

Azhgaliyeva, Dina; Mishra, Ranjeeta; Yoshino, Naoyuki; Karymshakov, Kamalbek

Working Paper

Performance in CAREC countries: Cross-sectional evidence at the firm level

ADB Working Paper Series, No. 1265

Provided in Cooperation with:

Asian Development Bank Institute (ADBI), Tokyo

Suggested Citation: Azhgaliyeva, Dina; Mishra, Ranjeeta; Yoshino, Naoyuki; Karymshakov, Kamalbek (2021) : Performance in CAREC countries: Cross-sectional evidence at the firm level, ADB Working Paper Series, No. 1265, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

<https://hdl.handle.net/10419/238622>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by-nc-nd/3.0/igo/>



ADB Working Paper Series

**INFRASTRUCTURE AND FIRM
PERFORMANCE IN CAREC
COUNTRIES: CROSS-SECTIONAL
EVIDENCE AT THE FIRM LEVEL**

Dina Azhgaliyeva, Ranjeeta Mishra,
Naoyuki Yoshino, and
Kamalbek Karymshakov

No. 1265
May 2021

Asian Development Bank Institute

Dina Azhgaliyeva is a research fellow, and Ranjeeta Mishra is a project consultant, both at the Asian Development Bank Institute in Tokyo, Japan. Naoyuki Yoshino is a professor emeritus at Keio University in Tokyo and director of the Financial Research Center, Financial Services Agency, Japan. Kamalbek Karymshakov is an economist at the CAREC Institute, People's Republic of China.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

Working papers are subject to formal revision and correction before they are finalized and considered published.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. Some working papers may develop into other forms of publication.

Suggested citation:

Azhgaliyeva, D., R. Mishra, N. Yoshino, and K. Karymshakov. 2021. Infrastructure and Firm Performance in CAREC Countries: Cross-Sectional Evidence at the Firm Level. ADBI Working Paper 1265. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/infrastructure-firm-performance-carec-countries>

Please contact the authors for information about this paper.

Email: kamalbek.karymshakov@carecinstitute.org

Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

© 2021 Asian Development Bank Institute

Abstract

This study aims to examine the impact of infrastructure on firm performance in nine CAREC countries: Afghanistan, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, and Uzbekistan. Empirical analysis is based on the enterprise survey for 2009, 2013, and 2019. Infrastructure is measured by the duration of power outages, electricity expenses as the share of total sales, access to broadband internet and efficiency of customs. Firm performance was measured by total sales, share of utilized capacity, dummy variable if firm exports, and the share of export sales. Results indicate that firm performance measured through sales and capacity utilization is negatively affected by the duration of power outages and electricity expenses. Moreover, access to broadband internet significantly increases the total sales and export sales of small firms, while efficiency of customs increases the exporting activities of medium and large firms. These findings underline that for the development of private sector and international trade in CAREC countries, sustainable access to, and quality of, electricity, telecommunications, and customs efficiency are important objectives for government policy.

Keywords: central Asia, electricity, telecommunications, infrastructure

JEL Classification: D24, H54, O18, Q48, Q41

Contents

1.	INTRODUCTION	1
2.	LITERATURE REVIEW	2
3.	METHODOLOGY	2
4.	DATA	5
5.	ESTIMATION RESULTS	8
6.	CONCLUSIONS AND POLICY RECOMMENDATIONS	12
	REFERENCES	14
	APPENDIX	15

1. INTRODUCTION

Effective infrastructure projects have a positive effect on the economic growth of a region, known as the “spillover effect.” An effective infrastructure project not only constructs the infrastructure but also leads to the growth of the region along that infrastructure, such as roads, railways, water supply, electricity, etc. (Yoshino, Azhgaliyeva, and Mishra 2021). An effective infrastructure affects firms by improving connectivity and ease of doing business, and as a result leads to greater sales, including exports.

Financing the access to infrastructure and improvements of the quality of infrastructure in central Asia is challenged by low user charger rates, low population density, and large distances in central Asia. This paper studies the importance of infrastructure quality for firm performance in central Asia.

There is a lack of empirical studies on infrastructure in central Asia due to a lack of data, and most of them are focused on a single country (Yoshino et al. 2021). This study fills the gap in the literature by providing empirical evidence based on a firm-level enterprise survey among nine CAREC member countries: Afghanistan, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, and Uzbekistan. Data are sourced from World Bank enterprise survey pooled data from 2008, 2009, and 2013¹.

The above data show that the access to, and quality of, infrastructure vary significantly across CAREC member countries. Below we provide a comparison of nine CAREC member countries based on World Bank enterprise survey data. The average duration of power outages is over seven hours per month. For example, the average duration of power outages is higher in Uzbekistan and Azerbaijan with over 12 and 11 hours per month, respectively. Only around half (54%) of firms have access to broadband internet. For example, access to broadband internet is lower in Afghanistan, with just over 10% of firms reporting that they have access to broadband internet. Customs efficiency is also low in these nine CAREC member countries. The average index of customs efficiency is low in the nine CAREC member countries, at 2.29, compared to the average customs efficiency index in high-income countries, which is 3.29 according to data from the World Bank Logistics Performance Index² (2018). The customs efficiency index measures the efficiency of the clearance process, i.e., speed, simplicity, and predictability of formalities, by border control agencies, such as customs. It takes values from 1 (low) to 5 (high), with 5 being the most efficient.

Using the above data for empirical estimation, this study demonstrates the positive spillover effect of access and quality of infrastructure, i.e., access to broadband, customs efficiency, and the quality of electricity connection, on firms’ sales, including exports. In addition, this study shows how the impact differs for small, medium, and large firms. Based on this evidence, we provide policy recommendations for improving the access to, and quality of, infrastructure for small, medium, and large firms. Since improvements in the access to, and quality of, infrastructure in nine CAREC member countries requires substantial financing, differentiated policy support for small, medium, and large firms will allow firms to be supported in a cost-effective way.

¹ <https://www.enterprisesurveys.org/en/data>.

² <https://data.worldbank.org/indicator/LP.LPI.CUST.XQ>.

The rest of the paper is structured as follows. Section 2 reviews the literature on infrastructure in central Asia. Section 3 explains the methodology. Section 4 describes the data. Section 5 provides and discusses results. Section 6 concludes and presents policy recommendations.

2. LITERATURE REVIEW

Several research papers focusing on a larger sample of Eurasian countries highlight the importance of infrastructure for trade and performance among firms in central Asian countries (Shepherd and Wilson 2007; Iimi 2011). Thus, Iimi (2011), using firm-level enterprise survey data for Europe and central Asia, investigated the impact of the quality of infrastructure services on firms' costs and found that electricity outages and longer durations thereof have a negative impact on costs.

To the best of our knowledge, there are few papers focusing on infrastructure and trade relationships in the context of Central Asian countries. Thus, Raballand (2003) measured the impact of landlockedness on trade in the case of central Asian economies. It is argued that landlockedness causes high transport cost, which in turn significantly reduces international trade. Grigoriou (2007) analyzed the impact of internal infrastructure development and landlockedness on central Asian countries' trade. It is argued that while the impact of internal infrastructure appears to be limited, the infrastructure of transit countries is expected to have a significant effect on the trade of central Asian countries.

Some studies at the regional level of a specific country show that infrastructure investment demonstrates a spillover effect on the social and economic conditions of regions, increasing economic growth and decreasing poverty level (Yoshino and Abidhadjaev 2017; Karymshakov and Sulaimanova 2019; Yoshino et al. 2021).

Among them, Karymshakov and Sulaimanova (2020), examining the impact of infrastructure on trade in three central Asian countries, note that both the quality and quantity of infrastructure have an impact on trade, though this effect varies by country. Thus, a positive relationship between infrastructure and trade flows is indicated in the case of Kazakhstan, while the Kyrgyz Republic and Tajikistan, with their limited development of railroad and air transportation infrastructure, did not demonstrate such an effect.

The main contribution of this study to the existing literature is that it provides empirical evidence of the role of access to infrastructure and the quality of infrastructure in firms' sales and exports, highlighting that the impact depends on firms' size. For example, electricity expenses affect small firms more, and customs affects medium and large firms more, while broadband has a large impact on all firms. Thus, policies should target the most affected firms. Using the results, we provide policy recommendations for CAREC member countries.

3. METHODOLOGY

Firm performance can be measured by several aspects. However, following the main purpose of the paper and the importance of understanding infrastructure as a factor for firm performance and international trade, we measure it by four indicators: total sales, share of capacity of firm utilized during the last fiscal year, status of firm as to whether or not it is an exporter, and share of export in total sales. The first two indicators refer

to general firm performance, while the last two indicate the extent to which a firm engages in international trade.

The total sales of firms are a continuous variable, while the share of capital utilization and export sales are given in percentage norms (from 0 to 100). Also, the exporting status of firms is expressed as a dummy variable taking the value 0 if a firm does not export and 1 if it does. Therefore, for modeling of total sales, a linear regression model is applied (Eq. 1). For capital utilization and share of export in total sales, a *tobit* model is employed, while for exporting status, a *probit* model is used (Eq. 2 and Eq. 3).

$$Y = \beta_0 + \beta_1 INFR + \beta_2 X + \varepsilon_i \quad (1)$$

Thus, Y refers to the log of total sales of firms during the last fiscal year. $INFR$ indicates variables used to measure the infrastructure. In this study, four variables are used to approximate the infrastructure: first, the number of power outages experienced in a typical month in the last fiscal year; second, electricity expenses as the share of total annual costs of electricity in the last fiscal year to total sales – this variable may approximate the cost of electricity consumption for firms and indirectly show the extent to which electricity is accessible for firms; third, a dummy variable showing whether firms have a high-speed, broadband internet connection is used to examine the effect of internet infrastructure; fourth, an indicator of the efficiency of customs and border management clearance from the World Bank's Logistics Performance Index (LPI) is used to approximate the potential impact of customs infrastructure and state regulations on the exporting activities of firms. The LPI is generated based on a survey of logistics professionals who are asked questions about the foreign countries in which they operate. The customs efficiency index measures the efficiency of the clearance process, i.e., speed, simplicity, and predictability of formalities, by border control agencies, such as customs. It takes values from 1 to 5, with 5 being the most efficient.

$$Z = w\delta + \varepsilon. \quad (2)$$

Another group of outcome variables is the capacity utilized and share of exports in total sales. As the share value ranges from 0 to 100, the *tobit* model is used (Eq. 2). Z is the dependent variable showing utilized capacity and share of export, while w is a vector of exogenous variables, including infrastructure indicators.

The exporting status of firms is measured by a dummy variable, and hence a *probit* model is used for estimation:

$$P(y_i = 1|x_i) = F(\beta_0 + \beta_1 INFR + \dots + \beta_k x_k) \quad (3)$$

where y_i is the discrete dependent variable, taking the value 1 if a firm exports and zero if it does not. $INFR$ and x_i show infrastructure and the set of other explanatory variables, respectively.

Firm performance may depict difference according to the size of firms. Therefore, estimations of each equation are performed for the total sample including an explanatory variable on firm size (Model 1) and by firm size: small firms (Model 2), medium firms (Model 3), and large firms (Model 4). Definitions of firm size given in the survey data are used in this study too. Small firms refer to firms with fewer than 20 employees, medium firms are those with 20 to 99 employees, and large firms have more than 100 employees.

Along with infrastructure, firm performance is affected by other exogenous variables. The set of explanatory variables include managerial and firm characteristics, location, industry, and other exogenous factors. A description of variables is given in Table 1.

Managerial characteristics include the gender and experience of the top manager in the sector. Years since establishment of the firm is included among the firm characteristics. One of the important determinants of firm performance in emerging markets is the internationalization of firms. Therefore, foreign capital participation in the ownership structure is included among explanatory variables. Generally, foreign capital via corporate governance practices and technology transfers is expected to have a positive impact on firm performance (Douma, George, and Kabir 2006; Thomas 2006).

Table 1: Description of Variables

Dependent Variables	
Log of total sales	Log of total annual sales in last fiscal year
Share of capacity utilized	Capacity utilization of firm in last fiscal year (in %)
Export	0 – firm does not have export sales, 1 – firm has export sales
Share of export	Share of export to total sales (in %)
Explanatory Variables	
<i>Infrastructure</i>	
Duration of power outages	Average duration of power outages in hours per month
Electricity expenses	Ratio of total annual costs of electricity in last fiscal year to total sales (in %)
Broadband internet	Firm has a high-speed, broadband internet connection (0 – no, 1 – yes)
Customs	Efficiency of customs and border management clearance from the Logistics Performance Index
<i>Manager characteristics</i>	
Gender	0 – manager is male, 1 – manager is female
Experience	Number of years of experience of the top manager in the sector
<i>Firm characteristics</i>	
Years since establishment	Number of years since establishment of the firm
Foreign capital participation in the ownership structure	Firm has private foreign individuals or companies as owner (0 – no, 1 – yes)
Credit	Firm has lines of credit and outstanding loans (0 – no, 1 – yes)
Number of employees	Total number of full-time employees, adjusted for temporary workers
City size	1 = if city has population over 1 million; 2 = from 250,000 to 1 million; 3 = if 50,000 to 250,000; 4 = if less than 50,000
Informal payment	Share of informal payments paid by firm in total annual sales (in %)
Sector	1 = food and beverages; 2 = light industry; 3 = heavy industry; 4 = construction; 5 = trade; 6 = hotels and restaurants; 7 = other services

Firms may demonstrate varying performance according to the labor force employed. Thus, number of employees is included in the set of exogenous variables. One of the important determinants of firm performance is the access to financial resources. Availability of financial resources promotes higher investment and faster growth of firms (Fafchamps and Schündeln 2013; Fowowe 2017). For approximation of the access to finance effect, we include a dummy variable indicating whether a firm has a loan or credit from financial institutions. Firm performance is affected by external factors too. Another source of variation of firm performance is the institutional environment and the barriers firms face in their operation. Burdensome government regulations and incentives for informal payments can be regarded as important obstacles to firm performance. In order to take into account this potential effect, a variable indicating the

share of total annual sales paid in informal payments is used. Higher shares of informal payments are expected to decrease indicators of firm performance.

The performance of enterprises varies by industry type. We use the ISIC codes and classify industries into seven categories: food and beverages, light industry, heavy industry, construction, trade, hotels and restaurants, and other services. Also, the location of firms in terms of city sizes is considered among explanatory variables.

4. DATA

Empirical analysis is based on enterprise survey data from the World Bank for 2008, 2009, and 2013. The data set includes nine CAREC countries: Afghanistan, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, and Uzbekistan. As can be seen in Table 2, the availability of data for these countries varies according to the survey years: The 2013 survey data set includes almost all countries in the sample, with the exception of Afghanistan. However, the 2008 and 2009 survey data sets include different countries – Afghanistan, Georgia, Tajikistan, and Uzbekistan are surveyed in 2008, and Azerbaijan, Kazakhstan, the Kyrgyz Republic, and Mongolia in 2009. Also, Pakistan survey data are available only for 2013. Given this distribution of countries in the sample by survey years, the use of panel data with repeated observations over the survey years is difficult. However, an enterprise survey contains important information about firm activities and enables measurement of the impact of relevant factors. Therefore, taking into consideration firm-level information provided by the enterprise survey data set, this study uses pooled data for 2008, 2009, and 2013 and applies a cross-sectional estimation approach.

Table 2: Sample Distribution by Countries

Country	2008	2009	2013	Total
Afghanistan	535	0	0	535
Azerbaijan	0	380	390	770
Georgia	373	0	360	733
Kazakhstan	0	544	600	1,144
Kyrgyz Republic	0	235	270	505
Mongolia	0	362	360	722
Pakistan	0	0	1,247	1,247
Tajikistan	360	0	359	719
Uzbekistan	366	0	390	756
Total	1,634	1,521	3,976	7,131

Source: Own elaboration using data from World Bank Enterprise Surveys Data <https://www.enterprisesurveys.org/en/data>.

The total sample size of the data set constructed from the above-noted survey years and countries accounts for 7,131 observations, of which 3,274 are small firms and 2,663 medium firms, while large firms account for 1,194 observations.

The survey questionnaire includes questions related to firm performance, trade, and other characteristics of firms. For the measurement of infrastructure used in this study, the survey questionnaire includes questions on the duration of power outages, electricity costs, and whether firms have access to broadband internet. It should be noted that not all the questions are answered by firms, and hence, depending on the variables used in the analysis, the sample size may vary.

Table 3 presents the distribution of observations by variables and firm size used in the empirical analysis. Thus, total sales are observed in 5,400 firms, while data on the share of utilized capacity exist for 2,522 firms. Their values demonstrate that on average, the capacity utilized does not exceed 75%, being highest for large firms, at 74.22%, and lower for small firms, at 69.92%. Out of the total sample, 11.96% responded that they conduct exporting activities, with the share among small firms being only 5.65%, while it is more than 29% cent for large firms. The share of export sales in total sales for the total sample is more than 5%, which is only slightly higher than the 2% for small firms, while it is more than 14% for large firms.

Table 3: Descriptive Statistics by Firm Size

	Observations	Total Sample	Small	Medium	Large
Observation number		7,131	3,274	2,663	1,194
Dependent Variables		Mean	Mean	Mean	Mean
Log of total sales	5,400	16.43	15.06	16.87	19.25
Share of capacity utilized (%)	2,522	69.92	68.33	69.00	74.22
Export (1 = firm is exporting, 0 = no; in %)	7,131	11.96	5.65	11.79	29.64
Share of export sales (% of total sales)	7,008	5.27	2.20	5.13	14.05
Explanatory Variables	Observations	Total Sample	Small	Medium	Large
Infrastructure					
Power outages (hours per month)	3,216	7.59	7.4	7.79	7.61
Electricity expenses (as % of total sales)	4,781	24.29	21.88	22.92	33.93
Broadband internet (1= firm has access to broadband internet, 0 = no, in %)	4,220	54.26	45.02	61.46	74.49
Customs efficiency index (from 1 to 5)	6,758	2.29	2.26	2.3	2.33
Firm and manager characteristics	Observations	Mean	Mean	Mean	Mean
Gender (1 = if female)	7,116	15.26	17.81	13.57	12
Experience of the manager (years)	6,908	14.62	13.99	14.84	15.88
Firm age (years since establishment)	6,942	14.38	11.63	14.91	20.76
Labor (number of employees)	7,094	88.04	9.96	41.93	408.5
Foreign capital participation in the ownership structure (%)	7,065	4.39	2.53	4.51	9.24
Loan (1 = if firm has loan)	7,131	25.35	19.53	26.96	37.99
Informal payments (% of sales)	6,973	3.2	1.73	1.99	1.82
City size	Observations	%	%	%	%
City with population over 1 million	2,726	38.23	38	38.27	38.78
From 250,000 to 1 million	1,628	22.83	21.01	23.66	25.96
50,000 to 250,000	1,363	19.11	19.55	18.33	19.68
Less than 50,000	1,414	19.83	21.44	19.75	15.58
Sector	Observations	%	%	%	%
Food and beverages	841	11.79	9.59	13.14	14.82
Light industry	820	11.5	9.56	11.53	16.75
Heavy industry	1,344	18.85	15.64	20.5	23.95
Construction	837	11.74	8.49	14.72	13.99
Trade	2,428	34.05	44.26	28.69	18.01
Hotels and restaurants	361	5.06	5.74	4.88	3.6
Other services	500	7.01	6.72	6.53	8.88

Source: Own elaboration using data from World Bank, Enterprise Surveys Data <https://www.enterprisesurveys.org/en/data>.

Among the variables used to measure the infrastructure in this study, the duration of power outages is generally longer than seven hours and does not vary significantly by firm size. However, in terms of the cost of electricity expressed as expenses on electricity as the share of total sales, firm size shows an increasing trend – large firms spend almost 34% of their annual sales on electricity consumption. Access to broadband internet increases with firm size: 45% of small firms indicate having access to the internet, while the rate is 62% among medium firms and more than 74% for large firms. Another indicator used to measure the impact of customs management, which is important for trade activity, is the score for customs from the Logistics Performance Index. A higher score reflects more efficient customs management. Its score is around 2.3. Although the infrastructure indicators used in this study described in Table 3 reported average terms, this may vary by country.

Figures 1–4 compare infrastructure variables by country samples. The average duration of power outages is higher in Uzbekistan and Afghanistan with more than 12 and 11 hours, respectively, while it is comparatively low in Azerbaijan and Georgia – about three and five hours, respectively. In terms of expenses on electricity, the share of total sales in Pakistan is more than 60%, while Azerbaijan and Uzbekistan indicate a low share of about 10%. As an approximation of telecommunication infrastructure, access to broadband internet data show that in Kazakhstan more than 80% of firms have access to broadband internet, while in Afghanistan and Uzbekistan about 10% and 40% of firms, respectively, indicated a positive response. In terms of customs, Georgia and Pakistan have the highest customs scores, while Afghanistan has the lowest.

Figure 1: Average Duration of Power Outages by Country (Hours per Month)

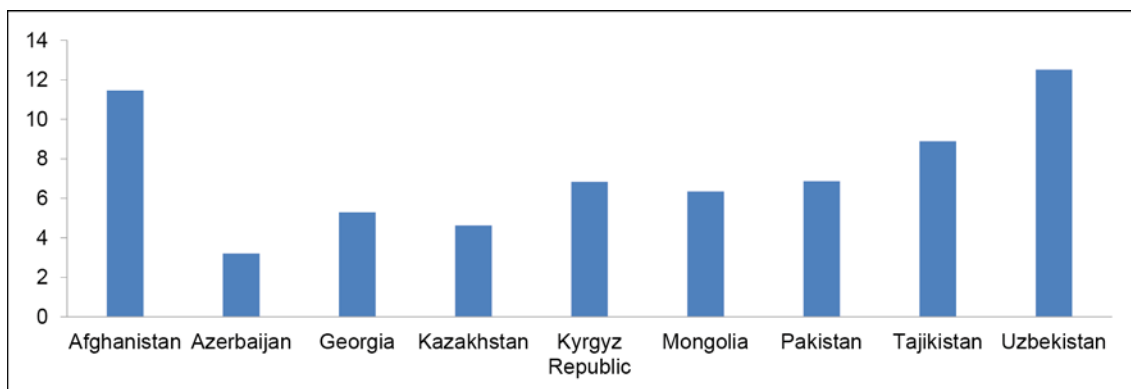


Figure 2: Average Electricity Expenses (as % of Total Sales)

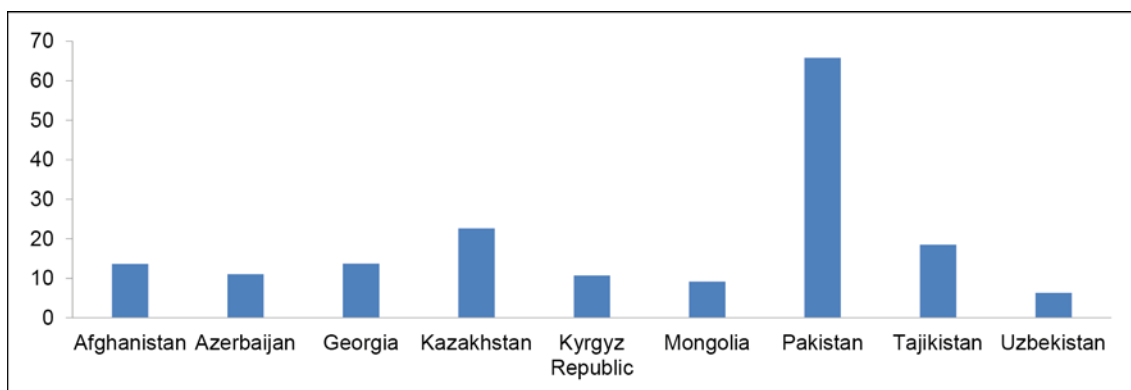


Figure 3: Average Access to Broadband Internet (% of Access)

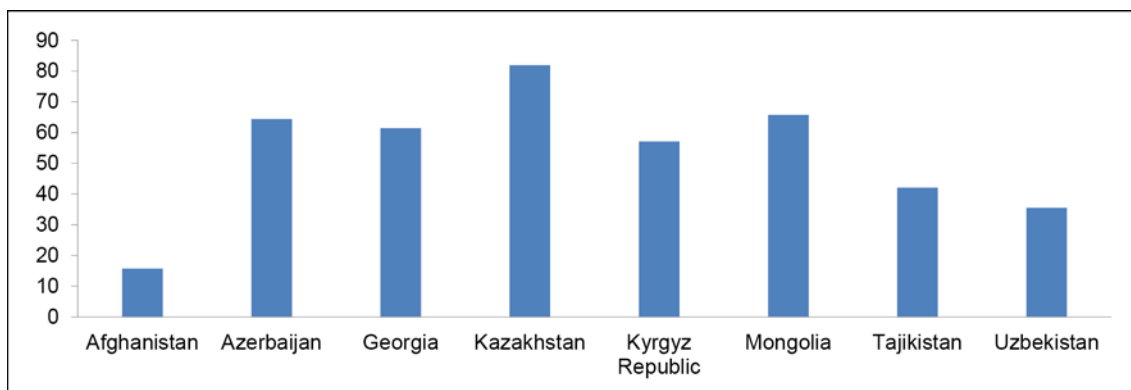
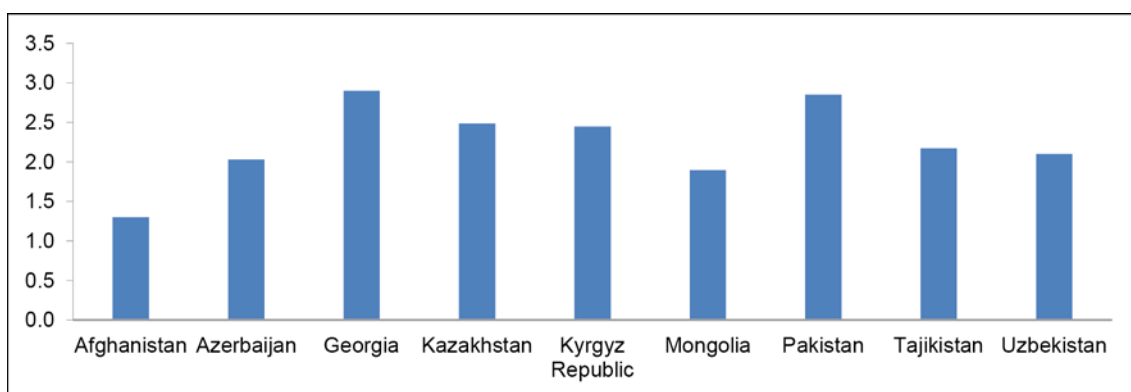


Figure 4: Customs Efficiency Index



As for the other explanatory variables, it is worth noting that small firms have a comparatively higher share of female managers, and as firm size increases, the share decreases. Among small firms, more than 17% of managers are female, while for large firms the rate is about 12%. Along with this, manager experience and years since establishment increase with firm size. Another important characteristic is that access to finance approximated by the dummy variable of whether firms have an outstanding credit line varies significantly by firm size. Thus, more than 19% of small firms have credit, while almost 38% of large firms have outstanding credit. An analogous tendency can be noted for the participation of foreign capital in the ownership of firms. Among small firms, foreign capital accounts for about 2.6%, while in large firms it accounts for more than 9%. Another important variable used to measure the institutional environment faced by firms is the percentage of total annual sales paid in informal payments. Although medium firms report a comparatively high rate of informal payment, at almost 2% of total sales, there is no high variation by firm size.

5. ESTIMATION RESULTS

Estimation results are summarized in Tables 4 and 5. Full results are presented in Tables A1–A4 (Appendix). The results demonstrate, as was expected, a significant impact of infrastructure, i.e., electricity, broadband, and customs efficiency, on the performance of firms. Broadband access and customs efficiency have the largest effect on the performance of firms, and electricity (outages and cost) has the smallest impact.

Estimation results indicate a statistically significant positive effect of access to broadband internet on the total sales of all sizes of firms (small, medium, and large) (Table 4). Although this effect is comparatively higher for large firms, large, medium, and small firms with a broadband internet connection have sales that are 80.7%, 38.4%, and 41.3% (respectively) greater than firms without a broadband internet connection. Capacity utilization shows a strong positive impact in the case of medium firms only (Table 4). Broadband internet has an important influence on export activities too (Table 5). Thus, firms with a broadband internet connection on average are more likely to be exporters by 2.4% than firms without a broadband connection, though this effect is statistically significant only for the total sample. Also, firms with a broadband internet connection on average have greater export sales by 1.68 percentage points in relation to total sales than firms without a broadband internet connection. The impact is particularly high for small firms. Small firms with broadband connections on average have greater export sales by 2.21 percentage points in relation to total sales than small firms without a broadband internet connection. These findings underline the fact that telecommunication infrastructure is one of the significant conditions for increasing the performance of firms. The results show that a broadband internet connection increases the total sales of firms and export sales. This may be related to the importance of online communication for promoting products and expanding markets for sales. This is more evident for small firms in particular. Improving access to, and the affordability of, a broadband internet connection could positively affect sales, including export sales. This finding is particularly relevant for countries with low access to a broadband internet connection. According to our data sample from the World Bank Enterprise Survey, three out of nine CAREC countries have access to broadband below the sample average (54%). They are Afghanistan (16%), Uzbekistan (35%), and Tajikistan (42%) (Figure 3).

Another indicator measuring the impact of infrastructure on export activities is the efficiency of customs and border management clearance index from the Logistics Performance Index (Table 5). As expected, it shows a positive impact on the probability of being an exporter and the share of export sales. Higher efficiency of customs and border management promotes firms in terms of being exporters and increasing export sales. However, this effect is not statistically significant for small firms. This is probably because small firms are less likely to be affected by cross-border trade. The magnitude of the impact on large and medium firms is large. Large and medium firms located in countries with greater customs efficiency by 1 unit of index (index takes values from 1 to 5) are more likely to be exporters by 121.7% and 59.6%, respectively, and have a greater share of export sales in total sales by 52.068 and 25.491 percentage points, respectively. This result is important for all CAREC member countries because the average customs efficiency index is very low at 2.29 (index takes values from 1 to 5) (Table 3). Large and medium firms from all CAREC countries could benefit from improved custom efficiency. According to our data sample from the World Bank's LPI, the lowest customs efficiency index is in Afghanistan (1.3), followed by Mongolia (1.89), Azerbaijan (2.02), Uzbekistan (2.09), and Tajikistan (2.16) (Figure 4), with a customs efficiency index below the sample average of nine CAREC countries (2.29).

Duration of power outages shows, as was expected, a negative impact on total sales and the share of capacity utilized (Tables 4 and 5 and Table A1). However, it has a statistically significant negative impact on capacity utilization in the case of the total sample only. Also, the impact of power outages on capacity utilization is relatively small. A one-hour increase in the duration of power outage per month decreases the share of utilized capacity by 0.139 percentage points (Table 4). This means that firms that experience one hour per month less of power outages utilized their capacity by 0.139 percentage points. Capacity utilization does not have a statistically significant

impact on exports (Table 5). This shows that the quality of energy infrastructure is important for firm performance in CAREC countries. This finding is particularly relevant for countries with the longest outages in the CAREC region, according to our data sample from the World Bank's Enterprise Survey, namely Uzbekistan (12.51 hours per month) and Afghanistan (11.46 hours per month) (Figure 1). Reduction of outages by Uzbekistan and Afghanistan to the sample average of 7.59 hours per month (Table 3) will allow firms' capacity utilization to be increased on average by 0.68 percentage points in Uzbekistan and 0.54 percentage points in Afghanistan.

Another indicator used to measure the infrastructure in this study is electricity expenses as the share of total sales demonstrates the expected negative impact on total sales and the capacity utilization rate. Although the impact of electricity expenses is mainly very small, the magnitude of its impact is great for small firms' total sales. Small firms (those with fewer than 20 employees) with greater electricity expenses by 1% in total sales have lower sales by 1.697% (Table 4). This means that small firms are particularly sensitive to electricity charges. For the capacity utilization outcome variable this influence is statistically significant for the sample of large firms only, however the magnitude of the impact is very small (Table 4). Overall, this finding supports the view that the cost of electricity is one of the fundamental factors for firm performance and its level of significance varies by firm size. Small firms may be more impacted by this effect. Interestingly, export activities are not affected by electricity expenses (Table 5). Although energy prices are low in most CAREC countries, due to price control or subsidies, usually energy prices are lower for residential users and higher for commercial users. Differentiated electricity rates according to firm size (or consumption size), with lower rates for smaller firms, could significantly improve the performance of small firms. Electricity expenses (% of total sales) are particularly high in Pakistan (66%), Kazakhstan (23%), and Tajikistan (18%), according to our data sample from the World Bank's Enterprise survey.

Table 4: Infrastructure Impact on Total Sales and Capacity Utilization

	Log of Total Sales			
	Total Sample	Small Firms	Medium Firms	Large Firms
Duration of power outages (hours per month)	-0.00337 (0.00397)	-9.07e-05 (0.00585)	-0.00646 (0.00541)	-0.0163 (0.0128)
Electricity expenses (% of total sales)	-0.000343*** (2.54e-05)	-1.697*** (0.242)	-0.0102*** (0.00185)	-0.000336*** (3.06e-05)
Broadband connection (0 or 1)	0.548*** (0.0710)	0.413*** (0.0926)	0.384*** (0.114)	0.807*** (0.235)
	Capacity Utilization (%)			
	Total Sample	Small Firms	Medium Firms	Large Firms
Duration of power outages (hours per month)	-0.139** (0.070)	-0.170 (0.144)	-0.176 (0.109)	-0.162 (0.132)
Electricity expenses (% of total sales)	-0.001*** (0.000)	-0.131 (3.462)	-0.036 (0.029)	-0.001*** (0.000)
Broadband connection (0 or 1)	1.549 (2.167)	-2.077 (3.442)	6.717** (3.254)	-8.497 (5.641)

Note: Estimations include other explanatory variables described in Table 1. Capital utilization represents marginal effects from the tobit models. Full estimation results are available from the authors upon request.

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Infrastructure Impact on Export Activities

	Export Dummy (0 or 1)			
	Total Sample	Small Firms	Medium Firms	Large Firms
Duration of power outages (hours per month)	0.000852 (0.000577)	0.000678 (0.000936)	0.00126 (0.000849)	-0.00263 (0.00225)
Electricity expenses (% of total sales)	3.13e-06 (3.65e-06)	0.0105 (0.0177)	0.000703 (0.00112)	7.50e-06 (6.31e-06)
Broadband connection (0 or 1)	0.0240** (0.0122)	0.0227 (0.0150)	0.0159 (0.0196)	0.0248 (0.0553)
Customs	0.393*** (0.138)	0.0550 (0.177)	0.596** (0.252)	1.217** (0.522)
	Export Sales (% of Total Sales)			
	Total Sample	Small Firms	Medium Firms	Large Firms
Duration of power outages (hours per month)	0.037 (0.033)	-0.022 (0.033)	0.047 (0.041)	-0.042 (0.096)
Electricity expenses (% of total sales)	0.000 (0.000)	0.211 (0.985)	0.052 (0.061)	0.000 (0.000)
Broadband connection (0 or 1)	1.680*** (0.605)	2.210*** (0.852)	0.611 (0.888)	1.584 (2.737)
Customs	14.168* (7.777)	-1.150 (9.613)	25.491* (14.569)	52.068* (30.460)

Note: Estimations include other explanatory variables described in Table 1. Share of export sales represents marginal effects from tobit models. Export dummy estimation results include marginal effects from probit model. Full estimation results are available from the authors upon request.

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Although Tables 4 and 5 include the main of variable of interest, the effect of other explanatory variables can be analyzed from Appendix Tables A1–A4, which include total sample estimation results for each model of infrastructure indicator. Among these variables, gender of the manager indicates that having a female manager has a negative impact on the total sales of firms. Firms with a longer history measured through the years since establishment have a higher volume of total sales and export activities.

In almost all four models, participation of foreign capital in the ownership structure of firms and having a current credit line from financial institutions increase firm performance. These findings indicate that along with the infrastructure, access to finance and foreign capital have a positive impact on firms' total sales, the probability of being an exporter, and the share of export sales. Inclusion of the firm size category in total sample estimations indicates that medium and large firms have a higher performance than small firms in almost all measured performance criteria.

Thus, estimation results indicate that stability of electricity, its cost expressed as expenses share in total sales, access to broadband internet and efficiency of customs have important impacts on the performance of firms. On the other hand, these effects vary according to the size of firms. Thus, for small firms, the importance of broadband internet access and electricity expenses can be noted, while medium and large firms mostly benefit from higher efficiency of customs and border management.

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

This study investigated the impact of infrastructure on firm performance in nine CAREC countries using the World Bank's Enterprise Survey pooled data from 2009, 2013, and 2019. Firm performance was measured by total sales, share of utilized capacity, dummy variable as to whether a firm exports, and the share of export sales. Infrastructure was evaluated via the duration of power outages, electricity expenses as the share of total sales, access to broadband internet and efficiency of customs. Our results suggest that the impact of infrastructure access and quality varies across firm sizes.

Empirical findings indicate that infrastructure has a significant impact on firm performance in the CAREC member countries. The greatest impact on firm performance is by broadband internet connection and customs efficiency. The impact of power outages and electricity expenses on firm performance is smaller. In particular, access to broadband internet has a strong positive impact on total sales and export sales, with this effect being especially notable in the case of small firms. Efficient customs increase the probability of being an exporter and the share of export sales, especially in large and medium firms. Higher electricity expenses have a negative impact on total sales and capacity utilization. Longer hours of power outages reduce capacity utilization too.

Along with its empirical findings, some limitations of this study can be noted. First, being based on pooled data, the study does not use panel data estimation techniques because of the data limitation. Further studies incorporating analysis of observations over several waves of the survey may provide more details on firm performance. Second, although several indicators are used to assess the infrastructure impact, transportation is among the important factors affecting firm performance and international trade. However, in the survey data used in this study, there is limited information on transportation. Future studies focusing on transportation infrastructure using firm-level data may suggest more insights into its relationship with firm performance in CAREC countries.

Policy Recommendations

The impact of infrastructure depends on firm size. Results for small, medium, and large firms are summarized in Table 6. While taking into consideration their potential limitations, these findings have several policy implications. These can be listed as follows:

- Improving access to, and the affordability of, a broadband internet connection could positively affect sales, including export sales. Policy in this direction can be oriented toward widening access to, and the affordability of, internet for firms, particularly in Afghanistan, Uzbekistan, and Tajikistan.
- Improvements in customs efficiency could positively affect firms' exports, particularly for medium and large firms. Customs efficiency is very low in nine CAREC member countries: Afghanistan, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, and Uzbekistan. These countries could benefit from the improvement of customs efficiency. Further bilateral and multilateral cooperation for reducing trade barriers, digitalization, and other measures improving customs efficiency may stimulate firms' engagement in international trade.

- Importance of stable energy infrastructure – a decrease in the number of power outages could improve firm performance, particularly in Uzbekistan and Afghanistan.
- Electricity expenses have a significant negative impact, particularly on small firms. Reducing electricity expenses for small firms could improve firms' performance, particularly in Pakistan, Kazakhstan, and Tajikistan. This necessitates government policies aimed at the reduction of electricity costs for small firms, for example by providing progressive electricity tariffs with smaller rates for smaller consumers/firms.

Table 6: Summary of Results and Policy Recommendations

Firm Size	Broadband +	Customs +	Electricity Outages -	Electricity Expenses -
Small	Large	No impact	No impact	Large
Medium	Large	Large	No impact	Small
Large	Large	Large	No impact	Small
All	Large	Large	Small	Small
Policy	Improve access and affordability of broadband	Improve customs efficiency	Reduce electricity outages	Progressive electricity tariffs
CAREC countries for attention	Afghanistan, Uzbekistan, Tajikistan	Afghanistan, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, Uzbekistan	Uzbekistan, Afghanistan	Pakistan, Kazakhstan, Tajikistan
CAREC countries for good examples	Kazakhstan		Azerbaijan	Uzbekistan, Mongolia, Kyrgyz Republic

REFERENCES

- Douma, S., George, R., and Kabir, R. (2006). Foreign and domestic ownership, business groups, and firm performance: Evidence from a large emerging market. *Strategic Management Journal*, 27(7), 637–657.
- Fafchamps, M., and Schündeln, M. (2013). Local financial development and firm performance: Evidence from Morocco. *Journal of Development Economics*, 103, 15–28.
- Fowowe, B. (2017). Access to finance and firm performance: Evidence from African countries. *Review of Development Finance*, 7(1), 6–17.
- Grigoriou, C. (2007). Landlockedness, infrastructure and trade: New estimates for central Asian countries. World Bank Policy Research Working Paper 4335, The World Bank.
- limi, A. (2011). Effects of improving infrastructure quality on business costs: Evidence from firm-level data in Eastern Europe and Central Asia. *The Developing Economies*, 49(2), 121–147.
- Karymshakov, K., and Sulaimanova, B. (2019). Measuring the Impact and Financing of Infrastructure in the Kyrgyz Republic. ADBI Working Paper 988. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/measuring-impact-and-financinginfrastructure-kyrgyz-republic>.
- Karymshakov, K., and Sulaimanova, B. (2020). The Impact of Infrastructure on Trade in Central Asia. ADBI Working Paper 1184. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/impact-infrastructure-trade-central-asia>.
- Raballand, G. (2003). Determinants of the negative impact of being landlocked on trade: an empirical investigation through the Central Asian case. *Comparative Economic Studies*, 45(4), 520–536.
- Shepherd, B., and Wilson, J. S. (2007). Trade, infrastructure, and roadways in Europe and Central Asia: New empirical evidence. *Journal of Economic Integration*, 22(4), 723–747.
- Thomas, D. E. (2006). International diversification and firm performance in Mexican firms: A curvilinear relationship? *Journal of Business Research*, 59(4), 501–507.
- Yoshino, N., and Abidhadjaev, U. (2017). An impact evaluation of investment in infrastructure: The case of a railway connection in Uzbekistan. *Journal of Asian Economics* 49, 1–11.
- Yoshino, N., Azhgaliyeva, D., and Mishra, R. (2021). Financing infrastructure using floating-interest-rate infrastructure bond. *Journal of Infrastructure, Policy and Development*, 4(2), 306–315. <https://dx.doi.org/10.24294/jipd.v4i2.1236>.
- Yoshino, N., Huang, B., Azhgaliyeva, D., and Abbas, Q. (2021). Developing infrastructure in Central Asia: Impacts and financing measures. ADBI Press. Tokyo, Japan. <https://www.adb.org/sites/default/files/publication/688061/adbi-book-developing-infrastructure-central-asia.pdf>.

APPENDIX

Table A1: Impact of Duration of Power Outages on Performance of Firms

	Total Sales	Capital Utilization	Export Dummy	Share of Export Sales
Duration of power outages	-0.00337 (0.00397)	-0.139** (0.070)	0.000852 (0.000577)	0.037 (0.033)
Gender (1 = if female)	-0.286* (0.150)	-0.033 (3.522)	0.0417 (0.0257)	1.904 (1.496)
Experience of the manager	-0.00375 (0.00504)	0.153 (0.094)	-0.000903 (0.000876)	-0.053 (0.052)
Years since establishment	0.00953** (0.00372)	-0.100* (0.058)	0.000112 (0.000579)	0.000 (0.033)
Number of employees	0.00196*** (0.000279)	0.006 (0.004)	5.75e-05 (3.78e-05)	0.002 (0.002)
Foreign capital participation	0.00772*** (0.00298)	-0.053 (0.057)	0.00113** (0.000456)	0.063** (0.026)
Credit	0.535*** (0.122)	-2.561 (2.377)	0.0667*** (0.0196)	4.300*** (1.152)
City size	-0.0731 (0.0514)	-0.214 (0.993)	0.0110 (0.00915)	0.971* (0.533)
Informal payment	-0.00857 (0.00886)	-0.255 (0.177)	-0.00223 (0.00163)	-0.143 (0.098)
<i>Sector (reference category: food and beverages)</i>				
Light industry	-0.440** (0.173)	0.557 (2.249)	0.0827** (0.0358)	7.540*** (2.176)
Heavy industry	-0.346** (0.160)	0.175 (2.098)	0.0254 (0.0308)	2.079 (1.666)
Construction	-0.142 (0.198)	3.629 (12.491)	-0.119*** (0.0269)	-5.999*** (1.224)
Trade	-0.135 (0.162)	6.294 (10.136)	-0.0691** (0.0276)	-2.238 (1.459)
Hotels and restaurants	-0.971*** (0.251)	9.380 (13.796)	-0.113*** (0.0313)	-4.688*** (1.577)
Other services	-0.583*** (0.220)	29.958*** (1.722)	0.0205 (0.0419)	1.733 (2.345)
<i>Firm size (small firm is reference category)</i>				
Medium firm				
Large firm				
Year	+	+	+	+
Country	+	+	+	+
Constant	15.41*** (0.230)			
Observations	1,358	697	1,590	1,581
R-squared	0.730			

Note: Estimations are based on full sample without firm size subsamples. Capital utilization and share of export sales represent marginal effects from tobit models. Export dummy estimation results include marginal effects from probit model. Full estimation results for subsamples based on firm size are available from the authors upon request.

Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A2: Impact of Electricity Expenses on Performance of Firms

	Log of Total Sales	Capital Utilization	Export Dummy	Share of Export Sales
Electricity expenses	-0.000343*** (2.54e-05)	-0.001*** (0.000)	3.13e-06 (3.65e-06)	0.000 (0.000)
Gender (1 = if female)	-0.245*** (0.0946)	1.557 (2.476)	0.00749 (0.0176)	0.221 (0.981)
Experience of the manager	-0.00173 (0.00343)	-0.023 (0.073)	-0.00109* (0.000636)	-0.058 (0.036)
Years since establishment	0.00697*** (0.00264)	-0.164*** (0.051)	0.000584 (0.000422)	0.025 (0.023)
Number of employees	0.00161*** (0.000206)	0.007** (0.003)	6.76e-05*** (2.39e-05)	0.002 (0.001)
Foreign capital participation	0.00507*** (0.00194)	0.022 (0.041)	0.000982*** (0.000299)	0.057*** (0.016)
Credit	0.460*** (0.0800)	0.009 (1.823)	0.0507*** (0.0138)	2.439*** (0.770)
City size	-0.112*** (0.0298)	-0.296 (0.732)	-0.00474 (0.00591)	0.085 (0.328)
Informal payment	-0.00331 (0.00747)	-0.275* (0.157)	-0.000907 (0.00134)	-0.051 (0.075)
<i>Sector (reference category: food and beverages)</i>				
Light industry	-0.604*** (0.126)	-0.056 (1.923)	0.0390 (0.0264)	3.808** (1.520)
Heavy industry	-0.244** (0.116)	0.472 (1.785)	-0.0154 (0.0225)	-0.578 (1.175)
Construction	-0.158 (0.149)	0.615 (11.389)	-0.0957*** (0.0236)	-5.134*** (1.072)
Trade	0.0556 (0.111)	12.878 (9.084)	-0.0700*** (0.0209)	-2.896*** (1.089)
Hotels and restaurants	-0.987*** (0.179)	30.329*** (1.392)	-0.103*** (0.0254)	-4.704*** (1.229)
Other services	-0.633*** (0.175)	28.082*** (3.040)	-0.0294 (0.0327)	-0.757 (1.791)
<i>Firm size (reference category: small firm)</i>				
Medium firm	1.461*** (0.0722)	3.331** (1.617)	0.0359*** (0.0127)	2.296*** (0.667)
Large firm	2.946*** (0.121)	7.449*** (2.290)	0.139*** (0.0268)	8.137*** (1.541)
Year	+	+	+	+
Country	+	+	+	+
Constant	15.27*** (0.178)			
Observations	2,071	1,025	2,394	2,384
R-squared	0.823			

Note: Estimations are based on full sample without firm size subsamples. Capital utilization and share of export sales represent marginal effects from tobit models. Export dummy estimation results include marginal effects from probit model. Full estimation results for subsamples based on firm size are available from the authors upon request.

Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A3: Impact of Access to Broadband Internet on Performance of Firms

	Log of Total Sales	Capital Utilization	Export Dummy	Share of Export Sales
Broadband internet	0.548*** (0.0710)	1.549 (2.167)	0.0240** (0.0122)	1.680*** (0.605)
Gender (1 = if female)	-0.283*** (0.0852)	-2.134 (2.780)	-8.12e-05 (0.0143)	-0.017 (0.688)
Experience of the manager	0.00151 (0.00313)	0.025 (0.089)	-0.000555 (0.000527)	-0.036 (0.026)
Years since establishment	0.00374 (0.00277)	-0.200** (0.079)	0.00111*** (0.000409)	0.044** (0.019)
Number of employees	0.00161*** (0.000203)	0.007 (0.004)	4.52e-05* (2.50e-05)	0.002 (0.001)
Foreign capital participation	0.00538*** (0.00177)	0.034 (0.044)	0.000843*** (0.000227)	0.037*** (0.011)
Credit	0.436*** (0.0740)	-3.077 (2.187)	0.0345*** (0.0117)	1.232** (0.561)
City size	-0.0664** (0.0272)	-1.235 (0.839)	-0.00460 (0.00484)	-0.015 (0.230)
Informal payment	-0.00646 (0.00749)	0.088 (0.325)	0.00107 (0.00106)	0.052 (0.051)
<i>Sector (reference category: food and beverages)</i>				
Light industry	-0.625*** (0.147)	-0.720 (2.579)	0.0435 (0.0319)	2.746 (1.703)
Heavy industry	-0.307** (0.130)	-3.527 (2.273)	-0.0101 (0.0252)	-0.822 (1.244)
Construction	-0.139 (0.131)	-0.386 (12.155)	-0.0928*** (0.0215)	-4.824*** (1.035)
Trade	0.0934 (0.115)	5.296 (7.161)	-0.0530** (0.0218)	-2.544** (1.092)
Hotels and restaurants	-0.835*** (0.169)	14.661 (16.279)	-0.0663** (0.0275)	-3.672*** (1.234)
Other services	-0.698*** (0.151)	24.782*** (5.564)	0.0126 (0.0300)	-0.340 (1.458)
<i>Firm size (reference category: small firm)</i>				
Medium firm	1.216*** (0.0669)	5.425*** (2.077)	0.00766 (0.0109)	0.666 (0.512)
Large firm	2.598*** (0.119)	5.207 (3.178)	0.0779*** (0.0243)	3.967*** (1.221)
Year	+	+	+	+
Country	+	+	+	+
Constant	15.23*** (0.151)			
Observations	2,151	709	2,652	2,637
R-squared	0.844			

Note: Estimations are based on full sample without firm size subsamples. Capital utilization and share of export sales represent marginal effects from tobit models. Export dummy estimation results include marginal effects from probit model. Full estimation results for subsamples based on firm size are available from the authors upon request.

Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table A4: Impact of Customs Management on Performance of Firms

	Export Dummy	Share of Export Sales
Customs	0.393*** (0.138)	14.168* (7.777)
Gender (1 = if female)	0.0106 (0.0149)	0.306 (0.808)
Experience of the manager	-0.000522 (0.000518)	-0.033 (0.028)
Years since establishment	0.000605 (0.000372)	0.028 (0.019)
Number of employees	6.64e-05*** (2.04e-05)	0.002** (0.001)
Foreign capital participation	0.00112*** (0.000247)	0.058*** (0.013)
Credit	0.0466*** (0.0117)	2.341*** (0.635)
City size	-0.00212 (0.00504)	0.148 (0.271)
Informal payment	-0.000623 (0.00104)	-0.031 (0.057)
<i>Sector (reference category: food and beverages)</i>		
Light industry	0.0246 (0.0242)	3.221** (1.368)
Heavy industry	-0.0119 (0.0210)	-0.237 (1.082)
Construction	-0.121*** (0.0185)	-5.778*** (0.888)
Trade	-0.0683*** (0.0193)	-2.642*** (0.991)
Hotels and restaurants	-0.0982*** (0.0238)	-4.623*** (1.104)
Other services	-0.0141 (0.0267)	-0.621 (1.387)
<i>Firm size (reference category: small firm)</i>		
Medium firm	0.0356*** (0.0107)	2.255*** (0.561)
Large firm	0.113*** (0.0215)	6.659*** (1.207)
Year	+	+
Country	+	+
Constant		
Observations	3,448	3,425

Note: Estimations are based on full sample without firm size subsamples. Share of export sales represents marginal effects from tobit model. Export dummy estimation results include estimation marginal effects from probit model. Full estimation results for subsamples based on firm size are available from the authors upon request.

Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.