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2017

Document Version:
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Lund Papers in Economic History

No. 168, 2017 *General Issues*

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Lund Papers in Economic History
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Between Malthus and the industrial take-off: regional inequality in Sweden, 1571-1850

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Abstract

The causes and extent of regional inequality in the process of economic growth are at the core of historical economic research. So far, much attention has been devoted to studying the role of industrialization in driving regional divergence. But empirical studies on relatively unequal countries such as Italy or Spain show that inequality was already high when their modern industrialization began (Felice, 2011; Rosés et al., 2010). This paper studies the extent and drivers of pre-industrial inequality for the first time with reference to a pre-industrial European economy. Using new estimates of regional GDP for the regions of Sweden for the period 1571-1850 (Enflo and Missiaia, 2017), we find that regional inequality increased dramatically between 1571 and 1750 and stayed high until the mid-19th century. This result discards the view that industrial take-off was the main driver of regional divergence. Decomposing the Theil index for GDP per worker, we find that the bulk of inequality from 1750 onwards was driven by structural differences across sectors rather than different regional productivity within sectors. We then show that counties with higher agricultural productivity followed a classic Malthusian pattern in its population dynamics when experiencing technological advancement, while ones with higher industrial productivity did not. The difference in the two sectors is what boosted pre-industrial regional inequality. We suggest that institutional factors such as the creation of the Swedish Empire, the monopoly trading rights for Stockholm and the protective industrial policy explain this exceptional pattern.

Keywords: Regional GDP, Sweden, long-run regional inequality, pre-industrial regional development, Malthusian dynamics.

JEL: N01, N13, N93

1. Introduction

How regional inequality evolves during the different phases of economic growth is a much debated issue in historical economic research. So far, scholars have focused on the role of industrialization in driving regional inequalities. In a pioneering article, Williamson (1965) proposed the view that industrialisation led to increasing regional inequality. The evidence was collected for several countries, but covered only a relatively short period in the middle of the 20th century. With this dataset, Williamson found a peak in regional inequality occurring sometime in the interwar period, and attributed it to the process of industrialisation. Since then, economic historians have extended the evidence for calculating regional GDP over longer periods. With today's new datasets it has become more and more clear that well before industrialization regional inequality and wide differences in the level of GDP were already present. For instance, recent estimates of regional GDP for Sweden from 1860 to 2010 show that inequality was high at the outset of the Industrial Revolution (Enflo et al., 2014). The same is true for other large European countries such as Italy (Felice, 2011) or Spain (Rosés et al., 2010). However, due to lack of data it has been deemed virtually impossible to extend most regional GDP series further back than the mid-19th century (see the forthcoming book by Rosés and Wolf with European data that start around 1900 for most counties). Since the industrial take-off arguably occurred in most cases in the 19th century, the existing evidence tells us very little about how regional inequalities came about and how they evolved as industrialization unfolded.

This paper aims to address this issue by looking for the first time at a pre-industrial European economy. The research question we ask is whether pre-industrial Sweden was regionally unequal and, if it was, what drove this inequality. To answer this question, we use a newly compiled dataset of regional GDP that covers every decade in the period 1750-1850 and has an s well as the early benchmark of 1571. While recent accounts have modified the stylized stagnant view of the pre-industrial economy by using new evidence from national GDP series (see for example Fouquet and Broadberry, 2015) and occupational structures (for example Shaw-Taylor and Wrigley, 2014; Wallis et al. 2017), we add the first long-run account of the evolution of regional inequality. By connecting our series to the existing ones by Enflo et al. (2014a) for the period 1860-2010, we have been able to produce the longest set

of regional GDP series to date for any single country.[1] The series is analyzed through the coefficient of variation as the main indicator of overall regional inequality for the entire period.

Regional inequality can arise from two components. The *within* component represents the regional inequality arising from labour productivity differentials within sectors across regions and may depend, for instance, on labour markets being poorly integrated even in the same sector. The *between* component, for its part, represents the regional inequality arising from the differences in labour productivity in between different sectors of the economy and is strong when regions differ in their economic structure. Using the methodology that Martínez-Gallaraga et al. (2015) use for Spain, we decompose the Theil index of GDP per worker, in and between components. We find that this latter was the main driver of inequality across Swedish counties. In a small, open and decidedly rural economy that had not yet started to enjoy the advantages of agglomeration and increasing returns from scale, our results point to the relative income differentials between regions resulting from relative specialization, and thus acknowledge the importance of trade for sectors that depend on natural resources. We then show that contrasting impact that technical advancement had on population dynamics, depending on whether the county specialized in agriculture or industry. Like earlier researchers on Malthusian mechanisms in Sweden's pre-industrial agriculture (Utterström, 1957; Olsson and Svensson, 2011; Gadd, 2011; Berger, 2016), we find that productivity gains in agriculture originating from technological advancement were crowded out by a population increase (see also Ashraf and Galor, 2011 for international evidence). But the industrial sector appears to have responded to technological advancement with a less than proportional population growth. This difference in population behavior and the presence of different regional economic structures do much to explain the high level of regional inequality in pre-industrial times. We believe that regulations to trade and industry imposed by the Swedish Crown that limited the entry of new actors, combined with an organic constraint on land use produced this result. The existence of some dynamism in value added per capita in the non-agricultural sector brings a new perspective on the pre-industrial population dynamics that challenges the classical version of the Malthusian view.[2]

[1] The second longest regional GDP series have been estimated for Belgium, starting in 1819 (Buyst, 2017).
[2] As outlined by Mokyr and Voth (2010), there are two views of the Malthusian model. Its strongest version predicts stagnant long-run wages at the subsistence level. The weaker form focuses not on outcomes but on such equilibrating mechanisms as positive and preventive checks. We are here able to relate only to the stronger version of the model.

Our paper also speaks more broadly to a burgeoning literature on pre-industrial inequality. Analyzing inter-personal income inequality, van Zanden (1995) has suggested the existence of a long-run "super-Kuznets curve". Demonstrating that income in the Dutch agricultural sector was relatively evenly distributed, he shows that modern economic growth and rising income inequalities were connected. Similarly, Milanovic et al. (2011) have suggested that poor and agrarian societies should be characterized by relatively low inequality, since only a limited amount of surplus can be extracted from people living at subsistence level. According to these scholars, modernization of the economy with rising productivity gaps between sectors would tends to make societies not only richer, but also more unequal. Although the literature has so far focused on inter-personal inequality, there are two main reasons to hypothesize that inter-personal inequality could translate into regional inequality. First, assuming that regions in the pre-industrial period had already exhibited some specialization into different sectors with differing productivity, rising productivity gaps between sectors will translate not only into individual inequality, but also into regional inequality. Secondly, the local elites extracting surplus from the rest of the population may not be evenly spread across regions. With a more centralized taxing system, extracting elites might have concentrated disproportionally in the capital region. However, the existing empirical evidence for the period 1750-1850 for Sweden is based on wealth, which does not necessarily follow the same dynamics of GDP per capita. One of the goals of this paper is to provide a regional view of pre-industrial inequality that is complementary to the inter-personal one.

The paper is organized as follows. Section 2 provides an overview of the existing research on regional disparities in Sweden in the long run; Section 3 describes the methods and sources used in the analysis; Section 4 illustrates the results, with an analysis of the long run trends in regional inequality and on the driving mechanisms behind pre-industrial regional inequality; Section 5 concludes.

2. The regional dimension of Sweden's long-run evolution

Sweden in the pre-industrial period has often been described as a poor and agricultural economy on the periphery of northern Europe. As seen in Figure 1, GDP per capita was relatively stagnant throughout the entire period 1571-1850. The picture is one that over the long run seems consistent with the Malthusian picture, but, like other peripheral economies such as Portugal (Palma and Reis, 2016), Sweden had relatively long periods of deviation

from the standard Malthusian model (for example the growth period during the 17th century) and signs of pre-industrial dynamism in several respects. Most prominently, the Swedish population almost quadrupled between 1571 and 1850. The population increase bears witness to the expansion of a frontier economy, especially in the northern and central parts of the country. It also shows that Sweden may have been closer to a Malthusian ceiling at the end of the period than it was at the beginning. A stagnating agriculture appears to have failed to meet the needs of a growing population, for net cereal imports increased in importance from 1650 onwards. Recent estimates of agricultural production and population growth in the 17th century suggest that as much as a fourth of the population could have depended on imports for their survival (Andersson-Palm, 2016). Not even the advent of the potato in the early 19th century met this need; it was merely translated into more population growth without improving the living standards (Berger, 2016).

But although the primary sector showed capacity constraints compared to the growing population, the secondary and tertiary sectors bear witness of increasing dynamism. The mining industry boomed, starting in the 17th century with iron ore exports from Sweden constituting more than 80% of London's imports (Olsson-Spjut, 2007) and copper covering about two thirds of the European market (Falu copper mine). Special legislative privileges were offered to hammer works for bar iron production as a first step towards the large scale organization of industrial production. However, although representing technological progress, the iron sector was still heavily dependent on the surrounding agricultural community for supplying energy and performing simpler services such as transports and chores around the sites (Schön, 2010, p. 82)

Simultaneously, state capacity grew. When Sweden entered a turbulent period of warfare and imperial expansion (sometimes described as the Great Empire Era, 1611-1718), the economy had to be modernized in its fiscal and military functions. Sweden developed a large and militarily strong political economy, effective in expanding its territory but less amenable to internal checks and balances. An administration capable of taxing households was set up under the influence and supervision of the Crown, and the reformed Lutheran Church. Indeed, many of our underlying sources in estimating regional GDP are the detailed tax records of individuals and households, first set up by the local bailiffs conducting Älvsborgs ransom (1571); we then use the church registers reporting the population in the Tabellverket data (1750-1850).

Figure 1 about here

However, simple direct taxation was not enough for the State to generate enough surplus and it therefore imposed mercantilist policies to control and tax the increasing revenues from trade. The prime instruments of these mercantilist policies were tariff protection to promote exports and the creation of industrial privileges to promote urbanization (Heckscher, 1968, p. 112). The view of the Crown was that commerce, shipping and craftsmen should be confined to towns, where it was easier to tax and control income. Consequently, rural trade was prohibited and strict regulations guided the conferring of market privileges on towns. Most towns were granted the right to trade only in the domestic market. In order to trade abroad, specific staple rights had to be provided. However, a few of the towns held the right to trade on the foreign market; Stockholm in particular was given an extremely favored positon in this regulated trading system. In order to concentrate tax revenues from the lucrative trade on iron, the Botnian trading restriction stipulated that all trade coming from north of Stockholm had to pass through its harbor before it could be exported abroad. Another field of policy was the regulation of the craft guilds and the support of some manufacturing industry. Early on, the Crown tried to encourage industrial production in the so-called manufactories. These production units, founded through generous state support, focused on textiles, sugar, tobacco and various metal works and were strictly regulated. However, no prominent role has been acknowledged for these manufactories either in the subsequent industrialization or more broadly in the success of the Swedish economy (Heckscher, 1968, p. 184). Their failure is often attributed to production being too rigid and directed into industries where Sweden lacked long-run comparative advantage (such as the cultivation of tobacco or mulberry trees for silk production).

The Swedish pre-industrial labor market was also relatively regulated, in the sense that market relations were still marked by more coercive labour relations on the manors. However, cash wages and short-term notice were starting to replace payment in kind. Gradually a more modern labor market was created with individual employment contracts between two equal parties (Prado et al., 2016). Yet internal migration was limited and internal passport laws severely restricted the free movement of labor between counties. Taken together, Sweden in the pre-industrial period was an economy deeply regulated according to Mercantilist principles. However in terms of economic outcomes, Heckscher deems the fruits of its

policies “few and insignificant” (ibid). The economy gradually liberalized during the 19th century when the passport laws were repealed and industry was deregulated. By 1860, the economy had broken from its Mercantilist past. At this time, colliding with the onset of the Industrial Revolution, the economy exhibited high regional inequality.

The pattern of regional inequality between the Swedish counties has been observed in previous studies, but only since the mid-19th century. The first to point out that Swedish counties experienced an early industrialization that did not lead to an increase of regional inequality were Enflo et al. (2014a), who produced GDP per capita estimates for the 10-year benchmarks from 1855 to 2000. Enflo and Rosés (2015) used the same series to inquire into the drivers of regional inequality in the very long run. They find that structural change was the main driver behind this convergence process. The present paper seeks to extend the long-term picture of the regional inequality of Sweden, covering for the first time both the century preceding industrialization (1750-1850) and the very early benchmark of 1571. The next section illustrates the sources and the methodology used for this purpose.

3. Methods and sources

3.1. Regional GDP reconstructions

A major challenge to estimates of historical regional GDP figures is the availability of reliable and homogeneous regional statistics before the mid-19th century. As with many types of historical source, Sweden stands as the exception among European countries: labour force statistics from the population censuses at regional level are available from the mid-18th century onwards. These can be used to allocate to regions the national estimates of agriculture, industry and services recently produced by Schön and Krantz (2015).[3]

[3] There are alternative GDP series from 1620-1800 supplied by Edvinsson (2013b). We have however chosen to work with the SHNA series by Schön and Krantz, since they are the only ones to offer sectoral data from 1560 onwards. The Edvinsson series do not provide the same break-down into sectors on an annual basis. Moreover, the latter series start in 1620, which does not allow us to construct our 1571 benchmark starting from the same national series of 1750-1850. It should however be noted that our regional labour force shares and wages can be applied to any national series.

The methodology, introduced by Geary and Stark (2002), is standard practice for historical estimates and is considered the most reliable when direct measures of output are not a viable option. GDP in county *i* (Y_i) is defined as:

$$Y_i = \sum^{j} \; y_j \; \beta_j \left(\frac{w_{ij}}{w_j}\right) \times L_{ij} \qquad (1)$$

where y_{ij} is the average value added per worker in county *i* and sector *j*, w_{ij} is the level of wages in county *i* in sector *j* and L_{ij} the number of workers in county *i* and industry *j*. β_j is a scalar that will reflect regional relative differences. Geary and Stark (2002), using UK data, show that their method yields results of promising precision. For the Swedish counties, Enflo et al. (2014a) demonstrate that the method produces reasonable results for the second half of the 19th and the whole 20th century. This is the method used by Enflo and Missiaia (2017) to produce GDP estimates for the period 1750-1850 for Sweden's 24 counties (roughly corresponding to NUTS-level 3). The series produced cover five sectors: agriculture, manufacturing, mining, private services and public services.

Enflo and Missiaia (2017), using a different methodology, also provide a benchmark for 1571: the main source is a one-off wealth tax called the "Älvsborgs ransom". Between 1563 and 1570 Sweden and Denmark engaged in one of many wars for the control of the Baltic Sea. During the war, the castle of Älvsborg fell under Danish control. The castle was of strategic importance because it granted Sweden access to the Nordic Sea. In order to regain it, Sweden paid 150,000 silver coins. To pay the ransom, a special wealth tax comprising a tenth of all cattle, agricultural surplus and metal goods was imposed. The data from this source have already been used by scholars and is considered of exceptionally good quality for the period. Between 1872 and 1883 the historian Hans Forsell was the first to organize the data at parish level. The source covers about 84,000 households and 500,000 taxed individuals, covering some 1100 parishes from Sweden at its historical borders. The ransom is the main source used by Enflo and Missiaia (2017) to derive regional GDP series for 1571 Sweden at the current borders.[4] The series produced cover three sectors: agriculture, industry and services.

[4] Additional sources have been used in the estimation to refine the estimates as well as to add the seven current Swedish counties that belonged to Denmark. Detailed information regarding sources and estimation methods can be found in Enflo and Missiaia (2017). The estimates are reported for consistent geographical borders

In this paper we therefore use the new estimates by Enflo and Missiaia (2017) to produce evidence of Sweden's long-run regional inequality from 1571 to 1850. We also provide in Section 4.1 a very long-run overview of regional inequality until today by connecting our series to the existing ones by Enflo et al. (2014a). It should be noted that the datasets of existing regional GDP mentioned above are all estimated to be consistent with the Swedish historical accounts. Thus, summing all the regional GDP will result in the same level of national GDP as reported by Schön and Krantz (2015). It was therefore straightforward to connect the newly produces series for 1571 and 1750-1850 to the existing ones from 1860 onwards.[5]

3.2. Theil index decomposition

After illustrating the patterns of regional inequality in our series through the use of a standard coefficient of variation, we propose a further indicator of regional divergence: the Theil index of inequality. Following Martínez-Gallaraga et al. (2015), we define the Theil index T as:

$$T = \sum_j^5 \sum_i^n \left(\frac{Y_{ji}}{Y}\right) \log\left(\frac{\frac{Y_{ji}}{Y}}{\frac{E_{ji}}{E}}\right) = \sum_j^5 \sum_i^n \left(\log(x_{ji}) - \log(\bar{x})\right) \frac{Y_j}{Y} \quad (2)$$

where Y is the per capita GDP, E is employment, $\bar{x}$ is GDP per worker, j indexes the sectors and i indexes the counties. The index can be disaggregated into two components, the within component T_w (the weighted average of regional inequalities of labour productivity within each sector across regions) and the between component T_b (the weighted average of regional inequalities of labour productivity between our five sectors).

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corresponding to the EU NUTS 3-level, or similarly the Swedish counties (län). The database refers to the counties of Sweden at their current borders, so in our early 1571 benchmark we add the seven counties of South and West Sweden that were incorporated in 1658 from Denmark-Norway. Despite the addition of new counties in the mid-17th century, Sweden has kept a stable geographical division of counties over the centuries, making this part of the GDP calculation relatively straightforward.

[5] We are aware that the production boundary might well be defined in a very different way than the one used by Schön and Krantz (2015), where the non-marketed part of production is not included. An alternative is represented by Edvinsson (2013a,b). However, the historical national account series for Sweden provide a sectorial disaggregation that is unique and allows us to apply the widely used Geary-Stark method with the highest level of precision. For a more detailed discussion, see Enflo and Missiaia (2017).

$$T = T_w + T_b = \sum_{j-1}^{5}\left(\frac{Y_j}{Y}\right)T_j + \sum_{j-1}^{5}\left(\frac{Y_j}{Y}\right)\log\left(\frac{\frac{Y_j}{Y}}{\frac{E_j}{E}}\right) \quad (3)$$

where

$$T_w = \sum_{j-1}^{5}\left(\frac{Y_j}{Y}\right)\sum_{i}^{n}(\log(x_{ji}) - \log(\bar{x}_j)\ \frac{Y_{ji}}{Y}) \quad (4)$$

$$T_b = \sum_{j-1}^{5}\left(\frac{Y_j}{Y}\right)\log\left(\frac{\frac{Y_j}{Y}}{\frac{E_j}{E}}\right) = \sum_{j-1}^{5}(\log(\bar{x}_j) - \log(\bar{x}))\frac{Y_j}{Y} \quad (5)$$

The decomposition of the index identifies two different sources of labour productivity differentials across regions: the *within-sector* inequality describes the inequality originated from the same sector having different productivity levels in different regions, whereas the *between-sector* inequality describes the inequality originated by different sectors with different overall productivity being present to different extents in different regions (basically this is inequality from structural change).

4. Results

In this section, we present the empirical results, first starting with some general comments on the long run trends in GDP per capita; we then move to analyzing in further detail the forces driving pre-industrial regional inequality for 1750-1850.

4.1. General patterns: long-run regional inequality in Sweden

In Figure 2 we present the long-run coefficients of variation obtained by connecting our new pre-industrial GDP series to the existing figures from 1860 onwards. As the figure sows, regional inequality was low in 1571 but had increased substantially by 1750. It remained high for about 100 years until the onset of industrialization, when it started to decrease. Thus, we observe a long-run inverted U-shape of regional inequality, which is quite unlike the famous inverted U-shape hypothesis defined by Williamson (1965). Our results point to the pre-industrial dynamics as the main driver of inequality.

Figure 2 about here

Figure 2 suggests that regional inequality was already considerable a hundred years before the modern industrialization of Sweden. The coefficient of variation fluctuates at around 0.25 to 0.3, which is a relatively high level of regional inequality. Studies of Spain and Italy report similar levels of inequality for the late 19th century (Rosés et al. 2010, Felice 2011). Thus, the counties of Sweden appear to have suffered relative inequality. If we come this with the evidence collected by Bengtsson et al. (2017) on inter-personal wealth inequality, we observe that although the levels of both kinds a hundred years before the industrial take-off were high by today's standards, the dynamics differ. Wealth inequality increased up to the early 20th century, while regional inequality stayed high until 1850 and then declined. It is interesting how both inequalities contradict the view that industrialization constitutes the prime driver but nevertheless they evolved in very different ways.

Table 1 reports the GDP per capita estimates for all years from Enflo and Missiaia (2017), indexed to the national average (Sweden=100), plus the estimates for 2010 from Enflo et al. (2014a), to provide a current benchmark. The results are also made visible in the maps of Figure 3. The maps show how compressed the regional inequality was in 1571. The Danish counties of the south and the mining district of central Sweden stand out as relatively rich, their best relative position (especially those in the former Danish parts), but Stockholm had emerged as the county with the uncontested highest regional GDP per capita (171 against a national average of 100). An analysis of the first two centuries of our sample shows an important upswing of regional inequality in Sweden that took place long before industrialization. Nevertheless, the picture that emerges is of a relatively equal country in 1571, replaced by something much more unequal in 1750. Comparing the maps for 1571 and 1750 in the left panels of Figure 3, two main issues stand out: the relative collapse of the southern and western counties (i.e. the counties that were incorporated into Sweden in the 17th century) and the remarkable relative increase of Stockholm's GDP per capita.

Table 1 about here

Figure 3 about here

In 1571, the Swedish borders were substantially different from the current ones. After the peace treaty of Roskilde in 1658, Sweden incorporated the counties of Malmöhus, Kristianstad, Blekinge and Bohuslän from Denmark (which at the time was in a union with Norway).[6] After 1675, the new counties became stable parts of Sweden and a policy of "Swedification" of these region started to be implemented. In 1658 the Swedish monarchy imposed a tax on all ships crossing the sound. In addition, export taxes and a prohibition of grain exports were imposed. The southern part of Sweden, from its position as an integrated part of Denmark, a more advanced economy in the 17th century, and a vigorous trader across the Öresund, became peripheral in its poorer new home of Sweden. Our results are corroborated by previous research by Skansjö (1997, p. 177) who has documented the negative economic impact on the region in term of the loss of market access when medieval trading routes across the Öresund were distorted after the annexation.

Finally, the role of Stockholm in driving regional inequality over the long run is confirmed by Figure 4, where we observe the long-run position of Stockholm in relation to the national average 1750-2010. From 1750 on, the relative GDP per capita of Stockholm county was almost twice as large as the GDP of Sweden as a whole. This position was sustained until the outset of industrialization around 1860, when Stockholm gradually lost out to other parts of the country as they took off into modern economic growth.

Figure 4 about here

The position and growth of Stockholm are probably related more closely to its geographical suitability for trade than any natural conditions to do with agricultural suitability or the availability of iron ore. Thus, Stockholm in 1571 did not stand out for its GDP per capita compared to the rest of Sweden. Instead, it was other areas such as the mining district of Bergslagen (especially the counties Västmanland and Örebro) that exhibited the highest GDP per capita of all the counties of old Sweden in 1571. The relative strength of the mining counties is evident in the historical outcries against the Monarchy from the 16th century (i.e. Dala-upproren).

[6] The counties of Halland, Jämtland and Gotland had already been incorporated in 1645 but continued to shift between Sweden and Denmark for some decades.

Institutional factors, especially Stockholm's protected position as the capital, main foreign trading port and home to the lion's share of protected manufactories may explain the pre-industrial upswing in regional inequality. At all events, by 1750 Stockholm had emerged as the richest part of the country. Our dataset unfortunately does not allow for a detailed analysis of the dynamics in the centuries between 1571 and 1750. We therefore cannot tell precisely when Stockholm started to emerge in terms of GDP per capita. However, we can imagine that the city's success was established with the growth of the Swedish Empire (1611-1721). During this period, Stockholm became the home for a number of national institutions and a growing public bureaucracy. Between 1600 and 1750, the population of the capital increased by nearly sevenfold (from 9,000 to 59,000 inhabitants). The increased State capacity relating to the Swedish military state became probably less responsive to internal checks and balances. Many of the gains from foreign trade were channeled through Stockholm by regulations such as the Botnian trade regulation. Such urban primacy (a dominant share of the nation's largest or capital city) has been related to protectionist trade policies and non-democratic institutions in the world's developing nations today (Ades and Glaeser, 1995). We find that pre-industrial Sweden fits remarkably well into this pattern. The next sections qualify the above statements through a sectoral decomposition for the period 1750-1850 and propose some hypotheses on the drivers of regional inequality.

4.2. Sectoral specialization mattered

From the more general picture of long-run regional inequality we have thus been able to distinguish three main periods of Swedish long-run regional inequality: an upswing of regional inequality in 1571-1750; a constant relatively high regional inequality in 1750-1850; and long-term convergence 1850-2010. How can we explain the great inequality in regional GDP per capita in the post-1750 period emerging from Figure 2? The descriptive analysis from the previous section suggests that two factors are potentially important: 1) the unevenly distributed and largely regulated industrial sector; and 2) Stockholm's protected position due to the implementation of a mercantilist policy favoring the capital. In this section we are interested in quantitatively testing the first of these factors through the decomposition of regional inequality into within and between components.[7] Table 2 and Figure 5 show the results.

[7] Unfortunately, we are unable to include the year 1571 since evidence on employment per sector/county for this year does not exist.

Table 2 about here

Figure 5 about here

The decomposition of the Theil index in *within* and *between* components suggests that the *between*-sectors component accounts for most of Sweden's pattern in regional inequality throughout the entire period, explaining around 90% of the total variation in all years.[8] The interpretation of this result is simple: although productivity differentials in the same sector existed across regions, the bulk of the inequality was represented by regions presenting different shares of the five sectors of the economy: economic activity was unevenly distributed regionally and structural change in the 19th century became a driving force of regional divergence. To confirm this, in Figure 6 we see the regional distribution of industrial workers mapped for 1750, 1800 and 1850.

Figure 6 about here

Throughout the period, Stockholm stands out in its exceptionally large share of industrial workers. More than 60% of Sweden's manufacturing workers in 1750 were located in Stockholm (Söderberg et al. 1984, Table 1). Some of these workers were part of the protected manufactories, where wages and value added per worker were clearly above other sectors of the economy thanks to regulations and subsidies.

But, apart from Stockholm's exceptional, and somewhat artificially supported, position, early industry shows substantial regional variation over time and space. In 1750, the industrial belt is concentrated around the mining district of Bergslagen, which appears as a C-

[8] Here we present the Theil index with mining and manufacturing as separate. We have also repeated the exercise with industry as one unique sector, as in Martínez-Gallaraga et al. (2015). The within component roughly doubles in share in the first three benchmarks, while it stays around the same share in the later benchmarks. This suggests that in the first decades of our sample, mining was far more productive than manufacturing. Since the Swedish mining sector continued to decline in the second half of the 18th century and the manufacturing sector started up in new counties (i.e. on the West coast), regional inequality went down.

shaped formation around Stockholm county in the left panel of Figure 6. Over the period, the industrial district grew in geographical scope and extended further from the mines. The county of Värmland was deliberately given a prominent role in iron-making under the policies of the Crown. It is known that rising industrial production brought additional pressure on energy resources (Kander et al., 2013, p.84) and vast forest reserves were needed to obtain the fuel for both the extraction and the production of pig and bar iron as well as metal goods. In order to reserve the forests for mining and pig iron production to the counties closest to the mines, the Crown moved the forges for bar iron production to adjacent areas where there were no mines (Hecksher, 1968, p. 96). Western Värmland, still close enough to the mines while richly endowed with fuel reserves, thus rapidly evolved into one of the major iron-making counties. The policy underlines how decisions on the location of industry were limited by the organic land constraints before coal could be substituted for wood as a source of energy.

However, industry was not confined to the rural mining counties alone. Gradually, it spread to the urbanized areas around Gothenburg, Malmo and Uppsala. In 1850, the counties close to Stockholm and to the very south had industrialized more in terms of employment share than the former mining counties had.[9] Towards the end of the 18th century, it can also be observed that Stockholm had started to stagnate. One of the reasons is that mercantilist policies were gradually being removed. In 1765, the Botnian trade restriction was abolished and Stockholm lost some of its favored position while other towns started expanding. One such town was the western port of Gothenburg, which gradually increased its population, and also its GDP per capita. Between 1750 and 1850, according to our calculations, the county of Gothenburg moved from a position of average GDP per capita to 50% above the average. The stagnating trend of Stockholm in terms of population and industrial employment has been noted by Söderberg et al. (1984). Population dynamics show how a much smaller town such as Gothenburg grew more quickly throughout the period 1730-1850.[10]

[9] It should be noted that, although Stockholm represents an important driver in the upswing of regional inequality in the period 1750-1850, its exclusion from the calculation of the coefficient of variation does not change the overall picture (CV goes from 0.25 to 0.21 in 1750, from 0.25 to 0.20 in 1800 and from 0.29 to 0.23 in 1850).

[10] It should be noted that although the population stagnated in Stockholm, Söderberg et al. (1984) claim that productivity may not have fallen to the same extent as employment.

4.3. Malthusian forces in regional inequality

How do we reconcile increasing regional inequality in the Early Modern Period with stagnant GDP per capita? If we are to believe the central hypothesis of the Malthusian theory in its stronger form, i.e. that technological improvements only generate temporary gains in income per capita before the take-off into modern economic growth, there should not be room for persistent pre-industrial inequality in regional GDP per capita.[11] Instead, any improvement in generating increasing GDP per capita would soon result in a larger population absorbing the improvements. This result has previously been shown broadly to hold for land productivity (proxying for technological improvements in agriculture) and population density in several countries before 1500 (Ashraf and Galor, 2011).

However, in this paper we show a persistent gap in GDP per capita among different counties, arising well before the industrial take-off. We argue that two factors can make this outcome possible. First, we claim that Sweden in 1571 cannot have been stretched to its Malthusian equilibrium. Since the increase in regional inequality that we observe between 1571 and 1750 translated into a decreasing GDP per capita for the poorest counties over the centuries, we cannot assume that people were already living at subsistence level in 1571. However, there is ample evidence of a relatively satisfactory living standard in the 16th century, a finding corroborated by Heckscher's comments on the food supply (Heckscher, 1968, p. 70). It is possible that the population had still not recovered from the losses of the Black Death of the 14th century and the subsequent waves of plague. Gradually, however, population increased, while previous scholars have documented declining living standards during the 17th century (Myrdal and Morell, 2011). Our findings suggest that the burden of gradually declining living standards were unevenly distributed across space, with some counties falling behind while Stockholm forged ahead.

Second, we argue that the sectors play some part in the pattern. We have already shown, using the Theil index, that sectoral specialization explained much of the observed regional inequality, and that counties specializing in non-agricultural production managed to sustain higher GDP per capita levels than the rest of the country. This mechanism is consistent with the Malthusian forces explaining the long-run population density in agriculture, but not in industry. We support this claim in Figures 7, 8 and 9.

[11] The weaker version of the Malthusian model, as outlined in note 3 above, focuses on the existence of an equilibrating mechanism, not outcomes; see Mokyr and Voth (2010) for a discussion.

Figure 7 about here

Figure 7 depicts Malthusian forces in agriculture similar to those described by Ashraf and Galor (2011). It is clear that improvements in pre-industrial agricultural productivity translated into population increases in the Swedish counties between 1571 and 1850. The forces were strongest around 1750 and gradually became weaker. Over the entire period, there is, however, a strong positive correlation between the two variables.

So while this finding supports the Malthusian claim within the agricultural sector, we need to look at the role of sectoral specialization to reconcile the existence of large pre-industrial inequalities. In Figure 8 we show some very different population dynamics with respect to increased industrial productivity.[12]

Figure 8 about here

The figure depicts the relationship between the logarithm of industrial production per worker and the logarithm of population density for the years 1750-1850. As seen from the plot, there is no systematic relationship to be seen between improvements in labour productivity and population density in the industrial sector. We can think of two explanations for this pattern. First, it could be a result of various restrictions that constrained population growth by the organic potential of the local economies in which industry operated. Before the advent of coal and the transport revolution, the high demands on forestry from the energy intensive metal-producing sectors competed with agriculture for land use. Local food shortages from a constrained agricultural sector, in combination with trade regulations and poor infrastructure impeding food imports, may have hampered the scope for population growth. As a result, value added per capita could have been high in counties with higher productivity in industry while population density remained low. Second, the profits generated in the mines were regulated by special privileges offered by the Crown and sites were often

[12] Here, lacking capital stock estimates for the industrial sector, we use industrial labor productivity to proxy for advancements in productivity due to technological change.

owned and controlled by the Crown. Thus, the entry of new agents and firms were constrained and increasing value added per capita may have been unevenly distributed among the local population or resulted in generally rising living standards driving population growth.

Figure 9 displays a similar pattern for the entire period 1571 to 1850 when industrial labor productivity is replaced by the share of industry in GDP. The pattern highlights the fact that Malthusian forces were not in play in the early industrialising counties. We are also unable to observe population density driving industrial specialisation, as predicted by theories on agglomeration effects and increasing returns to scale for most of the period. It is only in 1850 that a burgeoning industrial specialisation may be observed in more densely populated counties. These observations relate to the early industrialising areas around Malmöhus, Uppsala and Gothenburg as identified in Figure 6. Yet Figures 8 and 9 suggest that throughout most of our period, counties with higher productivity in industry generated substantial value added without seeing these improvements translate into increased population density.

Figure 9 about here

5. Concluding remarks

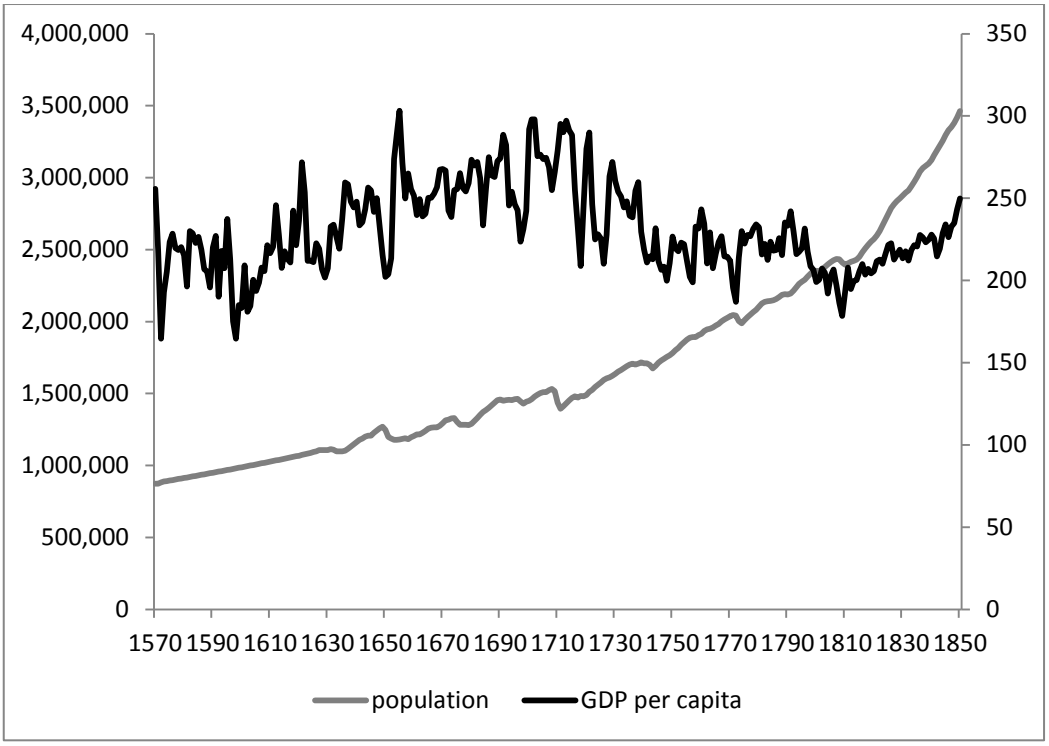
This paper has provided the first picture of long-run regional inequality in Sweden, covering the period 1750 to the present, with regular 10-year benchmarks for regional GDP, and the addition of an early benchmark for 1571. Our results show that regional inequality in 1571 was relatively contained but that it roughly doubled in the next two centuries. This means that regional inequality was already large and persistent a hundred years before Sweden's take-off into modern economic growth. Although 18th century Sweden was predominantly agricultural, wide differences in GDP per capita could be noted between its counties. Moreover, there was substantial dynamism in the industrial sector long before the industrial take-off. Industry was at this point concentrated in the mining district and the protected manufactories. As industry generated a substantial share of national value added, the regional concentration of early industry drove inequality. Another element that may explain the high level of pre-industrial inequality is that the capital city of Stockholm was extremely favored by Mercantilist policies, indicating a concentration of service and industry

in the capital. Extractors of surplus may also have been disproportionally located in the area. Between 1750 and 1850, as some of the Mercantilist restrictions were gradually relaxed, the county of Stockholm stagnated.

The decomposition of inequality in within and between components suggests that structural change was the main driver of the overall inequality, which declined when counties other than Stockholm started to industrialize in the 19th century. In spite of the wage differentials observed in agriculture and industry, the role of the within component was quite limited. This result can be explained by looking at the Malthusian mechanisms in both agriculture and industry. We do so by relating population growth and productivity in the two sectors. We find that, in regions with higher productivity in agriculture, technological advancements leading to higher land productivity also led to a proportional increase in population. However, the same was not true for the counties with higher productivity in industry. Instead, population growth appears to have been impeded by organic constraints and the particular institutional arrangements imposed by the Crown. This different action in the two sectors of the Malthusian mechanism explains the upswing in regional inequality.

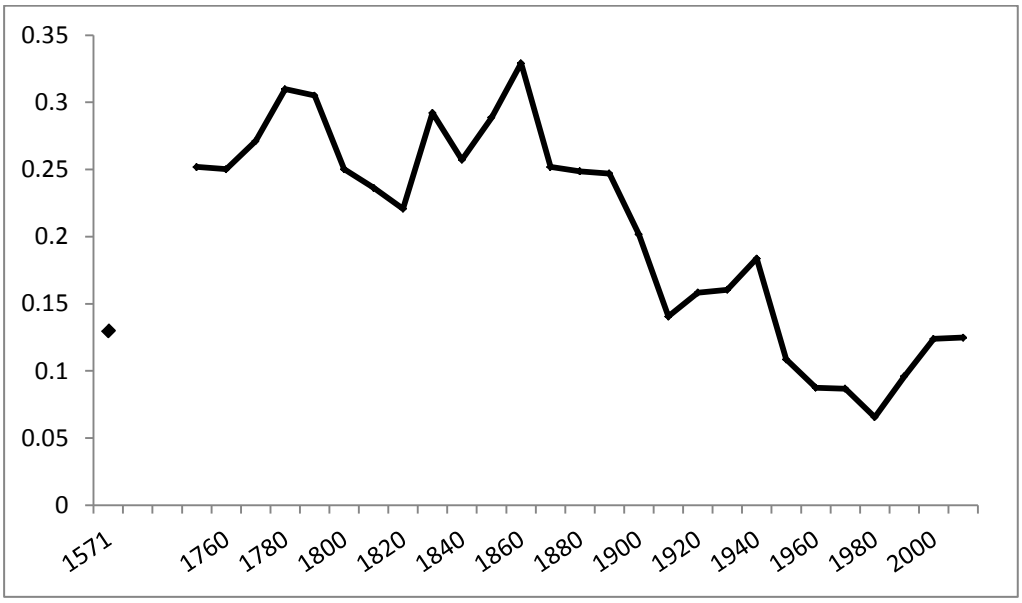
These findings on the pre-industrial period, along with the previous results on the decline of inequality during industrialization by Enflo et al. (2014a) and Enflo and Rosés (2015), provide a very distinctive picture of Sweden that contrasts with the classic view on regional inequality dynamics. Our results possibly speak to other cases of pre-industrial economies that may have experienced high levels of regional inequality not caused by the process of industrialization but rather by particular institutional settings and economic policies.

Figure 1. GDP per capita and population in Sweden, 1570-1850.



Source: Schön and Krantz (2015).

Figure 2. Coefficient of variation of GDP per capita across Sweden's 24 counties, 1571-2010.



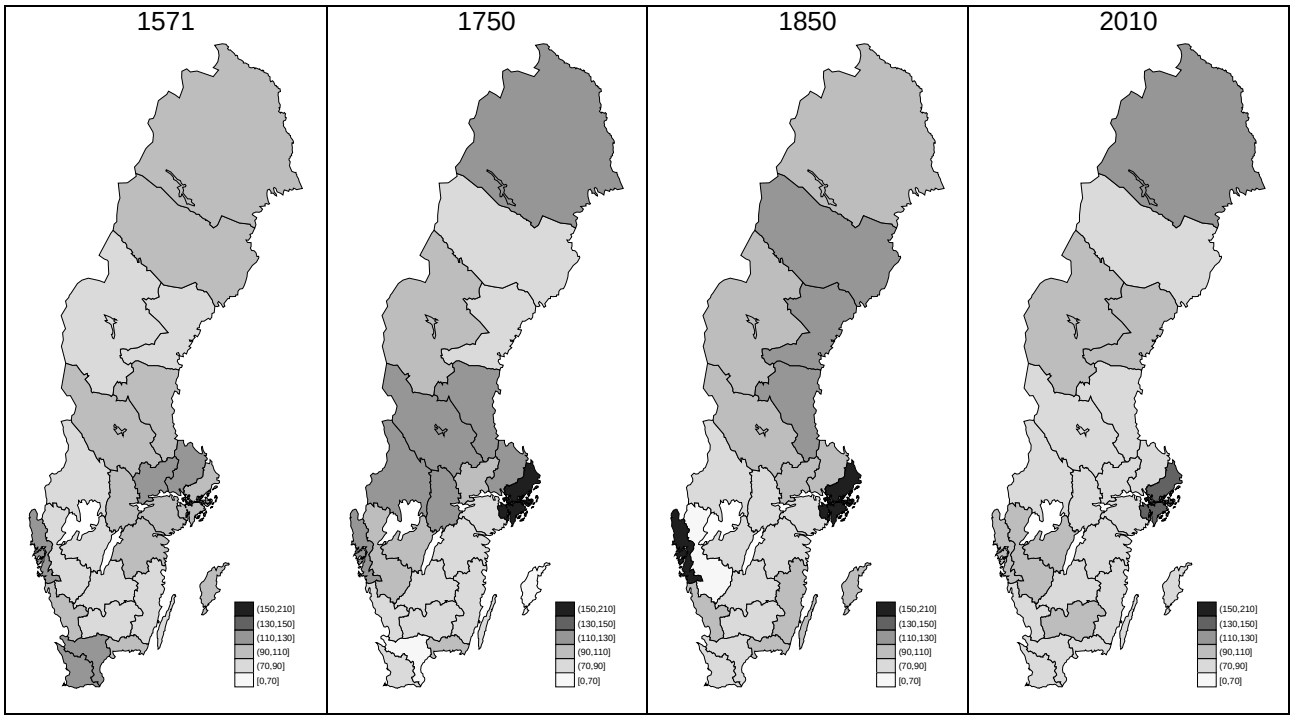
Sources: 1571-1850: Enflo and Missiaia (2017). 1860-2010: Enflo et al. (2014a).

Table 1. GDP per capita in the Swedish counties, 1571-2010 (Sweden=100).

	1571	1750	1760	1769	1780	1790	1800	1810	1820	1830	1840	1850	2010
STOCKHOLMS LÄN	108	171	182	175	218	223	176	148	160	200	188	190	137
UPPSALA LÄN	112	121	112	151	112	111	119	112	123	119	117	105	86
SÖDERMANLANDS LÄN	96	70	75	67	93	98	90	81	88	83	93	87	80
ÖSTERGÖTLANDS LÄN	99	81	83	99	83	99	98	90	89	91	94	87	84
JÖNKÖPINGS LÄN	90	74	78	71	72	80	76	84	85	81	79	81	87
KRONOBERGS LÄN	86	81	69	78	70	71	66	82	78	70	76	72	93
KALMAR LÄN	79	90	90	77	96	94	95	106	97	97	95	95	85
GOTLANDS LÄN	98	64	65	89	77	87	91	80	96	91	93	91	77
BLEKINGE LÄN	98	103	115	101	109	121	103	162	128	111	109	110	82
KRISTIANSTADS LÄN	111	58	62	61	61	63	57	77	86	71	73	77	85
MALMÖHUS LÄN	118	76	79	64	69	81	107	86	79	79	84	89	88
HALLANDS LÄN	106	85	82	89	89	86	82	95	80	93	97	94	88
GÖTEBORG/BOHUS LÄN	130	120	119	119	139	125	148	146	141	160	149	170	96
ÄLVSBORGS LÄN	78	92	88	73	77	76	81	92	77	67	65	67	96
SKARABORGS LÄN	74	93	93	106	82	81	74	84	72	79	79	77	96
VÄRMLANDS LÄN	77	118	104	84	92	85	86	75	86	92	94	88	81
ÖREBRO LÄN	106	127	111	114	96	90	97	77	85	98	96	86	88
VÄSTMANLANDS LÄN	116	94	109	113	106	105	116	108	103	109	109	101	87
KOPPARBERGS LÄN	99	119	101	122	92	88	98	94	116	111	110	105	88
GÄVLEBORGS LÄN	110	116	125	117	117	112	114	111	121	121	118	121	87
VÄSTERNORRLANDS LÄN	90	75	89	105	93	89	109	117	110	112	113	125	96
JÄMTLANDS LÄN	76	96	93	103	98	95	106	113	109	101	96	90	98
VÄSTERBOTTENS LÄN	106	88	84	94	93	88	99	105	98	91	110	124	89
NORRBOTTENS LÄN	102	111	101	110	104	96	103	110	107	99	97	102	114
SWEDEN	100	100	100	100	100	100	100	100	100	100	100	100	100

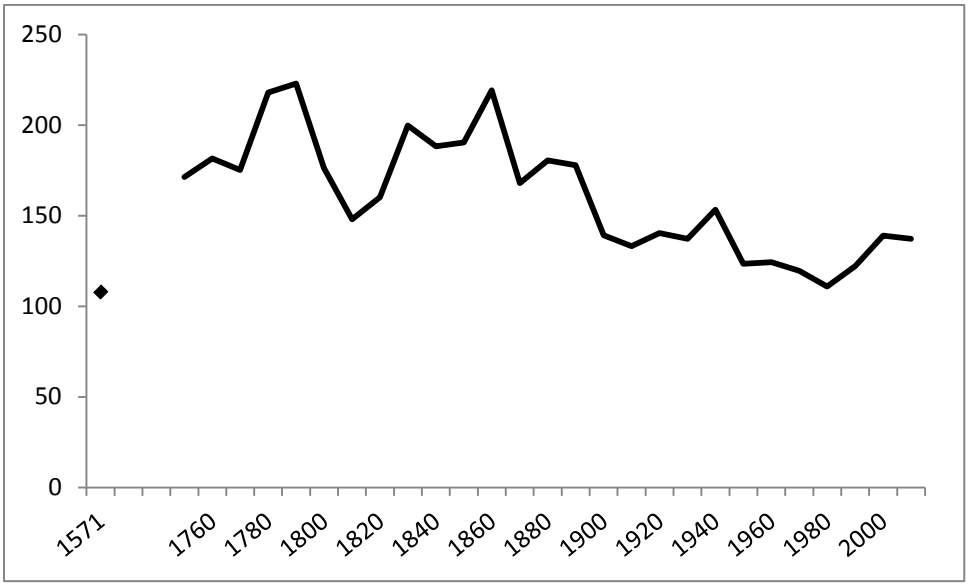
Source: our elaboration on Enflo and Missiaia (2017) for 1571-1850 and Enflo et al. (2014a) for 2010.

Figure 3. The relative evolution of GDP per capita, 1571-2010 (Sweden=100).



Source: our elaboration on Enflo and Missiaia (2017) and Enflo et al. (2014a).

Figure 4. Stockholm's GDP per capita in relation to the Swedish average, 1571-2010 (Sweden=100).



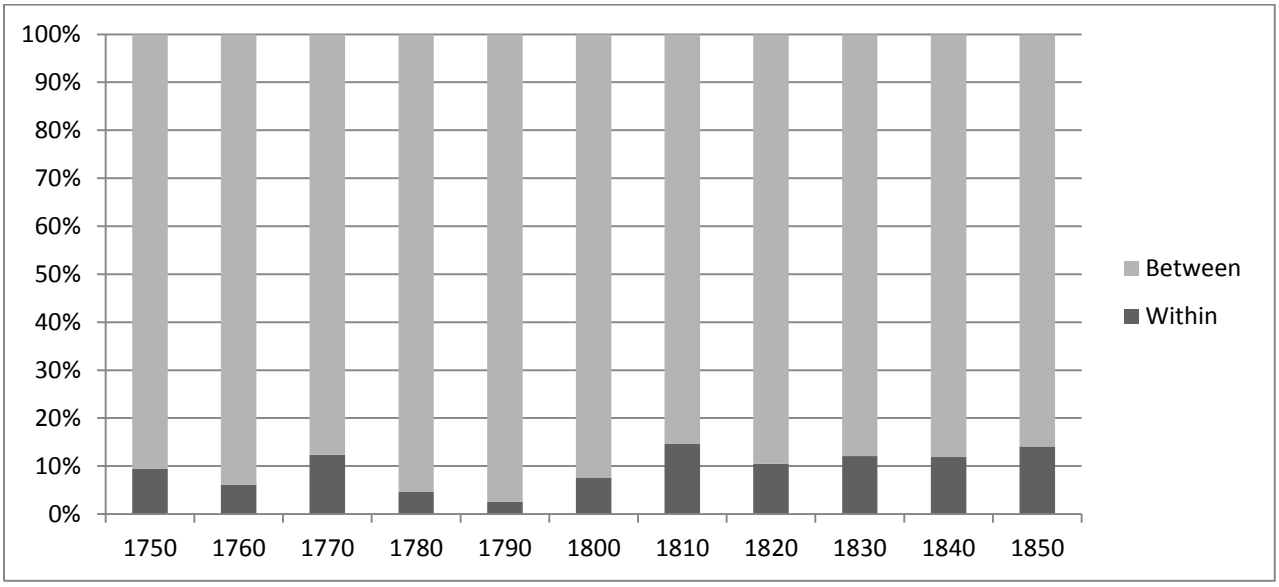
Source: our elaboration on Enflo and Missiaia (2017) and Enflo et al. (2014a).

Table 2. Theil inequality index of GDP per worker in the Swedish counties, 1750-1850.

	1750	1760	1770	1780	1790	1800	1810	1820	1830	1840	1850
Within	0.025	0.016	0.024	0.009	0.006	0.008	0.012	0.011	0.013	0.012	0.014
Between	0.240	0.252	0.168	0.188	0.221	0.098	0.067	0.092	0.095	0.089	0.086
Overall	0.265	0.269	0.192	0.197	0.227	0.106	0.078	0.103	0.109	0.101	0.101
Within %	9	6	12	5	3	8	15	10	12	12	14
Between %	91	94	88	95	97	92	85	90	88	88	86
	100	100	100	100	100	100	100	100	100	100	100

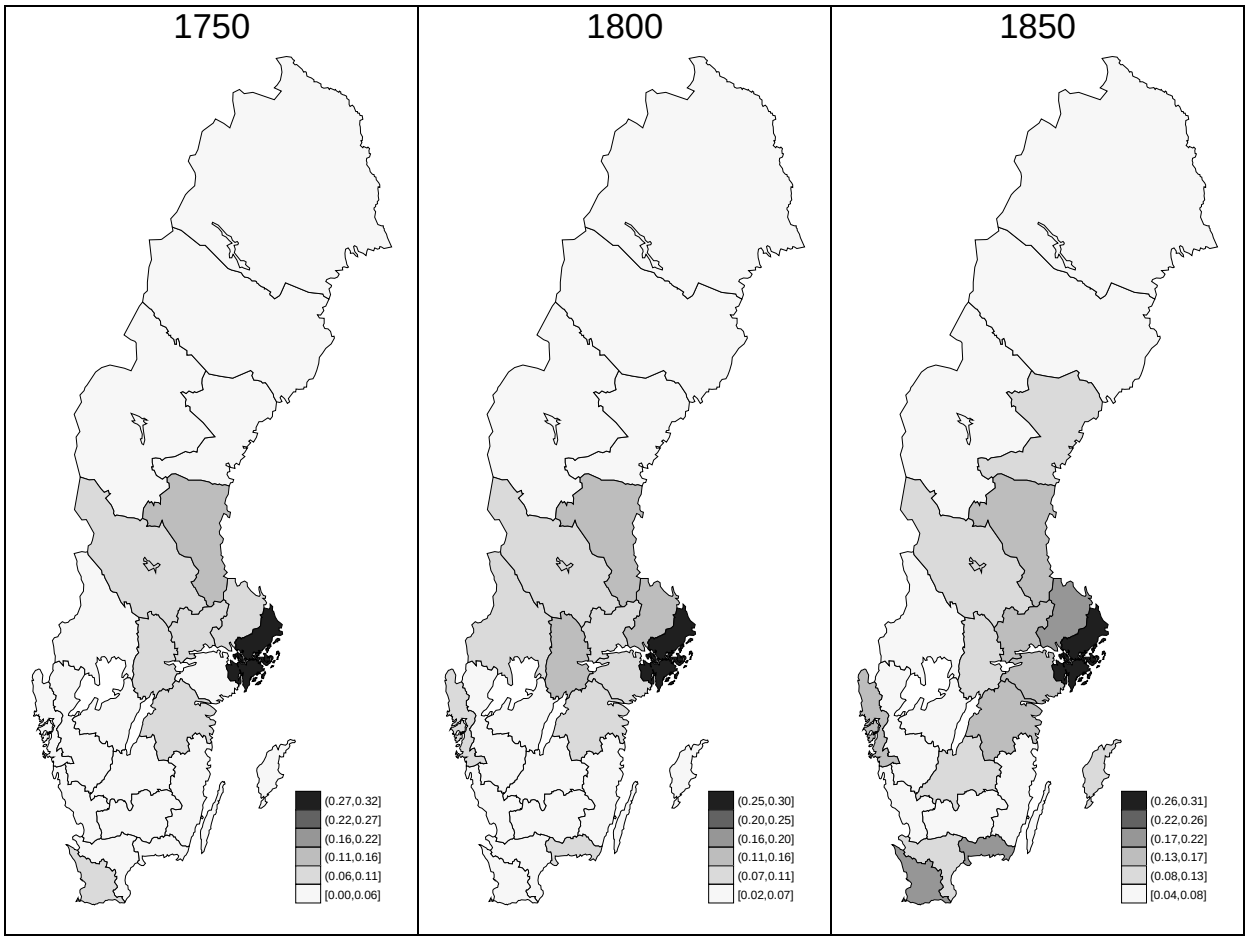
Source: Our elaboration on Enflo and Missiaia (2017) using 5 sectors: agriculture, manufacturing, mining, private services and public services.

Figure 5. Within and between components of the Theil index, 1750-1850.



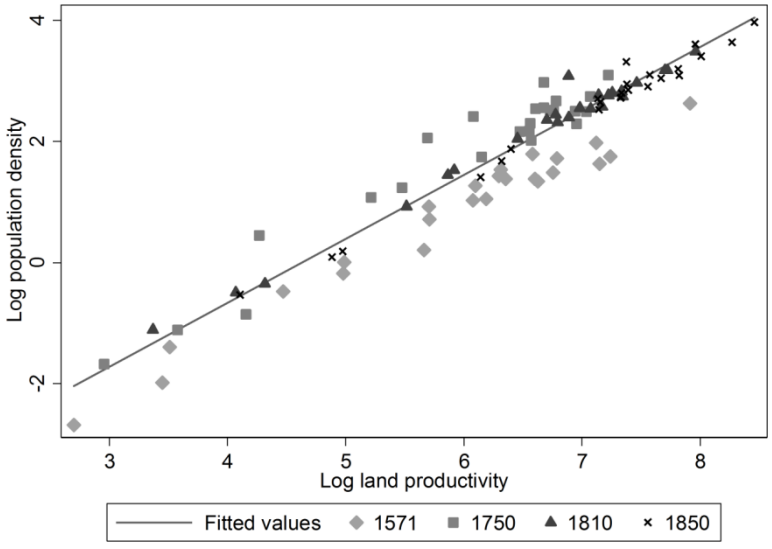
Source: see Table 2.

Figure 6. Share of industrial workers in each region, 1750-1850.



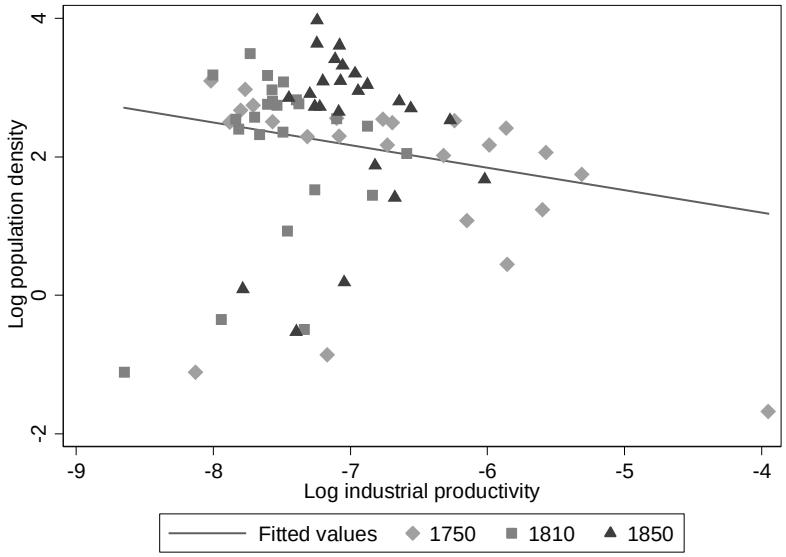
Source: our elaborations from Enflo and Missiaia (2017).

Figure 7. The logarithm of value added in agriculture divided by land area (land productivity) and the logarithm of population density 1571-1850.



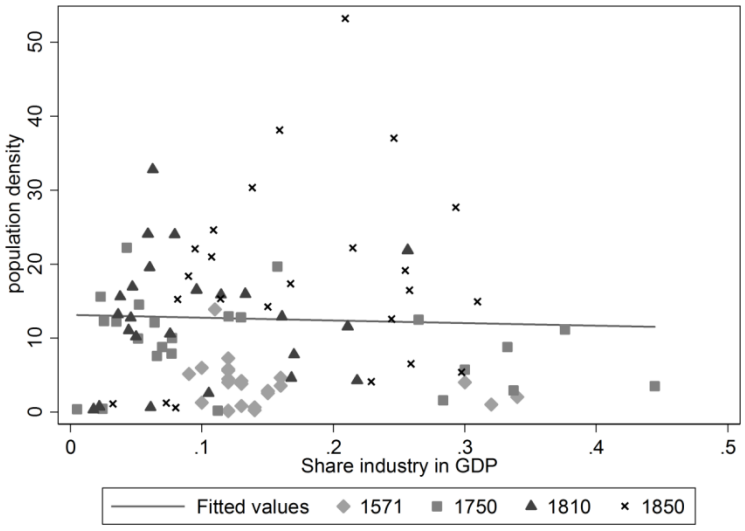
Source: our elaborations on Enflo and Missiaia (2017) for value added and population. The area used is land area (excluding lakes) from Statistics Sweden.

Figure 8. The logarithm of value added in industry divided by workers (industrial productivity) and the logarithm of population density 1750-1850.



Source: our elaborations on Enflo and Missiaia (2017) for value added and population. The area used is land area (excluding lakes) from Statistics Sweden.

Figure 9. Industrial specialisation (share of industry in total value added) and population density 1571-1850.



Source: our elaborations on Enflo and Missiaia (2017) for value added and population. The area used is land area (excluding lakes) from Statistics Sweden.

References

Andersson-Palm, L. (2016) Sweden's 17th century – a period of expansion or stagnation? *MIMEO Gothenburg University.*

Ashraf, Q. and O. Galor (2011) Dynamics and Stagnation in the Malthusian Epoch, *American Economic Review* 101(5): 2003-2041.

Bengtsson, E., A. Missiaia, M. Olsson and P. Svensson (2017) Wealth Inequality in Sweden, 1750–1900, *Economic History Review* forthcoming.

Berger, T. (2016) Engines of Growth: Essays in Swedish Economic History, *MIMEO Lund University*.

Boëthius, B. (1951) *Gruvornas, hyttornas och hamrarnas folk – Bergshanteringens arbetare från medeltiden till gustavianska tiden*, Tidens Förlag. Stockholm.

Buyst, E. (2017) Growth and Regional Imbalances during Belgium's Classical Industrial Revolution, *Journal of Interdisciplinary History* forthcoming.

Edvinsson, R. (2013a) New Annual Estimates of Swedish GDP in 1800-2010, *Economic History Review* 66: 1101–1126.

Edvinsson, R. (2013b) Swedish GDP 1620-1800: Stagnation or Growth? *Cliometrica* 7(1):37-60.

Enflo, K., M. Henning and L. Schön (2014a) Swedish regional GDP 1855-2000 Estimations and general trends in the Swedish regional system, *Research in Economic History* 30: 47-89.

Enflo, K., C. Lundh and S. Prado (2014b) The role of migration in regional wage convergence: Evidence from Sweden 1860–1940, *Explorations in Economic History* 52: 93-110.

Enflo, K. and A. Missiaia (2017) Regional GDP estimates for Sweden, 1571-1850, *Lund Papers in Economic History* 162.

Enflo K, and J. Rosés (2015) Coping with regional inequality in Sweden: Structural change, migrations and policy, 1860-2000, *Economic History Review* 68(1):191-217.

Felice, E. (2011) Regional value added in Italy, 1891–2001, and the foundation of a long-term picture, *Economic History Review* 64(3): 929-950.

Fouquet, R., and S. Broadberry (2015) Seven Centuries of European Economic Growth and Decline, *Journal of Economic Perspectives* 29(4):227-44.

Gadd, C.J. (2011) The agricultural revolution in Sweden 1700-1870, in J. Myrdal and M. Morell, *The agrarian history of Sweden: from 4000 BC to AD 2000*, pp.118-64. Nordic Academic Press. Lund.

Geary, F. and T. Stark (2002) Examining Ireland's Post-Famine Economic Growth Performance, *Economic Journal* 112(482): 919-935.

Heckscher, E. (1968) *An Economic History of Sweden*. Harvard University Press. Cambridge (MA).

Kander, A., P.Malamima and P. Warde (2013) *Power to the People: energy in Europe during the last five centuries.* Princeton University Press. Princeton.

Martínez-Galarraga, J., J.R. Rosés and D. Tirado (2015) The Long-Term Patterns of Regional Income Inequality in Spain, 1860–2000, *Regional Studies* 49(4): 502-517.

Milanovic, B., P. Lindert and J. Williamson (2011) Pre-Industrial Inequality, *Economic Journal* 121(551): 255-272.

Mokyr, J. and H.J. Voth (2010) Understanding growth in Europe, 1700- 1870: Theory and evidence, in K. O'Rourke and S. Broadberry, *The Cambridge Economic History of Modern Europe*, pp.7-42. Cambridge University Press. Cambridge.

Olsson-Spjut, F. (2007) Järnhanteringens dynamik: Produktion, lokalisering och agglomerationer i Bergslagen, *MIMEO Umeå University.*

Olsson, M. and P. Svensson (2010) Agricultural growth and institution: Sweden, 1700–1860, *European Review of Economic History* 14: 275–304.

Palma, N. and J. Reis (2016) From Convergence to Divergence: Portuguese Demography and Economic Growth, 1500-1850, *GGDC Research Memorandum* 161.

Prado, S., K. Collin, K. Enflo and C. Lundh (2016) Regional wage convergence of farm workers in Sweden, 1732–1980, *MIMEO Gothenburg University.*

Rosés, J.R., J. Martínez-Galarraga and D. Tirado (2010) The upswing of regional income inequality in Spain (1860–1930), *Explorations in Economic History* 47(2): 244-257.

Rosés, J.R. and N. Wolf (forthcoming) *The Economic Development of Europe's Regions – A Quantitative History Since 1900.* Routledge. London.

Schön, L. (1988) *Historiska nationalräkenskaper: Industri och hantverk 1800-1980*. Skrifter utgivna av ekonomisk-historiska föreningen, Vol LIX. Lund.

Schön, L. (2010) *Sweden's road to modernity: An Economic History*, SNS Förlag. Stockholm.

Schön, L. and O. Krantz (2012) The Swedish economy in the early modern period: constructing historical national accounts, *European Review of Economic History* 16(4): 529-549.

Schön, L. and O. Krantz (2015) New Swedish Historical National Accounts since the 16th Century in Constant and Current Prices. *Lund Papers in Economic History* 140.

Shaw-Taylor, L. and E.A. Wrigley (2014) Occupational Structure and Population Change, in R. Floud, J. Humphries and P. Johnson, *The Cambridge Economic History of Modern Britain: Volume I, 1700-1870*, pp.53-88. Cambridge University Press. Cambridge.

Skansjö, S. (1997) *Skånes Historia.* Historiska Media. Lund.

Söderberg, J., U. Johansson and C. Persson (1984) Stagnating metropolis, economy and demography in Stockholm 1750-1850, *Stockholm University* research report 4.

Utterström, G. (1957) *Jordbrukets arbetare: Del 1, levnadsvillkor och arbetsliv på landsbygden från frihetstiden till mitten av 1800-talet.* Stockholms Högskola. Stockholm.

Van Zanden, J. L. (1995) Tracing the beginning of the Kuznets' Curve, *Economic History Review* 48(4): 643-664.

Wallis, P., J. Colson and D. Chilosi (2017) Structural Change and economic growth in the British economy before the Industrial Revolution, 1500-1800, *Journal of Economic History* forthcoming.

Williamson, J. (1965) Regional Inequality and the Process of National Development: A Description of the Patterns, *Economic Development and Cultural Change* 13(4:2): 1-84.