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Monitoring Road Works Contracts and Unit Costs for Enhanced Governance in Europe and Central Asia

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Cover photo: Rehabilitation of a section of the Kiev-Kharkov expressway, Ukraine. By Cesar Queiroz. 2010.

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EXECUTIVE SUMMARY

A specialized dataset was generated for the road sector contracts under World Bank-funded projects in 14 countries of Europe and Central Asia: Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Estonia, Georgia, Kazakhstan, Macedonia, Poland, Romania, Serbia, and Ukraine. The data sample covers 200 completed or ongoing road works contracts signed between 2000 and 2010.

The study establishes a framework for cross-country comparative assessments of the procurement and implementation processes of road works contracts financed by the Bank. Trends for each country are captured through the following indicators: (i) difference between contract values and their engineer's estimates; (ii) cost overruns; (iii) time overruns; (iv) bidding indicators for contracts with and without prequalification: number of firms that applied for prequalification, number of prequalified firms, number of firms that bought bidding documents, number of bidders, number of disqualified bidders; (v) time elapsed between bid opening and contract signing dates; (vi) cost per km of similar works; (vii) road works unit costs; and (viii) ratios between supervision contract values and the related road works contract values.

Analyzing trends and key indicators

The contract values are observed to be within a 10 percent margin of their estimated costs, generally lower than their estimates. In almost all the reviewed countries of the Europe and Central Asia (ECA) region, on average the contracted prices tend to be lower than the engineer's estimated costs, except for Armenia, Macedonia, and Serbia. The road works in Poland are contracted at a much lower value than estimated – on average 20.5 percent below the engineer's estimates.

Half of the countries in the study have cost overruns in more than 40 percent of their contracts. The largest contract cost increases during implementation are observed in Kazakhstan, Azerbaijan, and Albania. In Kazakhstan all the reviewed road works contracts signed in 2000 had their costs go up on average by almost half a value (47 percent). Azerbaijan has 75 percent of the reviewed contracts with an average cost increase of 31 percent. Albania has a 23 percent average increase in the contract values.

Engineering estimates are a better signal of actual costs than contract values. The road works are generally contracted at a lower value than their estimated costs. This, however, does not seem to affect cost increase during the implementation of works. Cost overruns due to change orders generally turn the actual contract costs close to the engineering estimates.

Two thirds of the road works contracts are awarded to local firms in the region; however, if measured by values, most of the works contracts are awarded to foreign firms. Local contractors win the highest number of the Bank-financed road works contracts in the region. Foreign contractors though have the largest share, 70 percent, of the total sample of the road works contract values across the selected countries in ECA. Local/foreign joint ventures win around 5 percent of the present sample of contracts.

The road works contracts are generally signed within the original bid validity period. Extensions of the original validity period of bids are not common in the reviewed countries of Europe and Central Asia. However, in Kazakhstan the evaluation of bids in 2000 went beyond the original bid validity period; for a number of contracts, it took more than a year from bid opening to contract signature. Romania and Serbia tend to request some extensions of time for bids evaluation (for about a week on average).

In contracts without prequalification, half of the firms that buy bidding documents do not bid in most of the reviewed countries in Europe and Central Asia. The exceptions are Armenia, Azerbaijan, and Bosnia and Herzegovina, where on average more than 70 percent of the firms that purchase bidding documents participate in tenders for road works. However, Azerbaijan tends to

disqualify more than half of their bidders in the evaluation process; this was also observed in the contracts signed in Kazakhstan in 2000.

About 30 percent of the prequalified firms do not bid. This is observed in the reviewed contracts with prequalification in Azerbaijan, Georgia, Poland, and in Albania (the output and performance based road maintenance contracts). In Ukraine, about half of the prequalified firms did not bid in the four road works contracts included in the study. In Albania, Azerbaijan, and Poland, on average 15 percent of the prequalified firms do not buy bidding documents. In Ukraine it is around 20 percent. In Georgia almost all the prequalified firms purchase bidding documents.

The average unit cost of rehabilitation and reconstruction of an inter-urban road (2-lane, 7-m wide equivalent) excluding the costs of structures is US$446,750/km. The average unit cost of new construction of an inter-urban road (2-lane, 7-m wide equivalent) excluding the costs of structures is US$1,482,157/km. The highest unit cost of rehabilitation and reconstruction works of inter-urban roads across the reviewed countries is observed in Kazakhstan (US$878,703/km) and Ukraine (US$828,523/km). The sample of roads for these two countries mostly refers to expressways, which are reconstructed at higher design standards. For example, a geometric horizontal design with a long radius of curvature and thicker pavement layers (e.g., surface, base, sub-base).

The average unit costs of road works vary substantially across the countries. On average, the highest cost of asphalt concrete is observed in Armenia at around US$222 per m^3. Asphalt concrete cost is the lowest in Azerbaijan, at US$75 per m^3; however, the cost of Portland cement concrete in the country is the highest at US$353 per m^3, which may be explained by the fact that the country imports cement, and crushed stone comes from long distances. There is a wide range of rates for asphalt layer milling per $m^{3.}$. While Poland and Serbia have the lowest rates of around US$20 per m^3 for milling of asphalt layer, in Albania it is US$116 per m^3.

Examining red flags

The presence of red flags does not prove that corrupt or fraudulent practices take place in the procurement and implementation of a contract. Rather, it is a warning signal of a potential procurement and implementation problem that may justify further investigation. At the same time, the absence of red flags does not imply that fraud or corruption did not occur.

A total of 11 types of red flags were selected for the analysis of the present sample of road works contracts in Europe and Central Asia. The benchmarks for selected indicators were the same as proposed by the study on "*Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa*," which were jointly reviewed with the World Bank's Operations Policy & Country Services (OPCS) group, as follows:

1. **Period between bid opening and contract signing date is more than 7 months;**
2. **Cost increases by more than 20 percent during implementation;**
3. **Time overrun is more than 30 percent of the originally contracted period;**
4. **Contract value is more than 20 percent above its engineers' estimate;**
5. **Half or more firms buying bidding documents do not bid;**
6. **20 percent or more of prequalified firms do not bid;**
7. **Difference between winning bid and next lowest bid is within 2 percent;**
8. **Difference between contract price and read-out bidding price is more than 10 percent;**
9. **Winning bid is not the lowest bid accepted for detailed examination;**

10. **Only one or two bidders; and**

11. **Cost per km for similar work is higher than the 75th percentile.** For the selected types of road works included in the study (rehabilitation and reconstruction of an inter-urban and secondary road, and new construction of an inter-urban road), a statistical distribution was computed so as to determine the number of contracts with cost per km above the 75th percentile.

The most frequent red flags in the sample of 200 road works contracts reviewed in Europe and Central Asia are: *(i) half or more firms buying bidding documents do not bid; (ii) the winning bid is not the lowest bid accepted for detailed examination; and (iii) time overrun is more than 30 percent of the originally contracted period.* These red flags appear in around 20 percent of the total sample. At the same time, a red flag for contracts with prequalification - *20 percent or more of prequalified firms do not bid* - appear in half of the reviewed contracts with a prequalification requirement.

In almost half of the road works contracts with complaints received by the INT, the winning bid is not the lowest bid accepted for detailed examination. This does not reflect complaints from the lowest rejected bidders as the nature of complaints is mostly of bidder collusion. The other two red flags that appear frequently across contracts with complaints are: (i) difference between winning bid and next lowest bid is within 2 percent; and (ii) cost overrun is greater than 20 percent. On average, there are 2.2 red flags per contract with a complaint received by the INT; in the overall sample of road works contracts reviewed in the study, there are, on average, 1.5 red flags per contract.

The number of red flags seems to be an important determinant factor driving cost per kilometer. The results of a regression analysis to evaluate the determinants on cost per km of rehabilitation and reconstruction of an inter-urban road suggest a strong statistical significance for the "number of red flags" variable constructed for this study. The explanatory variables tested in the model also included the World Bank's World Governance Indicators (WGI) Control of corruption index, number of bidders, number of bidders accepted for detailed examination, crude oil price per barrel, whether the country is a net oil exporter or importer, country's GNI per capita, GDP growth, and climate conditions. The results, however, should be considered carefully given the limited number of observations. A more robust analysis could be undertaken with larger cross-country samples.

The results of the analysis reinforce the idea that the diagnosis of risks to integrity could help achieve greater efficiency and development effectiveness in Bank-funded projects. It is important to continue fostering governance and attain a higher degree of control of corruption in the road sector. Close monitoring of the procurement and implementation of road works contracts provides the basis for identifying early warning signs of potential fiduciary problems and the information to address them.

1 INTRODUCTION: ADDRESSING CORRUPTION RISKS IN THE ROAD SECTOR

The World Bank increasingly targets its efforts to strengthen integrity in the road sector and address sector-specific vulnerabilities to corruption. The task teams are moving forward with more effective ways to address governance weaknesses and tackle corruption in the projects. These are some of the examples of such operational practices in the road sector:

- The Paraguay road project team developed a set of alert indicators and "red flags" together with the Bank's Integrity Vice Presidency (INT) and offered a control framework to mitigate those risks in the road maintenance project.[1] The team received an Infrastructure Networks Anticorruption Award for incorporating innovative anti-corruption elements into the project design.

- The Road Sector Development Stage III Project in Ethiopia[2] aims to strengthen the institutional capacity through a number of measures that include support in establishing and implementing systems for monitoring contractors; consultants performance, construction costs and unit rates. This system ensures that the roads agency maintains the necessary performance and cost data for assessment of estimated costs, bid prices, unit rates, and quality of works. This governance tool is also expected to function as a deterrent and correction mechanism against wrong practices or mistakes. The monitoring results will be disclosed to the public.

- The Philippines program for the National Roads Improvement and Management (APL, Phase 2) embedded several anticorruption measures in the various project components and introduced safeguards to deal with collusion and bid rigging. Specific measures include the computerization of procurement and contract management systems, a parallel independent procurement evaluation, the enhanced procurement controls to ensure the reliability of contract cost estimates; detection of over-pricing through bid analysis, enhancement of supervision control over contract variations, and dissemination of complaints mechanisms in bid documents. [3]

- In the Orissa State Roads Project of India, the anti-corruption action plan is divided along three categories: (i) *preventing corruption* through procurement reforms and business process reengineering in corruption prone sectors and service delivery institutions; (ii) *enforcement actions* through establishment of internal vigilance units and new special courts to try corruption offences; and (iii) *citizen 'voice' and public awareness* through provision of information to communities about their service delivery rights.[4]

The Bank's analytical work addressing corruption in the transport sector includes the following products:

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[1] World Bank. 2006. Project Appraisal Document for a Road Maintenance Project in Paraguay. Report No: 3642.Washington, DC.
http://imagebank.worldbank.org/servlet/WDSContentServer/IW3P/IB/2006/08/08/000090341_20060808104830/Rendered/PDF/36421.pdf

[2] World Bank. 2007. Project Appraisal Document for a Road Sector Development Stage III Project (APL3) in Ethiopia. Washington, DC. http://go.worldbank.org/YQ6YLTWH50
http://wbln0038.worldbank.org/852572430067B82D/DOC_VIEWER?ReadForm&I4_KEY=77BE17E28D22A91B85256BCF006A315B45F6D4AF75EDB7A485256ED500059556&I4_UNID=8525770000765D33852572A30076452D&

[3] World Bank.2008. Project Appraisal Document for Phase 2 of the National Roads Improvement and Management (APL) Program in the Republic of the Philippines. Washington, DC. http://go.worldbank.org/B3IKASYAM0
http://imagebank.worldbank.org/servlet/WDSContentServer/IW3P/IB/2008/04/28/000334955_20080428082019/Rendered/PDF/407640PAD0REVI17362B01off0use0only1.pdf

[4] World Bank. 2008. Project Appraisal Document for Orissa State Roads Project in India. Washington, DC.
http://go.worldbank.org/XO2TXZHME0
http://wbln1038.worldbank.org/852572430067B82D/DOC_VIEWER?ReadForm&I4_KEY=9EF55438406762FD85256BCE006A1C9A0929B22C44F5A71885257015000594 6B&I4_UNID=C91FB3B04C8198DA852573E700280259&

- In *Making Inroads on Corruption in the Transport Sector through Control and Prevention*, the authors establish an analytical framework to assess the risks of corruption in transport. They synthesize the dimension of corruption the sector, looking specifically at the types of corrupt activities prevalent in the transport sector, the state capture and administrative corruption in the road sector, the mechanics of transport corruption at the project and transaction level, and a preventive strategy for enhancing institutional integrity in transport.[5]

- A detailed corruption-mapping matrix was developed by the India transport team in a guidance note for new projects in India. It guides through each step of the project cycle addressing chances of corruption and misuse of funds. The matrix identifies activities where corruption occurs throughout three main project stages: (i) planning and design; (ii) procurement; and (iii) project execution, contract administration, monitoring and evaluation. At each stage it evaluates opportunities for corruption and recommends remedies and appropriate sanctions.[6]

- A list of quantitative indicators was developed in the "*Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa*" study to recognize and track vulnerabilities to corruption in the roads projects funded by the Bank. A new cross-country database with information on bidding, costs, performance, and other details of the Bank-financed road works contracts was created to provide a framework for cross-country comparisons of the procurement processes and implementation of road works contracts.[7]

The present study generates a specialized dataset of road sector contracts for Bank-financed projects in 14 countries of Europe and Central Asia. The data sample covers 200 completed or ongoing road works contracts signed between 2000 and 2010. Trends for each country are captured through the following indicators: (i) difference between contract values and their engineers' estimates; (ii) cost overruns; (iii) time overruns; (iv) bidding indicators for contracts with and without prequalification: number of firms that applied for prequalification, number of prequalified firms, number of firms that bought bidding documents, number of bidders, number of disqualified bidders; (v) time elapsed between bid opening and contract signing dates; (vi) cost per kilometer of similar works; (vii) road works unit costs; and (viii) ratios between supervision contract values and the related road works contract values. An inventory of risks is developed for each road works contract using a checklist of possible entry points of corrupt activities or red flags. The frequency of observations is measured for the selected types of red flags from a sample of 200 road works contracts surveyed. The contracts with complaints received by the Bank's Integrity Vice Presidency (INT) are examined separately to check if they exhibit a pattern of indicators consistent with the presence of allegations of corruption or fraud. The study looks further into the determinants of road rehabilitation and reconstruction costs. It concludes with selected recommendations to sustain the platform fostering governance and integrity in the procurement and implementation of road sector contracts under Bank-funded operations.

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[5] Paterson, W.D.O. and P. Chaudhuri, "Making Inroads on Corruption in the Transport Sector through Control and Prevention", in The Many Faces of Corruption: Tracking Vulnerabilities at the Sector Level, ed. J Edgardo Campos and Sanjay Pradhan. (Washington DC, World Bank: 2007). http://www.igac.net/pdf/publications_adb_manyfacesofcorruption.pdf

[6] World Bank.2008. *Reducing Fiduciary Risk through Increased Transparency and Accountability.* A Guidance Note for New Projects in India. Washington, DC.

[7] World Bank.2008. *Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa.* Transport Paper No. 21. *http://go.worldbank.org/6HDCYBMRT0*

2 NEW DATASET OF ROAD WORKS CONTRACTS OF WORLD BANK- FINANCED PROJECTS IN EUROPE AND CENTRAL ASIA

2.1. OBJECTIVES

The objectives of creating a new database are to establish a framework for cross-country comparisons of the procurement and implementation processes of road works contracts in Bank-financed projects in Europe and Central Asia (ECA), and facilitate measurement of the performance of road works contracting under Bank-funded operations.

2.2 DESCRIPTION OF DATA

This specialized dataset is generated for the road sector contracts under Bank-funded projects in Europe and Central Asia. It is based on the data collected from the procurement and implementation files of the road sector projects in 14 countries: Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Estonia, Georgia, Kazakhstan, Macedonia, Poland, Romania, Serbia, and Ukraine.

The data sample covers 200 road works contracts signed between 2000 and 2010. This is a random sample of completed and ongoing road sector contracts over a threshold value of US$1 million in Europe and Central Asia.[8] All contracts (in local currency) were transformed into dollars using the exchange rate indicated in the contract or (if not included) with the spot exchange rate of the bid opening date, and then inflated or deflated to 2009 constant dollars. The list of road projects and the number of road works contracts reviewed for each country is presented in Table 2.1.

Data sources

The data were obtained from the following documents and project information systems of the World Bank:[9]

Source Documents

- Bid Evaluation Reports
- Road Works Contract Documents
- Progress Reports
- Aide Memoires
- Variation Orders

Project Information Systems

- Client Connections
- Integrated Records and Information Services (IRIS3 and IRIS4)
- Projects and Operations Database/Contract Awards
- Archives and Document Management

[8] Due to a large number of low value contracts procured in Armenia and limited availability of data, two road works contracts valued at US$911,542 and US$948,314 were included into the sample for the country.

[9] While not all sources of information are publicly available, several related documents can be found on the World Bank web site at: http://www.worldbank.org/reference/

Table 2.1: List of road projects in Europe and Central Asia included in the study

Country	Project ID	Contracts signature year	Number of road works contracts
Albania	P107833- Secondary and Local Roads	2008	6
	P078949- Transport Project	2007-2009	7
	P066260- Road Maintenance Project	2002-2004	4
Armenia	P115486- Lifeline Roads Improvement Project	2009	3
	P044829- Transport Project	2001-2004	9
Azerbaijan	P094488- Highway 2	2006- 2009	7
	P040716- Highway Project	2003-2006	5
Bosnia and Herzegovina	P100792- Road Infrastructure and Safety Project	2009	5
	P071347- Road Management and Safety Project	2003-2006	13
Bulgaria	P099894- Road Infrastructure and Rehabilitation Project	2008-2009	8
Croatia	P008329- Highway Sector Project	2000	2
Estonia	P035775- Transport Project	2000-2003	7
Georgia	P112523- East-West Highway Improvement 3	2009	2
	P086277- Secondary and Local Roads Project	2005-2009	16
	P083110- First East- West Highway Improvement	2007, 2009	2
	P094044- Second East- West Highway Improvement	2008	1
	P040556- Roads Project	2001-2004	16
Kazakhstan	P099270- South- West Roads: Western Europe-Western China International Transit Corridor (CAREC 1B & 6B)	2009	14
	P008499- Road Transport Restructuring Project	2000	10
Macedonia	P107840- Regional and Local Roads Program Support Project	2009	15
	P091723- Second Trade and Transport Facilitation Project	2008	1
Poland	P008593- Roads 2 Project	2000-2004	30
Romania	P093812- Transport Sector Support Project	2007	1
	P039250- Roads 2 Project	2003	3
Serbia	P075207- Transport Rehabilitation Project	2004- 2007	9
Ukraine	P100580- Roads and Safety Improvement	2010	4
14 countries	26 Projects	2000-2010	200

2.3 MAIN VARIABLES

The present dataset builds on the dataset developed by the authors in the "*Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa*" study.[10] The variables comprise detailed bidding information covering separately contracts with prequalification and without prequalification, names and nationalities of winning bidders, as well as their read-out bid amounts. The dataset includes bid opening dates, contract signing and completion dates, and actual completion dates (if there are delays in completion of works).

The costs data include contract cost per kilometer (contracted value) for a 7m wide, 2 lane equivalent road, its estimated cost (generated by the design engineer), and actual cost (if there are variation orders). The unit cost data are segregated into the following categories: asphalt concrete (US$/$m^3$), milling of asphalt layer (US$/$m^3$), Portland cement concrete for structures (US$/$m^3$), base and sub-base courses differentiated by types (US$/$m^3$), soft earthworks (US$/m^3), and single surface treatment (US$/$m^2$).

The database classifies roadwork activities into the following categories, which are most common in the contracts financed by the Bank in the road sector of the selected countries of Europe and Central Asia: (i) rehabilitation and reconstruction; (ii) new construction; (iii) asphalt pavement overlays; (iv) single surface treatment; and (v) periodic maintenance. The roads are divided into two types: (i) inter-urban/regional; and (ii) secondary/local. A set of variables and their characteristics are presented in Table 2.2.

2.4 METHODOLOGY

The following steps are used in the analysis of the present dataset of road works contracts financed by the Bank in the selected countries of Europe and Central Asia: (i) assessment of statistical trends; (ii) examination of red flags; and (iii) performance of a regression analysis.

Statistical trends

A set of indicators is used to perform comparative assessments of the contract procurement and implementation processes in the road sector across 14 countries in Europe and Central Asia. Trends for each country are captured through the following indicators: (i) difference between contract values and their engineers' estimates; (ii) cost overruns; (iii) time overruns; (iv) bidding indicators for contracts with and without prequalification: number of firms that applied for prequalification, number of prequalified firms, number of firms that bought bidding documents, number of bidders, number of disqualified bidders; (v) time elapsed between bid opening and contract signing dates; (vi) cost per kilometer of similar works; (vii) road works unit costs; and (viii) ratios between supervision contract values and the related road works contract values.

The statistical trends are also captured for the geographical groups of contractors who implement road works contracts financed by the Bank in the region.

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[10] Alexeeva, V., G. Padam and C. Queiroz. 2008. Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa. Transport paper TP-21. Washington, DC: World Bank http://siteresources.worldbank.org/INTTRANSPORT/Resources/336291-1227561426235/5611053-1229359963828/tp_21.pdf

Table 2.2: Main variables

ROAD WORKS COSTS (a 7m wide, 2 lane equivalent road)		
Type of work	**Function**	**Type of cost**
Rehabilitation and reconstruction		Estimate (2009US$/km)
New construction	Inter-urban/Regional	
Asphalt pavement overlays	Secondary/Local	Contract (2009US$/km)
Single surface treatment		Actual (2009US$/km)
Periodic maintenance		

COSTS PER UNIT OF WORKS	
Constituent layer	**Type of layer**
Asphalt concrete (2009US$/$m^3$)	
Milling of asphalt layer (2009US$/$m^3$)	
Portland cement concrete for structures (2009US$/$m^3$)	
Portland cement concrete pavement (2009US$/$m^3$)	
Base (2009US$/$m^3$)	Gravel, crushed stone, asphalt mix/bituminous, cement stabilized
Sub-base (2009US$/$m^3$)	Gravel, crushed stone, sand
Earthworks (2009US$/$m^3$)	Soft
Surface treatment (2009US$/$m^2$)	Single, double

BIDDING	
Contracts with prequalification	**Contracts without prequalification**
Number of applicants for prequalification	
Number of prequalified firms	
Number of firms buying bidding documents	Number of firms buying bidding documents
Number of bidders	Number of bidders
Number of bidders accepted for detailed examination in the evaluation process	Number of bidders accepted for detailed examination in the evaluation process
Names and nationalities of winning bidders	
Read-out and evaluated winning bid amount	
Next lowest to winning bid amount	

DATES
Bid opening date
Contract signing date
Contract completion date
Actual completion date

SUPERVISION CONSULTANCY CONTRACTS
Names and nationalities of supervision consultants
Supervision contract value
Actual supervision contract value

Examination of red flags

A set of alert indicators is applied to recognize and track vulnerabilities to corruption in the road sector. The benchmarks for selected indicators were the same as adopted by the study on "*Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa*," which were jointly reviewed with the World Bank's Operations Policy and Country Services (OPCS) Group. [11]

The dataset is searched for the following indicators: (i) period between bid opening and contract signing dates is more than seven months; (ii) cost increases by more than 20 percent during implementation; (iii) time overrun is more than 30 percent of the originally contracted period; (iv) contract value is more than 20 percent above its engineers' estimate; (v) half or more firms buying bidding documents do not bid; (vi) 20 percent or more of prequalified firms do not bid; (vii) difference between winning bid and next lowest bid is within 2 percent; (viii) difference between contract price and read-out bidding price is more than 10 percent; (ix) winning bid is not the lowest bid accepted for detailed examination; (x) only one or two bidders; (xi) cost per kilometer of similar works is higher than the 75th percentile.

The analysis is based on the comparison of contracts with the red flags assigned to them. The frequency of the different types of red flags is revealed for the sample of 200 road works contracts across the countries of Europe and Central Asia. The contracts with complaints received by the Bank's Integrity Vice Presidency (INT) are examined separately to check if they exhibit a pattern of indicators consistent with the presence of allegations of corruption or fraud.

Regression analysis

A single OLS regression analysis is used to evaluate the determinants on cost per kilometer of road works. The dependent variable is the actual cost per km of rehabilitation and reconstruction of an inter-urban road. The explanatory variables that are tested in the model include the "number of red flags" variable constructed for this study, the World Bank's WGI Control of corruption index, number of bidders, number of bidders accepted for detailed examination, crude oil price per barrel, a net oil exporter or importer country, country's GNI per capita, GDP growth, and climate conditions.

2.5 RECORDS MANAGEMENT: OBSERVATIONS AND SUGGESTIONS

The main contract files, such as bid evaluation reports and copies of the signed road works contracts, are not filed systematically in the Integrated Records Management System of the Bank (IRIS). The system contains extensive project information and documentation; however, it is often difficult to retrieve both a bid evaluation report and a signed contract document for the same contract. A continued effort to underscore the importance of the availability of information would lead to timely access and efficiency in information processing for operational and analytical purposes.

The progress reports to monitor performance of contractors are often missing in the electronic information system of the Bank. Only a small number of the revised road works contracts have the corresponding progress reports filed in IRIS, including the final progress report. A progress report is probably the only file that helps track the performance of a contractor. It documents in detail the progress, completion, and quality of works of a contractor. A more systemized method to file the road works progress reports would create a platform to measure performance more consistently that would help address inefficiencies that arise in the procurement and implementation processes of the road works contracts.

[11] Alexeeva, Victoria, G.Padam and C.Queiroz.2008. Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa. Transport paper TP-21. Washington, DC: World Bank http://siteresources.worldbank.org/INTTRANSPORT/Resources/336291-1227561426235/5611053-1229359963828/tp_21.pdf

Most often, if a file is not scanned in the Integrated Records Management System of the Bank (IRIS), it is harder to find it in a hard copy. The record- keeping practices across country offices are quite uneven. If not filed electronically, it is possible to request the missing files from the local office. While some field offices respond with a full set of requested documentation, others fail to provide them. Improved filing of the procurement and implementation documentation of the Bank-financed projects in the field could facilitate the related work in other Bank's country offices and headquarters.

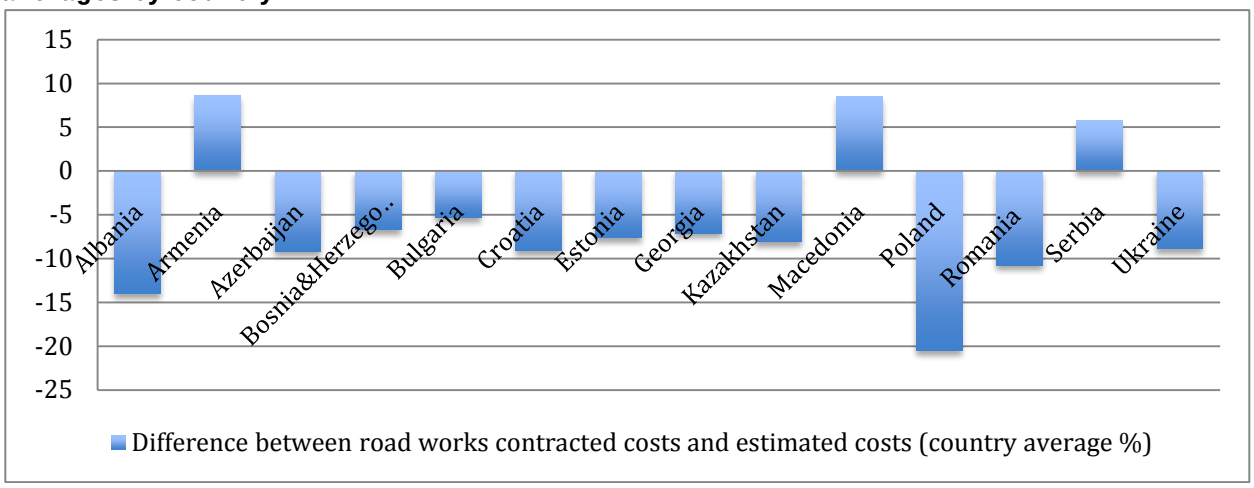
3 ANALYZING TRENDS AND KEY INDICATORS

This section examines the statistical trends of the contract procurement and implementation processes in the road sector projects across the selected countries of Europe and Central Asia. The indicators are selected through the entire project cycle covering the design, contract procurement and implementation, and supervision processes.

3.1 ENGINEER'S ESTIMATE AND CONTRACTED VALUE

The contract values are observed to be within a 10 percent margin of their estimated costs, generally lower than their estimates. In almost all the reviewed countries of the Europe and Central Asia Region, on average the contracted prices tend to be below the estimated costs, except for Armenia, Macedonia, and Serbia. The road works contracts in the Armenia sample of the study are all higher than their engineer's estimates, within a 3.6 and 12.4 percent range. The contract values in Macedonia range from 13.3 percent below the estimate up to 40.2 above the estimate. In Serbia the values range from 44.3 percent below the estimate up to 89.2 percent above the estimate. This, however, may be the result of an original design underestimation: in 2004 and 2005 the contract costs were 65 percent over their engineer's estimate on average, while the contracts signed in 2006 and 2007 were 24 percent on average below the engineer's estimates. A large difference between contract values and engineer's estimates could be also explained by the fact that in many cases cost estimates are prepared at the time of project appraisal based on a feasibility study and then not updated until a contract award. The road works in Poland are contracted at a much lower value than estimated- on average 20.5 percent below the engineer's estimates (see Figure 3.1).

Figure 3.1: Difference between contracted costs and estimated costs of road works, averages by country

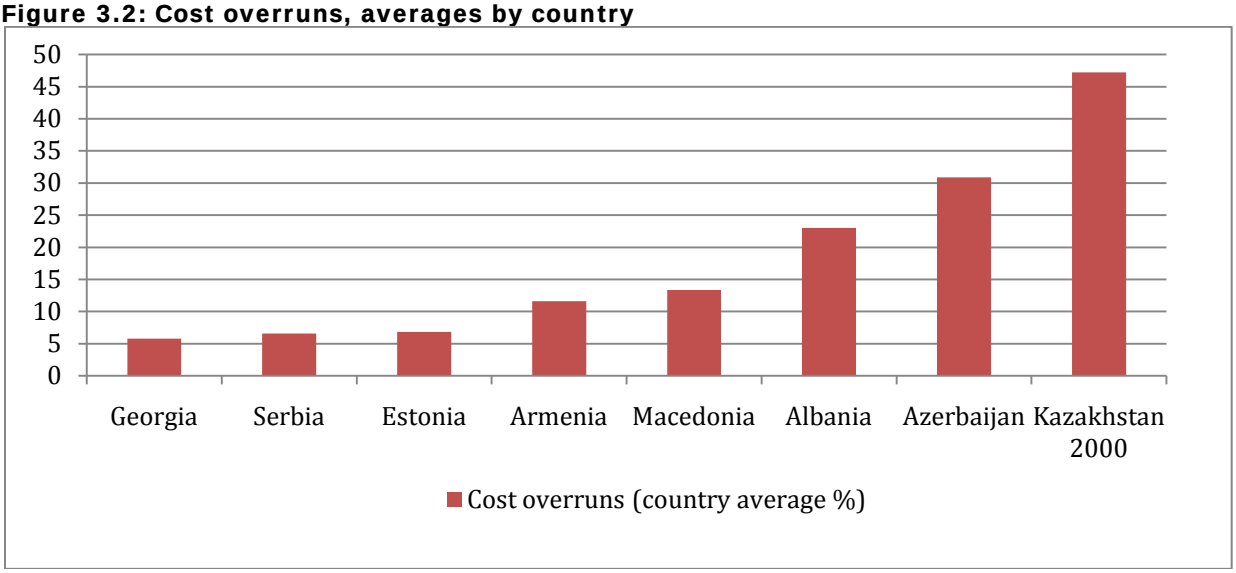


For the contracts with values much above their engineer's estimates, it would be important to verify if the cost estimates are updated before launching the procurement process and whether they are prepared based on the detailed engineering designs.

3.2 COST OVERRUNS

The largest contract cost increases during implementation are observed in Kazakhstan,[12] Azerbaijan, and Albania. In Kazakhstan all the reviewed road works contracts signed in 2000 had their costs go up on average by almost half a value (47 percent); Azerbaijan has an average cost increase of 31 percent; Albania a 23 percent average increase. In Armenia, Estonia, Georgia, and Serbia the average cost overruns do not exceed 15 percent, which is the threshold requiring an official no-objection letter from the Bank (see Figure 3.2). There are almost no cost overruns in Poland; one contract increased its value by 18 percent among 30 completed road works contracts for the country. Half of the countries in the study have cost overruns in more than 40 percent of their reviewed contracts.

Figure 3.2: Cost overruns, averages by country



However, if the actual costs (observed after works implementation) are compared with the works estimated costs, the actual road works costs in Azerbaijan exceed their estimated costs by only 8 percent on average. Compared to the estimated costs, in Albania the costs of road works raise on average by 12 percent during implementation. The highest cost increase in relation to the estimated costs is observed in the reviewed contracts in Armenia of around 21 percent on average (see Table 3.1). The contracted prices in the 12 reviewed contracts in Armenia are all above their estimated costs, within a 3.6 and 12.4 percent range.

Table 3.1: Difference between actual contract costs and estimated costs, averages by country

Country	Difference between actual costs and estimated costs (average %)
Armenia	20.9
Albania	12.0
Azerbaijan	7.9

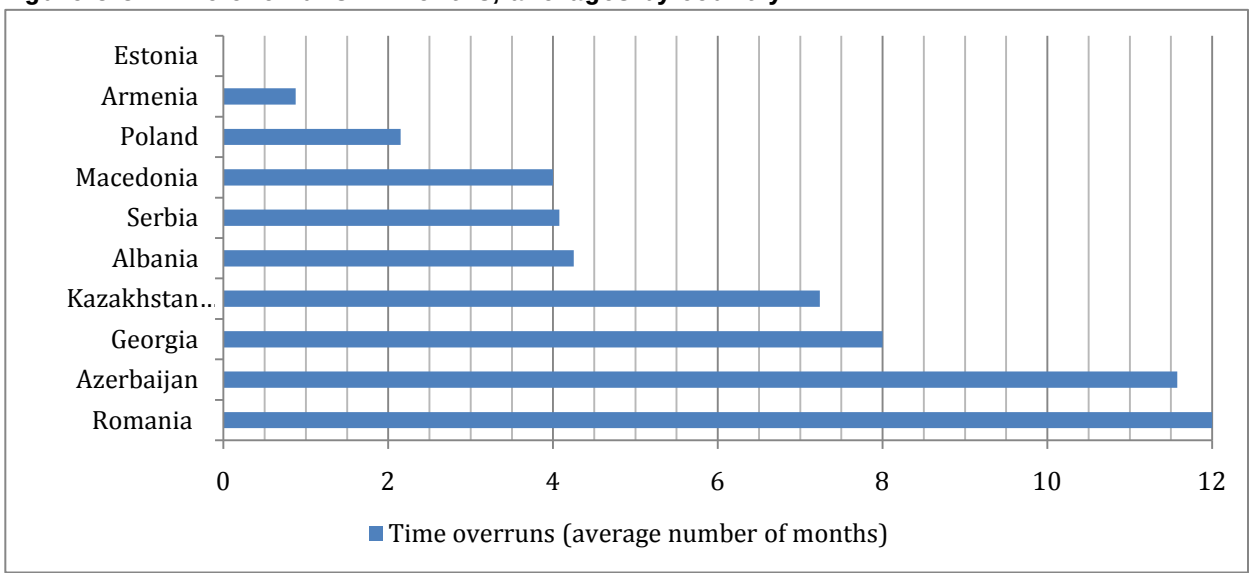
An analysis was also done to see if the bidders are intentionally quoting very low bids to win the contract and then try to compensate the difference through variation orders during works implementation. No significant correlation between bid prices lower than estimated costs and subsequent amount of variation orders during contract implementation was found.

3.3 TIME OVERRUNS

[12] The road works contracts signed in 2000 under the P008499 Road Transport Restructuring Project.

The average delay in completion of works varies across the selected countries of Europe and Central Asia. The longest extensions of time for up to a year to complete the road works are registered in Azerbaijan and Romania. In Romania, a delay of one and a half year in two contracts of new construction works is largely related to the land expropriation issues and the diversion of public utilities. In Azerbaijan, all the reviewed completed contracts are delayed by almost a year; this may be attributed to a late commencement of road works observed in the implementation processes in the country. In Georgia, the works are delayed by eight months on average in 42 percent of the reviewed completed contracts and by seven months in Kazakhstan in 80 percent of the road works contracts signed in 2000. An average delay of four months is observed in all the reviewed contracts in Serbia and in around a half of the contracts in Albania and Macedonia. Poland and Armenia extend their contract completion dates by one or two months in around 35 percent of the reviewed contracts. The reviewed road works contracts in Estonia are completed on time (see Figure 3.3). There are recently signed road works contracts in Bulgaria and Ukraine included in the sample.

Figure 3.3: Time overruns in months, averages by country



3.4 BIDDING

A detailed analysis is carried out to make comparative assessments of the bidding processes in 14 countries in Europe and Central Asia based on the selected indicators. The bidding data are separately examined for the contracts with prequalification and without prequalification in each country. The range of values for the reviewed contracts without prequalification is between US$911,542[13] (Armenia) and US$28,360,946[14] (Bulgaria). The range of values of the contracts with prequalification is US$1,451,426 (an output and performance based contract in Albania) and US$75,398,815 (Ukraine)[15]. In the sample, 25 percent of the reviewed contracts are procured with a prequalification requirement.

Contracts without prequalification

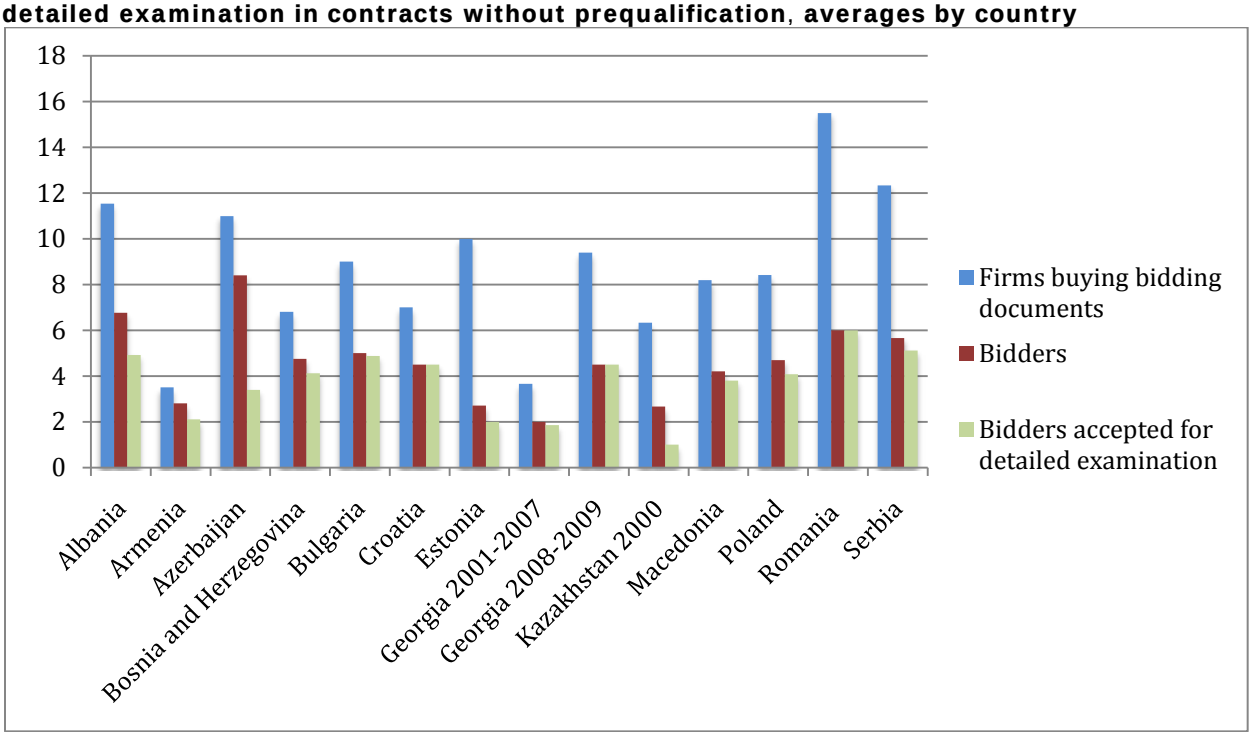
[13] Two contracts of US$911,542 and US$948,314 in Armenia are included in the study, which are below a US$1 million threshold of the contracts values in the sample. This is due to a large number of low -value contracts in Armenia and limited availability of data.

[14] All eight contracts reviewed in Bulgaria with a range of values between US$2,772,237 and US$28,360,946 were procured without a prequalification requirement.

[15] The highest value contract with prequalification in the sample is US$101,348,108 in Kazakhstan, however a bidding analysis (except for a firms pre-qualifying process) was not performed on the contracts signed in 2009 in Kazakhstan.

Half of the firms buying bidding documents do not bid in most of the reviewed countries in Europe and Central Asia. The exceptions are Armenia, Azerbaijan, and Bosnia and Herzegovina, where on average more than 70 percent of the firms that purchase bidding documents participate in tenders for road works. However, Azerbaijan tends to disqualify more than half of their bidders in the evaluation process; this was also observed in Kazakhstan[16]. These are the only two countries with such a high rate of bidders' disqualification; the other countries in the sample of contracts without prequalification accept on average from 75 to 100 percent of bidders for detailed examination. Estonia has a particularly low rate of bidders relative to a number of firms that buy bidding documents. Low participation in the bidding processes was observed in Georgia up to the years of 2008 and 2009 when the number of firms and bidders more than doubled (see Figure 3.4).

Figure 3.4 Number of firms buying bidding documents, bidders, and bidders accepted for detailed examination in contracts without prequalification, averages by country

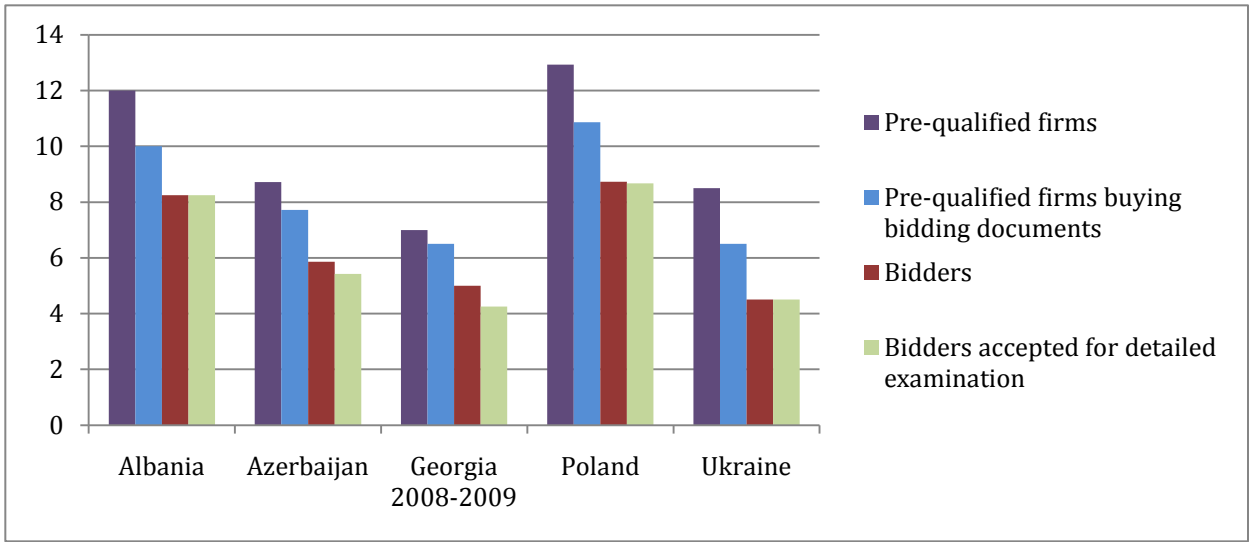


Contracts with prequalification

About 30 percent of the prequalified firms do not bid. This is observed in the reviewed contracts with prequalification in Albania[17], Azerbaijan, Georgia, and Poland. In Ukraine, about half of the prequalified firms did not bid in the four road works contracts selected for the study. On average, 15 percent of the prequalified firms do not buy bidding documents in Albania, Azerbaijan, and Poland, and around 20 percent in Ukraine; in Georgia almost all the prequalified firms purchase bidding documents. In Poland, Ukraine, and the output and performance based contracts in Albania all the prequalified bidders are accepted for detailed examination. In Azerbaijan some are disqualified; while on average around 20 percent of prequalified bidders are disqualified in Georgia during the evaluation process (see Figure 3.5).

Figure 3.5: Number of prequalified firms, firms buying bidding documents, bidders, and bidders accepted for detailed examination in contracts with prequalification, averages by country

[16] The road works contracts signed in 2000 under the P008499 Road Transport Restructuring Project
[17] The output and performance based road maintenance contracts under the Transport project (P078949)



The applicants for prequalification are prequalified to bid at varying degrees across the reviewed countries. The highest number of applicants for prequalification is observed in Kazakhstan (35 firms on average). At the same time, only 56 percent of them, on average, are prequalified. In Georgia, Azerbaijan, Poland, and Ukraine there are between 11 and 15 firms on average applying for prequalification. In Georgia only around 55 percent of firms are prequalified. On average, 75 percent of applicants pass prequalification in Azerbaijan, 83 percent in Ukraine, and 90 percent in Poland (see Table 3.2)

Table 3.2: Percentage of firms passing prequalification, averages by country

Country	%
Poland	90
Ukraine	83
Azerbaijan	75
Kazakhstan	56
Georgia	55

Time elapsed between bid opening and contract signing dates

The road works contracts are generally signed within the original bid validity period. Extensions of the original validity period of bids are not common in the reviewed countries of Europe and Central Asia. In most of the countries the contracts in the sample are signed on average within the originally specified 90 or 120 days. However, in Kazakhstan the evaluation of bids in 2000 went beyond the original bid validity period; for a number of contracts, it took more than a year from bid opening to contract signature. Romania and Serbia tend to request some extensions of time for bids evaluation—for about a week on average (Table 3.3). The time elapsed between bid opening and contract signing dates does not seem to depend on the size of road works contracts in the sample.

Table 3.3: Time elapsed between bid opening and contracts signing dates, by country

Country	Average period between bid opening and contract signing dates (days)
Estonia	41.0
Bosnia and Herzegovina	41.7
Georgia	45.3
Ukraine	84.3
Armenia	84.7
Albania	88.7
Poland	101.6
Macedonia	107.7
Bulgaria	114.7
Azerbaijan	116.4
Romania	123.5
Serbia	126.7
Kazakhstan (2000)	249.4

3.5 COSTS PER KILOMETER OF ROAD WORKS

The cost per kilometer of road works is calculated for a 2-lane, 7m- wide road equivalent per type of work: (i) rehabilitation and reconstruction; (ii) new construction; (iii) asphalt pavement overlays; (iv) single surface treatment; and (v) periodic maintenance. It is further disaggregated per type of road: (i) inter-urban/regional, and (ii) secondary/local.

The cost per kilometer of road works does not include the cost of structures. Major bridge/overpass works costs are subtracted from the total contract cost based on the bills of quantities. This also includes a value added tax applied to the contract cost. All costs (in local currency) are transformed into US dollars using the exchange rate indicated in the contract or (if not included) with the spot exchange rate of the bid opening date, and then inflated or deflated to 2009 constant dollars.

There are a number of significant factors that influence the road works costs per kilometer of similar nature that are not captured in the present analysis. The variations in prices could be explained by factors such as type of terrain and soil, the existing road condition, the availability of materials and their transport, the technical complexity of road works.

The highest unit cost of rehabilitation and reconstruction works of inter-urban roads across the reviewed countries is observed in Kazakhstan (US$878,703/km) and Ukraine (US$828,523/km). The sample of roads for these two countries mostly refers to expressways, which are reconstructed at higher design standards, for example a geometric horizontal design with a long radius of curvature and thicker pavement layers (e.g., surface, base, sub-base). The lowest road rehabilitation and reconstruction costs are observed in Croatia and Estonia (see Table 3.4).

Table 3.4: Cost per kilometer of a 2-lane, 7m wide road equivalent by type of work and road:
A: Rehabilitation and reconstruction, averages by country

REHABILITATION AND RECONSTRUCTION (2009 US$/KM)		
Country	**Inter-urban/ regional**	**Secondary/ local**
Albania		236,449
Armenia	186,876	
Azerbaijan	413,945	
Bulgaria	417,284	
Croatia	169,474	
Estonia	182,283	
Georgia	220,797	147,424
Kazakhstan	878,703	
Macedonia		172,430
Poland	479,540	
Serbia	235,099	
Ukraine	828,523	

B: New construction, averages by country

NEW CONSTRUCTION (2009 US$/KM)	
Country	**Inter-urban/ regional**
Albania	822,746
Azerbaijan	1,656,151
Georgia	1,546,638
Poland	1,596,966
Romania	1,668,658

C: Asphalt pavement overlays and single surface treatment, averages by country

ASPHALT PAVEMENT OVERLAYS (2009 US$/KM)			SINGLE SURFACE TREATMENT (2009 US$/KM)
Country	**Inter-urban/ regional**	**Secondary/ local**	**Inter-urban/ regional**
Bosnia and Herzegovina		62,286	
Georgia			91,682
Kazakhstan	133,524		

D: Cost per kilometer of periodic maintenance, averages by country

PERIODIC MAINTENANCE (2009 US$/KM)	
Country	**Inter-urban/ regional**
Albania	34,037
Serbia	23,463

The average unit cost of rehabilitation and reconstruction of an inter-urban road (2-lane, 7m-wide equivalent) excluding the costs of structures is US$446,750/km. The average unit cost of new construction of an inter-urban road (2-lane, 7m-wide equivalent) excluding the costs of structures is US$1,482,157/km (see Table 3.5).

Table 3.5: Quartiles and averages of costs per km of an inter-urban road, by type of work (2009 US$)

Type of work	First Quartile	Mean	Third Quartile
New construction	1,111,211	1,482,157	1,888,305
Rehabilitation and Reconstruction	192,239	446,750	687,276
Rehabilitation and Reconstruction *(Secondary roads)*	126,606	172,712	203,555
Asphalt pavement overlays	115,626	130,026	134,107
Single surface treatment	73,850	91,682	103,694
Periodic Maintenance	24,732	30,512	36,202

The averages and quartiles of cost per kilometer of similar works are calculated based on the reviewed sample of road works contracts signed between 2000 and 2010 in each country. The comparison of road works costs across the selected countries in a certain year was not possible due to a large variability in years when the contracts were signed. Therefore, all the contract values were converted into 2009 constant dollars. However, even if inflation adjusted, it was noticed in the analysis that the costs of road works increased over the years.

3.6 ROAD WORKS UNIT COSTS

The average unit rates are presented in the tables below for each country under review. The unit costs were collected from the bills of quantities of the road works contracts and transformed into dollars using the exchange rate indicated in the contract or (if not included) with the spot exchange rate of the bid opening date, and then inflated or deflated to 2009 constant dollars.

The average rates of the selected unit costs of road works vary substantially across the countries. On average, the highest cost of asphalt concrete is observed in Armenia at around US$222 per m^3. Asphalt concrete cost is the lowest in Azerbaijan, at US$75 per m^3; however the cost of Portland cement concrete in the country is the highest at US$353 per m^3, which may be explained by the fact that the country imports cement and the crushed stone comes from long distances. There is a wide range of rates for asphalt layer milling per m^3. While Poland and Serbia have the lowest rates of around US$20 per m^3 for milling of asphalt layer, in Albania it is US$116 per m^3 (see Table 3.6).

Table 3.6: Unit costs of road works, averages by country:

A: Average unit rates of asphalt concrete, milling of asphalt layer, Portland cement concrete, and Portland cement concrete pavement, by country

ASPHALT CONCRETE, PORTLAND CEMENT CONCRETE				
Country	Asphalt concrete (2009US$/$m^3$)	Milling of asphalt layer (2009US$/$m^3$)	Portland cement concrete (2009US$/$m^3$)	Portland cement concrete pavement (2009US$/$m^3$)
Albania	167	116	107	
Armenia	222			
Azerbaijan	75		353	
Bosnia and Herzegovina	153	45		
Bulgaria	189	32	173	
Estonia	86	40		
Georgia	145	84	128	
Kazakhstan	135			
Macedonia	140			
Poland	129	20	116	
Romania	145	32	80	
Serbia	176	22		133
Ukraine	153		160	117

B: Average unit rates of gravel, crushed stone, asphalt mix/bituminous, and cement stabilized base course, by country

BASE COURSE				
Country	Gravel (2009US$/m^3)	Crushed stone (2009US$/m^3)	Asphalt mix/ bituminous (2009US$/m^3)	Cement stabilized (2009US$/m^3)
Albania		17	152	
Armenia		40		
Azerbaijan			77	
Bosnia and Herzegovina	16			
Bulgaria	20		139	
Estonia		18		
Georgia				
Kazakhstan		27		
Macedonia		20	111	
Poland	32	41	98	23
Romania			108	
Serbia		28	113	
Ukraine			106	32

C: Average unit rates of gravel, crushed stone, and sand sub-base course, by country

SUBBASE COURSE			
Country	Gravel (2009US$/m^3)	Crushed stone (2009US$/m^3)	Sand (2009US$/m^3)
Albania	9		
Azerbaijan	18		
Bosnia and Herzegovina	17		
Georgia		13	
Kazakhstan	22		
Romania	15	40	17

D: Average unit rates of soft earthworks, by country

Country	SOFT EARTHWORKS (2009US$/M^3)
Albania	4
Azerbaijan	3
Bulgaria	4
Estonia	3
Georgia	5
Kazakhstan	1
Macedonia	3
Poland	2
Romania	4
Ukraine	1

E: Average unit rates of single surface treatment, by country

SURFACE TREATMENT		
Country	**Single (2009US$/m²)**	**Double (2009US$/m²)**
Georgia	2	4
Serbia		4

Table 3.7 presents the averages of road works unit costs and the average cost per km per month of four output and performance based road maintenance contracts reviewed in Albania. The unit costs of works for such contracts turn to be higher than those for traditional contracts in the country.

Table 3.7: Average unit rates and cost per kilometer per month of road maintenance works in the output and performance based contracts in Albania

Albania: Output and performance based contracts					
Asphalt concrete (2009 US$/m³)	Portland cement concrete (2009 US$/m³)	Crushed stone base (2009 US$/m³)	Gravel sub-base (2009 US$/m³)	Soft earthworks (2009 US$/m³)	Road maintenance (2009 US$/km-month)
257	189	26	15	11	673.5

If compared by the contracts with prequalification and without a prequalification requirement, the average unit costs of road works on a 2-lane, 7m-wide inter-urban road equivalent are higher in the contracts with prequalification (see Table 3.8). The contracts with prequalification are generally more complex by nature.

Table 3.8: Average cost per kilometer of a 2-lane, 7m-wide inter-urban road in contracts with and without prequalification

	Rehabilitation and reconstruction (2009US$/km)	**New construction (2009US$/km)**
Contracts without prequalification	309,344	1,231,833
Contracts with prequalification	577,283	1,607,319

In the contracts with and without prequalification, the average unit rates of asphalt concrete per m³ are almost the same, while the rate of Portland cement concrete per m³ is much higher in contracts with prequalification, which is mainly due to the two contracts in Azerbaijan (where the unit costs are US$499/m³ and US$602/m³). At the same time, the average asphalt mix/bituminous base rate per m³ is lower in the contracts with prequalification, including milling (see Table 3.9). Overall, there are 25 percent of contracts with prequalification in the present sample.

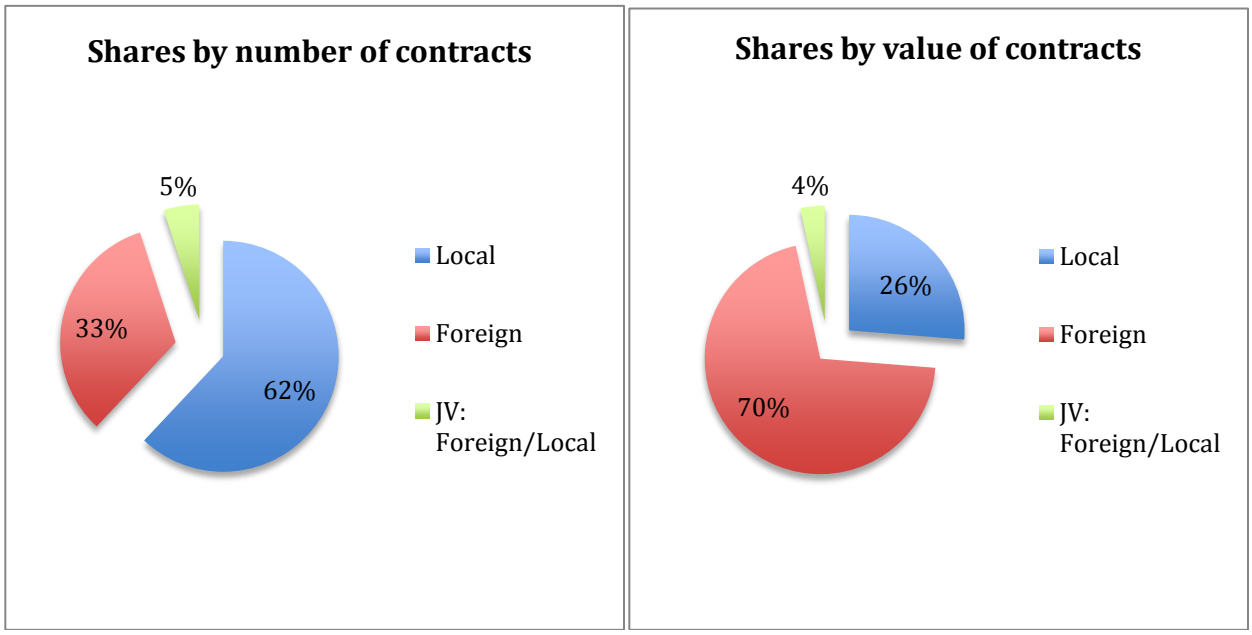
Table 3.9: Average unit costs of road works in contracts with and without prequalification

Units of road works	Average costs of road works units (2009US$/km)	
	Contracts without prequalification	Contracts with prequalification
Asphalt concrete (2009US$/$m^3$)	149.8	157.5
Milling of asphalt layer (2009US$/$m^3$)	40.5	13.1
Portland cement concrete (2009US$/$m^3$)	149.7	226.9
Gravel base (2009US$/$m^3$)	17.4	23.1
Crushed stone base (2009US$/$m^3$)	23.9	27.3
Asphalt mix/ bituminous base (2009US$/$m^3$)	126.4	97.1
Gravel subbase (2009US$/$m^3$)	10.0	17.3
Soft earthworks (2009US$/m3)	3.3	3.9

3.7 CONTRACTORS

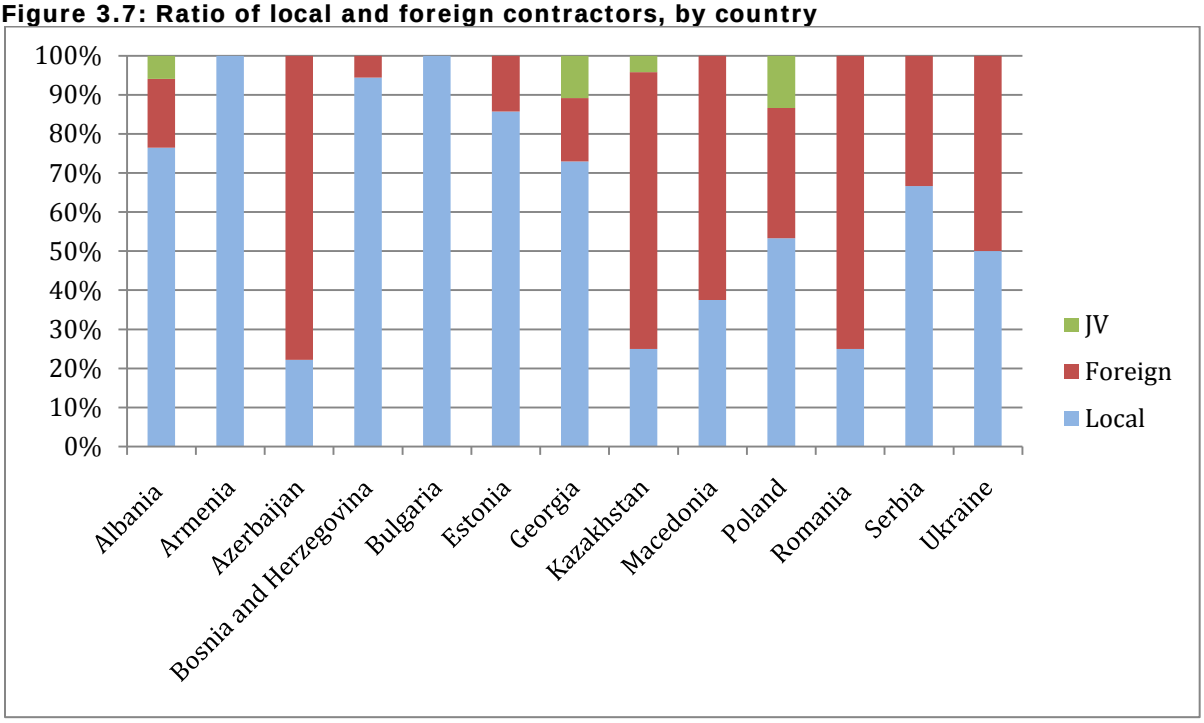
Two thirds of the road works contracts are awarded to local firms in the region; however, if measured by values, most of the larger works contracts are awarded to foreign firms. Local contractors win the highest number of the Bank-financed road works contracts in the region. Foreign contractors though have the largest share, 70 percent, of the total sample of the road works contract values across the selected countries in Europe and Central Asia. Local andforeign joint ventures win around 5 percent of the present sample of contracts (see Figure 3.6).

Figure 3.6: Percentage share of road works contracts by geographical group



The ratio of the local and foreign contractors implementing road works varies by country. In Azerbaijan and Kazakhstan the largest share of contracts is awarded to foreign contractors, mainly due to a large number of high value works procured in the countries. In Bulgaria, all the reviewed road works contracts with a median value of US$20,350,172 are awarded to local contractors. In Macedonia around 40 percent of the contracts are split between two local companies and one foreign company implements 60 percent of the road works in the reviewed sample of 16 contracts in the country (see Figure 3.7).

Figure 3.7: Ratio of local and foreign contractors, by country



If compared by a number of statistical indicators related to the procurement process and implementation of road works contracts, local and foreign contractors are within a close range. On average, the local and foreign contractors bid below the engineers' estimate by 8 and 11 percent respectively. Delays are about five and a half month for both types of contractors, and the average cost increase is 16 percent for the local contractors and 20 percent for the foreign contractors during the implementation of works. The foreign contractors have higher costs to carry out the rehabilitation and reconstruction works of inter-urban roads in the region what may be related to the technical complexity of road works. It takes a longer period to evaluate bids and sign a contract awarded to a foreign contractor of around 130 days; this may be explained by the fact that the foreign contractors generally implement large works of higher value across the reviewed countries in Europe and Central Asia (see Table 3.8).

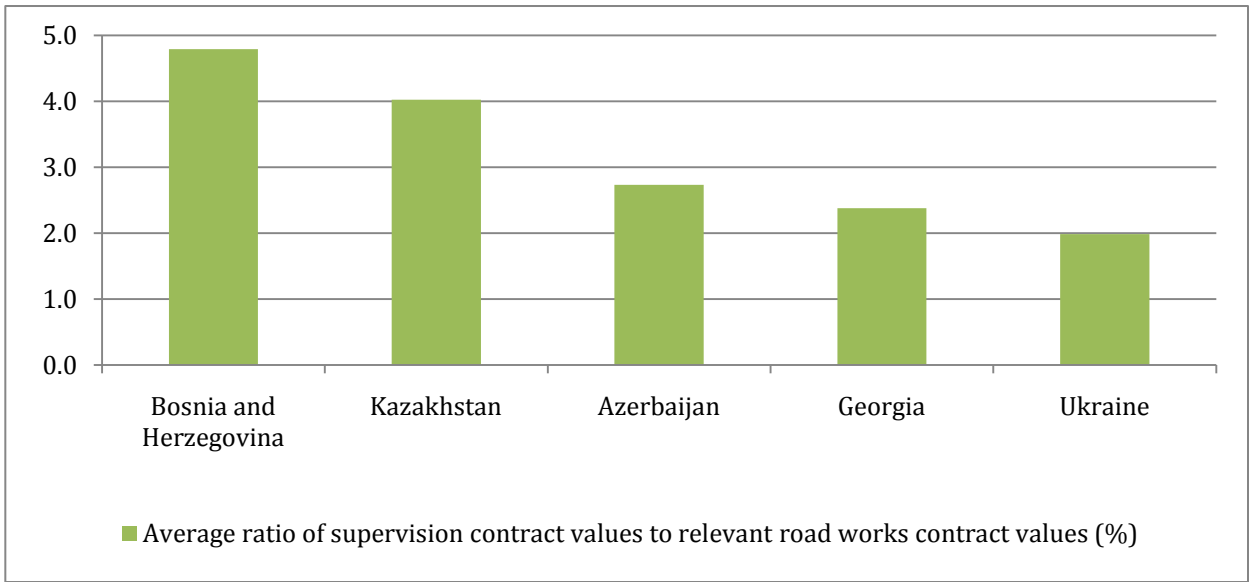
Table 3.10: Statistical averages by geographical group

	Diff between contract value and estimate (%)	Period between bid opening and contract signing dates (days)	Increase over contract value (%)	Delays (months)	Rehabilitation & reconstruction (2009US$/km)
Local	-8.2	73.3	15.9	5.6	308,693
Foreign	-10.9	130.9	19.6	5.3	496,105

3.8 SUPERVISION COSTS OF ROAD WORKS

The ratios of supervision contract values are between 2 and 5 percent of their relevant road works contract values in Azerbaijan, Bosnia and Herzegovina, Georgia, Kazakhstan, and Ukraine (see Figure 3.8). The average supervision cost per kilometer of rehabilitation and reconstruction works of an inter-urban road (2-lane, 7-m wide equivalent) is on average around US$17,000 in Ukraine and US$16,000 in Azerbaijan.

Figure 3.8: Ratio of supervision contract values to road works contract values, averages by country



In the reviewed countries in Europe and Central Asia, often a supervision consultant is awarded a contract to supervise several road works contracts divided into lots of the same road or multiple road works contracts procured under the project. It was possible in the sample to calculate the average ratios only in a number of countries where data was available. Also, some supervision contracts included supervision of a tunnel or bridge construction; therefore the average supervision cost per kilometer of similar works could be calculated for only two countries in the sample.

For the analysis of cost and time overruns, it would be interesting to distinguish between independent consultants and government's own supervision; the presumption is that the presence of independent construction supervision helps minimize cost and time overruns. Such analysis was not possible in the present sample due to the limited number of supervision consultancy contracts.

4 EXAMINATION OF RED FLAGS

This section makes an overview of the different types of red flags or alert indicators of the potential entry points of corrupt activities at various stages of the project cycle. It suggests eleven types of red flags for the analysis of the present sample of road works contracts in Europe and Central Asia. The benchmarks for selected indicators were the same as proposed by the study on "*Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa*", which were jointly reviewed with the World Bank's Operations Policy and Country Services (OPCS) Group. An inventory of risks is developed for each road works contract using the checklist of red flags. The analysis looks at the frequency of presence of different types of red flags in the sample. Based on the comparison of the road works contracts with complaints received by the Bank's Integrity Vice Presidency (INT) and other contracts in the sample, it is examined if the data exhibit a pattern of indicators consistent with the presence of allegations of corruption or fraud.

4.1 OVERVIEW OF RED FLAGS IN THE PROCUREMENT OF ROAD WORKS CONTRACTS

Red flags in the procurement of road works contracts are applicable to a contract procurement process in general. The following examples of red flags are selected from the software developed by Conan Albrecht as a technology based tool of fraud detection[18]:

Project identification and design:

- Winning bid too high compared to cost estimates;
- Estimates for items on one contract are significantly higher than the same item on other contracts;
- Specifications are significantly narrower or broader than similar previous requests for bids;
- Unreasonably narrow contract specifications; and
- Similarity between specifications and winning contractor's product or services.

Bidding stage:

- Bid amounts are too high;
- One bid is far too low compared to the rest;
- Winning bid just under the next lowest bid;
- Bids have round numbers;
- Bid line items that are exact percentages of one another (from two competing bids);
- Bid prices are identical or similar to prior or other bid;
- Bid amounts for items on one contract are significantly higher than the same item on other contracts;
- Particular line item bids appear to be unreasonably low compared with past bids of the product;
- Winning bid was not the lowest bid;
- Only one or a few bidders respond to request for bids;
- A significant number of qualified bidders fail to bid;
- All bidders but one are disqualified for being technically nonresponsive;
- High rate of rejections;
- A qualified bidder disqualified for questionable reasons;
- Same bidder is always last;
- Security deposit has a sequential check number;
- Apparent connections between bidders: common addresses, personnel, phone numbers, etc.;
- Winning bid too high compared to similar jobs; and
- Winning bid too high compared to industry averages.

Implementation and supervision:

- Rotation of winning bidders by job, type of work or geographical area;
- High number of competitive or sole source awards to one supplier;
- Apparent high prices compared to similar contracts;
- Multiple awards for similar work are given to the same contractor;
- Persistent high prices over time;

[18] Albrecht, Conan. 2007. Fraud detection software

- Low quality, poor performance and high volume of complaints;
- Pattern of low bid award followed by change orders that increase the price of the contract;
- Pattern of low bid award followed by change orders that increase the scope of the contract;
- Pattern of low bid award followed by change orders that extend the contract period; and
- Unusual or unexplained high volume purchases of products or services from a particular supplier.

Box 4.1 contains a number of red flags developed by the Federal Highway Administration of the U.S. Department of Transportation to detect collusive practices ad bid rigging in highway construction contracts.

Box 4.1: Detection of Collusion and Bid Rigging in Highway Construction Contracts

In an effort to detect and prevent contract bid rigging in highway construction contracts, the Federal Highway Administration of the U.S. Department of Transportation identifies the following bidding patterns that indicated collusion in the past:

- Certain contractors repeatedly bid against one another or, conversely, certain contractors do not bid against one another;
- The successful bidder repeatedly subcontracts work to companies that submitted higher bids on the same projects or that picked up bid packages but did not submit bids;
- Different groups of contractors appear to specialize in federal, state, or local jobs exclusively;
- An unusual disparity in front-end or lump sum payment items among the bidders;
- A particular contractor always winning in a certain geographical area;
- Contractors who bid frequently, but never win;
- Identical bid amounts on a contract line item by two or more contractors. Some instances of identical line item bids are explainable, as suppliers often quote the same prices to several bidders. But a large number of identical bids, or identical bids on any service-related item, should be viewed critically;
- Contractors previously convicted of bid rigging in other states who are operating in the state under review;
- Joint venture bids where either contractor could have bid individually as a prime;
- Failure of original bidders to rebid, or an identical ranking of the same bidders upon rebidding, where original bids were rejected for being too far over estimate; and
- Discrepancies in similar line items bid by a given firm on different projects in the same general area at the same letting or on comparable projects at different lettings within a relatively short time period.

Source: U.S. Department of Transportation. Suggestions for the Detection and Prevention of Construction Contract Bid Rigging. The Interdepartmental Bid Rigging Investigations Coordinating Committee, Federal Highway Administration http://www.fhwa.dot.gov/programadmin/contracts/dotjbid.cfm

4.2 SELECTION OF RED FLAGS FOR THE ANALYSIS: TYPES AND BENCHMARKS

A total of 11 types of red flags were selected for the analysis of the present sample of road works contracts in Europe and Central Asia. The benchmarks for selected indicators were the same as proposed by the study on "*Monitoring road works contracts and unit costs for enhanced governance in Sub-Saharan Africa*", which were jointly reviewed with the World Bank's Operations Policy and Country Services (OPCS) group, as follows:

1. **Period between bid opening and contract signing dates is more than 7 months;**

2. **Cost increases by more than 20 percent during implementation;**

3. **Time overrun is more than 30 percent of the originally contracted period;**

4. **Contract value is more than 20 percent above its engineers' estimate;**

5. **Half or more firms buying bidding documents do not bid;**

6. **20 percent or more of prequalified firms do not bid;**

7. **Difference between winning bid and next lowest bid is within 2 percent;**[19]

8. **Difference between contract price and read-out bidding price is more than 10 percent;**

9. **Winning bid is not the lowest bid accepted for detailed examination;**

10. **Only one or two bidders; and**

11. **Cost per km for similar work is higher than the 75th percentile.** For the selected types of road works included in the study (rehabilitation and reconstruction of an inter-urban and secondary road, and new construction of an inter-urban road), a statistical distribution was computed so as to determine the number of contracts with cost per kilometer above the 75th percentile.

4.3 FREQUENCY OF RED FLAGS IN THE SAMPLE

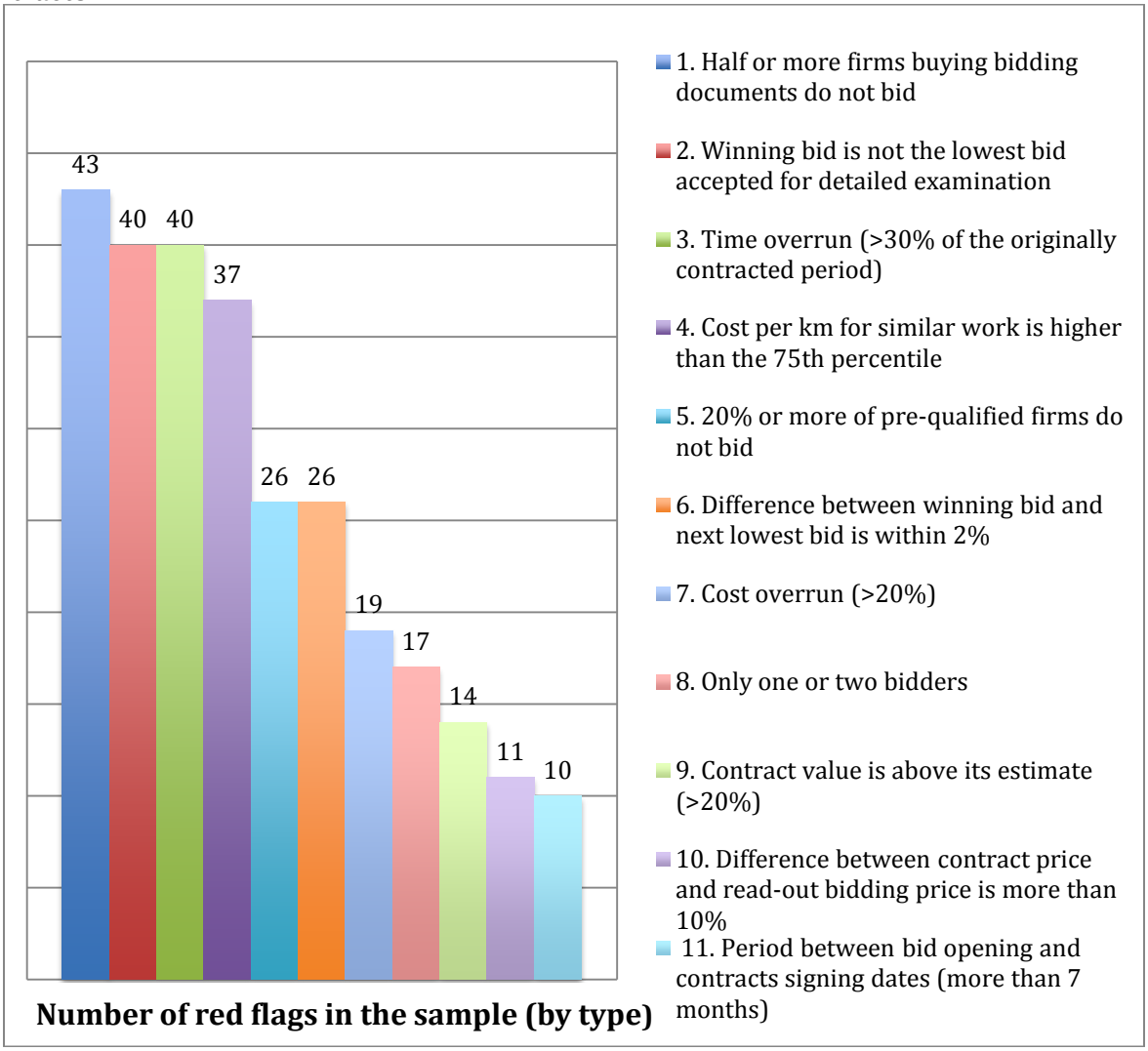
An inventory of risks is developed for each road works contract using a checklist of the selected red flags. The frequency of the different types of red flags is revealed for the whole set of the road works contracts reviewed in the study.

The presence of red flags does not prove that corrupt or fraudulent practices take place in the procurement and implementation of a contract. Rather, it is a warning signal of a potential procurement and implementation problem that may justify further investigation. At the same time, the absence of red flags does not imply that fraud or corruption did not occur.

The most frequent red flags in the sample of 200 road works contracts reviewed in Europe and Central Asia are: (i) half or more firms buying bidding documents do not bid; (ii) the winning bid is not the lowest bid accepted for detailed examination; and (iii) time overrun is more than 30 percent of the originally contracted period. These red flags, including high contracted costs, appear in around 20 percent of the total sample. At the same time, *20 percent or more of prequalified firms do not bid* in half of the reviewed contracts with a prequalification requirement (see Figure 4.1).

[19] Arguably, this red flag becomes more relevant if most of the bids are well spaced but only the lowest two are very close.

Figure 4.1: Frequency of selected types of red flags in the sample of 200 road works contracts

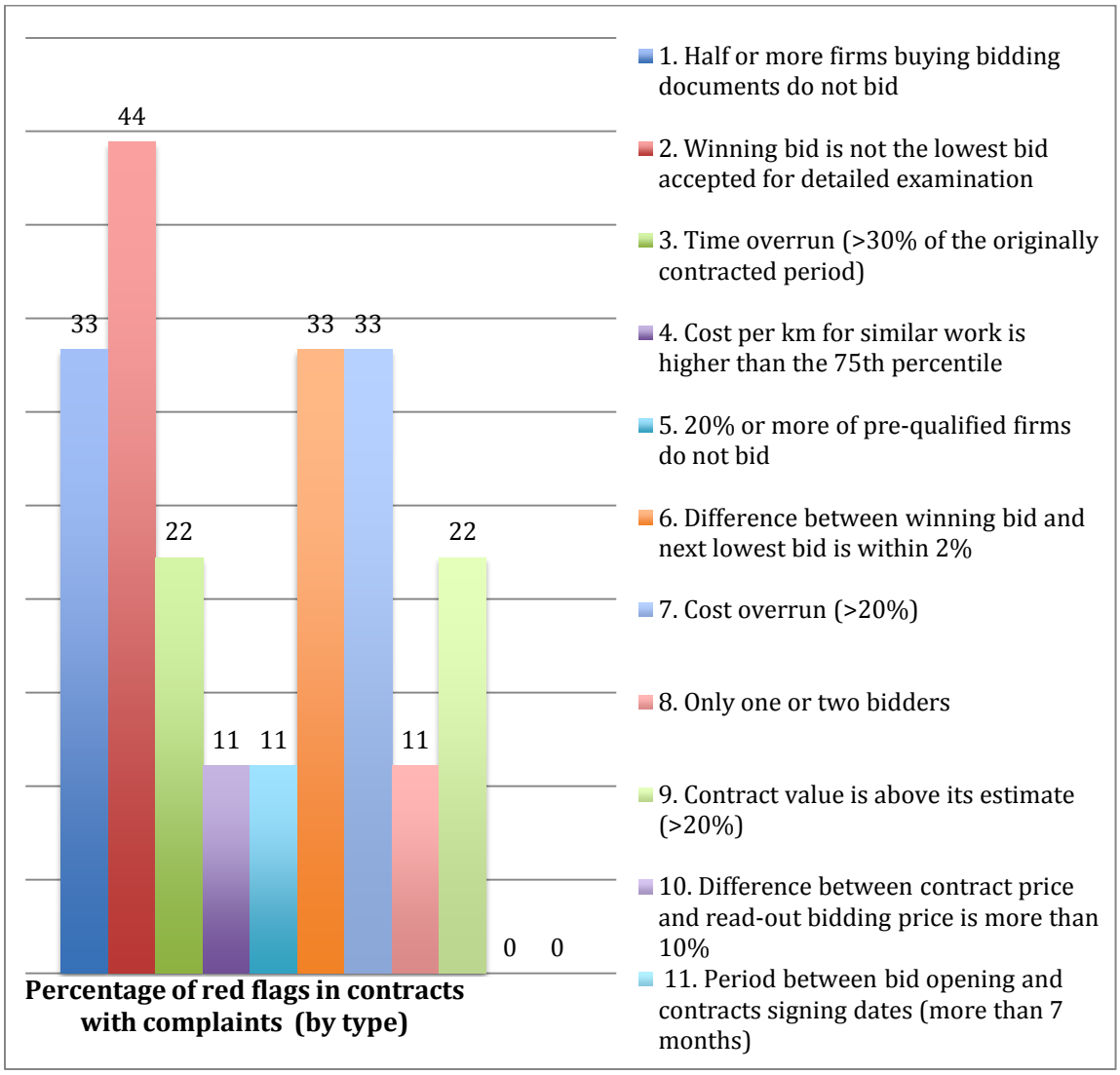


4.4 PATTERN OF RED FLAGS IN CONTRACTS WITH COMPLAINTS RECEIVED BY INT

A number of road works contracts in the sample have complaints received by the World Bank's Integrity Vice Presidency (INT) (nine contracts). The nature of complaints is mainly related to allegations of bidder collusion. A pattern of the selected types of red flags was examined in the contracts with complaints received by the INT. The results should be interpreted taking into account that a fraction of contracts with complaints of the total sample is small (4.5 percent).

In almost half of the contracts with complaints received by the INT, the winning bid is not the lowest bid accepted for detailed examination. This does not reflect complaints from the lowest rejected bidders as the nature of complaints is mostly of bidder collusion. The other two red flags that appear frequently across the contracts with complaints are: (i) difference between winning bid and next lowest bid is within 2 percent and (ii) cost overrun is greater than 20 percent (see Figure 4.2). On average, there are 2.2 red flags per contract with a complaint received by the INT; in the overall sample of road works contracts reviewed in the study, there are, on average, 1.5 red flags per contract.

Figure 4.2: Pattern of selected types of red flags in the contracts with complaints received by INT



4.5 NUMBER OF RED FLAGS PER CONTRACT

Azerbaijan and Romania have the highest number of red flags per contract, around three red flags on average. There are 1.5 red flags on average per contract in the overall sample of road works contracts reviewed in the study. The lowest number of red flags is in Bulgaria (see Table 4.1). In Kazakhstan more than half of the road works contracts reviewed in the sample for the country are recently signed (at the end of 2009). The data are not shown for Ukraine because all four contracts reviewed in the sample were signed in early 2010.

Table 4.1: Average number of red flags per contract, by country

Country	Average number of red flags per contract
Azerbaijan	3.08
Romania	2.75
Serbia	2.11
Albania	1.82
Estonia	1.71
Kazakhstan	1.54
Poland	1.37
Macedonia	1.25
Georgia	1.19
Armenia	0.75
Bosnia and Herzegovina	0.72
Bulgaria	0.56

4.6 RED FLAGS FOR COSTS PER KM OF SIMILAR WORKS

A red flag for cost per kilometer is defined as above the 75th percentile. The results for selected types of road works on an inter-urban road are presented in Table 4.2

Table 4.2: Cost per km on an inter-urban road above the 75th percentile, by type of work

Road works type	75th percentile (2009 US$)
New construction	1,894,287
Rehabilitation and reconstruction	691,969
Rehabilitation and reconstruction (secondary /local roads)	206,968

4.7 RED FLAGS FOR UNIT COSTS

A red flag for unit costs is defined as above the 75th percentile. The results for selected unit costs are presented in Table 4.3.

Table 4.3: Unit costs above the 75th percentile

Unit costs	75th percentile (2009 US$)
Asphalt concrete (m3)	171.14
Milling of asphalt layer (m3)	43.95
Portland cement concrete (m3)	215.61
Gravel base (m3)	23.97
Crushed stone base (m3)	28.08
Asphalt mix/bituminous base (m3)	134.23
Gravel sub-base (m3)	14.90
Soft earthworks (m2)	4.12

The costs of asphalt concrete (per m$^{3)}$ show less variance than other types of unit costs in the sample. Portland cement concrete for structures (per m^3) and crushed stone base (per m^3) have very high costs in a number of contracts compared to the rest of the sample (see Table 4.3).

Figure 4.3: Costs of asphalt concrete, Portland cement concrete, and crushed stone base (2009 US$/m^3)

Figure 4.3a: Costs of asphalt concrete

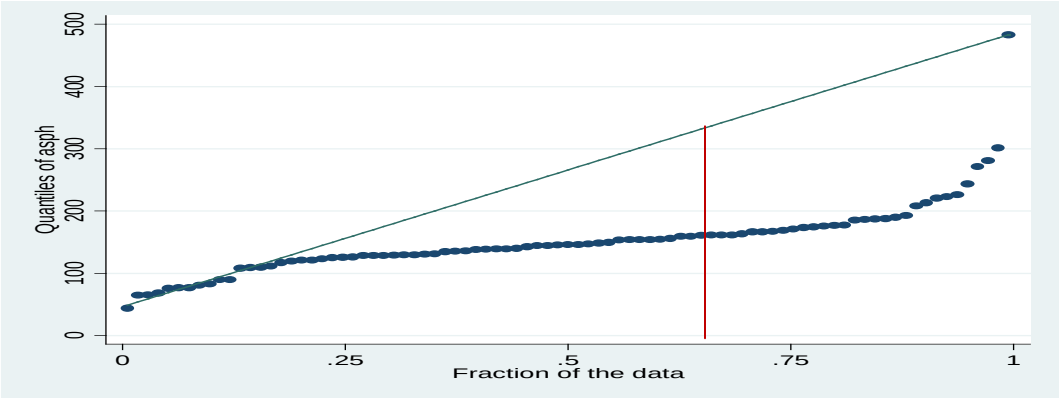


Figure 4.3b: Costs of Portland cement concrete

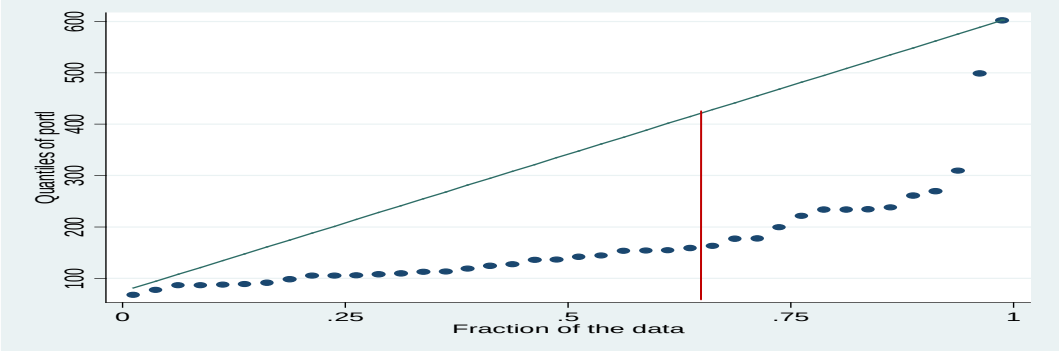
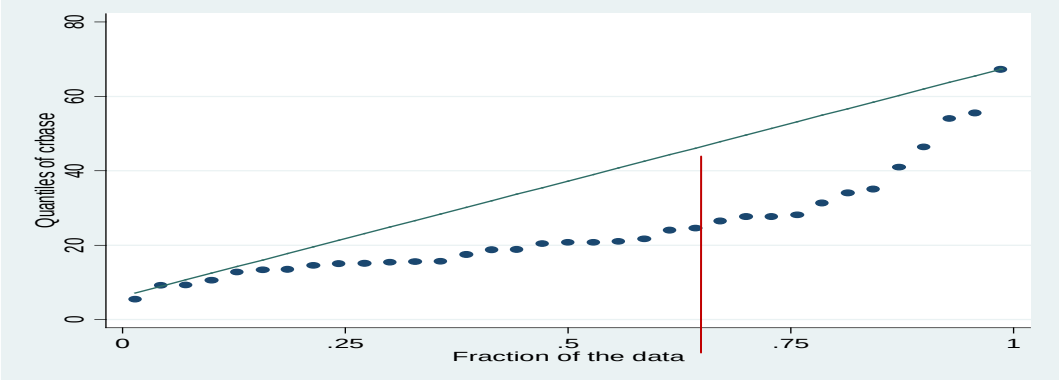


Figure 4.3c: Costs of crushed stone base



5 COST ANALYSIS

5.1 COSTS PER KILOMETER: REGRESSION RESULTS

The results of a regression analysis suggest a strong statistical significance for the "number of red flags" variable constructed for this study, in explaining unit costs of road works. To evaluate the determinants on cost per kilometer of rehabilitation and reconstruction of an inter-urban road, a single OLS regression analysis was used. The dependent variable was actual costs per kilometer of rehabilitation and reconstruction of inter-urban roads, including cost increases during the implementation of road works (based on variation orders, if issued to a contract).

Table 5.1: Determinants of cost per km of road rehabilitation and reconstruction: OLS regression analysis results

Dependent variable: Cost per km of road rehabilitation and reconstruction	Model specification (1)	Model specification (2)	Model specification (3)	Model specification (4)
Number of red flags per contract	100482.3	91089.67	95702.2	97962.96
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
WGI: Control of corruption	115643.7	141906.5		122728.1
	[0.177]	[0.093]*		[0.189]
Number of bidders	14207.71	9769.766	8805.067	1633.257
	[0.051]*	[0.125]	[0.163]	[0.944]
Number of evaluated bidders				12689.37
				[0.557]
Crude oil price (US$/ bbl.)	3425.247	3430.274	2581.258	3481.186
	[0.015]**	[0.015]**	[0.010]***	[0.018]**
Relatively harsh climate	273483.7	269068.9	255986.8	270766.5
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Net oil exporter country	-113816.5		-120605.1	-55973.66
	[0.199]		[0.151]	[0.670]
GNI per capita, Atlas method (US$)	21.39071	18.89401	44.26263	17.46857
	[0.312]	[0.373]	[0.000]***	[0.456]
GDP growth (annual %)	-1272.515	-3430.823	-519.8524	-2903.42
	[0.810]	[0.499]	[0.910]	[0.637]
Constant	-293853.7	-233931.7	-340223.2	-258033.4
	[0.007]***	[0.016]**	[0.000]***	[0.054]*
Observations	52	52	61	50
R-squared	0.7435	0.7334	0.7202	0.7427

Source: Authors' database

Note: GNI=Gross National Income; GDP=Gross Domestic Product; WGI=Worldwide Governance Indicators

*Significant at 10 percent level. ** Significant at 5 percent level. *** Significant at 1 percent level. Standard errors in brackets

The variables that were tested in the model include the "number of red flags" variable, the World Bank Governance Indicators' (WGI) control of corruption index,[20] number of bidders, and number of bidders accepted for detailed examination. The "number of red flags" variable is the number of red flags per

[20] http://info.worldbank.org/governance/wgi/index.asp

contract calculated for the eleven types of red flags selected in the study. The WGI control of corruption index measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests.[21] The variables of number of bidders and number of evaluated bidders are used as a proxy for the level of competition in a specific contract, the rational being that costs would tend to be lower with a higher degree of competition. The regression controls for key potential factors driving costs of road works, such as oil prices,[22] whether a country is a net oil exporter or importer,[23] country's GNI per capita,[24] GDP growth,[25] and climate conditions.[26]

The "number of red flags" was positively and significantly correlated with higher unit costs across several specifications of the model (see Table 5.1). The number of bidders, however, was significant in only one of the model specifications. Contrary to the expectation, it does not have a negative sign. A possible explanation is that if there is collusion, a higher number of bidders would not lead to lower prices.

There are other potentially important factors that could explain variance in road works costs that are not part of this analysis. These could include the terrain type (flat or hilly and mountainous), a variable indicating whether the country has a well developed road construction industry (this could be defined as a function of the proportion of contracts in the sample awarded to local contractors), and a variable indicating the stability of annual road funding cash flows in the country.

These results should be considered carefully given the limited number of observations (n=50 to 61). A more robust analysis could be undertaken with larger cross-country samples.

5.2 REASONS FOR COST OVERRUNS AND TIME EXTENSTIONS

The implementing agencies are responsible for the procurement, award, administration, and implementation of Bank-financed contracts. The Bank's role is to ensure that the procurement process is carried out in accordance with the established procedures and procurement rules. It also aims to ensure that this is done in an efficient and diligent manner. If issues arise that could affect adversely the fulfillment of these objectives, the Bank requests the project implementing agencies to address them.

These are a number of common factors singled out to explain contract price revisions and extensions of time in the reviewed contracts across the selected countries, as addressed by the project implementing agencies:

- **Additional works (new items or unforeseen works).** The requests to approve changes to a contract are often based on the necessity to add new quantities or new items as a variation order during the implementation of works. A wide range of possible causes justifies this. Some specific examples could include the upgrading of a road to a higher category that would carry a larger volume of traffic due to the flooding of another road in the neighborhood,[27] the occurrence of a terrain slippage due to extreme precipitation,[28] unforeseen circumstances related to the expropriation of land and the diversion of public utilities,[29] unsuitable sub-grade materials encountered during the works implementation that had to be removed.[30]

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21 http://info.worldbank.org/governance/wgi/pdf/cc.pdf
22 http://inflationdata.com/inflation/inflation_rate/historical_oil_prices_table.asp
23 A dummy variable where 0 is a net oil importer country and 1 a net exporter. http://data.worldbank.org/
24 http://data.worldbank.org/
25 http://data.worldbank.org/
26 A dummy variable where 0 is relatively mild climate (i.e., Balkans) and 1 relatively harsh.
27 Road works contracts under the Secondary and Local Roads project in Albania (P107833)
28 A road works contract under the Transport Rehabilitation Project in Serbia (P075207)
29 Road works contracts under the Roads 2 Project in Romania (P039250)
30 A road works contract under the Highway 2 project in Azerbaijan (P094488)

- **Adverse weather conditions** (exceeding normal levels) that incur contract extension costs. Generally, these are the extended periods of snow or heavy rainfall.

- **Inadequate engineering design** (underestimation of quantities, design omissions). Often the engineers' design specifies low quantities or does not properly diagnose the actual conditions of the road (surrounding area, utilities), safety issues, traffic volumes, and other parameters. In almost all the reviewed contracts signed in 2000 in Kazakhstan, the design change resulted in significant increases of the contract costs during the works implementation due to the poor condition of the existing pavement (a faster deterioration of pavement than evaluated by the design engineer due to the growth of traffic)[31]. There are other design omissions such as lack of sidewalks, traffic control and channelization procedures, protection of gas pipeline infrastructure adjacent to the roadway,[32] inaccurate approval of quantities,[33] and inconsistencies in geotechnical data.

- **Delay in supply of materials**. A number of works contracts in Georgia had to be extended due to delays in supply of bitumen and thermoplastic. The road works contracts in Serbia had to be extended because there were no sufficient quantities of polymer-bitumen in the country and its import would take 10-15 days.[34] In Azerbaijan, the contractors were not able to supply the required volumes of bitumen on time due to a high demand for bitumen and a significant number of ongoing projects in the country.

- **Poor performance of a contractor**. For example, , lack of competence and work techniques,[35] lack of equipment and resources, failure of a contractor to provide for viable (alternate) sources of bitumen and stockpile adequate quantities of bitumen to enable the timely completion of works. In Azerbaijan the works implementation schedules are largely affected by late commencement of works (generally at the end of the first year).

- **Other factors.** These might include:

    - force majeure circumstances, for example, the works had to be suspended in Georgia in August 2008 during the conflict with Russia, which interrupted construction and cut off some sources of materials;
    - delays in financing and weaknesses in construction supervision;
    - investment climate in the country;
    - long term business prospects of the bidder;
    - maturity of the domestic supply chain;
    - current market condition (saturation);
    - geographical and climate variability; and
    - variability in the application of standards and specifications.

[31] Road works contracts under the Road Transport Restructuring Project in Kazakhstan (P008499)
[32] Road works contracts under the Secondary and Local Roads Project in Georgia (P086277)
[33] A road works contract under the Second East-West Highway Improvement project in Georgia (P094044)
[34] Road works contracts under the Transport Rehabilitation Project in Serbia (P075207)
[35] Road works contracts under the Secondary and Local Roads Project in Georgia (P086277)

6 CONCLUSIONS AND GENERAL RECOMMENDATIONS

Engineering estimates are a better signal of actual costs than contract values. The road works are generally contracted at a lower value than their estimated costs under World Bank-funded projects in the selected countries of Europe and Central Asia. This, however, does not seem to affect cost increase during the implementation of works. Cost overruns due to change orders generally increase the contract costs close to the engineering estimates.

Delay in implementation can be long in some countries. The longest extensions of time for up to a year to complete the road works are observed in Azerbaijan and Romania. In Georgia the works are delayed by eight months on average in the completed contracts that were reviewed; in Kazakhstan, such average delay was seven months for the road works contracts signed in 2000.

Most contracts are signed within the original bid validity period. Extensions of the original validity period of bids are not common in the reviewed countries of Europe and Central Asia. Only in Kazakhstan the evaluation of bids in 2000 went well beyond the original bid validity period for a number of contracts, it took more than a year from bid opening to contract signature.

The most frequent red flags in the sample of 200 road works contracts reviewed in Europe and Central Asia are*: (i) half or more firms buying bidding documents do not bid; (ii) the winning bid is not the lowest bid accepted for detailed examination; and (iii) time overrun is more than 30 percent of the originally contracted period.* Such red flags appear in around 20 percent of the road works contracts reviewed in the study. At the same time, a red flag for contracts with prequalification - *20 percent or more of prequalified firms do not bid* - appears in half of the reviewed contracts with a prequalification requirement.

In almost half of the road works contracts with complaints received by the INT, the winning bid is not the lowest bid accepted for detailed examination. This does not reflect complaints from the lowest rejected bidders, as the nature of complaints is mostly of bidder collusion. The other two red flags that appear particularly often across the contracts with complaints to INT are: (i) the difference between the winning bid and the next lowest bid is within 2 percent; and (ii) cost overrun is greater than 20 percent.

Unit costs vary significantly across countries even for similar works. The variations in prices could be explained by many factors including the type of terrain, climate, the existing road condition, the availability of materials and transport distances, design parameters, and the technical complexity of road works. The highest unit cost of rehabilitation and reconstruction works of inter-urban roads across the reviewed countries is observed in Kazakhstan (US$878,703/km) and Ukraine (US$828,523/km). The sample of roads for these two countries mostly refers to expressways, which are reconstructed at higher design standards, for example a geometric horizontal design with a long radius of curvature and thicker pavement layers (e.g., surface, base, sub-base).

The "number of red flags" is positively and significantly correlated with higher unit costs. The number of red flags seems to be an important determinant factor driving cost per kilometer. The results of a regression analysis to evaluate the determinants on cost per km of rehabilitation and reconstruction of an inter-urban road suggest a strong statistical significance for the "number of red flags" variable constructed for this study. Correlations with the WGI control of corruption index, number of bidders, and number of bidders accepted for detailed examination were also tested. The regressions were controlled for potential factors driving the costs of road works, such as oil prices, whether the country is a net oil exporter or importer, country's GNI per capita, GDP growth, and climate conditions. The results, however, should be assessed carefully given the limited number of observations.

The results of the regression analysis reinforce the idea that the diagnosis of risks to integrity could help achieve greater efficiency and development effectiveness in Bank-

funded projects. Close monitoring of the procurement and implementation of road works contracts provides the basis for identifying early warning signs of potential fiduciary problems and the information to address them. While the presence of a red flag may provide a warning sign of possible poor governance, it does not necessarily mean that contracts with a red flag would involve corrupt behavior. Conversely, and importantly, a contract without a red flag or any abnormal sign does not mean that it is free from corruption or fraudulent behavior.

The following selected recommendations are geared to enhancing accountability and attaining a higher degree of control of corruption in Bank-financed projects in the road sector:

- **Capture costs and unit price information of road works for evaluation of trends in a country and across countries and regions.** The availability of systematic cost data facilitates monitoring and comparison of road works costs and bid price trends. Empirical evidence could be built on such indicators as price increases relative to the engineers' estimates, cost overruns, and key road input costs to investigate the sources of increased costs and possible factors behind the increase in bid prices and unit rates. It is essential to have timely and accurate data for the cost analysis of road works.

- **Assess bidding behavior, which is essential for measuring the level of competition and road works activity financed by the Bank.** Verifying the extent of a competitive bidding environment is an important tool for the procurement decisions. It is important to correctly evaluate the factors behind a declining number of bidders, the causes of bidding trends, and their potential influence on bid rates for contracts. Detailed bidding data could facilitate assessing whether the procurement process is affected by collusion and bid rigging through detection of patterns and "red flags" in the structure of bids and firms. It is useful to look separately at contracts with prequalification and without a prequalification requirement.

- **Measure performance more consistently to help address inefficiencies that arise in the current procurement and implementation practices.** This would ensure that irregularities are properly captured in the observed trends in a specific country or region. This would also help to distinguish if the trends are subject to potential corruption and fraud or rather stem from weak procurement environment and low capacity. It is important to link the performance measures to contractors and consultants as well as project implementing agencies for accountability.

- **Strengthen monitoring of the procurement and implementation processes to enhance detection of risks to integrity.** It is important to generate data to increase accountability. The availability of data on the procurement and implementation processes of the road sector contracts could allow comparison of cost trends, bidding competition, and performance in the road sector. The study was done in Europe and Central Asia and Sub-Saharan Africa, and could be replicated to other regions where the World Bank operates as it provides benchmarks and references against which individual projects performance and outcomes can be compared. It also establishes thresholds above which there may be cause for concern or further investigation. A standard framework has been developed within the study to provide a platform for monitoring and evaluation of prices, bidding data, and contractors' performance information to help improve governance.

ANNEX A: List of red flags by type

Table 1: Period between bid opening and contract signing dates is more than 7 months, by contract (4.5 percent of the total sample)

Country	Project ID	Contract ID	Year	Number of days between bid opening and contract signing	Number of months between bid opening and contract signing
Poland	P008593	1231351	2003	273	9.1
Poland	P008593	1231365	2003	273	9.1
Albania	P078949	1268826	2007	213	7.1
Albania	P078949	1272256	2008	309	10.3
Azerbaijan	P040716	1227460	2003	314	10.5
Kazakhstan	P008499	1201891	2000	422	14.1
Kazakhstan	P008499	1201879	2000	422	14.1
Kazakhstan	P008499	1207656	2000	457	15.2
Kazakhstan	P008499	1201940	2000	270	9.0

Table 2: Cost increases by more than 20 percent during implementation (9.5 percent of the total sample)

Country	Project ID	Contract ID	Year	Contract amount (2009US$)	Cost overrun (in percent)
Albania	P107833	1280645	2008	2150242.57	68
Albania	P078949	1263835	2007	12304849.12	25
Albania	P078949	1268826	2007	7907625.27	36
Armenia	P044829	1222391	2002	1134783.05	20
Azerbaijan	P040716	1237589	2004	6857782.83	44
Azerbaijan	P040716	1237608	2004	7428101.75	56
Azerbaijan	P040716	1237612	2004	5533819.35	57
Azerbaijan	P040716	1237614	2004	5388807.82	29
Azerbaijan	P094488	1263738	2006	33540063.33	24
Azerbaijan	P094488	12690172	2007	39222374.54	25
Georgia	P094044	1274659	2008	58499252.48	35
Kazakhstan	P008499	1201891	2000	22980657.48	24
Kazakhstan	P008499	1207656	2000	18390908.00	26
Kazakhstan	P008499	1201940	2000	31923652.99	36
Kazakhstan	P008499	1201934	2000	2476384.75	43
Kazakhstan	P008499	1206630	2000	2750888.29	64
Kazakhstan	P008499	1202470	2000	3573684.29	110
Kazakhstan	P008499	1206634	2000	3822211.33	60
Macedonia	P107840	1283186	2009	4141458.81	20

Table 3: Time overrun is more than 30 percent of the originally contracted period (20 percent of the total sample)

Country	Project ID	Contract ID	Year	Delay (months)
Poland	P008593	1224506	2002	3
Poland	P008593	1224451	2002	5
Albania	P107833	1286324	2008	3
Albania	P107833	1280645	2008	10
Albania	P107833	1280648	2008	4
Azerbaijan	P040716	1237589	2004	16
Azerbaijan	P040716	1237608	2004	16
Azerbaijan	P040716	1237612	2004	15.6
Azerbaijan	P040716	1237614	2004	15.6
Azerbaijan	P040716	1227460	2003	6
Azerbaijan	P094488	1263738	2006	8
Azerbaijan	P094488	12690172	2007	9
Azerbaijan	P094488	12690173	2007	9
Georgia	P040556	1221476	2002	12
Georgia	P040556	1221486	2002	12
Georgia	P040556	1222398	2002	4
Georgia	P040556	1231070	2003	9
Georgia	P040556	1234241	2003	8
Georgia	P040556	1231367	2003	12
Georgia	P086277	1252427	2005	10
Georgia	P086277	1256513	2005	7
Georgia	P086277	1256516	2005	7
Kazakhstan	P008499	1207656	2000	9
Kazakhstan	P008499	1201940	2000	8
Kazakhstan	P008499	1201934	2000	11
Kazakhstan	P008499	1206630	2000	6
Kazakhstan	P008499	1202470	2000	12
Kazakhstan	P008499	1206634	2000	6
Macedonia	P107840	1283178	2009	6
Macedonia	P107840	1283179	2009	3
Macedonia	P107840	1283181	2009	3
Macedonia	P107840	1283182	2009	5
Macedonia	P107840	1283183	2009	3
Macedonia	P107840	1283227	2009	5
Macedonia	P107840	1283228	2009	3
Macedonia	P107840	12832211	2009	4
Romania	P039250	1233003	2003	18
Romania	P093812	1274031	2007	6
Serbia	P075207	1250480	2005	5
Serbia	P075207	1266830	2007	6

Table 4: Contract value is more than 20 percent above the engineer's estimate (7 percent of the total sample)

Country	Project ID	Contract ID	Year	Difference between contract value and its estimate (in percent)
Poland	P008593	1245516	2004	34.9
Azerbaijan	P094488	12690173	2007	35.5
Azerbaijan	P094488	1278798	2008	23.0
Bosnia and Herzegovina	P100792	1289849	2009	20.8
Bosnia and Herzegovina	P071347	1233002	2003	50.6
Bulgaria	P099894	1282123	2009	26.9
Georgia	P086277	1252427	2005	25.1
Georgia	P086277	1256513	2005	32.1
Kazakhstan	P008499	1267177	2006	39.0
Macedonia	P107840	1290377	2009	21.4
Macedonia	P107840	1290378	2009	40.2
Serbia	P075207	1241898	2004	89.2
Serbia	P075207	1243527	2004	61.1
Serbia	P075207	1250480	2005	44.1

Table 5: Half or more firms buying bidding documents do not bid (22 percent of the total sample)

Country	Project ID	Contract ID	Year	Number of firms buying bidding documents	Number of bidders	Percent of firms that do not bid
Poland	P008593	1224451	2002	7	2	71
Poland	P008593	1227378	2003	9	3	67
Poland	P008593	1239230	2004	7	3	57
Poland	P008593	1245479	2004	7	3	57
Poland	P008593	1243680	2004	8	4	50
Poland	P008593	1240800	2004	13	5	62
Albania	P107833	1280648	2008	17	7	59
Albania	P078949	1263835	2007	20	10	50
Albania	P066260	1238582	2004	12	5	58
Albania	P066260	1237722	2004	6	3	50
Armenia	P044829	1232100	2003	4	2	50
Bosnia and Herzegovina	P100792	1289849	2009	6	3	50
Bosnia and Herzegovina	P071347	1233266	2003	10	5	50
Bosnia and Herzegovina	P071347	1233002	2003	11	3	73
Bosnia and Herzegovina	P071347	1252069	2005	6	3	50
Bulgaria	P099894	1284105	2009	7	3	57
Bulgaria	P099894	1285220	2009	13	6	54

Bulgaria	P099894	1290295	2009	16	8	50
Estonia	P035775	1213516	2001	9	4	56
Estonia	P035775	1213518	2001	8	3	63
Estonia	P035775	1221893	2002	11	2	82
Estonia	P035775	1221894	2002	11	2	82
Estonia	P035775	1233823	2003	11	2	82
Georgia	P040556	1214141	2001	4	1	75
Georgia	P040556	1214142	2001	6	2	67
Georgia	P083110	1289986	2009	7	2	71
Georgia	P086277	1283975	2009	12	4	67
Georgia	P086277	1289348	2009	9	2	78
Georgia	P086277	1289345	2009	7	3	57
Georgia	P086277	1290463	2009	13	6	54
Kazakhstan	P008499	1201934	2000	9	3	67
Kazakhstan	P008499	1202470	2000	9	4	56
Macedonia	P107840	1292425	2009	9	4	56
Macedonia	P107840	1290377	2009	6	3	50
Macedonia	P107840	1290378	2009	6	3	50
Romania	P039250	1233003	2003	14	5	64
Romania	P039250	1233004	2003	19	7	63
Romania	P039250	1233006	2003	16	7	56
Romania	P093812	1274031	2007	13	5	62
Serbia	P075207	1241898	2004	20	3	85
Serbia	P075207	1243527	2004	18	5	72
Serbia	P075207	1256584	2006	10	5	50
Serbia	P075207	1259327	2006	9	4	56

Table 6: *20 percent or more of prequalified firms do not bid* (52 percent of all the contracts with prequalification in the sample)

Country	Project ID	Contract ID	Year	Number of firms prequalified	Number of bidders	Percent of firms that do not bid
Poland	P008593	1229600	2003	15	8	47
Poland	P008593	1226913	2003	14	8	43
Poland	P008593	1226916	2003	15	8	47
Poland	P008593	1224950	2002	15	10	33
Poland	P008593	1224506	2002	15	9	40
Poland	P008593	1224507	2002	13	7	46
Poland	P008593	1223495	2002	15	10	33
Poland	P008593	1222277	2002	10	6	40
Poland	P008593	1209327	2001	12	8	33
Poland	P008593	1209080	2001	9	5	44
Poland	P008593	1205924	2000	7	5	29
Albania	P078949	1289305	2009	12	7	42
Albania	P078949	1289282	2009	12	4	67
Azerbaijan	P094488	12690171	2007	14	10	29

Azerbaijan	P094488	12690172	2007	12	7	42
Azerbaijan	P094488	12690173	2007	13	9	31
Azerbaijan	P094488	1281289	2009	8	5	38
Azerbaijan	P094488	1278798	2008	5	3	40
Azerbaijan	P094488	1278795	2008	5	3	40
Georgia	P094044	1274659	2008	6	4	33
Georgia	P112523	1285242	2009	8	5	38
Georgia	P112523	1285247	2009	4	3	25
Ukraine	P100580	10001	2010	8	4	50
Ukraine	P100580	10002	2010	7	4	43
Ukraine	P100580	10003	2010	9	5	44
Ukraine	P100580	10004	2010	10	5	50

Table 7: Difference between winning bid and next lowest bid is within 2 percent (13 percent of the total sample)

Country	Project ID	Contract ID	Year	Contract amount (2009US$)	Difference between winning bid and next lowest bid (percent)
Poland	P008593	1229600	2003	14897913.29	-1.2
Poland	P008593	1231351	2003	3082403.08	0.1
Poland	P008593	1231365	2003	4180645.94	2.0
Poland	P008593	1239230	2004	3285581.22	-1.8
Poland	P008593	1209327	2001	5092504.74	-0.4
Poland	P008593	1245479	2004	1830893.67	-1.5
Poland	P008593	1240800	2004	2979487.65	-1.3
Albania	P107833	1280648	2008	2226130.90	1.6
Albania	P107833	1280609	2009	2080889.51	-1.6
Albania	P078949	1289284	2009	1456651.78	-0.8
Albania	P078949	1289305	2009	1792075.73	-1.2
Albania	P066260	1238582	2004	3069638.56	-0.6
Armenia	P044829	1222816	2002	1205251.76	-0.3
Armenia	P044829	1233082	2003	1071554.47	0.9
Azerbaijan	P094488	12690172	2007	39222374.54	-1.7
Azerbaijan	P094488	1278795	2008	37597344.36	0.9
Bosnia and Herzegovina	P071347	1233002	2003	2807055.37	-0.5
Bulgaria	P099894	1278280	2008	28360945.79	-1.8
Croatia	P008329	1203266	2000	1849397.81	-0.9
Croatia	P008329	1202265	2000	1848103.12	-0.7
Estonia	P035775	1206069	2000	1779227.68	-0.3
Georgia	P083110	1289986	2009	1172053.17	-1.1
Georgia	P086277	1289349	2009	6409872.62	-1.6
Georgia	P086277	1289345	2009	1762161.72	0.5
Macedonia	P107840	1283186	2009	4141458.81	-1.6
Ukraine	P100580	10002	2010	72311879.58	0.8

Table 8: Difference between contract price and read-out bidding price is more than 10 percent (5.5 percent of the total sample)

Country	Project ID	Contract ID	Year	Difference between contract price and read-out bidding price (percent)
Albania	P078949	1289307	2009	14.0
Azerbaijan	P094488	1269017(1)	2007	-10.0
Azerbaijan	P094488	1269017(2)	2007	-10.0
Azerbaijan	P094488	1269017(3)	2007	-10.0
Georgia	P112523	1285242	2009	-15.5
Georgia	P112523	1285247	2009	-18.0
Kazakhstan	P008499	1201934	2000	16.8
Romania	P039250	1233004	2003	-14.0
Serbia	P075207	1256584	2006	-12.4
Serbia	P075207	1266830	2007	-15.6
Ukraine	P100580	10002	2010	-10.9

Table 9: Only one or two bidders (8.5 percent of the total sample)

Country	Project ID	Contract ID	Year	Number of bidders
Poland	P008593	1224451	2002	2
Armenia	P044829	1232100	2003	2
Armenia	P044829	1240372	2004	2
Estonia	P035775	1221893	2002	2
Estonia	P035775	1221894	2002	2
Estonia	P035775	1233823	2003	2
Georgia	P040556	1214141	2001	1
Georgia	P040556	1214142	2001	2
Georgia	P040556	1222398	2002	1
Georgia	P040556	1231069	2003	2
Georgia	P040556	1234241	2003	1
Georgia	P083110	1289986	2009	2
Georgia	P086277	1256513	2005	2
Georgia	P086277	1256516	2005	*2*
Georgia	P086277	1276974	2008	2
Georgia	P086277	1289348	2009	2
Kazakhstan	P008499	1267177	2006	1

Table 10: Winning bid is not the lowest bid accepted for detailed examination (20 percent of the total sample)

Country	Project ID	Contract ID	Year	Lowest bid amount (tender currency)	Winning bid amount (tender currency)
Poland	P008593	1231351	2003	10,558,502	10,573,562
Poland	P008593	1231365	2003	13,892,470	14,169,681
Poland	P008593	1243687	2004	17,995,144	18,418,718
Albania	P107833	1280645	2008	156,200,528	186,233,364
Albania	P107833	1280648	2008	189,799,444	192,785,798
Albania	P107833	1280601	2009	186,424,152	205,905,360
Albania	P078949	1263835	2007	10,164,568	12,920,988
Albania	P078949	1268826	2007	669,348,185	711,087,253
Albania	P078949	1272256	2008	8,888,000	10,641,267
Albania	P066260	1231480	2003	160,998,610	248,613,850
Albania	P066260	1240679	2004	87,142,460	154,078,520
Armenia	P044829	1222525	2002	599,458,743	749,439,268
Armenia	P044829	1222391	2002	481,149,807	527,120,864
Armenia	P044829	1233082	2003	528,413,353	532,999,999
Azerbaijan	P040716	1237589	2004	28,191,215,264	29,369,768,356
Azerbaijan	P040716	1237608	2004	28,990,278,006	32,958,480,962
Azerbaijan	P040716	1237614	2004	21,788,865,367	22,663,754,084
Azerbaijan	P094488	1269017(1)	2007	20,095,559	20,645,669
Azerbaijan	P094488	1269017(3)	2007	23,177,506	30,085,391
Azerbaijan	P094488	1278795	2008	29,966,000	30,242,717
B&H	P100792	1289853	2009	1,327,349	1,450,922
B&H	P100792	1288280	2009	2,307,943	2,498,989
Estonia	P035775	1206068	2000	17,162,241	18,688,612
Estonia	P035775	1213516	2001	31,110,956	32,849,258
Estonia	P035775	1213518	2001	58,927,396	62,356,151
Georgia	P086277	1289345	2009	2,944,810	2,958,493
Georgia	P112523	1285247	2009	107,303,199	149,163,727
Kazakhstan	P008499	1202470	2000	2,449,735	2,817,864
Macedonia	P091723	1278708	2008	650,837,172	719,566,808
Romania	P039250	1233003	2003	85,797,247,690	156,072,074,261
Romania	P039250	1233004	2003	219,232,930,870	281,464,968,855
Romania	P039250	1233006	2003	169,430,751,386	245,172,773,031
Serbia	P075207	1241898	2004	485,225,958	667,064,362
Serbia	P075207	1243527	2004	547,142,037	558,309,644
Serbia	P075207	1250480	2005	218,242,770	231,950,642
Serbia	P075207	1259326	2006	217,807,153	287,825,519
Serbia	P075207	1259327	2006	195,902,419	240,677,780
Serbia	P075207	1265189	2006	429,469,814	449,684,143
Serbia	P075207	1262878	2006	387,316,485	406,670,820
Ukraine	P100580	10002	2010	644,616,091	649,912,656

ANNEX B: Statistical summary of data

Variable	Obs	Mean	Std. Dev.	Min	Max
sap	200	1515540	1813942	10001	1.29e+07
year	200	2005.375	3.191442	2000	2010
preq	194	.257732	.4385173	0	1
fipreq	35	10.65714	3.669772	4	17
nfibd	140	8.807143	3.912526	1	20
nbids	163	5.110429	2.598685	1	15
nbidx	157	4.547771	2.560664	1	15
natbi	200	.43	.5803309	0	2
low	155	.2580645	.4389881	0	1
diff	165	-.0934545	.2290241	-1.03	.89
cvalue	200	1.30e+07	2.16e+07	911541.8	1.01e+08
incrco	200	.05895	.1433708	-.05	1.1
cokmr	97	445447.5	324999.6	111490	1719847
cokmn	21	1482157	542762.8	696920	3071976
cokms	32	172712.2	58096.4	81523	368826
actkmr	97	445588.2	324967.5	111625	1719847
actkmn	21	1482849	542156.6	699462	3071976
actkms	32	172805.7	58124.21	81609	368826
roadl	187	34.66631	57.10998	2	565.7
sign	169	90.40828	71.3798	7	457
delay	116	3.464655	4.417716	0	18
asph	87	152.4015	58.54149	43.93	483.04
mill	42	36.60786	35.32255	3.2	146.51
portl	40	170.208	107.2561	67.63	601.8
grbase	15	20.458	6.480816	10.5	37.5
crbase	35	24.23343	14.16046	5.39	67.31
mxbase	39	120.3731	30.12536	49.89	216.23
grsub	41	11.35585	9.94513	1.39	45.25
soft	55	3.670545	2.914228	.68	16.71
ared	200	.05	.2184919	0	1
bred	200	.095	.2939507	0	1
cred	200	.2	.4010038	0	1
dred	200	.07	.2557873	0	1
ered	199	.2160804	.4126078	0	1
fred	34	.7647059	.4305615	0	1
gred	200	.13	.3371474	0	1
hred	200	.055	.2285524	0	1
ired	186	.2150538	.4119686	0	1
jred	186	.0913978	.2889518	0	1
kred	200	.185	.389272	0	1
tred	200	.045	.2078243	0	1
nred	200	1.46	1.231251	0	6
wbicc	183	-.3906557	.4680514	-1.16	.85
ticc	161	3.269565	.7632204	1.8	5.7
oil	200	51.56345	20.76934	27.46	91.77
exoil	200	.18	.3851515	0	1
gniat	200	3763.807	1934.358	826.46	7239.54
gdpgr	153	6.656013	5.038979	1.17	34.5
clofo	200	.28	.4501256	0	1
clima	200	.655	.4765612	0	1

Variables	DEFINITIONS OF VARIABLES
sap	Contract SAP ID
year	Year of contract signature
preq	Prequalification (no=0, yes=1)
fipreq	If prequalification, number of firms prequalified
nfibd	Number of firms buying bidding documents
nbids	Number of bidders
nbidx	Number of bidders accepted for detailed examination
natbi	Nationality of contractor (local=0; foreign=1; local/foreign joint venture=2)
low	Lowest bid (yes=0, no=1)
diff	Difference between contract value and its estimate (%)
cvalue	Contract value (USD2009)
incrco	Increase as of contract value (%)
cokmr	Contract cost: Rehabilitation works per km of a 2-lane 7m wide road equivalent (USD2009/km)
cokmn	Contract cost: New construction works per km of a 2-lane 7m wide road equivalent (USD2009/km)
cokms	Contract cost: Secondary road rehabilitation works per km of a 2-lane 7m wide road equivalent (USD2009/km)
actkr	Actual cost: Rehabilitation works per km of a 2-lane 7m wide road equivalent (USD2009/km)
actkn	Actual cost: New construction works per km of a 2-lane 7m wide road equivalent (USD2009/km)
actks	Actual cost: Secondary road rehabilitation works per km of a 2-lane 7m wide road equivalent (USD2009/km)
roadl	Road length (km) -7m wide, 2 lane equivalent
sign	Period between bid opening and contract signing dates (days)
delay	Delay (months)
asph	Asphalt concrete (USD2009/m3)
mill	Milling of asphalt layer (USD2009/m3)
portl	Portland cement concrete for structures (USD2009/m3)
grbase	Base: Gravel (USD2009/m3)
crbase	Base: Crushed stone (USD2009/m3)
mxbase	Base: Asphalt mix/bituminous (USD2009/m3)
grsub	Sub-base: Gravel (USD2009/m3)
soft	Soft earthworks (USD2009/m3)
ared	1. Period between bid opening and contracts signing dates (more than 7 months)
bred	2. Cost overrun (>20%)
cred	3. Time overrun (>30% of the originally contracted period)
dred	4. Contract value is above its estimate (>20%)
ered	5. Half or more firms buying bidding documents do not bid
fred	6. 20% or more of prequalified firms do not bid
gred	7. Difference between winning bid and next lowest bid is within 2%
hred	8. Difference between contract price and read-out bidding price is more than 10%
ired	9. Winning bid is not the lowest bid accepted for detailed examination (if the lowest bid=0, not the lowest bid=1)
jred	10. Only one or two bidders =1; more than two bidders =0

kred	11. Cost per km for similar work is higher than the 75th percentile
tred	Number of complaints received by INT
nred	Number of red flags per contract
wbicc	WGI: Control of Corruption index
ticc	Transparency International Corruption Perceptions Index
oil	Crude oil price (US$/bbl.)
exoil	Exporter or importer of oil (importer=0, exporter=1)
gniat	GNI per capita, Atlas method (US$)
gdpgr	GDP growth (annual %)
clofo	Proportion of contracts (in the sample) awarded to local contractors in the country (if more than 50% =0; if less =1)
clima	Climate conditions (relatively mild=0, relatively harsh=1)