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## **Regional Determinants of Firm Creation in the Russian Empire. Evidence from the 1870 Industrial Exhibition**

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The industrial exhibition in St. Petersburg 1870 reports the number of firms in each gouvernement. As the Russian Empire included during this period not only Russia proper, but also today’s territories of Ukraine, Belarus, Poland, Lithuania, Estonia, Latvia, Moldavia and the Caucasian and Central Asian countries, we can study the firm development process in all those regions (however, we excluded the non-Russian Caucasus and the region east of the Ural, and Finland for lacking some of the variables). We do not exactly know when those firms were created, or when they were transformed from small craftsmen workshops to modern industrial enterprises. It is clear that they were created before the exhibition, and most of them probably underwent this process of creation or transformation in the decades before the exhibition, as we can guess from similar samples of German or American firms (Baten 2003). A transformation from craftsman workshop to industrial firm has many features of creating a new enterprise, therefore we will speak of “creation” in the following. We can relate this figure to the size of the population and study regional factors which might have increased the previous creation activity of firms, relative to the potential firm creators (given by the population of adult age). We define the potential firm creators as the population born before 1850, i.e., those aged 20 and above at the time of the exhibition, assuming similar mortality in the regions.

To which extent are the exhibiting firms a selective sample of the total underlying firm population? Certainly, not all firms participated in the exhibition, and Matthäi (1873), which is our main source, might not have included all exhibiting firms in his lists of “excellent firms”. We therefore actually study the creation of very promising firms in Russia. Secondly, there was certainly some minimum criterion of visibility demand, which might be higher, if the firm was addressing not only the regional market, but targeted national or international customers as well. Thirdly, firms with innovative products or new production methods might have been overrepresented among the exhibitors. Finally, a certain bias might be given by proximity to the exhibition place, which reduced transport costs to the exhibition, and increased the likelihood that an entrepreneur was informed at all about the exhibition. On the other hand, the organizers of the exhibition were clearly interested in showing a wide range of Russian firms, and hence advertised broadly. They also wanted to create the impression of a booming and promising industry which had a large and geographically dispersed base. Therefore, the number of firms is quite impressive and is not dominated, say, by machinery firms of St. Petersburg or Moscow, but contains also many sugar processing firms from Ukraine and even firms from Perm near the Ural, among many others. We gain the impression that while there might have been some bias towards size and modernity, we can obtain in general a broad picture of Russian industry in its geographical dispersion.

#### Determinants of firm creation

What might have determined the number of “excellent” firms, that were created in the regions of the Russian Empire during this time, and exhibited in St. Petersburg?

1. Urban demand of goods and supply of industrial and organizational skills might be one major driving force. Many rural taxes went to the large urban centres, therefore creating an additional demand. At the same time, urban handicrafts had developed the necessary skills to produce industrial goods. It is quite evident that this variable will be

important, the value-added of our study is rather to quantify the extent of this urban factor. We use the three large cities of St. Petersburg, Moscow, and Kiev to study this effect.

2. Related to urban demand and supply, but less obvious is the proximity-to-city effect. It might be that a combination of cheaper land prices (for the factory site and worker's dwellings) and modest transport costs led to setting up firms in the vicinity of large cities. There might also be human capital externalities which affect the gouvernements near big cities (See Baten et al. 2007). Marshall (1920), Arrow (1962), and Romer (1986) argued that industrial agglomerations (also termed "industrial districts") lead to advantages in the diffusion of knowledge and technology, as well as more effective labor markets, and this is even more likely for urban agglomerations. While those authors refer to agglomeration effects of similar industries, other effects have been proposed for the spread of knowledge across industries (Jacobs 1970). On the other hand, Christaller's (1933) theory might suggest that the areas near cities might rather specialize on producing agricultural products of limited transportability to feed the urban industrial producers. Moreover, there might have been industrial obstacles in the countryside of the Russian Empire, stemming from the traditional organization of the villages and estates. Hence we could expect both positive and negative signs from our "near city" dummies, which identify rural districts near big cities.
3. Special supply factors could play a large role, which is most obvious in the sugar processing industry, which relies heavily on a raw material that cannot be transported economically to far-distant locations.
4. In a similar vein, trade policy factors might influence industrial location. This point is quite influential in the case of Poland (the part of Poland which was, after the partition, included in the Russian Empire). The Russian protectionist policy attracted

textile producers from Prussia and the Habsburg Empire, which were not competitive after the removal of the Napoleonic continental blockade anymore. Those producers were able to develop rapidly in Poland, protected against British productivity advantage, serving the Russian and Polish market. Moreover, Czarist Imperial policy of the time aimed at weakening the Polish large landowners and nobility, creating incentives to invest in factories rather than agricultural production capital (Schermer 2001, p. 163). We will create a dummy variable for the Polish governments.

5. Transport infrastructure might have encouraged the creation of firms, such as harbours, rivers, and railways. We will distinguish in the following water access that was directed towards the Baltic, Black Sea, or large cities (with one dummy variable “Baltic/Black Sea river system”), as opposed to water access directed toward the Caspian Sea, which might have provided less access to consumers (another variable “Caspian Sea river system”). We will also separately study the effect of the first railway lines.
6. Special demand factors are important for some local industries. For example, in the proximity of mining there will mining machinery firms be created, which can react quickly to local demand and provide services to mining firms.
7. Regional human capital can provide an incentive to create a firm in a specific region, if the wages are not too high there. Even more important, the firm creator himself needs a substantial knowledge and ability to set up the firm and to survive especially the first difficult years. We measure regional human capital with the age-heaping indicator explained elsewhere in greater detail (see Crayen/Baten 2006, 2007, A’Hearn, Baten, Crayen 2007), and alternatively with the more traditional literacy rates of those born before 1850. Both variables stem from the Imperial census of 1897, which was friendly provided to us by Andrej Volodin and Leonid Borodkin. The importance of human capital has been demonstrated in the literature by studying the

unequal pay of skilled and unskilled workers (Gregory and Borodkin 2000). Our two indicator variables are modestly correlated, which is visible in the scattergram of Figure 1. Only Kurland (today a part of Latvia) and Kowno (today North Lithuania) stood out as being better in literacy terms than in numeracy terms, whereas North and East Russian regions such as Archangelsk, Wologda, Perm, Olonez, and Wjatka were somewhat better with numbers than with words.

8. Alternative specialization in agriculture. If agricultural profitability is high, there might be not enough incentives for creating industrial firms. Agricultural productivity is difficult to measure for the pre-1870 period. We use the grain and potato yields in kg per hectare in the 1880s (Materialy 1903, thanks to Boris Mironov for friendly communication) and assume that soil quality, ability of workers, demand and export possibilities, cities etc. remained similar between regions between the pre-1870 and the 1880s period.

## **Results**

Our dependent variable is the logarithm of the number of firms per million population in the gouvernement. Those five gouvernements with no firms mentioned were included with a value of zero. Very important for explaining regional differences was clearly human capital in the creation of Russian firms (Table 1). Regions with a population that could report their age exactly had a substantially higher rate of firms that exhibited on the St. Petersburg exhibition in 1870. This holds true even after controlling for urban demand and supply, railway and water access, and similar variables which might have stood behind the human capital proxies. Exchanging the numeracy proxy in the second model with log literacy does not change this result. Interestingly, the non-numeracy proxy of the Whipple Index has almost the same explanatory power than the literacy indicator. Both variables influence significantly the firm creation rate. In general, the adjusted R-square points to a high explanatory power.

We observe that Poland had a significantly higher rate of firms per capita than the other regions. Whether this might be due to trade policy that attracted entrepreneurial migrants or the Czarist policy that turned landowners into factory owners, or other factors, cannot be distinguished here. Moreover, urban supply and demand factors mattered quite substantially, even after controlling for human capital differences – the big city dummy is highly significant and robust. Interestingly, locations near big cities did benefit from some urban agglomeration effects, as can be seen from the significance of the “near big city” variable. The transport infrastructure variables did not exert a substantial positive effect. The Baltic/Black Sea river water system variable had even a negative effect, but its significance disappears as soon as agricultural productivity is controlled for (see below). Very important was the local availability of sugar beets, which provided ample possibilities to set up sugar processing firms (especially in the Ukraine)..

If we restrict the sample to those gouvernements on which we have data on agricultural land productivity (proxied here with the typical harvest per hectare of grain and potatoes), we have only 50 cases left (Model 3). We can see the opportunity costs of high agricultural productivity did not influence industrial plant creation in a significant way. The human capital, big city, and near-big-city effect was not made insignificant by including this opportunity cost variable.

## **Conclusion**

In general, we can explain the number of firms created before 1870 relatively well with those variables. What might be surprising is the degree to which educational differences decided about industrial firm creation in Russia, and this was not only a rural-urban effect. This could be also a hint that regional conditions actually mattered, and the industrial structure was not government-determined, as some older views reported (on the discussion see, Mironov 2003, Gerschenkron 1978, Gregory 1982). Agglomeration effects that included also the

neighboring gouvernements around the big cities were visible in mid-19<sup>th</sup> century. In contrast, transport infrastructure did not have a visible impact.

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Table 1: Determinants of Firm Creation in the regions of the Russian Empire before 1870

Model	1	2	3
Whipple (non-numeracy)	-1.40*** (0.00)		-1.30*** (0.00)
Literacy (Log)		1.19*** (0.00)	
Poland	2.54*** (0.00)	2.39*** (0.00)	
Big City	2.10*** (0.00)	2.20*** (0.00)	2.14*** (0.00)
Near big city	0.76** (0.01)	0.75** (0.02)	0.52* (0.10)
Railway access	0.36 (0.29)	0.34 (0.38)	
Baltic/Black Sea river system	-0.59* (0.05)	-0.96*** (0.00)	-0.29 (0.37)
Caspian Sea river system	-0.19 (0.59)	0.03 (0.92)	
Sugar gouv.	1.40*** (0.00)	1.38*** (0.00)	1.08*** (0.00)
Mining gouv.	-0.52 (0.12)	-0.34 (0.28)	0.03 (0.97)
Agr Land Productivity			-0.00 (0.20)
Constant	5.44*** (0.00)	-0.89 (0.33)	5.53*** (0.00)
Observations	60	60	50
Adjusted R-squared	0.63	0.65	0.53

Robust p values in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Agr Land Productivity is expressed in grain and potato yield in kg per year, the Whipple Index is divided by 100 for presentation purpose.

Figure 1. Comparison of Whipple Index and Literacy

