

Catching-Up and Falling Behind: Russian Economic Growth, 1690s–1880s

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We provide decadal estimates of GDP per capita for the Russian Empire from the 1690s to the 1880s, making it possible for the first time to compare the economic performance of one of the world's largest economies with other countries. Significant Russian economic growth before the 1760s resulted in catching-up on northwest Europe, but this was followed by a period of negative growth between the 1760s and 1800s and stagnation from the 1800s to the 1880s, leaving late-nineteenth century Russia further behind the West than at the beginning of the eighteenth century.

Russia has been largely absent from recent debates over the emergence of a GDP per capita gap between northwest Europe and other regions of the continent, known as the European Little Divergence. An important factor here is the absence of GDP data for Russia before 1885, when Gregory's (1982) series begins. In the 1880s, Russia was the sixth largest economy in the world, and is the only one among the ten largest economies that does not have even rough estimates of economic performance for the eighteenth and nineteenth centuries. This paper provides decadal estimates of GDP per capita for the Russian Empire from the 1690s to the 1880s, constructed from the output side using both archival

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and secondary sources. This enables us to encompass many strands of the existing literature on Russian economic history in a way that ensures consistency with the aggregate evolution of the nation's economic performance and, at the same time, places it in an international comparative perspective.

The most important factor behind the very limited increase in Russian GDP per capita over these two centuries was the failure of Russian agriculture to increase per capita output in a sustainable way. This picture of long-run agricultural stagnation may be seen as consistent with the emphasis on the negative effects of serfdom in much of the existing literature (Lyashchenko 1949; Gerschenkron 1965; Markevich and Zhuravskaya 2018). However, it is worth emphasizing that although agricultural output per capita was no higher in the 1800s than in the 1690s, there was a phase of substantial per capita agricultural output growth during the first half of the eighteenth century, followed by a period of negative per capita growth in the second half of the century. Although serfdom may have set limits to the level of productivity that could be achieved in Russian agriculture, such swings in agricultural output per capita require explanation and are suggestive of a significant role for other factors in determining economic performance over periods as long as half a century. An important role seems to have been played by demographic factors, with slow population growth in the first half of the eighteenth century permitting an increase in cultivated land per capita, but an acceleration of population growth during the second half of the century leading to a decrease in cultivated land per capita. On top of this, there was a positive correlation between grain yields and temperature, suggesting a subsidiary role for climate, with temperature turning downward during the second half of the eighteenth century (Kahan 1985, p. 49; Milov 2006).

Another strand of Russian economic history concerns an early phase of industrialization in the early eighteenth century following the reforms of Peter the Great (Lyashchenko 1949; Blackwell 1968; Falkus 1972; Kahan 1985; Mau and Drobyshevskaya 2012). Although the rapid growth of large-scale industry during this period has received a great deal of attention, it is important to remember the low base from which this growth was starting, which severely limited the scale of the impact on overall industrial production, let alone the economy as a whole. This is reminiscent of the powerful argument of Crafts and Harley (1992), who explained slow aggregate growth during the British Industrial Revolution, despite the rapid growth of modernizing industries such as cotton textiles and iron, by the small initial scale of those industries in the early stages of

industrialization. As late as the 1880s, large-scale industry accounted for less than half of industrial net output and only just over 10 percent of GDP in Russia. Small-scale industry grew much less rapidly than large-scale industry, thus ensuring that overall industrial production also grew relatively slowly.

A further strand of literature concerns the expansion of the Russian Empire. Although the colonization of new lands that were in some places highly fertile and in other places contained abundant natural resources may be expected to have boosted per capita incomes in the long run, this required the effective economic integration of those new areas into the Russian economy. Baykov (1954) stressed the difficulties of achieving integration before the coming of the railways in the late nineteenth century. Before then, Baykov (1954, pp. 137–38, 144) emphasized agrarian overpopulation in an economy where abundant resource endowments could not be effectively utilized. This is also a key theme in the work of Metzger (1974), who attempted to quantify the effects of market integration during the railway age.

Although GDP per capita in the 1880s was barely 3 percent higher than in the 1690s, this was not the result of continuous stagnation, but rather periods of growth followed by periods of shrinking, or growth reversals. Until recently, economic historians have written about phases of growth without paying much attention to the phases of shrinking. But the alternation of phases of growing and shrinking is the normal pattern of pre-industrial economies, and what matters for development is breaking free from this cyclical pattern by shrinking less (Broadberry and Wallis 2017; Broadberry and Gardner 2022). For Russia, there is little sign of breaking free from this pattern before the Soviet era, with the growth of the first half of the eighteenth century being completely reversed by the 1800s and the industrialization of the 1890s being followed by another phase of shrinking after the Bolshevik Revolution of 1917. It was only after Stalin's Big Push industrialization of the 1930s that GDP per capita gains were permanently consolidated (Allen 2003).

With a continuous series of GDP per capita from the 1690s, it is possible to place Russia's economic performance in an international comparative perspective. In the 1690s, there was a substantial GDP per capita gap between Russia and northwest Europe, with Russia at barely half the Dutch level and less than 60 percent of the British level. During the first half of the eighteenth century, however, Russia entered a catching-up phase, as per capita GDP grew faster than in Britain and the Netherlands. By the 1760s, Russian GDP per capita had reached over 60 percent of the Dutch level and nearly 70 percent of the British level.

However, this period of Russian catching-up was followed by a period of falling behind during the second half of the eighteenth century, as GDP per capita declined in Russia while growing rapidly in Britain and merely stagnating in the Netherlands. By the 1800s, Russia had fallen further behind northwest Europe than in the 1690s. As Russia stagnated during the nineteenth century, growth continued in Britain and the Netherlands, so by the 1880s, GDP per capita in Russia was just over 20 percent of the British level and less than 30 percent of the Dutch level. Within the Baltic region, Russia briefly overtook Sweden during the mid-eighteenth century, but then lost its lead during the second half of the eighteenth century before falling behind again during the nineteenth century. Although Russia's GDP per capita was relatively high compared with Asia for most of the period, Japan overtook Russia in the mid-nineteenth century, China's Yangzi Delta remained ahead as late as the 1880s, and the Ottoman Empire was catching-up with Russia.

The data for all the component series of Russian GDP are provided in Online Appendix 1, while details of the sources and methods are provided in Online Appendix 2. Both appendices can be accessed in Broadberry and Korchmina (2024).

RUSSIAN POPULATION

One issue that needs to be dealt with from the outset concerns the territory to be covered by the statistics reported here. We work primarily with the population of the Russian Empire, as its territory expanded from 14.1 million square kilometers in 1646 to 16.6 million km² in 1796 and 18.2 million km² in 1858. The reason for this is that although the population data are available with a regional breakdown so that estimates can be obtained on a constant territory basis, unfortunately, this is not generally the case for the output data. We therefore decided to work with the expanding territory of the Russian Empire to ensure comparability of the output and population data. While the territorial expansion of the Russian Empire accounted for a large share of the increase in both population and GDP, our main interest is in GDP per capita, where the effect of territorial expansion was inevitably much smaller. Providing a full set of regional estimates of GDP, population and GDP per capita would be a desirable further step, but is not currently feasible.

The data for the key benchmark years in Table 1 are taken from Mironov (2000, p. 2), based on population counts or *revizii*. Details of the sources and methods are provided in Online Appendix 2. However, because of the substantial territorial expansion of the Russian Empire, we

TABLE 1
POPULATION OF THE RUSSIAN EMPIRE, 1646–1914

A. Population in Millions		
	Total Population	Population within the Borders of 1646
1646	7.0	7.0
1678	11.2	9.6
1719	15.6	13.6
1762	23.2	18.1
1796	37.4	23.8
1815	46.3	28.6
1858	74.5	40.8
1897	128.9	52.0
1914	178.4	73.0
B. Population Growth (% per year)		
	Expanding Territory	Constant Territory
1646–1678	1.48	0.99
1678–1719	0.81	0.85
1719–1762	0.93	0.67
1762–1796	1.41	0.81
1796–1815	1.13	0.97
1815–1858	1.11	0.83
1858–1897	1.42	0.62
1897–1914	1.93	2.02
1646–1914	1.22	0.88

Source: Derived from Mironov (2000, p. 4).

also provide data on the population within the territory of 1646. Figure 1 provides a map of Russia's growing territory, with the shading becoming darker the later the date of annexation. From the 1697 boundaries, there was considerable expansion of the northern frontier into the Baltic region, the western frontier into Eastern Europe, and the southern frontier into the Caucasus and Central Asia, as well as further eastward expansion beyond Siberia into East Asia.

The decadal index of population from the 1690s to the 1880s using log-linear interpolation between census years for the eighteenth century and annual data from the *Statisticheskiiy yezhegodnik* [Statistical Yearbook of Russia] for the nineteenth century is plotted in Figure 2, while in Online Appendix 1, the series are provided in Table A1.1. Population within the expanding territory grew at an average annual rate of 1.11 percent over the whole period between the 1690s and the 1880s. However, there were significant decadal fluctuations, with the peak rate of population growth at 1.46 percent per annum occurring between the 1760s and 1800s. Although population growth fell back from this peak during the nineteenth century, it remained substantially higher than before the 1760s, so population growth between the 1800s and 1880s exceeded

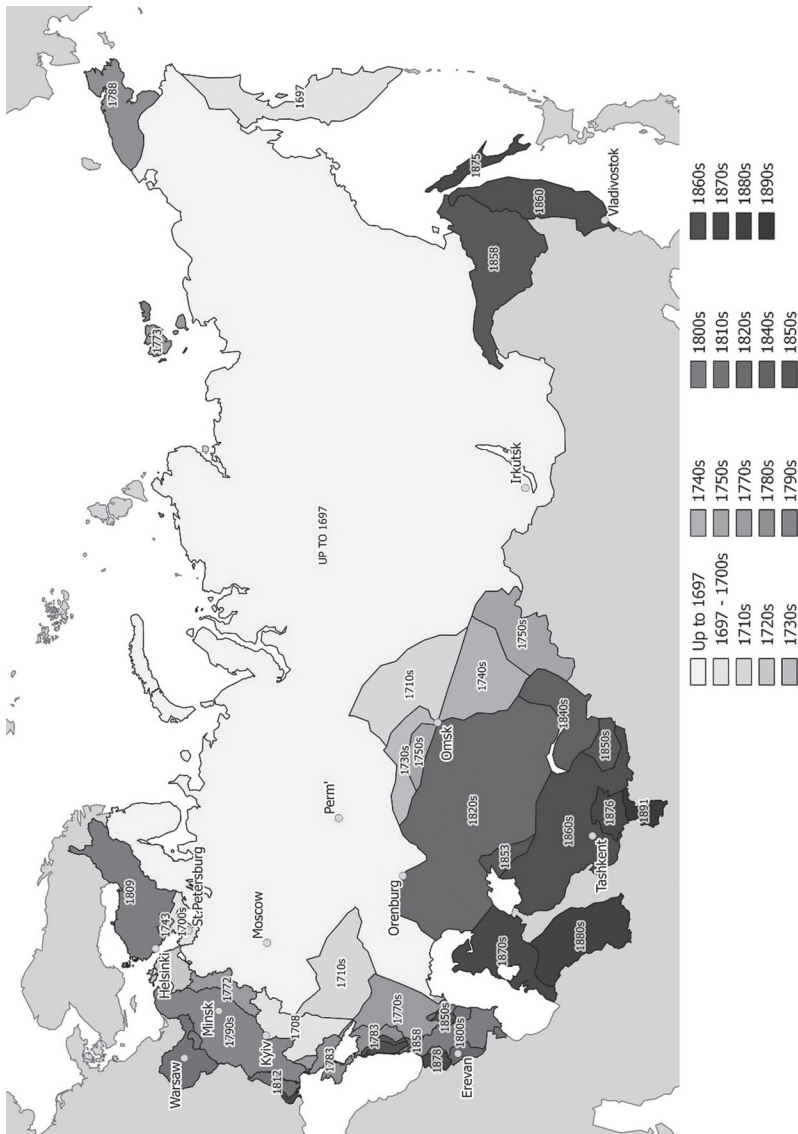


FIGURE 1
THE TERRITORIAL EXPANSION OF RUSSIA, 1690s–1890s
Source: Redrawn based on a map from Chepelkin and Dyakova (1995).

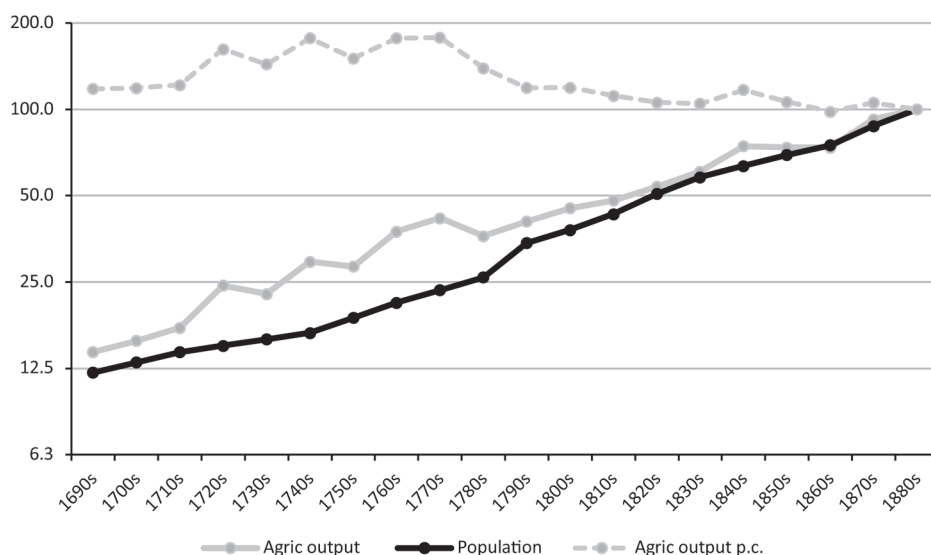


FIGURE 2
POPULATION, AGRICULTURAL OUTPUT AND OUTPUT PER CAPITA IN RUSSIA,
1690s–1880s (1880s=100)

Source: Online Appendix Table A1.1.

that between the 1690s and 1800s. As we shall see, this rapid population growth during the second half of the eighteenth century had a significant negative impact on the long-run evolution of Russian living standards.

RUSSIAN AGRICULTURE

In placing Russia's experience in an international comparative perspective, it will be useful to reconstruct GDP on a similar basis to that used in studies for other countries, built up from the output side.¹ This involves dividing the economy into the three main sectors of agriculture, industry, and services, and collecting indicators of economic activity in each sector, before aggregating them together using appropriate sectoral weights. We begin with agriculture, which was the largest sector in the

¹ Estimates of gross domestic product (GDP) and GDP per capita in Western Europe now exist back to the fourteenth century for Britain, the Netherlands, France, Italy, Spain, and Sweden, and back to the sixteenth century for Belgium, Germany, and Portugal (Broadberry et al. 2015; van Zanden and van Leeuwen 2012; Ridolfi 2016; Malanima 2011; Álvarez-Nogal and Prados de la Escosura 2013; Krantz 2017; Schön and Krantz 2012; Palma and Reis 2019; Buyst 2011; Pfister 2022). The recent appearance of Malinowski and van Zanden's (2017) study of Poland reaching back to the fifteenth century shows the possibility of extending the historical national accounting approach to early modern Eastern Europe, but the largest East European economy of the time has until now not attracted sufficient attention.

TABLE 2
LAND AREA FOR AGRICULTURAL CULTIVATION IN RUSSIA, 1690s–1860s

A. Land Area, 1696–1796 (1,000 Hectares)					
	Plowland	Meadow	Forest	Total Land Area	Plowland/Total Land (%)
1696	31,976	67,068	213,416	405,091	7.89
1725	41,848	66,296	213,958	418,219	10.01
1763	53,865	63,308	205,890	423,128	12.73
1796	81,359	76,650	217,322	485,465	16.76
B. Cultivated Land Area, 1802–1860s (Million Dessyatin)					
	1802		1860s		
Provinces	Million Dessyatin	%	Million Dessyatin	%	
21 black soil regions	17.9	47.1	23.0	39.7	
24 non-black soil regions	20.1	52.9	35.0	60.3	
45 provinces	38.0	100.0	58.0	100.0	

Sources: Part A: Kahan (1985, p. 46). Part B: Lyashchenko (1956, vol. 1, p. 507).

Russian economy between the 1690s and 1880s and therefore played a dominant role in determining the path of GDP per capita. Agricultural output for the eighteenth century is derived indirectly from data on the amount of cultivated land and grain yields. In the nineteenth century, however, grain output is estimated directly from harvest data. We have followed a common practice in the economic history of pre-industrial Europe of treating grain production as an indicator of overall agricultural output, as we currently lack data on livestock farming for both the eighteenth and nineteenth centuries. We know from the work of Gregory (1982, p. 58) and Markevich (2019) that livestock products accounted for about one-third of agricultural output in the 1880s and 1890s, which is also consistent with Goldsmith's (1961, p. 453) assessment of the situation in 1913.

Eighteenth-Century Agriculture

Table 2A provides data on the land area in Russia, taken largely from Kahan (1985, p. 46). While the total land area increased by 19.8 percent between 1696 and 1796, the amount of plowland increased much more rapidly, by 254 percent. Although the overall land quality was low compared with much of the rest of Europe, a growing part of the fertile black soil (*chernozem*) region was brought under cultivation, facilitating an increase in grain yields. However, the susceptibility of this region to drought also meant a high degree of variability in yields. Without systematic information on any change in seed sown per hectare, we have

TABLE 3
GRAIN YIELDS PER SEED IN RUSSIA, 1710s–1860s

A. Yields by Crop, 1710s–1800s					
	All Crops	Rye	Wheat	Oats	Barley
1710s	2.9	2.9	3.9	2.7	3.9
1720s	3.8	3.6	3.7	4.1	4.5
1730s	3.3	3.2	3.9	3.3	4.0
1740s	4.0	4.3	3.6	3.8	3.7
1750s	3.6	3.7	3.3	3.5	4.3
1760s	4.5	4.7	3.8	4.5	4.7
1770s	4.4	4.2	4.3	4.8	4.2
1780s	3.3	3.3	3.2	3.4	3.5
1790s	3.3	3.1	3.0	3.6	3.1
1800s	3.5				
B. Average Yields across All Crops, 1800s–1860s					
1800s	3.5				
1810s	3.5				
1820s	3.4				
1830s	3.4				
1840s	3.6				
1850s	3.5				
1860s	3.6				
1870s	4.0				
1880s	4.2				

Sources: Part A: Kahan (1985, p. 49), with additional information for 1800s from Mikhailovsky (1921, pp. 2–4). Part B: Mikhailovsky (1921, pp. 2–4); Kahan (1989, pp. 142–43).

assumed no change, so the trend in yield per seed is taken to represent the trend in yield per hectare.²

The grain yield data in Table 3A are taken from Kahan (1985, p. 49), based on the work of Indova (1970, pp. 146–51), who utilized all existing estimates available at the time from the work of other economic historians and economists, together with additional archival evidence from the Appanage Department (*Dvortsovyi otdel*) of the Russian State Archive of Ancient Acts (RGADA or *Rossiskii Gosudarstvennyi Arkhiv Drevnikh Aktov*). Her main source was the books on planting and harvesting grains for personal use of the owners. In Online Appendix 2, we discuss these estimates in more detail, including checking that they include a wide coverage of geographical areas, particularly given the importance of Russia's expansion into the black soil region. In the calculation of agricultural output for this period, the average yield across all four grains has been used. The plowland area has been interpolated log-linearly between the benchmark years, while the grain yield has been held at the low level of the 1710s for the preceding two decades. Multiplying the plowland

² The two moved closely together in medieval Britain (Campbell 2000, pp. 323, 335).

series by the index of grain yields results in an index of grain output. This can then be divided by population to yield a series for agricultural output per head. The data are plotted in Figure 2 and also provided in Online Appendix Table A1.1.

Agricultural output per head increased between the 1690s and the 1740s, as plowland kept pace with the moderately growing population and grain yields trended upward in line with average temperature (Luterbacher et al. 2004; Kahan 1985, pp. 13–14). This growth was linked to the colonization of the fertile black soil region, which raised grain yields as well as expanded the cultivated area (Nefedov 2010, p. 143). The rise in yields may also have been a result of the adoption of the Lithuanian scythe in place of the traditional reaping hook in the black soil and steppe regions (Milov 2006). Between the 1740s and 1770s, however, agricultural output per head stagnated as population growth increased, and a slow decline in plowland per head was just balanced by rising grain yields.³ Grain yields then began to fall from the 1770s, as the weather became more variable while population growth continued to outstrip the cultivated area, so agricultural output per head trended downward (Kahan 1985, p. 49). By the end of the eighteenth century, agricultural output per head was no higher than it had been in the 1700s.

Nineteenth-Century Agriculture

Agricultural output in the nineteenth century is derived directly from data on the Russian harvest, which is checked for consistency with lower-frequency data on the cultivated area and grain yields. Figure 2 and Online Appendix Table A1.1 set out the data for the Russian grain harvest in index number form. For the nineteenth century, our agricultural output data refer only to the 50 provinces of European Russia, so we derive our estimates of agricultural output per capita using population data for this territory from Rashin (1956). This series is then applied to the population data for the whole Empire to obtain a series for agricultural output in the Empire as a whole. With population growing rapidly, agricultural output also increased, but at a slightly slower rate, so output per capita declined at an annual rate of –0.2 percent. However, as Figure 2 shows, the decline was not monotonic, with agricultural output per capita showing two periods of positive growth in the 1840s and the 1870s.

A substantial increase in agricultural output was required as the population and territory of the Russian Empire expanded during the nineteenth century. Tables 2B and 3B provide some background data on how

³ Plowland has been assumed to increase at a constant rate between the 1720s and 1760s.

this increase in agricultural output was achieved. The increase in grain output depended on the cultivated area and the grain yields achieved. In Table 2B, Lyashchenko's (1956, vol. 1) data suggest an increase in the cultivated area of around 53 percent between 1802 and the 1860s, similar to the 54 percent increase in the population of European Russia over the same period. However, more of the increase came in the non-black soil regions, so the share of black soil regions declined from 47.1 to 39.6 percent, which would be consistent with a small decline in quality-adjusted cultivated land per head.

The evidence on grain yields in Table 3B is described by Lyashchenko (1956, vol. 1, p. 509) as showing "an almost stationary yield" between the 1800s and 1860s. Markevich and Zhuravskaya (2018) use similar data from Mikhailovsky (1921) for the longer period 1800–1914 to suggest an increasing trend from around the emancipation of the serfs in 1861, although most of the gains occurred only after the 1880s. Furthermore, although the rise in grain yields during the 1870s and 1880s did lead to an increase in agricultural output, population grew just as rapidly, so there was no increase in per capita agricultural output.

The negative effects of serfdom on agricultural productivity before 1861 and the delayed effects of emancipation are both easy to understand. Under the 1649 Code of Law (*Sobornoye Ulozhenie*), free peasants with the right to migrate across estates became serfs attached to the land, and migration without a passport was made a criminal offense. Landlords demanded seigniorial obligations of labor services (*barshchina*), cash or in-kind payment (*obrok*), or in most cases a combination of both, and also had the right to sell, buy, or lease their serfs (Markevich and Zhuravskaya 2018, p. 1081). But it was illegal to buy and sell serfs separately and without land. Economic decision-making of serfs was therefore highly constrained, distorting the allocation of labor, creating disincentives for investment, and impeding the adoption of improved agricultural techniques (Buggle and Nafziger 2021, p. 3). However, the abolition of serfdom was a drawn-out affair involving both the emancipation of the serfs and land reform (Gerschenkron 1965, pp. 717–83). Although landlords lost their seigniorial rights over the serfs in 1861, the emancipated serfs had an obligation to buy out the land from the landlords. The terms of this buyout, including the plots of land, the price, and the timing of the transaction, had to be negotiated between the landlords and the emancipated serfs. The time period for the signing of the contracts lasted from 1862 to 1882 (Khristoforov 2011).⁴

⁴ In Online Appendix 2, we provide more evidence on the key assumptions underlying our estimates of agricultural output during the eighteenth and nineteenth centuries, including the growth of plowland and the sown area, grain yields, new crops, and territorial expansion. In addition, we conduct sensitivity analyses using alternative assumptions about the growth of plowland.

RUSSIAN INDUSTRY

We construct an index of industrial production for the period between the 1690s and the 1880s, drawing an important distinction between large-scale industry carried out in manufactories and small-scale or cottage industry. For large-scale industry, which is relatively well documented, we combine indices of gross output for each industry with value-added weights. We use 1805 weights for the period from the 1690s to the 1800s, 1848 weights for the 1800s to the 1840s, and 1887 weights for the 1840s to the 1880s. The individual series included in the production index for large-scale industry cover both the major capital goods and consumer goods industries, and can be divided into three main groups. The best-documented sector is metals, with separate data for silver, gold, copper, pig iron, bar iron, and metalworking. Food and drink industries contain separate series for salt, alcohol, and sugar, while textiles are represented by wool, linen, and cotton. Although in many cases data are available at annual frequency, for some of the key series there are significant gaps for sizeable periods, so it makes sense to provide series at decadal rather than annual frequency.

For small-scale industry, the time path of output depends heavily on assumptions about productivity. In contrast to large-scale industry, there is no suggestion of rapid productivity growth or economic development in Russian cottage industry over this period, so our central assumption is that output grew in line with population. We consider the sensitivity of our results to alternative assumptions in Online Appendix 2.

The data series for large-scale industry are set out in Online Appendix Tables A1.2 to A1.5, together with sources and brief notes, while the data for small-scale industry and total industry are given in Online Appendix Table A1.6. Further details are provided in Online Appendix 2, together with a discussion of the most important developments in each industry. The starting point for large-scale industry has been the series for the eighteenth century provided in Kahan (1985), based largely on the manufactories set up as a result of Peter the Great's industrialization policies, which aimed at modernizing Russia sufficiently to place it among the European great powers. Blackwell (1968) provides a similar overview of large-scale industry for the first six decades of the nineteenth century, but with a much less comprehensive statistical database, so it has been necessary to draw on a wider range of sources for individual industries.⁵ However, to obtain an overview of Russia's overall industrial output, it

⁵ Writing during the Soviet era, Blackwell (1968, p. 7) notes that he was denied access to Russian archives.

TABLE 4
LARGE-SCALE INDUSTRY NET OUTPUT WEIGHTS, 1690s–1880s (%)

	c.1805	c.1848	1887
Silver	1.7	0.4	0.1
Gold	0.6	9.3	5.4
Copper	3.8	1.2	0.4
Pig iron	8.1	2.9	0.4
Bar iron	6.6	2.9	2.4
Metalworking		4.9	5.2
Metals	20.7	21.6	14.0
Salt	2.1	2.1	1.4
Alcohol	36.0	33.4	34.9
Sugar		1.4	8.1
Food and drink	38.1	36.8	44.5
Woollen cloth and goods	3.7	14.6	3.9
Linen cloth and goods	5.6	1.4	8.0
Cotton cloth and goods		10.1	15.4
Textiles	9.4	26.2	27.2
Other industries	31.8	15.4	14.3
Total large-scale industry	100.0	100.0	100.0

Sources: Derived for circa 1805 from RGIA (Russian State Historical Archive - St Petersburg) F. 16. Op. 1. D. 3, for circa 1848 from Semenov (1859), Tengoborskii (1855), Istoriko-statisticheskii obzor (1886), and for 1887 from Svod (1889). 1805 weights are used for 1690s–1800s, 1848 weights for 1800s–1840s, and 1887 weights for 1840s–1880s.

is important to balance these generally rapidly growing parts of large-scale industry with coverage of small-scale cottage industry (*kustarnye promysly*), which was less affected by the stimulus of government policy and may have been held back by the constraints of serfdom on mobility.

Large-Scale Industrial Production

The index of large-scale industrial production has been constructed using the net output weights shown in Table 4, derived from material on industry from the Russian State Historical Archive (*Rossiskii Gosudarstvennyi Istoricheskii Arkhiv*) at St Petersburg and additional secondary sources. Data are available on production volumes and unit prices, which can be used to derive gross output for benchmark years circa 1805, 1848, and 1887 (Rybakov 1976). To arrive at net output weights, we have used the ratio of net output to gross output for individual industries from the 1908 Production Census (*Ministerstvo torgovli i promyshlennosti* 1913), as these ratios tend to be fairly stable over time and across countries in the nineteenth century (Lewis 1978; Flux 1924).

There is a tradition in economic history of tracking industrial value added over time using value-added weights in a specific year and projecting

back through time with volume series of production in individual industries (Hoffmann 1955; Crafts and Harley 1992). Industry, in particular, presents the challenge of dealing with value-added and double-counting, when outputs from one activity become inputs to another. Attempts have been made where possible to distinguish between variations in the degree of processing and, hence, the degree of value added. For example, a distinction is made between pig iron, an intermediate product, and bar iron, a finished product. Such corrective measures make it unlikely that output will have been overestimated and growth consequently underestimated. Note also that infrequent changes in the weights (1805, 1848, and 1887 in the case of industry) do not imply the constancy of value-added shares over long periods. For example, when the volume of bar iron grew faster than the volume of pig iron, the share of pig iron was declining in real terms. However, this only captures the shares in constant price terms, and relative prices also change. Hence the desirability of calculating the weights in current price terms for a number of benchmark years where possible, as in Table 4.

Although the metal industries have received much attention in the literature, they accounted for only around one-fifth of net output in large-scale industry in 1805, with food and drink playing a much larger role. Within metals, the most significant changes over the nineteenth century were the declining share of iron production, the growing importance of gold during the first half of the century, and the emerging importance of metalworking. The share of metals as a whole declined sharply in the second half of the nineteenth century as the result of declining relative prices despite continued rapid real growth.

Food and drink accounted for the biggest share of net output in large-scale industry throughout the nineteenth century. It was dominated by alcohol production, with salt remaining much smaller, but the second half of the nineteenth century saw the rapid growth of a sugar beet industry concentrated in large-scale enterprise. The increasing share of food and drink between the 1840s and 1880s was driven by an increase in relative prices in a sector largely shielded from international competition.

Textiles increased their share of value added during the first half of the nineteenth century through rapid growth in real terms. The most significant change was the emergence of cotton as the dominant large-scale textile industry in place of woollen and linen cloth, although linen retained its importance in small-scale enterprise.

Output of large-scale industry by major branch is shown in Figure 3, while the decadal data are provided together with brief notes and sources in Online Appendix Table A1.5. Growth was rapid in all three component

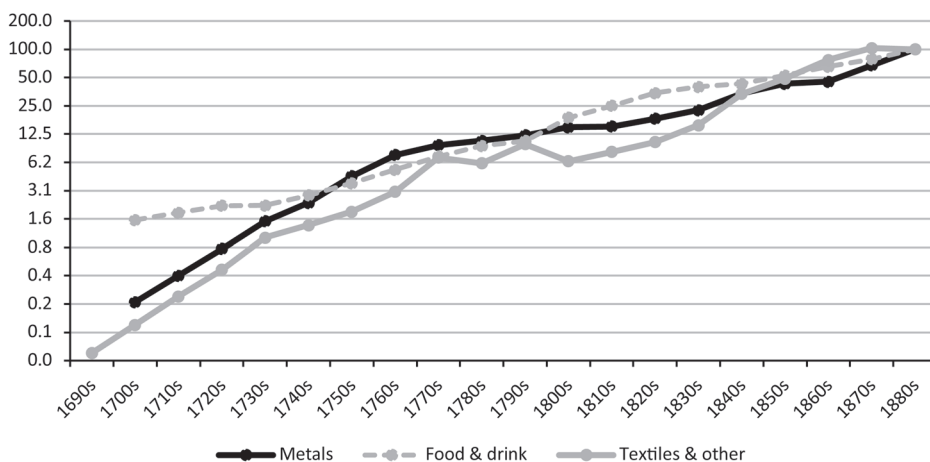


FIGURE 3
LARGE-SCALE INDUSTRIAL PRODUCTION IN RUSSIA, 1690s–1880s:
MAJOR BRANCHES (1880s=100)

Source: Online Appendix Table A1.5.

series, although food and drink grew a little more slowly than metals or textiles and others during the first half of the eighteenth century. The component parts of each of these three series are plotted in Online Appendix 2, together with a more detailed commentary on developments within each branch of industry. It is important, however, to realize that large-scale industry was only a very small part of the economy. To get a picture of overall industrial production, it is necessary to consider the role of small-scale or cottage industry.

Small-Scale Industrial Production

Small-scale enterprise was quickly eclipsed by large-scale production in metals and mining, where economies of scale were important. However, in industries such as textiles, food and drink, and small household goods such as candles, small-scale producers continued to account for the bulk of industrial output during the eighteenth century (Kahan 1985, pp. 120–24). By the 1880s, Gregory (1982, p. 73) estimates that after two centuries of rapid growth, large-scale manufactories produced 47.9 percent of all industrial net output. As noted previously, our central assumption for small-scale industry is that output grew in line with population. Projecting back from the 1880s with this assumption for small-scale industry and the index of output in large-scale from Table A1.5 produces an estimate for the share of large-scale industry of 22.1 percent

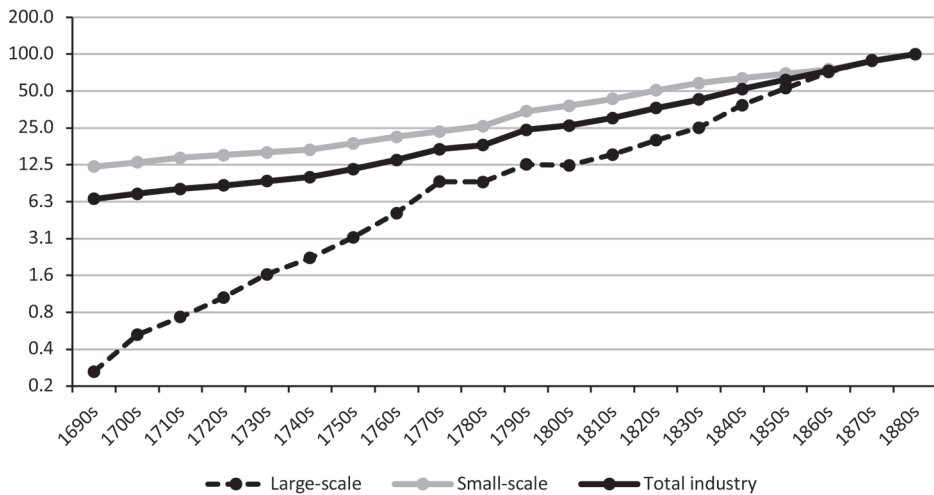


FIGURE 4
TOTAL INDUSTRIAL PRODUCTION IN RUSSIA, 1690s–1880s (1880s=100)

Source: Online Appendix Table A1.6.

of total industrial production in the 1800s, and just 4.2 percent in the 1710s at the start of Peter the Great's reforms. This is very much in line with the existing literature, which notes that although there had been earlier attempts by foreign entrepreneurs to establish large-scale industry in Russia during the seventeenth century, not much of it survived by the beginning of the eighteenth century (Falkus 1972, p. 21; Kahan 1985, p. 124).

Total Industrial Production

Figure 4 plots the path of total industrial production constructed from the series for large-scale industry using the weights from Table 4 and the series for small-scale industry aggregated together with Gregory's (1982, p. 73) weights for the shares of large-scale and small-scale industry in total industrial production. Online Appendix Table A1.6 provides the data series, together with sources and brief notes. Although large-scale industry grew at a rapid rate of 3.14 percent per annum between the 1690s and 1880s, small-scale industry is assumed to grow in line with population at a much slower annual rate of 1.11 percent. Since small-scale industry had a weight of more than half in total industrial production, the overall annual growth rate of industry was 1.43 percent, or just 0.32 percent on a per capita basis. As in the case of the British Industrial Revolution, rapid growth in the modernizing sector had only a limited

impact on the overall growth rate because it was starting from a very small base (Crafts and Harley 1992).⁶

RUSSIAN SERVICES

For services, we have followed the approach of Broadberry et al. (2015), which builds in turn upon Deane and Cole (1962), constructing volume indices for the main branches, distinguishing between commerce (including distribution, transport, and finance), government, and other domestic services. These volume indices are then combined using value-added weights to produce an overall index for services. The data series for services are set out in Online Appendix Tables A1.8 and A1.9, together with sources and brief notes.

Commerce

The output of the commerce sector is tracked using volume indicators of foreign and domestic trade. For foreign trade, we rely on the value of exports deflated by the general price index, with detailed data sources provided in Online Appendix Table A1.8. The volume of domestic trade is tracked using an index of commodity output constructed from the series of agricultural and industrial outputs described earlier, with details set out in Online Appendix Table A1.7.

Although exports and imports together only amounted to around 15 percent of GDP in the 1880s, they consisted entirely of marketed output, whereas a large proportion of domestically consumed commodity output was not marketed. We have therefore used weights of 30 percent for foreign trade and 70 percent for domestic trade to construct the commerce series in Figure 5. Although we have used a single set of weights, this does not mean that the shares of the two sectors remained constant over time. Rather, the shares of the sectors are changing implicitly over time because the growth rates of domestic trade and foreign trade differ (Crafts and Harley 1992, pp. 706–707, 722; Broadberry et al. 2015, pp. 131–36). For example, since foreign trade grew faster than domestic trade during the nineteenth century, the share of foreign trade in commerce increased from 12 percent in the 1800s to 30 percent by the 1880s. As a result, the commerce sector grew a bit more rapidly than domestic trade. The

⁶ Online Appendix 2 provides more evidence on the key assumptions underlying our estimates of industrial production, including details of the weights for large-scale industry in 1805, 1848, and 1887. It also includes plots of the output of all individual industries, together with a brief account of developments in each branch. In addition, sensitivity analysis is conducted for an alternative rate of growth of small-scale industry and an alternative weighting scheme for aggregating large-scale and small-scale industry.

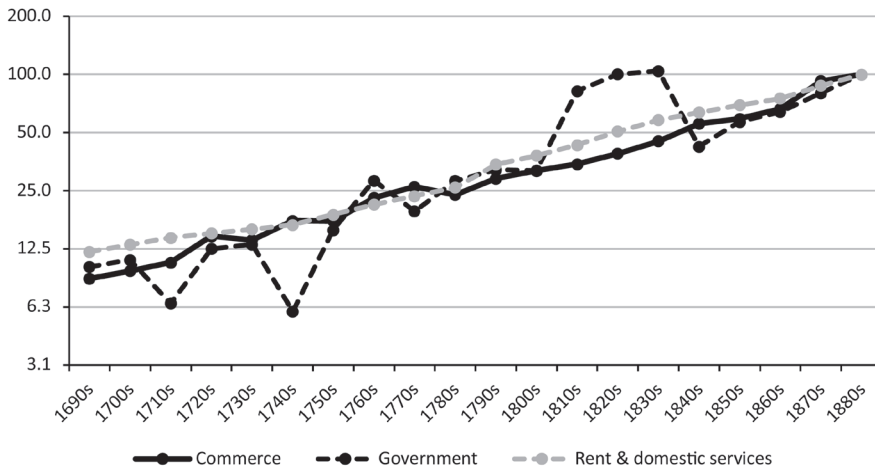


FIGURE 5
COMMERCE, GOVERNMENT AND OTHER SERVICES IN RUSSIA, 1690s–1880s
(1880s=100)

Source: Online Appendix Table A1.9.

overriding impression, however, is of only modest growth in commerce due to the limited degree of integration of the Russian economy before the railway age (Baykov 1954; Metzer 1974). The commerce series is plotted in Figure 5, while the domestic and foreign trade indices are shown in Online Appendix 2, Table A2.4.2.

Government and Other Services

The government provided services in civil administration and defense, with the necessary expenditures financed by raising revenue. However, the government's revenue and expenditure accounts are complicated by the heavy involvement of the state in production and distribution, where output has already been accounted for. For the nineteenth century, we have used the ordinary expenditure of the government provided on a consistent basis by Tabata and Tabata (2019). This current price series is deflated using the price index from Mironov (2012) to provide an index of real government services. For the eighteenth century, the accounting data have not yet been consolidated and since the coverage of the revenue and expenditure accounts became more complete over time, their use would give a misleading impression of very rapid growth during the eighteenth century, which does not reflect the reality of the provision of government services. We have assumed that the provision of civil administration grew in line with population, but have made a significant cyclical adjustment for defense spending.

TABLE 5
SERVICE SECTOR NET OUTPUT WEIGHTS, 1880s

	Net Output (m Roubles)	Weights (%)
Commerce	812	56.4
Government	143	9.9
Rent and domestic services	485	33.7
TOTAL SERVICES	1,440	100.0

Sources: Weights derived from Gregory (1982, p. 73). Current price value of total services derived from Gregory's (1982, p. 58) current price value of NNP in the 1880s.

The government services series at constant prices is set out in Table A1.9 of Online Appendix 1, together with brief sources and notes. During the eighteenth century, government services grew in line with population, but with a cyclical element of military expenditure between wars and peacetime based on military personnel for census years from Kahan (1985, p. 8), the details of which are set out in Online Appendix 2. There was a major spike at the time of the Napoleonic wars in the early nineteenth century, with high levels of military expenditure continuing through the 1820s and 1830s as a result of empire building in the Middle East and police actions in Eastern Europe (Blackwell 1968, pp. 182–83). Over the whole period between the 1690s and the 1880s, government grew at an annual rate of 1.37 percent, or 0.26 percent on a per capita basis. Other domestic services, including rent for housing, are assumed to grow in line with population. This follows a long tradition reaching back to Deane and Cole (1962). The series for real government services and other services are shown in Figure 5.

Total Service Sector Output

As for industrial production, service sector provision is tracked using a volume index derived from indices for each sector, with net output weights for the 1880s from Table 5. These weights for 1883–87 from Gregory (1982, p. 73) suggest that commerce was the largest sector and government the smallest. However, it must be borne in mind that a large part of government revenue and expenditure was a result of state industrial production, which has already been accounted for within the industrial sector. Hence, the 1880s value of net output of government services in Table 5, at 143 million silver roubles, is substantially lower than the level of government revenue, at 732 million silver roubles.

In Online Appendix 2, we provide further evidence on the key assumptions underlying our service sector estimates. This includes the construction of an index of commodity production used in estimating output of the

TABLE 6
GDP BY MAJOR SECTOR, 1880s

	Net Output (m Roubles)	Weights (%)
Agriculture	3,826	56.6
Industry	1,494	22.1
Services	1,440	21.3
TOTAL GDP	6,760	100.0

Sources: Sectoral shares for the 1880s from Gregory (1982, p. 73). Current price NNP from Gregory (1982, p. 87).

commerce sector, details of the estimation of government services during the eighteenth century and service sector weights. In addition, we conduct sensitivity analyses using an alternative weighting scheme for services.

RUSSIAN GDP AND PER CAPITA GDP

Having constructed volume indices for output in agriculture, industry, and services, these can now be aggregated into an index of real GDP using the sectoral net output weights from Table 6. The value of total net output in Table 6 is taken from Gregory (1982, p. 58), based on current price net national product (NNP), and is divided between the three sectors using the sectoral shares for 1883–1887 from Gregory (1982, p. 73). The resulting series for GDP is shown in Figure 6 together with the component sectoral outputs, which are also provided together with sources and brief notes in Online Appendix Table A1.10. Agriculture emerges as the slowest-growing sector, while the fastest-growing sector was industry, with services also growing substantially faster than agriculture.

Although GDP grew at 1.13 percent per annum between the 1690s and the 1880s, most of this was extensive growth as population grew by 1.11 percent per annum, so GDP per capita grew by just 0.02 percent per annum. This resulted in an increase in living standards of around 4 percent over the 190-year period as a whole. However, this masks some significant developments over shorter periods. In particular, the Russian economy experienced a phase of per capita growth in the first half of the eighteenth century, which petered out from the 1740s before going in reverse from the 1770s to the 1800s, then stagnating between the 1800s and the 1880s. Figure 7 shows the growth of GDP per capita, while annual growth rates for the component series are provided in Online Appendix 2.⁷

⁷ Online Appendix 2 provides further evidence on the key assumptions underlying our estimates of aggregate GDP and per capita GDP, including the changing structure of the Russian economy. We also conduct sensitivity analysis on the use of alternative estimates of the sectoral composition of GDP.

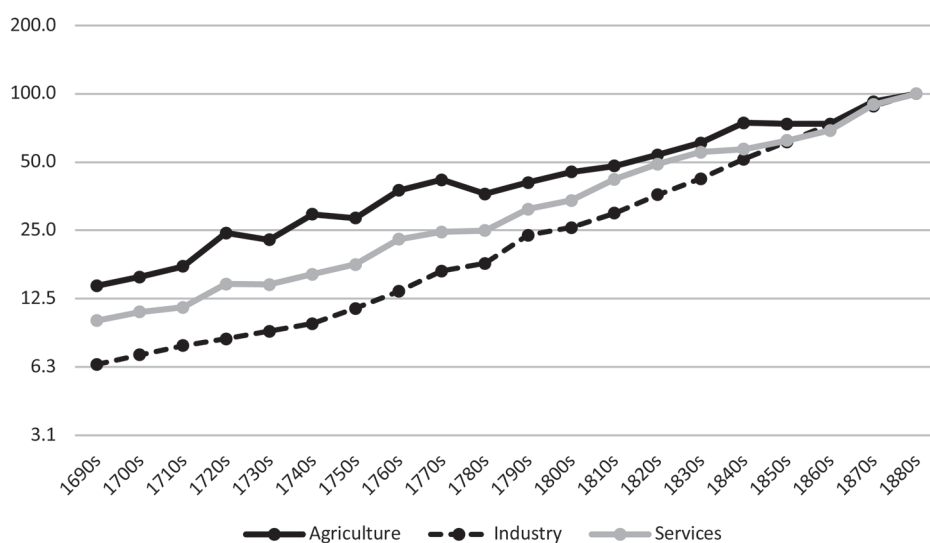


FIGURE 6

GDP BY MAJOR BRANCHES IN RUSSIA, 1690s–1880s (1880s=100)

Source: Online Appendix Table A1.10.

NOMINAL GDP

Although our estimates have been derived in real terms using volume data, it is possible to obtain a rough estimate of nominal GDP by reflatting real GDP with the general price index from Mironov (2012, p. 310). With real GDP increasing by a factor of 9 between the 1690s and the 1880s and the price level increasing by a factor of 5, nominal GDP increased by a factor of 45, as shown in Figure 8. Since it is sometimes useful to have a figure for GDP in current roubles, we also provide nominal GDP in this form in the final column of Online Appendix Table A1.11, by benchmarking the 1880s figure on the 1885 value from Table 6.

RUSSIA'S LONG RUN ECONOMIC PERFORMANCE

Russian GDP per capita from the 1690s to the 2000s

It is now possible to provide a single series for Russian GDP per capita covering the period from the 1690s to the 2000s by combining the estimates for the period 1690s–1880s from this paper with those of Maddison (2010) for the period 1880s–2000s. The Maddison series incorporates the estimates of Gregory (1982) for the period 1885–1913, Markevich and Harrison (2011) for 1913–1928, Moorsteen and Powell (1966) for 1928–1950, and CIA estimates for the post-war period. The complete

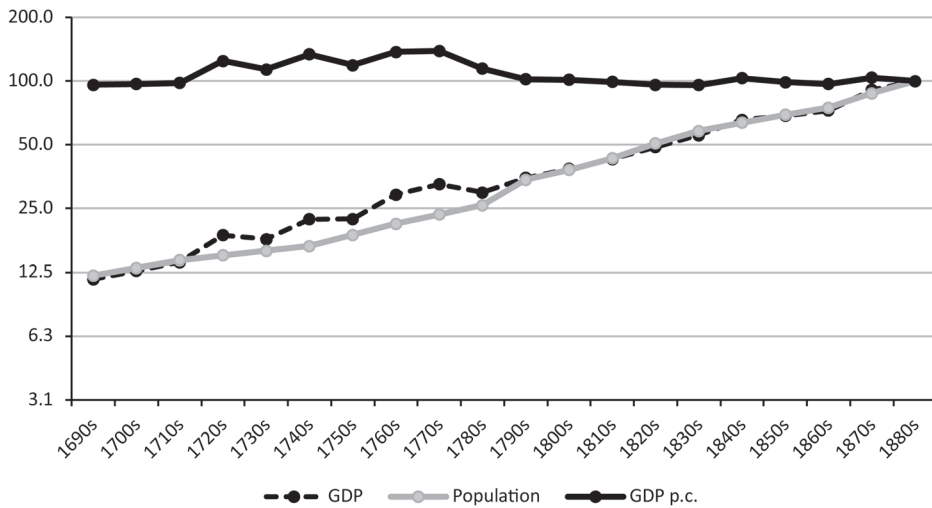


FIGURE 7
GDP PER CAPITA IN RUSSIA, 1690s–1880s (1880s=100)

Source: Online Appendix Table A1.10.

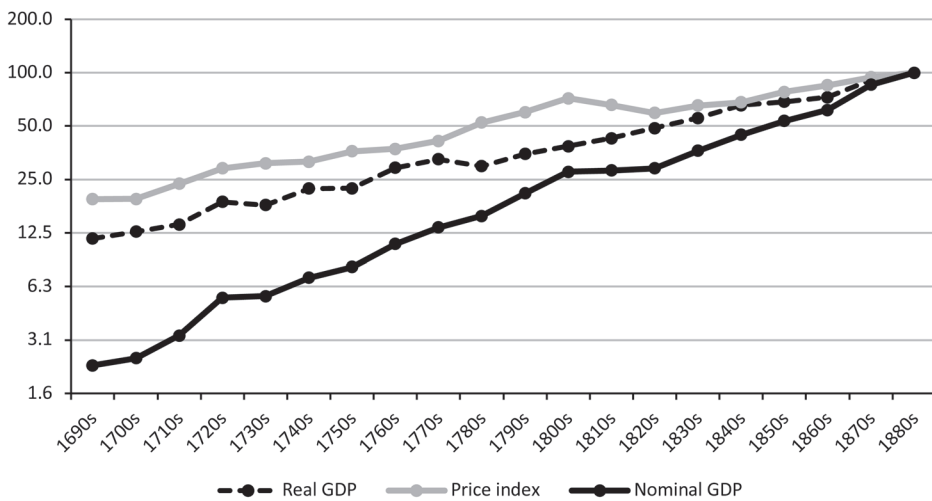


FIGURE 8
NOMINAL AND REAL GDP IN RUSSIA, 1690s–1880s (1880s=100)

Source: Online Appendix Table A1.11.

series from the 1690s to the 2000s in 1990 international dollars is plotted in Figure 9.

The Russian economy experienced a phase of growth in the first half of the eighteenth century, driven largely by developments in agriculture. Although there was rapid growth in large-scale industry, this modernizing

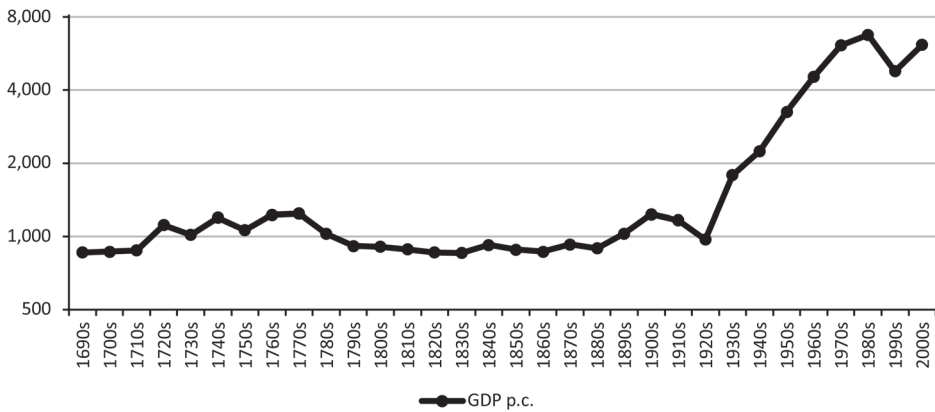


FIGURE 9

RUSSIAN GDP PER CAPITA, 1690s–2000s (1990 INTERNATIONAL DOLLARS)

Sources: 1690s–1880s: Online Appendix Table A1.10. 1880s–1910s: Gregory (1982). 1910s–1920s: Markevich and Harrison (2011). 1920s–2000s: Maddison (2010). The series in index number form are spliced together and converted to 1990 international dollars based on Maddison's (1995) benchmark for 1990.

sector was too small at this stage to have a large effect on overall growth. This growth phase petered out in the 1740s and went into reverse as agricultural output failed to keep up with the rapid population growth in the 1760s. By the 1800s, GDP per capita was a little higher than it had been in the 1690s. There then followed a long period of stagnation between the 1800s and 1880s. By contrast, the period between the 1880s and 1900s saw a return to strong growth as the state protected heavy industry and played a more active role in the construction and operation of railways. These policies were pursued most systematically between 1893 and 1903 by Sergei Witte, the Minister of Finance, who also encouraged foreign investment in Russia (Falkus 1972, pp. 69–74). The decade of the 1910s saw the twin setbacks of defeat in WWI and the Bolshevik revolution of 1917, followed in the 1920s by difficulties in adjusting to changing economic systems (Davies 1994).

Russia experienced a period of rapid growth during the 1930s through a policy of state-led industrialization, which provided the materials for Russia to successfully fight off the German invasion during WWII (Allen 2003). Although the setback of the 1940s seems modest in Figure 9, it involved a more than 25 percent decline in Russian GDP between 1940 and 1942 before recovery by 1945 and a return to rapid post-war growth in the second half of the decade (Harrison 1998, p. 283). Russia, in common with most of the rest of the world, experienced rapid growth during the 1950s and 1960s, but growth slowed down sharply in the 1980s, contributing to

the demise of the socialist system. The transition to a market economy in the 1990s saw a peak-to-trough decline of 45 percent in GDP per capita on an annual basis, and full recovery had still not been achieved by the time of the global financial crisis of 2008 (Dennison and Klein 2021).

A Benchmark Comparison of GDP per capita for Russia and Britain in 1795/96

Our estimates of Russian GDP per capita in Figure 9 are based on time series projection of real GDP from a 1990 benchmark. This provides a basis for comparisons of GDP per capita across both time and space in 1990 international prices, as in Maddison (2010). However, this exercise is inevitably fraught with index number problems, particularly concerning relative price changes (Prados de la Escosura 2000). It is therefore useful to construct another benchmark for an earlier year as a cross-check. Here, we have chosen to provide a benchmark in the 1790s through a direct comparison between Russia and Britain. This can be done by comparing the new nominal GDP per capita estimates for Russia with the estimates for Britain from Broadberry et al. (2015), which requires constructing a purchasing power parity (PPP) for the two nations. This is done by comparing prices in the two countries in 1795/96, when prices are available for a good sample of products in both countries. The prices and weights of individual products are discussed in Online Appendix 2 and presented in Table A2.6.1. Taking a weighted average of these price ratios establishes the purchasing power parity (PPP) between the two currencies.

Table 7 shows the sectoral and aggregate PPPs calculated at both Russian and British weights, together with the geometric means that we use as the compromise estimates. The market exchange rate was £1 = 5.65 silver roubles (Denzel 2010, pp. 359, 368), so a PPP of £1 = 3.49 roubles indicates that food was relatively cheap in Russia. However, relatively expensive food in Britain was offset by cheaper prices for other manufactured goods, so the PPP for other goods was £1 = 4.43 roubles. This reflects technological progress in Britain during the Industrial Revolution, which particularly affected the price of cloth and iron. The aggregate PPP is a weighted average of the PPPs for food and other goods, taking into account the different shares of agriculture and non-agriculture in commodity output in Britain and Russia. The aggregate PPP for 1795/96 works out at £1 = 3.79 roubles, which implies that the exchange rate for the silver rouble deviated from purchasing power parity by 33 percent.

The overall price level was lower in Russia, largely as a result of much cheaper food, offset by more expensive other goods. This is consistent

TABLE 7
SECTORAL AND AGGREGATE RUSSIA/GB PPPS FOR 1795/96

	PPP British Weights (Rbs per £)	PPP Russian Weights (£ per Rb)	PPP Russian Weights (Rbs per £)	PPP Geometric Mean (Rbs per £)
Grain and flour	3.44	0.31	3.25	3.34
Vegetables	4.65	0.24	4.16	4.40
Meat	2.49	0.40	2.49	2.49
Dairy and eggs	4.36	0.26	3.89	4.12
Sugar and spice	12.66	0.08	12.62	12.64
Drink and tobacco	3.41	0.39	2.54	2.94
TOTAL FOOD	3.82	0.31	3.18	3.49
Cloth	5.18	0.19	5.18	5.18
Bar iron	5.62	0.18	5.62	5.62
Tallow candles	3.99	0.25	3.99	3.99
Soap	3.33	0.30	3.33	3.33
OTHER GOODS	4.53	0.23	4.34	4.43
Food	3.82	0.31	3.18	3.49
Other commodities	4.53	0.23	4.34	4.43
AGGREGATE PPP	4.17	0.29	3.44	3.79
Market exchange rate				5.65

Notes: The sectoral and aggregate PPPs at British weights are calculated with the Rbs per £ PPPs while the sectoral and aggregate PPPs at Russian weights are calculated using the £ per Rb PPPs for consistency. We use the geometric mean as the compromise estimate.

Sources: Detailed sources for British and Russian prices and weights are given in Online Appendix 2, Table 2.6.1. The market exchange rate for the silver rouble is from Denzel (2010, pp. 359, 368).

with a general finding that when comparing per capita incomes between countries at different levels of development, using the exchange rate tends to exaggerate the difference in living standards. Hence, in Table 8, we see that at the silver exchange rate, Russian GDP per capita was 31.9 percent of the British level. However, using the PPP, which allows for the lower price level in Russia, suggests that Russian GDP per capita was 47.6 percent of the British level. This implies a GDP per capita in 1990 international dollars of \$966 for Russia in 1795/96. The time series projection of Russian GDP per capita from its 1990 benchmark yields a figure of \$914 for the 1790s, which is less than 6 percent different from the benchmark, thus well within any reasonable error bounds.

Russia in International Comparative Perspective, 1690s–1880s

Figure 10 places Russia's long-run economic performance in an international comparative perspective with other European economies for the main period covered by this study, 1690s–1880s. Beginning with the long eighteenth century, the spurt of Russian economic growth between

TABLE 8
A BENCHMARK ESTIMATE OF RUSSIA/GB GDP PER CAPITA CIRCA 1796

<i>Russia</i>	
Nominal GDP (million Rbs)	1,412
Population (millions)	37.4
Nominal GDP per capita (Rbs)	37.75
<i>Great Britain</i>	
Nominal GDP (£ million)	209.18
Population (millions)	10.0
Nominal GDP per capita (£)	20.92
<i>Exchange rates</i>	
Silver exchange rate (Rbs per £)	5.65
PPP (Rbs per £)	3.79
<i>Comparative Russia/GB GDP per capita (%)</i>	
At silver exchange rate	31.9
At PPP	47.6
<i>GDP in 1990 international dollars</i>	
GB	2,028
Russia	966

Sources: Nominal GDP from Table A1.10 for Russia and from Broadberry et al. (2015) for GB. Population from Table 1 for Russia and from Broadberry et al. (2015) for GB. Silver exchange rate from Denzel (2010). PPP from Table 7. GDP for GB in 1990 international dollars from Broadberry et al. (2015).

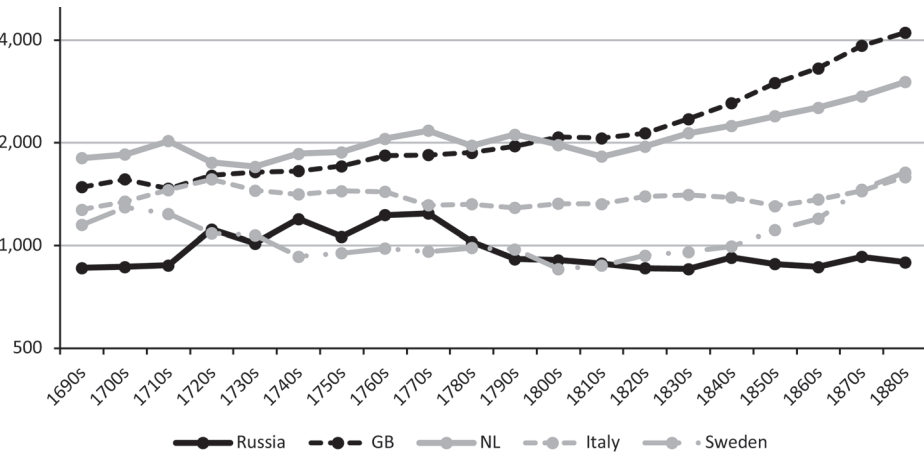


FIGURE 10
GDP PER CAPITA IN RUSSIA AND OTHER EUROPEAN ECONOMIES, 1690s–1880s
(1990 INTERNATIONAL DOLLARS)

Sources: Russia: Online Appendix Table A1.10, benchmarked on GDP per capita in 1990 international dollars from Maddison (2010); GB: Broadberry et al. (2015); NL: van Zanden and van Leeuwen (2012); Italy: Malanima (2011); Sweden: Schön and Krantz (2012); Krantz (2017).

the 1710s and the 1760s represented a period of strong catching-up on the West. During this period, Russia substantially narrowed the gap with Britain and the Netherlands, the richest West European economies, and overtook Sweden, Russia's rival power in the Baltic region, although this owed as much to Swedish decline as to Russian growth. Furthermore, Russia almost caught up with Italy, the leading Mediterranean economy. During the rest of the eighteenth century, however, although Russia remained on a par with Sweden, the absolute fall of Russian GDP per capita led to a growing gap with the rest of Western Europe as Britain and the Netherlands forged ahead while Italy stagnated. Turning to the nineteenth century, Russian stagnation between the 1800s and 1880s led to further falling behind as growth accelerated in Britain and the Netherlands. During this phase, Sweden also pulled decisively ahead of Russia.

At first sight, comparison with Asian rather than European economies in Online Appendix 2 Figure A2.6.1 shows Russian economic performance in a better light. However, although the level of GDP per capita was higher than in the large East Asian economies for most of the period, Japan overtook Russia around the mid-nineteenth century, and GDP per capita remained higher in the Yangzi Delta as late as the 1880s (Broadberry, Guan, and Li 2021). In West Asia, furthermore, the Ottoman Empire was also catching-up to Russia.

CONCLUSIONS

This paper presents a quantitative overview of economic growth in Russia from the 1690s to the 1880s, using a historical national accounting approach. As well as providing the first reconstruction of GDP from the output side for Russia during this period, it also creates a link to estimates of GDP for the period since 1885, so Russia's economic performance from the late seventeenth century to the twenty-first can be assessed within the standard international comparative framework of GDP per capita.

Previous work on the eighteenth century has focused on the modernization of the Russian economy begun by Peter the Great, involving state-driven expansion of large-scale industry, particularly in metal production, giving the impression of progress toward modern economic growth. However, although large-scale industry grew rapidly during the first half of the eighteenth century, it was too small at this point to have a major effect on the overall growth rate. The 45 percent increase in GDP per capita between the 1690s and 1760s was driven by agriculture, as the cultivated area grew faster than population and grain yields trended

upward. However, this was followed by a period of strong negative per capita income growth as population growth outstripped the ability of agriculture to maintain per capita food supply, so that by the 1800s, GDP per capita was a little higher than it had been a century earlier.

The main reason for the limited increase in GDP per capita over this period of almost two centuries is therefore the inability of Russian agriculture to increase output sufficiently to keep up with the rapidly growing population since the 1760s. A subsidiary reason is that although large-scale industry, the modernizing part of the economy, grew quite rapidly, it was a very small part of the economy at the end of the seventeenth century and took a very long time to have a significant effect on the economy as a whole.

Although Russia began to close the gap with northwest Europe between the 1690s and the 1760s, the rest of the period from the 1760s to the 1880s saw a renewed widening of the GDP per capita gap. Whereas the British and Dutch economies had been holding on to gains in per capita income during the late medieval and early modern periods, so that each growth episode was followed by a plateau on which the next growth episode could build, the eighteenth-century Russian economy continued to follow the familiar pattern of pre-modern Europe, with episodes of growing followed by episodes of shrinking. Although the period of shrinking from the 1760s coincided with a period of rapid population growth, it should also be noted that population growth was still positive during the earlier period of per capita income growth. This suggests that Russia's limited per capita growth between the 1690s and the 1880s was not purely a Malthusian phenomenon. Indeed, with its expanding frontier, Russia was in a position to reap the benefits of Smithian growth. However, this potential would not be realized in a sustained way before the railways led to the integration of the economy, allowing the effective utilization of Russia's abundant resources in the late nineteenth century in a way highlighted by Baykov (1954) and Metzger (1974).

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