for sectoral affiliations D_j[14] need to be included in the likelihood function.

Assuming that $f(A_i|x_i;\theta)$ follows the Weibull distribution, the hazard function λ can be estimated with my MLE, $\hat{\theta}$, which is defined as Eq. (10).

$$\lambda(A_i; x_i) = \exp(x_i^{'}\beta)\alpha A_i^{\alpha-1} \tag{11}$$

where α is the measure of duration dependence.

[13]The Polity score is about a state's level of democracy based on an evaluation of the competitiveness and openness of the elections, the nature of political participation, and the extent of checks on executive authority.

[14]Dummies for sectoral affiliation are coded using the Internetional Centre for Settlement of Investment Disputes (ICSID)'s industrial classification which categorizes each project into one of the following sectors: (1) agriculture, fishing, and forestry, (2) oil, gas, and mining, (3) electric power and other energy, (4) water, sanitation, and flood protection, (5) construction, (6) tourism, (7) transportation, (8) information and communication, (9) finance, and (10) other industry.

A Constructing the Input-price Shock Variable

To test Hypotheses II, it is necessary to construct a measure of the input-price shock during the contractual period. Domestic fuel prices are not observable, but country-specific variations of the input price shock can be constructed by weighting the global commodity price series by the compositions of input resources:

$$E[\Delta\text{Input cost}_{it}] = \sum_{c=1}^{3} \phi_{ic,t_1}(\ln p_{ic,t_1} - \ln p_{ic,t_1-1}) \tag{12}$$

They are the weighted average of the log difference of the global prices of three primary commodities (oil, natural gas, and coal) c for country i at year t. The share of energy sources $\phi_{c,t}$ (from the World Development Indicators) is used as a weight to construct the variable. In some countries, there is one dominant fuel for domestic production, and in others there are multiple fuel inputs. The level of exposures to fuel cost increase would differ by the dependency on fuel sources.

VI Results

A Hazard Analysis: Baseline

Table 3 reports the maximum likelihood estimates of the hazard model defined as Eq. (11). The whole sample is used in columns 1-5, column 6 removes 1,194 contracts signed in LAC countries, which is one of the epicenters of contractual disputes (see Figure 1) as in the case of expropriations (Weems and Salo, 2012),[15] columns 7-8 cover only greenfield projects, and column 9 again uses the whole sample.

To test Hypothesis V, the magnitude of duration dependence ($\ln(\alpha)$) is reported at the bottom of Table 3. This parameter captures the differential hazard as the contract ages. As

[15]The nature of contractual disputes in LAC region would be different from other regions as they are mainly triggered by expropriatory taking of private assets which were concentrated in the aftermath of the 2002 financial crisis in Latin America.

shown in Figure 4, the hazard curve is sloping fast up to 9 years of project life, which gets flatter and slopes up exponentially again as the contract matures further. This implies that the probability of disputes generally increases as the duration of projects gets longer, but the government tends to be more extractive when the maturity of projects becomes more than about 14 years. In any specification, the ancillary parameter is greater than one ($\alpha > 1$), confirming that there is a positive duration dependence in consistent with the obsolescing bargain hypothesis.

[insert Figure 4]

Column 1 is the benchmark regression. To account for the non-linearity due to different degree of risk transfer to private sector, separate dummies of the level of private participation in investment (above 50% and 80%) are added. In column 2, a dummy of private participation above 80% is interacted with a dummy of multilateral organizations' (IFI) participation in the PPP contract (in the form of lending of loans, equity investments, or provision of guarantees) to explore the potential role of multilateral institutions, such as the International Monetary Fund and the World Bank, in helping private investors mitigate the dispute risk. It appears that when the firm's financial participation exceeds 80%, the hazard rate significantly increases by 100[exp(0.468)-1]=59.7%, suggesting that excessive risk transfer to private sector would have an adverse impact on the success in PPPs. The interaction term with the IFI dummy is negative and significant, showing that the hazard rate can be 100[exp(0.527)-1]=69.4% lower if the contract was drafted with a partnership clause with multilateral donors. Contracts in energy sector (e.g., electricity generation) are likely to experience significantly higher risk than other sectors.

The results for macro variables are broadly consistent with findings in prior empirical studies. Similar to the case of expropriations, political regime is the critical determinant of contractual success. The negative coefficient of democratic regime variable implies that democratic countries are more likely to honor the contract by 100[exp(0.544)-1]=72.3% than

autocratic states. Column 3 and 4 additionally look at the effects of politician's ideology and the duration of national leaders. It shows that a right-wing government is more likely to support PPPs, which is consistent with a common understanding that a left-wing government tends to prefer stronger regulation in the economy through public ownership of infrastructure. As we expect, the dispute risk tends to be elevated in countries where the same ruler stayed as a leader of the government for a longer time period.

In column 3-9, the square term of income level (the log of GDP per capita in 2000) is negative, supporting an inverse-U shape relationship between the dispute risk and the initial income level (in Figure 2). The change in real GDP per capita is signed negatively, showing that higher economic growth during the contract would significantly reduce the hazard rate.

Column 5 includes the input price shock variable as defined in Eq. (12). As predicted in Hypothesis II, the cost-overrun in PPP projects due to higher input costs significantly increases the hazard rate. Column 6 offers a robustness check by restricting sample to non-LAC countries. Outside LAC region, the coefficient of the political regime variable gets smaller while the role of IFIs in mitigating dispute risk gets stronger. As many LAC countries are rich in natural resources, excluding Latin American countries will sharpen up the risk associated with higher input cost in public services. Other results remain to be robust.

The rest of columns add dummies to assess whether the risk will be elevated or mitigated for greenfield contracts with the government's direct subsidy (in column 7) or guarantee (in column 8), and by the type of contracts (either greenfield or concession contract) (in column 9). The result shows that the dispute risk will get higher for contracts with sovereign guarantees as the host government incurs fiscal costs due to contingent liabilities, and therefore would prefer to renege contract in the downside situation is likely to realize. Besides, it shows that concession contracts are riskier than greenfield contracts because the success of concessions fully relies on the financial viability of the projects, although projects tend to be inviable due to cost-overruns which the host government cannot perfectly foresee when signing contracts ex-ante.

[insert Table 3]

B Asymmetry by Contract Type and PFM

Table 4 estimates the semi-elasticity of the hazard with respect to each covariate by different degree of risk transfer depending on the contract type. Columns 1-2 are for greenfield projects but it separates out the availability-pay and the user-pay contract. Column 3 estimates only for concession contracts. Columns 4-5 are only for greenfield projects but estimates separately by the issuance of sovereign guarantees.

Under the availability-pay scheme, the government takes full demand risk and transfers recurring payment to the private operator. An increase in input cost therefore matters less for the private party under the availability-pay contract (column 1) than under the user-pay contract (column 2). In this case, the government absorbs cost overruns caused by higher fuel costs. The firm's participation constraint will be satisfied as long as the availability payment from the government is sufficient to cover the cost (see Eq. (6)). The government-led disputes are also less likely as long as the PPP project generates enough returns as initially expected. The government exploits all rents as a residual claimant of the project regardless of the political regime, and as a result democracy dummy is not a significant determinant of disputes. As private parties also do not take commercial risk under the availability-pay contract, the level of private participation (above 80%) and the interaction term with the IFI dummy do not significantly matter for the dispute risk.

On the other hand, under the user-pay contract (column 2) and the concession contract (column 3), the private operator takes full demand risk. In this case, the firm-led disputes increase when private parties made larger capital contribution above 80% and when PPP projects face cost overruns due to higher fuel input costs. For the user-fee contract, the private party can mitigate the elevated dispute risk through the partnership with multilateral partners. A democracy dummy is negative and significant (at 1% significance level), implying that political constraint is more binding in case of the user-pay contract as the host government

is responsible for fiscal and social costs to implement the PPP project, and therefore is more tempted to renege contracts to take control of it.

Columns 4-5 examine how the provision of sovereign guarantee, which creates fiscal cost for the host government (thereby increasing the risk of the government-led disputes) but mitigate demand risk for the private parties (thereby decreasing the risk of the firm-led disputes), will change the result. For contracts with sovereign guarantee (column 4), the average growth rate of the economy during the contractual period appears to have larger impact on the success of PPPs. As the host government takes commercial risk, this means that financial viability of the project becomes more critical, irrespective of the country's political regime or the engagement with multilateral partners, for the government to reduce contingent liability. In case of contracts without guarantee (column 5), the result is similar to the case of greenfield project under the user-pay contract (column 2).

The regression also includes a dummy variable which indicates better quality of PFM system. We measure the quality of PFM based on the new PIMI index which covers 119 countries.[16] The PIMI index provides established cross-country variations on the quality of public expenditure management although it captures the PFM quality in general (and not directly measure the quality related to PPPs)[17] The distribution is shown in Figure 5. At median, LAC and ECA regions exhibit higher ratings, the East Asia and Pacific (EAP) and South Asia at the middle, and the Middle East and North Africa (MENA) and the Sub-

[16]The PIMI index was originally developed by Dabla-Norris et al (2012) for 71 countries using diagnostics of countries' public investment management systems conducted by the World Bank, budget survey databases, donor assessments, and expert surveys. Missing countries are complemented by two recent studies conducted at the IMF, which have extended the PIMI index to the Middle East and Central Asia countries (IMF, 2014a) and to 22 emerging and advanced economies (IMF, 2015) using the responses to questions on PFM practices provided by country authorities and IMF's country desks. As this still misses several countries with significant exposure to PPPs (such as Argentina, Bulgaria, Chile, China, Costa Rica, Dominican Republic, Ecuador, Malaysia, Mexico, Sri Lanka, and Vietnam), we run Tobit regression (which estimates the PIMI index on the World Bank's governance indicators on bureaucratic quality and efficiency) and extrapolated the PIMI rating for these missing countries.

[17]IMF (2015) developed the public investment management assessment (PIMA) index which provides comprehensive scores (including the PPP-specific indicator) to evaluate the quality of PFM practices for 25 selected countries. The PIMA index is found to be consistent with existing PIMI index. The analysis of this paper is based on the PIMI index to maximize the sample size, but a robustness check using the PIMA index is an important step for the next research.

Saharan Africa (SSA) are rated as two worst performing regions. As the index is constructed from the most recently available reports from World Bank, IMF, and other sources to expand the country coverage, no historical PIMI index is available.[18] In Table 4, we include a dummy which indicates better PFM system and takes a value one when PIMI score is above mean and zero otherwise.

[insert Figure 5]

The result shows that the hazard rate gets lower for countries with better PIMI index in case of the user-pay contract, the concession contract, and contracts without sovereign guarantee, all of them involve significant private sector participations. The estimates get more significant when we exclude LAC countries (in column 6-8). This means that the quality of PFM could reduce dispute cases when larger demand risk is taken by private parties as the project needs to be more financially viable. The role of PFM is less significant for the sub-sample of contracts with sovereign guarantees as, once the guarantee is issued, the fiscal risk (related to contingent liability) is already borne off-budget and cannot be avoided upon the realization of downside demand scenario which requires the host government to cover commercial losses.

[insert Table 4]

C Robustness Check: Cohort Analysis

As contracts were signed at different points in time, the above results may systematically differ depending on the cohort of PPP contracts. There was a clear structural change occurred in the recent years after 2000 when the dispute risk rose around the world (see Figure 1). The global

[18] In this regard, the PIMI index cannot capture the causal effect of the PFM on the hazard rate for contracts signed in the past. The index can however be used to estimate the difference in hazard rate for countries grouped by the PFM quality assuming that the PIMI score rarely changes over time.

economy also experienced new risks caused by a surge in global commodity prices after 2000. In this sub-section, hazard rate is estimated for the sub-samples divided by cohort 1(contracts signed before 2000) and cohort 2 (ones signed after 2000).

In Table 5, column 1 uses the whole sample, and column 2 and 3 cover only greenfield and concession contracts respectively. In all three columns, a dummy of high private participation (above 80%) is positively signed only for contracts in cohort 2, implying the elevation of dispute risk for PPPs which were recently signed and transfer larger risk to private investors. We do not find a significant difference on the risk mitigation due to the engagement with multilateral partners between two cohorts in all columns. Interestingly, columns 1-2 show that PPP contracts (as greenfield investments) signed in oil, gas, and mining (OGM) sector prior to 2000 (cohort 1) experienced higher risk, as their off-shore price was set before the surge in the global commodity price and was fixed at the low level. On the other hand, contracts in OGM sector which were signed after 2000 (cohort 2) benefited from higher commodity prices as it increased the profit margin of companies in OGM sector during the commodity price boom. For the PPP contract signed in energy sector, the dispute risk was systematically higher than other sectors, in particular for ones recently signed after 2000 (cohort 2). In transportation sector, recently signed concession contracts experienced higher dispute risk as private parties run higher risk of cost-overrun due to a surge in input fuel costs during 2000s.

As similarly found in Table 4, democracy remains to play an important role in mitigating dispute risk for greenfield projects, but only for recently signed contracts. This implies that the government-led disputes in autocratic regimes have become more relevant risk for greenfield foreign investments (especially the investment to LAC regions) during the period of 2000s.

Finally, we found that concession contracts continued to face higher dispute risk regardless of cohorts (in column 1), while projects with sovereign guarantees exhibit higher dispute risk for cohort 2 (in column 2). This implies that the fiscal risk (of contingent liability) has been elevated as the PPPs became mainstream form of public investments in recent years.

[insert Table 5]

VII Conclusion

The successful development of PPPs is critical in filling in the infrastructure gap and reverting the downward trend of efficiency-adjusted public capital stock. However, an increase in PPPs has also accompanied an elevation of contractual disputes between the host government and private parties, and contrary to our expectation, renegotiation and termination of PPP contracts created large loss in efficiency. Following the previous study on the triggers of the breach of contract (Nose, 2014), this paper further examined how the type of incentive contract and the host country's institutional framework help successful development in PPPs using a comprehensive contract-level dataset.

Based on predictions from a bargaining model in a limited commitment framework, it estimates the difference in contractual hazards by the risk allocation scheme and by country's quality of institutions, particularly focusing on the role of public financial management system.

The empirical results show that incentive contracts which transfer larger financial risk to private parties without sovereign guarantees or government's direct subsidies faced higher risk of contractual disputes due to fuel cost-overruns in recent years. For the success of such PPP contracts, the quality of public financial management system is critical to ensure the financial viability in project appraisal. Second, involving multilateral partners in PPP contracts provides an insurance to reduce dispute risk (in consistent with the finding of Jensen et al (2013)), while issuing guarantees without proper assessment of contingent fiscal cost rather increases the risk of the government-led disputes as the government bears larger risk from the accumulation of contingent liabilities. This highlights the importance of fiscal prudence in designing PPPs to boost private investments in infrastructure, and thereby promote growth as similarly discussed in Basu (2014). Finally, our analysis supports the empirical evidence found in the past literature which highlights the importance of democratic regime and po-

litical ideology in enforcing contracts (Eden, Kraay and Qian, 2012; World Bank, 2012) and significance of adverse shocks (such as business cycle and commodity price shock) during the contractual period which needs to be absorbed by drafting more flexible contracts.

This paper provides useful insights for investors as well as policy makers working in PPPs. In a policy point of view, it suggests that excessive risk transfer to private parties with a longer project duration could significantly increase the dispute risk, especially under larger global economic uncertainties as we experienced during the period of 2000s (for a surge in commodity prices and the global financial crisis). This suggests that some contingencies need to be embedded when drafting PPP contracts, for example by involving multilateral partners or by balancing risk allocation between public and private sector. The result suggests that the government should improve fiscal institutions to boost private investments in infrastructure and to minimize the accumulation of contingent liabilities, which would help the promotion of growth while ensuring fiscal and debt sustainability in the long-run.

The similar analysis for advanced economies which tended to experience different types of contractual disputes in PPPs is left for the future research. Finally, given the complexity of the PPP contract design and the operational procedure, many countries have started to introduce the PPP model contract (e.g., India and Canada) and the standardized operational guideline (e.g., United Kingdom's business case model).[19] The benefit and cost of such contractual and institutional arrangements need to be carefully evaluated, and whether they could mitigate dispute risk in PPPs or not is an important agenda for my next research.

[19]For an example in India, see http://planningcommission.gov.in/sectors/index.php?sectors=infrastructure. For the UK's practice, see the HM Treasury's "The Green Book: Appraisal and Evaluation in Central Government".

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Table 1: Summary Statistics

	N	Mean	SD	P50	Min	Max
Disputes	4277	0.085	0.278	0	0	1
Micro variables						
Duration (Contract age)	4277	9.025	5.810	8	0	28
Partnership with IFI	4196	0.131	0.338	0	0	1
Private share above 50%	4114	0.946	0.227	1	0	1
Private share above 80%	4114	0.808	0.394	1	0	1
Concession contracts	4277	0.294	0.456	0	0	1
Government subsidy	4277	0.228	0.420	0	0	1
Sovereign guarantee	4277	0.070	0.256	0	0	1
Macro variables						
Log income per capita in 2000	4226	8.478	0.660	8.313	5.799	10.561
Change in real GDP per capita	4246	0.006	0.051	0.001	-0.360	0.563
Change in input cost	3827	0.158	0.095	0.183	-0.439	0.560
Democracy	4226	0.708	0.455	1	0	1
Duration of political leader	4237	34.331	23.539	26	0	92
Right wing government	3096	0.197	0.398	0	0	1
Better PFM system	3980	0.363	0.481	0	0	1
Sector dummies						
Oil, gas, and mining sector	4272	0.070	0.256	0	0	1
Energy sector	4272	0.347	0.476	0	0	1
Transport sector	4272	0.285	0.451	0	0	1
Region dummies						
East Asia and Pacific (EAP)	4277	0.321	0.467	0	0	1
Europe and Central Asia (ECA)	4277	0.090	0.287	0	0	1
Latin America and the Caribbean (LAC)	4277	0.313	0.464	0	0	1
Middle East and North Africa (MENA)	4277	0.026	0.164	0	0	1
South Asia	4277	0.170	0.376	0	0	1
Sub-saharan Africa (SSA)	4277	0.078	0.268	0	0	1

Note: Energy sector includes the activities related to the provision of electricity and natural gas.

Table 2: Contractual Type

	PPP contract Greenfield: BOT (user-pay)	**PPP contract** Greenfield: BOT (availability-based pay)	**PPP contract** Concession	**Public procurement**
Ownership of asset	Firm (transfer to Government upon completion)	Firm (transfer to Government upon completion)	Government	Government
Investment	Firm	Firm	Government	Government
User-fee collection	Firm	Government	Firm	Government
O&M cost	Firm	Firm	Firm	Government
Other		Government pays direct transfer (availability payment) to Firm	Firm pay concession fee to Government	

Source: World Bank PPP manual (2014). Based on the definition commonly used in the literature, the user-pay contract is similar to fixed-price contract while the availability-based pay contract is similar to cost-plus contract (Laffont and Tirole, 1998)

Table 3: Parametric Hazard Regressions: Baseline

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Partnership with IFI (IFI)	-0.300***	0.167	0.027	0.070	0.045	0.116	0.094	0.067	0.040
	(0.044)	(0.103)	(0.148)	(0.104)	(0.122)	(0.150)	(0.149)	(0.150)	(0.123)
Private share above 50%	0.056								
	(0.068)								
Private share above 80% = x	0.404***	0.468***	0.440***	0.507***	0.473***	0.554***	0.407***	0.411***	0.482***
	(0.044)	(0.043)	(0.060)	(0.046)	(0.050)	(0.056)	(0.058)	(0.057)	(0.051)
$x \times$ IFI		-0.527***	-0.502***	-0.438***	-0.500***	-0.701***	-0.554***	-0.549***	-0.486***
		(0.113)	(0.161)	(0.114)	(0.131)	(0.166)	(0.157)	(0.160)	(0.133)
Log income per capita = y			4.528***	2.655***	4.995***	4.311***	4.047***	4.203***	5.103***
			(0.851)	(0.591)	(0.665)	(0.816)	(0.729)	(0.823)	(0.689)
y^2			-0.291***	-0.177***	-0.319***	-0.284***	-0.257***	-0.265***	-0.326***
			(0.050)	(0.035)	(0.039)	(0.048)	(0.043)	(0.049)	(0.040)
Change in real GDP per capita			-3.878***	-3.169***	-3.147***	-3.420***	-2.294***	-2.338***	-3.170***
			(0.483)	(0.378)	(0.408)	(0.544)	(0.446)	(0.449)	(0.411)
Democracy	-0.534***	-0.544***	-0.527***	-0.158***	-0.331***	-0.260***	-0.446***	-0.470***	-0.327***
	(0.049)	(0.049)	(0.081)	(0.060)	(0.062)	(0.069)	(0.070)	(0.069)	(0.063)
Right wing government			-0.271***						
			(0.050)						
Duration of political leader				0.008***					
				(0.001)					
Change in input cost					1.938***	3.579***	1.412***	1.404***	2.046***
					(0.293)	(0.453)	(0.347)	(0.352)	(0.298)
Government subsidy							0.084		
							(0.060)		
Sovereign guarantee								0.889***	
								(0.115)	
Concession contract									0.191***
									(0.042)
Oil, Gas, and Mining sector	0.165***	0.161***	0.055	0.083	0.130**	0.193**	0.167**	0.125*	0.134**
	(0.052)	(0.052)	(0.079)	(0.053)	(0.061)	(0.081)	(0.068)	(0.068)	(0.061)
Energy sector	0.422***	0.421***	-0.059	0.363***	0.267***	0.195***	0.442***	0.418***	0.284***
	(0.043)	(0.043)	(0.057)	(0.043)	(0.049)	(0.064)	(0.057)	(0.054)	(0.050)
Transport sector	0.173***	0.172***	-0.071	0.148***	0.127***	0.145**	0.134**	0.063	0.054
	(0.039)	(0.039)	(0.053)	(0.039)	(0.044)	(0.059)	(0.064)	(0.061)	(0.046)
Constant	-3.979***	-3.987***	-23.208***	-14.207***	-24.455***	-21.466***	-20.669***	-21.437***	-24.944***
	(0.097)	(0.083)	(3.529)	(2.456)	(2.796)	(3.377)	(3.030)	(3.442)	(2.902)
Duration dependence									
Ln(α)	0.489***	0.491***	0.872***	0.519***	0.672***	0.646***	0.650***	0.663***	0.676***
	(0.013)	(0.013)	(0.015)	(0.014)	(0.014)	(0.016)	(0.016)	(0.017)	(0.014)
Observations	4050	4050	2934	3999	3614	2420	2481	2481	3614
Sample	All	All	All	All	All	Exclude LAC	Greenfield only	Greenfield only	All

***p<0.01, **p<0.05, *p<0.1; Standard errors are corrected for heteroskedasticity.

Table 4: Asymmetry by Contractual Type and PFM System

	(1) Greenfield: BOT availability-pay	(2) Greenfield: BOT user-pay	(3) Concession	(4) Greenfield: with guarantee	(5) Greenfield: without guarantee	(6) Greenfield: BOT user-pay	(7) Concession	(8) Greenfield: without guarantee
Partnership with IFI (IFI)	-0.694**	0.174	-0.289	-0.442	0.050	0.231	-0.236	0.085
	(0.305)	(0.200)	(0.248)	(0.868)	(0.172)	(0.247)	(0.328)	(0.210)
Private share above 80% = x	-0.127	0.454***	0.636***	0.081	0.451***	0.543***	0.665***	0.564***
	(0.184)	(0.069)	(0.102)	(0.323)	(0.067)	(0.075)	(0.111)	(0.076)
$x \times$ IFI	0.211	-0.602***	-0.070	-0.739	-0.514***	-0.803***	-0.329	-0.699***
	(0.344)	(0.209)	(0.272)	(0.925)	(0.181)	(0.262)	(0.411)	(0.223)
Change in real GDP per capita	-3.019**	-1.307**	-3.490***	-9.413***	-1.794***	-2.107***	-4.815***	-2.301***
	(1.309)	(0.594)	(0.782)	(2.793)	(0.563)	(0.793)	(1.447)	(0.724)
Democracy	0.115	-0.486***	-0.043	0.784	-0.498***	-0.388***	0.101	-0.432***
	(0.192)	(0.081)	(0.141)	(0.553)	(0.076)	(0.092)	(0.159)	(0.085)
Change in input cost	1.023	1.231***	3.291***	1.549	1.095***	3.689***	5.077***	3.323***
	(1.014)	(0.411)	(0.619)	(1.710)	(0.375)	(0.657)	(1.148)	(0.564)
Better PFM system	-0.366	-0.215**	-0.342	0.504	-0.255***	-0.401***	-0.615**	-0.465***
	(0.305)	(0.092)	(0.255)	(0.482)	(0.084)	(0.106)	(0.268)	(0.096)
Constant	-15.668**	-21.222***	-30.357***	-10.319	-19.643***	-15.937***	-33.625***	-14.996***
	(6.941)	(3.507)	(7.458)	(15.595)	(3.207)	(4.013)	(10.371)	(3.640)
Duration dependence								
Ln(α)	0.910***	0.619***	0.805***	0.786***	0.645***	0.620***	0.751***	0.639***
	(0.047)	(0.018)	(0.028)	(0.059)	(0.017)	(0.021)	(0.036)	(0.020)
Observations	317	2019	1126	129	2207	1457	608	1566
Sample	All	All	All	All	All	Exclude LAC	Exclude LAC	Exclude LAC

***p<0.01, **p<0.05,*p<0.1; Robust standard errors are in parenthesis. The regression also controls for log of GDP per capita in 2000 and the square term, and sector dummies.

Table 5: Parametric Hazard Regression: Cohort Analysis

	(1)		(2)		(3)	
	Cohort 1	Cohort 2	Cohort 1	Cohort 2	Cohort 1	Cohort 2
Partnership with IFI (IFI)	0.207	-0.231	0.308	-0.076	-0.026	-0.412
	(0.226)	(0.187)	(0.274)	(0.220)	(0.357)	(0.298)
Private share above 80% $= x$	-0.047	0.251***	-0.195*	0.228***	0.112	0.401***
	(0.091)	(0.064)	(0.107)	(0.074)	(0.220)	(0.104)
$x \times$ IFI	-0.317	-0.106	-0.445	-0.253	0.177	0.066
	(0.241)	(0.203)	(0.289)	(0.237)	(0.387)	(0.343)
Democracy	0.086	-0.188**	0.201	-0.232**	-0.352	-0.243
	(0.114)	(0.081)	(0.133)	(0.093)	(0.292)	(0.160)
Change in input cost	-0.048	0.943**	-0.041	0.312	0.509	1.996**
	(0.608)	(0.433)	(0.719)	(0.506)	(1.763)	(0.924)
Concession	0.151*	0.103*				
	(0.079)	(0.054)				
Sovereign guarantee			0.338	0.529***		
			(0.299)	(0.105)		
Oil, Gas, and Mining sector	0.251*	-0.335***	0.404**	-0.423***	-0.662**	-0.162
	(0.144)	(0.086)	(0.160)	(0.102)	(0.278)	(0.119)
Energy sector	0.169**	0.544***	0.324***	0.575***	-0.249	0.315
	(0.084)	(0.062)	(0.094)	(0.071)	(0.216)	(0.220)
Transport sector	-0.095	0.255***	-0.038	0.147*	-0.408**	0.284***
	(0.089)	(0.064)	(0.113)	(0.088)	(0.181)	(0.096)
Constant	-48.316***	-17.988***	-30.121***	-18.044***	-105.631***	-17.864**
	(5.279)	(4.294)	(5.907)	(5.033)	(15.183)	(8.366)
Duration dependence						
Ln(α)	1.876***	0.825***	1.887***	0.806***	1.971***	0.916***
	(0.020)	(0.017)	(0.023)	(0.021)	(0.052)	(0.033)
Observations	1395	2219	940	1541	455	678
Sample	All	All	Greenfield	Greenfield	Concession	Concession

***p<0.01, **p<0.05,*p<0.1; Robust standard errors are in parenthesis. The regression also controls for log of GDP per capita in 2000 and the square term, and the average growth rate of real GDP during the contractual period.

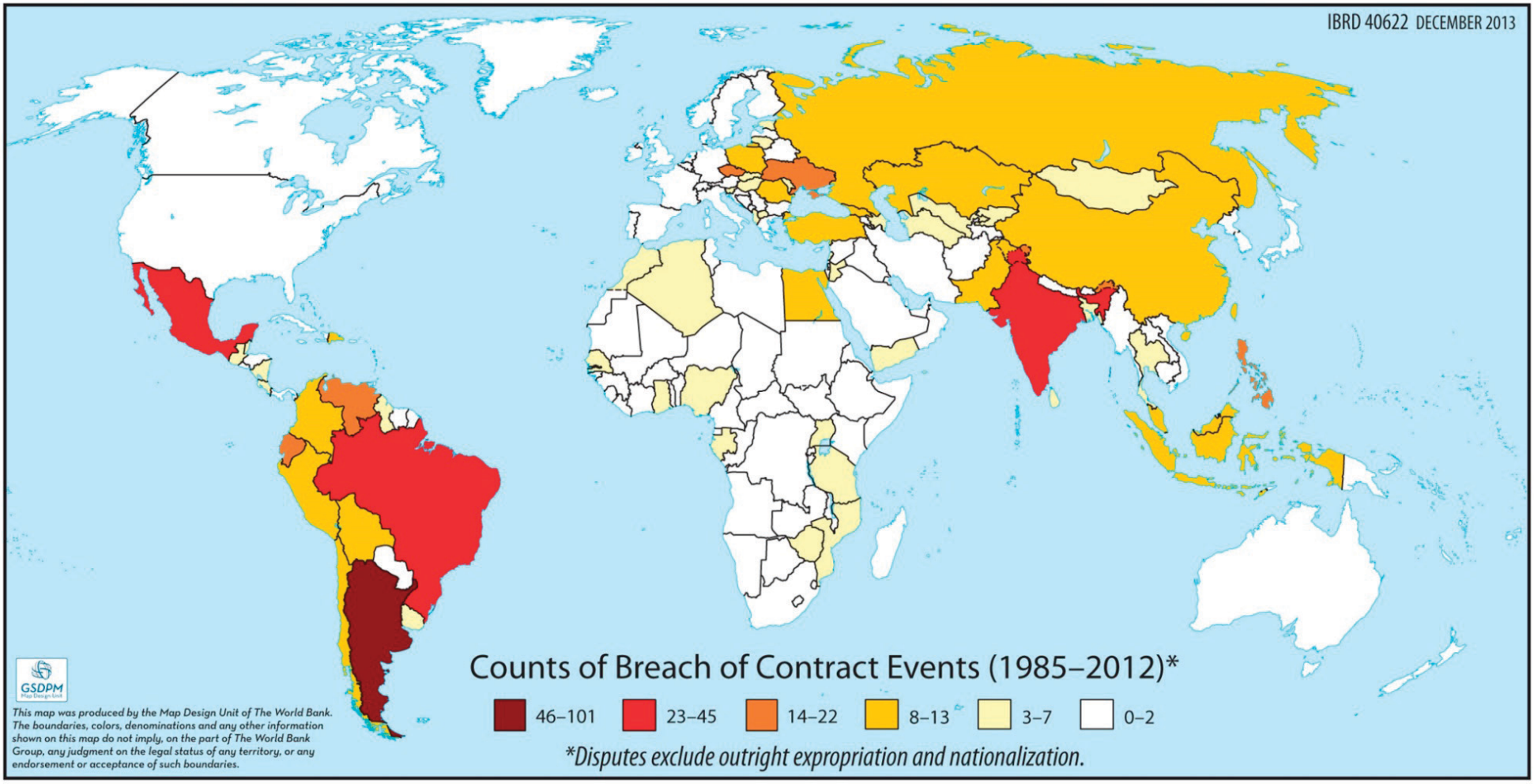
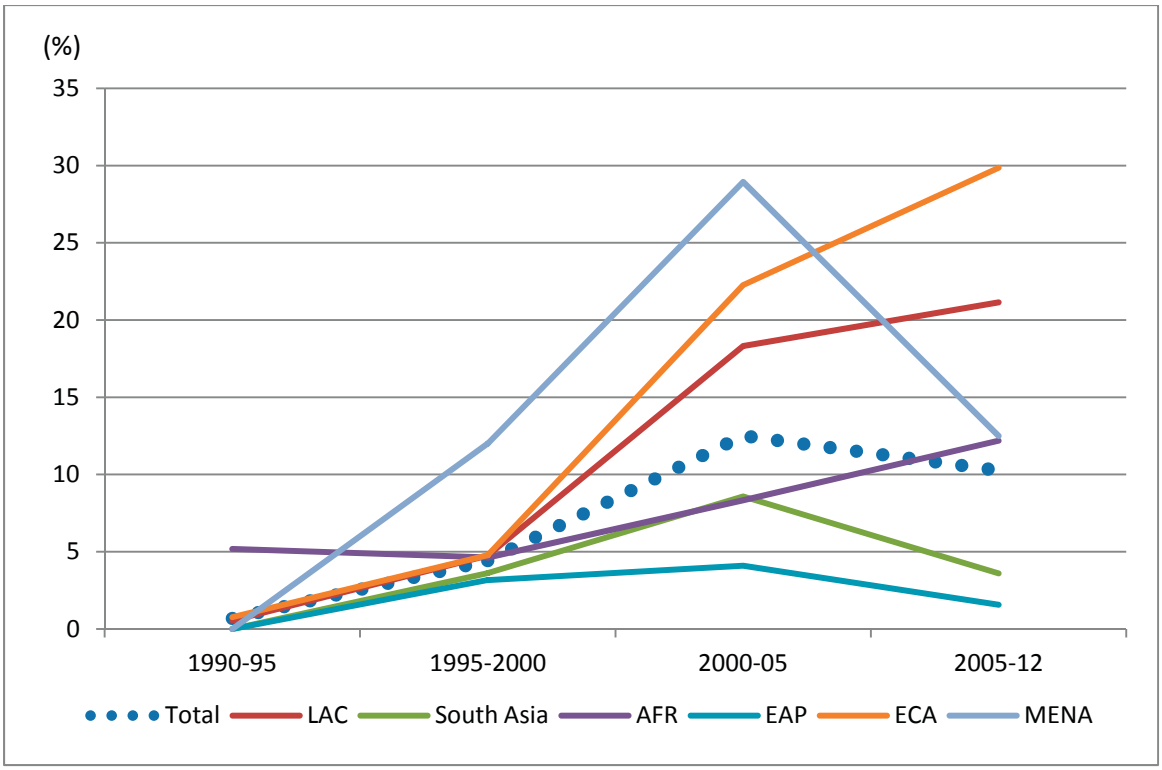


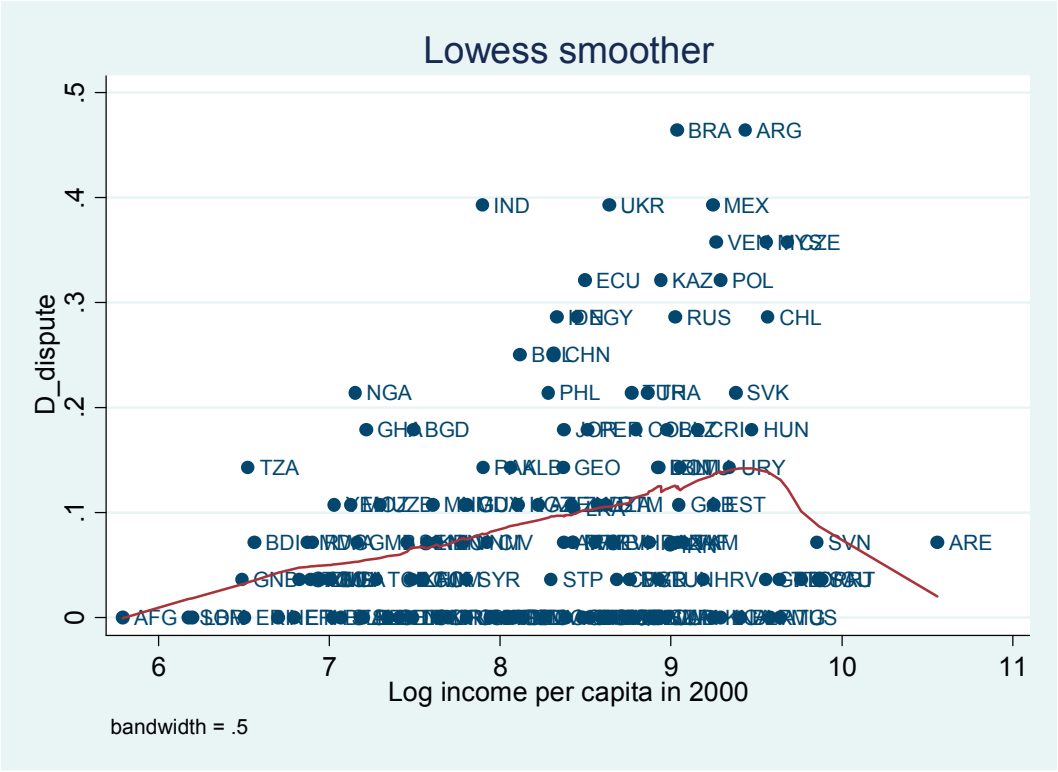
Figure 1. Counts of Breach of Contract Events (in 1985-2012)



Note: Y-axis shows the percentage of contract which experienced contractual disputes or termination out of total surviving contracts.

1/ LAC: Latin America and the Caribbean; AFR: Sub-Saharan Africa; EAP: East Asia and Pacific; ECA: Europe and Central Asia; MENA: Middle East and North Africa.

Figure 2: Historical Trend of Contract Breach Risk



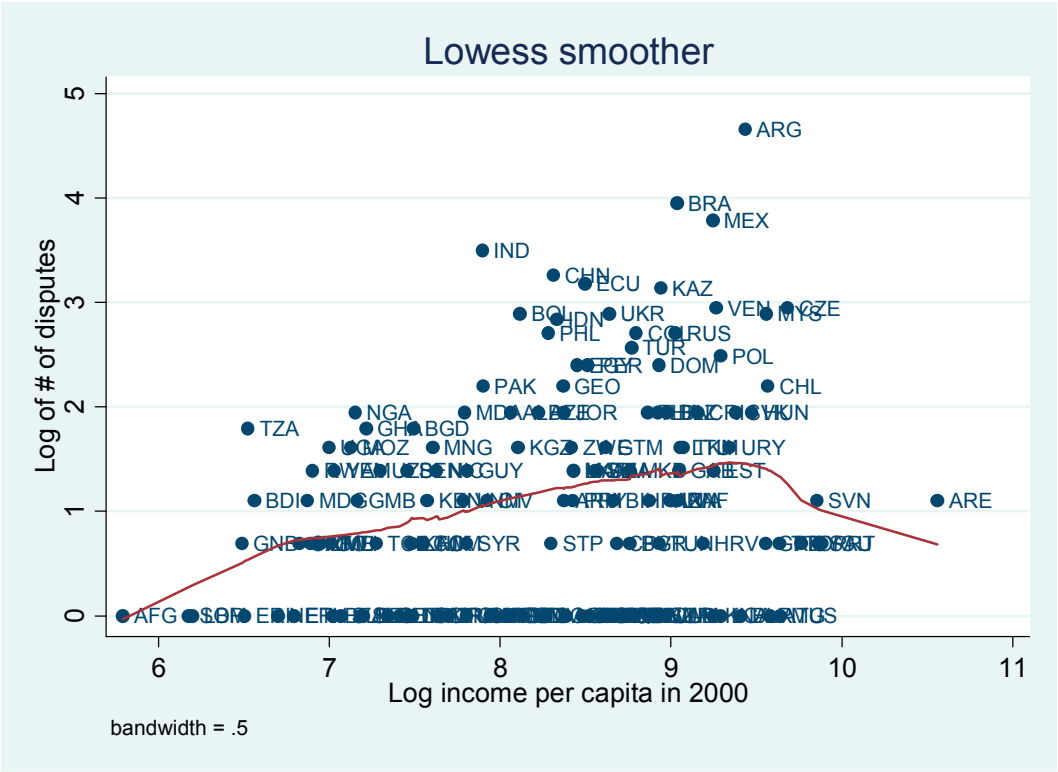


Figure 3: Disputes and Economic Development

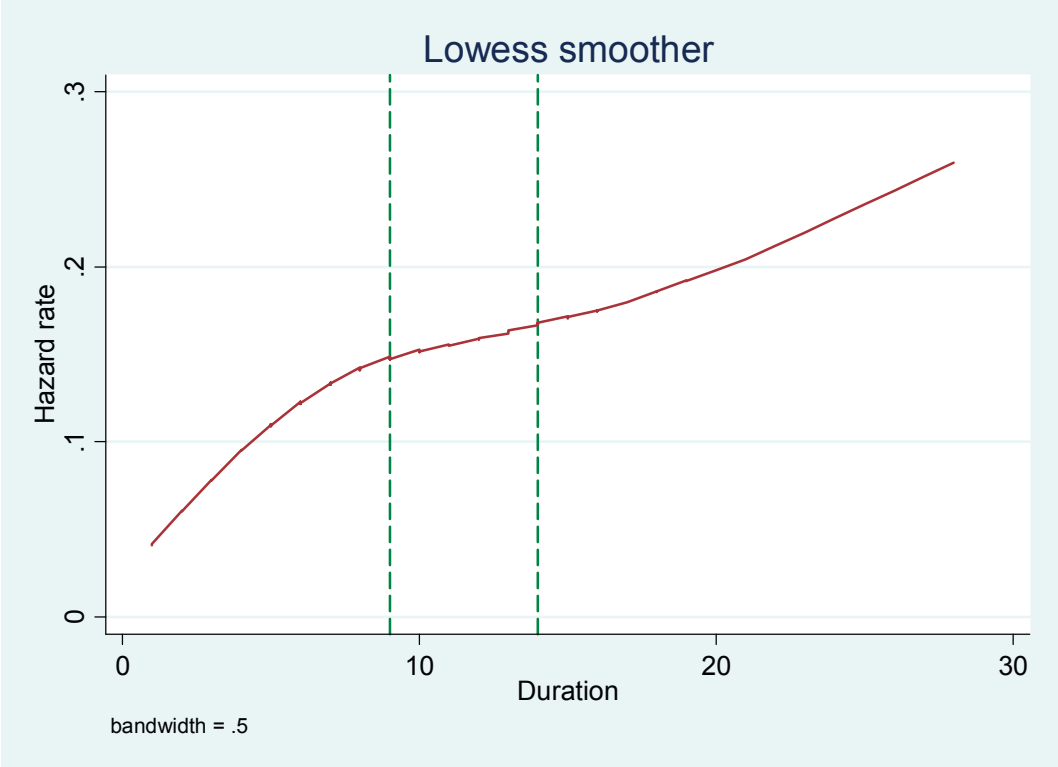
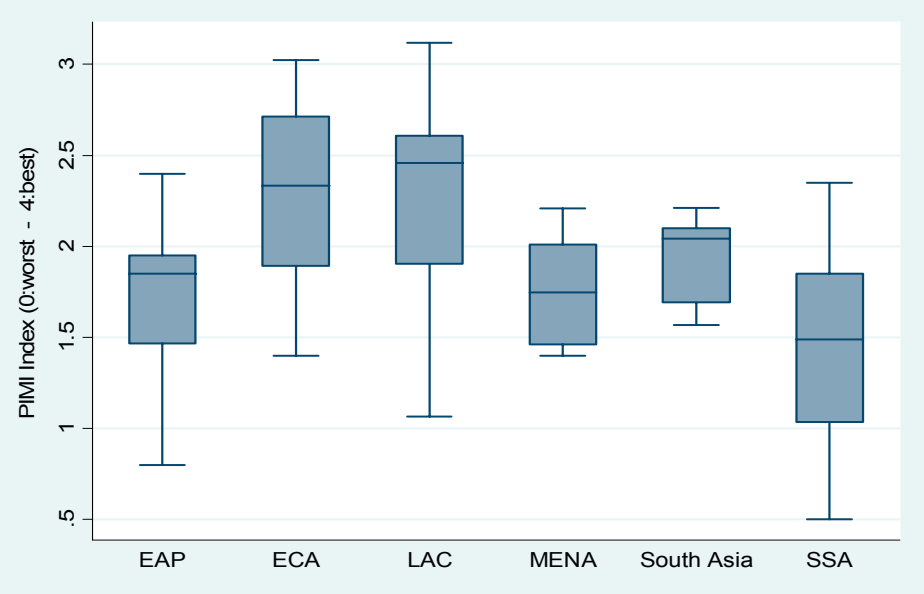


Figure 4: Hazard Rate by Contract Duration



Sources: Dabla-Norris et al (2012), IMF (2014a, 2015), author's calculation

Note: Y-axis indicates the PIMI index which ranges from 0 (worst PFM system) to 4 (best PFM system). The box plot depicts the distribution of the PIMI index across regional groups, with the middle line indicating median, the lower and upper boundaries of the box 25th and 75th percentiles, respectively, and the lower and upper lines 10th and 90th percentiles, respectively.

Figure 5: Distribution of PIMI index

Table A.1: Country List in the Sample

Low income (36)		Lower middle income (53)		Upper middle income (51)		High income (6)	
Afghanistan	6	Angola	8	Albania	8	Czech Republic	2
Bangladesh	38	Armenia	6	Algeria	21	Estonia	1
Benin	6	Belize	3	American Samoa	1	Latvia	2
Burkina Faso	3	Bhutan	2	Antigua and Barbuda	1	Poland	1
Burundi	3	Bolivia	17	Argentina	185	Slovak Republic	1
Cambodia	28	Cameroon	6	Azerbaijan	6	United Arab Emirates	1
Central African Republic	2	Cape Verde	1	Belarus	4		
Chad	3	Congo, Rep.	5	Bosnia and Herzegovina	2		
Comoros	2	Cote d'Ivoire	14	Botswana	3		
Congo, Democratic Republic	8	Djibouti	3	Brazil	446		
Eritrea	1	Egypt, Arab Rep.	25	Bulgaria	31		
Ethiopia	2	El Salvador	8	Chile	116		
Gambia, The	2	Fiji	2	China	885		
Guinea	7	Georgia	14	Colombia	99		
Guinea-Bissau	2	Ghana	13	Costa Rica	32		
Haiti	6	Guatemala	24	Cuba	4		
Kenya	14	Guyana, CR	1	Dominica	2		
Korea, Dem. Rep.	1	Honduras	13	Dominican Republic	20		
Kyrgyz Republic	7	India	575	Ecuador	25		
Liberia	7	Indonesia	84	Gabon	9		
Madagascar	9	Iraq	7	Grenada	2		
Malawi	4	Kosovo	2	Hungary	2		
Mali	2	Lao PDR	13	Iran, Islamic Rep.	7		
Mozambique	11	Lesotho	1	Jamaica	9		
Myanmar	4	Mauritania	2	Jordan	12		
Nepal	7	Micronesia, Fed. Sts.	1	Kazakhstan	9		
Niger	3	Moldova, Republic of	6	Lebanon	3		
Rwanda	4	Mongolia	3	Lithuania	6		
Sierra Leone	7	Morocco	13	Macedonia, FYR	4		
Somalia	9	Nicaragua	12	Malaysia	92		
South Sudan	5	Nigeria	48	Maldives	2		
Tajikistan	8	Pakistan	66	Mauritius	11		
Tanzania	22	Papua New Guinea	3	Mexico	196		
Togo	6	Paraguay	6	Montenegro	2		
Uganda	21	Philippines	87	Namibia	1		
Zimbabwe	3	Samoa	1	Panama	18		
		Sao Tome and Principe	1	Peru	63		
		Senegal	10	Romania	20		
		Solomon Islands	1	Russian Federation	110		
		Sri Lanka	32	Serbia	2		
		Sudan	6	Seychelles	4		
		Swaziland	1	South Africa	18		
		Syrian Arab Republic	3	St. Kitts and Nevis	3		
		Timor-Leste	1	St. Lucia	1		
		Tonga	2	St. Vincent and the Grenadines	1		
		Turkmenistan	1	Suriname	1		
		Ukraine	21	Thailand	103		
		Uzbekistan	5	Tunisia	8		
		Vanuatu	4	Turkey	104		
		Vietnam	59	Uruguay	12		
		West Bank and Gaza	4	Venezuela	14		
		Yemen, Rep.	6				
		Zambia	4				
Total number of PPPs	**273**		**1,256**		**2,740**		**8**

Note: Number of PPP projects are also listed next to country name. It only covers greenfield projects and concession contracts.

Table A.2: Contract Type by Region

	Greenfield	Divestitures	Management and Lease	Concessions	Total
EAP	1,033	154	36	338	1,561
ECA	302	312	53	62	729
LAC	769	166	64	535	1,534
MENA	85	10	21	18	134
South Asia	501	27	13	223	764
SSA	247	41	62	83	433
Total	2,937	710	249	1,259	5,155

Source: World Bank's PPI dataset, UNCTAD dispute data

Note: Greenfield projects includes BOT (buil-operate, and transfer), BOO (build, own, and operate), and BLT (build, lease, and transfer) contracts in which a private entity builds and operates a project and return the facility to the government at the end of the contract. Under divestitures contract, a private entity buys an equity stake from the public sector and owns the facility. Under management and lease contract and concessions, a private entity takes over the management of the project for a given period while ownership and investment decisions remain with the state.