RUSSIAN ECONOMIC GROWTH DURING THE EIGHTEENTH CENTURY

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1. INTRODUCTION

Although historical national accounts for the period before the nineteenth century have recently become available for many west European nations, there has been relatively little work on eastern Europe. In this paper we contribute to this process by using historical national accounting methods to evaluate the performance of the Russian economy during the eighteenth century.

We combine the first estimates of Russian GDP from the output side with population data to estimate GDP per capita at a decadal frequency throughout the eighteenth century. Our main finding is that GDP per capita increased at an annual rate of 0.57 per cent between the 1690s and the 1760s, but then exhibited negative growth of -0.64 per cent per annum during the shorter period between the 1760s and the 1800s. This resulted in an average growth rate of 0.13 per cent per annum over the whole period, leaving GDP per capita 16 per cent higher in the 1800s than it had been in the 1690s.

One reason for the limited increase in per capita income over the long run is that large-scale industry, the fast-growing part of the economy, accounted for a relatively small part of economic activity in eighteenth century Russia, and therefore had a smaller effect on overall growth than earlier writers sometimes implied. Russian agriculture failed to increase output sufficiently to keep pace with the acceleration of population growth from the 1760s, so that much of the per capita income gain of the previous half century was lost and Russia did not make the transition to sustained modern economic growth.

2. RUSSIAN POPULATION DURING THE EIGHTEENTH CENTURY

One issue which 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 kilometres in 1646 to 16.6 million km^2 in 1796 and 18.2 million km^2 in 1858.

TABLE 1: **Population in index number form (1815=100)**

	Expanding territory	Constant territory
1646	15.1	24.5
1678	24.2	33.6
1719	33.7	47.6
1744	39.4	
1762	50.1	63.3
1782	61.4	
1796	80.8	83.2
1815	100.0	100.0

Sources and notes: Mironov (2000: 4) for 1646, 1678, 1719, 1762, 1796 and 1815, with additional information for 1744 and 1782 from Kahan (1985: 8).

Since production data are largely available for the expanding territory, we use this as the basis of our preferred index of population. Clearly, territorial expansion accounted for a significant proportion of population growth, particularly during the periods before 1719 and after 1762. Over the long eighteenth century, 1678-1815, territorial expansion raised the annual population growth rate from 0.80 to 1.04 per cent per annum.

3. RUSSIAN AGRICULTURE

Agriculture was the largest sector in the 18th century Russian economy and therefore played an important role in determining the path of GDP per capita. Our estimate of agricultural output is derived from data on the amount of cultivated land and grain yields

TABLE 2: Land area in Russia, 1696-1861 (1,000 hectares)

	Ploughland	Meadow	Forest	Total land area	Ploughland/ 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
1861	98,033	71,781	207,279	490,318	19.99

Sources and notes: Kahan (1985: 46) with additional information for 1861 from Tsvetkov (1957: 115).

While the total land area increased by 19.8 percent between 1696 and 1796, the amount of ploughland increased much more rapidly by 254 per cent. 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. This upward trend in yields is visible in Table 3. 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 assumed no change, so that the trend in yield per seed is taken to represent the trend in yield per hectare.

The ploughland area in Table A2.1 needs to be adjusted to yield the sown area, since under the three-field system, one third of the ploughland was left fallow each year. The upper bound of the sown area was therefore two-thirds of the ploughland, and this is the area that we have used in our lower bound calculation of agricultural output. This results in a decline in the sown area per head of the population by about 20 per cent, concentrated in the last two decades.
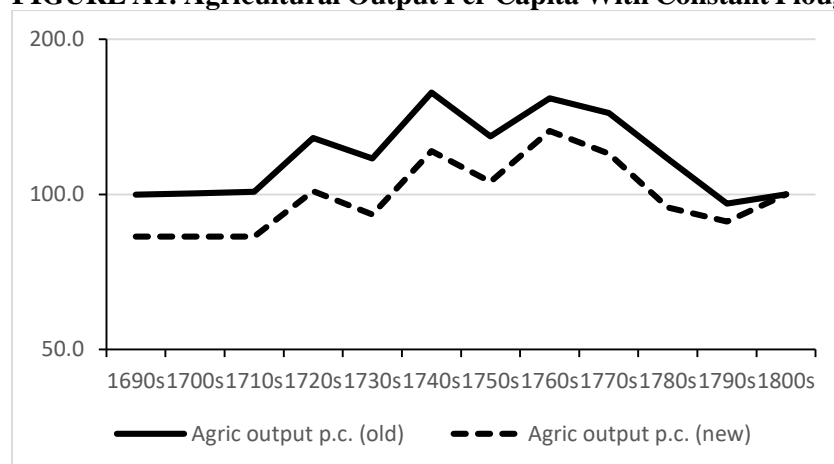
TABLE A2.1: Sown area in Russia, 1696-1861

	Ploughland (1000 ha)	Sown area (1000 ha)	Population expanding area (m)	Sown area p.c. (ha)	Sown area p.c. (1800s=100)
1690s	31,976	21,317	13.218	1.61	120.5
1700s	34,976	23,318	14.360	1.62	121.3
1710s	38,258	25,505	15.600	1.63	122.1
1720s	41,848	27,899	16.423	1.70	126.9
1730s	44,574	29,716	17.288	1.72	128.4
1740s	47,478	31,652	18.200	1.74	129.9
1750s	50,571	33,714	20.548	1.64	122.6
1760s	53,865	35,910	23.200	1.55	115.6
1770s	61,803	41,202	25.669	1.61	119.9
1780s	70,910	47,273	28.400	1.66	124.4
1790s	81,359	54,239	37.400	1.45	108.3
1800s	83,552	55,701	41.613	1.34	100.0

Sources and notes: Ploughland from Kahan (1985: 46). Sown area = 2/3rds of ploughland. population from Mironov (2000: 4) and Kahan (1985: 8).

We therefore also estimate in Figure A1 agricultural output under the assumption of constant sown area per capita, which is broadly consistent with the data for the period from the 1690s to the 1780s. Making ploughland move in line with population does make agricultural output per capita around 20 per cent lower in the 1690s-1710s than in the 1800s, rather than at approximately the same level as in our current preferred estimates. Since agriculture accounts for slightly more than half of GDP, this makes GDP per capita lower by around 10 per cent in the 1690s compared with the 1800s. However, it does not remove the effect of the falling grain yields from the 1770s, which is the main cause of the decline in agricultural output per capita and GDP per capita from the 1770s.

FIGURE A1: Agricultural Output Per Capita With Constant Ploughland Per Capita (1800s=100)

Sources and notes: Agricultural output per capita (old): Table A1.1. Agricultural output per capita (new): ploughland assumed to grow in line with population.

3.1. Grain yields

The grain yields presented in Table 3 are for the four main grains of rye, oats, wheat and barley.

TABLE 3: Grain yields per seed in Russia, 1710s to 1800s

	Rye	Wheat	Oats	Barley
1710s	2.9	3.9	2.7	3.9
1720s	3.6	3.7	4.1	4.5
1730s	3.2	3.9	3.3	4.0
1740s	4.3	3.6	3.8	3.7
1750s	3.7	3.3	3.5	4.3
1760s	4.7	3.8	4.5	4.7
1770s	4.2	4.3	4.8	4.2
1780s	3.3	3.2	3.4	3.5
1790s	3.1	3.0	3.6	3.1
1800s	3.5			

Sources and notes: Kahan (1985: 49), based on the estimates of Indova (1965: 146-151), with additional information for 1800s from Mikhailovskii (1921: 4). However, we have checked the grain yields in Table 3 with data for the 1760s and 1790s from Prokhorov (1997) and Rubinshtein (1957) as well as archival sources (RGADA. F. 248, D. 3577, RGADA. F. 1239. Op. 1. D. 5134, Op. 3, D. 5920, 59239, 59132, 58964, 59213, 59130), which yield similar levels.

Table A3.1 provides grain yields for rye and wheat in the central region, distinguishing between the blacksoil and non-blacksoil zones, and also in the Volga region. The yields are generally higher in the central blacksoil region, as expected.

TABLE A3.1: Grain yields per seed by major regions, 1710s to 1790s

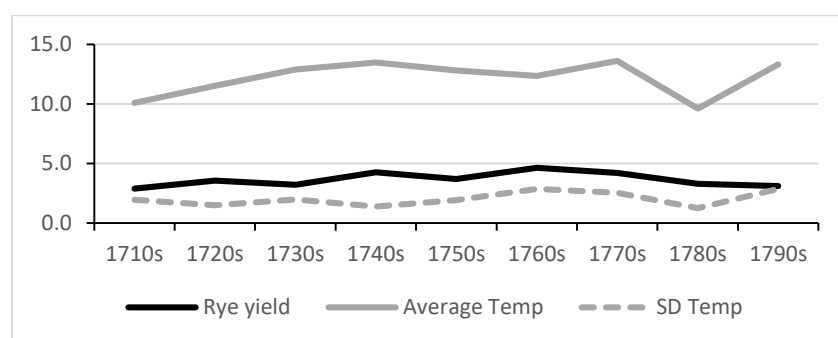|	Rye			Wheat		
	Central non-blacksoil	Central blacksoil	Volga	Central non-blacksoil	Central blacksoil	Volga
1710s	2.7	4.0	3.0	3.2	4.5	--
1720s	3.2	4.3	3.3	4.9	4.1	3.0
1730s	3.5	3.2	3.7	3.0	5.5	3.7
1740s	3.8	4.7	5.1	3.5	4.3	--
1750s	3.2	4.6	4.0	2.7	4.1	3.6
1760s	3.3	6.8	4.4	3.4	5.1	3.2
1770s	3.7	4.8	4.8	3.7	5.7	4.9
1780s	3.0	3.6	3.6	2.5	4.0	3.3
1790s	3.0	3.2	3.1	3.0	3.0	3.1

Sources and notes: Kahan (1985: 50).

We have used the rye yield data, since it was the most widely used grain, but Figure A2.2.2 shows that this was very highly correlated with the weighted average grain yield using gross output weights for the 1790s from Kahan (1985: 57).

FIGURE A2.2.3: Grain yields, 1710s to 1790s (output per seed)

Sources and notes: Grain yields from Kahan (1985: 49). Weighted average of rye, wheat, oats and barley yields derived using gross output weights for the 1790s from Kahan (1985: 57).

Kahan (1985: 46-47) considers the effect of weather conditions on grain yields in an informal way. In Figure A2.2.3, we assess the impact of average temperature and its variability on rye yields in Russia using data from Luterbacher et al. (2004). The average annual temperature is derived from monthly observations and for comparability with the rye yield data is averaged across decades. The standard deviation for each decade is also derived using the annual average data. The correlation between the rye yields and average temperature is +0.48, which is suggestive of a role for the weather in agricultural productivity. However, the correlation between the rye yields and the standard deviation of the temperature is +0.23, which is the wrong sign, suggesting that volatility of the weather is good for grain yields. One complicating factor which needs to be borne in mind here is that a bad winter harvest was often offset by a good spring harvest and vice versa (Rubinshtein, 1957: 357). Clearly, more research is needed to pin down the causes of variation in grain yields.

FIGURE A2.2.3: Rye yields and temperature, 1710s-1790s

Sources and notes: Rye yield is output per seed from Kahan (1985: 49). Average temperature and its standard deviation in degrees centigrade derived from from Luterbacher et al. (2004).

3.2. The level of net output in Russian agriculture, circa 1805

Table 4 sets out the value of net output in agriculture, divided between grain production, livestock and other agriculture, forestry & fishing. The level of output is pinned down by grain production, while the levels of net output in the other sectors are obtained using their ratios to grain production in 1897 from Markevich (2019).

TABLE 4: Net output in Russian agriculture, circa 1805

	Net output (m roubles)	Shares (%)
Grain production	504	41.8
Livestock	408	33.8
Other agriculture, forestry & fisheries	294	24.4
TOTAL AGRICULTURE	**1,206**	**100.0**

In Table A4.1 we set out the details of the calculations for obtaining the level of net output in grain production.

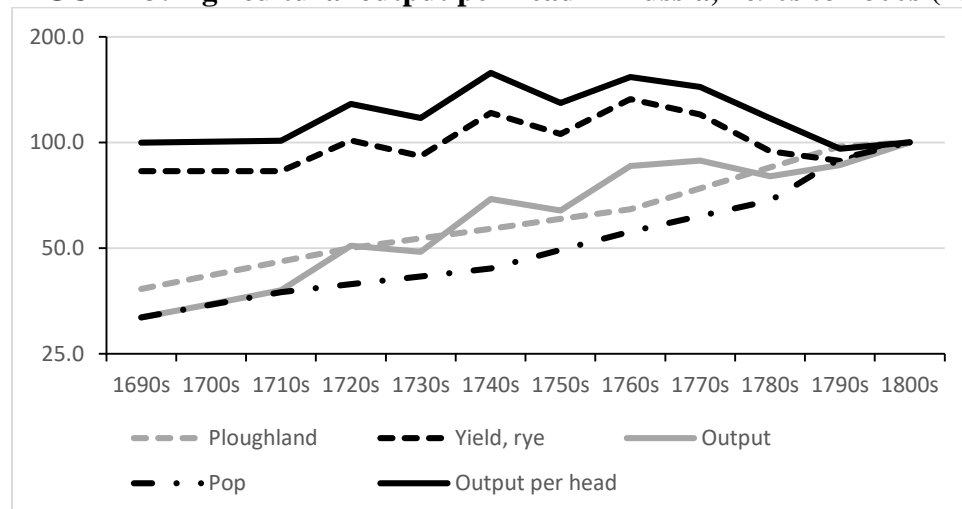**TABLE A4.1: Grain production in Russia, circa 1805**

	Units	Volume	Value
Population	million	41.6	
Grain consumption per capita	kg	350	
Grain consumption volume	m kg	14,560	
Average grain price	Rbs per kg		0.033
Grain consumption value	m Rbs		483
Grain exports value	m Rbs		21
Grain production value	m Rbs		504

Sources and notes: Population from Mironov (2000), log-linearly interpolated between 1795 and 1815. Grain consumption per capita from Kahan (1985: 57). Grain consumption volume = population x grain consumption per capita. Average grain price = weighted average of the price of rye and wheat in 1805 from Moscow Vedomosti (1805), with a 10% weight for wheat. Grain consumption value = grain consumption volume x average grain price. Grain exports value from Valetov (2017). Grain production value = grain consumption value + grain exports value.

Agricultural output per head increased between the 1690s and the 1740s, as ploughland kept pace with the moderately growing population and grain yields trended upwards in line with average temperature (Luterbacher et al., 2004; Kahan, 1985: 13-14). This growth was linked to the colonisation of the fertile black soil region, which raised grain yields as well as expanding the cultivated area (Nefedov, 2010: 143). The rise in yields was also 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 1760s, however, agricultural output per

head stagnated as population growth increased and a slow decline in ploughland per head was just balanced by rising grain yields. From the 1760s, however, grain yields began to fall as the weather became more variable while population growth continued to outstrip the cultivated area, so that agricultural output per head trended downwards (Kahan, 1985: 49). By the 1800s, agricultural output per head was no higher than it had been in the 1700s (see Figure 3).

FIGURE 3: Agricultural output per head in Russia, 1690s to 1800s (1800s=100)

Ideally, of course, it would be useful to have separate output estimates for the livestock sector in addition to the arable sector, but for Russia, there is very little systematic information available from which to build an independent time series, so that we follow a common practice in the economic history of pre-industrial Europe of treating grain output as an indicator of overall agricultural activity.

4. RUSSIAN INDUSTRY

We follow the standard procedure of combining indices of gross output with value added weights for the benchmark decade of the 1800s, to produce an index of industrial production for eighteenth century Russia. However, we also need to make a distinction between large-scale industry carried out in manufactories and small-scale or cottage industry. 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 and bar iron. Food processing contains separate series for salt and alcohol, while textiles is represented by wool and linen.

The starting point for large-scale industry has been the series provided in Kahan (1985), based largely on the manufactories set up as a result of Peter the Great's industrialisation policies, which aimed at modernising Russia sufficiently to secure its position as a European great power. However, to obtain an overview of Russia's overall industrial output, it is important to balance these generally rapidly growing parts of large-scale industry with

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coverage of small-scale cottage industry (*kustarnye promysly*) which was not so affected by the stimulus of government policy.

4.1 Large-scale industry: Metals

Russia's metal industries were stimulated by the industrialisation policies of Peter the Great during the first quarter of the eighteenth century, and continued to make substantial progress during the rest of the century. Under Peter, the Russian state set up and operated manufactories to meet Russia's military needs, involving the production of metals, armaments and even woollen cloth for military uniforms (Falkus, 9172: 21). Many of these enterprises were later sold to private entrepreneurs from 1720 and private enterprise was heavily involved in further expansion during the post-Petrine period, but the state continued to play an important role through subsidies, tax exemptions, monopolies and other concessions. Perhaps the most important role of the state throughout the eighteenth century, however, was as the main buyer of the output of these manufactories (Kahan, 1985: 80). In addition, the state also helped to solve the problem of securing a labour force for the manufactories by supplying state serfs and drafting criminals and beggars (Mavor, 1965: 124-127).

The government was heavily involved with the non-ferrous metal industries because of its demand for silver and copper for coinage. The production of silver experienced a temporary boom under Peter the Great, as well as a more sustained period of growth from the 1730s to the 1770s. Gold was produced largely as a by-product of silver production and therefore followed a similar pattern of growth. Over the century as a whole, silver and gold production grew at an annual rate of around 7 per cent, while copper production grew at 3.5 per cent per annum.

Iron was the most important metal industry in eighteenth century Russia. The industry grew faster than the copper industry at 4 to 5 percent per annum. A key stimulus was Peter the Great's desire to become self-sufficient in armaments production, but the industry also developed a large export trade to England during the eighteenth century as state demand proved insufficient to absorb the whole output of the new works established during Peter the Great's reign. The most important iron-producing region was the Urals, with its high-quality ores and abundant supply of fuel and water required for heat and power. By the end of the eighteenth century, the Urals and Siberia supplied 81.8 per cent of Russia's iron output, with European Russia accounting for the other 18.2 per cent (Strumilin 1954: 463).

4.2 Large-scale industry: Food and drink

Kahan (1985) provides data on two important food and drink industries, salt and alcohol, which were controlled by the state. The state acted as a monopsonist in salt and from the 1750s imposed a high tariff to protect domestic production. However, since the Baltic provinces were

very far from the main Russian sources of production, they continued to import salt from abroad. The main Russian centre of salt production was Perm province in the northern Urals, although there was a brief period in the mid-century when Elton salt lake, east of the lower Volga, became more important. Salt output grew at an annual rate of 1.85 percent during the eighteenth century as a whole, yielding a per capita growth rate of 0.8 percent.

The sale of alcohol was a government monopoly during the eighteenth century, and output can be derived from data on alcohol tax revenue, deflated by the unit price of alcohol per *vedro*, a Russian liquid measure approximately equal to 2.7 imperial gallons. Alcohol production grew faster than salt production from the 1740s, at an annual rate of 2.4 per cent per annum between the 1720s and 1800s. It is nevertheless likely that these official estimates of alcohol production substantially understate the total including illegal domestic alcohol production, perhaps by as much as 50 per cent (Troitskii, 1966: 153, Volkov, 1979).

4.3 Large-scale industry: Textiles and other industries

In textiles, government played an important role in the wool industry through placing orders for cloth that was needed for army uniforms. Both the demand and supply sides of the wool industry can be quantified through monitoring orders placed by the military and the supply response through producer deliveries (Kahan, 1985: 103). Where possible, we have used the supply side data, but it has been necessary to interpolate the figures for the 1770s and 1780s using the demand side estimates. Despite being able to meet all the army's needs by mid-century, the wool cloth manufactories were not able to establish themselves in the civilian market, where they were unable to compete with small-scale domestic producers at the lower end of the market and with foreign producers at the higher end.

Peter the Great set up state-owned manufactories for the production of sail cloth and broad linen, which he also saw as providing demand for domestically produced flax and hemp, and providing potential for increased exports. In contrast to the wool industry, the linen manufactories succeeded in finding export markets. Output of both woollen and linen cloth grew at similar rates over the eighteenth century.

Other large-scale industries include glass & pottery, chemicals, paper and miscellaneous (including shipbuilding). Although we do not have independent time series data for these industries, we know that they also expanded rapidly so assume that they grew in line with textiles (Kahan, 1985: 86-88, 99, 105-108, 117-118).

4.4 Total large-scale industrial production

The net output weights for large-scale industry are derived from material on industry in 1804/05 from the Russian State Historical Archive at St Petersburg. Data are available on production volumes and unit prices, which can be used to derive gross output. Information is

also provided on inputs so that it is possible to derive estimates of net output. The metal industries were dominated by ferrous metals, with pig iron and bar iron together accounting for 66 per cent of 1805 net output in the sectors for which we have time series production data. Since the iron industry grew more slowly than gold and silver and not much faster than copper, it must also have been the most important metal at the beginning of the eighteenth century.

In the food and drink industries, alcohol dominated salt by 1804/05, although the shares would have been closer in the early eighteenth century, since alcohol production grew more rapidly than salt. Turning to textiles, the woollen cloth industry remained a little smaller than the linen cloth industry within the manufactories, although linen cloth was much more important in small-scale industry.

To get a picture of overall industrial production, it is necessary to consider the role of small-scale or cottage industry.

4.5 Small-scale industrial production

Small-scale enterprise was quickly eclipsed by large-scale producers in metals and mining, where economies of scale were important. However, in industries such a textiles, food & drink and small household goods such as candles, small-scale industrial production continued to dominate large-sale manufactories (Kahan, 1985: 120-124). For each industry it is possible to gauge the value of gross output in 1805 and apply the ratio of inputs to gross production from large-scale industry to derive net output and hence arrive at an indication of the relative size of the large-scale and small-scale sectors of industry in Table 5C.

For textiles, the level of production is obtained by multiplying population with the per person consumption of cloth, which Konotopov et al. (1992) put at 11 arshin per year. This is multiplied by the unit price of linen to derive gross output and net output is assumed to be the same proportion of gross output as in the large-scale linen industry. For food and drink, we have assumed that large-scale enterprise accounted for only half of the alcohol consumed, leaving the other half to be provided by small-scale enterprise. For other industry, we use data on the production of wax and tallow candles from the Russian State Historical Archive at St Petersburg. Textiles accounted for around three-quarters of cottage industry, with food & drink the next most important sector. In contrast to large-scale industry, there is no suggestion of rapid growth or economic development in Russian cottage industry during the eighteenth century, so output is assumed to grow in line with population.

TABLE 5: Industrial net output weights, circa 1805
A. LARGE-SCALE INDUSTRY

	Within sector weights (%)	Main sector weights (%)
Silver	9.4	2.4
Gold	3.4	0.8
Copper	21.4	5.4
Iron	29.5	7.4

Pig iron	36.3	9.2
METALS	100.0	**25.2**
Salt	9.4	2.8
Alcohol	90.6	27.0
FOOD & DRINK	100.0	**29.8**
Woollen cloth	47.6	7.0
Linen cloth	52.4	7.7
TEXTILES	100.0	**14.7**
Glass & pottery	68.9	20.9
Chemicals	22.8	6.9
Paper	3.0	0.9
Miscellaneous	5.3	1.6
OTHER	100.0	**30.4**
FACTORY NDUSTRY		**100.0**

B. SMALL-SCALE INDUSTRY

	Within sector weights
Textiles	75.7
Food & drink	15.7
Other	8.6
SMALL-SCALE INDUSTRY	**100.0**

C. TOTAL INDUSTRY

	Main sector weights
Large-scale industry	39.2
Small-scale industry	60.8
TOTAL INDUSTRY	**100.0**

Sources and notes: Derived from RGIA (Russian State Historical Archive - St Petersburg) F. 17. op. 1. d. 44.

4.6 Total industrial production

Although large-scale industry grew at the rapid rate of 3.62 per cent per annum, small-scale industry grew in line with population at a much slower annual rate of 1.04 per cent (see Figure 5). Since small-scale industry had a weight of more than 60 per cent in total industrial production, the overall annual growth rate of industry was 1.46 per cent, or just 0.42 per cent on a per capita basis. As in the case of the British Industrial Revolution, rapid growth in the modernising sector had only a limited impact on the overall growth rate because it was starting out from a very small level (Crafts and Harley, 1992).
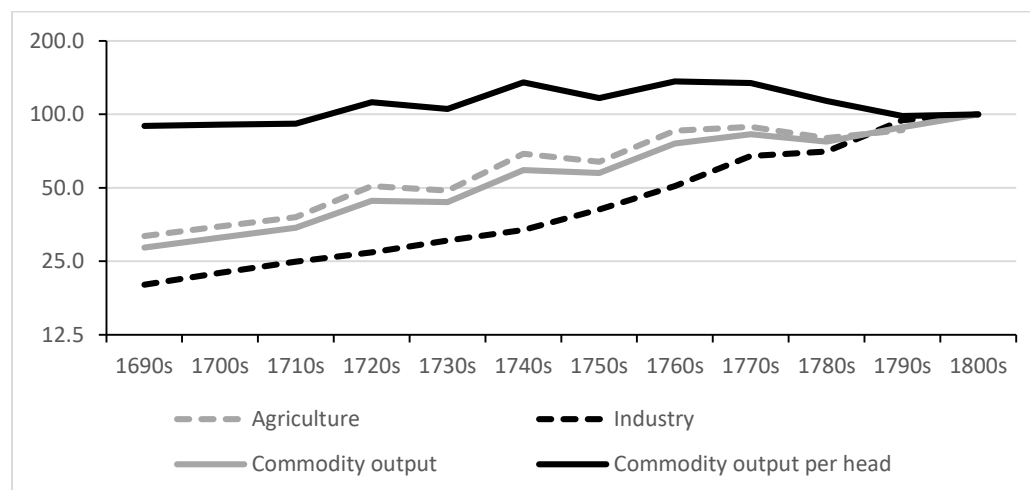
FIGURE 5: Total industrial production in Russia, 1690s to 1800s (1800s=100)

5. RUSSIAN COMMODITY PRODUCTION

It is useful to construct an index of commodity production, which provides a basis for the estimation of output in commerce, the sector that was responsible for the transport, distribution and finance of agricultural and industrial production. In 1805, agriculture accounted for 72 per cent of Russian commodity output. The importance of agriculture shows up clearly in Figure 6, where commodity output moves very closely in step with agriculture for both long term trend and shorter term fluctuations. Dividing commodity output by population provides a series for commodity output per head, which looks very similar to the path of agricultural output per head in Figure 3, but with some additional growth injected by the inclusion of industry.

FIGURE 6: Commodity production in Russia, 1690s to 1800s (1800s=100)

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 from Table 6 to produce an overall index for services.

TABLE 6: Service sector net output, circa 1805

	Net output (m roubles)	Weights (%)
Commerce	256	56.4
Government	45	9.9
Rent & domestic services	153	33.7
TOTAL SERVICES	454	100.0

Sources and notes: Weights derived from Gregory (1985: 73).

6.1 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. The value of exports in current prices is taken from Kahan (1985: 164) for the period 1742-1799, with data for additional years from other sources, including Repin (1985), Strumilin (1954), Semenov (1859), Chulkov (1788) and Troitskii (1966). The export value series is

deflated using the price index from Mironov (2012a). The volume of domestic trade is tracked using the commodity output index constructed in section 5. In deriving the weights for these two series, although we do not observe the breakdown of net output between domestic and foreign trade, we can gauge the relative importance of the two sub-sectors by considering the value of marketed output in domestic trade and the value of exports in foreign trade. We follow Blanchard (1989: 236) in assuming that domestic economic activity was characterised by a high level of self-consumption amongst both lords and peasants, but raise the marketed share in domestic commerce to 10 per cent from Blanchard's very low figure of 6 per cent. This results in a value of 165 million roubles for domestic trade in 1805. For the value of gross output generated in the international trade sector, we use the value of exports, which was 72 million roubles in 1805. The two series are therefore combined with weights of 70 per cent for domestic trade and 30 per cent for foreign trade in Figure 11. Since foreign trade grew faster than commodity output, the commerce sector grew a bit more rapidly than domestic trade.
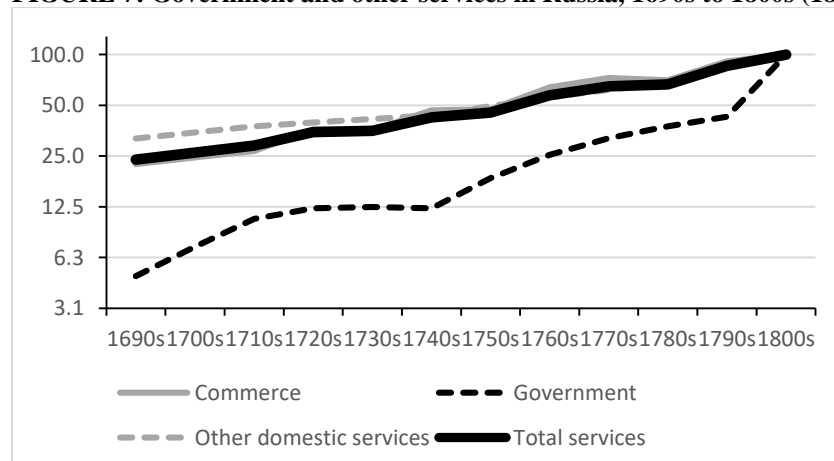
6.2 Government and other domestic services

The government raised revenue to provide services of civil administration and defence. Data are available on both the revenue and expenditure sides of the government budget. The revenue data are taken from Chechulin (1906: 254), Strumilin (1966: 307) and Mironov (2012b: 200), and are interpolated between the 1700s and 1720s. The expenditure data, which show the same trend, are taken from Kahan (1985: 337, 344) and Troitskii (1966: 224, 243). Government grew rapidly under Peter the Great, followed by a period of relative stagnation before a return to rapid growth from the 1740s. Other domestic services, including rent for housing, are assumed to grow in line with population.

6.4 Total service sector output

The volume of services grew more rapidly than the volume of commodity production. This was a result of the state-driven growth of industrial production and exports, which led to an expansion of commerce as well as the government sector (see Figure 7).
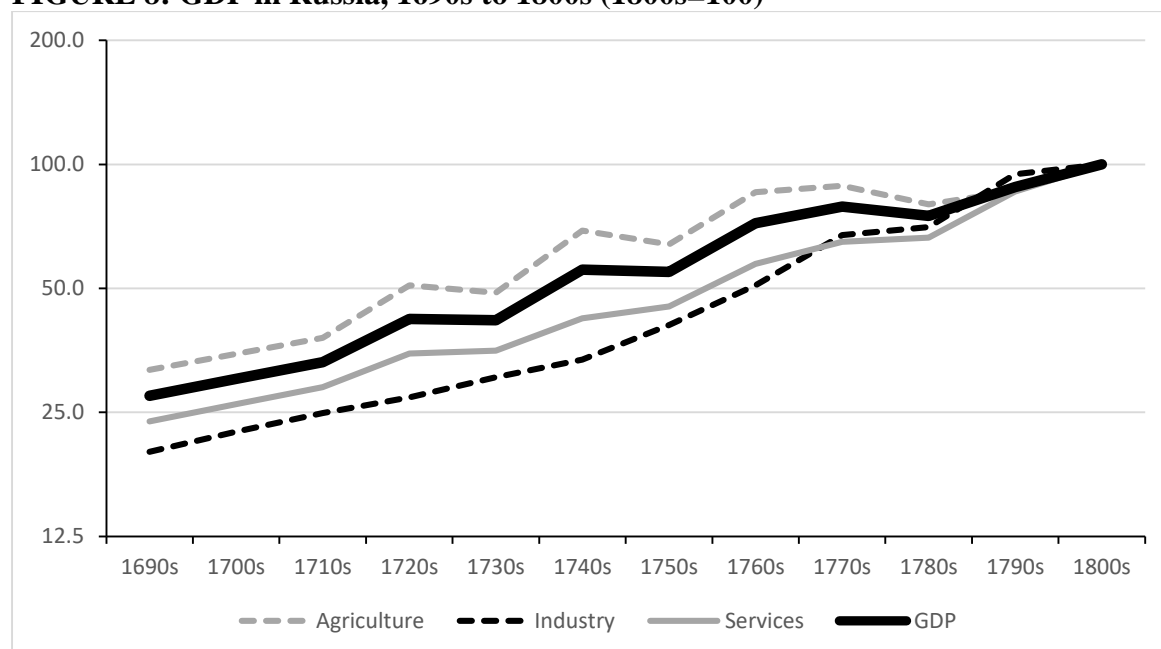
FIGURE 7: Government and other services in Russia, 1690s to 1800s (1800s=100)

7. 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 in Figure 8 using the sectoral net output weights from Table 7.

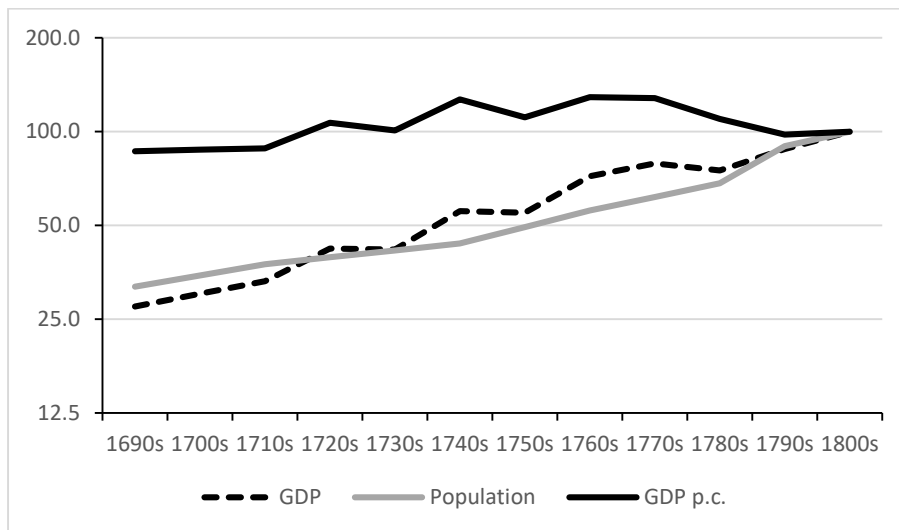**FIGURE 8: GDP in Russia, 1690s to 1800s (1800s=100)**

TABLE 7: GDP by major sector, circa 1805

	Net output (m roubles)	Weights (%)
Agriculture	1,206	56.6
Industry	471	22.1
Services	454	21.3
TOTAL GDP	2,131	100.0

Sources and notes: The weights are taken from Gregory (1982: 73). The value of net output in agriculture is taken from Table 4 and the weights are used to obtain the value of net output in industry and services relative to net output in agriculture.

Figure 9 shows the impact of this output growth on GDP per capita. Although GDP grew at 1.17 per cent per annum over the long eighteenth century, most of this was extensive growth as population grew by 1.04 per cent per annum, so that GDP per capita grew by just 0.13 per cent per annum. However, even this meagre growth in living standards over the century as a whole was the result of a period of positive growth of per capita income between the 1690s and 1760s at 0.57 per cent per annum, followed by a period of negative growth at an annual rate of -0.64 per cent from the 1760s to the 1800s, with the reversal occurring during a period of rapid population growth.

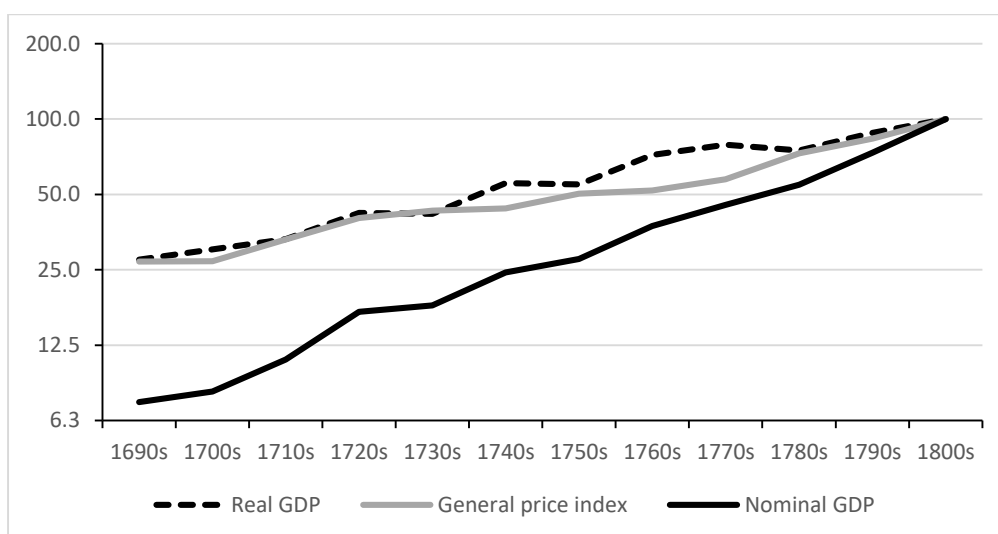**FIGURE 9: GDP per capita in Russia, 1690s to 1800s (1800s=100)**

This pattern of a period of positive economic growth followed by a period of negative economic growth is typical of most pre-industrial European economies for which we have data covering the period between the late middle ages and the mid-nineteenth century. The only exceptions identified so far are the British and Dutch economies, which began to experience a pattern of episodic growth, interspersed with periods of remaining on a plateau rather than experiencing negative trend growth of GDP per capita, suggesting that the key to modern economic growth had more to do with reducing the rate and frequency of shrinking rather than accelerating the rate of growing (Broadberry and Wallis, 2017).

8. 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 reflating real GDP with the general price index from Mironov (2012a). With real GDP increasing by a factor of 3.6 over the long eighteenth century and the price level increasing by a factor of 3.7, nominal GDP increased by a factor of more than 13, as can be seen in Figure 10.

FIGURE 10: Nominal and real GDP in Russia, 1690s to 1800s (1800s=100)

9. Russia's 19th Century Economic Performance In International Perspective

9.1 A comparison with Britain in 1796

It is possible to compare the new GDP per capita estimates for eighteenth century Russia with the estimates for Britain from Broadberry et al. (2015). However, this requires converting the estimates for both countries into a common currency. The standard procedure in the economic history literature is to work in terms of 1990 international dollars, as in Maddison (2010). Since Broadberry et al. (2015) provide GDP per capita in 1990 international dollars for Britain, we can arrive at a figure for Russian GDP per capita in the same units by establishing Russian GDP per capita as a proportion of British GDP per capita in a benchmark year. This we do in Table 8 by comparing prices in the two countries in 1795/96, when prices are available for a good sample of products in both countries. Taking a weighted average of these price ratios establishes the purchasing power parity (PPP) between the two currencies.

TABLE 8: A Russia/GB PPP for 1795/96
A. Prices And Weights

	Units	Russian price (Rbs)	Russian weights (%)	British price (£)	British weights (%)	PPP (Rbs per £)
Wheat	Kg	0.097	11.6	0.018	10.6	5.45
Wheat flour	Kg	0.093	11.6	0.027	10.6	3.50
Rye	Kg	0.044	11.6	0.012	10.6	3.75
Oats	Kg	0.019	11.6	0.010	10.6	1.95
Barley	Kg	0.024	11.6	0.010	10.6	2.37
GRAIN & FLOUR			**58.0**		**53.0**	
Peas	Kg	0.048	3.0	0.010	2.5	4.83
Potatoes	Kg	0.006	3.0	0.004	2.5	1.59
VEGETABLES			**6.0**		**5.0**	
Beef	Kg	0.139	16.0	0.056	15.0	2.49
MEAT			**16.0**		**15.0**	
Butter	Kg	0.408	5.0	0.073	4.0	5.59
Eggs	Dozen	0.090	5.0	0.031	4.0	2.92
DAIRY & EGGS			**10.0**		**8.0**	
Sugar	Kg	0.306	3.5	0.092	2.5	3.32
Ginger	Kg	3.659	3.5	0.234	2.5	15.65
SUGAR & SPICES			**7.0**		**5.0**	
Hops	Kg	0.391	1.5	0.120	7.5	3.26
Tobacco	Kg	0.588	1.5	0.349	7.5	1.68
DRINK &			**3.0**		**15.0**	
TOBACCO						4.83
TOTAL FOOD			**100.0**		**100.0**	
Cloth	Yards	0.527	51.7	0.050	62.8	10.54
Bar iron	Cwt	4.745	9.9	0.845	13.4	5.62
Tallow candles	Kg	0.366	19.2	0.087	11.9	4.23
Soap	Kg	0.306	19.2	0.090	11.9	3.40
OTHER GOODS			**100.0**		**100.0**	
Food			72.0		51.0	
Other goods			28.0		49.0	
TOTAL GOODS			**100.0**		**100.0**	

Sources and notes: British prices for food, candles and soap from Clark (2004). Russian prices for food, candles and soap from Moscow Vedomosti, 1796, RGADA. F. 248. Op. 112. D. 222, F. 1204. Op. 1. D. 19315, 19341, 19342 (annual average, our calculations). British prices for cloth from Harley (1998: 79) and bar iron from Gayer, Rostow and Schwartz (1953, Vol. 1: 28-31). Russian prices for cloth and bar iron from Semenov (1859, vol. 3: 502-503). British weights for food derived from Feinstein (1995: 22) and for other goods from Broadberry et al.

(2015: 134). Russian weights for food derived from Mironov (2012: 255, 261) and for other goods from Table 5. British weights for total goods from Feinstein (1995: 22). Russian weights for total goods derived from Table 7. PPPs for individual products obtained as the ratio between the Russian price and the British price.

TABLE 8 (CONTINUED): A Russia/GB PPP for 1795/96
B. SECTORAL AND AGGREGATE PPPs

	PPP British weights (Rbs per £)	PPP Russian weights (£ per Rb)	PPP Russian weights (Rbs per £)	PPP geometric mean (Rbs per £)
Grain & flour	3.40	0.33	2.99	3.19
Vegetables	3.21	0.42	2.39	2.77
Meat	2.49	0.40	2.49	2.49
Dairy & eggs	4.26	0.26	3.84	4.04
Sugar & spice	9.48	0.18	5.48	7.21
Drink & tobacco	2.47	0.45	2.22	2.34
TOTAL FOOD	**3.49**	**0.34**	**2.98**	**3.23**
Cloth	10.54	0.09	10.54	10.54
Bar iron	5.62	0.18	5.62	5.62
Tallow candles	4.23	0.24	4.23	4.23
Soap	3.40	0.29	3.40	3.40
OTHER GOODS	**8.28**	**0.17**	**5.93**	**7.01**
Food	3.49	0.34	2.98	3.23
Other commodities	8.28	0.17	5.93	7.01
AGGREGATE PPP	**5.84**	**0.29**	**3.47**	**4.50**
Market exchange rate				5.65

Sources and notes: The sectoral and aggregate PPP 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. The market exchange rate for the silver rouble is from Denzel (2010: 359, 368).

Table 8A presents the prices and weights of individual commodities in sections dealing with food and other commodities. For food, British prices are taken from Clark (2004) while Russian prices are taken from the Russian State Archive of Ancient Acts and Moscow Gazette (*Moskovskie vedomosti*). British weights are based on Feinstein's (1995) analysis of budget studies in Britain at the end of the eighteenth century, with the weights reflecting the relative importance of different food items in household expenditure. Feinstein's weights are for broad categories of expenditure, and within those categories we have taken unweighted averages of individual items. The earliest Russian weights are for the mid-nineteenth century, taken from Mironov (2012: 255, 261). PPPs for individual products are obtained as the ratio between the Russian price and the British price. For other goods, prices for candles and soap are taken from the same sources as for food, while prices for cloth and iron are taken from Harley (1998) and Gayer et al. (1959) for Britain and from Semenov (1859) for Russia. British weights for other goods are from Broadberry et al. (2015) while Russian weights are derived from Table 5. The weights used to aggregate food and other goods are the shares of agriculture and industry in commodity output, derived from Broadberry et al. (2015: 194) for Britain and Table 7 for Russia.

TABLE 9: A benchmark estimate of Russia/GB GDP per capita circa 1796

Russia	
Nominal GDP (million Rbs)	1,565
Population (millions)	37.4
Nominal GDP per capita (Rbs)	41.84
Great Britain	
Nominal GDP (£ million)	209.18
Population (millions)	10.0
Nominal GDP per capita (£)	20.92
Exchange rates	
Silver exchange rate (Rbs per £)	5.65
PPP (Rbs per £)	4.50
Comparative Russia/GB GDP per capita (%)	
At silver exchange rate	35.5
At PPP	44.5
GDP in 1990 international dollars	
GB	2,028
Russia	903

Sources and notes: 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 9. GDP for GB in 1990 international dollars from Broadberry et al. (2015).
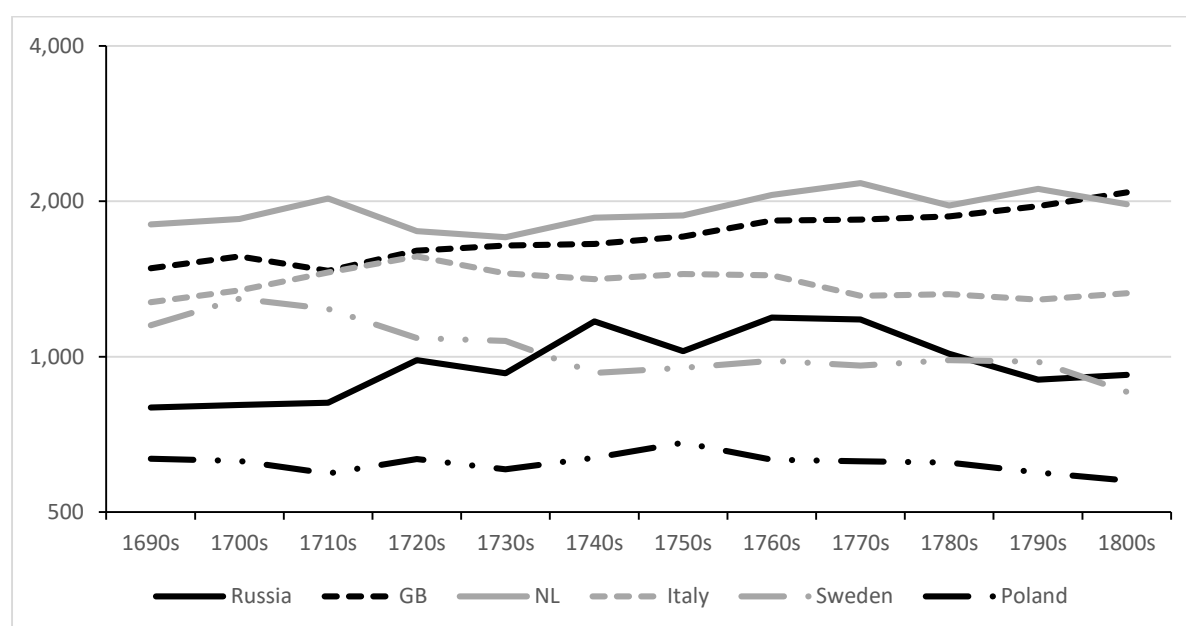
The overall price level was lower in Russia largely as a result of much cheaper food, offset by more expensive other goods. This is consistent with a general finding that when comparing per capita incomes between countries at different levels of development, using the exchange rate tends to exaggerate the difference in living standards. Hence in Table 10, we see that at the silver exchange rate, Russian GDP per capita was 35.5 per cent of the British level. However, using the PPP which allows for the lower price level in Russia, suggests that Russian GDP per capita was 44.5 per cent of the British level. Taking the 1796 level of British GDP per capita in 1990 international dollars as $2,028 (Broadberry et al., 2015) and Russian GDP per capita as 44.5 per cent of the British level, yields a figure of $903 for Russian per capita GDP at the end of the eighteenth century in 1990 international dollars.

9.2 A comparison with Europe, 1690s-1800s

Figure 11 places Russia's economic performance during the long eighteenth century in an international comparative perspective. The first thing to note is that during this period GDP per capita in Russia was always substantially higher than in Poland, the only other East European economy for which we have data. Second, the strong growth of Russian GDP per capita during the reign of Peter the Great substantially narrowed the gap with Britain and the Netherlands, the richest west European economies and also with Sweden, Russia's rival power in the Baltic region. Indeed, by the 1740s, Russia had caught up with Sweden, although this owed as much to Swedish decline as to Russian growth. In addition, Russian GDP per capita peaked at 70.8 per cent of the British level. After this, however, although Russia remained on a par with Sweden, the gap with northwest European economies widened again as growth accelerated in

Britain and GDP per capita at first stagnated and then began to shrink in Russia. By the end of the eighteenth century, Russia had pulled further ahead of Poland, but was still lagging substantially behind Italy. This is broadly consistent with the views of Mau and Drobyshevskava (2012), who survey three hundred years of Russian catching-up. They note that the modernisation begun under Peter the Great enabled Russia to briefly narrow the gap with the leading countries of Europe, before falling back again as the reform process stalled.

FIGURE 11: GDP per capita in Russia and other European economies, 1690s-1800s (1990 international dollars)

Sources and notes: Russia: Table 9; GB: Broadberry et al. (2015); NL: van Zanden and van Leeuwen (2012); Italy: Malanima (2011); Sweden: Schön and Krantz (2012); Krantz (2017); Poland: Malinowski and van Zanden (2017).

9.3 Comparing Russia in the eighteenth and nineteenth centuries

In assessing the plausibility of our estimates of Russian GDP per capita in the eighteenth century, it is useful to make a comparison with the late nineteenth century. From 1885 to the present, it is possible to provide a continuous series of Russian GDP per capita. This is based on Maddison's (1995) benchmark for 1990 and time series covering the period from 1928 onwards, extended back further in time using the estimates of Markevich and Harrison (2011) for the period 1913-1928 and Gregory (1982) for the period 1885-1913. Projecting back from 1990, these data result in a GDP per capita in 1885 of $865 in 1990 international dollars, which compares with a figure of $853 in the 1800s. This suggests that Russian GDP per capita was at about the same level in the first and eighth decades of the nineteenth century. Blanchard (1989: 354) also found similar levels of GDP per capita in 1807/09and 1868/70, although his pattern of a catastrophic 60 per cent decline in per capita GDP between the 1800s and the 1830s followed by a more than complete recovery by the 1860s seems hard to square with Mironov's

(2012a) evidence on biological status during this period.[1] Filling in the gap in Russia's historical national accounts between the 1800s and the 1880s seems an urgent priority.

9.4 Explaining Russia's economic performance

Agriculture was the largest sector of the Russian economy during this period, and its performance was the key driver of GDP per capita. Agricultural output grew faster than population between the 1690s and 1740s, then stagnated between the 1740s and 1760s before declining so that output per head was no higher in the 1800s than it had been in the 1700s. The territorial expansion of the first four decades, particularly into the black soil region, thus permitted a combination of intensive and extensive growth. But as the rate of population growth increased from the 1740s, output per head began to stagnate and this led to absolute decline from the 1760s as ploughland failed to keep up with population growth and grain yields fell back.

Although per capita agricultural output was no higher in the 1800s than during the 1690s, GDP per capita was 16 per cent higher. This owed much to the growth of large-scale industry, begun under Peter the Great. This impacted most obviously on the metals branch, where Russia was transformed into a major iron exporter. The state-led modernisation strategy also had significant effects in textiles via government orders for linen sailcloth and woolen military uniforms. There was also strong growth of alcohol and salt production under government intervention in the food and drink industry. However, this rapid growth in large-scale industry was swamped by slower growth in small-scale industry, as consumer demand was held back due to the taxes raised to pay for the industrial policies. This underlines a conclusion drawn by Crafts and Harley (1992) from the British Industrial Revolution, that even rapid growth in the modernising sector can have only a small effect on the overall growth of the economy in the early stages of industrialisation because it is starting from a low base.

The modernisation policies also contributed to growth of per capita GDP through both commerce and government. The boost to services output came directly through the expansion of government services (administration and defence) and indirectly through the growth of commerce associated with increasing exports, as Russia emerged from political and economic isolation (Kahan, 1985: 163).

10. CONCLUSIONS

This paper provides an overview of economic growth in Russia during the eighteenth century, using a historical national accounting approach. Previous work has focused on the modernisation of the Russian economy begun by Peter the Great, involving state-driven

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[1] Even if a large decline occurred in the money supply, which forms the basis of Blanchard's GDP estimates, a fall in real output of such a magnitude could not have occurred without mass starvation.

expansion of large-scale industry, particularly in metal production, giving the impression of progress towards modern economic growth. However, although GDP per capita increased by around 30 per cent between the 1690s and 1760s, this was followed by a period of strong negative growth or shrinking, so that by the 1790s, GDP per capita was just 16 per cent higher than it had been a century earlier.

Although Russia began to close the gap with northwest Europe between the 1690s and 1760s, the rest of the century 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 over the eighteenth century as a whole was not purely a Malthusian phenomenon. Indeed, with its expanding frontier, Russia was in a position to reap the benefits of Smithian growth, but the institutional framework of autocracy and serfdom meant that the long run gains in living standards were very limited.