The Historical Gender Gap Index

A Longitudinal and Spatial Assessment of Sweden, 1870-1990

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Abstract. – Our knowledge of the long-run evolution of gender equality is limited. We currently lack quantitative indicators capable of capturing the variations on and changes in the individual dimensions of gender equality. This paper seeks to assess the long-run evolution of gender roles and relations in Sweden. To this end, we build a database with quantitative indicators of gender equality. These indicators allow us to construct a Historical Gender Gap Index (HGGI), which is used to describe and analyze the evolution of gender equality in Sweden during a phase characterized by industrialization, urbanization and demographic transition. We find that after a period of stagnation, Sweden from the 1940s onwards made significant progress in closing the gender gap to reach the high level of gender equality that it is now famous for. All counties have made substantial improvements in closing the gap over time, although some counties have been quicker than others. Our investigation reveals the existence of a convergence pattern between counties.

Keywords: Gender Equality • Index • Development Process • Sweden

JEL Codes: J16, N33, O11

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1. Introduction

Despite the recognition of gender equality and the empowerment of women and girls as key goals for sustainable development and the progress made in recent years, gender differences persist and continue to be a major challenge for both developed and developing countries. Yet we still know very little about the way that gender roles and relations evolved in the past. In particular, we lack consistent and comprehensive summary measures for quantifying how much gender gaps evolved over time and across space. Such measures are instrumental in deepening our understanding of the relationship linking gender equality and economic development in the long run.

Theoretical contributions have highlighted various mechanisms and channels through which gender equality fosters economic development, e.g. fertility decisions, human-capital formation, or as a source of productive workers, to list a few of them.[1] Among them, Diebolt and Perrin (2013, 2019) argue that female empowerment and the movement toward greater gender equality was at the origins of the demographic transition and involved in the take-off to modern economic growth. More specifically, they point out that the evolution of family organization away from a clear division of the roles toward a greater equality between spouses has been a crucial ingredient of the transition to sustained economic growth. Yet few studies have explicitly considered the impact of gender equality on economic development from a historical perspective. Most evidence supporting the positive effect of gender equality on economic growth are based on modern data (e.g. Hill and King, 1995; Dollar and Gatti, 1999; Klasen, 1999; Seguino, 2000; Klasen, 2002; Knowles, Lorgelly and Owen, 2002; Klasen and Lamanna, 2009, among others).[2] Although the literature on gender history is vast, contributions are typically based on qualitative evidence or are delimited to particular gender gaps, such as those concerning wages or education. The lack of consistent indicators capturing gender differences and/or similarities is one of the crucial reasons why we still know very little about the evolution of gender relations in the past, and therefore how much it contributed to the development process.[3]

A few contributions have attempted to construct indices to capture the size of gender (in-)equality in the past. The work of Perrin (2014), which looked at the gender gap in France in the middle of the nineteenth century, was the first proposing the construction of such an index at the historical level, and then to investigate its association with economic development (Perrin, 2021). Using a similar methodology, Dilli et al. (2019) constructed a gender equality index for a collection of 129 countries during the period 1950 to 2003. Despite these recent works, there is still a lack of macroeconomic appraisal of the various dimensions of the gender gap in the past.[4] Given the vast differences between the methods of statistical agencies at the national level for defining and measuring variables of interest, we believe that the most fruitful approach for research on the historical gender gap is to consider variation within countries and use sub-national entities as the main units of analysis. Moreover, the evolution of gender gaps over time at the national level may hide important variation within countries.

[1] See Klasen and Santos Silva (2018) for a detailed and exhaustive review of the theoretical literature.
[2] See Cuberes and Teignier (2014) for a presentation of the empirical literature.
[3] Various indices are proposed by European and worldwide institutions, such as the UN, OECD, European Commission, or the World Economic Forum, to offer comprehensive measures of gender (in)equality, discrimination against women or gender empowerment. In 1995, the UN was the first to launch an annual construction of a Gender Development Index and Gender Empowerment Measure to track the evolution of gender relations over time.
[4] Complementary work and contributions have developed indicators capturing additional characteristics of gender differences. Among them, Carmichael et al. (2011) have developed a 'Girl Power Index', measuring the difference between the female mean age at marriage and the spousal age gap to capture the relative power that women have in the household and more globally in societies. A second type of index was developed by Gruber and Szoltysek (2016): the Patriarchy index. Compared to the Girl power index, the Patriarchy index puts more emphasis on intergenerational aspects. This indicator – constructed from microdata for 91 regions in Europe – has been shown to correlate strongly with other measures of gender equality (Szoltysek et al., 2017).

The current paper aims to contribute to this literature by providing a method for one country that could be generalized and applied to others and at various geographic levels. In this endeavor, we investigate the case of Sweden, a particularly interesting country from the standpoint. On the one hand, Sweden is generally regarded as a leading country in the field of gender equality. Since the World Economic Forum launched its annual global gender gap report in 2006, Sweden, along with its Scandinavian neighbors, has consistently ranked among the top countries (4th with 82% in 2020). On the other, it is well established that Sweden in the period 1870-1970 was among the fastest growing economies in the world; in those ten decades the country also experienced a sharp decline in fertility and the profound modernization of many aspects of society. The problem is that, while we know a good deal about economic growth in Sweden's history, we have only a dim idea of what the long-term development of gender equality may have looked like. Although we may assume that Sweden began to take substantial steps toward closing the gender gap and emerging as an international role model in the second half of the twentieth century, we know very little about how the gender gap, broadly defined, evolved over time.[5] How have various components of the gender gap been related? Has the closing of the gender gap been a uniform pattern across the country or were particular regions spearheading the development?

The purpose of this paper is to assess the long-run evolution of gender roles and relations in Sweden by constructing a spatial historical gender gap index. We have collected and digitized an important set of data on the various dimensions of gender equality – over time and across space. The index covers the 1870-1990 period, in 10-year intervals, and provides information for the 24 Swedish counties (NUTS-3 regions). We use a disaggregated approach that has the advantage to offer a better appraisal of the differences existing within large macroeconomic entities. Accordingly, we are able to capture the diversity and the size of the gender gap within Sweden, during a key phase characterized by industrialization, urbanization and demographic transition. The construction of the index allows us to track the evolution of gender equality over 120 years and to identify the strengths and weaknesses of Sweden in closing the gender gap. Beyond offering a method that could be used and generalized, and highlighting the strengths and weaknesses of Sweden, an additional contribution of this paper is to provide preliminary explanations of the key forces behind the evolutions observed over time and across space.

The article is organized as follows. Section 2 sets up the scene by providing a contextual background and presenting some of the main characteristics of the Swedish counties. Section 3 presents the data and method used to calculate the Swedish spatial historical gender gap index. Section 4 presents the national index and the spatial distribution of the index across Swedish counties. Section 5 discusses convergence between counties. Section 6 sums up the main results and opens the discussion on future research.

2. Setting the Scene – Sweden and its Counties

2.1. Economic Growth, Democratization and the Welfare State

Extensive research has been conducted about Swedish economic growth. Swedish historical national accounts go back as early as the sixteenth century (Edvinsson, 2005; Lobell, Schön and Krantz, 2008; Schön and Krantz, 2012) and at the regional level have been advanced to account for regional trends with the elaboration of estimates (Enflo, Henning and Schön, 2014; Enflo and Missiaia, 2018).

[5] In recent decades, Sweden has been known among the developed economies for its low gender wage gap and its high rates of labor force participation. Yet it should be recalled that married women's entrance into the labor market was to a great extent confined to part-time work (Stanfors, 2014) and that Sweden does not stand out as a country where women have managed to reach the very highest positions in the private sector (Datta Gupta et al., 2008).

Sweden was one of the world's fastest-growing economies between 1870 and 1970, concurrently undergoing a steep reduction in the birth-rate and thoroughgoing social modernization. In the mid-nineteenth century, Sweden was still a predominantly rural society that had experienced some decades of rapid population growth and pronounced agricultural reforms. The demographic transition had begun with decreasing levels of infant and child mortality, resulting in growing numbers of adults without access to land. A growing demand for oats and timber from England and other advanced countries stimulated the country's early resource-based industrialization, which towards the turn of the century became increasingly focused on products with higher value added. Meanwhile, the internal market for consumer goods was expanding as farmers benefited from enclosures and increased opportunities to participate in export production.

Nineteenth-century Sweden has been described as "the impoverished sophisticate" (Sandberg, 1979); that is, a poor country with remarkably high levels of literacy and sophisticated capital market institutions. Another characterizing feature of social development in the nineteenth century was the spread of popular movements, of which the revivalist, the temperance and the labor movements are most often thought of (Lundkvist, 1977). Women could and did participate in the revivalist and temperance movements, and to a lesser extent in the labor movement. The Swedish women's movement was less radical than its English counterpart; female suffrage was not achieved until 1919 (Holgersson and Wängnerud, 2018; Östberg, 1997). Still, leading advocates of the Swedish women's movement achieved some influence in existing parties and made important advances in the 1920s and 1930s (Jonsson and Neunsinger, 2011). Among the important signs of progress, the marriage bar for women employed in the public sector was lifted in 1925 and in 1939 a more general prohibition of marriage bars was introduced (Frangeur, 1998).

However, Sweden was not spearheading the movement towards democracy (Bengtsson, 2019). Initially, democracy was associated with political instability. Weak minority governments replaced one another until 1932, when the Social Democrats and the Farmers Party struck a deal that is thought to have laid the foundations for major welfare reforms. While some early reforms were launched in the 1930s, including opening up secondary education for girls, the major expansion of the Swedish welfare state ensued after World War II. Some of these systems, such as child-care provision, helped to free the female labor force, but only after a substantial lag (Nyberg, 2000). The public sector also became the major employer of women, especially after the decline of the female-dominated textile and garment industry in the 1950s and 1960s. A notable institutional reform in this era, indicating the dual breadwinner norm that came to characterize the Swedish welfare state, was the introduction of separate taxation for husbands and wives in 1971 (Gustafsson, 1992).

2.2. Sweden in Gender History

The past 40 years have seen an upsurge of gender history in Sweden (Nyström, 2015). While this academic field had early connections with quantitative social history (cf. Göransson, 1988), its mainstream, following the influential work of Yvonne Hirdman (1990) has had a clear theoretical flavor, centered on the study of power relationships and discourses.[6] With some notable exceptions, most of this research has been qualitative in nature and not been aimed at creating long time series.

[6] The strong position of gender history in Sweden was manifested in the active participation of Hirdman in a government-appointed scholarly commission on "the distribution of power and influence within different sectors of Swedish society" in 1985-1990 (Maktutredningen, 1990, p. 471). Another leading gender historian, Lena Sommestad, participated in the Welfare Commission in the 1990s (Kommittén Välfärdsbokslut, 2001).

While Swedish gender history has been tilted towards the past two centuries (Fiebranz et al., 2011), there is also substantial literature on the pre-historical, medieval and early-modern periods. Ideas on the role of women in the Viking age, reflecting contemporary norms, have shifted over time from women being depicted as housewives in the late nineteenth century to the current emphasis on their relative independence (Arwill-Nordbladh, 1998; Borgström, 2002). As observed by Sawyer (1993), western and eastern Scandinavia had different legal traditions on inheritance and the definition of families. In the west, men had priority as heirs and a woman was included in her husband's family upon marriage. In the east, to which the Swedish core region belongs, women were on an equal footing with regard to inheritance and marriage pre-supposed a new family. Some scholars have suggested that the adoption of Christianity restricted women's roles, whereas others have pointed to the importance of women, and matrimonial ancestral links, for state building. Because permanent family names in Scandinavia were not introduced until the late medieval period, men could choose to define their lineage to their mothers' side if that yielded most benefit. There was also a significant development in the increasing recognition of women as legal subjects. The early-modern period saw the emergence of Sweden as a great regional power. From this era, there is at least patchy evidence of the way in which women could transcend traditional gender boundaries and undertake male jobs (Lindegren, 1980; Lindström et al., 2017; Gary, 2018). Towards the latter part of the early-modern era, however, women's opportunities as economic and political agents were restricted. For example, the Civil Code in 1734 placed Swedish women under the coverture of their husband (Sweden, 1874). Widows of craftsmen and civil servants were no longer allowed to maintain the work of dead husbands. Women were barred from public secondary schools until 1927 (Schånberg, 2004) and the general franchise was extended to women only in 1919 (Florin and Kvarnström, 2001). But the second half of the twentieth century marked the beginning of an overall shift in attitudes toward women.

Comparative quantitative research on gender history is rare. A bold and recent exception is Buckwalter and Baten's (2019) review of archaeological evidence from the Viking and medieval periods. Based on skeleton remains, the authors argue that Scandinavian women had better nutritional and health relative to men than women had in other parts of Europe, a difference which they attribute the importance of cattle farming. This explanation aligns with the view of Esther Boserup (1970), and more recent studies (Alesina, Giuliano and Nunn, 2013), suggesting that variation in gender inequality across modern societies and individuals has deep historical roots. It is not a line of thought that has been pursued in the fairly rich strand of comparative welfare-state research with gender focus. According to Lewis (1992), the most influential writer in this field, Sweden did not enter its distinctive path toward a "dual-breadwinner model", until the late 1960s and early 1970s. In this account, three reforms were of particular importance for boosting female participation in labor force, namely, separate taxation, the expansion of public child-care and parental insurance. Lewis' explanation is political, emphasizing the role of Social Democratic governments. Sommestad (1997, p. 174) shifts attention to the inter-war period as the formative years of the "comparatively gender-neutral model of citizenship", under the influence of a perceived population crisis caused by emigration and low fertility levels. In this context, Swedish politicians became more receptive to ideas of a universal welfare state, most forcefully advocated by Alva and Gunnar Myrdal. The explanations of Lewis and Sommestad are to some extent complementary and share an understanding of Swedish gender equality as a twentieth century phenomenon. Both Lewis and Sommestad regard political factors as key determinants of gender equality. Economic and demographic forces are acknowledged, but mainly as motivators of political reform, not as explanations on their own. Moreover, both Lewis and Sommestad focus on decisions at the national level, and neither of them pays attention to regional diversity.

2.3. Sweden and its Regions

Sweden is a sparsely populated country. It covers a huge area, including areas where the soil quality and climate zones vary; some parts show historical concentrations of land ownership while others were dominated by self-owning farmers. Situated as it is on a north-south axis, it is reasonable to assume that it would have generally varied economic and social structures and that these might have implications for the gender gap in some regards.

Our account of the development of the HGGI has two levels of analysis: Sweden as a whole and its 24 individual counties. The county organization, which was established for administrative reasons in the seventeenth century, was largely stable from 1810 onwards. Previous researchers have frequently used the county-level of observation (equivalent to NUTS-3 regions) in an aggregated way, by focusing on the three "lands": Norrland (the north), Svealand (the east) and Götaland (the west). An influential example of this is found in Emigrationsutredningen (1908), where the geographer Gustav Sundbärg observed distinct demographic patterns in the three lands. Historically, Svealand, in particular the east-central part (the counties surrounding Stockholm), has been the most affluent part of the country (Söderberg, 1993). Agriculture in the east-central region, and in the southernmost part of the country (Malmöhus), was to a greater extent than elsewhere dominated by manors and focused on crop production. Farming in northern Sweden, whose interior was not colonized until the eighteenth and nineteenth centuries, was diversified and more based on cattle rearing. Götaland, and western Sweden in particular, enjoyed an upswing in the early half of the nineteenth century, manifested in the large-scale export production of oats. East-central Sweden regained its position as the most dynamic part of the country when the process of industrialization took off in the second half of the century (Söderberg, 1984). This period also saw growth in the south (Malmöhus) and the north of the country. Striking features of early industrialization in Sweden were its spatial diffusion and rural character. Early industrialization was to a great extent built upon the exploitation of natural resources, such as timber in the north (the counties of Gävleborg, Västernorrland, Västerbotten and Norrbotten), and iron in Bergslagen. The textile industry, which produced goods for the domestic market, had its center in Älvsborg, in western Sweden, whereas the mechanical engineering industry was more important in east-central Sweden. Although known for its glass works, south-eastern Sweden was for a long time relatively untouched by industrialization and urbanization.

The second phase of industrialization, beginning around 1900 and completed around 1930, was associated with relative decline in the north of Sweden, as well as in the larger cities, when low-wage industries moved to regions with cheaper labor (Berger et al., 2012). The maturation of the industrial society in the period 1930-1960 saw regional convergence. Overall, the first half of the twentieth century also put an end to the rural character of Swedish industry. In 1900, 60 percent of manufacturing employment was found outside cities (Berger et al., 2012). In 1953, the proportion was 47 percent, and much lower for industries such as metal-working and machinery.

Quite a few pieces of ethnographic evidence suggest regional differences in women's work. It has, for example, been observed that in the grain-producing areas dominated by manors women were more confined to the home (Nyberg, 1987). Taking care of cattle, milking in particular, was often considered as a "female" task (Sommestad, 1994). So far, few researchers have quantitatively explored and analyzed the evolution of gender roles and regional economic development in Sweden. The main exception is Schultz (1985), who exploits regional differences in agricultural production to analyze the relationship between labor demand and fertility in the period 1860-1910.[7] Schultz uses the relative prices of animal products and grains to identify changes in the demand for women's labor at the county-level and finds that higher butter prices coincided with a reduction in the birth-rate.

[7] For some preliminary explorations, see Clivemo, Stanfors and Önnerfors (2019) and Kok (2018, 2019).

The relatively limited investigations conducted at the regional level might reflect the fact that Sweden in the latter half of the twentieth century appeared to be a highly centralized country. In fact, centralization is sometimes presented as a defining feature of the Swedish Model (Magnusson, 2000). Yet this may be a matter of writing history backwards. Given the geographical variety within Sweden, both with regard to natural resources and socio-economic structure, analysis at the regional level may have an untapped potential.

3. Data and Method

The question addressed in this paper requires working from a long-run and disaggregated comparative perspective. In order to explore the size of the gender gap, we build up gender-related variables in three critical categories: *(i)* economic participation and opportunity; *(ii)* health and survival; and *(iii)* political empowerment.

3.1. Data

Our database consists of transversal and longitudinal data that allow the construction of a number of socio-economic, demographic, and political variables. We have made use of official publications, such as censuses and statistics on population and manufacturing industry, which are available from the nineteenth century onwards and often contain detailed information by gender. We focus on the period between 1870 and 1990. Digitized Population Censuses, conducted every ten years from 1860 onwards, also constitute an important source of material for capturing regional variations. Thanks to Sweden's extraordinary data, we can provide an overview of gender disparities in the most important dimensions captured by a contemporaneous composite index.

Economic Criteria. – Economic participation and opportunities, as a category, includes aspects such as labor force participation and wages. Male and female labor force participation is estimated from information from population censuses. The variable is defined as the number of women (men) with gainful employment divided by the female (male) population aged 15 and over. To assess the gender wage gap, we use a range of different sources. For the years 1870 to 1920, relative hourly wages are constructed using agricultural wage data. Over this period, Sweden remained largely agrarian, although the industrial sector slowly started to grow. Starting from 1930, wages are calculated using information from manufacturers. Wages are constructed from this as the weighted average of wages paid in different industries, using the number of total work hours as weights. Data on wages are not available for every point of the period under consideration. Consequently, the wages for the years 1930, 1950, and 1960 correspond to the closest available information, namely, 1931, 1949, and 1962, respectively.

Health Criteria. – With regard to health and survival, we take advantage of Sweden's population statistics to calculate crude mortality rates for females and males. The rates are calculated as the number of deaths per thousand people. We use a second measure to assess the gap in health: the female-to-male live births, defined as the number of girls born alive divided by the number of boys born alive. This measure aims to assess parents' relative preference for boys over girls. In certain economic and cultural contexts, unbalanced sex ratios can reflect practices such as female infanticide (and/or mortal neglect of young girls).

Political Criteria. – Political representation is difficult to include in a historical assessment of the gap between men and women. However, our period of investigation includes the major extensions of the franchise in 1918-1919, after which most men and women earned the right to vote and be elected at the municipal level.

We use data on men and women elected in municipal elections (*kommunala val*) to capture the political participation of women relative to men. These elections took place every fourth year from 1922, and every third year after 1970.

Table 1: Summary Statistics

Variables	Obs.	Mean	Standard Deviation	Min.	Max.
Economic Variables					
Female-to-male labor force	**312**	**0.4314**	**0.1627**	**0.2494**	**0.8943**
Female labor force		33.61	8.84	20.05	60.85
Male labor force		80.49	8.68	59.04	93.02
Female-to-male wage	**312**	**0.6663**	**0.1365**	**0.4263**	**0.9567**
Female wage agriculture		0.7928	0.4017	0.12	2.25
Male wage agriculture		1.4146	0.6865	0.17	3.5
Female wage industry		1.1192	0.4530	0.55	2.07
Male wage industry		1.75	0.6417	0.92	3.31
Health Variables					
Female-to-male mortality (inverted)	**312**	**1.0127**	**0.0908**	**0.8292**	**1.3388**
Female mortality		13.42	3.64	6.78	25.93
Male mortality		14.31	3.85	8.13	30.20
Female-to-male births	**312**	**0.9474**	**0.0307**	**0.8558**	**1.0523**
Girls living births		2399.34	1495.60	314	12367
Boys living births		2533.34	1580.28	339	12956
Political Variable					
Female-to-male elected	**312**	**0.1033**	**0.1658**	**0**	**0.7336**
Females elected in municipal elections		92.78	79.66	0	559
Males elected in municipal elections		870.25	498.65	20	2722

Sources: Using data from SCB

Note: Statistics about wages in agriculture and industry concern the periods 1870-1910 and 1930-1950, in turn. For the purpose of statistical comparability, only the years for which data are expressed in similar units are presented in the table.

Table 1 reports the descriptive statistics of the variables used in the construction of the gender gap index. The share of individuals working evolved substantially over time and across space. Despite these substantial evolutions for both genders, men over the studied period remained dominant in the labor market. On average, 80.5% of men were working against 33% for women. The labor force participation spreads from a minimum of 20% (in Gävleborg, 1890) to reach a maximum of 60.8% (in Stockholm, 1990) for women, and from a minimum of 59% (in Jämtland, 1980) to a maximum of 93% (in Stockholm, 1910) for men. The average female-to-male labor force participation is 0.43, meaning that on average Swedish counties closed 43% of the gender gap between 1870 and 1990. The Swedish counties succeeded in closing the wage gap by 67%, although differences persisted throughout the entire period, from a minimum of 43% (in Västerbotten, 1870) to a maximum of 96% (in Gotland, 1990).

Regarding the health and survival variables, Table 1 displays relatively similar mortality rates and numbers of living births between men and women, both being on average relatively close to gender equality, with

lower heterogeneity across counties than can be observed for other variables. Yet gender differences exist. Hence the (inverted) female-to-male mortality spreads from a minimum of 83% (in Skaraborg, 1940) to a maximum of 134% (in Västerbotten, 1970); and the female-to-male births from 86% (in Jämtland, 1880) to 105% (in Halland, 1930). The highest female mortality rate is found in 1870 in Norrbotten, while that of males is found in Stockholm the same year.

Turning to political empowerment, the overall average of female-to-male elected is very low; counties closed only 10% of the gender gap over the period of interest. The ratio, however, substantially increased over time and across space: from 0% it reached a maximum of 73% in Stockholm in 1990, i.e. a representation of 73 women for 100 men.

3.2. Method

The HGGI is constructed in line with the Gender Gap Index introduced by the World Economic Forum in 2006 (Hausmann, Tyson and Zahidi, 2006). The index captures the size of the gap between men and women in three critical areas: economic participation and opportunities, health and survival, and political empowerment.[8] It provides a comprehensive measure of gender equality easily comparable with other variables, i.e. economic, demographic or cultural variables, from a historical perspective. The index is constructed by measuring gaps between men and women, independently of the level of development of the considered area. Reasoning in terms of gaps and not in terms of levels enables us to focus strictly on gender differences. The methodology ensures the integration of the same relative impact on the sub-index for each variable. The overall HGGI is calculated as a simple average of the sub-indices.

The index is constructed using a five-step process in line with the one used by Hausmann, Tyson and Zahidi in computing the Gender Gap Index 2006. The procedure is applied to the 5 gender-related dataset variables, consisting of 24 county-level observations.

Step 1: Conversion to ratios. – The index consists in measuring the gaps between men and women, with the condition that the indicators are a priori independent of the level of development of the county. Richer counties, for instance, might have more job opportunities for their population. Therefore, reasoning solely in terms of gaps and not in terms of levels enables us to focus strictly on gender differences, all other things being equal. Hence, as a first step, we convert all our data into female-to-male ratios. For instance, a county with 32% of women in paid activity and 77% of men is assigned a ratio of 32/77 = 0.42 on this variable.

Step 2: Data rescaling and truncation at equality benchmark. – The second step of the process involves rescaling the natural female-to-male ratios at the equality benchmark and truncating the ratios to one. Truncating the data at the equality benchmark enables us to assign the same score to a country that has reached parity between women and men and to a country where women have surpassed men. This equality benchmark is considered to be 1 – meaning equal numbers of women and men – on all variables except the health variables. In human societies, the sex ratio (also called the secondary sex ratio) varies according to the age profile of the population but may also be affected by environmental and social factors. Grech et al. (2002)

[8] Despite the very rich data from the Swedish Central Bureau of Statistics, there is no standardized data gathering information about boys' and girls' education at the national level, nor at the county level. Existing data, tracking the evolution of schooling in the past, do not distinguish genders. Hence, contrary to the original gender gap index, our current index does not include the education dimension of the gender gap. Sweden is known for being a leading country with regard to educating its population without gender distinction. Primary schooling was made mandatory (in 1842) and became universal in the nineteenth century. Integrating educational indicators would not deeply affect the trend of our current index, for literacy rates and schooling were already very high for both genders over the period under review. Appendix B discusses in greater detail the evolution of educational attainments at the national level.

have estimated the natural sex ratio at birth to be close to 1.06 males per 1 female. Accordingly, the equality benchmark is set to be 0.944 to correct for the natural factors of the sex differential. Similarly, we truncate the reversed mortality ratio according to the equality benchmark set to be 1.06.[9] We use the reversed value of the mortality ratio in order to work with a dataset with the same sign on interpretation (i.e. the higher the value, the better the score) that integrates in this case the positive effect of having a low mortality ratio in the health outcome. The equality benchmark needs to remain fixed to allow the evolution of counties over time to be tracked.

Step 3: Calculation of weighted averages. – As a third step, we calculate the weighted average of the variables within each sub-index, in order to calculate the sub-index scores. Through this computation, we aim to give the same weight to all the variables, even though some variables are more volatile than others, shown by their larger standard deviation[10] (see Sugarman and Straus, 1988; Harvey, Blakely and Tepperman 1990). The calculation of sub-index scores involves: *(i)* calculating the standard deviation of each variable; *(ii)* normalizing the variables by equalizing their standard deviations to determine the percentage change in terms of standard deviation to a 1% change of each variable; and *(iii)* using these weights to calculate the weighted average of the variables. The calculation of weights within each sub-index is given in Table 2.

Table 2: Description of Sub-indices and Calculation of Weights

Economic Opportunity	Standard Deviation	Standard Deviation per 1%	Weights
Female-to-male labor force	0.1627	0.0615	0.4562
Female-to-male wages	0.1365	0.0732	0.5438
Total		**0.1347**	**1**
Health and Survival	Standard Deviation	Standard Deviation per 1%	Weights
Female-to-male mortality (reversed)	0.0429	0.2332	0.2934
Female-to-male living births	0.0178	0.5616	0.7066
Total		**0.7947**	**1**
Political Empowerment	Standard Deviation	Standard Deviation per 1%	Weights
Female-to-male election ratio	0.1658	0.0603	1
Total		**0.0603**	**1**

Step 4: Calculation of sub-index scores. – This step consists in calculating the weighted average score of the three sub-indices. This process ensures that the same relative impact will be integrated in the sub-index for each variable – so that a variable for which most counties have already reached equality would be penalized. For

[9] This ratio is based on the standards used to calculate female-to-male life expectancy in the UN's Gender-Related Development Index, which takes 87.5 years as the maximum age for women and 82.5 years as the maximum age for men.
[10] See Figure C1 in the Appendix.

example, the wage ratio in industry – which has a relatively small standard deviation – weighs more within the economic opportunity sub-index than the labor force ratio – which has a larger standard deviation. Similarly, for any variable characterized by a higher ratio and lower variability (i.e. larger weight), a county that deviated would be more heavily penalized.

Step 5: Calculation of final scores. – The last step in the process involves calculating final scores. All sub-indices are bounded between 0 and 1. The value 0 corresponds to perfect inequality; 1 to perfect equality. To create the overall Gender Gap Index, we bring together our three sub-indices by simply taking their (un-weighted) average for each county. The final score is therefore also bounded between 0 and 1, which allows comparisons between counties to be made.

4. Sweden's Strengths and Weaknesses in Closing the Gap

4.1. Longitudinal HGGI

Figure 2 presents the evolution of the HGGI at the national level in the period between 1870 and 1990. The long-run evolution of gender equality in Sweden follows a hockey-stick shape, reflecting the impressive progress made by Sweden's efforts to close the gender gap during the second half of the twentieth century.

Contrary to what many may assume, Sweden has not always been as equal as it is today and may not always have acted as a forerunner. Comparing the economic participation sub-index of Sweden in 1870 to that of France in 1851 (provided by Perrin, 2014), we observe that while Sweden had closed 46% of its gap by 1870, France had already closed 60.5% of its gap by 1851 – a level that Sweden reached only in the 1960s.

Over time, the average level of gender equality in Sweden increased from 48.5% in 1870 to 80.6% in 1990. This means that the gender gap declined by more than 32 percentage points during this period, which corresponds to a 66.2% growth rate. Three periods can be identified: *(i)* a period of stagnation between 1870 and 1910 during which the index remained stable at around 0.48; *(ii)* a tiny (and temporary) improvement observed in 1920, bringing the index to 0.50; and *(iii)* a period of rapid and continuous increase of the HGGI, from 1940 onwards – speeding up between 1970 and 1980 and slowing down in the following decade.

Sweden, in fact, displayed relatively large gender inequalities until the 1940s. At the end of the 1930s it had closed only 50% of its gender gap. The timing suggested by Figure 2 is interesting in the light of previous research, particularly the views of Hirdman and Lewis, according to which the major take-off for gender equality was seen in the late 1960s and early 1970s, although it is true that the pace of change seems to have accelerated around this time. Figure 2 also shows that Sweden's path towards closing the gender gap began earlier. The period from which Sweden made significant improvements in closing the gender gap coincides with the golden age of the Swedish Social Democratic Party from the mid-1930s to mid-1980s – when it got between 44.6% and 46.2% of the votes in half of the general elections, making it one of the most successful political parties in the history of the liberal democratic world (Therborn, 1996). The ideology and policies of the Social Democratic Party are recognized to have had a strong influence on Swedish politics, notably its aim of minimizing social inequalities (Svensson and Gunnarsson, 2012; Bengtsson, 2019). The reforms providing universal social insurance – identified as one of the core parts of the "Swedish Model" – came in the 1940s and 1950s (about a decade after the Social Democrats won the elections).[11] Yet as Hirdman (2012) reminds us, the ideology of the Social Democratic Party of the 1940s and 1950s can hardly

[11] As pointed out by Bergh (2014) and others, the Swedish welfare state was built on a broad political support.

be described as feminist. In this era, even the Social Democratic Women's Union endorsed the norm of male-breadwinner.

Radical reforms addressing gender inequality issues were implemented in the 1960s and 1970s.[12] The reforms aimed notably to further encourage women to participate in the labor market, as well as making it easier for women to combine paid work and family life. The policies in favor of a better integration of women into the public sphere – accounting for measures such as the abolition of joint taxation (Gustafsson, 1992; Selin, 2014), the introduction of publicly financed day-care for children (Gustafsson and Stafford, 1992), and sex-neutral parental leave (see Gunnarsson and Svensson, 2009) – contribute to explain rapid progress made by Sweden in closing the gender gap in economic participation.

The reforms in the 1960s and 1970s coincided with economic changes that expanded women's opportunities in the labor market. As the economy underwent a phase of rationalization, with the introduction of Fordist modes of production, relatively unskilled labor was in high demand (Schön, 2010). Women were also employed in the growing public sector, as nurses, school-teachers and social workers. In many ways, jobs that had once been performed by women at home, without pay, became formal waged work. As argued by Svensson (1995), these structural changes contributed to a compressed gender wage gap, along with higher rates of female participation in the labor force.

The overall gender gap performance is a synthesis of performances across the three dimensions composing the index, measuring economic participation, health and survival, and political empowerment, but it masks potentially significant differences in the gender gap between the dimensions. Figure 3 presents the evolution of gender gaps across the three dimensions. As shown in Figure 3, these gender gaps vary significantly.

The economic sub-index shows a slow but steady increase until 1930, when it temporarily falls and then starts to increase again from 1940, at an accelerating pace. The temporary setback in the 1930s is mainly explained by the relatively lower rates of female participation in the labor market (see Figure C3). This was hardly the result of a widespread introduction of marriage bars.[13] The population structure, along with the opening up of public secondary education for women, was probably a more important cause of the temporary reduction in participation. Relative wages, the other component of the economic sub-index, remained stable in the 1930s but increased substantially thereafter. What happened in the 1940s was probably the result of a general wage compression during World War II, whereas the 1950s saw more explicit policies for eliminating gender wage discrimination from collective agreements. General wage compression reappeared in the period from the 1960s to the early 1980s. This time, wage compression was initially driven by an increased demand for unskilled labor and later by the so-called solidaric wage policy adopted by the labor market parties (Svensson, 1995; Molinder, 2019).

The health and survival sub-index displays very high and stable values over the entire period. Looking at the components of the sub-index separately (see Figure C2 in the Appendix), we note a small decrease in the mortality ratio in 1930, while the ratio of women's and men's death rates remained stable despite the sharp increase in mortality rates caused by the Spanish flu pandemic which affected Sweden in 1918-19 (see Figure C4 in the Appendix).

[12] Hirdman (2012) notes that the feminist ideas underpinning these reforms were first launched by a group of young liberals in 1960 and later by left-wing radicals before being adopted by the social democrats.
[13] While married women's gainful employment was certainly called into question by some groups in these years (Frangeur, 1998), the Swedish Women's Organizations were, unlike their counterparts in, for example, the United States, united in their resistance to marriage bars and similar measures (Sommestad, 1997).

Figure 2: HGGI National – Weighted by the population size of counties

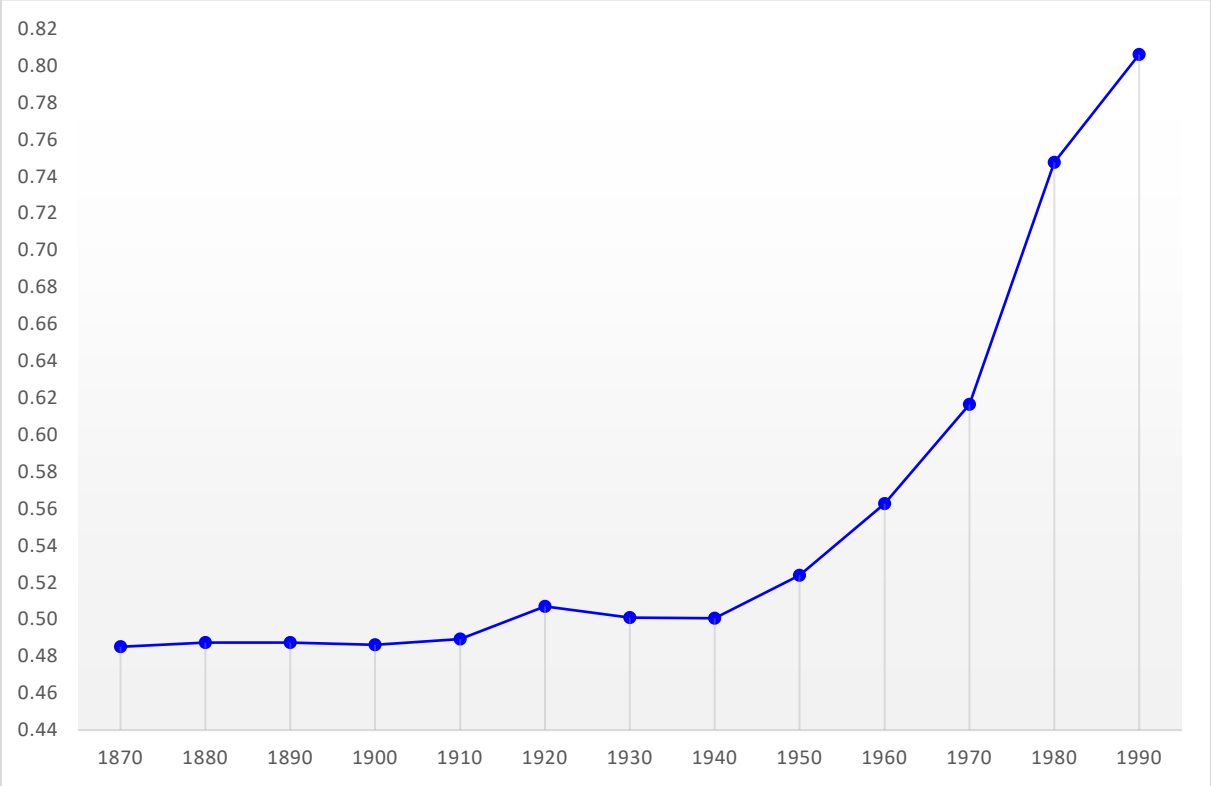
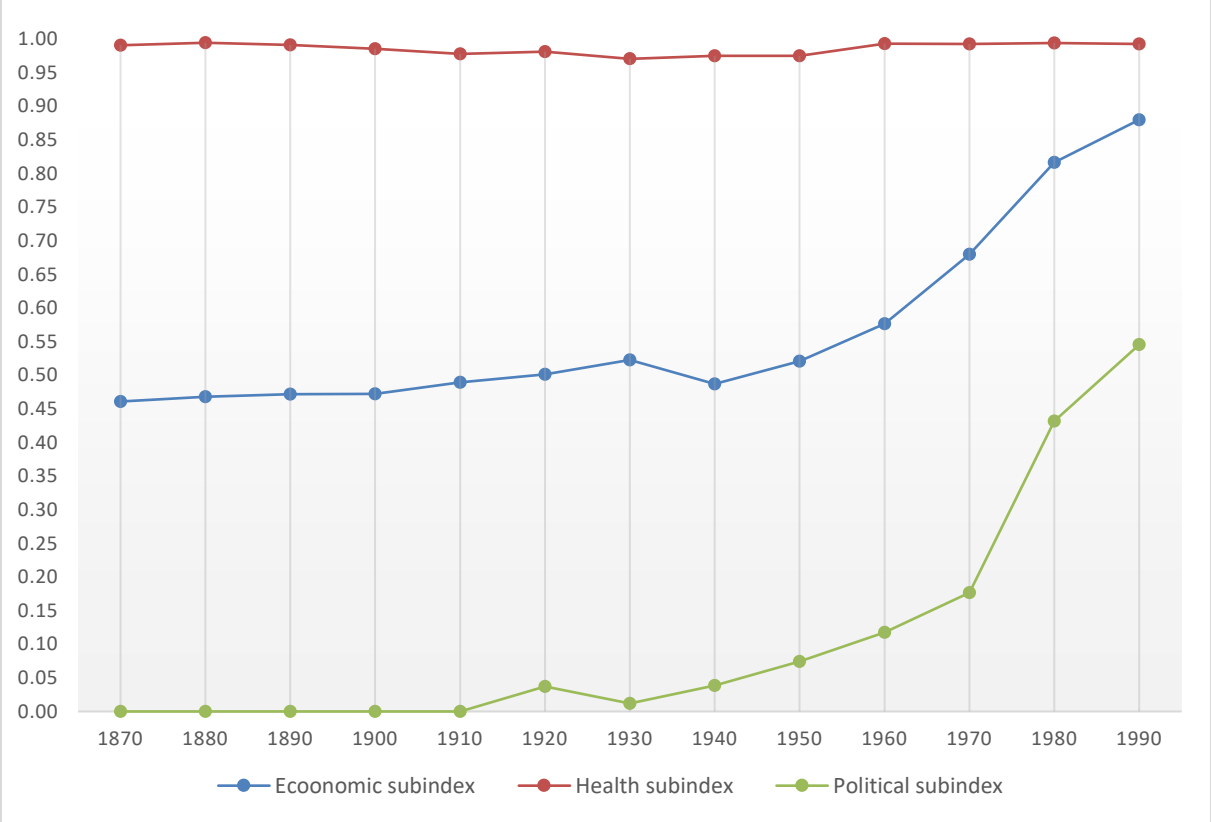


Figure 3: HGGI Sub-indices – Weighted by counties' population size



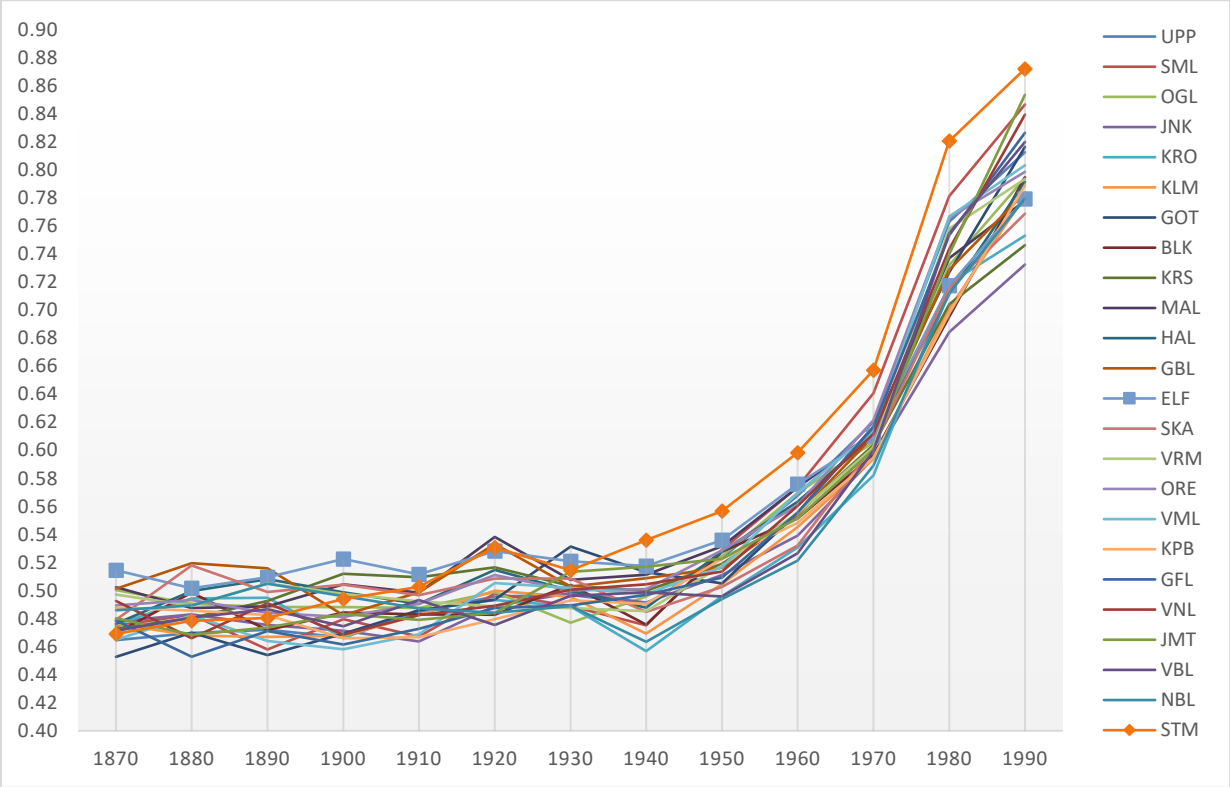
The temporary increase of the HGGI observed in 1920 is explained by the progress of political empowerment, reflecting the rise in the number of females elected in municipal councils, made possible in 1919. As can be seen in Figure 3, the ratio declined to a lower level in 1930, which according to Österberg (1997), can partly be explained by the fact that some women left their commissions, or decided not to run for re-election. This suggests that early female politicians may have faced hostility from their male colleagues. However, this momentary decline in female empowerment was brief and from 1940 female political empowerment grew steadily and fast, reaching 0.54 in 1990. However, a closer look at the municipal assemblies reveals that men still hold most of the higher positions nowadays. In 2019, for example, men chaired 68 percent of the municipal boards (SCB, 2020, p. 53). Although the composition of most Swedish governments since 1994 has been characterized by gender parity, no woman has so far seized the position of prime minister.

Gender equality has evolved substantially in Sweden throughout the twentieth century. The clear improvements made by Sweden to close the gender gap started in the 1940s, before institutions and policies started to actively support women. The progress appears to have been driven by both greater equality in economic participation and political empowerment.

4.2. Spatial Distribution

After the 1940s all counties made astonishing progress in closing the gap. Policies favorable to gender equality are likely to have contributed to levelling out regional differences. Figure 4 presents the geographical distribution of the HGGI across the Swedish counties over the two periods under review.

Figure 4: HGGI by Counties



All Swedish counties follow a similar trend to that observed at the national level, as shown by Figure 4. However, one county, Stockholm, stands out with regard to the pace of the progress made. While Stockholm displayed one of the lowest HGGI in 1870 – together with Gotland, Uppsala, and Västmanland – its growth was continuous between 1870 and 1990 and was faster than that of any other county. While Stockholm was performing poorly with regard to the economic participation sub-index over the 1870-1990 period, after 1920 it continuously ranked best, together with Småland, for the political empowerment sub-index. In 1990, Stockholm was 87.2% close to parity, almost 7 percentage points higher than the national average.

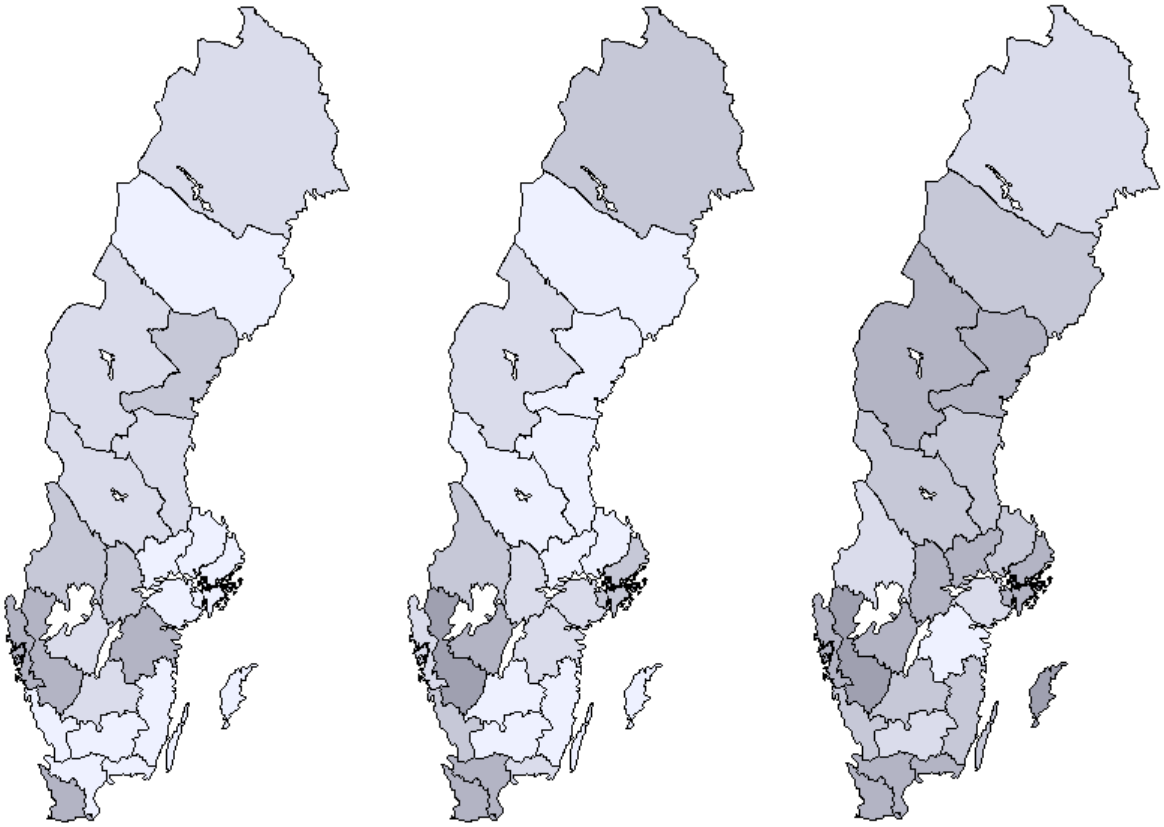
Conversely, Älvsborg, which had ranked first in 1870 (55% of the distance to parity), grew more slowly than most of the other counties. In 1990, Älvsborg ranked 19th (out of 24) by closing 78% of the gap. The strength of Älvsborg originates from its top score in the economic participation sub-index, followed by Malmöhus and Göteborg och Bohus which ranked second and third, respectively. The importance in Älvsborg of the textile industry, known for intensively relying on a female labor force, can explain the high score made by this county.[14] Only from the 1960s did other counties, such as Jämtland or Gotland, catch up and outperform Älvsborg. Unlike Stockholm, which always scored high in political empowerment, Älvsborg scored relatively poorly and its ranking worsened over time, clustering at the bottom of the list with Jönköping, Kristiandstad, Kronoberg, Skaraborg, and Malmöhus.

The contrasting evolution of Stockholm and Älvsborg reflects the existence of diversity in the trajectories taken by different counties and confirms the need to take the spatial dimension into account. These differences can be observed in more detail in Figure 5. The figure presents the distribution of the HGGI across Sweden and shows its evolution over time. The darker counties reflect higher gender equality. The maps become darker over time, reflecting the strong effort made by Sweden to close its gender gap. The darkness gets more intense from 1970 onwards, when the pace of progress increases faster. Despite the clear trends towards greater gender equality, the maps reveal the existence of substantial differences in the distribution of the index across Swedish counties.[15] At the beginning of the period, some counties were clearly scoring better than others. Älvsborg led, followed by Malmöhus, Göteburg och Bohus, and Östergötland. Later, in 1930, other counties started to emerge. This is notably the case with Gotland, Jämtland, Stockholm, and Skaraborg – though Älvsborg kept its top position, starting to slowly lose it only in the following decades. Then Stockholm took the lead and kept it all the way through 1990. Stockholm was then followed as leader by Jämtland, Småland, Västernorrland, Gävleborg, and Västerbotten.

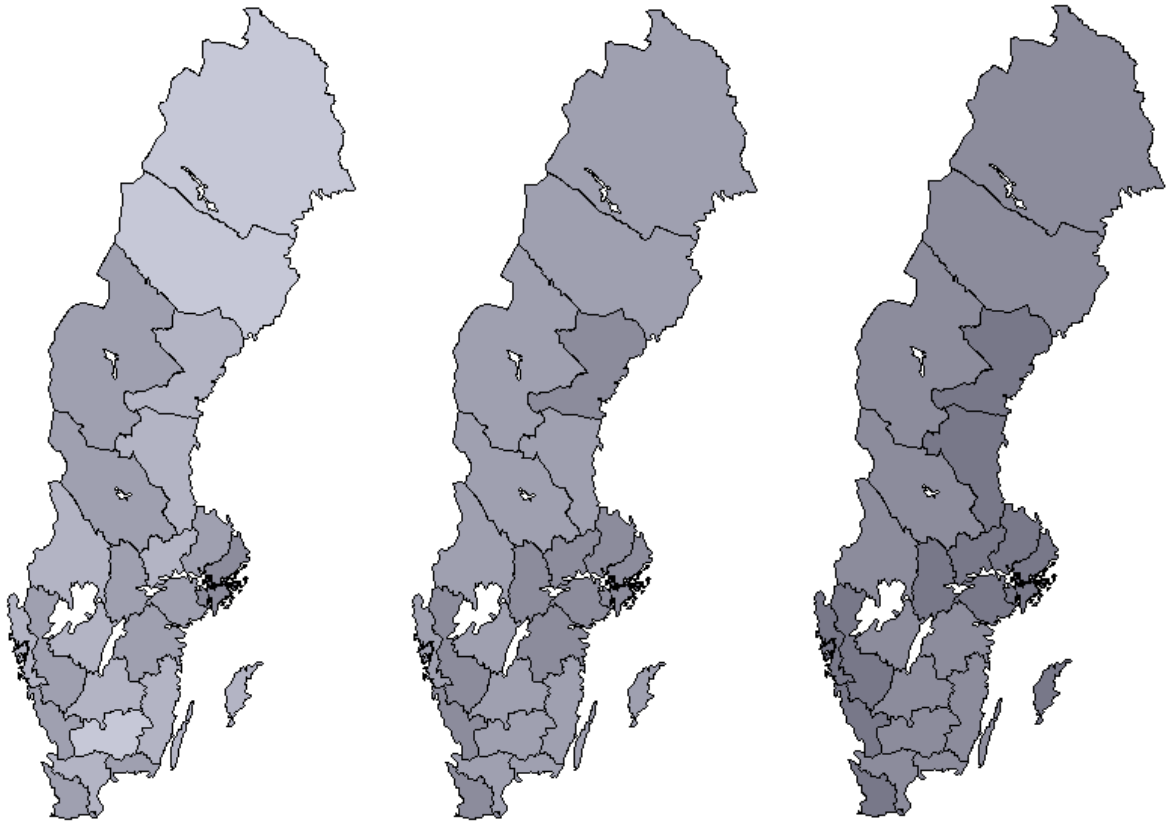
[14] See Clivemo, Stanfors and Önnerfors (2019) for an empirical investigation of the determinants of the evolution in Swedish counties of female participation in the labor force over the 1870-1950 period.
[15] Figure C5 in the Appendix uses different intervals to better highlight the strengths and the weaknesses of Sweden in closing the gender gap, mapping four different years: 1870, 1900, 1940, and 1990.

Figure 5. Distribution of HGGI – Based on percentile intervals

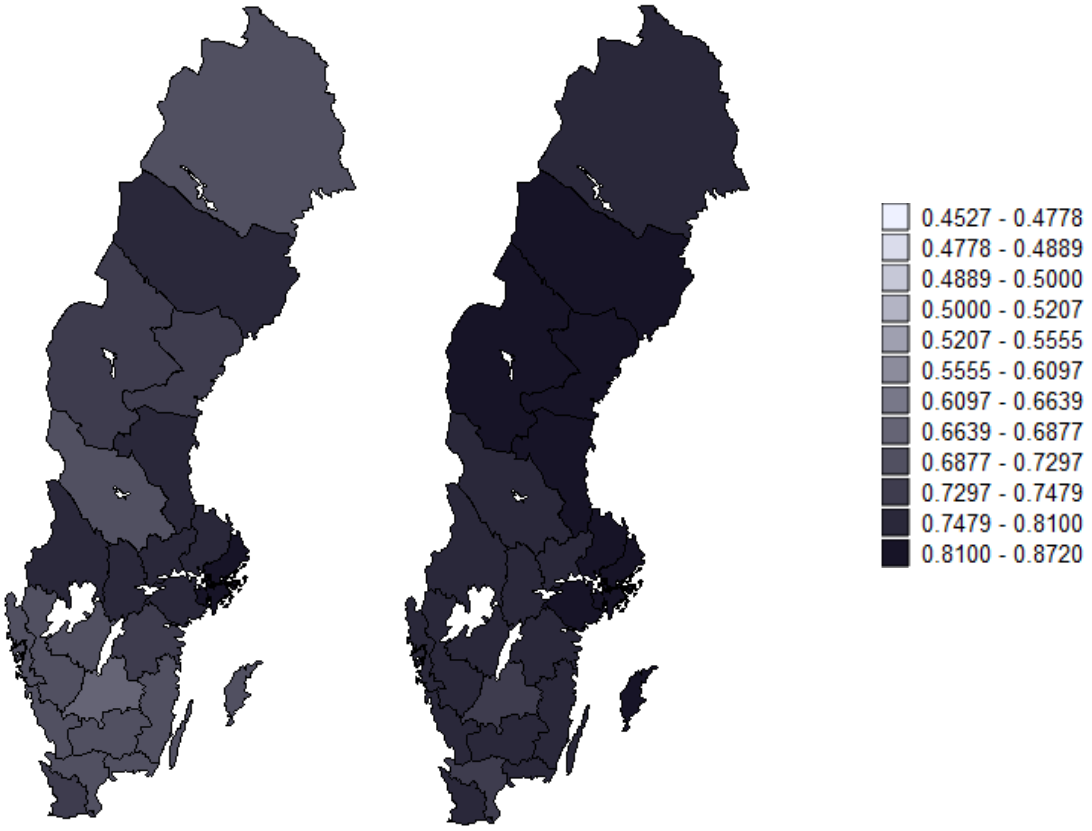
(a) 1870 (b) 1900 (c) 1930



(d) 1950 (e) 1960 (f) 1970



(g) 1980 (h) 1990



5. Trends and Regional Patterns

Was there convergence across Swedish counties towards greater gender equality in the long run? We rely on two measures of regional convergence: the β and σ convergences. The β-convergence measures the inclination of low gendered equal counties to catch up with high gendered equal counties. The σ-convergence measures the spread of gender equality levels over time. A declining σ coefficient reflects the decline of the dispersion of the gender gap.

5.1. Regional Catch-up

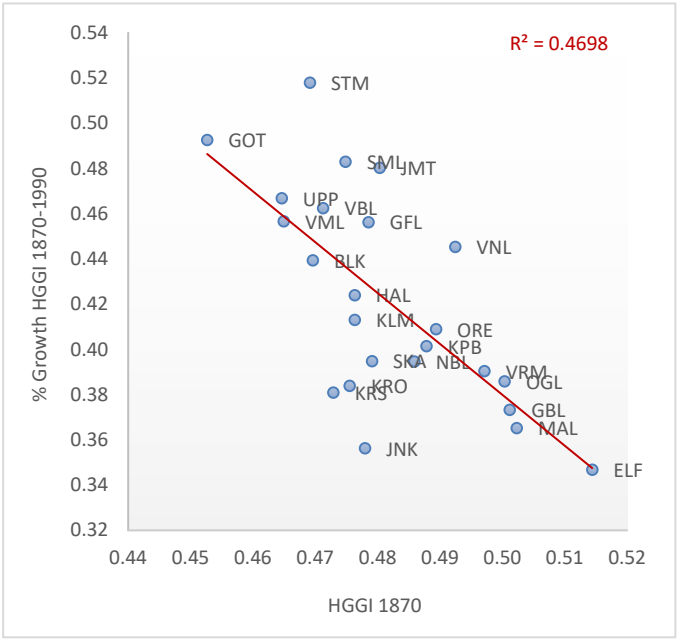
Figure 6 offers evidence for the presence of convergence among Swedish counties. It relates the growth rate of the HGGI – as well as its three sub-indices – of each county over the 1870-1990 period compared to their starting values in 1870 (in 1920, for the political sub-index). The negative slope of the line is remarkably strong for all (sub-)indexes. The economic participation sub-index displays the highest R-square value: 0.96 (Figure 6b).

This convergence pattern shows that counties which were performing best at the beginning of the period displayed lower growth rates of gender equality over time. This is clearly the case for Älvsborg and Malmohüs, as already noted in subsection 4.2. While the two counties exhibited the highest HGGI level in

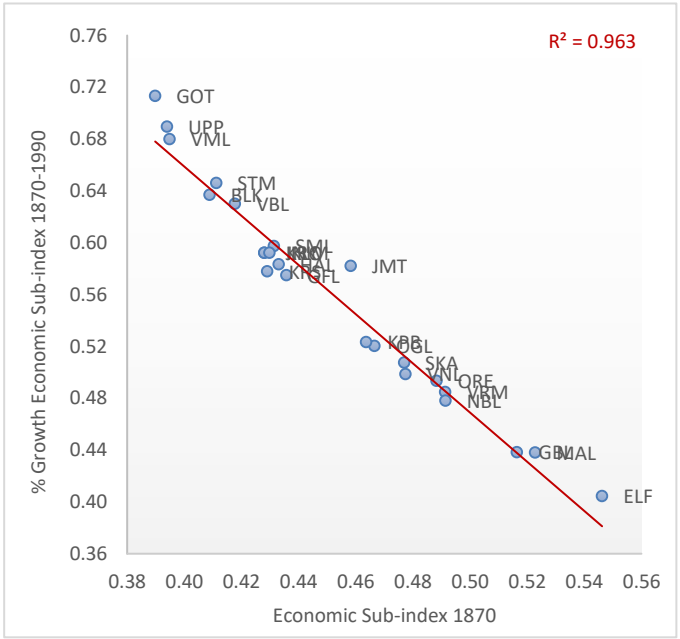
1870, they grew the slowest. Meanwhile, Stockholm and Gotland made the most progress. While they displayed HGGI levels in 1870 that were among the lowest, they grew the fastest. Stockholm is undoubtedly the county that made the most and quickest progress, with a 91% growth rate between 1870 and 1990. Looking at the components of the index separately, one can observe that Stockholm was doing very well in 1990 with regard to the labor force and the election ratio (seizing first place for both), but scored relatively poorly for the wage ratio – the worst, together with Norrbotten and Västernorrland.

Figure 6: HGGI and its Components in Level and Growth

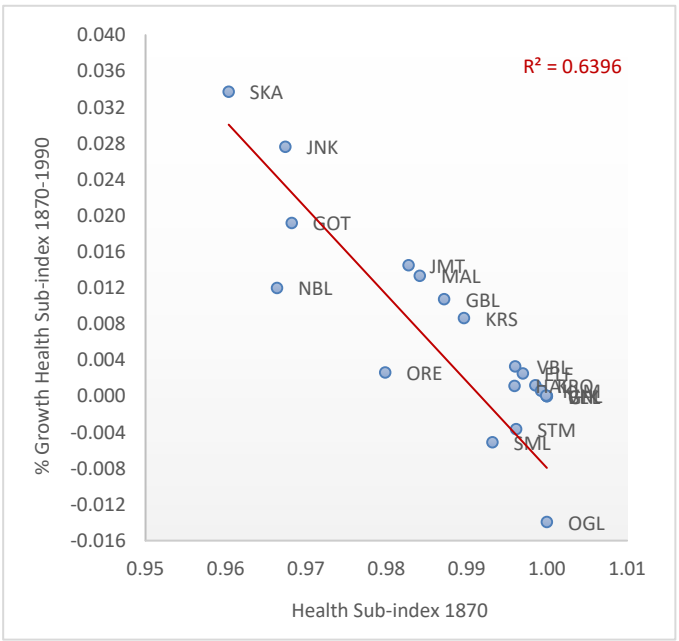
(a) HGGI, 1870-1990



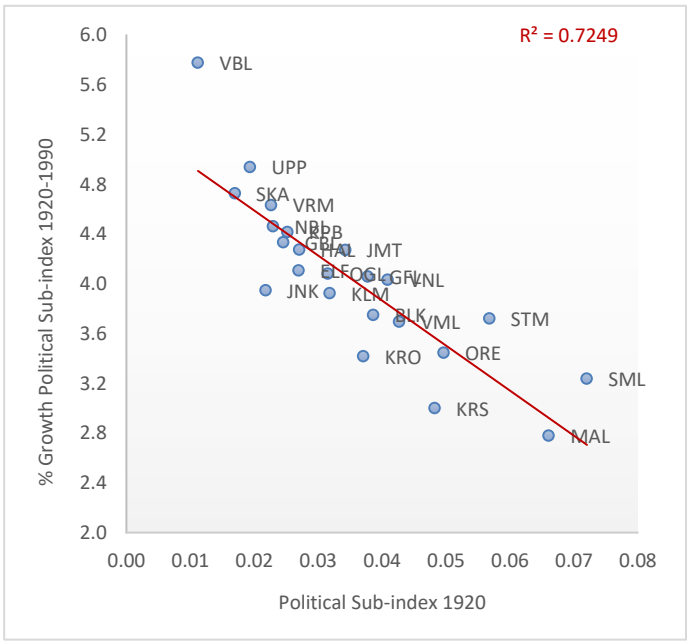
(b) Economic Sub-index, 1870-1990



(c) Health Sub-index, 1870-1990



(d) Political Sub-index, 1920-1990



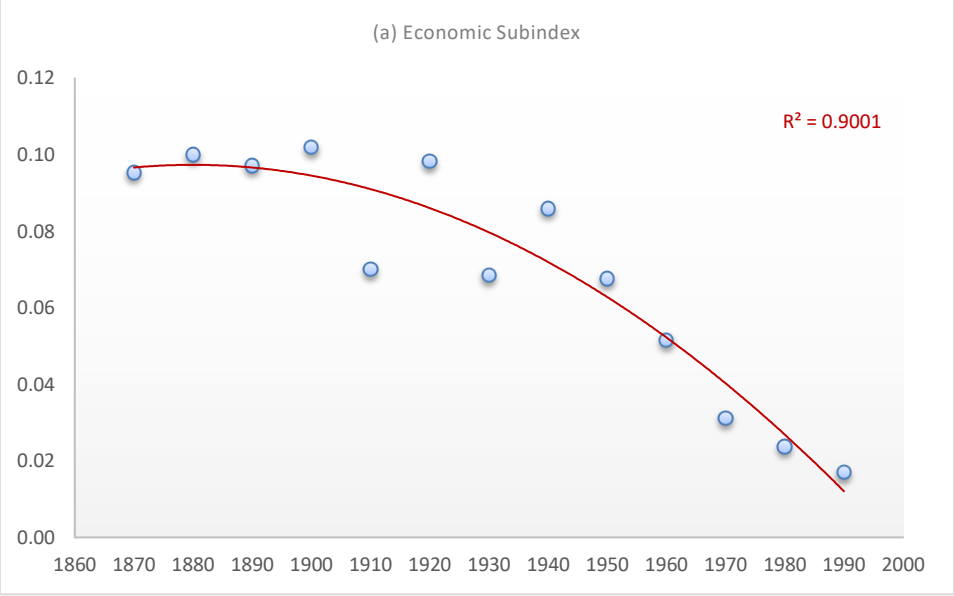
5.2. Regional Inequalities over Time

The analysis of the σ-convergence (Figure 7) is similarly eloquent. All counties made substantial progress in closing their gender gaps and the differences between counties drastically declined over time. The negative slope of the economic sub-index confirms the occurrence of a convergence process between Swedish regions during the periods under study (Figure 7a). The σ-convergence shows that the process of convergence reduced regional gender inequalities more quickly after 1940.

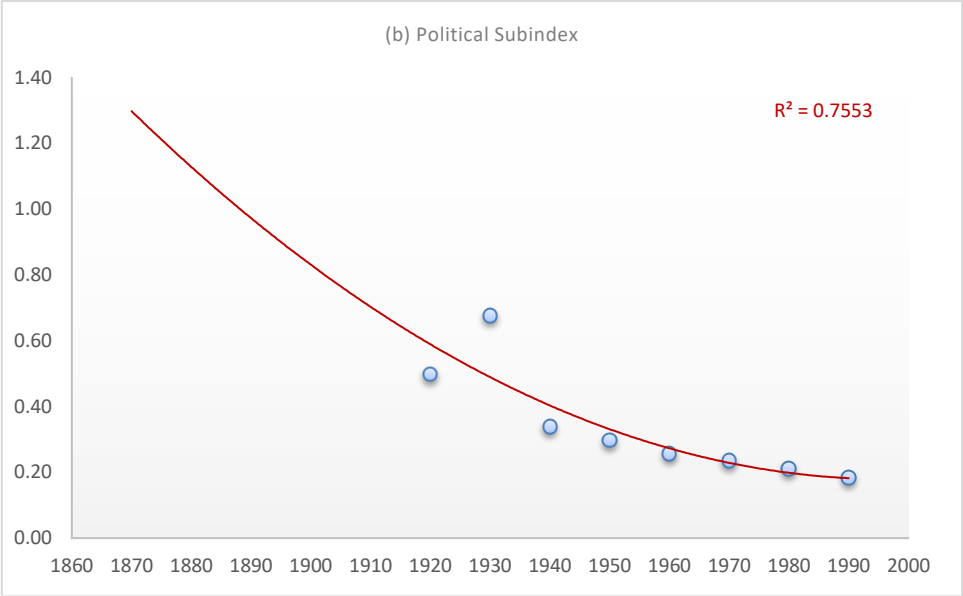
The σ-convergence of the political empowerment and health sub-indexes confirms the improvement made by Sweden to reduce the regional gender inequalities from 1940 onwards. The fast progress of women's political representation is illustrated by the strong decline of the coefficients of variation from high values to lower values (Figure 7b).[16] An inverted U-shape is noticeable in the case of the health sub-index, confirming a long-run trend towards lower dispersion – reflecting a decrease in regional inequalities – from 1940 onwards (Figure 7c).

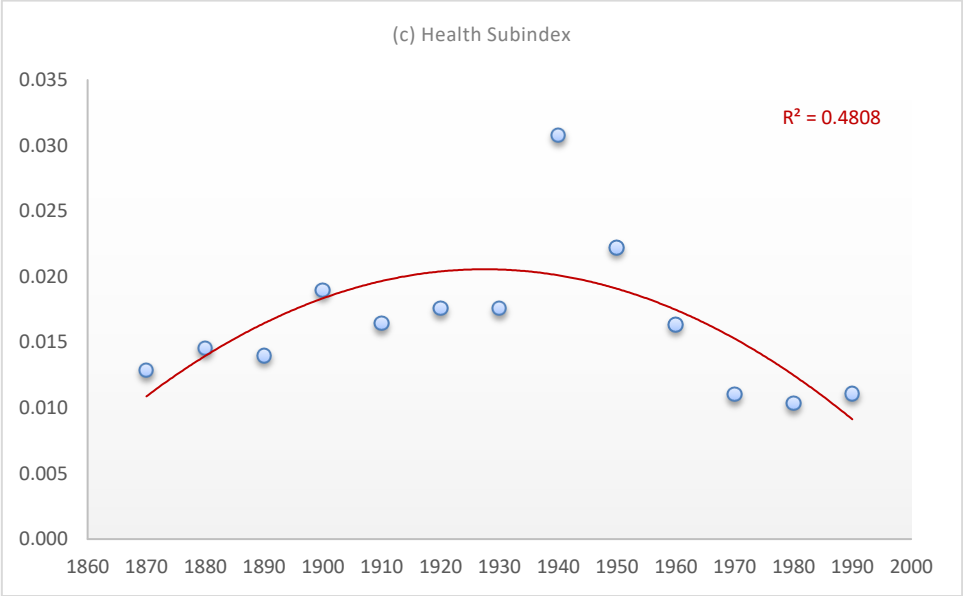
These results align surprisingly well with the convergence process observed by Enflo and Josés (2015) in the case of Swedish regional incomes, in particular with the 1940-1980 period during which these authors identify a strengthening of regional convergence. They explain the regional convergence in Swedish income by the implementation of institutional arrangements that favored the reduction of productivity differentials across industries and by the reallocation of the workers from declining to thriving regions and economic sectors – aided by successive governments. This period was characterized by a marked increase in both women's relative employment and their relative wages (as illustrated by Figure C2 in Appendix).

Figure 7: Sigma-Convergence of the Sub-indices



[16] Although the decline in regional inequalities of the political representation is strong and significant, it is important to acknowledge that regional differences remained larger for the political sub-index than for the economic and health sub-indexes (as reflected by their relatively low coefficients of variation).





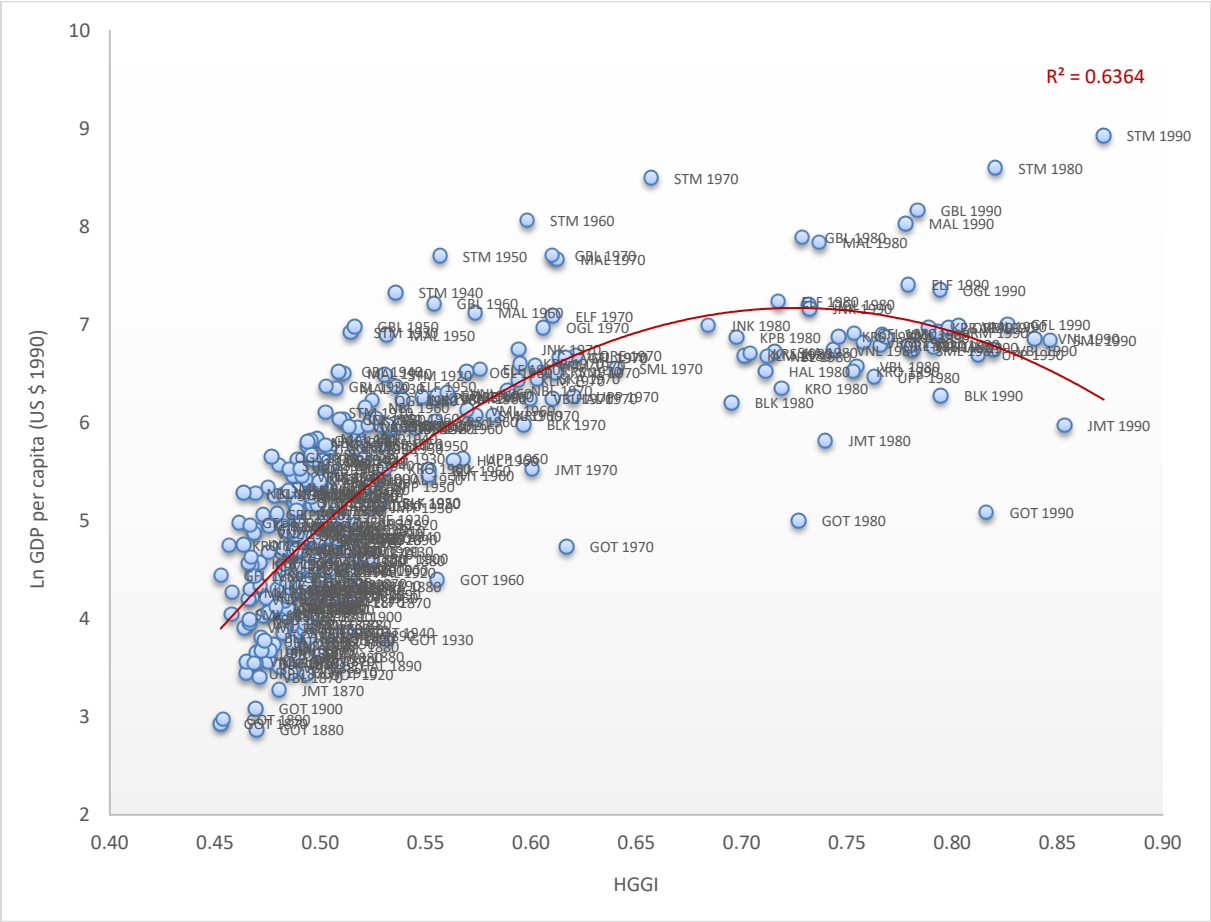
5.3. Preliminary Explanations – Opening Discussion

The convergence analysis confirms the observations made in section 4 that gender equality started to increase substantially in Sweden from 1940 onwards, a year from which regional inequalities also reduced significantly. What can explain the regional paths observed in the long run (β-convergence) and in the different periods (σ-convergence)? A combination of various ingredients is certainly at the heart of the patterns observed over time and across space. Among them, we retain three possibly key channels for discussion: the roles played by economic factors, institutional determinants, and cultural forces.

The evolution from an agrarian to an industrial society brought substantial transformations to the Swedish economy and society. This structural change marked the transition to modern economic growth. The 1870-1970 period represents the most successful part of Swedish industrialization and growth (Schön, 2007). The convergence process and homogenization of Sweden in closing its gender gap occurred during the golden age of Sweden's modernization. The economic catching-up of Sweden, through technological transfer from

more advanced economies, was followed by a period during which it became a leader in many (innovative and sophisticated) industrial areas (Schön, 2007). The economic success of the country transformed the structure of employment and certainly contributed to more economic opportunities being offered to women and the boosting of women's employment (as illustrated by Figure C3 in the Appendix).

Figure 8: Relationship between HGGI and GDP per capita, 1870-1990



Source: GDP per capita estimates from Enflo, Henning and Schön (2014)

The association between gender equality and economic development is presented in Figure 8. The figure graphs the HGGI of Swedish counties against the (log) GDP per capita, over the 1870-1990 period. It shows a positive and strong association for most counties between economic growth and gender equality over the 1870-1970 period, and a weakening of the positive association over the 1970-1990 period.[17] The association that emerges from Figure 8 confirms the intuition that changes in economic needs fostered greater gender equality.

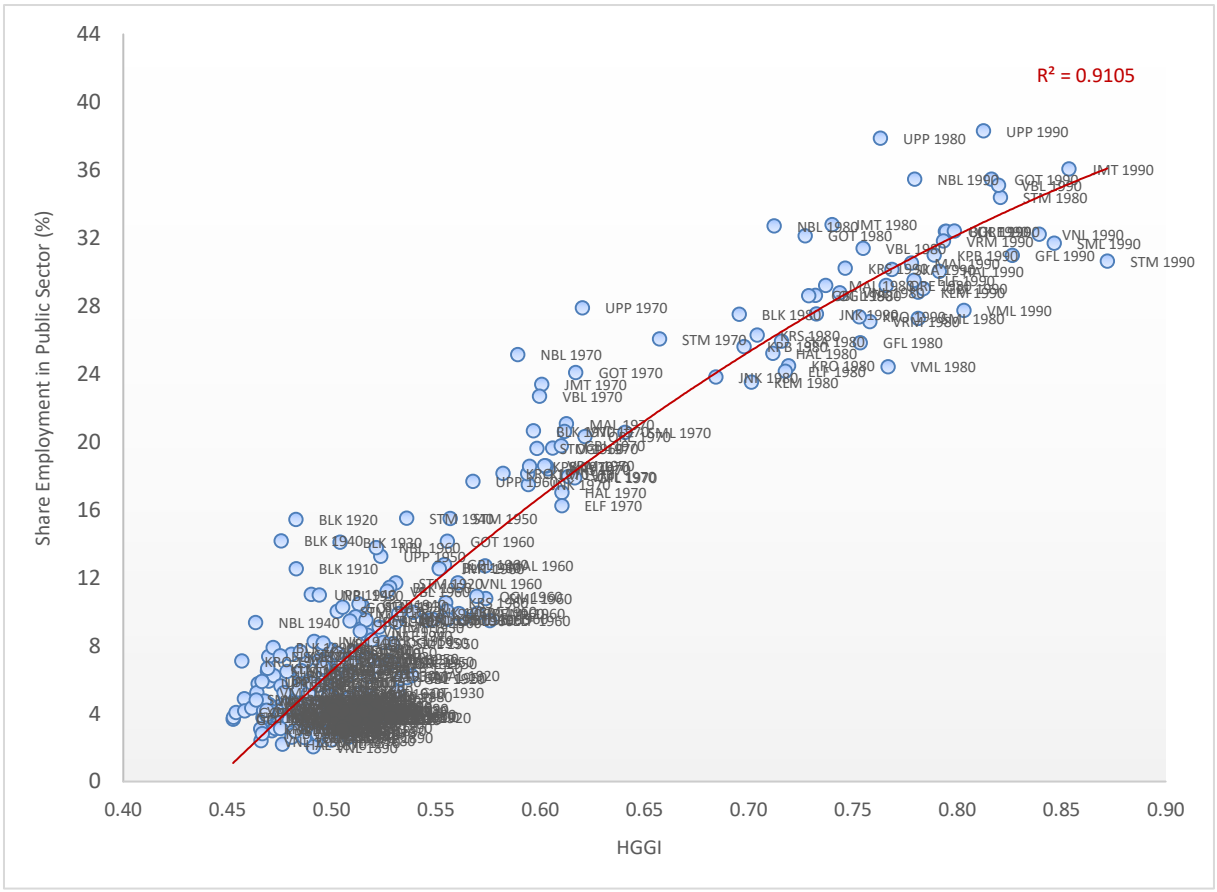
Institutional change is another crucial factor that must be taken into account to understand the homogenization of Sweden and its improvement in closing the gender gap during the twentieth century. Various policies favorable to greater gender equality were implemented by the successive governments.

[17] The slowdown in Swedish growth from the 1970s occurred when a number of industries ran into crisis and when components of the Swedish Model were weakened or eliminated (Schön, 2007).

Among the most noticeable examples were the women's right to vote, granted in 1919, and the inclusion of girls in publicly funded secondary education from 1927. Policies specifically oriented towards women's participation in the labor force increased after World War II – during a period that witnessed the consolidation of the Swedish Model (Rosen, 1997). The greater public responsibility characterizing the Swedish Model – as discussed in section 4 – contributed to the expansion of the public sector; it took the form of an increasing supply of public services, such as educational investments, child-care structures and policies, and measures facilitating the balance between family and professional life.

Figure 9 presents the association between the HGGI and the share of individuals employed in the public sector in each county over the 1870-1990 period. The share of individuals employed in the public sector is used as a proxy to capture the strengthening role of the welfare state. Figure 9 shows a positive and strong association between the two indicators – the values of both indicators increasing more intensively after the 1940s.

Figure 9: Relationship between HGGI and Public Employment, 1870-1990



Source: Share of individuals employed in the public sector from Enflo, Henning and Schön (2014)
Note: The public sector includes occupations in public administration, education, healthcare, and other public services.

Sweden is often highlighted as an example of a country characterized by an encompassing union confederation with strong egalitarian ideology. Unions played an instrumental role in a number of changes that affected the labor market in Sweden in the 1960s and 1970s. The LO (*Landsorganisationen*) on the workers' side and the SAF (*Svenska Arbetsgivareföreningen*) on the employers' side worked hand in hand in implementing the labor program. The "solidaristic wage policy" negotiated between 1956 and 1983 was designed to reduce wage differences across the economy (see Molinder, 2019). In particular, it aimed to

achieve equal wages for equal work and to raise wage levels in low paid areas. Among the labor agreements it was decided to gradually remove separate wage rates for women. This period also saw a significant change in income taxation, from joint to separate taxation, making it fiscally attractive for married women to either enter work or expand their working hours.[18]

Although institutions have undoubtedly been incremental to the progresses made by Sweden towards becoming a world leading country with regard to gender equality, it is also important to remind that the Swedish trajectory towards greater gender equality – as measured by the HGGI – began before the most famous institutional reforms were implemented in the 1960s and 1970s. Additional and complementary factors are therefore also to be found elsewhere.

The converging roles between men and women over time undeniably reflect the changing economic needs of the country and demonstrate the political will to take practical measures. Yet the implementation of policies in favor of women's participation in economic activities or in favor of girls' access to publicly funded education is also a reflection of a change in attitude towards women within Swedish society. From the mid-nineteenth century, debates and discussions evolved from the dominant view that education should focus on making girls ideal wives and mothers to offering women the opportunity to support themselves as productive members of society (Kyle, 1972). The demand for women's authority gained increasing support and women's rights to work outside the home subsequently increased (Lundh, 2003). The improvements made by Sweden to close the gender gap in the decades before institutions and policies started to actively support women reveal the deep changes that were already happening in Swedish society.

6. Conclusion

This paper tracks the evolution of gender equality in Sweden along three key dimensions (economic participation and opportunity, health and survival, and political empowerment) over 120 years and brings a spatial dimension that allows the heterogeneity in the country to be accounted for. This paper is the first to contribute by providing a longitudinal dimension (going as far back as 1870) and a spatial one in the appraisal of gender equality from a historical perspective.

Beyond improving our understanding of gender relations in the past by studying the magnitude of gender-based inequalities, the ultimate purpose of the paper is to provide a comprehensive measure of gender equality that will be easy to compare with other variables (economic, demographic, and cultural). Following a similar methodology to the one proposed by Hausmann, Tyson and Zahidi (2006) and applying it to the 24 Swedish counties over the 1870-1990 period, we find that Sweden made impressive progress in closing the gender gap. At the national level, the average (county population-weighted) distance towards parity increased from 48.5% in 1870 to 80.6% in 1990. All counties made astonishing progress over time in closing the gap. It is from 1940 onwards that the gender gap reduces at an increasing pace.

Of the three sub-indexes, political empowerment improved the most, followed by economic participation and opportunity. Despite being the most improved dimension (in terms of growth rates), political empowerment presents the largest gender disparity. Only 54% of the political empowerment gap was closed at the end of the periods under study, against 88% of the economic participation and opportunity gap, and

[18] The solidary wage policies were broken following the decentralization of labor agreements in 1983. With agreements being reached at the industry level, the wage distribution between industries and sexes increased in the 1980s and 1990s (Edin and Richardson, 2002).

99% of the health and survival gap. All the counties followed a similar trend. However, some counties stand out with regard to the pace of the progress made. Of all the counties, Stockholm made the most progress. Even though it was at the bottom of the list in 1870, it became the most gender-equal county from 1940 onwards. In 1990, Stockholm had closed 87.2% of its gender gap, almost 7% more than the national average. Conversely, Älvsborg, which had led the other counties in 1870 (by having closed 55% of its gender gap), grew more slowly than most of the other counties. In 1990, Älvsborg ranked 19th (out of 24) by closing 78% of the gap. This example shows the existence of diversity in the trajectories taken by the counties, and confirms the need to keep the spatial dimension in mind.

Despite the diversity in the trajectories taken by counties, any investigation of the convergence patterns reveals that Swedish counties converged and that regional inequalities declined during the periods under study. The investigation of the sub-indices, taken separately, shows that the convergence was even more pronounced for the economic sub-index. The counties that displayed larger gender inequality in 1870, made faster progress in closing their gender gap than the counties with the greatest equality.

The idea of Sweden's historic equality is called into question by our quantitative indicator capturing the long-run evolution of Swedish gender gaps. As argued by Bengtsson (2019), while it has become commonplace to see Sweden's twentieth-century egalitarianism as the outcome of a long historical trajectory, the trajectory may not have been as persistent as is sometimes argued. The comparison with France adds additional and complementary arguments to this view. Economically, mid-19th century France appears to have been considerably more gender-equal than Sweden (see Perrin, 2014, 2021). It took a century for the Swedish economic sub-index to reach the level displayed by France in 1851. Before 1940 Sweden was not performing significantly better than most countries of a similar level of development. Sweden was within the average of other economies. It is only in its recent history that Sweden has become one of the most gender-equal nations in the world and the Swedish Model has become famous. Our findings suggest that rapid progress towards high gender equality occurred from the 1940s onwards. Institutions seem to have played an important role in the efforts made by Sweden to close its gender gap, notably with the implementation of various policies favorable to gender equality. But it should also be remembered that the Swedish trajectory towards gender equality – as measured by the HGGI – began before the most famous institutional reforms of the 1960s and 1970s. These reforms may have turned Sweden into a role model for other countries but did not mark the beginning of change.

Beyond its significance for Swedish economic history, this paper adds substantial knowledge to our currently limited knowledge of the evolution of gender differences in the past. The spatial dimension offers a unique opportunity to study the heterogeneity of gender equality across space – focusing on a case that is central for the whole debate on gender equality. This paper provides a crucial quantitative indicator of gender equality that can be generalized and applied to other countries and geographical areas. The indicator will be used in future research: *(i)* to investigate the determinants of gender equality; and *(ii)* to assess and deepen our understanding of the long-run relationship between gender equality and economic and demographic developments (extending the research by Perrin, 2021). In particular, the spatial historical gender gap index will be used to investigate both directions of the causal relationship(s) linking gender equality and development process.

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Appendix A

A. 1. Data sources

Data at the Swedish county-level were collected for the years 1870 to 1990 from the Swedish Central Bureau of Statistics (SCB). The SCB, founded in 1858, collected and processed parish records performed by *Tabellverket* over the 1749-1858 period. After 1860, Swedish censuses were published regularly every 10 years until 1960, and every 5 years since then. While the census is available from 1860, we chose to collect data from 1870 onwards because of limitations in the data for the year 1860.

From 1997, the structure of the counties changed. Until 1997, Sweden consisted of 24 counties. Skåne was created as a combination of Malmöhus county and Kristianstad county. A year later, Skaraborg county, Gothenburg och Bohus county, and Älvsborg county merged to become Västra Götaland county, leaving Sweden with 21 counties. To keep consistency over time, we decided to limit our analysis to the study of the original 24 counties over the 1870-1990 period.

We have collected and manually entered the county-level data (*länvis*) to construct our variables. The only exception was for wage data already collected, digitized and made available by the University of Gothenburg. The tables contain Swedish industrial and wage data from 1865 to 1990 by gender and county.

Table A: Structure of the Historical Gender Gap Index

Sub-index	Variables	Sources
Economic Opportunity	Ratio: female labor force over male value	*BiSOS A Tredje – Folkräkningen – Folk och bostads-räkningen* Swedish Central Bureau of Statistics (SCB)
	Ratio: female wage over male value	*BiSOS N – Lönestatistisk Årsbok* HILD University of Gothenburg
Health and Survival	Ratio: female living births over male value	*BiSOS A – Befolkningsrörelsen* Swedish Central Bureau of Statistics (SCB)
	Ratio (inverted): female mortality over male value	*BiSOS A – Befolkningsrörelsen* Swedish Central Bureau of Statistics (SCB)
Political Empowerment	Ratio: female elected in municipal elections over male value	*Valstatistik* Swedish Central Bureau of Statistics (SCB)

A. 2. Variables construction

- Economic opportunities

Female-to-male labor force participation. – In order to calculate the female-to-male labor force participation we needed to construct the female labor force participation and the male labor force participation separately.

The statistics about employed individuals are organized by sector. The years 1870 and 1880 include the following sectors: agriculture, industry, 'Handel och sjofart', 'Förvaltning', 'Undervisning', and 'Sjukvard'.

We calculated the size of the labor force by summing the number of individuals employed in the various sectors. For the years 1870 to 1900, we included the head of household, servants, and assistants. We safeguarded against the risk of double counting by adding only the head of household of the category 'tjenstehjon utan […]' and 'arbetare med obestamdt slag'. The sectors differ slightly from one year to the next. Since we summed the number of people employed in all sectors, this did not affect our labor force variables.

For the years 1910 to 1950, the employed population is given in the column 'yrkesutövare', which includes the following sectors: agriculture, industry, 'Handel och samfardsel', 'Allman tjenst', 'Husligt arbete', 'Utan närmare angivet yrke' (for some years 'f.d. yrkesutövare m. fl.' or 'Ospecificerad verksamhet'). We used the sum of 'yrkesutövare' and 'tjänare', while the 'yrkesutövare' of 'utan närmare angivet yrke' was taken out, to avoid double counting. Servants were included. Then the 'yrkesutövare' of 'arbetare av obestämt slag' were added; not their 'tjänare,' to avoid double counting. For the years 1940 and 1950, the statistics include the distinction 'with unspecified workers' and 'without unspecified workers'. We decided to exclude the unspecified workers. The difference is small and hardly affects the ratios.

The female (male) labor force participation was calculated as the number of female (male) employed divided by the female (male) population aged 15 and over. The ratio was constructed as the female labor force participation over the male value.

Note: Despite the presence of child workers, the census data did not measure children among the working population; children under the age of 15 were enumerated in a separate category. The same threshold was held for the whole period 1870-1990, although assisting labor was not mentioned after 1950. Furthermore, up to 1970 the data for any woman with gainful employment were provided. Since then, however, figures have been distinguished by the amount of hours worked per week. For consistency's sake, a 20-hour working week was chosen as the measure. By doing so, we hope to address some concerns regarding possible overestimation of the female labor force in the late twentieth century, since female working hours have increased much less quickly than the female labor force, suggesting that a large share of the increase in female LFP was due to increases in the number of part-time working women (Stanfors, 2014). Nonetheless, part-time employment has arguably played a role in empowering women on the labor market, and should therefore not be overlooked, which is why we took the decision to use part-time as the threshold.

Female-to-male wages. – Female and male wages were calculated using information about wages in agriculture and in industry.

Agricultural wages by county and gender from 1865 until 1945 are available. From 1940, data about women wages are not available for all counties. We constructed female-to-male wage ratios using statistics for workers in agriculture for the decadal years 1870-1920. The statistics offer information about agricultural daily wages in winter and summer.

For the years 1870 and 1880, the statistics integrate additional information giving minimum and maximum daily wages. We decided to use the average of the female-to-male ratios for the minimum and maximum daily wages in winter and in summer. For the year 1870, statistics are missing for 3 counties: Kalmar, Gotland, and Jämtland. Ratios were calculated for the closest year for which data are available. Hence, for Kalmar we used information for the year 1869, and for Gotland and Jämtland, we used statistics for the year 1872.

From 1890 to 1910, we found no information about minimum and maximum amounts. We therefore simply calculated the female-to-male ratios in winter and in summer and used the average of the two.

In 1920, the daily wage (*daglönare*) was divided into "fixed" (*fasta*) and "temporary" ('*tillfälliga*) wages, and each of these was further divided into "at own cost" (*i egen kost*) and "at employer's cost" (*i arbetsgivares kost*). All this information is available for winter and for summer. Here, we decided to calculate the ratios for every situation. Because the ratios of the different types of wage were very similar to each other, we decided to use the average of the eight types of ratio.

From 1930 onwards, we used statistics about industrial wages to construct our female-to-male wage ratios. The 1930s correspond to the decades from which the industrial sector becomes as important as the agricultural sector in Sweden. Statistics about industrial wages are available for the periods 1931-1949 and 1963-1990. For the decadal years 1930, 1950, and 1960, we used information from the closest statistics, namely 1931, 1948, and 1963.

In the first period (1931-1949), wages were given as the average for adult workers (*'genomsnittlig löneinkomst för vuxna arbetare [exkl. förmän] i kr'*) by county and gender. The wages were available as hourly, daily, or annual wages. Hourly wages were further divided into "all companies" (*samtliga företag*), "export-oriented companies (*exportinriktade företag*), "mixed" (*blandade*), and home-market companies (*hemmamarkn. Företag*). To avoid differences in hours worked to skew wages in favour of men – and to maintain the data comparable with later statistics – we used the average hourly wage for all companies and calculated the female-to-male ratio.

In 1963 and 1970, the average hourly wage (*genomsnittliga timförtjänster*) was given in öre by county, gender, and specific industry. Here we used the female and male wages for the combined industries (*samtliga industrigrupper*). In 1980, the average hourly wages were no longer given as an average of the present industries, but separately for each type of industry. The number of hours worked ('arbetstimmar') by gender are included. Therefore, the average wage was calculated by multiplying the wages by their hours worked and dividing by the total number of hours worked by county and gender. For 1990, we calculated the ratios in each industry and weighted each ratio by the weight of each industry (measured by the total number of hours worked in the considered industry). A greater weight was therefore given to larger types of industry.

- Health and survival

Female-to-male mortality (inverted). – To measure gender differences with regard to mortality, we used the mortality ratio. We separately constructed the female and male crude death rates. The crude death rate may be defined as the number of (female/ male) deaths per thousand (female/male) individuals.

We then used the inverted female-to-male ratio to capture the ability of Swedish counties to close the gender gap in mortality. Mortality is a "negative" variable: using the female-to-male ratio would capture the opposite effect to the one we wanted to measure. Using the inverted ratio allowed us to give high values to counties in which female mortality was lower than male mortality, and low values to counties in which female mortality was higher than male mortality.

Appendix B – Some Notes on the Education Sub-index

The original version of the GGI has a sub-index for education, made up of four components: literacy rate, enrollment in primary education, enrollment in secondary education and enrollment in tertiary education (Hausmann, Tyson and Zahidi, 2006). We have so far not been able to construct the education sub-index for the period between 1870 and 1990 in the same way as the other sub-indices. This appendix briefly explains why and presents some preliminary figures for the four components, as well as their average, for Sweden as a whole. Our ongoing research is aiming to add the spatial dimension to the education data.[19]

A complicating feature of the Swedish system of schooling as it emerged in the nineteenth century was its heterogeneous structure. There were two parallel systems: on the one hand, the elementary school for the children of peasants and workers, the so-called *folkskola*, formally established in 1842, and on the other, grammar schools for the upper classes, so called *läroverk*. Whereas the folkskola was a dead end, the läroverk prepared for tertiary education.

There is hardly any previous research on literacy rates in Sweden in the twentieth century, which suggests that basic literacy was close to universal and there were very small differences between men and women. A study of catechetical examinations in a parish in northern Sweden for the period 1845-1873 did not find significant gender differences (Johansson, 1972). A study on some parishes in the southern part of the country argues that men had higher levels of *functional* literacy; that is, men were not only able to read but also to write (Nilsson, Pettersson and Svensson, 1999). Over time, it seems as though much of the gender gap in literacy had closed in the South also, even before the system of primary schooling had fully expanded. Finally, a study of school absenteeism in four parishes of western Sweden in the period 1865-1920 documents insignificant gender differences (Sjöberg, 1996). There may have been a small gap, with girls being more absent in particular years at the beginning of the period, but this pattern disappeared towards the end of the period of investigation. Based on this fragmentary evidence, we think it is reasonable to assume a certain gender gap in literacy that narrowed over time.

Primary school enrollment was not broken down by gender in the Swedish public statistics (see BiSOS P, various years). This was probably because gender differences were small, not because contemporary observers regarded sex as an irrelevant category of analysis in general. We assume that future research will reveal some gender differences in enrollment in the primary education of the relevant age group in the late nineteenth century and that the gap was closed by 1890.

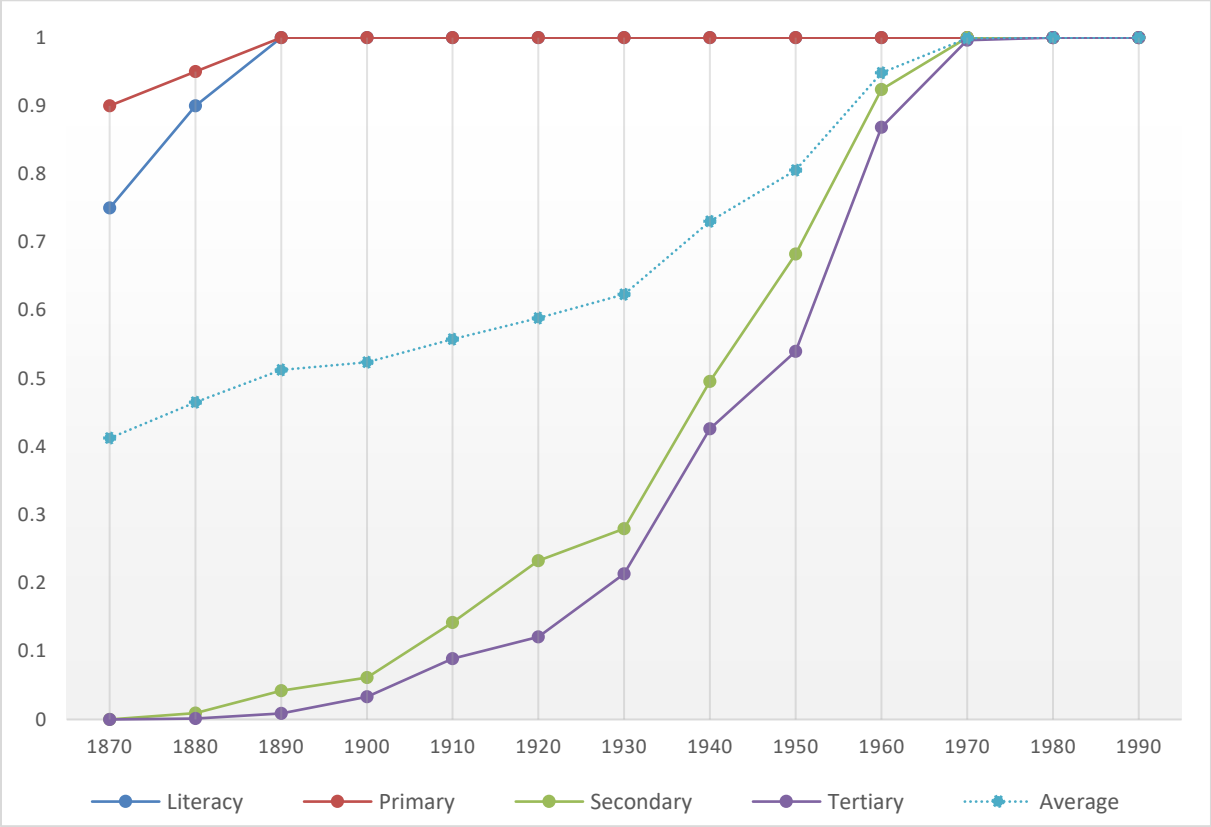
For *non-compulsory* schooling, the story is different. Here, the official statistics do clearly pay attention to the sex of the pupils. The main challenge for us is that the system of schooling for a long time was so heterogeneous, and segregated by sex, that it is difficult to identify groups and forms of schooling that can be compared to today's secondary schooling. Until 1927, public grammar schools were open only to boys. The grammar schools included some primary education, as well as lower- and upper-level secondary education. Excluded from the public grammar schools, girls could obtain secondary education only in some of the private girls' schools that had been founded in cities in the nineteenth century (Schånberg, 2001). The heterogeneity of the schooling system makes it difficult to calculate enrollment rates. Instead, we decided to compare graduation rates in relation to the age group 15-19 years. It should be mentioned that secondary

[19] We expect to find geographical variation in education in particular with regard to enrollment rates in secondary and tertiary education. A snapshot of these differences reveals that the spread of the female-to-male ratio in tertiary education (among those aged 30-40) ranged between 0.09 and 0.27 (calculations based on data from the education census of 1930 – Folkräkningen (1937). Although nationally in 1990 women in tertiary education outnumbered men, the education census of that year also shows that certain counties (for example Östergötland and Värmland) had not achieved parity.

schooling in Sweden was reserved for a very tiny proportion of each age cohort until the second half of the twentieth century.

The same applies to tertiary education. This level of education was formally opened to women in 1873, but at that date very few women could apply, since most girls' schools did not prepare students for entry to higher education. For a long time, the tertiary level of education was also geographically concentrated in the cities of Uppsala, Lund, Stockholm and Göteborg. However, in the second half of the century private girls' schools were established in many cities, opening up opportunities for secondary education (and eventually tertiary education) for women. Consistent time series of enrollment in tertiary education by gender can easily be obtained for the period until 1950. Tertiary education in Sweden expanded and became more multifaceted, creating some initial problems of classification. For simplicity, the enrollment rates presented in this appendix concern the five original sites of higher education (Uppsala universitet, Lunds universitet, Göteborgs högskola, Stockholms högskola, and Karolinska institutet).

Figure B: Education Sub-index and its Components

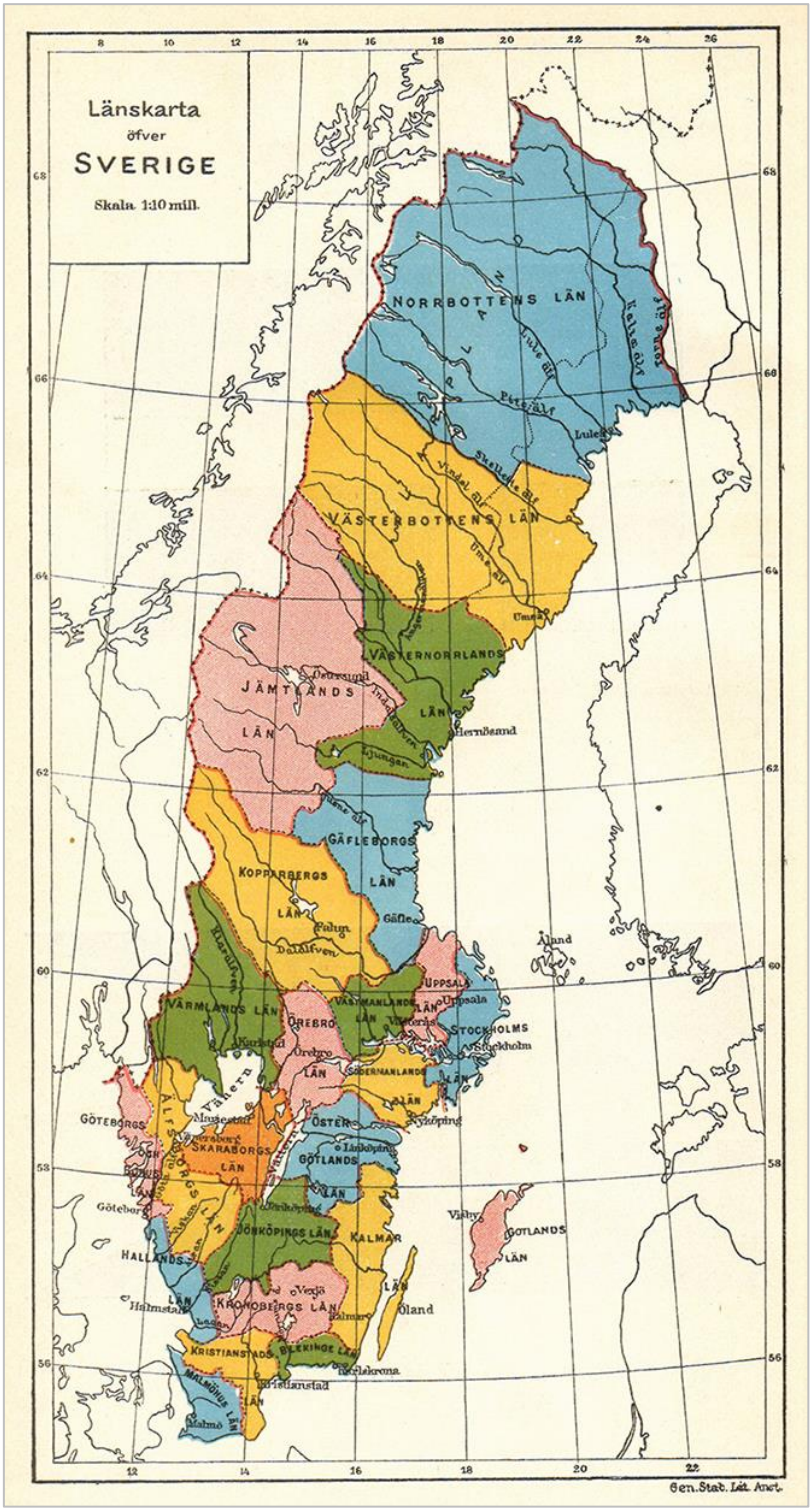


Note: The values for literacy and primary education rates for the earlier decades are partly based on qualitative knowledge of enrollment and ability to read and to write in Sweden in the period under study (see text).
Source: BiSOS P; Graduation rates have been extracted from Vinge (1977) and the number of men and women in the relevant age group from Befolkningsutvecklingen (1999).

Based on our assumptions, the education gender gap steadily narrowed, reaching parity at all levels in 1970 as can be seen in Figure B. Although parity in literacy and primary education was already achieved in 1890, institutional barriers kept women out of secondary and tertiary schooling for a longer period. Following the opening of public secondary schooling for girls in 1927, a rapid improvement is seen in both secondary and higher education. Interesting to note is the relatively small lag between the two. Moreover, adding the

education sub-index in its current state to our existing index would alter the shape only slightly, because some gains in decreasing the distance to parity had already occurred in education in the nineteenth century. That said, the most significant gains were made after 1930, in accordance with our current HGGI index.

Appendix C



Source: Project Runeberg

Table C: List of Counties' Codes and Names

ID	County Code	County Name
3	UPP	Uppsala län
4	SML	Södermanlands län
5	OGL	Östergötlands län
6	JNK	Jönköpings län
7	KRO	Kronobergs län
8	KLM	Kalmar län
9	GOT	Gotlands län
10	BLK	Blekinge län
11	KRS	Kristianstads län
12	MAL	Malmöhus län
13	HAL	Hallands län
14	GBL	Göteborgs och Bohus län
15	ELF	Älvsborgs län
16	SKA	Skaraborgs län
17	VRM	Värmlands län
18	ORE	Örebro län
19	VML	Västmanlands län
20	KPB	Kopparbergs län
21	GFL	Gävleborgs län
22	VNL	Västernorrlands län
23	JMT	Jämtlands län
24	VBL	Västerbottens län
25	NBL	Norrbottens län
111	STM	Stockholm län and city

Figure C1: Spread of the Data

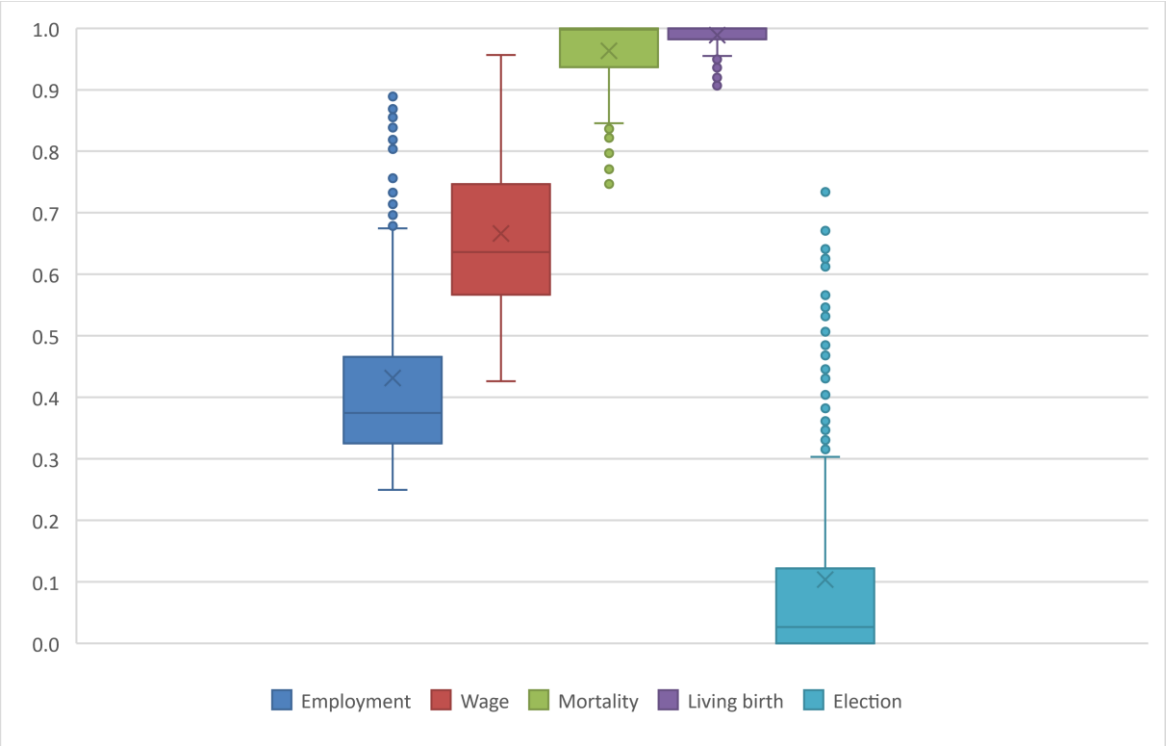


Figure C2: HGGI Components – Weighted by population size of the counties

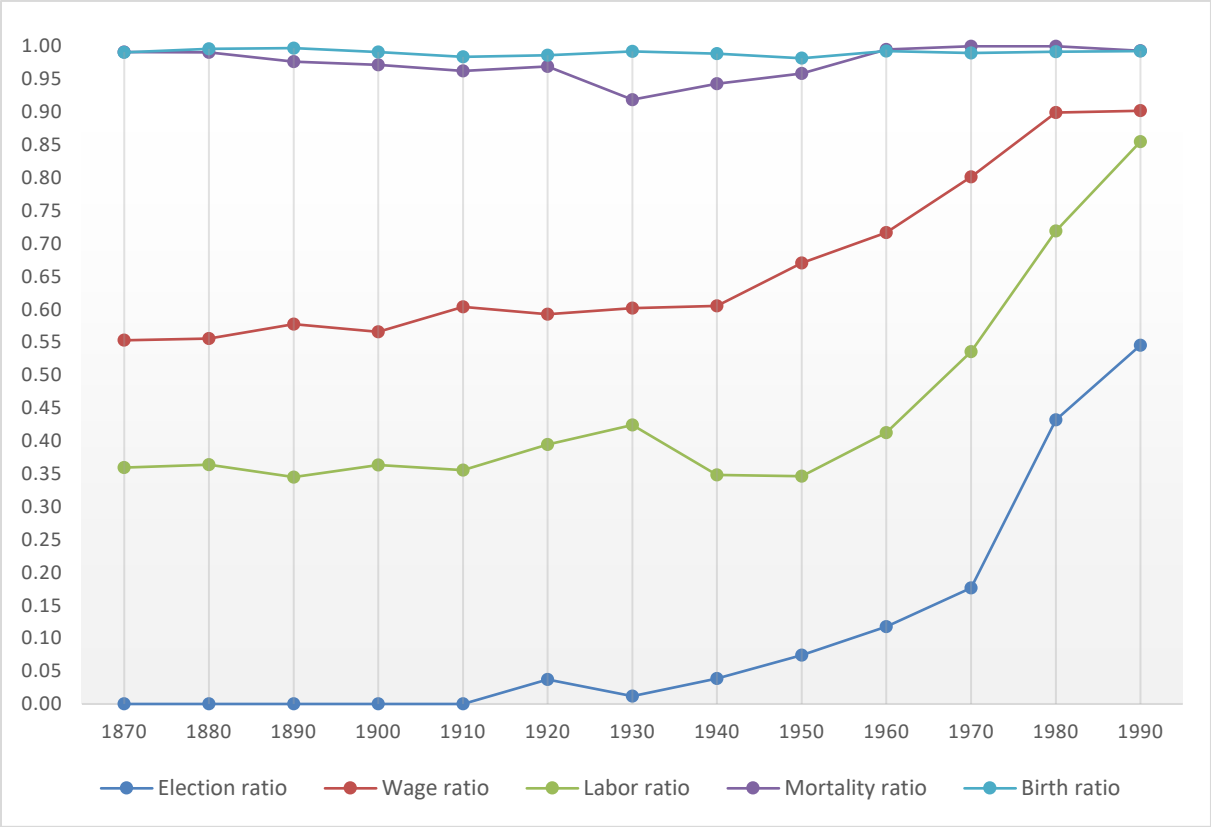


Figure C3: Labor Force Participation (average)

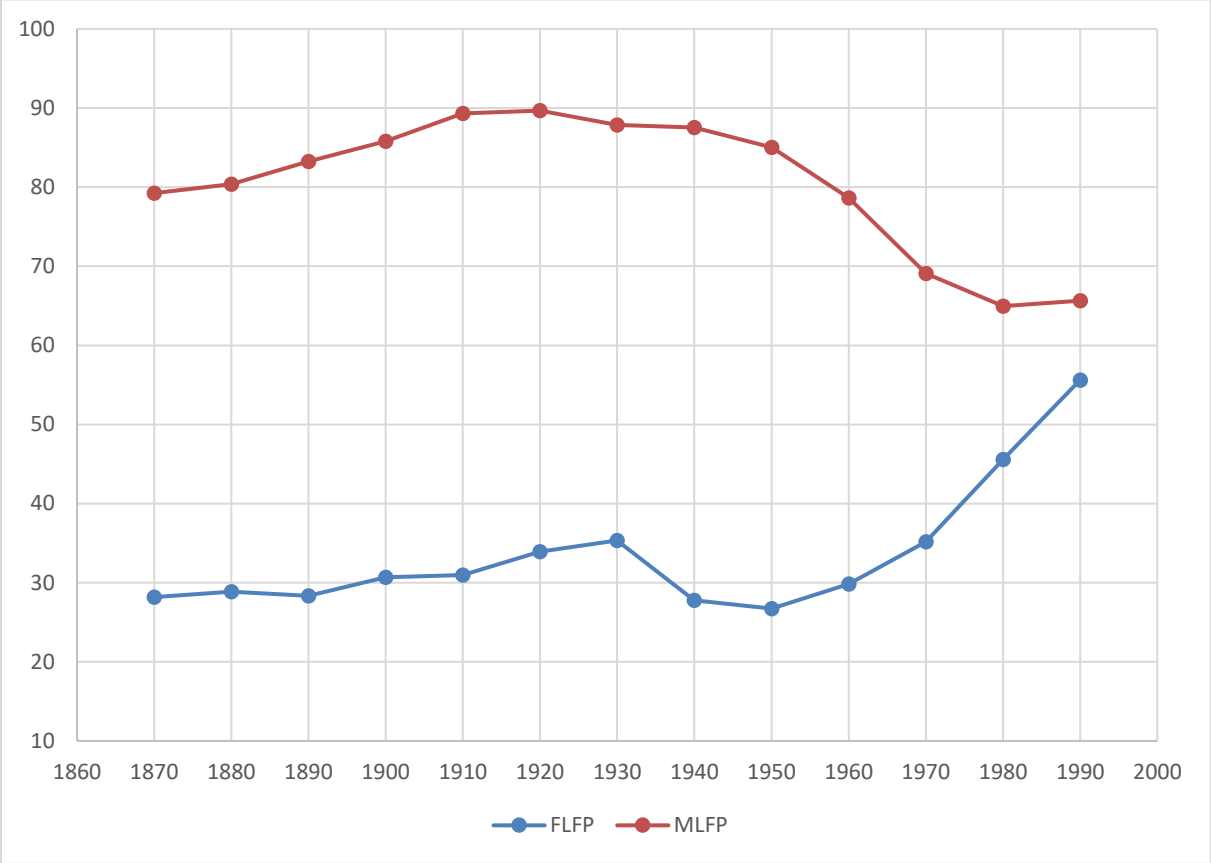


Figure C4: Mortality Rate (average)

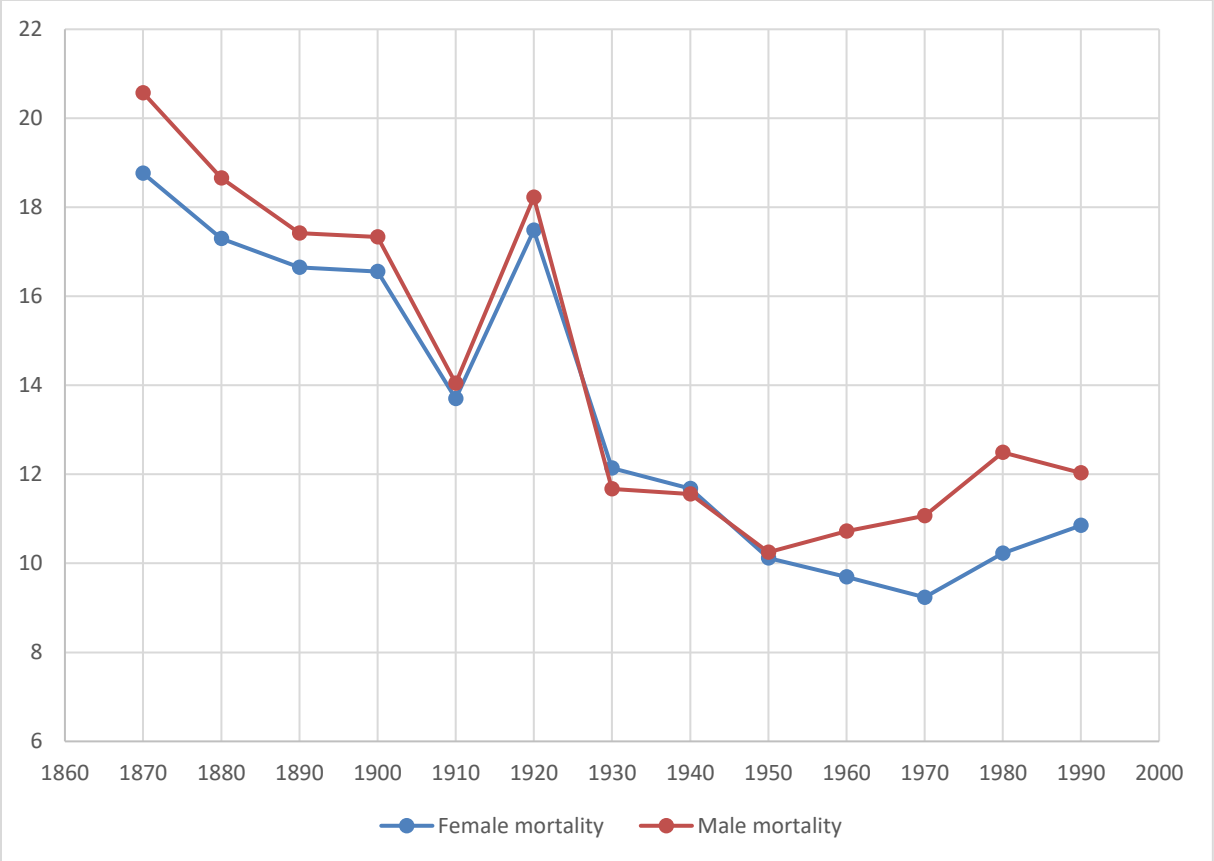
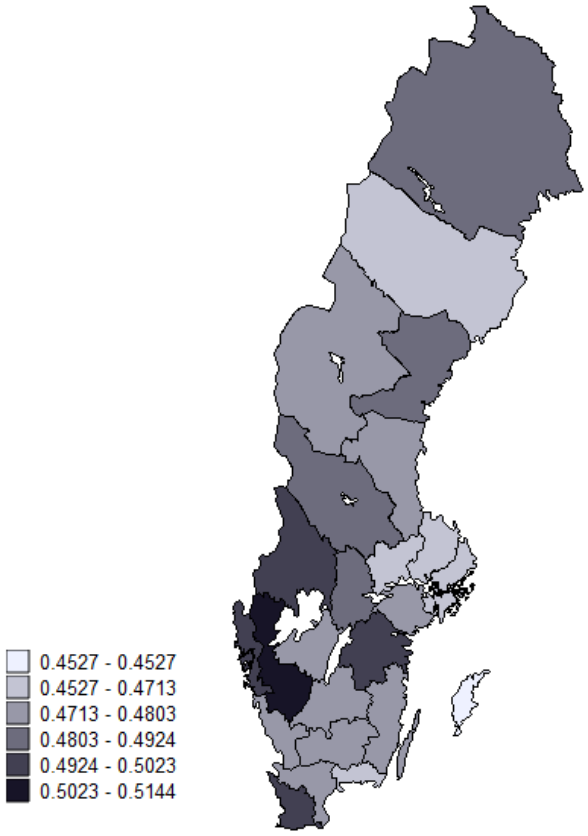
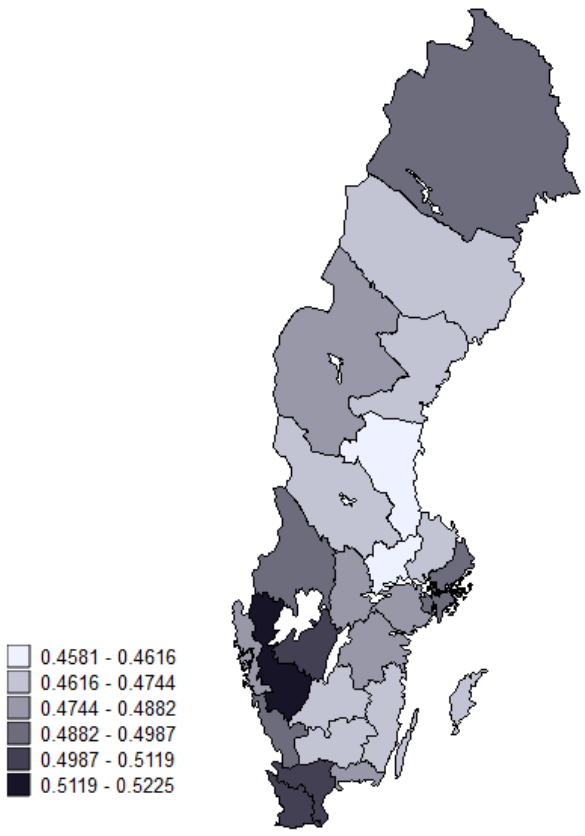


Figure C5. Distribution of HGGI – Jenks intervals by year

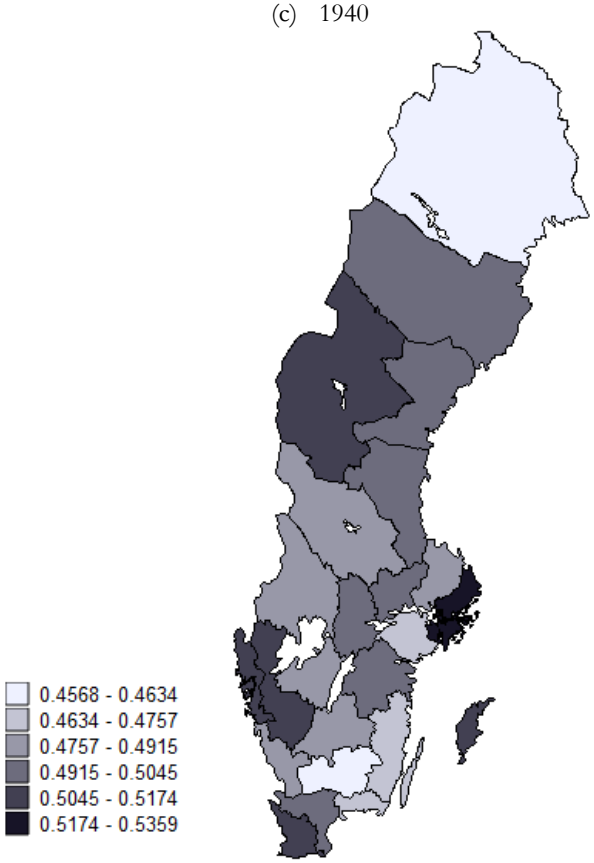
(a) 1870



(b) 1900



(c) 1940



(d) 1990