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Catching-up in Europe: Finland's convergence to Sweden and EU15 on GDP per capita[1]

1. Introduction

The economic convergence of countries has been one of the big research issues since the mid-20th century. In line with Alexander Gerschenkron's classical thesis of the advantage of relative backwardness (1952, 1962) numerous studies have tried to find empirical evidence on whether productivity growth rates tend to vary inversely with productivity and production levels. The study of long run development is important because even small differences in growth rates can have enormous long term consequences for standards of living. However, the catching up of the poorer countries is not automatic. In fact the differences between rich and poor countries' GDP per capita have grown during the last century (De Long 1988; Pritchett 1997).

The convergence literature is linked to the growth theories. For instance, the neo-classical theories (Ramsay 1928; Solow 1956, 1957; Swan 1956; Cass 1965; Koopmans 1965) predict convergence in economic growth among countries that have similar saving rates and population growths. In the new growth theories (e.g. Romer 1986, 1987, 1990; Lucas 1988; Rebello 1991) as well as in empirical research the country's ability to technological progress in production with human capital and social capability has been emphasised. For instance, according to Moses Abramovitz's famous article (1986) countries should avoid institutional and technological obstacles to reach faster growth than in the leading countries. When technological progress is achieved, it is accompanied with structural changes of the economy, meaning both changes in the shares of different industries and structural changes inside the same industry when unprofitable old technology firms are replaced with more profitable new technology firms.

One of the topics related to the convergence discussion has been whether it is possible to find common patterns in economic development among countries. According to Gerschenkron the early industrialised countries and the latecomer countries develop in different ways. However, Gerschenkron stressed the

[1] We wish to thank Concepción García-Iglesias for participating in the early ideating of the paper. Warm thanks also belong to Stephen Broadberry, Angus Maddison, Lennart Schön and other participants of the seminar "Convergence and Non-convergence since the Second World War", held on January 20-21, 2006, at the University of Helsinki, for their helpful comments without implicating them for any remaining errors. Riitta Hjerppe, Arto Kokkinen and Matti Hannikainen thank the Yrjö Jahnsson Foundation for financial support in this research. Jukka Jalava's research is partly supported by the Research Project "EUKLEMS 2003. Productivity in the European Union. A Comparative Industry Approach" supported by the European Commission, Research Directorate General, within the Sixth Framework Programme, Contract No. 502049.

importance of manufacturing industries in the progress of latecomer countries – the more backward a country is the faster the potential growth of industrial output[2]. The vitality of industrial production was also emphasised by Nicholas Kaldor (1967) who suggested that aggregate economic growth is related to growth in manufacturing and that manufacturing productivity increases the productivity of other fields in the economy. The classical overall pattern of economic development and structural change was presented slighthly later (e.g. Hartwell 1973): the main contributor to economic growth is the shift from primary production to secondary production during the process of industrialisation, subsequently followed by the shift from secondary production to tertiary production as the post-industrial stage is entered.[3]

Defining absolute convergence as a poorer country's GDP per capita catching up the leading countries' GDP per capita, Finland is a clear, positive case of economic convergence in the 20th century[4]. However, most of the convergence seems to have happened after World War II. In Finland the industrialisation phase started late compared with Sweden and EU15 average. The share of secondary production in GDP did not decrease until the 1970s (Hjerppe 1989; Hjerppe and Jalava 2006) while in many Western European countries the share of manufacturing had started to decline earlier. Thus it seems that Finland was in a different phase of structural development after WWII. In addition, the labour force moved from primary production not only to secondary but also to tertiary production in Finland at the same time in contrast with the classical view of separate industrialisation and post-industrialisation phases. Therefore, Finland has had a somewhat different path in her fast structural change after WWII compared with Sweden and EU15.

The structure of the article is as follows. In section 2 we will describe some general features of Finland's economy and catching up with Sweden and EU15. In section 3 we will examine how primary, secondary and tertiary production and labour productivity growths have contributed to aggregate development, and whether the late industrialisation and different path in structural change have been some of the sources to Finland's faster labour productivity growth, faster GDP per capita growth and convergence. The final section concludes.

[2] See also Prados de la Escosura (2005).
[3] This classical view has also been challenged as e.g. Broadberry (1998) argued that Germany and the United States surpassed Britain's level of aggregate labour productivity by shifting resources out of agriculture and improving the productivity of services rather than manufacturing.
[4] The growth theories have introduced yet another concept – conditional convergence – to the discussion. In conditional convergence countries converge to their own steady state GDP per capita growth rate, which is determined by their steady state capital per worker (to technology) ratio. In this paper the focus is on absolute convergence, since in the case of Finland there has also been absolute convergence to her leading neighbours, which is rather rare worldwide.

2. Some general features of Finland's economy and catching up with Sweden and EU15

Finland in the early 2000s is an industrialized country with a standard of living ranked among the top fifteen, twenty countries in the world. Finland has been a member of the European Union since 1995 and has belonged to the European Economic and Monetary Union since 1999 with Euro as currency. One hundred years ago it was a poor agrarian country with a gross domestic product per capita less than a half of that of the United Kingdom or the United States, world leaders at the time. We know Finland's GDP growth from 1860 on from the historical national accounts of Finland, which were completed in the late 1980s (Hjerppe 1989) The long drawn research was done by researchers at Statistics Finland, the Bank of Finland and the Department of Economic and Social History at the University of Helsinki. We have fairly detailed annual series for the balance of total supply and demand at current and constant prices since 1860, value added and employment by industry, structure of foreign trade by commodities and countries, etc.

Though not blessed with abundant natural resources Finland embarked on the road of industrialisation utilizing the Russian market for commodity goods, her forest sector, her hydropower potential and the rural labour reserve. The role of electrification and other technical innovations as enablers of productivity increase have been important (Jalava 2004). The Finnish GDP per person grew 12-fold from 1900 to 2000. That means a growth of 2.5 per cent per year. The Swedish GDP per person increased 9-fold, that is 2.3 per cent per year, while that of the 15 European Union countries grew almost 7-fold or 1.9 per cent per year in 1900–2000. All mentioned economic areas experienced incredibly fast growth compared with any other period before in known history. Figure 2.1 shows that the long term economic growth in the 20th century has been an almost continuous process with, however, severe disruptions during the World Wars and the 1930s depression especially in Finland and in EU15.

Some acceleration of growth can be seen from 1900 to the 1970s in Figure 2.1, but all the curves flatten down to clearly slower growth rates in the 1970s, after the so-called Golden Years of Economic Growth in the post-Second World War period. In the early 1990s the Finnish economy quite unexpectedly fell into a serious depression for several years and GDP fell by more than 10 per cent. The depression was deeper than any other peace-time depression since the middle of the 19th century. European Union countries also experienced recessions or depressions then, but not nearly as bad as that in Finland.

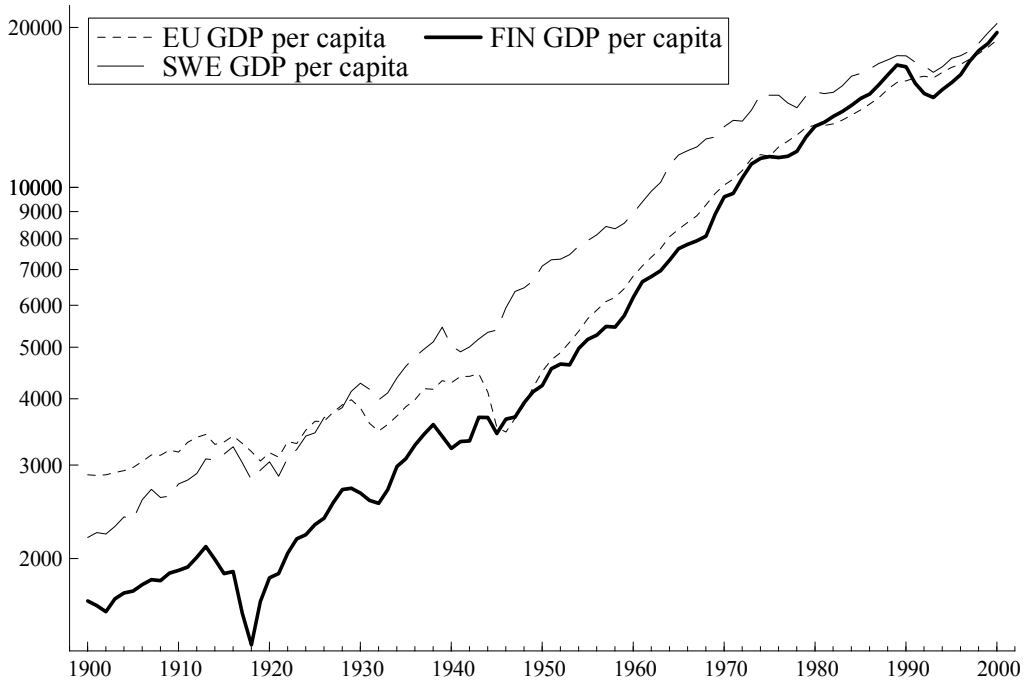


Figure 2.1 GDP per capita in EU15, Sweden and Finland 1900–2000, logarithmic scale 1990 US dollars
Sources: Own calculations; data from Hjerppe (1996) and Statistics Finland; Carreras and Tafunell (2004); Krantz (2001); Statistics Sweden; Maddison (2001).

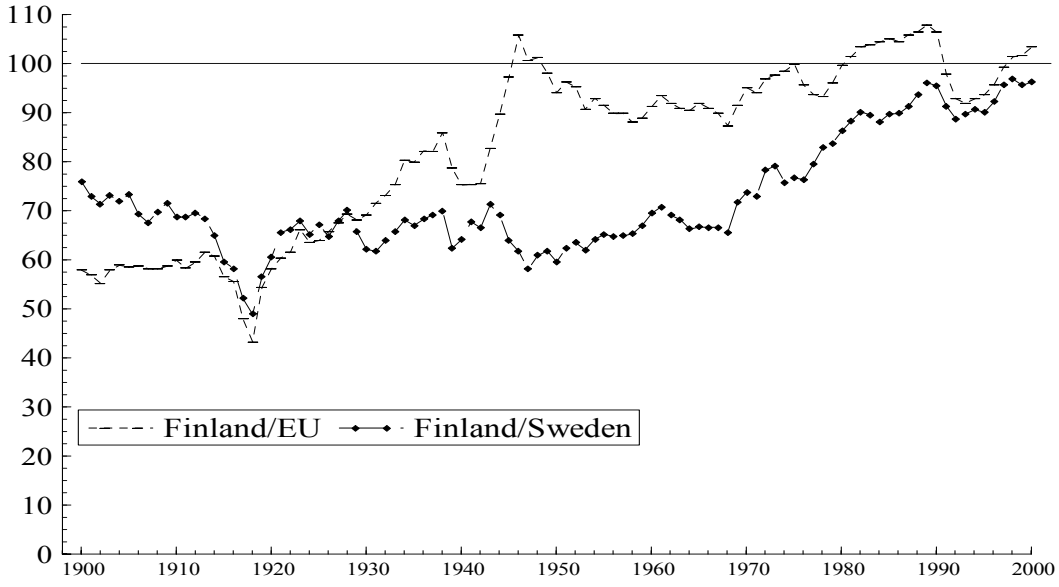


Figure 2.2 Finland's GDP per capita compared with EU15 and Sweden, 1900–2000, per cent.
Sources: Own calculations; data from Hjerppe (1996) and Statistics Finland; Carreras and Tafunell (2004); Krantz (2001); Statistics Sweden. Note that statistics from different sources (national, OECD, World Bank etc.) give somewhat different levels of GDP per capita in PPPs around the turn of the millennium. In some GDP per capita in Finland is slightly higher than that of Sweden, in most it is the other way round.

Compared with EU15 in 1900, Finland started from a level of less than 60 per cent of the West-European GDP per capita (Figure 2.2). There was slow convergence until the First World War. The drop in the Finnish GDP per capita during the First World War and the Finnish Civil War dropped Finland to little over 40 per cent level. After the war the recovery of the economy was quite fast in Finland compared with Western Europe and during the interwar period the Finnish economy did much better than the western world.[5] The GDP per capita gap narrowed to about 20 per cent and even less before the outbreak of the Second World War.

The development of the Finnish economy after the Second World War compared with EU15 was more uneven than in the other peace time periods under consideration. First, there was a brisk catching-up immediately after the war, GDP per capita actually passing the EU15 level in 1946–48.[6] The gap widened again in the 1950s. The gap kept widening until the end of the 1950s, and only after the devaluation and easing of foreign trade regulations in 1957, it was followed by a virtual standstill of the gap until the end of the 1960s. After Finland's devaluation of 1967, the tide turned. The Finnish economy closed the gap to EU15 over the 1970s despite the difficulties caused by the oil crises, to exceed the EU15 level in 1980. The early 1990s depression again changed the situation and caused a 15 per cent collapse. This was followed by a fast recovery during the second half of the 1990s.

Compared with Sweden the Finnish economy did less well before the First World War (Figure 2.2). Sweden was really experiencing fast growth, and the gap in GDP per capita to Sweden widened to 30 per cent, due to Sweden's earlier industrialisation. The hardships of the First World War and Finland's Civil War in 1918 increased the difference further. Finland's fast recovery in the early 1920s reinstalled the 30 per cent difference. This gap prevailed in the interwar period, on average. Finland's deeper 1930s depression widened the gap again, but fast growth after the depression corrected the situation. The Second World War again expanded the distance but not to the same extent as the late 1910s. Finland's GDP fell less during the Second World War, i.e. during long term active war-faring, compared to the hardships of the First World War and the short Civil War in 1918. In the late 1940s and 1950s there was some catching up, but because of some set-back in the middle of the 1960s, there actually was no substantial catching up between 1945 and 1965. A new catching up started and was rather fast in the 1970s and 1980s. The difference was almost closed before the devastating 1990s depression set in and widened the gap again for many years, with some recovery after 1997. The reasons for this fast catching up by more than 20 percentage points from the late 1960s to the late 1980s are not at all clear.[7]

[5] According to Krantz (2001) this was the period of the Finnish take off.
[6] Obviously reconstruction of Finland, settlement of Karelian evacuees and soldiers as well as payments of the war reparations to the Soviet Union forced the Finnish economy into fuller speed than the other countries devastated by the Second World War. The physical civil destruction was also less extensive in Finland than it was in many of the other war-faring countries.
[7] For example, what was the significance of large emigration from Finland to Sweden around 1970?

Labour input and productivity of labour as factors of Finnish economic growth

GDP per capita can be expressed as the product of two components: labour productivity and labour input per capita. Labour productivity (GDP per hours worked) is often seen as the more important one as it can grow without bounds. For the amount of work that can be done per person there is an upper limit. Therefore economic growth can in the long run perspective be sustained only by labour productivity change. Rephrasing the variables in natural logarithms GDP per capita can be divided as follows:

(1) log (GDP / capita) = log (GDP / hours worked) + log (hours worked / capita).

From equation 1 it can be seen that GDP per capita is the higher the higher labour productivity is, the larger the employment share of population is and the more each employee works. An increase in labour input (hours worked) per capita has a level effect on GDP per capita. Labour productivity, on the other hand, has an effect on GDP rather through productivity growth, which acts on the interest on interest principle – even a slight change in the long run productivity growth rate has significant long term implications.

Figure 2.3 shows the levels and evolution of Finnish GDP per capita and its components in index form (natural logarithmic scale) for the years 1900–2004. It is obvious that the main contribution to Finnish GDP per capita growth came from the increase of labour productivity (GDP per hours worked).

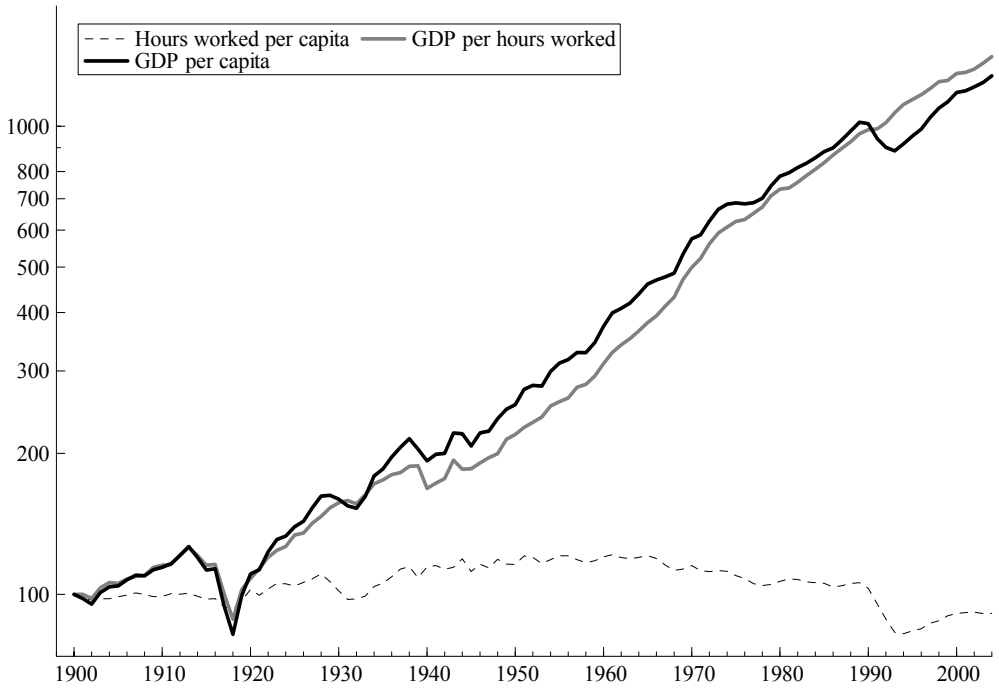


Figure 2.3 GDP per capita and its components in Finland, 1900–2004, GDP at year 2000 prices, Indices 1900=100, logarithmic scale
Source: Own calculations; data from Hjerppe (1996) and Statistics Finland.

3. Structural change and productivity growth as sources of Finland's convergence

In this section we will study whether the late industrialisation and a somewhat different path in structural change have been some of the sources to Finland's faster labour productivity growth, faster GDP growth and convergence. In subsection 3.1 we will first explore whether the later fast growth of secondary production elucidates Finland's catching up. The vitality of industrial production for the economic growth was emphasised e.g. by Nicholas Kaldor (1967). Moreover, the importance of manufacturing growth has been constantly brought up in the Finnish economic policy discussion. We will use the so called Kaldor's growth laws as a framework to test whether the development in secondary production can explain the convergence of Finland after WWII. Later in subsection 3.2 we will broaden our examination and explore the impacts of primary and tertiary production on Finland's convergence to Sweden as well as the impacts of secondary production. Using the non-parametric index number approach in the National Accounts framework the contributions of primary, secondary and tertiary production to GDP and labour productivity growth are studied in both countries in 1945-2003.

3.1 Can GDP and labour productivity growth be explained by secondary production?

In this subsection we will focus on secondary production in explaining economic growth in Finland and in Sweden in 1945-2003 and in EU15 in 1980-2003. In accordance with Kaldor's growth laws (1967, 1978)[8] we will test the hypothesis, whether with the late fastest growth phase in secondary production Finnish convergence to economies mentioned can be explained via its effects on aggregate labour productivity and GDP growth. In other words, we make an assumption here that the fast GDP growth and the essential labour productivity growth in catching up are due to secondary production growth.

First the possibility to explain economic growth by Kaldor's growth laws is examined. With OLS regressions, the statistical significance and explanatory power of the laws are tested on Finland's, Sweden's,

[8] It is worth noticing that originally Kaldor (1967) suggested his growth laws in a different economic environment in accordance with the UK's relatively slow growth in the post-WWII period. At that time the convergence discussion had barely begun. As mentioned before, we will use these growth laws as a framework for testing if the catching up of Finland can be explained by relatively late but fast secondary production growth, which has constantly been brought up in the discussion of Finnish economic policy.

and EU15's data. After that we will focus on the differences in explanatory power and statistical significance of each law in Finland and Sweden in 1945-2003 in order to find out whether Finland really has had different industrialisation phases compared with Sweden and to determine whether the fast secondary production evolution can explain Finland's catching up.

Kaldor (1967) stressed that a precondition for the growths of the secondary and tertiary production is that primary production produces a surplus over the bare subsistence minimum. As a nation passes from economic immaturity to maturity, by which Kaldor (1978) meant a state where real incomes per head in each sector are comparatively similar, the role of secondary production is crucial due to increasing returns to scale. Kaldor in his time (1967, 1978) suggested that 1) aggregate economic growth is related to growth in manufacturing, and that 2) manufacturing productivity increases the productivity of the other sectors. These observations are often called Kaldor's growth laws[9] (e.g. Stoneman, 1979; Bairam, 1990; Mamgain, 1999; Wells and Thirlwall, 2003).

Ordinary Least Squares (OLS) regressions were carried out to cast some light on the applicability of Kaldor's laws on Finnish and Swedish historical economic change in 1945–2003 and on EU15 in 1980-2003. The comparison of Finland and Sweden is also done in the sub-periods 1945–79 and 1980–2003.

regression (1) $\Delta Y_{GDP} = \alpha_1 + \beta_1 \Delta Y_{SEC} + \varepsilon_1$,

regression (2) $\Delta LP_{GDP} = \alpha_2 + \beta_2 \Delta Y_{SEC} + \beta_3 \Delta E_{PRIM\&TERT} + \varepsilon_2$,

where

Δ = *the absolute change of the variable (when variables are expressed in natural logarithms Δ approximates closely relative change e.g. in per cents, sometimes marked with log %)*

Y = *value added, footnote implies the part of the economy under review, ΔY = the change of value added*

LP = *labour productivity, value added / hours worked, ΔLP = the change of labour productivity*

E = *number of hours worked, ΔE = the change in number of hours worked*

α = *a constant in the regression equation*

β = *a regression coefficient for the explanatory variable, if $\beta \neq 0$ according to statistical tests with the data, the variable have explaining power for the left hand side variable in the equation*

ε = *residual or error from the regression equation, the part of variation of the left hand side variable in the equation that could not be explained*

[9] Not to be confused with Kaldor's stylized facts. Kaldor did actually propose several growth laws. One of them stated that manufacturing productivity growth is related to manufacturing output growth (also called Verdoorn's law). We will concentrate here on the two laws mentioned in order to assess the impacts of secondary production on GDP and aggregate level labour productivity growth on Finland's catching up. Jalava (2006a) has estimated the applicability of Verdoorn's law on Finnish data as well.

Kaldor's first proposition is assessed with regression 1, where GDP growth was explained by secondary production's real value added growth in each country or area (Table 3.1). According to the results some confirmation can be given to Kaldor's first law. The model fits fairly well to each country's data, all variables' coefficients are statistically highly significant[10] in each time section available. The model's explaining power (adjusted R squared) is 70 per cent for Finland and 80 per cent for Sweden in 1945–2003. However, comparing Sweden and Finland in two subsections of time (1945–79, 1980–2003), differences in the model fit can be found: The variation in secondary production value added explains only 57 per cent of Finland's GDP variation in the first time section, at the same time it explains as much as 90 per cent of Sweden's GDP variation. In contrast, in the latter time section the secondary production variation explains more in Finland (as much as 85 per cent). Thus, secondary production's contribution to GDP has been more important in Finland in 1980-2003. Therefore, according to these results as well, the benefits from Finland's full industrialisation came later compared with Sweden. With the latter period data, the model gets confirmation on the EU15 (91 per cent R squared) data as well. One must remember that tertiary production also contributed to GDP growth, which was not argued in Kaldor's first law and not tested with regression 1.

Table 3.1 Results for regression 1

	1945–2003	*1945–1979*	*1980–2003*	*1945–2003*	*1945–1979*	*1980–2003*	*1980–2003*
Country	FIN	FIN	FIN	SWE	SWE	SWE	EU15
N	58	34	24	58	34	24	24
equation	1	1	1	1	1	1	1
constant	0.008*	0.013**	0.004	0.011***	0.012***	0.010**	0.014***
	(2.25)	(2.83)	(1.16)	(6.85)	(6.77)	(3.16)	(19.45)
$\beta_1 (\Delta Y_{SEC})$	0.556***	0.493***	0.627***	0.506***	0.579***	0.371***	0.502***
	(5.95)	(3.84)	(19.95)	(10.61)	(18.99)	(8.34)	(11.52)
Adj. R^2	0.70	0.57	0.85	0.80	0.90	0.72	0.91
D.W.	1.21	1.42	1.20	1.24	2.35	1.27	1.63
F	35.37***	14.77***	397.82***	112.55***	360.43***	69.63***	132.76***

***= significant at the 0.1% level. **=significant at the 1% level. *=significant at the 5% level. +=significant at the 10% level. Source: Own calculations, data from Hjerppe (1996) and Statistics Finland; Edvinsson (2005); Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

[10] The t-statistics and F-statistics have been obtained using the Newey-West (1987) regression procedure in the software Intercooled Stata 8.2 for Windows. The idea is that the error structure is expected to be heteroskedastic and autocorrelated up to some predetermined lag. We chose the lag length to be $N^{1/3}$, this means 3 for each of the both sub-periods and 4 for the whole period.

As an assessment of Kaldor's second proposition aggregate LP growth was explained by secondary production's value added growth and the non-secondary sectors' labour input growth (regression 2). According to our regression results in Table 3.2, the growth in the non-secondary sectors' input at first glance seems to have a clear negative relationship with labour productivity change at the total economy level, as Kaldor expected: the β_3-coeffiecients are negative. But with a more careful scrutiny of the results, one notices that with our data, β_3 is not statistically significant (at the 5 per cent level) in Finland in 1945-79 and the explaining power (11 per cents) is dramatically low. Kaldor's second law does not seem to hold for Finland in 1945-1979, although it gets confirmation in all the other time periods and countries. For the whole time section the explaining power is clearly weaker for Finland than for Sweden. On the other hand, the explaining power is the strongest in Finland in the second time period, which corroborates the later continuing industrialization phase in Finland. However, non-secondary labour input growth has not decreased aggregate labour productivity in Finland in 1945-79, which implies primary and tertiary production contributions to aggregate labour productivity as well.

Table 3.2 Results for regression 2

	1945–2003	*1945–1979*	*1980–2003*	*1945–2003*	*1945–1979*	*1980–2003*	*1980–2003*
Country	FIN	FIN	FIN	SWE	SWE	SWE	EU15
N	58	34	24	58	34	24	24
equation	2	2	2	2	2	2	2
constant	0.022***	0.026***	0.019***	0.019***	0.021***	0.017***	0.023***
	(6.83)	(4.41)	(8.24)	(8.50)	(6.24)	(10.00)	(16.26)
β_2 (ΔY_{SEC})	0.232*	0.185	0.319***	0.352***	0.411***	0.186***	0.334***
	(2.20)	(1.20)	(11.84)	(6.12)	(8.29)	(4.82)	(4.48)
β_3($\Delta E_{PRIM\&TERT}$)	-0.464**	-0.315+	-0.778***	-0.773***	-0.580***	-0.587***	-0.880***
	(-2.90)	(-1.94)	(-11.37)	(-7.66)	(-3.57)	(-6.91)	(-6.32)
Adj. R^2	0.29	0.11	0.73	0.61	0.69	0.51	0.64
D.W.	1.27	1.24	0.94	1.14	1.63	2.37	0.90
F	4.53*	2.15	101.36***	34.71***	43.06***	23.90***	21.28***

***= significant at the 0.1% level. **=significant at the 1% level. *=significant at the 5% level. +=significant at the 10% level. Source: Own calculations, data from Hjerppe (1996) and Statistics Finland; Edvinsson (2005); Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

To conclude, we found that Kaldor's laws can be used partially in analysing economic growth (the second law does not hold for Finland in 1945-79). With these Kaldor's laws we may cast some light on Finland's catching up with Sweden in 1945–2003. Secondary production has had its biggest impacts on Finnish GDP growth as late as in 1980–2003, whereas its biggest impact on Swedish GDP growth was already in 1945–1979. However, this does not account for Finland's convergence to Sweden in 1945–1979. Thus we must

reject our first hypothesis, that Finnish growth and convergence to Sweden, and consequently to EU15 as well, could be explained solely with the late fastest growth phase in secondary production by its impacts in speeding up aggregate labour productivity change. The fast growth in secondary production explains partly Finland's convergence to Sweden, but it seems that primary and tertiary production may have had a positive effect on aggregate labour productivity at least in Finland in 1945–79.

3.2 Primary, secondary and tertiary production contributions to Finland's catching up

In order to find out more of the roles of structural change and aggregate labour productivity growth as explanatory sources of Finnish convergence to Sweden in 1945–2003, we will explore the value added growth and the labour productivity growth in other fields of the economy as well. Special attention is given to service production. To shed more light on the growth and convergence in 1945–1980 we will further divide this period into two sub-periods, i.e. 1945–65 and 1965–80. From now on, because of a small number of observations, the non-parametric index number approach is used.

The evolution of the production structures of Sweden and Finland are shown in Table 3.4 and in Figures 3.1 and 3.2. Sweden had a more industrialised, welfare state economic structure already in 1945, whereas Finland, although considerably rapidly changing, was much more an agricultural society in the first years of the first period. Looking at the shares in Table 3.4, one notices that while Sweden's primary production share diminished from 14 to 2 percentage points from 1945 to 2003, Finland's primary production share decreased from 42 to 3 percentage points. The fastest structural change seems to have happened in Finland from 1945 to 1965 when the share of primary production declined from 42 to 16 percentage points and at the same time both secondary and tertiary production shares increased the most. However, from 1980 to 2003 the services share grew substantially again in Finland at the same time when primary production and also secondary production share diminished. In Figures 3.1 and 3.2 it is worth noticing that the highest share of secondary production in Sweden was in the early 1960s and in Finland in the mid-1970s.

Table 3.4 Production structure of the economy in Sweden and Finland, in 1945, 1965, 1980, 2003

SWE	1945	1965	1980	2003
PRIM	14%	7%	4%	2%
SEC	39%	42%	32%	27%
TERT	47%	51%	64%	71%

FIN	1945	1965	1980	2003
PRIM	42%	16%	10%	3%
SEC	27%	36%	38%	32%
TERT	31%	48%	52%	65%

Source: Own calculations, data from Hjerppe (1996) and Statistics Finland; Edvinsson (2005); Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

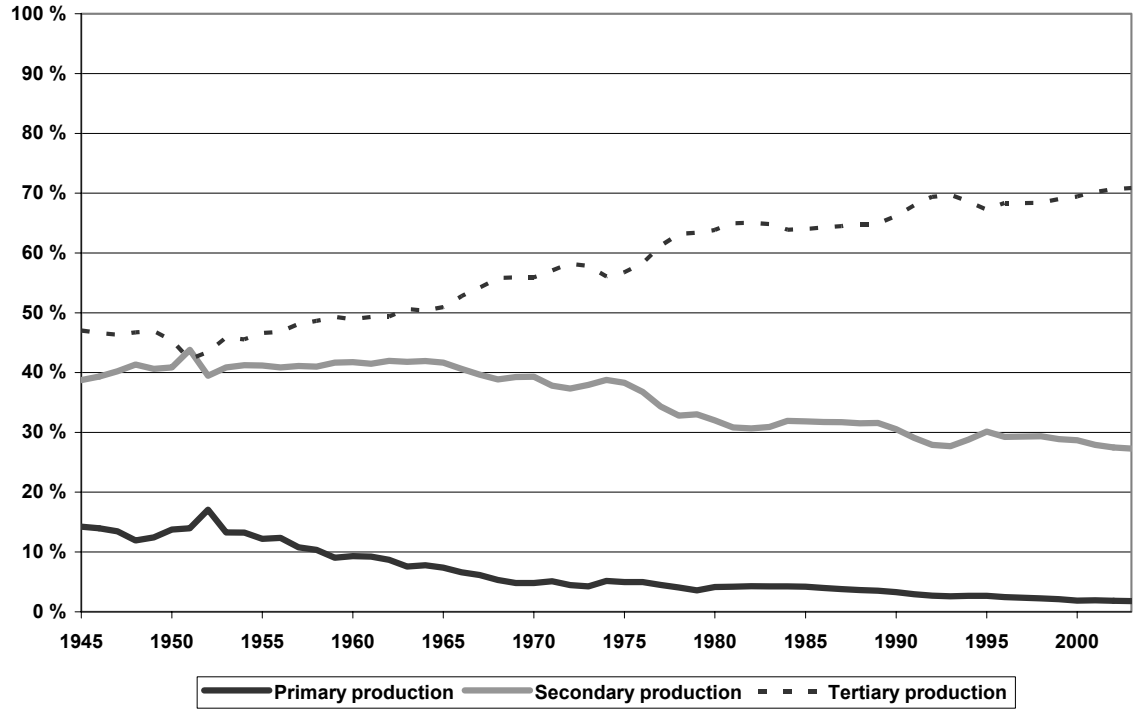


Figure 3.1 Shares of primary production, secondary production and tertiary production in Swedish GDP, 1945–2003 per cent. Source: Own calculations, data from Hjerppe (1996) and Statistics Finland; Edvinsson (2005); Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

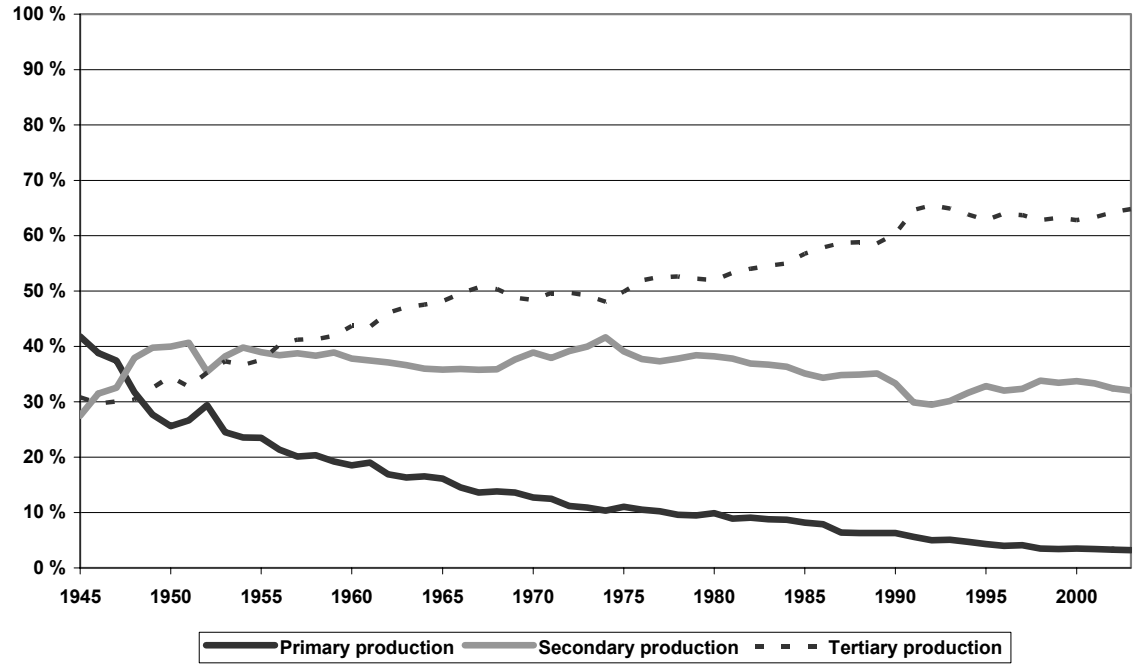


Figure 3.2 Shares of primary production, secondary production and tertiary production in Finnish GDP, 1945–2003, per cent. Source: Own calculations; data from Hjerppe (1996) and Statistics Finland.

Value added growth contributions

Table 3.5 shows that the value added in secondary and tertiary production grew very fast in Finland in the first two periods. This confirms – together with previous results – that the labour force moved from primary production to secondary and tertiary production at the same time in Finland. Sweden's secondary production share was higher than in Finland until the late 1960s (Figures 3.1 and 3.2). The secondary production share did not diminish in Finland before 1974. This shows that Finland has gone through a good part of its industrialisation phase after WWII, but Sweden deepened its industrialisation in the first period under review as well. In Table 3.4 we can see that the tertiary production share increased in Finland from 1945 to 2003 from 31 to 65 percentage points. The growth in secondary and tertiary production in Finland (Table 3.5) has been faster than in Sweden in all of the periods. Labour force moved at the same time from primary production to secondary and to tertiary production as early as 1945-1965. Hence, Finland came behind Sweden in structural change but went both faster and more simultaneously through the transformation from agricultural to industrialised and post-industrialised country.

Table 3.5, Average growth by period, %, FIN & SWE

	1945-1965		1965-1980		1980-2003	
	FIN	SWE	FIN	SWE	FIN	SWE
PRIM	0.9 %	0.7 %	0.5 %	-0.6 %	-0.2 %	0.7 %
SEC	6.7 %	5.5 %	4.4 %	2.0 %	3.4 %	2.8 %
TERT	5.3 %	4.1 %	4.2 %	3.3 %	2.4 %	1.8 %
GDP	**4.4 %**	**4.2 %**	**3.7 %**	**2.6 %**	**2.5 %**	**2.1 %**

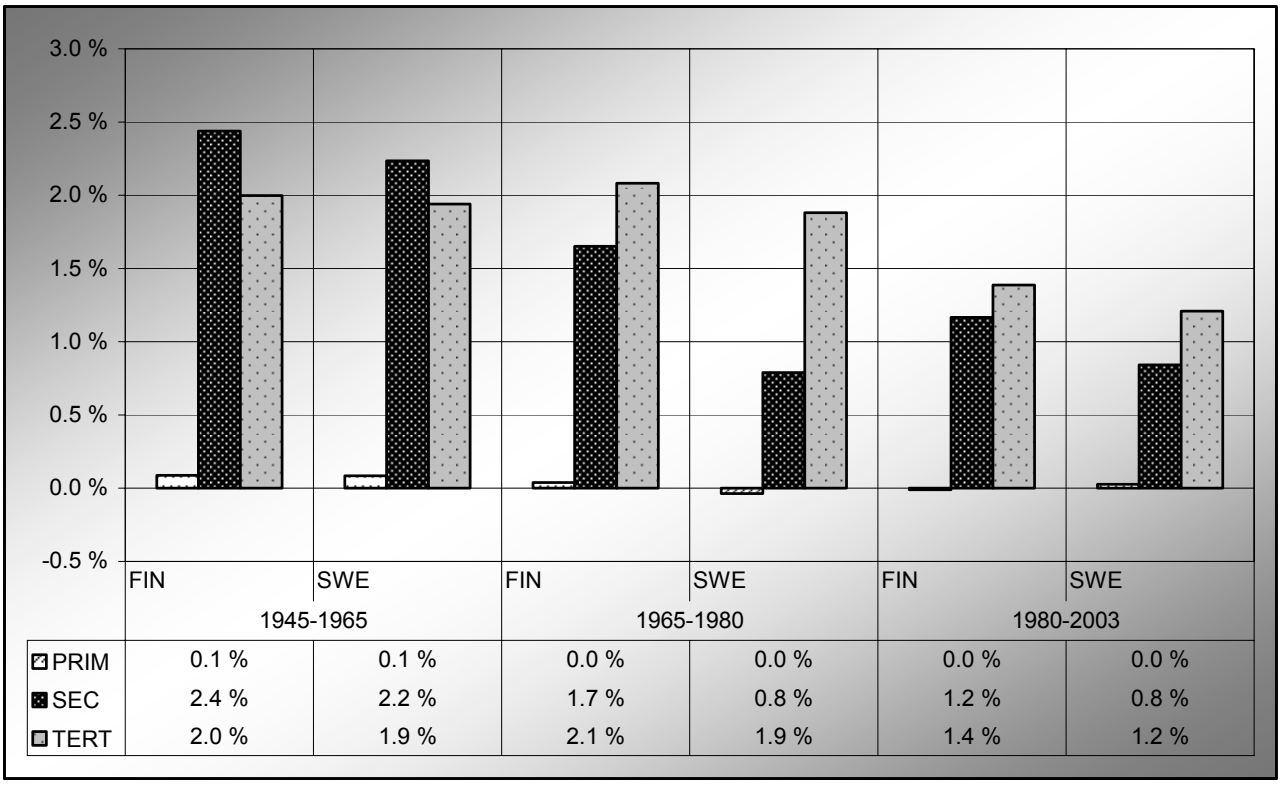
Source: Own calculations, data from Hjerppe (1996) and Statistics Finland, Edvinsson (2005) and Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

How much did then the growth of the primary, secondary and tertiary productions contribute to GDP growth in Finland and Sweden? In Figure 3.3 the primary, secondary and tertiary production growth contributions to GDP growth are presented in each time period. The contributions were calculated by multiplying annual current price production share with the annual volume log per cent growth in each production class[11]. The values by periods are averages of annual growth contributions in each period. Because the growth contribution rates are expressed in logarithms, they exhibit the average period growth contribution rates (including the interest on interest effect) in each production field as well.

As can also be seen from Table 3.5, the average GDP growth rate was almost similar in both countries in the first period, which – together with the fast population growth in Finland – confirms the fact that Finland did

[11] The annual volume growth rates in primary, secondary and tertiary production were aggregated from more detailed sub-classes by using Törnqvist aggregation in accordance with Törnqvist-index methodology.

not catch up to a large extent with Sweden in GDP per capita in 1945-65 (see also Figure 2.2). In both countries, the growth came from both secondary and tertiary production, with the emphasis on secondary production growth in 1945–1965. Observing Table 3.5 it is clear that Finnish secondary production growth rate was higher (6.7 per cent) than the Swedish (5.5 per cent). However, because of essentially larger secondary production's share (Table 3.4) secondary production growth contribution did not differ to a great extent in Sweden.



	1945-1965 FIN	1945-1965 SWE	1965-1980 FIN	1965-1980 SWE	1980-2003 FIN	1980-2003 SWE
PRIM	0.1 %	0.1 %	0.0 %	0.0 %	0.0 %	0.0 %
SEC	2.4 %	2.2 %	1.7 %	0.8 %	1.2 %	0.8 %
TERT	2.0 %	1.9 %	2.1 %	1.9 %	1.4 %	1.2 %

Figure 3.3 Primary, secondary and tertiary production growth contributions to GDP growth, log %, annual average by period, Finland and Sweden Source: Own calculations, data from Hjerppe (1996) and Statistics Finland, Edvinsson (2005) and Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

It is important to discern that Finland's both secondary and tertiary production grew faster (Table 3.5) in all periods and contributed more particularly in the last two periods (Figure 3.3) than in Sweden. In the first period both countries' GDP growth pace was considerably high, but from Finland's point of view the difference in GDP per capita remained almost as big at the end of this period as at the beginning. Figure 3.3 reveals that the service production growth contributions to GDP in Finland have been even bigger than secondary production contributions in the second and third time periods when Finnish growth was faster and convergence to Sweden mostly took place. Thereby, the GDP growth contribution came strongly from two sources, from secondary and tertiary production growth, both of whose growth contributions were higher in Finland than in Sweden in the last two periods.

Labour productivity growth contributions

Above we noticed that it was not only the rise of secondary production but also the rise of tertiary production that caused Finland's faster GDP growth in 1965–80 and in 1980–2003. At this point it is crucial to remember that catching up and convergence are measured in terms of GDP per capita. Figure 2.3 in chapter 2 showed the vitality of labour productivity (LP) growth in contributing to GDP per capita growth. This is why we will conclude this discussion by evaluating the primary, secondary and tertiary labour productivity growths and their contributions to aggregate labour productivity in Finland and in Sweden.

Table 3.6 Labour productivity average growth by period, %, FIN & SWE

	1945-1965		1965-1980		1980-2003	
	FIN	SWE	FIN	SWE	FIN	SWE
PRIM	2.3 %	4.4 %	5.1 %	4.9 %	3.5 %	3.5 %
SEC	4.0 %	4.8 %	4.1 %	4.1 %	4.7 %	3.7 %
TERT	2.0 %	2.4 %	3.0 %	1.9 %	1.3 %	1.0 %
TOT economy	**3.1 %**	**3.9 %**	**4.2 %**	**3.1 %**	**2.8 %**	**1.9 %**

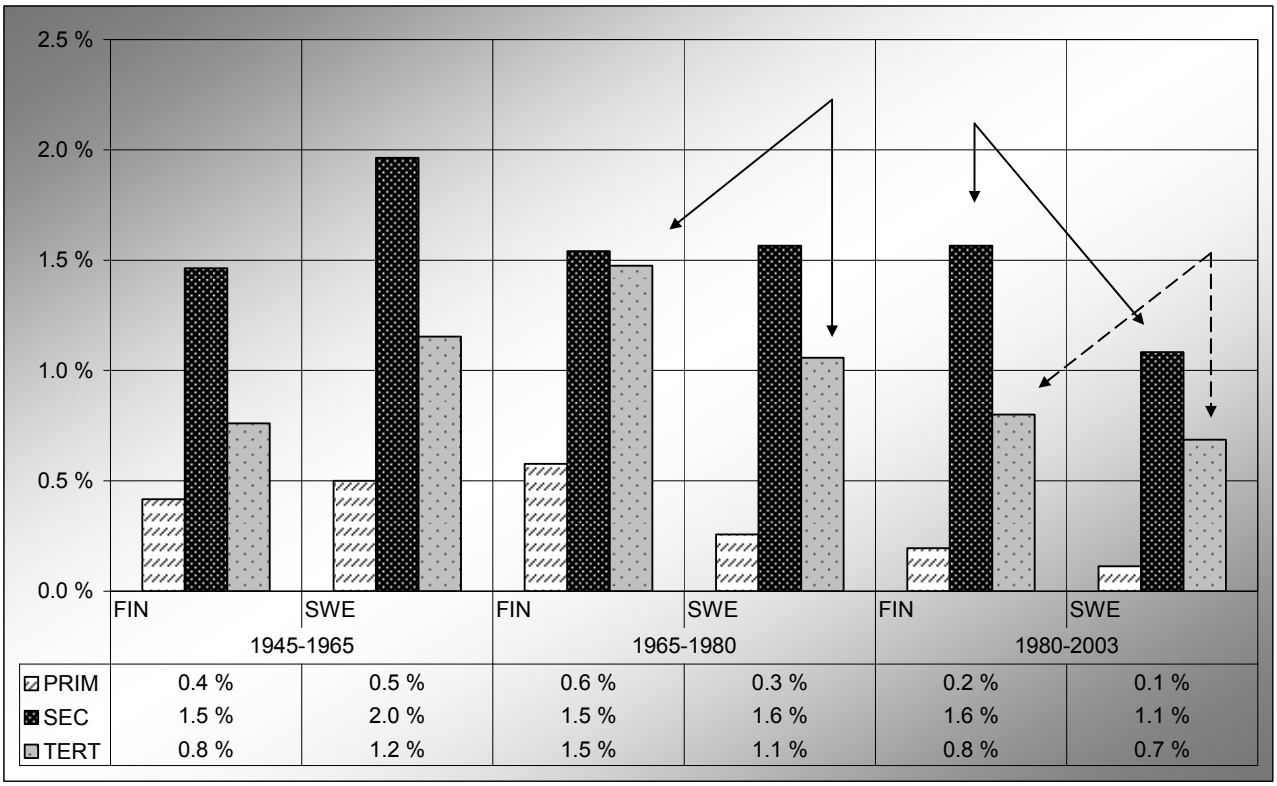
Source: Own calculations, data from Hjerppe (1996) and Statistics Finland, Edvinsson (2005) and Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

From Table 3.6 it can be seen that labour productivity grew faster in Sweden in 1945–1965 both at the aggregate level and in each field of activity. This also shows why Finland did not actually catch up with Sweden in that period, although labour input grew after WWII in Finland together with labour productivity. At the same time, a large number of employed persons were moved from primary production to secondary and tertiary production, where new production was developed. The faster structural change and labour input growth in secondary and tertiary production during the first period helped Finland reply to Sweden's fast GDP growth and not fall behind in GDP per capita either in 1945–65.

In 1965-80 Finland's labour productivity grew on the aggregate level at a higher rate than in Sweden. The speed of secondary production labour productivity growth was still higher in Sweden, but Finnish labour productivity in services grew more rapidly. In Sweden the productivity growth in services decelerated already in this period. This reveals the fact that the fastest labour productivity growth in services was indispensable for Finnish catching up in the period of 1966–79.

Particularly in the third period (1980–2003) aggregate level productivity and secondary production's productivity[12] grew faster in Finland than in Sweden. At this point tertiary production's productivity growth slowed down in Finland as well, although it was still growing faster than in Sweden. It seems that Finland by the last period had reached a similar welfare state economic structure as Sweden.

Finally, the primary, secondary and tertiary LP growth contributions to aggregate LP growth are presented in Figure 3.4. Comparing developments in the labour productivity contributions in both countries it can be detected that Finland's labour productivity growth contribution in services exceeded the Swedish one in 1965-80 and in 1980-2003. Especially in 1965-80 this was decisive for Finland's catching up as Sweden outdid Finland's secondary production labour productivity contribution. In the last period, 1980-2003, Finland surpassed Sweden's labour productivity contribution in secondary production for the first time. In this period the difference to Sweden was biggest in secondary production and therefore secondary production labour productivity growth had the biggest impact on Finland's faster GDP per capita growth in 1980-2003.



	1945-1965 FIN	1945-1965 SWE	1965-1980 FIN	1965-1980 SWE	1980-2003 FIN	1980-2003 SWE
PRIM	0.4 %	0.5 %	0.6 %	0.3 %	0.2 %	0.1 %
SEC	1.5 %	2.0 %	1.5 %	1.6 %	1.6 %	1.1 %
TERT	0.8 %	1.2 %	1.5 %	1.1 %	0.8 %	0.7 %

Figure 3.4 Primary, secondary and tertiary labour productivity growth contributions to economy's labour productivity growth, average by period, log %, FIN & SWE (average productivity growths multiplied with current price annual share, period value is annual average in period)
Source: Own calculations, data from Hjerppe (1996) and Statistics Finland, Edvinsson (2005) and Groningen Growth and Development Centre, 60-Industry Database, October 2005, http://www.ggdc.net.

[12] In 1980-2003 Finnish manufacturing productivity growth was yet very polarized. It was mainly due to the so-called Nokia effect Jalava (2006b).

The bigger value added growth contributions in 1965-2003 and faster than Sweden's labour productivity growth in 1965-80 in Finnish services may also be partly a consequence of the later phase in structural change – probably there was more room for new economic production in services as well. In addition we have to notice that the share of services produced by the public sector has been bigger in Sweden. In National Accounts public sector production is valued through the costs of production and consequently its labour productivity growth becomes zero in the calculations. This means that services' labour productivity growth in both countries has come from privately produced services, in which there must have been more growth in Finland in 1965-1980.

In the end, a word of caution: when detecting only the effects on GDP per capita growth separately in both countries, it is important to notice that looking at the whole time period 1945–2003 the biggest (but not only) contributions to Finland's and Sweden's aggregate labour productivity came from secondary production. Thus, if we were explaining only the GDP per capita growth separately in each country, we might state that compared with primary and tertiary production, secondary production seems to have had the largest impacts on Finland's and Sweden's labour productivity and GDP per capita growth in 1945-2003. It probably has had its effects through innovations (e.g. overall electricity implementation in the first period and ICT implementation in the last period) on labour productivity growth in services as well. Nevertheless, as noted before, Finland's catching up and convergence to Sweden has happened only when Finland has performed better than Sweden in some part of the economy. Taking into account Sweden's substantially strong secondary production performance and Finland's inability to overcome it in labour productivity contribution until 1980-2003, services' production contributions have contributed significantly to Finland's catching up in GDP per capita particularly in 1965-80.

4. Conclusions

The main task of this paper was to trace Finland's economic catching up with the EU15 and especially with Sweden. We also wanted to see whether the late industrialisation and different path in structural change were sources of Finland's faster labour productivity growth and convergence. We found that despite considerable catching up with EU15 in the interwar period, the gap in GDP per capita between Finland and the EU15 was closed mainly in the 1960s and the 1970s. Sweden's lead was only closed in the 1970s and the 1980s, and again in the 1990s. Sweden was ahead of EU15 average in GDP per capita already in 1945 and at the beginning of the 21st century as well. Therefore when converging to Sweden Finland has consequently caught up and overtaken the EU15 average income level.

GDP per capita has grown considerably fast both in Finland and Sweden in 1945–2003. A comparison of the countries shows that the difference in GDP per capita remained almost constant in 1945–1965 and that Finland's catching up with Sweden mostly took place in 1965–2003. During the whole time period reviewed, it seems that there was more room to expand to new fields of economic activities in the Finnish economy. Thus, in compliance with the classical view, beginning from a low production level Finland gained from the latecomer position and from faster structural change.

Gerschenkron (1952, 1962), Kaldor (1967) and the classical view of structural change (e.g. Hartwell 1973) emphasised the importance of manufacturing industries to the latecomer country's catching up. The vitality of manufacturing production is constantly brought up in the Finnish economic policy discussion as well. Therefore, we wanted to find out whether the late industrialisation and the secondary production growth would explain Finland's convergence after WWII. We used the so-called Kaldor's growth laws as a framework to test this. We found that Kaldor's laws could be partially used in explaining economic growth. Secondary production had its biggest impacts on Finnish GDP growth as late as in 1980–2003, whereas its major effect on Swedish GDP growth was already in 1945–1979. However, labour input growth in non-secondary production did not have a statistically significant negative influence on the aggregate labour productivity in Finland in 1945–1979. Thus we rejected our first hypothesis that Finnish growth and convergence to Sweden, and consequently to EU15 as well, could be explained solely with the later growth phase in secondary production via its impacts on speeding up aggregate labour productivity. Contrary to the classical view and Kaldor's growth laws, it was not only the advantages of the secondary production growth that caused Finland's catching up with Sweden and subsequently with EU15.

To shed more light on the roles of non-secondary parts of the economy as well, we explored the value added growth and the labour productivity growth and their contributions to aggregate level in primary, secondary and tertiary production. For further examination of Finnish catching up we compared Sweden and Finland in

each field of activity in three sub-periods 1945-65, 1965-80 and 1980-2003. The analysis showed that the service production growth contributions to GDP in Finland have been even bigger than secondary production contributions in the second and third time periods when Finnish growth was faster and convergence to Sweden mostly took place. However, we must bear in mind that convergence is assessed in terms of GDP per capita and labour productivity growth is an important factor for GDP per capita growth. From the analysis of labour productivity contributions we saw that labour productivity growth contribution in services exceeded the Swedish one in 1965-80. Thus, labour productivity growth contribution from services was essential for Finland's GDP per capita catching up in 1965-80 since Sweden gained slightly more from secondary production labour productivity even in that period. In the last period, 1980-2003, Finland finally exceeded Sweden's labour productivity growth contributions in secondary production and the most important effect for faster Finnish GDP per capita growth came from secondary production at that time.

To conclude, the difference in GDP per capita between Finland and Sweden remained almost constant in 1945–1965 and the impacts for Finland's catching came clearly from the advantages of both secondary and tertiary production in 1965-2003. The fast growth in secondary production explains partly Finland's convergence to Sweden, but tertiary production growth had an indispensable effect on faster GDP and aggregate labour productivity growth in Finland in 1965–80 and a positive effect together with secondary production's strongest impact in 1980-2003.

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