

GOTHENBURG STUDIES IN ECONOMIC HISTORY 17

# Regional wages and labour market integration in Sweden, 1732–2009

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SCHOOL OF BUSINESS, ECONOMICS AND LAW



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## ABSTRACT

Regional wages and labour market integration in Sweden, 1732–2009  
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Doctoral Dissertation in Economic History at the Department of Economy and Society, School of Business, Economics and Law, University of Gothenburg, P.O. Box 625, SE 405 30 Gothenburg, Sweden. (Written in English).

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This dissertation consists of an introduction, four research papers and two papers that describe the data collected. Three county-specific data sets were constructed: one wage data set for the manufacturing sector, one wage data set for the agricultural sector, and one cost-of-living data set. The four research papers examine regional wage dispersion and labour market integration.

Paper 1 explores regional wage dispersion in the Swedish manufacturing sector between 1860 and 2009. It shows a long-term tendency of convergence, interrupted by a brief spell of divergence in the period 1913–1931, and by stability after the early 1980s. Regional changes in the share of workers employed in industry played a minor role in this development. Instead, regional wage compression resulted from the catch-up between low-wage and high-wage regions.

Paper 2 investigates the regional wage convergence of farm workers in Sweden between 1732 and 1980. Mainstream economic theory predicts that labour market outcomes will converge as transports and communication technologies increase labour mobility. This paper shows that regional wage dispersion declined from about 40 per cent to 4 per cent. Convergence characterised the era up to the Napoleonic wars; the period that followed was marked by quite stable wage dispersion. Industrialisation set in motion a new wave of convergence, also temporarily interrupted by the turmoil during the First World War and the deflation in the early 1920s.

Paper 3 examines regional wage gaps between agricultural and manufacturing workers from 1860 to 1945. Previous research has mostly looked into aggregated wage differences between urban and rural workers. This paper shows large variations in wage gaps across regions and time. Geographical patterns prevailed during the widening of the wage gaps between the First World War and the early 1930s, as a result of different labour market responses to economic crises and wars. Regional wages between agricultural and manufacturing workers show a weak positive association until the Second World War, when it became negative, thus indicating regional disintegration.

Paper 4 focuses on regional specialisation and the wage structure during the early industrialisation years, from 1860 to 1879. This paper employs regional industry-specific wages and employment data, yielding results that differ from those presented by other researchers. The results presented here show a more compressed inter-industry wage structure. A decomposition of the wage structure shows a shift from within-region to between-region factors, suggesting that regional specialisation played an important role in the wage structure.

This dissertation provides new evidence of the long-term movement of regional wages in Sweden. The regional wages and cost-of-living series presented here capture wide time spans and make an important empirical contribution for future research into wages and prices.

**KEYWORDS:** Regional wages, wage convergence, wage dispersion, wage gap, cost of living, manufacturing, agriculture, labour market integration.





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# Introduction

## 1. Setting the scene: convergence and regional wages

Wages are often held to be the core of historical and socio-economic research (Scholliers, 1989). In the historiography of economic history, real wages have been taken as an indication of the purchasing power and living standard. A well-known example of the relevance of real wages for research in economic history is the debate on the evolution of the standard of living of the British working class during the industrial revolution. This is probably the longest-running debate in economic history, which still attracts attention and new participants. Wages have also traditionally been employed in studies of income distribution and of the relationship between unemployment and wages. Furthermore, issues of convergence and divergence between continents, countries, regions, sectors, and different categories of workers have also been commonly addressed by means of research that resorts to wages, and in particular to real wages. This dissertation ties in with the research tradition that examines wage convergence and divergence. The research theme is to investigate the long-term movement of regional wages in Sweden.

During the late nineteenth and early twentieth century, the spread of transportation and communication such as railroads, telegraph networks, and transatlantic steamships spurred economic growth and integration within and between countries in Western Europe, North America, and Australia (Maddison, 1991). The convergence debate gained momentum in the 1990s after the seminal work done by Baumol (1986) and by Abramovitz (1986), both of which used Angus Maddison's long-term GDP estimates (Maddison, 1982). Baumol and Abramovitz provided empirical evidence for Gerschenkron's (1962) argument that relatively backward countries with lower levels of output and productivity enjoyed gains by growing more rapidly than countries starting with higher levels of output and productivity.

The terms of the debate changed in the mid 1990s. Jeffrey Williamson argued that factor prices, and especially real wage rates (PPP-adjusted), are a better measure than GDP or GNP per worker or capita to assess long run convergence (Williamson, 1995). In later works, Williamson shows that the increasing integration of labour markets, measured by declining wage differentials between countries during the late nineteenth and twentieth century,

was important for the international convergence (Williamson, 1996). Since then, the convergence literature has focussed on how flows of labour, goods, and capital influenced wage convergence across countries and continents, in particular between the Old and the New World (Hatton & Williamson, 1998; O'Rourke & Williamson, 1999; Williamson, 1996).<sup>1</sup> These studies show that the great migration across the North Atlantic Ocean in the late nineteenth and early twentieth century shifted the relative magnitude of labour relative to other factors of production, which in turn bolstered wage growth in the Old World and weakened wage growth in the New World. The Scandinavian countries, and in particular Sweden, accounted for most of the real wage convergence in the Atlantic economy (O'Rourke & Williamson, 1999; Williamson, 1995).<sup>2</sup>

As Williamson and others have shown, the transatlantic migration stands out for growth, income distribution, and international integration. As far as international integration in particular is concerned, Lundh, Schön and Svensson (2005) have addressed that increasing integration of the national market is a precondition for international integration. Scholarly interest in the integration of national markets has, however, been somewhat modest, despite the important changes that have taken place within countries. In Sweden, for example, regional wage differences declined significantly in the late nineteenth and early twentieth century (Enflo, Lundh, & Prado, 2014; Lundh et al., 2005). For our understanding of economic development, it is important to establish when and to what extent national labour markets show signs of geographic labour market integration and integration between sectors, such as the rural and the urban sectors.

The literature on regional labour markets within national boundaries dates back to at least the 1960s. Easterlin's (1960) pioneering study of regional income differences in the United States between the mid-nineteenth and mid-twentieth century is one example; another is Hunt's (1973) study of regional wage variations in Britain in the late nineteenth and early twentieth century.<sup>3</sup> In Sweden, pioneering work was done by Jörberg (1972b) on regional differences

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1 On convergence across countries and continents, see, for instance: Allen (1994); Begley, Geary and Stark (2016); Bértola and Williamson (2006); Curtis and Gerald (1996); Prado (2010a); Söderberg (1985).

2 The Scandinavian and Swedish catch up with the core was further discussed in O'Rourke and Williamson (1995a, 1995b). Ljungberg (1996) presents a critical discussion of the two articles, and Prado (2010a) showed that the Swedish catch up, estimated by Williamson (1995), was overestimated.

3 Changes in local or regional wage variations over time have a long pedigree in the UK. See, for instance: Bowley (1898, 1900) and Fox (1903).

in agricultural wages during the eighteenth and nineteenth century, and by Olsson (1971) on regional wage differences in the mechanical engineering industry during the first half of the twentieth century.

Although the pioneering studies of regional income differences (Easterlin, 1960) did not account for the potential impact of regional price differences, followers have controlled for the importance of regional cost-of-living differences (Coelho & Shepherd, 1974). Nominal and real wages have been the focus of Swedish research; Söderberg (1985), for instance, relied on nominal wages, while Ahlström (1974) and Jörberg and Bengtsson (1981) constructed cost-of-living indices. Carrying on the tradition, Persson (1997) and Lundh et al. (2005) constructed price indices for broader regions.

The number of studies on regional wage differences in a national setting increased considerably in the 1990s and early 2000s.<sup>4</sup> This strand of the literature continues to grow with studies that focus on different time periods and market sectors. For instance, Caruana Galizia (2015) has recently published a book on Mediterranean real wages and labour market integration. The empirical evidence provided by these studies testifies mostly to the convergence of regional wages during the nineteenth century and early twentieth century, as well as to its interruption by the First World War.

Yet, it should be noted that comparisons among different countries might be marred by several methodological and empirical problems. One of them is data availability; data may vary from one country to another because of the scarcity of historical regional wages, or regional wages may refer to different sectors (agriculture, manufacturing, construction) and to workers with different skill levels (unskilled or skilled). Another problem is the lack of a standard measure of wages; these may be measured as annual, daily, or hourly. Most studies also lack a common definition of the spatial unit; it is common to conceive of broader regions, but they can be based on the four cardinal points, or departments, provinces, states, and counties. This heterogeneity also owes to data availability, as well as to each country's definition and administrative classification. Furthermore, most studies do not capture the same time period, and even when they do so, the length of the time periods under consideration varies. Inconsistencies such as these make it difficult to draw general conclusions about generic forces, but it is nevertheless important to emphasise that the

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<sup>4</sup> See, for instance: Boyer and Hatton (1994, 1997); Collins (1999); Heikkinen (1997); Lundh et al. (2005); Margo (1999); Rosenbloom (1990, 1996, 1998, 2002); Rosés and Sánchez-Alonso (2004); Sicsic (1995).

literature does provide important knowledge about country-specific trajectories of regional wage differences and labour market integration.

Despite the problems that are likely to arise in international comparisons, scholarly interest in regional wage differences continues to grow, and the key factor that prompts research on the issue is the absence of insights into the long-term movement of regional wages and labour market integration. This dissertation engages directly with this absence, which is a result of the rather short time span of most studies, by investigating the long-term movement of regional wages in Sweden. I have undertaken the laborious task of constructing regional wages series, following the regional classification of counties (*län*), with a view to establishing county-specific manufacturing wages from 1860 to 2009, and agricultural wages from 1732 to 1980.<sup>5</sup> In order to study the movement of real wages, I have estimated county-specific cost-of-living indices from 1732 to 1959. The series were constructed from different sources, such as market price scales (*markegångstaxor*), Swedish official statistics, and archival material (see section 4). The new series provided here is a valuable empirical contribution for future research into wages and prices.

This dissertation ties in with the international economic history literature that examines regional wage convergence and labour market integration (see footnote 4) and, in particular, with the strand of literature that examines regional wage differences in Sweden (Bengtsson, 1990; Enflo, Lundh, et al., 2014; Jörberg, 1972b, 1972c; Jörberg & Bengtsson, 1981; Lundh et al., 2005; Söderberg, 1985). All the previous studies on regional wages in Sweden have focused on agricultural wages, with two exceptions. Lundh et al. (2005) examined regional wage convergence during the late nineteenth and early twentieth century using industrial wages for nine broader regions, and Olsson (1971) examined regional wage differences during the first half of the twentieth century by employing wages for the mechanical engineering industry wages and the regional classification provided by the Labour Market Board (*Arbetsmarknadsstyrelsens A-regioner*).

Although a relatively small number of studies have examined regional wage differences in Sweden, giving special attention to regional manufacturing wages, the study of wages has a long pedigree in Swedish economic history. Previous research has, for instance, examined the long-term movement of wag-

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5 The county-specific agricultural wages were co-constructed with colleagues.



es;<sup>6</sup> firm-specific wages;<sup>7</sup> female relative wages;<sup>8</sup> the general wage dispersion;<sup>9</sup> and wage differences between urban and rural workers.<sup>10</sup>

The vast timeline of county-specific manufacturing wages constructed and analysed in this dissertation captures the essence of the rise and decline of the manufacturing sector in Sweden. In contrast to the previous research on agricultural wages, the present study examines two and a half centuries of regional wage distribution.

This dissertation comprises four analytical papers (1–4) and two papers that describe the data construction (5–6). Two of the papers analyse the long-term convergence of regional manufacturing and agricultural wages, respectively. The third paper addresses regional wage differences between agricultural and manufacturing workers, while the fourth paper examines regional specialisation and the wage structure during the early industrialisation.

This dissertation makes a significant empirical contribution to research into wages and prices by presenting regional wages and cost-of-living series that capture wide time spans. The main results of the investigation into the long-term movement of regional wages in Sweden show that the country transitioned from segmentation to integration as a result of a pronounced regional wage compression. This dissertation establishes that the catch-up growth of low-wage regions in relation to high-wage regions was important for the process from segmentation to integration.

The spread of regional wages for manufacturing workers declined from about 20 to 5 per cent over a period of 150 years. Convergence predominated, except during the First World War, when inflation was rampant, and in the early 1920s, which were marked by severe deflation. The spread of regional wages for agricultural workers declined from about 40 per cent to 4 per cent over 250 years. Convergence prevailed up to the Napoleonic wars; the era that followed saw a relatively stable wage dispersion. A new wave of convergence started in the second half of the nineteenth century, but it was also temporarily interrupted by the turmoil during the First World War and the deflation in the

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6 See, for instance: Bagge, Lundberg and Svernlund (1933, 1935); Björklund and Stenlund (1995); Jungenfelt (1959, 1966); Ljungberg (2004); Prado (2010b).

7 See, for instance: Gustafsson, (1965); Larsson, (1986).

8 See, for instance: Gärtner (2014); Löfström and Gustafsson (1991); Stanfors, Leunig, Eriksson and Karlsson (2014); Svensson (1995).

9 See, for instance: Edin and Holmlund (1995); Edin and Zetterberg (1992); Hibbs and Locking (2000); Svensson (2004).

10 See, for instance: Allen (1955); Bohlin and Larsson (2007); Lundh and Prado (2015).

early 1920s. Regional variation in wages between agricultural and manufacturing workers increased between the First World War and the early 1930s, and geographical patterns prevailed on account of different labour market responses to the economic turmoil. In addition, the First World War put an abrupt end to the convergence of regional wage ratios, which never again returned to the pre-First World War levels.

Over the long haul, markets (through labour mobility and trade) and institutions (through collective action and labour laws) took turns pushing towards wage convergence. The different ways in which these forces influenced the course of wage convergence make one hesitant to consider labour market integration as ruled merely by the equilibrium forces described by the so-called “law of one price”.

## 2. Regional wages and labour market integration

According to the literature on the long-term development of regional wages, declining regional wage differences indicates a process that brought previously segmented labour markets together. Before integration, labour markets were predominantly local or regional, and wages varied geographically. The transportation revolution, which stimulated the increasing mobility of goods, capital and labour, brought a change to this scenario. In this literature, increasing labour mobility is commonly identified as the main driver of geographical wage convergence.

### *2.1. Labour market integration: the law of one price*

French economist and mathematician Antoine Augustine Cournot published in 1838 *Recherches sur les principes mathématiques de la théorie des richesses*, a book that would later leave a significant imprint on the research on market integration.<sup>11</sup> In the decades that followed its publication, however, Cournot’s book was completely ignored by economists; its contribution was only acknowledged fifty years later, in 1890, when Alfred Marshall declared in the preface to the first edition of *Principle of economics* that “Cournot’s genius must give a new mental activity to every one who passes through his hands” (Marshall, 1920, p. ix). Despite Marshall’s recognition, it would take another sixty years

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11 The book was translated into English in 1897 and given the title *Researches into the mathematical principles of the theory of wealth* or, alternatively, *Mathematical principles of the theory of wealth*.

for Cournot's characterisation of market integration to attract serious attention among scholars. In 1952, Paul Samuelson published an influential article on spatial price equilibrium that discussed Cournot's definition of market integration (Samuelson, 1952).

Cournot's definition of market integration appears in a footnote; integration takes place in "an entire territory of which the parts are so united by the relations of unrestricted commerce that prices take the same level throughout with ease and rapidity" (Cournot, [1838] 1971, pp. 51–52). This definition includes two conditions. First, the level of prices must be equal (the law of one price); second, prices must quickly and freely return to initial levels after any imbalances (efficiency).

These two conditions are independent of each other, since prices can return slowly to the same level or quickly to a new level (Federico, 2012). According to Federico (2012), there is no method that can test both of these conditions; some methods can assess whether prices are equal or to some extent converging, while others can assess if the market is efficient. Consequently, the growing literature on commodity market integration, which makes frequent use of the market integration framework, most often tests either the efficiency condition, by means of co-movement and variance-based measures, or the price convergence, by means of measures such as the coefficient of variation or trends in relative prices. A small number of studies on commodity market integration, however, test both of Cournot's conditions for integration.<sup>12</sup>

In contrast to the large and growing bulk of research on the changing geography of commodity and financial markets, as well as research on global labour markets, research on national labour market integration is less common. It is often argued that establishing the timing and the extent of national labour market integration is important for our understanding of economic development. The point of departure for research on labour market integration, as mentioned, is the notion that economic development and increased labour mobility spur geographic labour market integration and integration between sectors, such as the rural and the urban sectors. As a consequence, previously segmented local or regional labour markets become gradually integrated at the national level (Boyer & Hatton, 1994).

In an integrated labour market, information flows easily and rapidly between employers and workers at different locations, and participants in the labour market should respond rapidly to employment signals (Rosenbloom, 1996).

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12 See Federico (2012) for an extensive survey of the literature on commodity market integration.

Researchers, however, cannot directly observe the communication channels and the participants' responsiveness and turn, therefore, to the indirect measure – the behaviour of wages.

Those scholars who define labour market integration often refer to Cournot's footnote or to Marshall's writing about Cournot's definition (Marshall, 1920, pp. 270–271). The definition of market integration can differ somewhat, but the implication it carries is the same: "the flow of information and labour will ensure that wages (for the same type of labour, employed under the same conditions) at different locations will 'tend to equality easily and quickly'" (Rosenbloom, 1996, p. 627). Most of the tests of labour market integration, however, are derived from Cournot's first condition, that is, the "law of one price".

American economist and economic historian Joshua Rosenbloom has in several papers and books applied the market integration framework to American labour markets in the late nineteenth and early twentieth century (Rosenbloom, 1990, 1991, 1996, 1998, 2002; Sundstrom & Rosenbloom, 1993). Edward H. Hunt and George Boyer and Timothy Hatton have studied the integration of labour markets in the United Kingdom in the same period (Boyer & Hatton, 1994, 1997; Hunt, 1973). This framework has also been used to assess the Swedish labour market integration during the late nineteenth and early twentieth century (Lundh et al., 2005), as well as to provide insights into the integration of Mediterranean labour markets (Caruana Galizia, 2012, 2015).

## *2.2. Measuring labour market integration*

As mentioned above, information flows freely and quickly between job-seekers and employers in a fully integrated labour market, and market participants are able to respond quickly to any imbalances in supply and demand (Rosenbloom, 1998). Yet, since the flow of information and the reaction of market participants cannot be directly observed, studies must rely on the performance of regional wages.

The law of one price (Cournot's first condition) predicts that workers equipped with the same human capital will receive an equilibrium wage regardless of location (Cournot, [1838] 1971; Federico, 2012). The historical evidence, however, does not confirm the fulfilment of wage equalisation, but rather reveals the presence of regional variations in wages.

The application of the law of one price to labour markets is often surrounded by difficulties (e.g. Rosenbloom, 1998, p. 290, 2002, p. 115). Suppose, for instance, that we have two distinct regions whose labour markets are integrated.

In both, a single category of labour is employed and workers can move between the two regions without costs. If workers in both regions have full information about the wage levels, a difference in wage level would encourage workers from the low-wage region to migrate to the high-wage region. As a result, labour supply would increase in the high-wage region and decrease in the low-wage region, which would in turn entail that wages in the high wage-region would decrease until the wages in the two regions were equalised. A corollary implication of this model is that an economic or political turmoil that affects wages in one region would have an effect on wages in the other region as well. Besides, it is unrealistic to assume that workers could indeed have full access to information about wages in both locations, and that they could move between these locations without costs. In addition to transportation costs, a number of transaction costs, such as those for collecting information and financing migration, are likely to affect potential migrants. As long as there are costs of moving, migration can only continue until the regional wage difference equals the migration cost. Thus, wage equalisation will not occur to a full extent.

Another factor that complicates the application of the law of one price is labour mobility. As Rosenbloom argues, the law of one price requires perfect labour mobility (Rosenbloom, 1998). This requirement is, nevertheless, most often not met, and workers may be willing to accept different compensation levels depending on how they evaluate the specific attributes of each region (Eberts & Schweitzer, 1994). For instance, urban workers are typically better paid than rural workers as compensation for disamenities associated with the quality of life in urban areas, such as higher unemployment risk (Hatton & Williamson, 1992; Todaro, 1969) shorter life expectancy, higher infant mortality, and poorer environment (Williamson, 1981). Besides, the availability of employment for family members is likely to influence labour mobility (Boyer & Hatton, 1997). Finally, one could also assume that the regional variation in working conditions or the frequency of shift work, underground work, and dangerous work might lead to regional differences in compensation wages.

The lack of empirical support for the law of one price may also be attributed both to measurement errors and to equilibrium differentials. Measurement errors may occur because of geographical variations in cost of living (Coelho & Shepherd, 1974). When regional variations in nominal wages and cost of living show a strong correlation close to one, regional nominal wages can serve as a reliable indicator of the convergence or divergence of wages. Equilibrium differentials may prevail because of immobile characteristics specific to each

region that affect the localisation of production facilities. Productive amenities that lower the cost of production, such as nearness to raw materials or transportation facilities, may encourage firms to pay wages above the market rate (Eberts & Schweitzer, 1994).

There are, in sum, a number of problematic issues that affect the application of the law of one price to labour markets. Yet, the major challenge to the law of one price is that the labour market, precisely because it is not a regular market, violates the law itself. The law of one price is attached to the impact that market arbitrage and trade have on the price of homogenous commodities traded across markets. It is not possible, though, to expect the same type of arbitrage on the labour market and on the commodity market (Persson, 1999, 2008). In addition, labour is not a homogenous commodity; thus, even workers who are equipped with the same human capital will not receive an equilibrium wage.

Previous studies have tried to circumvent these problems by performing wage comparisons within homogenous groups of workers and adjusting for differences in the cost of living, non-cash payments, working hours, working conditions, and non-wage characteristic of regions. Still, the historical evidence shows that real wage differences were persistent, which is related to the fact that labour markets are protected, for instance, from national and international migration barriers.

Although labour markets violate the conditions of integration stipulated by the law of one price, regional wage convergence is often on equal footing with labour market integration. In this case, the concept of integration is used in a broader sense, as the price of labour will not be fully equalised across regions, and any remaining wage differentials are not attributed to market failure. Instead of placing emphasis only on market factors, other aspects such as migration and information dissemination, along with broad institutional factors such as the strength of unions and politics, are also important to explain declining and existing wage differentials. One must remember, however, that wage convergence does not equal integration straight off. Wage equalisation is neither necessary nor sufficient to establish the existence of market integration. Regional wages might diverge even in a well-functioning labour market, given that divergent and persistent trends in the demand of labour dominate the supply of labour. Regional wage convergence, on the other hand, might occur even if no improvements have been made to facilitate the functioning of the labour markets (Boyer & Hatton, 1994, 1997). Yet, as Lundh et al. (2005, p. 75) argue, regional wage convergence gives an indication of improved geographical labour market integration.

Although wage convergence can be considered an indication of integration, the concept of labour market integration is somewhat ambiguous. In the absence of criteria to determine the extent of the labour market, one can wonder when the market is integrated and when it is not (Collins, 1999). In fact, the concept of labour market integration requires comparisons across time and space, which favours the kind of approach adopted in this dissertation. Methodological concepts from the long-run convergence literature, that compares units across space aiming to capture wide time spans are borrowed to examine the topic of regional labour market integration. Accordingly, the concept of labour market integration is used in a broad sense in this dissertation, as long-term declining regional wage differentials should indicate the underlying trend of labour market integration.

### *2.3 Testing labour market integration and convergence*

Previous studies have tried to circumvent the violation of the law of one price applied to labour markets by performing wage comparisons within homogeneous groups and adjusting for various aspects such as labour characteristics, differences in the cost of living, non-cash payments, working hours, working conditions, and non-wage characteristic of regions (Rosenbloom, 1998). If wage differentials persisted, this persistence has often been attributed to a market failure.

This adjustment approach has several drawbacks, however, three of which have been pointed out by Boyer and Hatton (1994, p. 89). First, all the advantages and the disadvantages of a region cannot be measured with precision. Second, even if all wage and non-wage characteristics of a region are correctly valued and measured, determining whether a labour market is integrated or not remains a problem, given the impossibility of full wage equalisation across regions. The third problem has to do with the imperfect arbitrage under which labour markets work. It is difficult to assess the effect of labour demand, supply shocks, and deficient labour mobility on wage differentials.

Another approach that tests the degree of labour market integration employs time series tests, such as the correlation coefficient of wage change between regions. A high coefficient would indicate integration, and vice versa. Alternatively, one could also employ a number of cointegration tests to explore the long-run integration of labour markets (Carlino & Mills, 1996; Federico, 2012). These methods resemble the commodity market integration approach, which often emphasises the degree of integration and market efficiency (Collins,

1999; Federico, 2012). One of the major disadvantages of the correlation or the cointegration test is, however, the exclusion of the forces that determine labour market integration.

To account for the major driver of regional convergence – migration – one could employ a vast number of models, such as an error correction model (Boyer & Hatton, 1994, 1997), OLS regression models including migration as explanatory variable (Barro & Sala-I-Martin, 1991; Rosés & Sánchez-Alonso, 2004), or panel data models based on GMM regressions including migration as the main explanatory variable (Enflo, Lundh, et al., 2014).

This dissertation employs a method that makes it possible to test for changes in integration by exploring trends over time in the convergence of regional wages. Most importantly, the method chosen makes it possible to underscore the underlying trend of long-term regional wage dispersion even when temporary changes occur.<sup>13</sup> More specifically, the method chosen employs the two conventional tests for convergence of cross-sectional data commonly referred to in the literature (Barro & Sala-I-Martin, 1991):  $\sigma$ -convergence (sigma) and  $\beta$ -convergence (beta). The test for  $\sigma$ -convergence is designed to capture the change in the spread of wages across regions over time, using the coefficient of variation (the standard deviation normalised by the mean) as a measure of wage dispersion. In the convergence literature, an alternative measure of dispersion is the standard deviation of log wages or incomes, which might produce different results compared to the coefficient of variation because they differ in the weighting scheme of growth in observations (Dalgaard & Vastrup, 2001). I do, however, follow the convention and use the coefficient of variation as a measure of dispersion. By plotting the coefficient of variation, one can view the trend of dispersion, while a log-linear regression tests more formally if the dispersion of regional wages declines over time (Federico, 2012).

The test for  $\beta$ -convergence is designed to measure whether initially low-wage regions outgrow initially high-wage regions. It is a simple OLS regression of the logged initial wage levels against the annual growth rates across a stipulated time period. As a measure, it is adequate to estimate the growth-enhancing potential of regions lagging behind and the pace of catch up with the average wage level. In contrast,  $\sigma$ -convergence sheds light on the distribution of wages

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13 Two obvious drawbacks in relation to the degree of integration must, nevertheless, be mentioned. The first concerns the assumption that regional wages capture the advantages and disadvantages in every region. The second has to do with wage dispersion: this is not a particularly trustworthy measure of the degree of integration between regional labour markets since, as mentioned above, wages might diverge in well-integrated labour markets and converge in poorly integrated ones.



across counties from a historical vantage point. In most cases,  $\beta$ -convergence and  $\sigma$ -convergence give similar insights into convergence or divergence. Manifest disturbances in the movement of wages may, however, lead to different conclusions about the rate of convergence because the estimated magnitude of  $\beta$ -convergence is particularly sensitive to the selected time period.

In addition to the convergence measures, I employ a number of measures to explore regional wages and labour market integration. For instance, the analysis of variance (ANOVA) is used to decompose the overall variance of wages into within- and between-group components. In addition, an index methodology is used to address the unequal regional distribution of industries and to decompose the convergence. Finally, I tackle the issue of regional specialisation during the early industrialisation by means of Krugman indices of regional specialisation and location quotients (Krugman, 1991).

### 3. Wages: measure of convergence and integration

In the historiography of economic history, as previously mentioned, real wages have been used as an indication of the purchasing power and living standard.<sup>14</sup> The most well-known example of the relevance of real wages in economic history is the debate on the evolution of the standard of living of the British working class during the industrial revolution. This is probably the longest-running debate in economic history, which still attracts new participants.<sup>15</sup> Wages have also traditionally been employed in studies of convergence and divergence, as well as labour market integration and disintegration between different categories of workers, sectors, and regions.

The recurrent employment of wages as a measure has also been under scrutiny. It might be argued that their significance is limited because of the exclusion of non-monetary income, unemployment, and welfare payments. Besides, price series might be biased because of the insufficient inclusion of consumption goods. Despite such potential deficiencies, there are also convincing reasons to employ real wages as measure. One of them is the clear definition of what is measured; real wages are an indication of the purchasing power of workers in a given region (Scholliers, 1989). In addition, Williamson (e.g. 1995, 2000) mentions four favourable aspects concerning the use of wages to investigate convergence and integration. First, researchers often use GDP per capita to

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<sup>14</sup> For an overview of the use of real wages, see Scholliers (1989).

<sup>15</sup> See, for instance, Humphries and Weisdorf (2016).

study convergence, but real wages are of much better quality and often more readily available than GDP benchmarks series. Scholars have recently started reconstructing historical regional GDP to assess regional convergence and inequality.<sup>16</sup> The method used for this, by Geary and Stark, distribute national GDP estimates regionally by using regional labour inputs and wage differentials (Geary & Stark, 2002). As data on sector output per worker in each sector are not available, this method assumes that regional variation in sectoral labour productivity can be proxied by regional variations in wage rates in each sector. This method requires accurate and reliable sector-specific county wages.<sup>17</sup> In addition, it assumes that the wage share is equal within sectors in every region at a given point in time. A more straightforward approach to examining convergence and regional differences would be to use the actual wage observations. Second, GDP per capita or worker does not take into account the distribution issue. Workers make important decisions such as to migrate from one area to another taking into account what they can afford with the wages they earn. Regional GDP, which is probably a statistical artefact, does not say anything about workers' actual living standards; real wages, in contrast, are a more trustworthy indicator of economic well-being. Third, real wages are the price of labour, on which globalisation operated. Migration from one region in Sweden to a booming region or to the New World reduced the supply of labour in that region, raising the real wage level. Real wages are a direct measure of these issues. Fourth, economic change almost always produces winners and losers. While GDP per capita may increase in receiving regions or countries, workers in the native regions or countries may experience downward wage pressure. Again, real wages offer more direct insights into these issues.

### *3.1 Wages versus earnings*

The wage data used in this dissertation reflect wages as compensation for labour input, and not total income. Thus, any type of subsidies and capital income are not included.

The source material, as is often the case with historical studies that construct wages, consists of a combination of wage rates, market price scales, and earnings.

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16 For Swedish regional GDP, see: Enflo, Henning and Schön (2014); Enflo and Rosés (2015); Henning, Enflo and Andersson (2011).

17 The wages for the manufacturing sector in the second half of the nineteenth century used in these calculations are extracted from Lundh, Schön and Svensson (2004), who constructed regional manufacturing wages for nine broader regions.

Wage rate is the specified return for a given time unit of labour input, often daily or hourly for workers in the manufacturing industry. Wage rates do not include payment for overtime, premiums, bonuses, or payment in kind. As a measure, earnings are more inclusive because they incorporate the standard (wage) payment and other types of payments.<sup>18</sup> Average hourly earnings are calculated by dividing the wage bill by the number of working hours.

The official Swedish statistics distinguish three types of hourly wage, labelled *a*, *b*, and *c*. Category *a* represents time wages, whereas category *b* represents piece wages. Both categories represent payments for regular working time. The category labelled *c*, on the other hand, consists of the total wage sum paid out divided by the number of working hours. The wage sum includes all kinds of payments, such as time wage (*tidlönearbete*), piece rate (*ackordsarbete*), overtime work (*övertidsarbete*), shift supplement (*skifttillägg*), inconvenient working hour supplement (*ob-tillägg*), holiday pay (*helgdagslön*), vacation pay (*semesterlön*), and other benefits (*övriga förmåner*). The Social Board and Statistics Sweden rely on the *c*-wage to explain the movement of average hourly earnings.

Payments in kind are estimated and included in the constructed regional manufacturing wages in this dissertation, as well as other payments for overtime, premiums and bonuses. Thus, county-specific average hourly earnings are estimated. The established county-specific agricultural wages refer to day wages.

The terms “earnings” and “wages” are used distinctly when the distinction is relevant, such as in Paper 5, where the construction of county-specific manufacturing earnings is described. In the remaining papers, I use the term “wage”.

## 4. Data

I have compiled three different county-specific data sets: one manufacturing wage data set spanning over the years from 1860 to 2009 (male and female workers); one agricultural wage data set that covers the period between 1732 and 1980 (male workers); and one cost-of-living data set that ranges from 1732 to 1959.

The papers in this dissertation describe with broad strokes the most important aspects of the data. Details of the source materials and the construction of the data series are presented in Paper 5, which covers the manufacturing wages and cost of living (1860–1959). Paper 6 covers agricultural wages and cost of

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<sup>18</sup> For a detailed discussion of wage rates and earnings, see Feinstein (1990) and Officer (2009).

living (1732–1959). As the data are constructed from various source materials, difficulties have arisen during the construction process, such as making the different sources comparable. Papers 5 and 6 address these difficulties.

As Lindert and Williamson (2016) point out, studies that reconstruct historical statistics are subject to some fundamental problems. In the present study, one such problem arises in relation to the adequacy of the original data to the kind of analysis conducted here. Some of the original numbers are likely to be incorrect; errors might have occurred, for instance, when they were first recorded or subject to calculation. In addition to this, errors might also have occurred during the excerption of the original data or during the calculations. If these potential errors are random and not systematic, they should not affect the results in any substantial manner. Systematic errors should be corrected, but the errors are less sensitive to comparisons over time and regions if the errors can be assumed to be similarly under- or over-estimated for all regions (Feinstein & Thomas, 2002). The data constructed in this dissertation have been subjected to multiple steps of aggregation and weighting schemes, which should limit the influence of potential errors. Papers 5 and 6 give a detailed account of the steps taken in the construction process and in the calculations. My aim was to make readers and future users of the material aware of its potential problems and limitations.

Unfortunately, I have not been able to locate any source materials appropriate for the construction of county-specific manufacturing wages between 1880 and 1909. This is an important period in the Swedish industrialisation process: the country was on the brink of massive industrialisation and employment increased rapidly in the manufacturing sector, but decreased in agriculture (Schön, 2010).

The following section presents briefly the empirical foundation of this dissertation.

#### *4.1 Manufacturing wages*

The Swedish official statistics provides information on county-specific wages between 1931 and 1990. Between 1950 and 1962, however, no county-specific wages were reported, for unknown reasons. These wages are available in the Historical Labour Database (HILD), compiled by the unit of Economic History of the University of Gothenburg. This dissertation extends the wage series backwards to 1860 and, in order to circumvent the incompleteness of the published official statistics in the period 1950–1962, it also extends the series forward beyond 1990.

The county-specific manufacturing wages from 1860 to 1990 are constructed from four sources. First, the original returns from survey data collected by the Tariff Commission (*Tullkommittén*) in 1880, available in the National Archives (*Riksarkivet*), were used to establish benchmarks for 1860–64, 1865–69, 1870–74, 1875–79, and 1879. Second, data collected by the Swedish Metal Trades Employers' Association (*Sveriges Verkstadsförening*), available in the Centre for Business History (*Centrum för Näringslivshistoria*), were used to establish benchmarks for 1910, 1912, and 1913. These benchmarks cover only the mechanical engineering industry. Third, the benchmarks for 1922 and 1955 were established with recourse to the original returns of the official wage statistics provided by the Social Board (*Socialstyrelsen*). The original returns of the official wage statistics are available in the National Archives. The first three sources of firm-specific data from archives were digitised and coded geographically. In short, county-specific wages were estimated as the employment-weighted mean of the hourly wage. Fourth, as mentioned, I use the official statistics available in HILD for the periods 1931–1949 and 1963–1990.<sup>19</sup>

In order to extend the series forward beyond 1990, I employ unpublished data from Statistics Sweden between 1995 and 2009. These data differed from the regional data previously published by Statistics Sweden because the classification of counties changed in 1997/98. Counties were merged into larger units in South and West Sweden. Paper 1 explains how the inter-temporal incongruity has been handled.

#### 4.2 Agricultural wages

The county-specific agricultural wages were constructed from wages for day labourers, which were hired and paid on a day-to-day basis. The wages are homogenous with respect to geographical coverage, worker skills, and payment regimes before the mid-twentieth century.

The long-term county-specific agricultural wages from 1732 to 1980 are constructed from three sources covering the following sub-periods: 1732–1865, 1865–1945, and 1945–1980. The first two sources share important attributes to establish wage series of day labourers, and a third source with properties different from these.

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19 The Historical Labour database (HILD) includes detailed bibliographic references to the official statistics. <http://es.handels.gu.se/avdelningar/avdelningen-for-ekonomisk-historia/historiskalonedatabasen-hild>

First, data on market price scales for day labourers compiled by Jörberg (1972a) were used to establish wages for the period 1732–1865. The market price scales were not observed market wages; instead, they were the outcome of a bargain between the parties. Urban employers and farmers had a joint interest in keeping the county wage level down because the market price scale was the norm for local agreements on wages in the year to come. Second, data from the official wage statistics were used for the period 1865–1945. The official wage statistics started to report wages for agricultural workers by county in 1865, but stopped in 1945. Besides day labourers, they also reported wages for contract workers and farm servants.

Bagge et al. (1935), who also offer market price scales with important modifications, make an observation about the accuracy of Jörberg's wage levels that is relevant in the context of my preference for the official wage statistics instead of Jörberg's market price scales between 1865 and 1914. Jörberg's wage levels are generally too high and indicate too much variation as a result of the inclusion of casual labour in urban areas for some of the 24 counties. Casual labour in towns probably received a wage premium relative to day labourers in the countryside. To put it differently, the official wage statistics beginning in 1865 give a more realistic variation of nominal wage levels. Jörberg's wage series are used to extrapolate the wage levels of the official statistics in 1865 backwards to 1732, which implies that the county-specific wage levels are slightly lower than Jörberg's pre-1865 wage series.

Third, to extend the wage series of agricultural workers beyond 1945, when the official wage statistics ceased reporting wages by county, the original surveys of the official wage statistics are used to establish benchmarks for 1950, 1955, 1960, 1970, and 1980. The original returns are available in the National Archives. Each return refers to a particular farm and contains information on location, labour characteristics, kinds of remunerations, and working hours. Two criteria were employed for the selection of workers. First, the workers should be relatively unskilled; second, they should be prevalent throughout Sweden.

### *4.3 Cost-of-living indices*

The county-specific annual cost-of-living indices from 1732 to 1959 are constructed from five sub-periods: 1732–1860, 1860–1913, 1913–1930, 1930–1946, and 1946–1959.

The first sub-period, 1732–1860, draws both on Jörberg's (1972a) county-specific market price scales of prices of eight different food items and on

Myrdal and Bouvin's (1933) budget weights (budget a). Jörberg's original prices in *daler silvermynt* and *riksdaler specie* per barrel were converted to *öre* per kilo. The second sub-period, 1860–1913, draws on the work of Enflo, Lundh, et al. (2014), based on Myrdal and Bouvin's (1933) county-specific market price scales of prices of eleven different food items, as well as on Myrdal and Bouvin's budget weights (budget b). The following sub-periods are based on price information provided by the Social Board. The third sub-period, 1913–1930, draws on prices and budget weights that appear in *Detaljpriser och indexberäkningar åren 1913–1930* (1933), which reports food, fuel, and lightning prices for 53 towns, as well as the consumed quantities of 31 items. Town-specific price quotations are weighted by population to establish the average county-specific prices. The fourth sub-period, 1930–1946, draws on household budget weights for 45 items. These are given in *Konsumentpriser och indexberäkningar 1931–1959* (1961). Prices are gathered from *Sociala meddelanden* (1931–1947), which supplies prices for 49 cities until 1946, and for additionally 11 cities from 1943 to 1946. Again, town-specific price quotations are weighted by population to establish average county-specific prices. Finally, the fifth sub-period, 1946–1959, draws on the price observations of eight regions for every fifth year, beginning in 1945. These observations appear in *Konsumentpriser och indexberäkningar 1931–1959* (1961). The same household budget of the previous period is used here as well, but prices are only available for 42 items.

Regional prices of food and fuel/lighting ceased to appear in the official price statistics in 1960. Previous research has, thus, resorted to house prices (Gärtner, 2016; Persson, 1997; Westerlund, 1998). For the purposes of this study, however, the use of house prices to extend the cost-of-living indices post-1959 presents a number of problems. One might, for example, exaggerate inter-county cost-of-living differences. While price differences of most consumables are minor because of inconsequential transport costs, house price differentials across regions remain significant and are likely to increase over time. Besides, most workers often did not own their housing, and the expenditure share of housing in most people's budgets is small relative to the entire bundle of consumables. Yet, the main problem posed by house prices as a measure of cost-of-living differences is that they are relevant only for house buyers, and only a fraction of all houses are sold every year. If house prices increase, house owners do not experience an increase in cost of living, on the contrary; owners experience increasing wealth when house prices go up. Therefore, county-specific cost-of-living indices are established up to 1959.

The weighting scheme used to establish average price levels for each county resembles the Laspeyres index methodology: consumed quantities in physical units that refer to a base year are multiplied by a given year's prices. However, the assumption that the consumed quantities at the national level apply to all counties differs from the true version of Laspeyres index methodology. The fixed budget weights across regions probably over-estimate price differences because consumed quantities do not vary by relative prices, just as in inter-temporal comparisons, in which Laspeyres early base year leads to a higher increase in prices than Paasche and Laspeyres late base year weights. The sub-periods are spliced together, which results in 24 county indices that capture the era from 1860 to 1959 in Paper 5, and 1732 to 1959 in Paper 6. The last step in the construction of cost-of-living indices scales each county relative to the nationwide mean in 1935 (Paper 5), and to the price level of Stockholm county in 1935 (Paper 6), so that the indices capture differences in changes and levels.

## 5. Presentation of the papers

### *5.1 Paper 1: Exploring regional wage dispersion in Swedish manufacturing, 1860–2009*

With Christer Lundh and Svante Prado

This paper explores the long-term regional wage dispersion in the Swedish manufacturing sector. Mainstream economic theory predicts that, provided that human capital does not vary a great deal, wages will converge among workers and regions as transport and communication bring labour markets together. The starting point for this convergence is that pre-industrial labour markets were mostly local or regional, which implies that wages varied geographically. The transportation revolution, with the expansion of railways and telegraphs, stimulated the increasing mobility of goods, capital, and labour. Increasing labour mobility generated the decline of wage differentials. This convergence indicates a development from the segmentation to the unification of labour markets. Historical labour markets, however, fail to confirm this prediction because the evidence indicates that large wage differentials across space were common.

Barring Lundh et al. (2005), who examined regional wage convergence using industrial wages for nine broader regions during the late nineteenth and early twentieth century, all previous research on regional wages in Sweden has focused



on agricultural wages. In contrast, our data refer to 24 counties and capture the essence of the rise and decline of the manufacturing sector in Sweden.

The results show that regional wage dispersion in Swedish manufacturing in the period 1860–2009 featured a long-term tendency of  $\sigma$ -convergence, interrupted by a brief spell of divergence in 1913–1931, and by stability after the early 1980s. We show that regional changes in the share of workers employed in industry played a minor role in this development. Instead, regional wage compression manifested itself largely through  $\beta$ -convergence, since low-wage regions caught up with high-wage regions. In addition, we employ the analysis of variance (ANOVA) to test whether the total variance of wages is largely attributable to site-specific characteristics (within-industry variance) or industry-specific characteristics (between-industry variance). The decomposition shows that between-industry wage variation accounted for most of the total wage variation throughout the period.

As convergence occurred unevenly across different time periods, we identify four regimes of regional wage dispersion and examine explanatory factors. First, the increasing labour mobility generated by emigration and the transport revolution brought convergence before the First World War. Second, the economic turmoil in the Swedish economy that resulted from price inflation and economic depression led to regional wage divergence during the First World War and through the 1920s. Third, resumed labour mobility and, above all, new labour market institutions ushered in an era of wage convergence from the 1930s to the early 1980s, wiping out most of the regional wage dispersion. We attribute the remaining wage dispersion to equilibrium differentials because of regional-specific amenities. Fourth, despite increasing pressure from inequality forces, such as changes in the aggregated labour demand, technology shifts, and globalisation, the institutional design of manufacturing labour markets assured that the regional wage dispersion remained largely unchanged from the early 1980s until the late 2000s.

### *5.2 Paper 2: Regional wage convergence of farm workers in Sweden, 1732–1980*

With Svante Prado, Christer Lundh and Kerstin Enflo

This paper shares with Paper 1 the same point of departure: mainstream economic theory predicts that labour market outcomes will converge as transports and communication technologies increase labour mobility. In contrast to Paper

1, however, the focus here lies on the long-term regional wage convergence of farm workers. Regional wage series that cover a wide time span are necessary to examine the labour market transition from separation to integration; otherwise, we may run the risk of capturing only brief spells of a process subject to recurrent swings and temporary setbacks. Few countries offer regional wage series that span more than half a century. This paper attempts to fill the lacuna of long-term studies of regional wage convergence by engaging with the measurement and the corollary of regional wage differences in Sweden from a long-term historical perspective.

The record of regional wage dispersion is established with basis on data referring to farm workers in general and day workers in particular. The use of day workers in agriculture circumvents the problem of changes in the composition of industries and labour skill levels that often arise in studies of regional wage convergence. Previous attempts have examined instances of this potential long-term record of wage dispersion among Swedish counties, but this paper paints the long-term evolution of regional wage convergence with a single brush stroke by splicing the bits and pieces of wage evidence together.

Our analytical strategy adheres to what has become standard in the international convergence literature: we enquire into the spread of wage levels over time ( $\sigma$ -convergence) and into the inclination of low-wage counties to catch up with high-wage counties ( $\beta$ -convergence).

The results show a wage convergence across the entire era, manifested most significantly through a drop of the coefficient of variation from 40 to 4 per cent. Apart from this long-term pattern, we identify an early period of wage convergence in 1732–1813, a period of quite stable wage dispersion in 1813–1872, and a new wave of convergence in 1872–1980, temporarily interrupted by the turmoil during the First World War and the economic depression in 1920–1922.

Catching-up growth makes up an important part of the pattern of decreasing wage dispersion for the entire period. The coefficient of variation tends to decrease by an annual rate of about 1 per cent until the early nineteenth century. Although we find stable regional wage levels in 1813–1872, there was a clear pattern of higher than average growth rates for low-wage regions, and lower than average for high-wage regions. During the era of industrialisation from the 1870s until the First World War, wage convergence occurred at an annual rate of about 2 per cent. After a period of instability in the development of wages during the war and the severe deflation in 1920 to 1922, wage compression resumed with vigour from the early 1930s onwards.

We attribute the regional wage convergence to market forces, mainly labour mobility, and labour market institutions, such as unionism and collective bargaining, which interchangeably decrease the long-run wage dispersion.

The regional wage spread during the first period stemmed partly from compensation for regional differences in costs of living. Controlling for the influence of cost differentials, we find that the dispersion was 35 per cent in the 1730s; it declined to 17 per cent during the Napoleonic Wars. We attribute the pronounced reduction in wage spread from the 1750s to the 1780s to institutional factors such as the minting reform and changes in the assessment of the market price scales, as well as to the integration of regional grain markets, which led to converging regional prices.

Emigration and internal migration from low-wage to high-wage regions were the major drivers of wage convergence during the industrialisation, up to the First World War. After the Second World War, labour mobility also played an important – if somewhat different – part in the convergence of regional wages for farm workers. The manufacturing industry expanded and attracted farm workers. This expansion of labour demand in manufacturing put pressure on agrarian employers to offer wages at levels similar to manufacturing workers' wages. The close ties between the two sectors ensured that demand forces affecting manufacturing also affected agriculture. In addition, agrarian trade unions pushing for nationwide collective agreements grew in power during the interwar period, and continued to wield their political clout in the post-war period. The nationwide character of collective agreements contributed to the decrease in the regional wage spread of farm workers.

### *5.3 Paper 3: Regional wage gaps between agricultural and manufacturing workers in Sweden, 1860–1945*

This paper examines regional wage gaps between agricultural and manufacturing workers from the early industrialisation through the Second World War. Previous studies have found a substantial and persistent wage gap of 50 per cent or more between urban/industrial and rural/agricultural workers. These findings challenge the assumption held by mainstream economics that increased migration and labour mobility should close the wage gap; higher wages in industrial than in agricultural areas should encourage migration from agriculture to industry, causing the wages across the two labour markets to equalise.

In general, the wage gap decreases by roughly half of its nominal size once cost-of-living differences are estimated. In Sweden, the relative real wage gap was

substantial and even increased during the interwar years. Previous studies have explained the widening of the wage gap as a result of different labour market responses to economic crises and wars; these different responses are attributed to dissimilar institutional structures in the two labour markets. Although some progress has been made toward understanding the Swedish urban–rural wage gap, all previous research has been done on aggregated wage data. In fact, regional patterns of agricultural and manufacturing development, as well as compositional effects between different types of agriculture and industries, determine the aggregated wage levels. In addition, previous research, albeit very scarce, has shown that the examination of regional wage gaps provides insights into key issues of labour market behaviour.

In Swedish economic historiography, regional agricultural and manufacturing wages are commonly described as being positively associated, thus indicating integration between the two sectors, as a result of the localisation of industries in rural areas, rural population growth, and seasonal migration. The available evidence for this relationship, however, is scanty.

The aim of this paper is to contribute to the understanding of urban–rural wage gaps in Sweden by exploring regional agriculture–manufacturing wage gaps. Three central questions structure the analysis. First, was there regional variation in the agriculture–manufacturing wage gap? Second, did the regional differences in the wage gap change over time? And finally, if changes occurred, what explanations can be provided?

I compare regional wages of agricultural day labourers with wages for manufacturing workers. Day labourers are chosen because their employment conditions resemble those of manufacturing workers. I account for the price differences between agricultural and manufacturing workers and the regional price differences.

The results show variations between regions and a significant widening of the wage gaps between the First World War and the early 1930s. In addition, the First World War and economic crises in the early 1920s put an abrupt end to the convergence of regional wage ratios. During the following decades, the regional differences in wage ratios declined, without ever returning to the pre-First World War levels.

The results also show that geographical patterns prevailed during the widening of the wage gaps between the First World War and the early 1930s, which resulted from different labour market responses to economic crises and wars. Wage differences increased more in the southern regions than in the northern regions between the early 1910s and the early 1920s. Between the early 1920s

and the early 1930s, the wage differences in the northern regions increased more than those in the southern regions. I attribute this development to the fact that manufacturing workers in the industrialised southern regions were compensated for the rising cost of living they experienced during the First World War. Besides, higher unionisation rates and collective agreements in the industrial labour market kept manufacturing wages from falling during the economic downturn and from increasing unemployment in the early 1920s. The agricultural terms of trade decreased during the 1920s, with the result that agrarian prices fell more than manufacturing prices. Consequently, the wage differences in the northern regions and other predominantly agrarian areas increased more than the southern wage differences.

In addition, I show that agricultural workers in regions with a larger agricultural sector received higher relative wages than agricultural workers in regions with a larger industrial sector. This pattern, however, weakened in the late 1930s and disappeared in the 1940s, as the structural change in employment between the two labour markets progressed. The association between regional agricultural and manufacturing wages was positive but weak until the mid-1930s. When agricultural workers gained relative to manufacturing workers during the late 1930s and 1940s, the association became weaker and turned negative, thus indicating disintegration between the two sectors.

I attribute this disintegration to three differences in institutional configurations in the two labour markets. Agricultural protection and subsidies, reductions in agricultural working hours, and a wartime wage policy that favoured agricultural workers changed the geographical pattern of that high agricultural wages accompanied high manufacturing wages. Regional patterns were swept away by politics and labour market institutions that promoted institutional changes during the 1930s and 1940s to improve the standard of living for agricultural workers and dampen inflation during the Second World War.

#### *5.4 Paper 4: Regional specialisation and wage structure during the early industrialisation in Sweden, 1860–1879*

This paper explores the wage structure during the early industrialisation period using newly constructed industry-specific wage data that cover 8 industries and 24 counties. It also addresses the role played by regional specialisation and unequal distribution of industries in the wage structure.

It is commonly held that the distribution of economic activity becomes unequal during industrialisation because some regions specialise in manufac-

turing, while others specialise in agriculture. At some point in time, however, this pattern reverses, and regions become more equal due to the movement of labour from declining agrarian regions to booming industrial regions, as well as to the ensuing development of similar industrial structures and wage levels. Regional inequality of per capita income displays an inverted U-shaped curve.

The historical experience of long-term regional growth in Sweden fits poorly with this conventional notion of an inverted U-shaped curve. Previous research shows that the Swedish economic growth during the early industrialisation period was closely connected to regional specialisation, since a number of resource-intensive regions located in central Sweden and in southern Norrland benefitted from the booming export of wood, steel, and paper. Economic growth was also noticed clearly in the largest cities. Accordingly, a large dispersion of regional growth can be noticed during the second half of the nineteenth century. The spatial connection to growth disappeared towards the end of the nineteenth century, however, as regional growth began to converge. In sum, regional patterns of specialisation and unevenly distributed natural resources steered the early Swedish industrialisation.

Research on Swedish economic history has examined regional specialisation by estimating regional GDPs. The method employed distributes already known national GDP estimates regionally. As data on sector output per worker in each sector are not available, this method assumes that regional variation in sectoral labour productivity can be proxied by regional variations in wage rates in each sector. A number of factors, however, call this assumption into question. For instance, imperfect information flows, as well as agricultural wages set by market price scales that may result in sluggish wage change, would possibly affect wage levels differently among regions and sectors. A more straightforward approach to investigate specialisation would be to focus solely on the growing manufacturing sector and use regional industry-specific wage observations.

The available evidence on regional wages testifies to higher wages in the booming resource-rich regions during the second half of the nineteenth century. In addition, the regional differences in wages were quite large and persistent during the early phase of industrialisation. On the other hand, evidence on industry wage differences, albeit scarce and based on few wage observations, shows a substantial and volatile wage dispersion across industries during the early industrialisation. One cannot attribute high wage levels unequivocally to the booming industries, since the average wage levels were both higher and lower than the average wage level in the export industries during the early industrialisation.

This paper shows that employment was concentrated in booming regions and industries. The results also show that resource-rich regions or regions in east-central Sweden close to Stockholm experienced higher real wage levels. In addition, wages were higher in the exporting industries, such as metal and mining, wood, and paper, pulp and printing, but lower in industries that mainly produced goods for the domestic market, such as food and beverages, and textiles and clothing.

The regional wage dispersion was somewhat stable during the period, but the dispersion of industry wages was relatively low and showed a substantial compression in the late 1870s. In terms of wage growth, this paper establishes that low-wage industries were catching up with high-wage industries. In contrast to previous research, the new evidence of wage dispersion across industries suggests that the wage structure was more compressed during the early industrialisation period.

To disentangle the within- and between-effects of the wage structure, this paper decomposes the variance of wages, by means of the analysis of variance (ANOVA). Two conclusions can be drawn with basis on the decomposition of the wage structure by industry and region. First, wage differences between industries are more important for the overall variance of wages than differences within industries. This result downplays the regional dimension as it indicates that industry-specific attributes are important for the wage structure. Second, wage differences within regions are more important than differences between regions, which confirms the findings in the industry decomposition by emphasising the importance of the composition of industries within regions. The contribution to the total wage variance shifted in favour of the between-component in the end of the period. This result underscores the concentration of industries in specific regions and that all industries in these regions did not experience similar gains.

The new industry-specific wages by county presented in this paper is an empirical contribution for future research into wages and prices during the early industrialisation period.

## 6. Concluding remarks and suggestions for future research

The main empirical contribution of this dissertation is the regional wage and cost-of-living series that capture wide time spans.

There is, of course, scope for improvement in future studies. Some benchmarks would potentially benefit from a larger sample of firms (for instance,

in the manufacturing wage series). In addition, provided that source material can be located, it is possible to extend the number of benchmarks in the end of the nineteenth and early twentieth centuries, when Sweden stood on the brink of massive industrialisation. This extension would open up for more research on regional wages and prices in the context of the industrial expansion. The cost-of-living series could also be improved by the inclusion of further budget weights, such as housing, and by the extension of the series to the period post-1959. Again, these improvements are conditioned by the availability of suitable source materials.

Apart from the empirical improvements suggested above, other issues that are relevant for future research can be mentioned. One such is migration between regions as the major levelling force of regional wages, which is addressed throughout the dissertation. It is possible to expand on the research presented here by examining the role of regional migration in regional wage convergence. Similarly, one could also address the issue of labour mobility within regions by investigating what role an increased labour demand in the expanding manufacturing sector played in regional wage levels in the agricultural sector.

Paper 2 shows a pronounced compression of regional wages in the late eighteenth century, which we attribute to institutional factors, such as the minting reform and changes in the assessment of the market price scales, as well as to the integration of regional grain markets. These factors, however, cannot account for all the compression. There may have been changes over the eighteenth century in the practice of the system for regional price and wage setting that implied much larger differences in wage dispersion up to the 1770s than thereafter. This, however, calls for future research.

In Paper 3 I show that regional labour markets witnessed disintegration during the Second World War as politics and labour market institutions promoted institutional changes to improve the standard of living for agricultural workers and to dampen the inflation. A main driver of this development was the exclusion of agricultural workers from the general wage agreement that tied wages to the cost-of-living index, which meant that agricultural workers experienced higher real wage increases. Although wage differentials between agricultural and manufacturing workers decreased on an aggregated level, the regional outcome seems to be asymmetrical, since the disintegration increased. It would be possible to expand on the findings presented in Paper 3 by investigating more closely what role the agricultural wage agreement during the Second World War played in the regional wage levels between agricultural and manufacturing workers.



Although this dissertation provides regional wage series for female workers, the analysis conducted here is mainly concerned with regional wage development of male workers. The development of female regional wages is one of the topics that I plan to address in the near future. One could, for instance, examine regional wage convergence of female workers and regional wage gaps between female and male workers. Since part of the underlying manufacturing wage data is on firm level, it is also possible to address firm-level wage differences between female and male workers. The firm-level data also make it possible to geocode the material and address research issues such as wage dispersion within regions in relation to town size and differences between urban and rural areas.

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# Svensk sammanfattning

Denna avhandling behandlar regionala löner och arbetsmarknadsintegration i Sverige mellan åren 1732 och 2009. Mer specifikt undersöker jag lönespridning och lönekonvergens mellan Sveriges län för industri- och jordbruksarbetare. Avhandlingen är en sammanläggningsavhandling. Den består av en introduktion, fyra olika uppsatser och ytterligare två uppsatser som behandlar empirin som denna avhandling bygger på.

För att kunna analysera regionala löner har jag konstruerat tre dataset. Det finns ingående beskrivningar av dessa i uppsats fem och sex. Dataseten bygger på källor av olika slag, såsom markegångstaxor, officiell statistik och arkivmaterial. Jag har skapat löneserier för industriarbetare mellan 1860 och 2009 och för jordbruksarbetare mellan 1732 och 1980. För att kunna studera reallöneutvecklingen har jag även skapat regionala levnadskostnadsindex mellan 1732 och 1959. De nya serierna som presenteras i denna avhandling är ett empiriskt bidrag för framtida forskning om löner och priser.

Den första uppsatsen undersöker långsiktig regional lönespridning inom svensk industri. Utgångspunkten är att neoklassisk ekonomisk teori förutspår att löner bland arbetare och regioner kommer att konvergera i takt med att transporter och kommunikationer förbättras. Förindustriella arbetsmarknader var mestadels lokala eller regionala, vilket innebar att lönerna varierade geografiskt. Transportrevolutionen med utbyggnaden av järnvägar och telegrafi stimulerade rörlighet av varor, kapital och arbetskraft, vilket enligt neoklassisk teori borde generera minskade löneskillnader. Det finns dock ingen historisk empiri som entydigt stödjer teorin, eftersom geografiska löneskillnader förblev vanligt förekommande även efter transporter och kommunikationer förbättrats.

All tidigare forskning om regionala löner i Sverige har baserats på löner inom jordbruket. Det enda undantaget är en studie som undersökt regional lönekonvergens för industriarbetare i nio större regioner under det sena 1800-talet och början av 1900-talet.

Resultaten i den första uppsatsen visar på en långsiktig konvergerande lönetrend under perioden 1860-2009. Det finns två avbrott i den långsiktiga trenden, dels en kortare period av divergerande löner mellan 1913-1931, dels en period av stabil lönespridning efter 1980-talets början. Det övergripande mönstret är att regioner med lägre löner har en snabbare lönetillväxt än regioner med högre löner. Där till visar jag och mina medförfattare att regionala

förändringar i andelen anställda inom industrin har spelat en mindre roll i denna utveckling.

Vi identifierar fyra delperioder av regional lönespridning och undersöker olika förklaringsfaktorer. Inom den första delperioden, fram till och med första världskriget, beror lönekonvergensen främst på den ökande arbetskraftsrörligheten. Den andra delperioden, från första världskriget till den ekonomiska krisen i början av 1920-talet, präglades av prisinflation som ledde till regional lönedivergens. Under den tredje perioden, som löper från 1930-talet till början av 1980-talet, tilltog lönekonvergensen till följd av återupptagen arbetskraftsrörlighet och nya arbetsmarknadsinstitutioner. Under den fjärde och sista tidsperioden, från 1980-talets början fram till 2000-talets början, var den institutionella utformningen av arbetsmarknaden så stark att den regionala lönespridningen förblev i stort sett oförändrad, trots ett ökat tryck från ojämlikhetsdrivande faktorer såsom förändringar i den aggregerade efterfrågan på arbetskraft, teknikskiften och globalisering.

I den andra uppsatsen undersöks långsiktig regional lönekonvergens för jordbruksarbetare. I likhet med den första uppsatsen är utgångspunkten att neoklassisk ekonomisk teori förutspår konvergerande löner, eftersom förbättrade transporter och kommunikationstekniker ökar arbetskraftens rörlighet. Få länder har regionala löneserier som spänner över mer än ett halvt sekel. Sverige utgör dock ett fall som kan fylla kunskapsluckor på området. Jag och mina medförfattare undersöker regionala löner för jordbruksarbetare i allmänhet och daglönearbetare i synnerhet. Genom att använda daglönearbetare inom jordbruket undviker vi vanliga förekommande problem inom studier av regional lönekonvergens, såsom sammansättningseffekter av olika branscher och yrkeskategorier.

Resultaten visar att perioden i sin helhet präglas av konvergerande löner; variationskoefficienten minskar från 40 till 4 procent. Från detta långsiktiga mönster urskiljer vi en tidig period av lönekonvergens mellan 1732 och 1813, en period med ganska stabil lönespridning mellan 1813 och 1872 och slutligen en ny period av konvergens mellan 1872 och 1980. Konvergensen under den sista perioden avbryts tillfälligt under första världskriget och den ekonomiska krisen i början av 1920-talet. Det övergripande mönstret är att regioner med lägre löner har en snabbare lönetillväxt än regioner med högre löner.

Vi anser att den minskande lönespridningen under andra halvan av 1700-talet beror på institutionella faktorer, som till exempel myntreformen och förändringar i markegångstaxor samt integreringen av regionala spannmålsmarknader. Emigration och intern migration var viktiga drivkrafter för lönekonvergens



under industrialiseringen och fram till första världskriget. Migranter flyttade från regioner med låga löner till regioner med höga löner. Arbetskraftsrörligheten var viktig för lönekonvergensen även efter andra världskriget, om än med andra bakomliggande mekanismer. Den expanderande tillverkningsindustrin attraherade allt fler jordbruksarbetare, vilket i sin tur pressade arbetsgivare inom jordbruket att erbjuda löner på nivåer som var i paritet med industrilöner. Under mellankrigstiden växte sig jordbruksarbetarnas fackföreningar allt starkare. Efter kriget materialiserades den ökade fackliga styrkan genom rikstäckande kollektivavtal. Kollektivavtalens landsomfattande karaktär bidrog till att den regionala lönespridningen för jordbruksarbetare minskade.

I den tredje uppsatsen undersöker jag regionala löneskillnader mellan jordbruks- och industriarbetare mellan 1860 och 1945. Tidigare studier har påvisat en betydande och ihållande löneklyfta på 50 procent eller mer mellan industriarbetare i städerna och jordbruksarbetare på landsbygden under industrialiseringen på 1800- och 1900-talet. Detta utmanar antagandet om att ökad migration och arbetskraftsrörlighet minskar löneklyftan.

I allmänhet minskar lönegapet med ungefär hälften när skillnader i levnadskostnad mellan stad och landsbygd tas i beaktande. I Sverige var reallöneskillnaden betydande under det sena 1800-talet och tidiga 1900-talet och under mellankrigstiden ökade skillnaderna ytterligare. Tidigare forskning har förklarat dessa ökade löneskillnader med att ekonomiska kriser påverkade arbetsmarknaderna på olika sätt, eftersom de skilde sig åt i sin institutionella utformning. Även om vissa framsteg har gjorts för att förstå löneskillnader mellan arbetare i städer och de på landsbygden, så har all tidigare forskning byggt på aggregerade löneuppgifter. Dessa aggregerade löner bestäms dels av regionala mönster inom jordbruks- och industriutveckling, dels av sammansättningseffekter mellan olika typer av jordbruk och industrier.

Resultaten i den tredje uppsatsen visar på stora variationer mellan regioner och en betydande generell vidgning av löneskillnaderna mellan första världskriget och tidigt 1930-tal. Löneskillnaderna utvecklades olika geografiskt. Från tidigt 1910-tal till tidigt 1920-tal ökade löneskillnaderna mer i de södra regionerna än i de nordliga regionerna, medan förhållandet var omvänt från 1920-talet till början av 1930-talet. Under denna period ökade löneskillnaderna i stället mer i norr än i söder. Denna utveckling beror på att industriarbetare i de mer industrialiserade södra regionerna kompengades för sina stigande levnadskostnader under första världskriget. Dessutom bidrog den högre fackliga organisationsgraden och de mer frekventa kollektivavtalen till att hålla industrilönerna uppe under den ekonomiska nedgången i början av 1920-talet.

Under 1920-talet föll jordbrukspriserna mer än industripriserna, vilket ledde till att löneskillnaderna i de nordliga regionerna – liksom i andra övervägande agrara områden – ökade mer än i de södra regionerna.

Inom svensk ekonomisk-historisk forskning beskrivs det ofta att jordbruks- och industrilöner samvarierar regionalt. De tillgängliga beläggen för detta är dock knapphändiga. I denna uppsats visar jag att regionala jordbruks- och industrilöner är svagt korrelerade fram till mitten av 1930-talet. Under 1930- och 1940-talet försvagas detta redan svaga samband ytterligare och blir till slut negativt i takt med att jordbruksarbetarnas löner ökade i relation till industrilönerna. Lönerna i de två sektorerna och i regioner drevs i olika riktningar under 1930- och 1940-talet, vilket var ett resultat av politiska reformer som dels syftade till att förbättra levnadsstandarden för jordbruksarbetare, dels dämpa inflationen under andra världskriget.

I den fjärde uppsatsen undersöks lönestrukturen i industrin under den tidiga industrialiseringsperioden med nyskapade löneserier för åtta branscher och tjugofyra regioner. Denna uppsats behandlar även hur regional specialisering påverkade lönestrukturen.

Det är allmänt ansett att industrialisering kan leda till geografiska ojämlikheter i den ekonomiska fördelningen, eftersom vissa regioner specialiserar sig på industritillverkning medan andra regioner specialiserar sig på jordbruk. Vid någon tidpunkt vänder detta och skillnader mellan regionerna blir mindre när arbetskraftsförflyttningar sker från jordbruksregioner till industriregioner. Det här utvecklingsmönstret överensstämmer dock inte fullt ut med Sveriges långsiktiga regionala tillväxt.

Tidigare forskning har studerat regional specialisering genom att estimerat regionala BNP-siffror. Resultaten visar att den ekonomiska tillväxten i Sverige under den tidiga industrialiseringsperioden var nära kopplad till några få råvaruintensiva regioner – mellersta Sverige och södra delen av Norrland – som exporterade råvaror såsom trä, stål och papper. Den ekonomiska tillväxten var också starkt koncentrerad till de största städerna. Följaktligen var spridningen av regional BNP stor under andra halvan av 1800-talet. I denna uppsats undersöks regional specialisering inom industrin genom att använda regionala branschlöner.

Lönerna var högre i råvaruintensiva regioner under andra hälften av 1800-talet. Dessutom var de regionala löneskillnaderna ganska stora. Tidigare forskning har visat på betydande lönespridning mellan branscher under den tidiga industrialiseringsperioden. Forskningen visar dock inte entydigt att höga löner var koncentrerade till exportindustrin.

Den fjärde uppsatsen visar att den industriella sysselsättningen var koncentrerad till ett fåtal blomstrande regioner och branscher. Resultaten visar också att reallönerna var högre i råvaruintensiva regioner, samt regioner i östra och centrala delen av Sverige i direkt närhet till Stockholm. Dessutom var lönerna högre i exportbranscher som till exempel metallindustrin och gruvdriften, trävaruindustrin samt pappersindustrin. Å andra sidan var lönerna lägre i branscher som producerade varor för den inhemska marknaden, såsom mat och dryck samt textilier och kläder. Till skillnad från tidigare forskning så visar denna uppsats på en mer sammanpressad lönespridning mellan branscher.

Denna uppsats dekomponerar den totala regionala lönevariansen för att särskilja hur mycket inomregionala och mellanregionala skillnader bidrog till lönespridningen. Resultaten visar att löneskillnader inom regionerna är viktigare än skillnader mellan regionerna, vilket betonar vikten av bransch-sammansättningen inom regioner. Detta förskjutits dock över tid och i slutet av 1870-talet är skillnaderna utjämnade så skillnader inom och mellan regioner bidrar ungefär lika mycket till lönestrukturen. Detta tyder på att specifika regioner och branscher gynnades av industrialisering, vilket ökar betydelsen av skillnader mellan regioner. Vikten av löneskillnader inom regioner tyder också på att alla branscher inom regioner inte utvecklades i samma riktning. De nya löner som presenteras i denna uppsats är ett empiriskt bidrag till framtida forskning om löner under den tidiga industrialiseringsperioden.

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*Regional wages and labour market integration in Sweden, 1732–2009*

consists of four research papers that explore regional wage dispersion and labour market integration, and two papers that describe the construction of the data. The analysis of the data sets provides novel insights into the long-term regional wage convergence and labour market integration in Sweden. Paper 1 explores regional wage dispersion in the Swedish manufacturing sector between 1860 and 2009. Paper 2 investigates the long-term regional wage convergence of farm workers between 1732 and 1980. Paper 3 explores regional wage gaps between agricultural and manufacturing workers between 1860 and 1945. Paper 4 focuses on regional specialisation and the wage structure during the early industrialisation period.

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