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Студент/Student:

Vasily Rusanov

Научные руководители/Supervisors:

Professor S. Djankov

Professor P. Dower

Professor A. Markevich

Оценка/Grade:

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MINORITIES AND BUSINESS: THE CASE OF RUSSIAN OLD BELIEVERS*

Vasily Rusanov[†]

[†]New Economic School

Abstract

In 19th century Russia, a close-knit and persecuted religious minority, the Old Believers, controlled a large share of textile manufacturing. I estimate the production functions of the textile factories of Moscow province (the main center of Old Believers' business) in 1882–1883, using their share in the population within a 7 km range from the factory as a proxy for the status of Old Believers' factory. The Old Believers' factories had a higher Total Factor Productivity, but this effect is only observed in the districts that generally had a high share of Old Believers. I interpret this as evidence of the social capital theory of this minority's economic prominence, indicating the importance of business networks that developed in the Old Believers' communes. Following the existing literature on the role of Protestants in the economic development of Europe, I also control for human capital and geography factors and do not find that they explain the business success of Old Believers.

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Introduction

In 19th century Russia, a close-knit religious minority, the Old Believers, owned over-proportionate share of textile factories. The Old Belief originated from the disagreement (the schism) of a part of the population with the religious reforms of the 1667 Great Moscow Synod, which codified a set of fixed rituals. The new order demanded to use three fingers to cross oneself, to say “halleluiah” thrice at the end of a prayer, to walk counter-clockwise (“against the sun”) in the Procession and to write the Christ’s name as *Иисусъ* (double “И”). As protests against the reform began, Tsar Aleksei Mihailovich ordered all those who disagreed be executed, which exacerbated the conflict and made some “schismatics” see a sign of the End of the world in the rituals’ changes, with patriarch Nikon, who conceived the 1667 reform, impersonating the Antichrist.

The Old Belief formed as a protest against both religious and the secular authorities and their reforms. Forty years after the schism, some Old Believers denominations saw impersonation of Antichrist in Tsar Peter the Great, whose government reforms in Russia in the early 18th century aimed at westernizing the bureaucracy and the society as a whole. He also subordinated the official Church to the government. Those reforms completely split the Old Believers from the government and strengthened their self-perception of a chosen group, responsible for preserving the true religion. The events in the first 100 years of schism set a foundation of Old Believers culture (or “ethic”): strong belief in the approach of the End of the world that paradoxically developed into personal responsibility and self-initiative, low support for the Tsar, moderation and thriftiness, independence from the government and conservatism in both the religious rituals and the everyday life.

In late 18th Catherine the Great permitted Old Believers to settle in several cities, and Moscow and Moscow province became their religious and economic center. Later, in the 19th century, Moscow became the heart of the Central Industrial Region — the most industrialized and developed area in the Imperial Russia. The Old Believers, at some point, controlled about a third of cotton textile production in the Moscow province (Raskov 2012), while their share in the population was never estimated to be above 15 %. Similarly to Quakers in the United States, Jews in Europe and Armenians in Turkey, they became an economically important minority whose role and path to success have never been fully explained by economists and economic historians.

Like many religious minorities, the Old Believers always faced a risk of being persecuted for confessional reasons. Russian government changed its attitude toward the Old Believers through the 19th century (e.g., in 1853, they were prohibited from joining the merchants’ guild, but then in 1870s this law was revoked), and the repressions did not end until 1905. And yet, despite the incapacitation, a limited access to legal and financial institutions and numerous government’s attempts to dissolve the movement, the Old Believers accumulated remarkable amount of wealth

and made a significant contribution to the economic development of Russia¹.

In this paper, I establish two major results. First, I find that Old Believers' textile factories indeed had a higher Total Factor Productivity, which goes in line with the vast historical evidence of their propensity to business activities. Second, I find a likely explanation for the higher productivity lay in the social capital of the Old Believers, and not in the human capital or geography. Higher intragroup trust and stronger business networks allowed Old Believers to manage their factories more efficiently. I also find evidence that the positive effect only existed in the factories that did not use steam or water power. This reliance on backward technologies most likely resulted from the Old Believers' intrinsic conservatism and traditionalism.

There are several sources of motivation to study Old Believers. They provide an example of a relatively unexplored (at least by the economists) economically important minority which developed its own specific culture and institutions within the legal and cultural framework of the Russian Empire. The Old Believers were compared to the Protestants by Russian philosopher and economist Sergei Bulgakov ² soon after the publication of Weber's "The Protestant Ethic and the Spirit of Capitalism". They do bear some similarities with the Protestants: some of their denominations do not have priests and therefore have to read the Bible by themselves ³, they also tend to be more ascetic and thrifty than the Orthodox population. Like the Protestantism, the Old Belief has never been a single religion — rather, it is a movement, a composition of different branches and teachings that are only united by their opposition to the official Orthodox Church. However, as tempting as it is to motivate the research on Old Believers by portraying them as "the Russian Protestants", the difference between the Old Belief and the Protestantism could not be ignored. The Old Believers were not willing to reform the Church — quite the opposite, they appeared as a group that stood against a reform. The Old Believers were conservative, especially in all aspects of the rituals and the liturgy. The Old Belief did not become a predominant religion in Russia (although historians note that their contribution was very substantial, especially in the middle of the 19th century in Moscow region).

Another feature of Old Believers is worth mentioning: they co-existed with adherents of official Orthodoxy without major conflicts. In the words of Leroy-Beaulieu, "Rather than hating or

¹Anatole Leroy-Beaulieu, a French historian who traveled to Russia in 1870s and left a thorough description of the economic and social life of the Empire, wrote in his book (Leroy-Beaulieu, 1897): "The monetary prosperity of the Old Believers is similar to that of the Protestant movements in England and in the United States ... In the cities, to which the access was only granted to the Old Believers by Catherine the Great, the dissidents are among the richest Russian merchants, whose large fortunes challenge those of the American businessmen. In Moscow, the commercial and financial center of the Empire, the most beautiful mansions, the largest factories often belong to the schismatics".

²The work of Bulgakov, a renown economist and philosopher, is often cited when the Old Believers are compared to Protestants, although Leroy-Beaulieu made the comparison forty years prior to that.

³The "priested" Old Believers had to rely on the priests who left the official church, and treated them as employees of commune, emphasizing the role of individual in reading and interpreting the Bible, so the human capital theory applies to them too.

rejecting [the Old Believers] as the rebels or heretics, a peasant or a factory worker faithful to the official Church often considers Old Believers as the most pious and fervent Christians, as the early Christians, persecuted for their religion.” Thus, the story of ethnic conflict that is often discussed in economic literature (the studies of ethnic conflict in Africa or of the coexistence between the Armenians and the Turks in the Ottoman Empire) is not the case of the Old Believers. In the environment there was a constant burning conflict between the Orthodox population and business on the one side and the Jewish, German and Polish minorities on the other, Old Believers were never a target of any pogroms⁴.

As different as the Old Believers are from the Protestants, the reasons for studying them are similar: this research contributes to the analysis of the interaction between economic and social development, and the role of religion as a factor of economic growth.

It is important to distinguish between the culture and the institutions of the Old Believers, since these two concepts tend to overlap. The *culture* of Old Believers is the set of norms and beliefs (in the economic sense) directly deriving from their group definition. Truly, as Raskov (2012) notes, like the Protestants have been noted by Weber and others to take the business success as a sign of God’s favor, the Old Believers thought that the coming end of the world makes them responsible for what they were doing, and doing things that please the Lord was the only way to salvation. However, being oppressed, the Old Believers developed several important institutions that also affected their performance.

Alesina & Giuliano (forthcoming) resolve the issue of distinguishing between the culture and the institutions by using the term *culture* for “values and beliefs (informal rules)” and *institutions* for the “formal institutions (formal legal systems, formal regulation)”. This separation is often used in the empirical literature, and they note that the problem with the usage of the term *informal institutions* is that it makes them seem of less importance and derived from the formal ones. However, in light of the case of the Old Believers, this distinction proposed by Alesina & Giuliano seems a little confusing since the Old Believers, being an oppressed group, were in fact excluded from the formal institutions of the Russian Empire. They did not serve in the army, the state refused to acknowledge the Old Believers’ Communes’ collective (rather than individual) right of ownership of monetary capitals⁵ etc. Thus, I stick to the definition of institutions as the set of economic features and traits of the Old Believers: that is, the way their economic life was organized. The Old Believers’ ban on charging the interest (but not on trade: trade was considered honorable if it increased the

⁴See Owen, 1995, for the discussion of xenophobia in the Russian Empire, where he provides evidence that many limitations that Jews, Poles and foreigners faced in the business regulations were based on the Slavophile movement, and that Old Believers were in fact fueling the conflict.

⁵A persecution campaign initiated by Nicholas I included a prohibition to leave inheritance to communes, which made Old Believers’ wills null and void, with all the property going to the “true” heirs who sometimes did not adhere to the Old Belief.

wealth of the commune), their conservatism and higher intragroup trust caused by the oppression were elements of their *culture*. The organization of the Old Believers' commune that typically had a religious and a business leader, their accounting practices, interest-free loans for the members of the commune, communal property are *institutions*.

This approach makes sense given the Old Believers' own "formal" rules of conduct in economic and everyday activities and the terminology of Raskov (2012), who provides a thorough description of both the religious and cultural norms of the Old Believers and their institutions, although does not use any modern empirical techniques to test their relative importance.

The culture of the Old Believers should not be treated as completely exogenous, and it was affected by both their (economic) institutions and by the government's oppression. Moreover, paradoxically, preserving the religious rituals and the culture required the ability to change and to adopt. Some Old Believers stopped praying for the Tsar, the Priestless branch of the Old Believers rejected the liturgy and the marriage altogether (as they believed there were no genuine priests left to hold the ceremonies) — all of these were innovations that the Old Church was introducing, and, basically, inventing, following the changes in the government attitudes and the development of religion.

I do not aim to fully describe the connection between the Old Believers' culture and institutions. It is clear that these two shaped one other, and, like in case of Protestants, one could hardly state that the economic success of the Old Believers was a direct result of the "work ethic" or the thriftiness (see Becker & Woessmann, 2009, for the human capital theory of the Protestants' success, which rejects the "work ethic" hypothesis). Rather, my goal is to discuss which specific combination of cultural norms and institutions best describes the Old Believers at the end of the 19th century, present several existing hypotheses about the reasons behind their success, and show empirically that social capital theory is more supported by the data. I provide a snapshot of Old Believers engagement in the industrial activity of Russia in the late 19th century, leaving the development of this position of the Old Believers (or, economically speaking, the specific setup that led to this particular observed equilibrium) for future research.

Hypotheses

Several hypotheses exist about how the Old Believers achieved business success. Blackwell (1965) discusses the key role that the Moscow communes played in the Russia-wide trade of the pre-reform books and icons, and how later the monetary capital that they accumulated was used for loans to the

(often newly-converted) members of the commune to start business or to buy freedom.⁶ Historians analyzed the life of the communes, the changing state's attitude to the schism, and "case studies" of individual dynasties of Old Believers' businessmen. However, almost no econometric analysis of the Old Believers has been performed so far (with the exception of Raskov & Kufenko, 2014, who only compare the total and average outputs of the factories). In this paper, I argue that Old Believers benefited from their social capital. Persecution by the government created special bonds between the entrepreneurs, the managers and the workers at the factories, allowing Old Believers to develop business networks. This advantage is only found in the subsample of the factories located in districts with a higher concentration of Old Believers. In this section, I discuss historical evidence that supports this theory as well as the alternative hypotheses for the Old Believers success (the following three sections summarize ideas from Kufenko & Raskov, 2014, and Blackwell, 1965).

Social capital: persecution and higher intragroup trust

Old Believers started to create trade networks very soon after their split from the official church. The Vyg commune in the North of the Empire, for example, created an extensive trade network to sell bread to the newly-built Saint-Petersburg in the early 18th century, with grain and other products transported via a network of Old Believers from as far as the Volga region, more than a thousand kilometers to the South. At that time, there were already several denominations of Old Believers (priestless or with priests, praying for the Tsar or not...), although all of them had extensive business relations with each other. The weak contract law and the Old Believers' incapacitation contributed to the creation of these networks. Leroy-Beaulieu a witness of the relations within the Old Believers' communes in the late 19th century, wrote: "Thanks to the support that the dissidents give each other, thanks to the ties that the religious belief creates between them, the schism sometimes had a chance to be considered as a path leading to fortune".⁷

Of course, the vast trade networks allowed for opportunistic behavior. With very weak contract law, on which the Old Believers could not rely anyway, the communes developed special rules for trade conduct. The Vyg commune established strict rules for its trade agents, mandating collective discussion of every important business deal and stipulating the role of the collective in making every decision. From the early years of the schism, Old Believers relied on the communes in doing

⁶See the paper by Raskov and Kufenko (2014), who matched the data on Moscow textile factories to religious adherence of their owners, using the communes' documents: protocols of election of patrons, synodicons, data on necropolises, private correspondence etc. Their dataset contains the revenue, the total number of workers and primary produce (wool, cotton and silk) of the factories from the industrial reports in five years: 1843, 1867, 1871, 1879 and 1890. They compare the factories attributed to the Old Believers with the other firms in the textile industry and find that share of Old Believers in production was over proportionate (the market share in terms of revenue and number of firms was greater than the Old Believers' share in population).

⁷Leroy-Beaulieu also points at the view expressed by some of the contemporary authors that the Old Believers earned their fortunes by exploiting the workers — but then refutes this argument by discussing the charity that the Old Believers are engaged in.

business, which created information networks and also allowed to build reputation mechanisms like those of the Maghribi traders discussed by Greif (1993) — the unfair businessmen were condemned by the Commune.

Two sociologists, Hillman and Aven, emphasize the importance of reputation and social capital in the late 19th century Russia. They use the RUSCORP database (a complete description of all Imperial Russian incorporated firms since Peter the Great's times by Owen, 1992) to discuss the patterns of company formation in Russia between 1869 and 1913. They use observations over 4172 companies with 11545 founders and perform a network analysis of the Russian businessmen who founded companies together. The information on the previous successes of the partners (success is defined as raising capital above the medium for the same industry and same 8-year period) is taken as a factor for the capital that a newly formed company managed to raise. They find a positive effect of the past successes of one of the partners on the amounts of capital raised in the future, and interpret this link as a reputation effect.

Hillman and Aven also draw a network of the entrepreneurship ties (the network of businessmen who founded companies together) and find a well-connected core and a scattered periphery. These are not based on the geographical proximity, as businessmen from different regions are found both in the core and in the periphery. The core appears to have more diverse interconnected entrepreneurs, while the periphery consists of the more homogenous groups. Hillman and Aven show that the reputation effect of having a successful partner was two times higher in the periphery firms. Thus, the authors suggest, the core acted as a bridge between different ethnic and geographic groups that had to rely more on reputational mechanisms. Finally, they find that fragmentation and the division into core and periphery persisted over time, and the network did not become significantly more connected from 1860 up to 1913, neither did the reputational effect diminish.

Hillman and Aven's analysis points at the importance of ties between the businessmen in the 19th century Russia. They also mention the Old Believers, giving them as an example of a group with high "network closure", and also giving the example of the merchant Morozov who was a very successful entrepreneur who adhered to the Old Belief and was connected to many businessmen through marriages. His social capital allowed him to become the President of the Moscow Exchange Society, representing the interests of the entrepreneurs to the government. Owen (1995, pp 80–81) also underscores the importance of "relationships of confidence and trust" and describes how the trust operated among the Old Believers as well as other ethnic groups in the Russian Empire.

Access to finance and lending

Being a fundamentalist Christian movement, some Old Believers denominations explicitly prohibited collecting interest (it appears that the Russian Orthodoxy traditionally did not have this prohibi-

tion). The accumulation of funds by the communes was boosted further by mandatory celibacy, with all possessions becoming collective property after his or her death⁸. Unlike the Jews, who are allowed to collect interest on the loans given to the outsiders, Old Believers often considered unethical giving loans with interest to anyone, which precluded the use of capital that communes accumulated for specializing in finance. Sometimes the communes even decided not to keep the money in a bank because of ethical concerns. However, the accumulated capital was used in a system of intragroup interest-free loans. Blackwell (1965) describes how, according to the police reports, the peasants in the Moscow region decided to convert to the Old Belief and join the factories in exchange for having their debts paid and getting some money for purchasing their freedom. He also describes how the loans were used to start a new business or to expand the existing factories. E.g., in 1847 the Nosov brothers obtained a huge loan of 500000 rubles from the Preobrazhenskoe cemetery commune with no interest to pay for the first three years. The Nosovs and many other successful businessmen made contributions to their communes. In the framework of undeveloped financial markets in 19th century Russia, access to interest-free loans could give the Old Believer entrepreneurs a big advantage over the rest of the population for starting a business and then purchasing equipment and machinery.

The research of Abramitzky (2007) on the Kibbutz communities in Israel is relevant to the research on financing policies and communal property of Old Believers. Kibbutzim (plural of Kibbutz) began to form in 1910 as rural communities based on Zionist principles of equality, with each member receiving the same share of the total income. With the institution of equal-sharing, a trade-off arises between the insurance that equality provides and the moral hazard and adverse selection issues associated with redistribution policy. Abramitzky's work is related to the research on Old Believers because it explains the reasons people stay (or do not stay) in the communes. Many movements of Old Believers avoided private property — however, this created some difficulties as the government could deny the right to inherit (Raskov, 2012), and in the Moscow region the collective ownership of assets was not always followed. At the same time, other mechanisms (interest-free loans, other types of support like food and shelter) could provide the social insurance similar to those of kibbutzim. Unfortunately, no individual-level data are available for the Old Believers, and so it is impossible to replicate Abramitzky's research to see whether the financial policies of the Old Believers' communes had similar effect on individuals' incentive to stay or leave.

⁸See Raskov, 2012 for the description of the marriage ban and the inheritance, the religious debates over the ethics of collecting the interest in different Old Believers denominations and communes.

Human capital: literacy and sobriety

The adherents to the “priestless” denomination of the Old Believers (*bezpopovtsy*) had to read the Bible themselves, which increased literacy rates. The Russian Empire never had a system of universal primary education, and, until the 1917 revolution the overall literacy rates remained low. Historians also describe meticulous accounting and reporting practices of trade agents in the mentioned Vyg commune, which caused higher numeracy rates and bookkeeping skills. This potentially indicates a mechanism similar to that discussed by Becker and Woessmann (2009) for the case of Protestants: literacy, together with the need to read and to interpret the Bible, could have increased the human capital of the Old Believers, raising workers productivity and managerial abilities.

Also, there is some anecdotal evidence of higher sobriety of Old Believers (although they never were teetotalers, and special moonshine and sometimes drank *braga*, a special moonshine for ceremonial purposes), but this feature was never studied systematically and there is no quantitative evidence of lower alcohol consumption among Old Believers. The Old Believers in the Guslitsi region specialized in growing hops, and alcohol itself was not considered immoral, unlike many of the “modern” goods: tobacco, tea and coffee that religious leaders explicitly prohibited.

Identification strategy

I estimate the textile factories production functions to test whether the Old Believers factories had a higher productivity. I use data from the Statistical bulletin by Bobkov (1885), prepared on an agreement between factory owners and the local authorities of Moscow region (the *zemstvo*). The survey included the whole population of the 272 factories that operated in the Moscow province at that time, so the sampling bias is not an issue. Unfortunately, it excluded the factories located in the city of Moscow. In all regressions I estimate, the unit of observation is a factory that operated in 1882-1884. See Appendix A for details on data collection and processing, as well as the summary statistics table.

To attribute a factory to the Old Believers I use their share in the population within a 7 km-range of the factory, i.e. the treatment is continuous. This method is imperfect — the meticulous attribution procedure used by Raskov & Kufenko (2014) is more appealing but is also incredibly laborious, and their data are not available. I use the population census from 1897 (12 years after the survey of factories was published) as a source of data on the number of Old Believers in population. To check the credibility of this source, I compare the results of the 1897 All-Russia Census to the 1882 Census of the City of Moscow. Despite this period in the history of the Moscow region was

characterized by a rapid population growth and that these two Censuses were performed by different government bodies, they do not diverge significantly, and that makes the 1897 data credible for our purposes⁹.

To estimate the production functions, the factory's total revenue is used as a measure of output, the number of workers is used for labor and the total value of machinery is used for the capital. The aggregation of output using prices allows studying factories with different products at a cost: it does not allow us to study the oppression that the Old Believers could face on the demand side (for example, because of barriers to entry to some markets). However, no evidence of direct closure of markets for the Old Believer is found in the literature. Moreover, Raskov (2012) notes that the Old Believers took over the textiles market precisely because in the industry, unlike, for example, railroad construction or finance, establishing good contacts with government was not critical for starting a business and creating supply chains. I use the number of workers rather than the total wage bill because the data source explicitly states that the total wage bill column is for the laborers and the managers together, and only for a few factories the two categories are separated.

I estimate A , α , β and γ from the Cobb-Douglas equation of the form:

$$Y_i = AS_i^\gamma L_i^\alpha K_i^\beta \epsilon_i \quad (1)$$

Here, Y is output, K and L are labor and capital, S is the share (from 0 to 100) of Old Believers within the circle of 7 km around the factory location and ϵ_i is the error term. The interpretation of the share of Old Believers S_i is that it affects the Total factor productivity, AS_i^γ , and should not be interpreted as a choice variable (like a factor of production). Our first regression of interest is (substitute $\varepsilon_i = \log \epsilon_i$):

$$\log Y_i = \log A + \gamma \log S_i + \alpha \log L_i + \beta \log K_i + \varepsilon_i \quad (2)$$

Another equation that I estimate incorporates the interaction between the returns on labor and capital α and β and the share of Old Believers:

$$\log(Y_i) = \log A + \gamma \log S_i + (\alpha + \alpha' \cdot \log S_i) \log(L_i) + (\beta + \beta' \cdot \log S_i) \log(K_i) + \varepsilon_i \quad (3)$$

I test two hypotheses: 1) greater S increases the Total factor productivity; that is $\gamma > 0$; and 2) the returns on labor and/or capital differ for different S ; that is, $\alpha', \beta' \neq 0$.

Syverson (2011) notes that estimating the Cobb-Douglas function creates biases associated with

⁹See Appendix E for the comparison of the two Censuses as well as the distribution of the Old Believers within the districts of the Moscow province

the problem of endogenous choices of factors of production. For example, if the Old Believers benefited from greater social capital, they could be choosing to use more labour, because the production function is different for them. To tackle this problem, and some other endogeneity concerns discussed below, I use instruments for the share of Old Believers, the machinery used by the factories and the number of workers employed.

Instruments for the share of Old Believers

A possible source of endogeneity in the above regressions is the selection of the Old Believers into regions with worse conditions for the textile industry because of oppression (or better conditions if they specialized in textiles selecting locations that are better suited for textile industry). Moreover, if the government's public goods and infrastructure procurement was lower in the areas with greater share of Old Believers, this could also lead to the omitted variable bias: we do not observe the quality of local policing, health care, roads and other factors that are important for the business and can be correlated with the share of Old Believers through the government's policy.

To tackle this issue, I use distances to Old Believers' religious centers as an instrument for their share in population near the factory. Moscow province had 3 religious centers of Old Believers: Rogozhskoe and Preobrazhenskoe cemeteries¹⁰ within the Moscow city and the Guslitsi region on the very east of the Moscow province, in the south of Bogorodsky and the east of Vereysky districts. Historically, these were the three centers in the Moscow Province where the Old Believers were allowed to perform their rituals and even build modest churches. The centers were formed at least 100 years before the year that I consider (1882): Rogozhskoe and Preobrazhenskoe cemeteries had the first entombments of the Old Believers in 1771, after the 1771 plague, and Guslitsi were a remote region where many Old Believers fled after the 1682 Streltsy Uprising. Thus, the location of these centers is most likely to be orthogonal to the characteristics important for the textile industry that was formed later: the presence of banks, the roads and the railroads, the local supply of wool etc.

I use the logged geographic distances to Guslitsi and to the Rogozhskoe cemetery to instrument the share of Old Believers near the factory. The reason I have to drop one of two cemeteries in Moscow is collinearity: the two cemeteries are only 6 km from each other, which makes the distances to them indistinguishable on the scale of the whole province. In fact, both of them are also very close to the center of Moscow: the Rogozhskoe cemetery is just 5.5 km from the Moscow city center (although when they were formed, their location was outside the city border). However, I construct the distance for the Rogozhskoe cemetery separately from the distance from the Moscow

¹⁰There were rules that did not allow Old Believers to have their own churches. Although these rules have never been completely implemented, Old Believers' centers in Moscow were called "cemeteries" to avoid persecution. See Raskov (2012), Blackwell (1965) for the history of formation of the cemeteries.

city center.

Another argument that supports the usage of the geographic instruments is that the mobility of labor, both of the workers and of the entrepreneurs, was limited in Imperial Russia. The surveys of factory workers reveal that they often came from the district (*uezd*) where the factory was located or from the neighboring districts (see Orlov, Kablukov, 1878). Many Old Believers factories were founded in the same village where the founder came from, because they were still serfs, bound by their ties with land owners (like one of the most famous Old Believer merchants, Savva Morozov, who built his first factory in the village he came from). Thus, my identification strategy assumes that the founders of the factories did not select the location of their factory by the share of Old Believers in the region. Rather, I assume that the inhabitants of a particular locality decided to open a factory in their place of origin or somewhere nearby, and so the share of Old Believers near the location of the factory is a proxy for whether a factory belongs to Old Believers or not.

Instruments for the the machinery and the number of workers

To instrument the labour and the machinery employed by the factories, I use a set of variables that affect local peasants' choice of whether to join the factories and become workers or whether to stay in agriculture the animal husbandry, and also whether to invest their savings in the industry or in the cattle. I use the township (*volost'*) level data. These variables are:

- The winter and the spring crop yields (*ozimie* and *yarovie*), measured as the seed ratios: the ratios of the amount of grain collected to the amount of grain sown. It reflects both the quality of the land in the township and the level of technology in agriculture.
- Number of cattle per capita of peasant population in 1885. Cattle acted as an alternative investment asset: financial markets were underdeveloped, and so peasants used the cattle as an investment (eg, buying a cow that brings milk and can be slaughtered in a couple of years). Thus, the number of cattle heads per capita should be negatively correlated with the supply of credit to the local factories. It also reflects how developed the local animal husbandry was, which affected the peasants' decision to join the factories as workers (higher agricultural income increased the opportunity cost of becoming a factory laborer).
- Number of horses per capita of peasant population. Horses were unlikely to be used as an investment asset (they can't be eaten and pay no dividends in form of milk). Rather, they show the development of the agricultural sector as a whole.

Results

Table 1 show the OLS estimation of Cobb-Douglas production functions, as in Equation (2). Greater share of Old Believers did increase the total factor productivity (TFP). This result is robust to the inclusion of the factory's location cluster effects (proxied by the number of factories within 10 km radius), two geography controls and dummies for different categories of factories. However, the share of Old Believers becomes insignificant as I include the longitude of the factory in the regression. The likely reason for this is very high correlation between the longitude and the share of Old Believers in the population, which is explained by their historical presence in the East and almost complete lack of them in the West of Moscow Province.

I use Model (6) from Table 1 as my reference regression for the IV estimation, keeping the number of factories within 10 km and the latitude as the control variables. Note that the numerical interpretation of the coefficient on the logged share of the Old Believer in the population, γ , is a little tricky. Consider model (6) from Table 1. The coefficient estimate of 0.071 means that, *ceteris paribus*, an increase in the share of Old Believers by 10 percent (not percentage points!) increases the TFP of a factory by 0.71%. A 10 percent increase in the share of Old Believers could be, for example, an increase from 2% of the population to 2.2% of the population. Thus, the effect is actually quite sizable: when the share increases from 2% to 4% (that is, increases by 100%), the total factor productivity increases by 7.1%. Thus the effect is not only statistically, but also economically significant. This is an important result, and it supports the motivation to study Old Believers' because of their economic success.

Table 1: OLS estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(Workers)	0.775*** (0.047)	0.757*** (0.046)	0.741*** (0.046)	0.742*** (0.046)	0.742*** (0.041)	0.676*** (0.058)	0.651*** (0.057)
log(Value of machinery)	0.252*** (0.032)	0.267*** (0.031)	0.279*** (0.032)	0.282*** (0.032)	0.282*** (0.026)	0.357*** (0.045)	0.365*** (0.043)
log(Share of Old Believers near the factory)		0.105*** (0.033)	0.080** (0.034)	0.077** (0.034)	0.077 (0.066)	0.071** (0.035)	0.033 (0.037)
log(Number of textile factories within 10km)			0.103*** (0.035)	0.095** (0.038)	0.095** (0.034)	0.086** (0.034)	0.074** (0.036)
Distance to Moscow, km				−0.001 (0.001)	−0.001 (0.002)		
Latitude of factory				0.158* (0.089)	0.158 (0.111)	0.165* (0.092)	0.197** (0.095)
Longitude of factory							0.132** (0.065)
Dummies for types of factories	No	No	No	No	No	Yes***	Yes**
Constant	5.705*** (0.182)	5.510*** (0.188)	5.286*** (0.212)	−3.446 (5.032)	−3.446 (6.258)	−4.509 (5.134)	−11.142* (6.390)
St. errors	Robust	Robust	Robust	Robust	Clustered by district	Robust	Robust
Observations	272	272	272	272	272	272	272
R^2	0.896	0.900	0.903	0.905	0.905	0.912	0.914

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

Note: Dependent variable is log(Total revenue), robust standard errors are used except in (5) where they are clustered by 13 districts (uezds) of the Moscow province. Type dummies are jointly significant (F-test p-value=0.4 % and 1.1% in models 6 and 7).

The positive effect of the share of Old Believers on TFP persists as I proceed to the estimation with the instrumental variables. Even if all three variables of interest are instrumented, we see a positive and significant effect of the share of OB, and the magnitude of it is close to that of the OLS estimation. Unlike the OLS estimation, the IV setup is robust to the usage of standard errors clustered by district. However, as I instrument the machinery and the workers, the results become strange: the machinery loses significance and the coefficient for the number of workers becomes very high. This suggests that there are problems on the first stage of the estimation, that do not disappear if I use Limited information maximum likelihood (LIML) or Generalized Method of Moments (GMM) rather than 2SLS estimator. See Appendix F for the first stage estimation.

In Appendix B, I also present some robustness checks for model (2) in Table 2, and control for the incorporation status of the company (following a paper by Gregg, *forthcoming*, that discusses the importance of incorporation for the capital accumulation of the factories in Russia at that time),

Table 2: Results of IV estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(Workers)	0.984*** (0.325)	0.747*** (0.045)	0.706*** (0.206)	0.769** (0.310)	0.677*** (0.057)	0.846*** (0.223)	0.846*** (0.192)
log(Value of machinery)	0.193 (0.198)	0.277*** (0.031)	0.346*** (0.123)	0.319 (0.214)	0.357*** (0.043)	0.277 (0.174)	0.277 (0.212)
log(Share of Old Believers near the factory)	0.103** (0.042)	0.167*** (0.048)	0.162*** (0.053)	0.074** (0.036)	0.101* (0.053)	0.077* (0.046)	0.077* (0.042)
log(Number of textile factories within 10km)				0.074 (0.047)	0.076** (0.038)	0.066 (0.042)	0.066 (0.050)
Latitude of factory				0.170 (0.113)	0.164* (0.089)	0.162 (0.108)	0.162* (0.098)
Constant	5.124*** (0.676)	5.397*** (0.195)	4.937*** (0.623)	-4.929 (7.026)	-4.498 (4.969)	-4.406 (6.680)	-4.406 (7.147)
Dummies for types of factories	No	No	No	Yes***	Yes***	Yes***	Yes***
Workers and machinery instrumented?	Yes	No	Yes	Yes	No	Yes	Yes
Share of Old Believers instrumented?	No	Yes	Yes	No	Yes	Yes	Yes
St. errors	Robust	Robust	Robust	Robust	Robust	Robust	Clustered by district
Estimator	2sls	2sls	2sls	2sls	2sls	2sls	2sls
Observations	266	272	266	266	272	266	266
R^2	0.886	0.899	0.896	0.911	0.912	0.909	0.909
Overid test score	2.009	0.687	2.184	1.243	0.673	1.506	.
Overid test p-value	0.366	0.407	0.535	0.537	0.412	0.681	.

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

Note: Dependent variable is log(Total revenue), robust standard errors are used. Type dummies are jointly significant when used. Using Wooldridge overidentification test for 2SLS with heteroskedasticity-robust st. errors, we do not reject the null hypothesis that our instruments are valid at the 1% significance level. Using GMM estimator rather than 2SLS (and J-stat rather than Wooldridge test) does not alter the results in any important way. 6 observations are lost when Workers and Machinery are instrumented because no crops data are available for some of the counties (volost's) in Serpuhov district and for the 4 factories located next to Moscow.

allow for the measures of capital other than the value of the machinery, and control for some other characteristics that are important for the factory. None of these alters the results.

In Table 3, I estimate the production functions allowing for the interactions between the returns on the factors of production and the share of Old Believers in order to find the mechanism behind the greater Total Factor Productivity of the Old Believers. As both OLS and 2SLS regressions imply, greater share of Old Believers increased the output but decreased the marginal products of the machinery, although this effect is not significant once the machinery and the number of workers are instrumented.

Table 3: Results of OLS and 2SLS estimation of Cobb-Douglas production function with interactions

	(1)	(2)	(3)	(4)	(5)
log(Workers)	0.578*** (0.077)	0.531*** (0.099)	0.975** (0.452)	0.531*** (0.088)	0.975** (0.387)
log(Workers) · log(Share of OB)	0.060 (0.039)	0.090 (0.068)	−0.033 (0.174)	0.090 (0.058)	−0.033 (0.135)
log(Value of machinery)	0.458*** (0.057)	0.502*** (0.069)	0.327 (0.279)	0.502*** (0.074)	0.327 (0.212)
log(Value of machinery) · log(Share of OB)	−0.069*** (0.025)	−0.099** (0.041)	−0.022 (0.093)	−0.099** (0.043)	−0.022 (0.060)
log(Share of Old Believers near the factory)	0.438*** (0.161)	0.591*** (0.190)	0.449 (0.397)	0.591*** (0.190)	0.449** (0.217)
log(Number of all textile factories within 10km)	0.071** (0.034)	0.061 (0.040)	0.032 (0.056)	0.061 (0.047)	0.032 (0.068)
Latitude of factory	0.176* (0.091)	0.180** (0.087)	0.210* (0.116)	0.180*** (0.038)	0.210** (0.082)
Dummies for types of factories	Yes	Yes	Yes	Yes	Yes
Constant	−5.640 (5.061)	−6.039 (4.868)	−8.402 (7.096)	−6.039*** (1.971)	−8.402 (5.897)
Workers and machinery instrumented?	No	No	Yes	No	Yes
Share of Old Believers instrumented?	No	Yes	No	Yes	No
St. errors	Robust	Robust	Robust	Clustered by distr.	Clustered by distr.
Estimator	OLS	2SLS	2SLS	2SLS	2SLS
Observations	272	272	266	272	266
R^2	0.915	0.914	0.899	0.914	0.899
Overid test score		1.640	3.392		
Overid test p-value		0.650	0.494		

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

Note: Dependent variable is log(Total revenue), robust standard errors are used in models (1)–(3), st. errors are clustered by district in (4)–(5). To instrument the interaction terms, the interactions between the exogenous variable and all the instruments were used. That is, in (2) and (4), log(Machinery) and log(Workers) are assumed exogenous, so there are 4 instruments for the interaction terms, produced by: $\{\log(\text{Machinery}); \log(\text{Workers})\} \times \{\log(\text{Distance to Rogozhskoe}); \log(\text{Distance to Gustlitsi})\}$ and also there are 2 usual non-interacted instruments for the log(Share). In (3) and (5) log(Share of OB) is assumed exogenous, so there are 4 instruments for the interaction terms: $\{\log(\text{Share of OB})\} \times \{\text{Winter crops}; \text{Spring crops}; \text{Cattle}; \text{Horses}\}$ and the also 4 usual instruments for log(Machinery) and log(Workers). Type dummies are jointly significant when used. We do not reject the null hypothesis that our instruments are valid at the 1% significance level using the same test as in Table 2. 6 observations are lost when Workers and Machinery are instrumented because no crops data are available for some of the counties (volost's) in Serpuhov district and for the 4 factories located next to Moscow.

The Results in Table 3 indicate relative disadvantage of Old Believers in the usage of machinery. Most likely, this is a result of their general backwardness and conservatism. Despite some historic evidence that Old Believers did form beneficial relations with foreigners and their trade agents (a large part of capital at that time was imported) we can see that overall the marginal and the average returns on capital were lower for them. Note that the reason for instrumenting the capital and the machinery was the endogenous firm's selection of the more suitable technology (perhaps because the technologies were different for the Old Believers and the general Orthodox population). As we control for the share of Old Believers, allowing the production technology to be different for them through coefficients α' and β' in equation (2), this type of endogeneity is no more a cause for concern. Thus, we can take specifications (2) or (4) as our baseline.

In Table 4, which shows the main result of this paper, I find support for the social capital theory of the Old Believers' success. I include a dummy variable for the "OB districts": the ones where the share of Old Believers was high. In Models (1) and (2) I take the districts where the share of Old Believers in general population was greater than 3% according to the overall results of the Census (see Appendix E). In Models (3) and (4) I use another method to define the "OB districts": I find the average share of the Old Believers in the vicinity of all factories in each district, and then take the districts where this share was greater than 7%¹¹. I also use an alternative variable to account for the cluster effects: I divide the 11 Types of factories in the sample into 3 classes (cotton, wool and silk) and include the number of the factories *of the same class* within 10 km rather than the total number of all textile factories in the sample. I do this to account for possible differences in the clustering effects that the factories of same class provide, but find little difference in estimates.

The two methods of denoting a district to be and "OB district" and the two different variables that account for the clustering effects provide very similar results. The share of Old Believers does not have positive effect on the Total Factor Productivity without the interaction between the share of Old Believers and the dummy for the district with high share of Old Believers. However, once we allow for this interaction, we find that the share of Old Believers did have a positive effect on productivity, but only in districts with high proportion of the Old Believers in the population. This supports the social capital theory: the share of the Old Believers near the factory mattered, but only if there were sufficiently many other Old Believers in the district for the networking effect to take place. In order to benefit from the status of the member of the group, it was important to have other adherents to the same belief nearby to share the insights about the good and the bad suppliers, get the latest information on the market quotes or create a supply chain.

¹¹According to the first method, Bogorodsky, Bronnitsky, Kolomensky and Vereysky districts have many Old Believers. Under the second method, this set becomes "Bogorodsky, Bronnitsky and Kolomensky".

Table 4: Interaction between share of OB and the OB districts, with district fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
log(Value of machinery)	0.272*** (0.036)	0.269*** (0.037)	0.291*** (0.037)	0.289*** (0.038)	0.291*** (0.037)	0.288*** (0.038)
log(Workers)	0.732*** (0.049)	0.735*** (0.049)	0.707*** (0.048)	0.711*** (0.049)	0.707*** (0.048)	0.711*** (0.049)
log(Share of Old Believers near the factory)	0.034 (0.047)	0.031 (0.047)	-0.140 (0.089)	-0.117 (0.087)	-0.141 (0.089)	-0.117 (0.087)
Dummy for OB district · log(Share of OB)			0.261** (0.105)	0.239** (0.102)	0.261** (0.106)	0.240** (0.103)
log(Number of all textile factories within 10km)	0.022 (0.049)		0.056 (0.052)		0.056 (0.052)	
log(Number of similar factories within 10km)		-0.016 (0.048)		0.009 (0.048)		0.010 (0.048)
Bogorodsky district	0.203 (0.183)	0.276* (0.160)	-0.101 (0.235)	0.015 (0.196)	-0.101 (0.235)	0.014 (0.197)
Bronnitsky district	-0.482** (0.233)	-0.459* (0.235)	-0.819*** (0.269)	-0.792*** (0.265)	-0.818*** (0.269)	-0.792*** (0.266)
Dmitrovsky district	0.086 (0.211)	0.115 (0.209)	0.016 (0.217)	0.075 (0.214)	0.016 (0.217)	0.075 (0.214)
Kolomensky district	-0.095 (0.170)	-0.048 (0.168)	-0.322 (0.198)	-0.251 (0.188)	-0.321 (0.199)	-0.252 (0.188)
Moskovsky district	0.184 (0.163)	0.265* (0.145)	0.256 (0.170)	0.349** (0.154)	0.257 (0.170)	0.348** (0.154)
Mozhaysky district	-0.254 (0.235)	-0.264 (0.233)	-0.297 (0.266)	-0.307 (0.262)	-0.298 (0.266)	-0.307 (0.262)
Podol'sky district	0.232 (0.154)	0.264* (0.160)	0.327** (0.143)	0.340** (0.149)	0.328** (0.143)	0.340** (0.149)
Ruzsky district	-0.368 (0.297)	-0.365 (0.294)	-0.455 (0.308)	-0.438 (0.303)	-0.455 (0.308)	-0.439 (0.303)
Serpuhovskiy district	-0.052 (0.160)	0.024 (0.159)	-0.141 (0.172)	-0.044 (0.164)	-0.140 (0.172)	-0.046 (0.165)
Vereysky district	0.106 (0.205)	0.123 (0.208)	-0.047 (0.212)	-0.009 (0.212)	0.071 (0.223)	0.098 (0.220)
Volokolamsky district	-0.515** (0.218)	-0.483** (0.210)	-0.596*** (0.228)	-0.528** (0.214)	-0.596*** (0.228)	-0.529** (0.214)
Zvenigorodsky district	-0.002 (0.171)	0.033 (0.174)	-0.037 (0.168)	0.002 (0.171)	-0.036 (0.168)	0.002 (0.171)
Constant	5.553*** (0.238)	5.582*** (0.244)	5.564*** (0.243)	5.577*** (0.247)	5.567*** (0.243)	5.578*** (0.247)
Estimator	2sls	2sls	2sls	2sls	2sls	2sls
Observations	271	271	271	271	271	271
R^2	0.911	0.911	0.912	0.912	0.912	0.912

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

Note: Models 1 and 2 use general Census results to construct the dummy “OB district”, models 3 and 4 use the localities data. Dependent variable is log(Total revenue), robust standard errors are used. Klinsky Uezd (with low share of OB) is taken as a base category.

Apparently, the social capital used by the Old Believers came at a cost of technological backwardness. The total value of the machinery, used in the other regressions, includes all sorts of capital: not only steam boilers, turbines and steam engines, but also manually operated weaving machines, spindles etc. Our final step in the analysis is the estimation results from Table 5, where the data are divided into 2 subsamples: factories that used steam and/or water power and those that did not.

Table 5: Results of OLS and 2SLS estimation with sample restricted only to factories that used steam power/only those that did not use steam power.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(Workers)	0.625*** (0.106)	0.625*** (0.100)	0.617*** (0.100)	0.589 (0.412)	0.708*** (0.073)	0.713*** (0.069)	0.720*** (0.068)	1.779** (0.789)
log(Value of machinery)	0.346*** (0.086)	0.346*** (0.082)	0.359*** (0.083)	0.764*** (0.191)	0.376*** (0.080)	0.375*** (0.076)	0.374*** (0.077)	-0.958 (0.909)
log(Share of Old Believers near the factory)	0.129 (0.083)	0.128 (0.148)	0.230*** (0.078)	0.167 (0.104)	0.019 (0.038)	0.039 (0.047)	0.057 (0.045)	0.039 (0.069)
log(Number of all textile factories within 10km)	0.152 (0.112)	0.153 (0.164)		0.133 (0.133)	0.028 (0.032)	0.026 (0.030)		0.030 (0.085)
Latitude of factory	0.077 (0.166)	0.077 (0.169)	0.128 (0.162)	0.146 (0.234)	0.235** (0.107)	0.233** (0.100)	0.228** (0.101)	0.174 (0.200)
Dummies for types of factories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.556 (9.094)	0.148 (9.393)	-2.586 (9.039)	-6.400 (13.218)	-8.682 (5.919)	-8.609 (5.573)	-8.342 (5.585)	4.702 (12.137)
Sample of with/without steam power	Only w/out	Only w/out	Only w/out	Only w/out	Only with	Only with	Only with	Only with
Workers and machinery instrumented?	No	No	No	Yes	No	No	No	Yes
Share of Old Believers instrumented?	No	Yes	Yes	No	No	Yes	Yes	No
Estimator	OLS	2SLS	2SLS	2SLS	OLS	2SLS	2SLS	2SLS
Observations	120	120	120	117	152	152	152	149
R^2	0.795	0.795	0.789	0.699	0.881	0.881	0.880	0.523
Overid test score		2.729	1.965	0.935		6.204	3.753	1.314
Overid test p-value		0.099	0.161	0.627		0.013	0.053	0.518

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

Note: Dependent variable is log(Total revenue), robust standard errors are used. Type dummies are jointly significant when used, although some of them are omitted when the sample is restricted (All the factories of Types 1, 2, 3 and 4 used some steam power, and none of the factories of type 13 used any power). We do not reject the null hypothesis that our instruments are valid at the 1% significance level using the same test as in Table 2.

From Table 5, we see that the positive effect of Old Believers disappears as we split the sample. However, it is clear from the magnitude of the point estimates of the coefficients that positive effect

comes from the observations in the subsample of the factories that did not use steam power. The difference becomes significant as we remove the number of textile factories near the factory from the control variables. Note that in models (3) and (7) the coefficient before the $\log(\text{Share of OB})$ is significant in the “no power” subsample despite there are only 120 observations in that group compared to 152 in the “with power” group.

The likely interpretation of the lack of Old Believers effect in the subsample of the more advanced factories is their intrinsic backwardness and conservatism. This result goes in line with the findings of Raskov and Kufenko (2014) who find that the role of Old Believers, measured as the share of the output in the overall textile production, began to diminish in the late 19th as the textile industry continued its development, although the reason they suggest for this decline is different. According to Raskov and Kufenko, Old Believers could not be a part in the developing financial markets (because the communal leaders found it unethical) and so they could not catch up with the other factories developing from the banks’ loans. On the other hand, as we observe lower returns on machinery rather than lower level of machinery stock (the sample exhibits no relation between the share of Old Believers and the capital stock of the factories), it is likely that the cause is in the usage of the capital rather than in its level.

In Appendix C, I run regressions controlling for literacy rates in the township where the factory is located. I find that the literacy rates did matter, although they do not overshadow the effect of the share of Old Believers. This means, that the Old Believers’ success is different from that of the Protestants as discussed in Becker & Woessmann (2009).

Conclusion

Total Factor Productivity (TFP) was higher in Old Believers factories, with about 7.1% increase in the TFP for every twofold increase in the population of the Old Believers (eg, from 2% to 4% or from 5% to 10% of the population). This result explains their prominence in the textile industry, relative to their share in population. This relation is likely based on the social capital that was the driver of the Old Believers' efficiency. If we introduce the district fixed effects, the positive impact of the share of Old Believers near the factory is only observed in the districts that had a high share of the Old Believers, suggesting that business networks were crucial for the relation. The positive effect of the Old Believers on the TFP is robust to controlling for the latitude (but not for the longitude) of the factory and its distance to Moscow, as well as for the literacy rates or the number of pubs in the township where the factory is located. From this I conclude that geography and human capital, although they did matter for the factories in general (not only those of the Old Believers), were not the main factor of Old Believers' success.

Substantial discussion of the formation of the Old Believers' social capital exists in historical literature. From the beginning of the schism in the 17th century, the Old Believers faced harsh oppression from the government: being executed or put in prison and later having to pay double head taxes, being banned from testifying in courts and condemned by the official church. The oppression shaped the Old Believers' culture, increasing the intragroup trust and, in words of Raskov (2012) formed the people "strong spiritually and physically". The formation of the Old Believers' culture was accompanied by the development of the institution of the communes that acted as the coordination and exchange centers. The business networks created by the Old Believers allowed them to be more efficient (spending less on management, having more motivated and disciplined workers who 'did not require monitoring, and exchanging information with their fellow adherents to the Old Belief).

Another result of this paper is that the greater productivity of the Old Believers is only observed in the factories that did not use steam or water power. The Old Believers had an advantage in the social capital, but their overall productivity was only higher when manual labor or horses were used rather than modern steam machinery. I interpret this as evidence of the Old Believers' inability to adopt the new technologies that fast, which derived from their conservatism and preference for traditional production processes. Their intrinsic conservatism lead to backwardness, counterbalancing the positive impact of social capital.

Future research may focus on the development of the communes: the change in the number of the factories near the Old Believer localities. Several other complete factory studies from Russian Empire in the 19th century are available, allowing to track the dynamics of the development of the textile industry and of the role of Old Believers in it. More generally, studying how the networks of

the Old Believers were formed (through the communes' documents and the data on the incorporations) will provide insights about the interplay between the culture and the institutions of the Old Believers and the importance of the social capital among the oppressed minorities for the economic development.

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Appendix A: Data sources and calculation of the share of OB

Data on factories

This section discusses the data on the factories and the corrections made to it. The source of this data is Bobkov (1885), a statistical bulletin prepared after the survey in 1881–1884 ordered by zemstvo for the purpose of collecting the zemstvo tax. Several such bulletins on the Moscow province industry were published throughout the 19th century (for example, Matissen, 1872), and I chose to use the 1885 bulletin because it was the closest to 1897 — the year for which I have the data on the share of Old Believers in the population from the Russian Imperial Census.

Bobkov’s study includes all manufacturers that satisfied *at least one* of the following conditions:

- Mechanical engines are used in the production process,
- The factory has 16 or more workers (working at home or in the factory building),
- The factory uses expensive equipment (leather processors, cheese producers and alcohol producers are given as examples of such).

The factories are classified into 15 types according to the main material they worked with (cotton, wool or silk) and the stage of the production process (yarn spinning, weaving, dying etc.) See Table 6 for the distribution of factories by type. To keep the sample homogeneous, I exclude the Types which mostly employed outside workers, giving the work away.

I had to perform some manipulations with the data to fill the gaps in the total number of the horsepowers of the factories. The source provides the horse powers of different types of equipment (turbines, steam and water machines etc.) together with the quantities of each type (eg., “2 turbines, 6 hp in total”). However, sometimes the number of steam boilers is given without their total power. In this case, I took the average of the power of all steam boilers of other factories of the same types and used it to infer the missing observations (eg, if the average for Type 1 “Cotton spinning (yarn production)” is 46 hp per steam boiler, I multiplied the number of boilers in the factories where their total power was unknown by 46). For types 11 and 13 I used the averages of types 9 and 12 because they worked with the same raw materials (wool and silk, respectively).

I’ve excluded factory number 69, because most of its workers worked from outside (the source says it had 800 external workers compared to the 72 within the factory). However, even though the data on factories that had external workers is available, I did not exclude other factories that had outside workers: they did not create visible outliers and the coefficient before the share of Old Believers in model (5) in Table 2 is unaffected if I include a dummy for these factories.

All the logged variables I used in the estimation were $\log(x + 1)$ if the variable takes zero values (power, lighting, share of Old Believers etc.)

Table 6: Factories by types

Type	Description	Number of factories
1	Cotton spinning	9
2	Cotton spinning and weaving	11
3	Cotton spinning, weaving, dyeing and printing	5
4	Mechanical cotton weaving	11
5	Weaving, dyeing, whiting and printing	12
6	Dyeing, whiting of spinning and fabric, and printing	41
7	Ditribution of warps for working at home	<i>Not in the sample</i>
8	Manual cotton weaving	<i>Not in the sample</i>
9	Wool spinning and woolen manufacture	57
10	Wool clothes fulling and processing	<i>Not in the sample</i>
11	Weaving of wool	35
12	Silk and its products	62
13	Brocade production	16
14	Miscellaneous textile products	19
15	Hessian (burlap) production	<i>Not in the sample</i>

Share of Old Believers in the population

This section describes the process of calculation of the share of Old Believers in the vicinity of each factory and the data sources used. There was only one all-Russia Imperial Census before the Soviet Union: the All-Russia Census of 1897. This census included a question on the religion. Other censuses were sometimes performed locally, usually in the cities (Moscow, for example, had city censuses in 1871, 1882, 1902 and 1912, which also included questions on religion), and that gives another source of the statistics on the religion of the population. Unfortunately, the results of the 1897 Census were only published on the aggregate level: for the *уездные города*, the district city-centers and the districts themselves without specific localities. However, 8 years after the Census, *Населенные места Российской Империи...*, “The localities of the Russian Empire with the population of 500 or greater” which lists all the localities of the Empire with more than 485 citizens ¹² was published. I use this source to construct a measure of the number of Old Believers near each factory. 472 localities existed in Moscow province. If more than 10% of the population adhered to a religion, then the number of the adherents in the religion was given (otherwise it was omitted). I fill in the missing values using two steps. First, I closed the gaps when possible using

¹²Although the bulletin’s name suggests that only localities with >500 inhabitants are included, the author allow a 5% margin.

Table 7: Summary statistics of the factory-level data, one observation=one factory

	Mean	Std. Dev.	Min.	Max.	Source
Total revenue, <i>rubles</i>	520208.088	918806.704	700	5507000	[1]
Total horse powers of steam and water machinery	122.189	236.198	0	1460	[1]
Months per year the factory works	11.629	0.948	7	12	[1]
Hours per day the factory works	16.083	5.688	10	24	[1]
Total spending on coal, wood etc., <i>rubles</i>	17395.438	37953.273	30	300000	[1]
Total spending on kerosene, candles etc., <i>rubles</i>	872.253	1890.807	0	15000	[1]
Number of workers	367.548	722.26	2	7255	[1]
Yearly wage bill, <i>rubles</i>	50773.456	105973.377	100	1100000	[1]
Yearly on raw materials, <i>rubles</i>	355606.312	633307.107	0	3520000	[1]
Value of machinery, <i>rubles</i>	100017.217	221469.972	100	1766122	[1]
Value of all buildings, <i>rubles</i>	74700.107	127223.62	605	1071860	[1]
Did the factory have external workers?	0.188	0.391	0	1	[1]
Incorporation status	0.122	0.328	0	1	[2]
Type according to Bobkov (1885) classification			1	14	[1]
Share of OB in the population within 7 km	0.058	0.102	0	0.762	[3]
Literacy rate in the township	58.568	14.033	0	91.900	[4]
Winter harvest in the township, <i>seed ratio</i>	3.417	1.535	1.4	8	[5]
Spring harvest in the township, <i>seed ratio</i>	2.883	0.746	1.8	5.7	[5]
Number of pubs in the township	15.631	8.608	1	36	[5]
Work horses of peasants in the township	1023.765	394.497	175	2624	[5]
Heads of cattle in the township	1102.914	483.523	196	3041	[5]
Male peasant population in the township , 1885	3804.265	1122.408	1428	8526	[5]
Female peasant population in the township, 1885	4094.265	1189.173	1636	9023	[5]
Latitude of factory	55.724	0.385	54.863	56.525	
Longitude of factory	37.834	0.712	35.833	38.987	
Number of all textile factories within 10km	10.419	7.572	0	27	
Number of factories of the same class within 10 km	5.32	4.887	0	18	
Distance to the center of Guslitsi, <i>km</i>	84.392	41.525	5.47	203.098	
Distance to Rogozhskoe cemetery, <i>km</i>	53.646	31.948	4.255	123.862	
Distance to nearest major road, <i>km</i>	6.455	8.76	0	72.233	[1]
Distance to nearest RR station, <i>km</i>	10.944	12.617	0	65.666	[1]

Sources: [1]: Bobkov, 1885, [2]: Owen, 1992 (RUSCORP database) [3]: 1897 all-Russia Census, *Naseleennie mesta Rossyjskoj Imperii...*, [4]: Bogolepov, 1896, [5]: Orlov, Kablukov, 1878-. Distances to Guslitsi and to the Rogozhskoe cemetery, as well as the number of factories within 10 km from the factory come from author's own calculations after the factories were geocoded.

the official results of the Russian 1897 census. These results include the data on districts' capitals (Bogorodsk, Vereya, Mozhaysk...) separately from the rest of the district, which allowed me to close the gaps for the 12 districts' capitals. Second, I found that except for a Catholic minority in the Podolsky uezd, no religious minority apart from the Old Believers had a greater than 1% share in the population of any district. The adherents of Judaism, Protestantism, Armenian Catholicism and other religions were concentrated in the district capitals (taken into account on the first step), and their population was negligibly small in the rest of each district. So, as the second step, I closed the missings by assuming that all non-Orthodox population in the localities consisted of the Old Believers.

After preparing the data on localities, I manually geocoded (that is, found the geographic coordinates of) each locality by using historical maps (Strel'bitsky, 1871 and Schubert map from 1860), and also using on-line sources that provide the location of churches and the 1890 edition of the "Memory book of Moscow province" (*Pamyatnaya knizhka Moskvockoy gubernii*'), an address and reference book which included the distance of each locality to the nearest railroad station and sometimes the river. In case of doubt, I verified that the coordinates of the locality correspond to the township (*volost'*) where the locality is supposed to be (taken also from the "Memory book..."). I've successfully geocoded 471 out of 472 localities. I have also geocoded all 274 factories. Factory number 277¹³ was found given the name of the owner, even though its address was missing in the original source.

After obtaining coordinates of the factories and coordinates of the localities, I used `-geonear-` package to find all localities within 7 km-range from each factory. In case when the factory had no localities within 7 km, a single nearest locality was taken with the share of Old Believers in it. There were 13 such factories, see the histogram for the distance to their nearest localities below.

The choice of 7 km seems rather arbitrary, although there is some reasoning behind it. Given the 11 hour working day in Russia at that time, it is unlikely that workers could spend more than one hour to get to the factory — and 7 km is a one hour walking distance (given there is a good road, of course).

Agricultural data for instrumenting the workers and the machinery

There were 13 districts in Moscow province, with 165 *volost*'s in them (plus the Moscow city). However, the 272 factories in the dataset were only located in the 80 *volost*'s of the province, which still provides a good variation in the instruments.

¹³I use the numbering from the source, and since I skipped the types where the factories only gave the work for the external workers, the numbering of the 274 factories in the dataset goes up to 412.

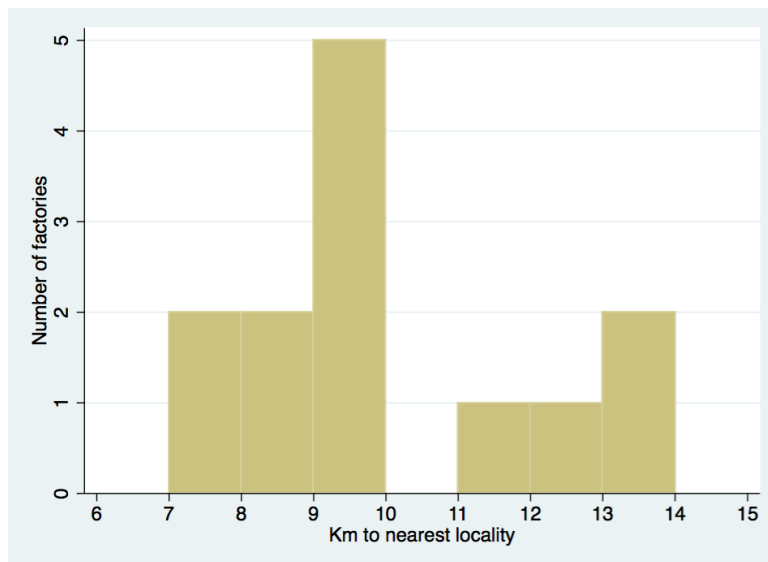


Figure 1: Distances to the nearest locality for the factories that have no localities within 7 km

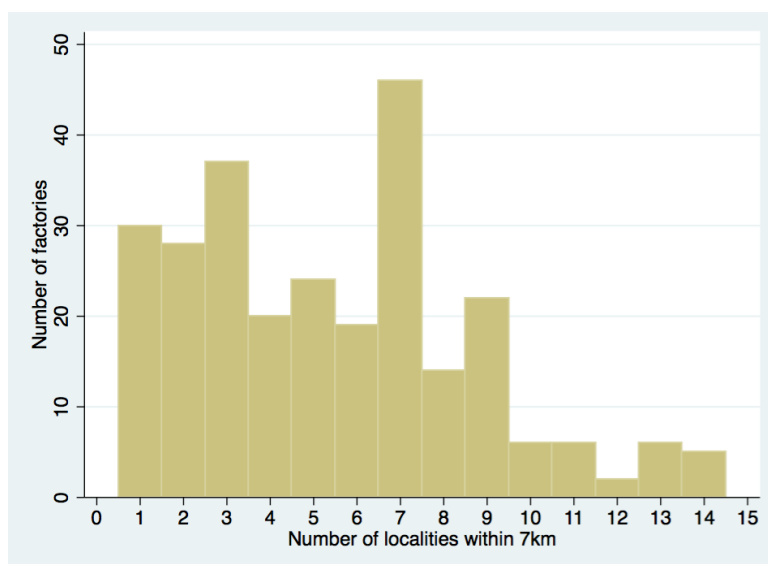


Figure 2: Number of localities within 7 km, factories with no localities excluded.

Appendix B: Robustness checks

This table provides a variety of robustness checks for the Model (2) in Table 2. In Model (1) I control for the incorporation status of the factory, following a paper by Gregg (*forthcoming*) that discusses the benefits that incorporation gave for capital accumulation in the Russian Empire. Model (2) clusters the standard errors by district instead of using the heteroskedasticity-robust estimator. Model (3) controls for the seasonality of the factories' operation and the difference in working time (many factories worked 24 hours a day) and the access of transport networks. Model (4) restricts the sample to factories with >30 workers (two times greater than the sufficient condition to include the factory in Bobkov's survey) to make sure that the effect I find is not driven by small enterprises. Models (5) and (6) use alternative proxies for factory's capital.

Table 8: Robustness checks for the positive effect of the share of Old Believers on the TFP

	(1)	(2)	(3)	(4)	(5)	(6)
log(Share of Old Believers near the factory)	0.132*** (0.046)	0.131*** (0.045)	0.102* (0.056)	0.100** (0.049)	0.112** (0.047)	0.085* (0.048)
log(Workers)	0.695*** (0.055)	0.697*** (0.053)	0.704*** (0.056)	0.695*** (0.062)	0.935*** (0.050)	0.514*** (0.094)
log(Value of machinery)	0.347*** (0.043)	0.343*** (0.006)	0.332*** (0.043)	0.351*** (0.044)		0.152*** (0.056)
log(Horse powers of machinery)					0.119*** (0.031)	
Incorporation status	0.012 (0.138)					
log(Hours working per day)			0.005 (0.154)			
log(Months working per year)			0.128 (0.410)			
log(Distance to nearest major road)			0.044 (0.033)			
log(Distance to nearest RR station)			-0.062 (0.045)			
log(Total cost of raw materials)						0.170 (0.119)
log(Total value of buildings)						0.191** (0.084)
log(Spending on combustibles)						0.028 (0.034)
log(Spending on lighting)						-0.015 (0.016)
Dummies for types of factories	Yes	Yes	Yes	Yes	Yes	No
Constant	4.782*** (0.358)	4.832*** (0.337)	4.679*** (1.053)	4.774*** (0.394)	6.982*** (0.288)	3.791*** (0.575)
Workers and machinery instrumented?	No	No	No	No	No	No
Share of Old Believers instrumented?	Yes	Yes	Yes	Yes	Yes	Yes
Estimator	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Observations	271	272	267	225	273	271
R^2	0.911	0.909	0.910	0.883	0.893	0.920
Overid test score	0.305		0.075	0.481	1.736	0.029
Overid test p-value	0.581		0.785	0.488	0.188	0.866

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

Note: Dependent variable is log(Total revenue), robust standard errors are used, except in model (2) where they are clustered by types of factories. Type dummies are jointly significant when used. Model (4) restricts the sample to factories that had more than 30 workers.

Appendix C: Controlling for the human capital

In this section, I present evidence that although the literacy rates in the township did matter, they did not account for the higher Total Factor Productivity of the Old Believers. I include the literacy rate in the township where the factory is located and find that it has a strong positive impact on the factory's production, but the effect of the Old Believers is still significant. Also, the number of pubs and drinking houses, an (imperfect) proxy for the sobriety of the population, does not have a significant impact on the total revenue, nor does it take the significance from the coefficient before the share of Old Believers.

Table 9: Controlling for the human capital via the literacy rates and the number of pubs

	(1)	(2)	(3)	(4)	(5)	(6)
log(Workers)	0.664*** (0.105)	0.685*** (0.058)	0.686*** (0.056)	0.675*** (0.055)	0.835*** (0.312)	0.889*** (0.191)
log(Value of machinery)	0.331*** (0.087)	0.349*** (0.044)	0.349*** (0.043)	0.356*** (0.042)	0.303 (0.218)	0.270 (0.214)
log(Share of Old Believers near the factory)	0.187*** (0.058)	0.070** (0.035)	0.099* (0.052)	0.098* (0.053)	0.075** (0.036)	0.077** (0.036)
log(Literacy rate in the township)	0.188*** (0.044)	0.168*** (0.034)	0.166*** (0.033)	0.164*** (0.034)	0.171*** (0.033)	0.172*** (0.017)
log(Number of pubs per capita in the township)				-0.070 (0.056)		
log(Number of textile factories within 10km)		0.073** (0.035)	0.063 (0.039)	0.087** (0.038)	0.057 (0.047)	0.052 (0.047)
Latitude of factory		0.219** (0.093)	0.218** (0.090)	0.221** (0.090)	0.224* (0.114)	0.217** (0.101)
Dummies for types of factories	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.413*** (0.518)	-8.140 (5.257)	-8.102 (5.080)	-8.727* (5.079)	-8.767 (7.103)	-8.300 (7.217)
Workers and machinery instrumented?	No	No	No	No	Yes	Yes
Share of Old Believers instrumented?	No	No	Yes	Yes	No	Yes
Estimator	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Observations	117	268	268	268	266	266
R^2	0.794	0.914	0.914	0.915	0.911	0.908
Overid test score			1.103	0.269	0.784	
Overid test p-value			0.294	0.604	0.676	

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

Note: Dependent variable is log(Total revenue), robust standard errors are used in all models except (6) where they are clustered by districts. Model (1) restricts the sample to factories that did not use the steam power (see Table 5). 4 observations out of 272 are lost because there is no literacy rate data available for two counties.

Thus, unlike the case of Protestants as discussed by Becker & Woessmann (2009), the success of Old Believers did not come from their human capital. Although more research is needed to make a definite conclusion about the importance of their human capital, historians offer an interesting theory about the difference between the human capital of the Old Believers and the Protestants. As Leroy-Beaulieu (1897) suggests, the Old Believers read the books in the Old Slavonic rather than in modern Russian and preferred the books copied by hand to those printed. Perhaps the reason why we do not observe higher literacy rates driving higher productivity is that the Old Believers never valued the knowledge and its creation — rather, they copied the books from the past and did not accumulate knowledge by interpreting or translating the Bible, as the Protestants did.

Appendix D: >500 inhabitants sampling bias

I use the data on 471 localities and the share of Old Believers in them to find the share of the Old Believers within a 7 km range from each factory in the sample. Data is only available on localities with >485 people (500–3%). In this section, I run some regressions to show that the truncated distribution of the localities is not likely to provide a source of bias in the share of Old Believers that I use as an explanatory variable. As we can see, the share of the Old Believers is not correlated with the population of the locality in the sample of localities with 485–1000 and 485–10000 inhabitants. There is no correlation under the generalized linear model estimation (that I use to take into account the fact that the dependent variable can only take values between 0 and 1). This rejects the concern of the sampling biased caused by a truncated distribution of the population of the localities: we can assume that the small localities with <485 inhabitants were not different from bigger ones in terms of the distribution of the share of Old Believers.

Table 10: The relation between the population of a locality and the share of the Old Believers in it

	(1)	(2)	(3)	(4)
Population of the locality, thousands	−0.003 (0.006)	0.138 (0.115)	−0.031 (0.058)	1.345 (1.082)
Constant	0.125*** (0.014)	0.022 (0.075)	−1.944*** (0.134)	−2.964*** (0.736)
Estimator	OLS	OLS	GLM, logit	GLM, logit
Observations	463	357	463	357
R^2	0.000	0.005	—	—

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

Note: Dependent variable is “Share of Old Believers in the population of the locality”, each observation is one locality, robust standard errors are used. Models (1) and (3) include localities with <10000 people, models (2) and (4) include localities with <1000 people.

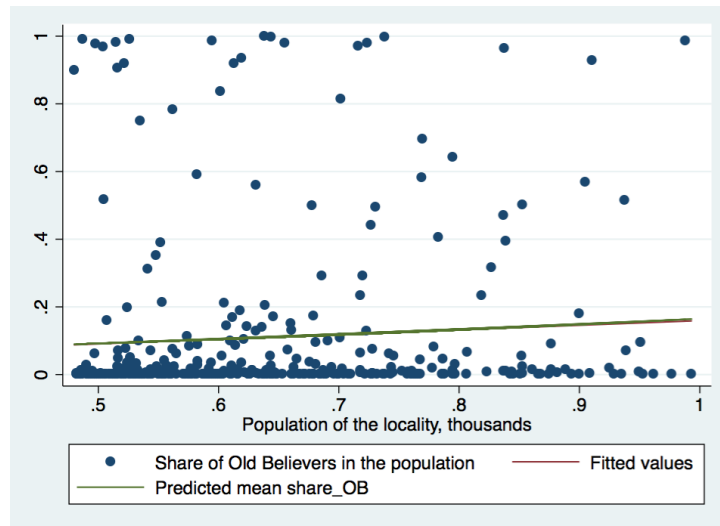


Figure 3: Share of OB and the population of the localites, OLS and GLM regression lines.

Appendix E: Distribution of the Old Believers by district

Table 11: Share of Old Believers by district, 1897

District center or the District excluding the district center	Total population	Orthodox population	Old Believers population	Share of Old Believers
Moskva	1038591	967414	18881	1.82%
Moskovsky	165335	158149	5726	3.46%
Bogorodsk town	11102	10656	351	3.16%
Bogorodsky	211239	160540	50174	23.75%
Bronnitsy town	3897	3434	350	8.98%
Bronnitsky	126407	114316	11995	9.49%
Vereya town	3707	3580	102	2.75%
Vereysky	50367	48031	2141	4.25%
Volokolamsk town	3091	3065	15	0.49%
Volokolamsky	77893	76319	1507	1.93%
Dmitrov town	4480	4443	4	0.09%
Dmitrovsky	115206	114597	373	0.32%
Zvenigorod town	2381	2350	0	0.00%
Voskresensk town	2289	2284	0	0.00%
Zvenigorodsky	79705	78799	297	0.37%
Klin town	4655	4554	3	0.06%
Klinsky	110507	108980	1320	1.19%
Kolomna town	20277	19337	302	1.49%
Kolomensky	91650	87326	4243	4.63%
Mozhaysk town	3194	3146	3	0.09%
Mozhaysky	50773	49836	829	1.63%
Podolsk town	3798	3668	38	1.00%
Podolsky	82513	81579	421	0.51%
Ruza town	2349	2341	0	0.00%
Ruzsky	53173	52695	206	0.39%
Serpuhov town	30571	29852	64	0.21%
Serpuhovsky	81431	80854	480	0.59%
Moskva (1882 city census)	753469	690977	16640	2.21%

Source: 1897 All-Russia census, reported by the Ministry of Domestic affairs.

The data for Moscow city is from the Moscow 1882 census, reported by the Statistical Bureau of the Moscow City Council.

Appendix F: First stage results of 2SLS estimation

Table 12: First stage results of the 2SLS estimation of Models (4) and (5) from Table 2

	log(Workers)	log(Machinery)	log(Share of OB near the factory)
Winter grain harvest	−0.053 (0.067)	0.008 (0.088)	
Spring grain harvest	−0.074 (0.111)	−0.026 (0.127)	
Cattle heads per peasant	−5.155** (2.496)	−9.046*** (3.135)	
Horses per peasant	0.841 (2.677)	2.733 (3.473)	
log(Distance to Rogozhskoe cemetery)			−0.391*** (0.079)
log(Distance to the center of Guslitsi)			−1.422*** (0.094)
log(Share of Old Believers near the factory)	−0.025 (0.063)	−0.079 (0.086)	
log(Workers)			−0.162* (0.088)
log(Value of machinery)			0.049 (0.064)
Latitude of factory	0.079 (0.191)	−0.231 (0.253)	0.022 (0.120)
log(Number of textile factories within 10 km)	0.047 (0.097)	−0.115 (0.122)	0.008 (0.072)
Dummies for types of factories	Yes	Yes	Yes
Constant	2.969 (10.534)	26.671* (13.984)	7.876 (7.089)
Observations	266	266	272
R^2	0.541	0.604	0.603
Shea Partial R^2	0.0316	0.0316	0.5369
Kleibergen-Paap Wald. F-stat	1.795	1.795	120.597

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

Note: Dependent variable is given as the column heading. The instrumental variables are the harvests and the cattle & horses per capita for the workers and the machinery and the distances to religious centers for the share of Old Believers.