THE DEVELOPMENT OF MA PROGRAMS AT NAZARBAYEV UNIVERSITY:

THE IMPACT OF SUBSIDIES ON FIRM SALES IN THE COMMONWEALTH OF INDEPENDENT STATES (CIS)

by

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Abstract

The aim of the following study is to investigate the impact of subsidies on firm sales in Commonwealth of Independent States (CIS) countries. This study is based on the fifth round of Business Environment and Enterprise Performance Survey (BEEPS) that is implemented by the European Bank for Reconstruction and Development (EBRD) in partnership with the World Bank. In order to account for the possibility that *subsidy* is jointly determined with the dependent variable *lsales* through an equilibrium mechanism, I use simultaneous equations model. According to the estimation results, receiving a subsidy does not have a significant positive impact on firms' sales in CIS countries and Russian Federation. In addition, the results show that larger firms are more likely to receive a subsidy.

Contents

1 Introduction

The aim of this paper is to analyze the impact of subsidy programs launched by local, regional or national government, or EU sources on firms' sales in Commonwealth of Independent States (CIS) countries. CIS is a political and economic confederation that consists of nine member states and two associate members, including Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Armenia, Moldova, Russia, Tajikistan and Uzbekistan. Two associate states are Turkmenistan and Ukraine.

As it is known, subsidies granted to small and medium enterprises (SMEs) are aimed to promote productivity growth in the manufacturing sector and thus to foster economic growth. Taking this fact into account, it is possible to conclude that capital and interest-rate subsidies granted by the government and other local or international institutions in CIS countries might lead to improved firm performance, higher sales and profits. This view is supported by De Long and Summers (1991), who assert that machinery and equipment investment has a strong association with growth.

Although, subsidies are aimed to promote growth and lead to improved firm performance, it might be the case that they are not allocated efficiently and do not reach its intended beneficiaries. In some cases, already efficient and large firms might receive a subsidy. Bergström (1998) asserts that resources might be suboptimally allocated, as politicians and bureaucrats might be more interested in maximizing political objectives rather than in economic efficiency. In addition, Patacchini and Rapisarda (2003) find some evidence that in Italy subsidies are more likely to be granted to firms that are in good health and that would have received finance even without a subsidy. A similar effect might be present in the context of CIS, as larger firms with higher potential to develop as well as better financial indicators possibly could have some advantages in receiving a subsidy.

In this paper, I study the impact of subsidy program on sales of the firm in a simultaneous equations framework to account for the possibility that *subsidy* is jointly determined with the dependent variable *lsales* through an equilibrium mechanism. To estimate simultaneous equations model, `cmp` routine is used. Modeling in the `cmp` frame-

work allows joint estimation of two or more equations with linkages among their error processes. My findings suggest that the OLS estimates are biased, and subsidy does not have a significant positive impact on sales of the firm. At the same time, sales has a significant positive impact on the probability of receiving a subsidy, which is indicative of the fact that larger firms are more likely to receive a subsidy.

This paper is organized as follows. Section 2 discusses available literature on subsidy programs and puts current research into perspective. Section 3 provides background information on subsidy programs in CIS countries and government decrees. Section 4 describes data used for this study. Section 5 presents methodology, Section 6 provides explanation of estimation results and Section 7 concludes.

2 Literature Review

There is a number of works in the literature analyzing the impact of subsidy/loan programs on economic growth and firm performance. Gale (1991) assesses the impact of subsidy programs on economic growth and welfare while Dihn et al. (2013) empirically assesses the impact of subsidy programs on firm performance in terms of profits and employment growth. In addition, Wallsten (2000) addresses the problems of endogeneity when estimating the impact of subsidy programs on firm performance applying a number of methods to deal with this issue.

In one of the papers, Gale (1991) provides numerical estimates of the federal lending on credit allocation and economic efficiency. According to the United States Budget, since 1980, the federal government had directly subsidized one-third of all nonfederal borrowing. Taking into account this fact, Gale shows that efficiency costs were large, approximately 10-15 billion dollars, or 1/3 percent of GNP in 1987. In addition, credit subsidies have important effects on the allocation of credit, but little effect on aggregate investment. Moreover, most direct welfare gains appear to accrue to borrowers who would have received credit without government subsidies.

Dihn et al. (2013) also addresses the issue of the effectiveness of the subsidy program.

Using the firm-level data, they quantitatively evaluate the effect of interest rate subsidy program on firm performance and investment behavior during economic recession. Using the PSM approach, they show that firms that received subsidized loans are more likely to increase labor, to expand investment and to possess optimistic plans. Authors use the PSM approach in order to address self-selection issue.

Lee (1996) examines the impact of government industrial policy, including subsidized credit and tax incentives, on productivity growth in the Korean manufacturing sector. Empirical results show that subsidized credit and tax incentives were not correlated with the growth rate of total factor productivity in the promoted industries of the Korean manufacturing sector. Furthermore, Lee finds that Korean industrial policies have not been successful in promoting productivity growth.

Bergström (1998) examines the effects on productivity, at the firm level, of capital subsidies that have been used in Sweden. He finds that that subsidisation can influence growth, but there is a little evidence that subsidies have affected productivity. According to this study, subsidisation is positively correlated with growth of value added and productivity of the subsidised firms seems to increase the first year after the subsidies were granted. But, after the first year it seems that the more subsidies a firm has been granted, the lower TFP growth is observed. Bergström (1998) asserts that the influence of important pressure groups can lead to subsidisation of less productive firms. Moreover, he argues that subsidisation can also make firms less efficient.

Tzelepis and Skuras (2004) examine the effects of regional capital subsidies on four dimensions of firm performance, namely efficiency, profitability, leverage and growth in Greece. Authors use the database of firms in Greek food and drinks manufacturing sector for the period 1982-1996. According to the results of their study, capital subsidization affects solely firm growth. In addition, capital subsidization has a negative and insignificant impact on the return on assets (ROA).

Using a dataset of firms involved in the Small Business Innovation Research (SBIR) program, Wallsten (2000) find that firms with more employees and patents win more federal research and development grants from the program, but that the grants do not

appear to affect employment. In order to control for endogeneity, Wallsten estimates a multi-equation model. Total SBIR budget of all agency years in which the firm won an award is used as the instrumental variable.

Pattacchini and Rapisarda (2003) also address the issue of efficiency of subsidy/loan program using a dataset of Italian firms. Authors share the idea that a proper evaluation of the effectiveness of credit programs should be based on the fact whether they reach the intended beneficiaries. Using a unique panel of bank-firm relationships, authors study the impact of interest-rate subsidies on the total amount of borrowing and the average cost of borrowing for subsidised firms. To study these impacts the autoregressive distributed lag panel data model on the whole sample of firms is estimated. By estimating this model, authors argue that subsidies reach borrowers that could have received finance even without subsidies. In addition, by estimating the effect of subsidies on non-subsidized interest rates over time, authors find that a unit change in the size of the subsidy exerts a significant positive effect.

Jha and Mehta (2008) also numerically evaluate the effectiveness of the rice subsidy program run by the Philippine's National Food Authority (NFA). Using the household consumption expenditure survey data, authors examine program's performance in terms of participation and utilization by the poor. Utilizing the Heckman's model to address the issue of self-selection, authors find that nonparticipation is probably involuntary, being the result of limitations or fixed costs in accessing the program. Authors conclude that the subsidy program could be more effective if it can reach the poor.

3 Subsidy Programs in CIS countries

Commonwealth of Independent States (CIS) is a political and economic confederation that consists of nine member states and two associate members, including Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Armenia, Moldova, Russia, Tajikistan and Uzbekistan. Two associate states are Turkmenistan and Ukraine. In October, 2010 heads of the Republic of Belarus, the Republic of Kazakhstan, the Kyrgyz Republic, the Russian Federation, the

Republic of Tajikistan signed the Treaty on the Establishment of the Eurasian Economic Community that was entered into force on May 30, 2001. The Treaty laid the concept of close and effective trade and economic cooperation to achieve the goals and objectives defined by the Treaty on the Customs Union and the Common Economic Space. In 2014, Eurasian Economic Community were replaced by the Eurasian Economic Union, an international organization of regional economic integration. The EAEU ensures free movement of goods, services, capital and labor, and pursues coordinated, harmonized and single policy in macroeconomic sphere, transport, industry and agriculture, energy, foreign trade and investment, customs, technical regulation, competition and antitrust regulation. The Member States of the Eurasian Economic Union are the Republic of Armenia, the Republic of Belarus, the Republic of Kazakhstan, the Kyrgyz Republic and the Russian Federation.

According to the Analytical Review on the conditions of small and medium enterprises in CIS countries, official subsidy programs were initiated in the Russian Federation and the Republic of Kazakhstan. Government Decrees on provision of subsidies were issued in the Russian Federation, the Republic of Kazakhstan, the Republic of Moldova, the Republic of Belarus and the Republic of Tajikistan. In Armenia and Azerbaijan government provides subsidies to firms operating in the agricultural sector.

In Russian Federation, the Ministry of Economic Development has been implementing a special program of granting subsidies from the federal budget to the budgets of the constituent entities of the Russian Federation to provide support to small and medium-sized businesses at the regional level since 2005. All the funds are allocated on a competitive basis among different regions. As of 2011, as the result of this program more than 10,000 enterprises and 170,000 new workplaces were created and about 450,000 jobs were saved. In 2012, federal budget allocated 20.8 billion rubles (669,46 million dollars) to the development of small and medium enterprises, of which 1.8 billion rubles (58 million dollars) were allocated to the creation of infrastructure facilities, such as business incubators and industrial parks, while 19 billion rubles (612 million dollars) were spent on provision of direct subsidies to entrepreneurs, financing of guarantee funds and micro-finance funds.

The main emphasis of the 2012 Program was to provide access to financial resources for medium-sized companies, leaders in improving competitiveness and modernization of the economy. The following subsidy program is aimed at the development of medium enterprises and firms with innovative potential.

In addition, the Analytical Review on the conditions of small and medium enterprises in CIS countries states that in Russian Federation a number of subsidies were provided to support firms located in regions, to support export-oriented firms, to recover costs related to machinery and equipment spending, to support newly established firms and organizations as well as to support entrepreneurship among youths.

The Government of Russian Federation issued official decrees on providing a subsidy for firms with exporting potential and subsidies aimed to recover some of the costs related to the machinery and equipment spending. On August 12, 2013 the Government of Russian Federation issued the Decree 687 on the approval of the rules for granting subsidies from the federal budget to light and textile industry organizations for reimbursing interest payments on credits received in Russian credit organizations in 2013-2015 for the realization of investment projects for technical modernization. On October 25, 2013, the Decree 961 on granting subsidies from the federal budget to Russian organizations exporting industrial products for military purposes to reimburse part of the cost of paying interest on loans received from Russian credit institutions and the state corporation Bank for Development and Foreign Economic Affairs (Vnesheconombank) was issued.

In Kazakhstan, the "Damu" fund was established in 1997 with aim to provide financial assistance to small and medium enterprises. The Fund provides financial assistance to small and medium enterprises using instruments such as financing of SMEs through second-tier banks or conditional cash placement programs, interest rate subsidies, provision of guarantees as well as informational and consultative support. In 2013, according to the official information published in the Annual Report of the Fund, 1455 projects received approximately 27 billion tenge (180 million dollars) in the form of interest-rate subsidy. "Damu" provides financial subsidies to firms operating in manufacturing industry and export-oriented firms.

The Government of the Republic of Kazakhstan also issued official decrees on providing a subsidy to support agricultural sector and single industry towns. On March 12, 2011 the Government of the Republic of Kazakhstan issued the Decree 322 on the approval of the rules for the use of targeted current transfers from the Republican budget by regional budgets and budgets of Astana and Almaty cities to support seed production, as well as the use of budget subsidies for the laying of queen cells of perennial plantations of fruit and berry crops, grapes and 1 ton of "basic seeds" of agricultural plants. On April 19, 2012 the Government issued the Decree 488 on approval of the rules for subsidizing interest rate for loans issued to support agricultural sector. In 2013, the Government issued decrees on the approval of subsidization rules to increase productivity and quality of livestock products, support of livestock breeding and seed production, provision of interest-rate subsidies on loans issued to support agricultural sector and entities of agro-industrial sector. Government also provided financial support aimed at the development of single-industry towns. Decree 1449 issued on November 16, 2012 approved the rules on subsidization of interest rates on loans issued to private enterprises.

The Kyrgyz Republic also provides a number of subsidies to its agricultural sector. As Dooranov and Maniyeva (2016) report, in 2009, the Kyrgyz Republic established a voluntary crop insurance scheme, according to which 50% of the cost of the insurance premium is subsidized from the state budget. In 2011, the Government developed and implemented a program of concessional lending "Available loans to farmers", within which 1.0 billion soms were allocated with an interest rate of 9% per annum. In 2012, such a program was continued with the same amount of lending at 7% per annum. In addition, on January 12, 2013, the Government of the Kyrgyz Republic issued the Decree 10 to support the development of the processing sector, livestock and crop production. According to this Decree, farmers should receive loans from commercial banks on preferential terms for a period of 12 to 24 months.

State program for support of small and medium-sized entrepreneurship in the Republic of Belarus for the period 2010-2012 was approved by the Decree 1721 of the Council of Ministers on December 28, 2009. The program consists of seven sections and includes

47 events. According to this program, regional executive committees and the Belarusian Fund for the Financial Support of Entrepreneurs provide subsidies for reimbursement of a part of interest for the use of bank loans.

On April 30, 2012, the Government of the Republic of Tajikistan issued the Decree 201 to approve a State program aimed to Support Entrepreneurship for 2012-2020 period. One of the aims of this program is to provide government subsidies for small and medium enterprises.

In Azerbaijan, government provides subsidies to firms operating in the agricultural sector. According to Trend News Agency article, in 2012 Azerbaijan planned to increase the total amount of subsidies for the purchase of motor oil and fuel for producers of agricultural products by 3.964 million manat. From this it is possible to conclude that government provides subsidies to promote development of firms operating in agricultural sector.

Armenia also provides a number of subsidies to firms operating in agricultural sector. According to ARKA News Agency article, in 2011 and on spring 2012, 34,300 economic entities operating in the agricultural sector were granted affordable loans worth about 25 billion drams. Credits are issued at a rate of 14%, four percent of which are subsidized.

The Government of the Republic of Moldova issued a number of decrees to approve the allocation of subsidies to support agricultural sector. On January 31, 2012 and on February, 26, 2013 the Government of the Republic of Moldova issued Decrees 57 and 152 on the approval of the procedure for allocating funds to support agricultural producers. The following official decrees indicate that a number of subsidies were granted mostly to agricultural producers.

4 Data Description

For this study I use Business Environment and Enterprise Performance Survey (BEEPS) implemented by the European Bank for Reconstruction and Development (EBRD) in partnership with the World Bank. BEEPS is a firm-level survey that consists of firms

represented in manufacturing sector (excluding extraction), retail and residual sectors including wholesale, hotels, restaurants, transport, storage, communications, IT as well as construction sector. In terms of size coverage, only formal (registered) companies with 5 or more employees are eligible for interview. In addition, firms with 100% government/state ownership are not eligible to participate in a survey.

For the following study, I employ the fifth round of BEEPS. It covers 15,883 enterprises in 30 countries of Eastern Europe and Central Asia. As I'm interested in the impact of subsidy on firm sales in nine Commonwealth of Independent States (CIS), namely Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan and Uzbekistan, I include only these countries to my sample.

The standard Enterprise Survey includes topics on firm characteristics, gender participation, access to finance, annual sales, costs of inputs/labor, workforce composition, bribery, licensing, infrastructure, trade, crime, competition, capacity utilization, land and permits, taxation, informality, business-government relations, innovation and technology, and performance measures.

The sampling methodology for BEEPS is stratified random sampling. Compared to the simple random sample, where all members of the population have the same probability of being selected, in a stratified random sample all population units are grouped within homogeneous groups and simple random samples are selected within each group. This method allows computing estimates for each of the strata with a specified level of precision. The sampling weights address the varying probabilities of selection across different strata.

The strata for Enterprise Surveys are firm size, business sector, and geographic region within a country. As in most economies surveyed by BEEPS, the majority of firms are small and medium-sized, survey oversamples large firms since larger firms tend to be engines of job creation. Sector breakdown is usually manufacturing, retail, and other services. Geographic regions within a country are selected based on which cities/regions collectively contain the majority of economic activity.

For this study, I am interested in the impact of subsidies on small and medium en-

terprises. According to the Analytical Review on the conditions of small and medium enterprises in CIS countries (2013), microorganization is defined as the organization with less than 10 employees, small organization is defined as the organization with less than 50 employees, while medium organization is defined as the organization with less than 250 employees.

For the reason that I'm going to use simultaneous-equations model, *lsales* and *subsidy* variables are both dependent and explanatory variables.

Log of sales, *lsales* variable is log of sales of the firm measured in dollars. This variable is defined by a response to the question: "Total annual sales last fiscal year in local currency units". According to the BEEPS survey, the average value of sales for SMEs in CIS countries constitute 3 million dollars.

A *subsidy* variable indicates whether a particular firm received a subsidy from local, regional, national government or EU sources over the past 3 years. In the following survey, a subsidy might be financial as well as a capital subsidy.

For CIS countries, in terms of the BEEPS weights, 358 (3,83%) out of 9,339 firms received a subsidy. In regional context, 7.81% of firms received a subsidy in Kazakhstan, 7.04% of firm received a subsidy in Kyrgyzstan, followed by Russian Federation (5.31%), Belarus (2.15%), Moldova (0.60%) and Uzbekistan (0.32%) (Table 3 of the Appendix). In terms of the industrial sector representation, taking BEEPS weights into account, 70 (19.55%) out of 358 firms that received a subsidy operate in the food industry, 49 (13.69%) in machinery and equipment, 49 (13.69%) in furniture, 42 (11.73%) in textiles, 30 (8.38.%) in plastics and rubber, 25 (6.98%) in non-metallic and mineral products, 25 (6.98%) in fabricated metal products, 25 (6.98%) in electronics industry, while other firms operate in publishing/printing and recorded media, chemicals and garments industries.

In terms of the BEEPS weights, a small number of observations is observed for variables representing percentage of fixed assets, workers' education (in years) and hours of operation in a week. This is due to the fact that smaller number of firms provided responses to questions on which those variables were defined.

In addition, firms which were granted a subsidy are larger in size and have a larger

Variable	Subsidised firms	Non-subsidised firms
Workers (mean value)	94.41	51.12
Sales (mean value in dollars)	6,217,948	2,875,431

Table 1: Summary table for CIS countries.

number of workers compared to firms which did not receive subsidy. In terms of sales figure, for firms which were granted a subsidy the average value of *sales* variable is 6,217,948 dollars, while for firms which did not receive a subsidy, the average value of *sales* variable is 2,875,431 dollars. In terms of the number of workers, for non-subsidised firms, the average number of workers does not exceed 51.12, while for SME's involved in the subsidy program the average number of workers is 94.41. These figures show that two variables, *subsidy* and *sales* are causing each other. In order to account for this fact, it would be better to estimate simultaneous equations model, where *subsidy* variable will be jointly determined with *lsales* variable through an equilibrium mechanism.

5 Methodology

As it might be the case that subsidy might has a positive impact on firm performance, and at the same time receiving a subsidy itself depends on sales, *subsidy* variable could be endogenous. To be more explicit, *subsidy* is jointly determined with the dependent variable *lsales* through an equilibrium mechanism. For this reason, in order to solve endogeneity problem, I estimate simultaneous equations model. This model is non-recursive, as endogenous variables figure in one another's equations and error terms are correlated.

To estimate simultaneous equations model, `cmp` routine is used. According to Baum (2016), modeling in the `cmp` framework allows joint estimation of two or more equations with linkages among their error processes. In addition, CMP modeling framework is similar to seemingly unrelated regressions, but in a much broader sense. The individual equations need not be classical regressions with a continuous dependent variable. In the following model, *lsales* is a continuous dependent variable, while *subsidy* is a binary dependent variable.

According to Roodman (2011), `cmp` implements an estimator for all the model types

except rank-ordered probit, and it allows mixing of these models in multiequation systems. Although `cmp` is written as a SUR estimator, it works for a substantially larger class of simultaneous-equation systems.

In the following model, two equations are

$$lsales = \alpha_1 subsidy + \boldsymbol{b_1 X} + \gamma_1 Z_1 + u_{i1},$$
$$subsidy = \alpha_2 lsales + \boldsymbol{b_2 X} + \gamma_2 Z_2 + u_{i2},$$

where $\boldsymbol{X}$ includes variables on firm characteristics presented in Table 4 of the Appendix and variables representing 8 CIS countries. There is no overcontrolling problem, as none of the variables included in $\boldsymbol{X}$ are not highly correlated with each other.

In the following model, I assume that joint probability distribution function of error terms u_{1i} and u_{i2} is a bivariate normal probability distribution function (PDF).

Due to the fact that a larger number of firms is observed for the Russian Federation, it is chosen as the base country for this model.

Z_1 includes instrumental variables for *lsales*, which are *education* and *educsq*, employees' education in years and its square term. Z_2 includes *foodind*, instrumental variable for *subsidy*. A dummy variable *foodind* indicates whether a firm operates in the food industry or not. Statistically, *foodind* is a good candidate for IV, as it is uncorrelated with u_{1i}, but partially and sufficiently strongly correlated with *subsidy* once the other independent variables are controlled for. In the same way, *education* is a good candidate for IV, as it is uncorrelated with u_{i2} and strongly correlated with *lsales*.

First equation describes financial performance of firms, measured in terms of sales, while the second equation describes decision that is made by local, regional and national commission. Secondly, independent variables except *lsales* and *subsidy* are exogenous, or uncorrelated with the supply and demand errors, u_{i1} and u_{i2}.

In a given simultaneous equations model, it is assumed that both equations are identified or satisfy both rank and order conditions. The first equation in a given system of equations satisfies order condition, as *foodind*, instrumental variable for *subsidy*, is

omitted from this equation. I assume that once firm characteristics are controlled for, *foodind* variable does not have a significant effect on sales of the firm. This could be explained by the fact that industry type does not significantly alter sales of the firm, as we are not controlling whether a firm operating in the food industry is related to services or production. Moreover, operating in the food industry does not directly affect financial performance, compared to firm characteristics and market conditions like equipment costs, modernization of technology, introduction of new marketing methods, number of competitors, etc.

Variable *foodind* is assumed to be a good instrument for the probability of receiving a subsidy, as firms operating in the food or agricultural industry are more likely to receive a subsidy. This is consistent with the Decrees summarized in Section 3, according to which subsidies are granted mostly to firms operating in the agricultural sector. As in the following dataset, there is no information provided indicating whether a particular firm is operating in the agricultural sector, I used *foodind* variable as the proxy. In addition to this, first equation satisfies rank condition as *foodind* variable is highly significantly different from zero in the second equation.

In the same way, second equation also satisfies both rank and order conditions. It is assumed that once *foodind* and other firm characteristics are controlled for, *education* does not significantly affect the probability of receiving a subsidy. I assume that employees' education measured in years does not affect probability of receiving a subsidy, as subsidies are granted based on special rules determined within the framework of the program. According to the subsidy programs and government decrees discussed in Section 3, a firm is granted a subsidy only if its activity is compatible with the requirements of the program.

Variables *education* and *educsq* have nonzero population coefficients in the first equation and are assumed to be a good IVs for *lsales* variable. I assume that the higher the education level of the employees is, the higher are the sales and better is the financial performance of a firm. A firm with specialists in research and development, as well as specialists in marketing is more likely to improve the quality of the product and increase

its sales volume. On the other hand, as firms expand, they require a number of educated specialists in different fields - lawyers to settle down the disputes, scientists to do a research, specialists in marketing to recruit new products, as well as employees specialized in transport and logistics.

6 Results

According to the estimation results of the probit model, which are shown in Table 6 of the Appendix, sales of the firm have a significant positive impact on the probability of receiving a subsidy. 1% increase in sales of the firm, on average, increases the probability of receiving a subsidy by 0.007%, while 10% increase in sales increases probability of receiving a subsidy by 0.07%. In terms of the average marginal effects, the average difference in the expected value of *subsidy* associated with the fact that a firm licensed technology is 3.24%. The average difference in the expected value of *subsidy* associated with the fact that a firm purchases or licenses inventions is 1.60%. These results are consistent with the subsidy programs in CIS, as innovative firms are more likely to receive a subsidy in these countries.

Location in the capital city has a significant negative impact on the probability of receiving a subsidy. The average difference in the expected value of *subsidy* associated with the fact that a firm is located in the capital city amounts to 3.18%. In other words, location in the capital city decreases the probability of receiving a subsidy on average by 3.18%. This could be explained by the fact that a number of subsidy programs in CIS countries are aimed at the development of small and medium enterprises in regions, industrial cities and rural areas.

Having a line of credit or a loan also increases the probability of receiving a subsidy by 5.44%. So, as it was assumed, a firm with a line of credit or a loan might have a better financial performance and thus, is more likely to receive a subsidy.

In terms of the country effects, coefficients for Belarus, Uzbekistan, Kazakhstan and Moldova are negative and significant. These results could be explained by the fact that

a smaller percentage of firms received a subsidy in these countries compared to Russian Federation, which is a base country in this model (Table 3 of the Appendix). Variables representing Azerbaijan, Armenia and Tajikistan are omitted from the equation, as a perfect collinearity was reported. This can be explained by the fact that a small percentage of firms received a subsidy in these countries.

Results of the OLS estimation reported in Table 7 of the Appendix show that receiving a subsidy increases sales of the firm by 19.5% holding everything else constant. As it might be the case that subsidy might be associated with different aspects of the firm mission, including research and development and purchasing or licensing innovations, I added interaction terms, *sub*RD* and *sub*inventions*. With the inclusion of interaction terms the impact of subsidy on sales of the firm becomes insignificant. At the same time, for firms which purchased or licensed inventions, receiving a subsidy increases sales by 67.6%, holding other factors fixed. However, for firms doing RD, subsidy does not have any significant positive impact on sales. According to the estimation results, the effect is negative and insignificant.

In terms of the country effects, coefficients for Belarus, Tajikistan, Uzbekistan, Moldova, Azerbaijan, Armenia and Kyrgyzstan are negative and significant. These results could be explained by the fact that firms' sales is less compared to that of Russian Federation.

The results of simultaneous equations model show that receiving a subsidy from local, national or regional government does not have a significant impact on firm sales in CIS countries, a result which differs from the result obtained from the least squares estimation. This difference in subsidy coefficients could be the outcome of the endogeneity issue, as it might be the case that *subsidy* variable is correlated with u_{i1}. Hence, the results of the OLS estimation overestimate the impact of receiving a subsidy on sales.

In addition, firms located in the capital city have larger sales by 50.3% compared to firms which are not located in the capital city. Age of the firm also has a significant positive impact on sales of the firm, as every year increases sales by 3.07%. As it was predicted, exports, licensing of technology, purchasing and licensing inventions, equipment and machinery spending have a significant positive impact on sales of the firm. It should

be noted that the estimation results of the simultaneous equations model do not differ significantly from that of the OLS estimation results.

At the same time, sales of the firm have a significant positive impact on probability of receiving a subsidy. 1% increase in sales increases the probability of receiving a subsidy by 0.77%, while 10% increase in sales increases the probability of receiving a subsidy by 7.7%. This indicates that the OLS estimates are biased, and firms with larger sales are much more likely to receive a subsidy.

In terms of the effects on the probability of receiving a subsidy, the results of simultaneous equations model show that on average, location in the capital city decreases the probability of receiving a subsidy by 23.3%. This is a significantly larger effect compared to that of the probit model, according to which location in the capital city decreases the probability of receiving a subsidy by 3.18%, on average. Interestingly, according to the simultaneous equations model, licensing a technology and purchasing or licensing inventions no longer have a positive significant effect on the probability of receiving a subsidy. On the contrary, the effect is negative and insignificant.

The beta coefficient for having a line of credit or a loan variable is larger in the simultaneous model, 18.7% compared to 5.44% of the probit model. The same could be said for the *foodind* variable, as based on the `cmp` framework, a firm operating in the food industry is more likely to receive a subsidy. Operating in the food industry increases the probability of receiving a subsidy by 5.8%, which is significantly larger compared to the estimate of the probit model, 1.89%. This is also indicative of the fact that *foodind* is a good instrument for *subsidy*.

7 Conclusion

In the following paper, using the data from the BEEPS survey, I tried to evaluate whether a subsidy has a significant positive impact on sales of the firm in CIS countries. To evaluate this, I used the results of the probit model, OLS estimation, and the simultaneous equations model.

To estimate simultaneous equations model, `cmp` command is used. According to Baum (2016), modeling in the `cmp` framework allows joint estimation of two or more equations with linkages among their error processes. In the following simultaneous equations model, I assume that joint probability distribution function of error terms u_{1i} and u_{i2} is a bivariate normal probability distribution function (PDF). According to Roodman (2011), `cmp` implements an estimator for all the model types except rank-ordered probit, and it allows mixing of these models in multiequation systems. Although `cmp` is written as an SUR estimator, it works for a substantially larger class of simultaneous-equation systems.

According to the results of the OLS estimation, receiving a subsidy increases sales of the firm by 19.5% holding everything else constant. However, as there might be an endogeneity issue, I use simultaneous equations model. According to the simultaneous equations model results, it is possible to conclude that receiving a subsidy does not have a significant positive impact on firms' sales in CIS countries. This result is compatible with the previous studies, according to which subsidy does not have a significant impact on firm performance indicators, such as productivity and return on assets (ROA). At the same time, sales of the firm have a significant positive impact on the probability of receiving a subsidy in CIS countries. So, it is possible to conclude that there is a selectivity bias, as larger firms are more likely to receive a subsidy. In particular, 1% increase in sales increases the probability of receiving a subsidy by 0.77% in CIS countries. In addition to selectivity bias, this result could be explained by the fact that firms which are going to be promoted already large and have a better potential to develop.

It should be noted that to get better and more plausible results, it is better to look at other indicators of firm performance, such as profits, return on assets, productivity and growth. In addition, it might be better to examine the effect of subsidies in longer term, not in a short term.

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Appendix

Year	Document
2013	Decree 687 of the Government of the Russian Federation 12.08.2013 (expired on 28.01.2017)
2013	Decree 961 of the Government of the Russian Federation 25.10.2013
2012	Decree 322 of the Government of the Republic of Kazakhstan 12.03.2012
2012	Decree 488 of the Government of the Republic of Kazakhstan 19.04.2012
2012	Decree 679 of the Government of the Republic of Kazakhstan 25.05.2012
2012	Decree 1449 of the Government of the Republic of Kazakhstan 16.11.2012
2013	Decree 35 of the Government of the Republic of Kazakhstan 25.01.2013 (expired on 03.03.2014)
2013	Decree 36 of the Government of the Republic of Kazakhstan 25.01.2013 (expired on 03.03.2014)
2013	Decree 129 of the Government of the Republic of Kazakhstan 13.02.2013 (expired on 04.06.2014
2013	Decree 202 of the Government of the Republic of Kazakhstan 28.02.2013 (expired on 02.07.2015)
2013	Decree 304 of the Government of the Republic of Kazakhstan 29.03.2013 (expired on 23.05.2015)
2013	Decree 816 of the Government of the Republic of Kazakhstan 09.08.2013 (expired on 01.01.2014)
2013	Decree 1542 of the Government of the Republic of Kazakhstan 31.12.2013 (expired on 21.09.2015)
2012	Decree 57 of the Government of the Republic of Moldova 31.01.2012
2013	Decree 152 of the Government of the Republic of Moldova 26.02.2013

Table 2: List of Decrees on subsidies in CIS countries

Source: Internet Source on the Legislation of the CIS countries, *base.spinform.ru*

Country	Number of firms which received a subsidy	Number of firms which did not receive a subsidy	Percentage
Armenia	0	113	0%
Azerbaijan	0	12	0%
Belarus	38	1726	2.15%
Kazakhstan	66	779	7.81%
Kyrgyzstan	10	132	7.04%
Moldova	2	329	0.60%
Russian Federation	237	4228	5.31%
Tajikistan	0	90	0%
Uzbekistan	5	1572	0.32%

Table 3: A number of firms which received a subsidy in CIS countries

Firm characteristics
Location in the official capital city
Age of the establishment: less than 5 years
Direct and indirect exports as % of total annual sales, more than 30%
Technology licensed from a foreign-owned company
Purchase/license inventions
A line of credit or a loan Government/State ownership (%)
Firm's current legal status
Number of permanent, full-time individuals working at the end of last fiscal year
Fixed assets (internal funds or retained earnings) (%)
Availability of training programs for permanent full-time employees

Table 4: Firm characteristics

Table 5: Summary statistics for firms in CIS countries

	Mean	SD	Min	Max	Obs
Log of sales	13.244	1.992	6.224	19.307	9339
Subsidy	0.038	0.192	0	1	9339
Capital city	0.350	0.477	0	1	9339
Age	12.714	9.814	1	88	9339
Age squared	257.955	599.154	1	7744	9339
Exports	5.316	17.336	0	1	9339
Food industry	0.105	0.306	0	1	9339
Technology licensed	0.107	0.0.309	0	1	9339
Purchase/license inventions	0.052	0.222	0	1	9339
A line of credit/loan	0.338	0.473	0	1	9339
Legal status	0.859	0.349	0	1	9339
Government ownership	0.693	6.265	0	90	9339
Number of workers	52.782	58.224	3	251	9339
Fixed assets(%)	83.302	32.285	0	100	9339
Workers' education(years)	12.720	2.094	3	20	9339
Training programs	0.422	0.494	0	1	9339
Armenia	0.012	0.109	0	1	9339
Azerbaijan	0.001	0.036	0	1	9339
Belarus	0.189	0.391	0	1	9339
Kazakhstan	0.091	0.287	0	1	9339
Kyrgyzstan	0.015	0.122	0	1	9339
Moldova	0.035	0.185	0	1	9339
Russian Federation	0.478	0.500	0	1	9339
Tajikistan	0.010	0.098	0	1	9339
Uzbekistan	0.169	0.375	0	1	9339

Table 6: Regression Results of the probit model for firms in CIS countries

	Probit (marginal effects)
Dependent variable	Subsidy
Log of sales	0.007***
	(0.002)
Capital city	-0.032***
	(0.006)
Age of the firm	0.003***
	(0.000)
Agesq	-0.000***
	(0.000)
Direct and Indirect sales exported	0.0002
	(0.000)
Food industry	0.019***
	(0.005)
Technology licensed	0.032***
	(0.005)
Purchase/license inventions	0.016*
	(0.007)
A line of credit or a loan	0.054***
	(0.004)
Legal status	-0.004
	(0.006)
Government/State ownership (%)	0.002***
	(0.000)
Number of workers	0.000
	(0.000)
Fixed assets (%)	-0.000***
	(0.000)
Education, workers (years)	-0.005
	(0.005)
Educsq	-0.000
	(0.000)
Training programs	-0.009*
	(0.004)

Table 6: Regression Results of the probit model for firms in CIS countries (continued)

	Probit (marginal effects)
Dependent variable	Subsidy
Belarus	-0.088***
	(0.009)
Tajikistan	
Uzbekistan	-0.061***
	(0.015)
Kazakhstan	0.003
	(0.005)
Moldova	-0.078***
	(0.016)
Azerbaijan	
Armenia	
Kyrgyzstan	0.028*
	(0.011)
Observations	9124

* robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Regression Results of the OLS estimation and SEM model for firms in CIS countries

	OLS	OLS	SEM
Dependent variable	Log of sales	Log of sales	Log of sales
Subsidy	0.195*	0.183	0.236
	(0.079)	(0.095)	(0.230)
sub*RD		-0.271	
		(0.150)	
sub*inventions		0.676**	
		(0.254)	
Capital city	0.423***	0.424***	0.503***
	(0.027)	(0.027)	(0.090)
Age of the firm	0.038***	0.037***	0.031***
	(0.003)	(0.003)	(0.008)
Agesq	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
Direct and Indirect sales exported	0.008***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)
Technology licensed	0.662***	0.670***	0.582***
	(0.043)	(0.042)	(0.110)
Purchase/license inventions	0.478***	0.416***	0.431***
	(0.069)	(0.071)	(0.084)
A line of credit or a loan	0.063*	0.061*	-0.056
	(0.030)	(0.030)	(0.142)
Legal status	-0.291***	-0.289***	-0.282***
	(0.038)	(0.038)	(0.043)
Government/State ownership (%)	-0.009***	-0.007**	-0.012**
	(0.002)	(0.002)	(0.004)
Number of workers	0.017***	0.017***	0.017***
	(0.000)	(0.000)	(0.001)
Fixed assets (%)	0.000	0.000	0.001
	(0.000)	(0.000)	(0.001)
Education, workers (years)	0.418***	0.407***	0.302***
	(0.049)	(0.050)	(0.082)
Educsq	-0.019***	-0.018***	-0.014***
	(0.002)	(0.054)	(0.004)
Training programs	0.845***	0.851***	0.854***
	(0.027)	(0.027)	(0.238)

Table 7: Regression Results of the OLS estimation and SEM model for firms in CIS countries (continued)

	OLS	OLS	SEM
Dependent variable	Log of sales	Log of sales	Log of sales
Belarus	-0.807***	-0.805***	-0.563*
	(0.037)	(0.037)	(0.238)
Tajikistan	-2.124***	-2.124***	-1.774***
	(0.140)	(0.140)	(0.391)
Uzbekistan	-1.722***	-1.723***	-1.558***
	(0.045)	(0.045)	(0.180)
Kazakhstan	0.061	0.070	0.064
	(0.054)	(0.054)	(0.054)
Moldova	-1.160***	-1.160***	-1.006***
	(0.098)	(0.098)	(0.199)
Azerbaijan	-5.828***	-5.821***	-4.783***
	(0.259)	(0.259)	(1.04)
Armenia	-1.295***	-1.294***	-1.084***
	(0.103)	(0.103)	(0.250)
Kyrgyzstan	-0.703***	-0.708***	-0.773***
	(0.186)	(0.187)	(0.208)
Constant	9.941***	10.000***	11.000***
	(0.337)	(0.338)	(0.760)
Observations	9339	9339	9339

* robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Regression Results of the SEM model for firms in CIS countries table

	SEM (margins)
Dependent variable	Subsidy
Log of sales	0.770***
	(0.055)
Capital city	-0.233***
	(0.024)
Age of the firm	0.001
	(0.003)
Agesq	0.000
	(0.000)
Direct and Indirect sales exported	-0.001*
	(0.001)
Technology licensed	-0.042
	(0.029)
Purchase/license inventions	-0.056
	(0.033)
A line of credit or a loan	0.187***
	(0.028)
Legal status	0.062*
	(0.029)
Government/State ownership (%)	0.009***
	(0.001)
Number of workers	-0.004***
	(0.001)
Fixed assets (%)	-0.001***
	(0.000)
Training programs	-0.246***
	(0.023)
Food industry	0.058*
	(0.023)
Belarus	-0.155*
	(0.069)
Uzbekistan	0.201*
	(0.082)
Kazakhstan	-0.013
	(0.022)
Moldova	0.031
	(0.079)
Kyrgyzstan	0.289***
	(0.067)
Constant	-10.90***
	(0.531)
Observations	9339

* robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$