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Growth and structural change in Sweden and Finland 1870–1990: A story of convergence

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Introduction

In the late 19th century, the Nordic countries underwent an economic progression similar to that occurring from the 1960s onwards in several developing countries. This process can be characterised as a transition to a development path of modern economic growth and industrialisation. Industrialisation also started a process of convergence in income levels. From being part of the European periphery, the Nordic countries have advanced to the upper half of the income league.

The development process was, however, not homogenous among the Nordic countries. Denmark had the highest incomes during the 19th century, following a modernisation path based on agriculture and small-scale industry. Sweden took an early lead in heavier industries and industrialised more quickly than the other Nordic countries. A latecomer in this process was Finland, for long one of the poorest Nordic countries, which has only recently advanced in the Nordic income ranking. Thus, within the Nordic countries, convergence has also occurred during the last 150 years.

1.2 Previous research, objectives and general approach

Although a comparison between Finland and Sweden offers a relevant case for studying convergence, there are virtually no long-term studies that go beyond descriptive accounts of

GDP per capita convergence and partial productivity measures in the Nordic countries¹. It is true that O'Rourke and Williamson have undertaken analyses of convergence that are firmly rooted in economic theory². Although they have studied a large number of countries, they pay no special attention to intra-Nordic convergence and do not follow up the convergence process to the present. Thus, we can conclude that there is a need to deepen the studies of convergence among the Nordic countries.

The specific objective of this article is to examine intra-Nordic convergence by comparing the Swedish and Finnish economic long-term macroeconomic development, and to examine those factors behind the similarities and differences in economic performance leading to convergence that for practical reasons are obscured in large samples of countries.

Convergence is here primarily defined as convergence in income levels and growth rates. As changes in economic structure are an indispensable part of the growth process, a second objective is to study divergence and convergence in economic structure. Sweden and Finland are chosen both for their apparent differences in long-term development, but also for the availability of high-quality historical national accounts, which makes reliable analysis of the development path and driving forces possible. Based on the objective, the article deals with the following questions:

- What are the general characteristics of growth and structural change in Sweden and Finland?
- What are the driving forces behind these development patterns?
- Based on these facts, what can be said about the role of institutions in the Swedish-Finnish convergence process?

In the article, we focus on the performance of both the total economy and the manufacturing industry sector. By analyzing economic performance at these two levels, it is possible to obtain more detailed information on similarities and differences in Swedish and Finnish development. One advantage of pursuing an industry sector analysis is that technological change can be measured with a lesser degree of influence of structural change as compared to an investigation of the total economy level. If only the total economy level had been considered it is for instance likely that part of the technological change will be caused by

¹ Krantz, O. and Nilsson, C.-A., Relative income levels in the Scandinavian countries, *Economy and History*, vol. 12, 1974; Krantz, O., Industrialisation in three Nordic countries: a long term quantitative view, in *Convergence? Industrialisation of Denmark, Finland and Sweden 1870-1940*, ed. Hans Kryger Larsen. The Finnish Society of Sciences and Letters, Commentationes Scientiarum Socialium 58, Helsinki 2001; Krantz, O., Productivity in Scandinavia in the 20th century: a comparative view, *Umeå Papers in Economic History*, 2, 1991

² O'Rourke, K.H. and Williamson, J. G., Open Economy and late nineteenth century Swedish catchup. A Quantitative Accounting, *Scandinavian Economic History Review*, vol. 43, 1995:2, 171-203; O'Rourke, K. H. and Williamson, J. G., Open economy forces and late 19th century Scandinavian catch-up. *Working paper* 5112. Cambridge, Massachusetts: National Bureau of Economic Research, 1995; O'Rourke, K. H. and Williamson, J. G., *Globalization and History. The Evolution of a nineteenth-century Atlantic economy*. Cambridge, Massachusetts. London: The MIT Press 2001.

growth in the high-productivity manufacturing industry sector. Thus, we expect that the industry sector comparison will provide a more accurate picture of technological backwardness than is otherwise possible. As the article focuses on long-term convergence, it covers the 1870-1990 period. The end year 1990 is chosen mainly due to data availability. The article is organised as follows. The next section describes and discusses theoretical and methodological issues of importance for the investigation. This includes theoretical approaches to growth and convergence and methodological issues concerning how to measure economic growth and structural change. This section also includes descriptions of the procedures that have been used for obtaining estimates of factor inputs and technical change. In section three, the empirical results are described. Section four concludes.

2. Theoretical and methodological issues

2.1 Convergence and divergence in growth theory

In the standard neoclassical growth model, also known as the Solow growth model, investments in physical capital drive growth.³ A country's economy is described by a production function, where labour and capital are the two factors of production. The savings in the economy are invested in new capital, and if investments exceed depreciation then the capital stock will grow in relation to the labour force.

This means that output per worker grows and the economy will grow. However, in the neoclassical model, capital is assumed to show declining marginal rates of return, which together with the assumption that capital depreciates with a fixed percentage leads to a decreasing rate of growth of net investments and the capital stock. Eventually, the capital stock per worker stops growing and the economy reaches a steady state. In the steady state, growth is determined by the exogenously given rate of technical change. The neoclassical growth model gives strong predictions for convergence between different countries. In the poorer countries, growth rates will be higher than in the rich countries in the short run. In the beginning, poor countries have the smallest capital stock per worker, which yields high rates of return on new investments and low depreciations. When the poor countries get richer, the growth rates will decline and in the end the growth rates in the (former) poor countries and the rich countries will be the same. The neoclassical model will thus predict an unconditional convergence in growth rates. This predicted convergence in growth rates does not imply a convergence in income levels. Countries that save and invest a higher proportion of their income will eventually have higher per capita incomes than countries that save and invest less. Thus, convergence in income levels is conditional on the fact that all countries save and invest similar amounts. Another important conclusion that can be drawn from the

³ Solow, R. M., Technical change and the aggregate production function, *Review of Economics and Statistics*, vol. 39, 1956, 312-320.

neoclassical model is that it is possible by economic-political means to affect the investment level and thus growth in the short run and income levels in the long run.

In the new growth models introduced in the 1980s, the simple neoclassical models have been given more complex and realistic properties⁴. An important property is that knowledge or human capital is introduced as a separate production factor. The inclusion of this new production factor gives fundamentally different predictions about what generates growth in the long-run. Perhaps the most important difference is that in the new growth models, capital no longer has diminishing returns and that growth is no longer totally dependent on exogenous technical change.

The recognition of no diminishing returns for capital has important implications for the predictions about convergence. The new growth model by Ray predicts that if countries have the same original relation between physical and human capital, then they will have equal growth rates.⁵ If the relation is not equal in the beginning, or there are differences in the propensities to invest in the two kinds of capital, then the growth rates do not converge. In the growth models by Romer the predictions of divergence of growth rates and income levels are clear.⁶ Due to economies of scale and the presence of technological externalities that are proportional to the physical capital stock, rich countries will grow faster than poor and the gap in income levels will increase.

Another approach for explaining differences in growth performance in different countries is the institutional one.⁷ The institutional approach as used by North is, as we see it, a complement to the neoclassical explanations for the source of growth. Differences in the institutions and institutional lock-in effects known as path-dependency explain differences in economic performance and why some countries show persistent poor growth performance despite good preconditions.

In the institutional approach, a vital condition for convergence is that all countries are able to adopt efficient institutions. Those countries that cannot manage this will be doomed to lag behind other more successful countries. As there is evidence that Sweden and Finland have converged, the starting point for the analysis is that the process can be examined within the framework of the neoclassical model. The other approaches will be seen only as complementary tools that will be explored when observations inconsistent with the neoclassical growth theory are made. Thus, we start with the basic neoclassical explanation in

⁴ Lucas, R. E., Increasing returns and long-run growth, *Journal of Political Economy*, vol. 94, 1986:5, 1002-37; Lucas, R. E., On the Mechanics of Economic Development, *Journal of Monetary Economics*, vol. 22, 1988:1, 3-42.

⁵ Ray, D., *Development Economics*. Princeton: Princeton University Press 1998.

⁶ Romer, P.M., Endogenous Technological Change, *Journal of Political Economy*, Part 2, vol. 98, 1990:5, 71-102; Romer, P. M., Increasing returns and long-run growth, *Journal of Political Economy*, vol. 94, 1986: 5, 1002-1037.

⁷ North, Douglass C. *Institutions, institutional change, and economic performance*. Cambridge: Cambridge University Press 1990.

order to assess its power of explanation and subsequently approach institutional explanations. As institutional explanations are more complex and multi-dimensional, it is not possible in this article to fully examine them, but instead it will be possible to formulate one probable explanation that is consistent with the empirical observations.

Methodologically, the neoclassical approach uses growth accounting practices to explore the link between output, labour inputs, capital inputs and technical change. The production function is typically a Cobb-Douglas type with constant returns to scale. The basic growth accounting methodology following the Solow approach tries to measure the rate of technical progress under the neoclassical assumptions of competitive factor markets and input exhaustion. Technology is treated as Hicks-neutral, which implies that output is modelled as:

$$Y_t = A_t \cdot f(K_t, L_t) \quad (1)$$

where Y is output and A is the Hicks-neutral technological factor. Put this way, the rate of Hicks-neutral technological change will equal the Solow residual or total factor productivity (TFP) growth. In practice, TFP is measured as the difference between output growth and the growth of primary inputs (capital and labour) where the primary inputs are weighted by their income shares. The basic growth accounting equation is formulated as:

$$\frac{\Delta Y}{Y} = (1 - \alpha) \frac{\Delta K}{K} + \alpha \frac{\Delta L}{L} + \frac{\Delta A}{A} \quad (2)$$

where α is labour's share of output. The equation is a decomposition of growth of output into components depending on traditional production factors and a component depending on technical change. Similarly, it is possible to separate the sources of average labour productivity growth, defined as output per hours worked, into effects of capital deepening, increased labour quality and TFP growth. Changes in labour quality are defined as the difference between labour input and hours worked.⁸ The relation between labour productivity growth ($\Delta Y - \Delta L$) and TFP can be formulated as:

$$\Delta Y - \Delta L = \Delta A + (1 - \alpha)(\Delta K - \Delta L) \quad (3)$$

where $\Delta K - \Delta L$ is the change in the capital-labour ratio. However, if the neoclassical assumptions behind the growth accounting procedure fail to hold, then TFP will measure not only technical change. The measurement of TFP will be distorted by several factors, including imperfect competition, externalities, production spill-overs, omitted inputs, cyclical

⁸ Stiroh, K. J. • What drives productivity growth? *Federal Reserve Bank of New York Economic Policy Review*. vol. 7. 2001:1. 37-59.

fluctuations, and non-constant returns to scale. This has led to the opinion that TFP is not a measure of technical change, but merely "a measure of ignorance".⁹

In the recommendations proposed by OECD for productivity measurement, TFP is denoted as multi factor productivity (MFP).¹⁰ Therefore, in order to be consistent with the modern terminology we will use MFP instead of TFP in this article.

Despite the difficulties with the measurement of technical change, the analysis of the convergence process between Sweden and Finland will be based on a growth accounting investigation, where the sources behind growth in each country are separated and compared.

2.2 Measuring growth rates

Convergence studies rely on proper measurements of growth rates. The commonly used simple linear trend for measuring long-term growth rates, where the series is regressed on time, has several shortcomings. First, a linear trend may not be consistent with the economic-historical perspective, where a linear deterministic trend implies a steady growth path and that the series only temporarily deviates from this path. Second, the use of linear trends is often contradictory to the stochastic properties of macroeconomic series, and applying deterministic trends in this case can lead to spurious cyclical behaviour of the detrended series and incorrect inferences on the parameters of the model.¹¹ The use of segmented linear trends can also be questioned, as pointed out by Ben-David and Papell.¹² This approach is unnecessarily complicated and the results are sensitive to the methods used to estimate the trend breaks.¹³

A solution to the problem is to use the framework of structural time series models based on unobservable components.¹⁴ These models have also been applied in various economic-historical analyses.¹⁵ The basic idea is that the observed time series can be decomposed into a number of unobservable components that are given stochastic properties and then estimated, by reformulating the models in state-space form and then applying an iterative procedure

⁹ Abramovitz, M., *Thinking about growth*. Cambridge: Cambridge University Press 1989.

¹⁰ *GECD. Measuring Capital - A Manual on the Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services*. Paris: GECD 2001.

¹¹ Nelson, C. R. and Kang, H., Spurious periodicity in inappropriately detrended series, *Econometrica*, vol. 49, 1981:3,741-751; Nelson, C. R. and Kang, H., Pitfalls in the use of time as an explanatory variable, *Journal of Business and Economic Statistics*, vol. 2, 1984: 1. 73-82.

¹² Ben-David, D. and Papell, D. H., Slowdowns and Meltdowns: Postwar Growth Evidence from 74 countries, *Review of Economics and Statistics*, vol. 80, 1998:4,561-571.

¹³ Harvey, A. C., and Jaeger, A., Detrending, Stylized Facts and the Business Cycle, *Journal of Applied Econometrics*, vol. 8, 1993:3,231-247.

¹⁴ Harvey, A. C., *Forecasting, Structural Time Series Models and the Kalman Filter*. Cambridge: Cambridge University Press 1989.

¹⁵ Crafts, N. F. R., Leybourne, S. I. and Mills, T. C., Trend and Cycles in British industrial production 1700-1913, *Journal of Royal Statistical Society, Series A*, vol. 152, 1989:1,43-60; Crafts, N. F. R., Leybourne, S. I. and Mills T. C., Measurement of Trend Growth in European Industrial Output before 1914: Methodological Issues and new Estimates, *Explorations in Economic History*, vol. 31, 1990:4,442-467.

known as the Kalman filter. The most commonly used decomposition, which is also used in this article, is the familiar decomposition of the time series into a trend, cyclical and irregular (residual) component.

The possibility of giving the components stochastic properties is especially attractive when the analysis covers such a long period as in this case. It would be erroneous to assume, for instance, that the trend would display deterministic behavior over more than a hundred years. Moreover, the formulation of the trend that is used here also allows the estimation of not only the trend itself, but also the slope component or the rate of change of the trend. The slope component is an important tool for describing the changes in the trend and makes it easier to compare the behaviour of two or more trend components. Thus, it will be the slope component that will be the main component of interest when the pattern of growth is examined.

The basic formulation of the model is:

$$Y = T + C + I \quad (2)$$

where Y is the observed time series and C is the cyclical component. The irregular component I can be considered to be the residual or unexplained component of the time series. It is assumed to have the normal stochastic properties of a residual.

The trend component is regarded as consisting of two parts, i. e. a level and a slope:

$$\begin{aligned} \mu_t &= \mu_{t-1} + \beta_{t-1} + \eta_t \\ \beta_t &= \beta_{t-1} + \xi_t \end{aligned} \quad (3)$$

where μ_t is the level and β_t is the slope. The η_t and ξ_t , are disturbances that give the trend its stochastic properties. The disturbances are assumed to have zero mean and constant variances. If the variance of both disturbances is set to zero, then (3) reduces to a deterministic linear trend with slope β . If the variance of ξ is zero, then (3) reduces to a random walk with drift. Finally, if the variance of η_t is zero and the variance of ξ_t is positive, then (3) is known as a smooth or integrated trend.¹⁶ In order to examine the change of the basic long-term movements of the series, the smooth trend model will be used, if it does not violate the stochastic properties of the series used for the analysis.¹⁷

As the slope is the component of main interest here, it must be emphasised the slope measures the *change* of the trend. A positive value for the slope indicates an upward sloping

¹⁶ Harvey and Jaeger, Detrending. Harvey, A. C. and Nyblom, I., *Testing against Smooth Stochastic Trends*, working article, University of Cambridge 1999.

¹⁷ Harvey, A. C., *1Tend Analysis*, working article, Faculty of Economics and Politics, University of Cambridge, July 7, 2000, 3.

trend, and a rising value of the slope component indicates an accelerating growth rate, i. e. a steeper slope of the trend. It should also be noted that the growth rates indicated by the slope components are the growth of the slow-moving trend, which differs from year-to-year growth rates of the raw series, due to business cycles and other short-term effects. From an economic-historical perspective, the goal is often to capture the slow-moving underlying forces of growth that could be related to other basic and slow-moving forces such as technological change and institutions. When investigating long-term economic performance, it is exactly the slow-moving factors that are of interest, which makes this kind of trend analysis a suitable tool to assess the existence of growth patterns and the general pattern of long-term growth. The cyclical component is defined as a combination of sine/cosine components.¹⁸

$$\begin{aligned}\psi_t &= \rho (\psi_{t-1} \cos \lambda_c + \psi_{t-1}^* \sin \lambda_c) + \omega_t \\ \psi_t^* &= \rho (-\psi_{t-1} \sin \lambda_c + \psi_{t-1}^* \cos \lambda_c) + \omega_t^*\end{aligned}\tag{4}$$

where ω_t is a stochastic disturbance, similar to those discussed previously. Alternatively, the cyclical component could be defined as an AR(2) process.¹⁹ The trend and cyclical component can then be estimated using a suitable software package. The STAMP package has been used here.²⁰

2.3 Measuring structural change

The standard method for measuring structural change is to measure the changes of the shares of different sectors in total output. However, this method provides information only on the magnitude and direction of structural changes that are attributable to these individual sectors. It gives no information on the overall magnitude of structural change. Therefore it is desirable to obtain a measure of the overall rate of structural change, especially if structural change is examined on a fairly disaggregated level. As in the case of mean or standard deviation, a single measure of the magnitude of structural change implies that the dimensions of the underlying data are reduced, and that information is lost along the way. However, the lack of details can often be an asset, especially when the broad patterns are interpreted.

A one-dimensional measure of the magnitude of structural change can be defined in many ways. A simple and intuitive measure for capturing the total magnitude of structural change between two points in time is to use the changes of each sector's share in the total output.

¹⁸ Harvey, *Forecasting*.

¹⁹ Watson, M. W., Univariate detrending methods with stochastic trends, *Journal of Monetary Economics*, vol. 18, 1986:1,49-75; Crafts et al., *Measurement of Trend Growth*.

²⁰ Koopman, S. 1., Harvey, A. C., Doornik, J.A. and Shephard, N., *STAMP: Structural time series analyser, modeler and predictor*. London: Timberlake Consultants Press 2000.

When the absolute values of the changes of each sectoral share are added, the resulting measure is large when the changes in sectoral shares are large.

Another approach is to compare the growth rate in each sector with the overall growth rate.²¹ The idea is that structural change implies differences in growth rates between different sectors.

These measures, however simple, have several theoretical shortcomings that render them less usable. Moore (1978) discusses the theoretical properties of these measures and highlight their weak link with theories of economic growth and the index numbers that are used to measure growth.²² These measures are not invariant to homogenous growth in the elements in the output bundle and are therefore not independent of changes in the overall growth rate unaccompanied by structural change.

It is the approach used in Moore (1978) that will be used in this article to analyse the pattern of structural change in Finland and Sweden.²³ Moore's measure of structural change is based on the fact that the structure of output can be described as a vector whose coordinates are the quantities of output. The angle between two vectors measured at different points in time or in different countries is then a measure of structural change. The principle for the measure is illustrated for the two-sector or two-country case in figure 1 below.

Figure 1 The principle for the angle measure of structural change

Source: Moore, J. H., A Measure of Structural Change in Output, *Review of Income and Wealth*, vol. 24, 1978:1, 105-118.

²¹ Roman, Z., A Note on Measuring Structural Changes, *Review of Income and Wealth*, vol. 15, 1969:3, 265-268.

²² Moore, J. H., A Measure of Structural Change in Output, *Review of Income and Wealth*, vol. 24, 1978:1, 105-118

²³ See also: Lindmark, M., & Vikström, P., The determinants of structural change: Transformation pressure and structural change in Swedish manufacturing industry 1870-1993, *European Review of Economic History*, vol. 6, 2002:1.

In the figure, vector oA describes the composition or structure at the starting point and vector oB describes the structure at the end point. The angle θ is thus a measure of the extent of structural change between the starting and the end points. The two-commodity case can easily be extended to an arbitrary number of commodities, using a vector in n-space. The measure used in this article is based on sectoral shares. Furthermore, Moore shows that the vector coordinates can consist of sectoral shares as well as commodities in physical or monetary values. Using sectoral shares and following Moore's definition, the angle θ is defined as:

$$\cos \theta = \frac{\sum_{i=1}^n s_{i,t} s_{i,t-1}}{\left(\sum_{i=1}^n s_{i,t}^2 \right)^{1/2} \left(\sum_{i=1}^n s_{i,t-1}^2 \right)^{1/2}} \quad (5)$$

The measure of structural change using θ can be estimated in two ways, either as the change from year to year or as the change relative to a specific comparison year. The year-to-year measure gives a picture of the short-term dynamics of the structural change process, but it can be misleading when it concerns the long-term dynamics. It is not certain that high year-to-year changes imply permanent changes in the structure. A large change in one year can be balanced by a large change in the following year in the opposite direction, even if it is plausible that a period with sustained high year-to-year changes also implies a high level of permanent structural change.

The alternative approach is to compare the structure of each year with the structure of a comparison year, which raises the question of how to choose a suitable comparison year. It can be stated that the comparison year should be chosen as the first or final year of the investigated period. Due to the definition of the measure, the angle θ cannot have negative values, which means that if the comparison year is chosen in the middle of the time period, the resulting series will have a V-shape and will be hard to analyse. In the period before the comparison year, the slope of the series is negative, as the structure is approaching the structure of the comparison year. From the comparison year, the slope of the series is positive, as the structure is departing from the comparison year structure.

When comparing changes in structure between two countries, as in this article, the comparison approach can also be used, as shown by Timmer and Szirmai.²⁴ In this study, the

²⁴ Timmer, M. P. and Szirmai, A., Comparative Productivity Performance in Manufacturing in South and East Asia, 1960-93, *Oxford Development Studies*, vol. 27, 1999:1,57-79.

angle measure (5) is used to examine how the industrial structure in a number of countries in South East Asia developed in respect to the structure in the United States between 1960 and 1993. Here, for each year covered in the study, the angle measure was used to measure the difference in structure between the structure of the Asian countries and the structure of the U.S.A. In this way, it was possible to estimate whether the industrial structure in the investigated countries was converging or diverging with respect to the U.S. structure. This comparative approach will also be applied in this article, in addition to inter-temporal measures, in order to examine changes in structure as part of the convergence process between Sweden and Finland.

2.4 Estimating capital stocks and multi factor productivity

In national accounts, capital stocks are constituted as accumulated investments that are gradually phased out as they are ageing. This phasing-out process is known as discarding of capital ("scrapping"). The time during which the capital is in use, or is ready to be used in a production process, is called its service life. To estimate the gross capital stock the investments are accumulated and removed after the capital has reached the end of its service life. Capital is, however, also consumed,

a process known as depreciation. Depreciation is reflected in falling asset values with increasing age due to physical deterioration, normal obsolescence or normal accidental damage. When the accumulated consumption of capital is deducted from the gross capital stock the net capital stock is obtained, which is the relevant stock for analyses of multi-factor productivity.

Since the seminal works of American engineer Robert Winfrey, various mortality and survival functions for capital have been tried.²⁵ Even today, the bell shaped curves known as Winfrey curves, which describe the probability that the investment is discarded after a certain percentage of the asset's average service life, are assumed to reflect the general mortality and survival functions for capital. A probability function that shares similar properties as the Winfrey curves is the Weibull frequency function. By altering two parameters, the Weibull function can be changed to reflect various mortality patterns. Statistics Netherlands has shown that

Weibull functions can be used for estimating retirement patterns based on data obtained from surveys. Therefore, Weibull functions for estimates of gross capital stocks and are used in this investigation.²⁶

²⁵ Winfrey, R., *Statistical Analyses of Industrial Property Retirements*, Bulletin 25, Iowa Engineering Experiment Station, Iowa State College 1935.

²⁶ OECD, *Measuring Capital*

Besides investments, necessary input data are the parameter values that determine the shape of the function and the service lives for various asset types. While contemporary capital stock accounts use a very detailed range of assets, the historical counterpart is much simpler. The Finnish historical national accounts (FHNA) use three categories of investments with relevance for manufacturing industry (machinery, engineering works and non-residential buildings), while the Swedish historical national accounts (SHNA) include only two kinds of investments, namely non-residential buildings and machinery. The service lives and the parameters for the Weibull functions used in this investigation are obtained from Statistics Netherlands for the categories of industrial buildings, including the Finnish categories of engineering works (47 years) and machinery (33 years). Furthermore, we use straight-line depreciation for estimating consumption of capital. Here, the market value in constant prices is assumed to decline by the same amount in each period. Other depreciation methods may also be considered, but the straight-line depreciation has the advantage that it is easy to use. By using a formula in which the Weibull survival function and the straight-line depreciation are combined, it was possible to estimate directly the net capital stock.²⁷ With the net capital stock index and a labour input index, a quantity index of combined primary inputs was constructed by using a Thörnqvist formula.²⁸

$$Q = \left(\frac{L_t}{L_{t-1}} \right)^{\bar{s}_L} \cdot \left(\frac{K_t}{K_{t-1}} \right)^{\bar{s}_K} \quad (6)$$

where L and K are labour and capital inputs and $\bar{s}_L$ and $\bar{s}_K$ are the labour and capital shares in value added. The shares for Sweden were obtained from Vikström.²⁹ For Finland the capital share was obtained by estimating the difference between the industrial value added and the corresponding wage sum.³⁰ The final step is the estimation of MFP as a residual that measures the shift in production possibilities. For estimating an index of value-added-based MFP, the volume index of industrial value added is divided by the index of combined primary inputs.

²⁷ Meinen, G., Verbiest, P., and de Wolf, P., *Perpetual Inventory Method - Service Lives, Discard Patterns and Depreciation Methods*, Statistics Netherlands 1998.

²⁸ OECD, *OECD Productivity Manual: A Guide to the Measurement of Industry-level and Aggregate Productivity Growth*, Paris: OECD 2001.

²⁹ Vikström, P., *The Big Picture - A Historical National Accounts Approach to Growth, Structural Change and Income Distribution in Sweden 1870-1990*, dissertation, Umeå University 2002.

³⁰ Hjerpe, R., National Accounts. Historical Series, unpublished CD-ROM, 2001.

2.5 The data used

The data used in this investigation require some further notes because neither labour inputs nor investment data are consistent in the still preliminary SHNA. For Finland similar problems pertain to investments in the industrial sector. There are also differences in the branch divisions in the SHNA and FHNA that have to be dealt with in order to compare structural change.

Output data

Data for CDP and industrial value added were collected from the respective countries' historical national accounts.³¹ The total economy is divided into eight sectors, using the same definitions in the historical national accounts of both countries. Furthermore, current prices are used for the investigation of structural change. The use of current prices leads to the same structural index as if a common deflator was used for all branches. Swedish and Finnish HNA are, however, constructed with separate deflators for the different branches. It would have been possible to calculate the structural index based on fixed-price value-added figures. However, using separately deflated value-added series would have imposed violation of the accounting rules in the national accounts due to the so-called index number problem, and is therefore not appropriate.³²

Investments

The basic data required for estimating net stocks in this investigation are the manufacturing industry's investments in buildings and machinery. For Sweden, building investments and investments in machinery were obtained from Schön, with the addition of Johansson's estimates of imports for industrial investments.³³ The series were deflated separately with the SHNA building and construction deflator and a machinery price index based on Ljungberg's machinery industry index, linked to the deflator for mining and metal industries for the first half of the 19th century and, for years after 1969, to Statistics Sweden's machine prices in the producer's price index.³⁴ The investment volumes were subsequently used for the stock estimates. Finally, the series were weighted in accordance with Statistics Sweden's estimates of stocks of fixed assets for 1980, in order to allow aggregation.³⁵ It is also worth noting that

³¹ Krantz, O., *Swedish Historical national accounts*, mimeo, Umeå University, 2001; Schön, L., *Industri och hantverk*, Lund, 1988; Hjerpe, R., *National Accounts. Historical series*.

³² *System of National Accounts* 1993. UN, IMF, OECD, World Bank, Commission of the European Communities, Brussels/Luxembourg/New York/Paris/Washington, D.C., 1993, 383; Lindmark, M. and Vikström, P., *Den deflaterade kvotens dilemma*, in *Nordiske Historiske Nasjonalregnskaper*, ed. Ola Honningdal Grytten. Bergen: Norges Handelshøyskole 1999.

³³ Schön, L., *Industri och hantverk 1800-1980*, Lund: Studentlitteratur 1988; Johansson, Ö., *The Gross Domestic Product of Sweden, and its Composition 1861-1955*. Stockholm: Almqvist & Wiksell 1967.

³⁴ Krantz, *Swedish Historical National Accounts*; Schön, *Industri och hantverk*; Ljungberg, I., *Deflatörer för industriproduktionen 1888-1955*. Lund: Studentlitteratur 1988.

³⁵ Statistiska Centralbyrån, *National wealth and stocks of fixed assets 1980-1990*. Stockholm: SCB förlag 1992.

the SHNA series begins in the year 1800. Therefore, the first investments are discarded from the stock prior to 1870, which marks the starting year for this investigation. This solves the problem of exaggerating the growth of the capital stock during the early part of the investigation. For Finland, Jukka Jalava, Statistics Finland, kindly supplied the investment volumes for the manufacturing industry 1920-1990. Furthermore, the aggregated indices for machinery, engineering and building from FHNA were used as variation indices for backward extrapolation until 1860. Here, we tried various extrapolation approaches, for instance by assuming co-variation between investments and labour productivity. The reasons why this and similar approaches were not used are that (1) they consume information, and (2) they cause only minor changes to the net capital stock.

For the 1800-60 period, the Swedish investment series were used as variation indices. Here, the Finnish category 'engineering investments' was assumed to follow the Swedish category 'investments in non-industrial buildings'. The procedure is necessary since the first investments must have been discarded from the stock by 1870. Finally, the series were weighted in accordance with the official national accounts estimates of stocks of fixed assets in 1990, in order to allow aggregation.

Labour

The labour input, measured as the number of employed plus the number of selfemployed company owners, has for Sweden been obtained from the National Accounts from 1960. Gunnarsson's and Lindh's estimates were used for 1950-60.³⁶ For 1870 to 1950 Jungenfeldt's estimates, completed with Schon's estimates of employed in handicrafts, have been used as a variation index.³⁷ For Finland, labour inputs were obtained from FHNA. Measuring labour input as the number of employed is certainly a simplification. There are, however, no series for working hours that are consistent with the SHNA and the FHNA. Therefore, we believe that the data become more reliable in comparison with a series for working hours that requires more or less arbitrary adjustments of the original labour data.

Branch divisions in manufacturing industry

An important precondition for the comparative measurement of structural change is that a common branch division is used. The branch divisions in SHNA and FHNA are rather similar, but harmonization of the classifications is necessary in order to obtain compatible datasets. Such a common industrial classification has been elaborated by Eloranta, to allow a

³⁶ Gunnarsson, G., and Lindh, T., *Swedish employment in the 1950s - Filling the lacuna*, working article, Dept of Economics, Uppsala University 1997.

³⁷ Jungenfeldt, K. G., *Lonemas andel av nationalinkomsten*, mimeo, Nationalekonomiska institutionen, Uppsala Universitet 1959; Jungenfeldt, K. G., *Loneandelen och den ekonomiska utvecklingen*. Stockholm: Industriens utredningsinstitut 1966; Schön, *Industri och hantverk*.

structural comparison between Finnish and Swedish manufacturing industry.³⁸ In the present study we follow what Eloranta calls a "New Uniform Division of Branches", comprising eight branches. This means that additional data had to be obtained from sources outside the FHNA.³⁹

Diagram 1 Swedish and Finnish GDP per capita, 1870-1990 (1990 Geary-Khamis \$). Bottom panel: Log difference in GDP per capita levels between Sweden and Finland.

Sources: Hjerpe, R., National Accounts Historical Series, unpublished CD-ROM; Krantz, O., *Swedish Historical national accounts- Aggregated output series*, mirneo, Umeå University, 2001.

The diagram reveals no clear-cut divergence or convergence in long-term growth rates for GDP. Instead, it is possible to identify periods where the Swedish growth rate is higher than the Finnish and vice versa. Up to 1950, the Swedish long-term growth rate is generally higher than the Finnish, indicating a divergence in income levels. In the period after 1950, the situation is the opposite, where the Finnish long-term growth rate is higher than the Swedish, indicating convergence in income levels. These observations are consistent with the evidence

³⁸ Eloranta, J., Comparing industrial production in Sweden, Finland, and Denmark: Towards consistent classifications, in *Nordiska Historiska Nationalräkenskaper*, ed. Iari Eloranta, Suomen historian julkaisu. 25, Iyväskylä 1997.

³⁹ Hjerpe, R., Hjerpe, R., Mannerman, K., Niitamo, O.E., and Siltari, K., *Suomen Teollisuus ja Teollinen Kiisityö 1900-1965*, Kasvututkimuksia. Helsinki: Bank of Finland 1976; Heikkinen, S. and Hjerpe, R., *Suomen teollisuus ja teollinen kiisityö 1860-1913*, Suomen Pankin julkaisu, Kasvututkimuksia 12, Suomen Pankki. Helsinki: Bank of Finland 1986.

in diagram 1. In a similar way as for GDP, the growth rates for real value added in the industrial sector are estimated, which is shown in diagram 3.

Since the 1920s, the Finnish growth rates have been generally higher than the Swedish ones. However, the size of the Finnish industrial sector was for long much smaller than the Swedish, which explains why these growth differences did not lead to a general convergence. In both countries, the growth rates of the industrial sectors have also been higher than the GDP growth rates. The exception is the last decades in Sweden. This confirms that the manufacturing industry has been an engine of growth, which in turn requires a closer examination of the industrial growth process.

Diagram 2 Long-term trend growth rates for Swedish and Finnish real GDP, 1870-1990.

Sources: Own estimates based on Hjerpe, R., National Accounts Historical Series, unpublished CD-rom; Krantz, O., *Swedish Historical national accounts - Aggregated output series*, mimeo, Umeå University, 2001.

Diagram 3 Long-term trend growth rates for Swedish and Finnish industrial real value added, 1870-1990.

Sources: Own estimates based Hjerpe, R., National Accounts Historical Series, unpublished CDROM; Krantz, O., *Swedish Historical national accounts - Aggregated output series*, mimeo, Umeå University, 2001.

3.2 Convergence in economic structure

By using the angle measure described in section 2, it is possible to compare changes in economic structure between Sweden and Finland. In diagram 4, structural changes on the level of the total economy are shown. The top panel shows structural change separately for each country, with 1870 as a base year. The bottom panel shows the angle measure, calculated as the difference between the Swedish and Finnish structures at each point in time.

In diagram 4 it can be noted how the Swedish structure changes more rapidly than the Finnish during the first half of the investigated period. This reflects that industrialization began earlier in Sweden than in Finland. The difference with respect to economic structure was, in other words, at its highest during the 1930s. During the latter part of the investigated period, the Finnish and Swedish structures become increasingly more similar. This process of divergence and convergence in structure can be clearly seen in the lower panel of diagram 4, where the turning point is around 1930.

Diagram 4 Structural change in the total economy for Sweden and Finland, 1870-1990.

Sources: Own estimates based on Hjerpe, R. National Accounts Historical Series, unpublished CD-ROM;
Krantz, O., *Swedish Historical national accounts - Aggregated output series*, mimeo, Umeå University, 2001.

Diagram 5 Structural change in the Swedish and Finnish manufacturing industry sectors, 1870-1990.

Sources: Own estimates based on Schon, L., *Industri och hantverk 1800-1980*. Lund: Studentlitteratur 1988; Hjerpe, R., Hjerpe, R., Mannermaa, K., Niitamo, O.E., and Siltari, K., *Suomen Teollisuus ja Teo/linen Kasityo 1900-1965*, Kasvututkimuksia. Helsinki: Bank of Finland 1976; Heikkinen, S. and Hjerpe, R., *Suomen teo/lisuus ja teo/linen kasityo 1860-1913*, Suomen Pankin julkaisuja, Kasvututkimuksia 12. Helsinki: Bank of Finland 1986.

The process of structural change is also studied within the industrial sector on the branch level. Diagram 5 shows the same measures as in diagram 4, but for the industrial sector.

For the industrial sector, the pattern of structural change in respect to the prevailing structure of 1870 is quite different between Sweden and Finland. Sweden experiences a steady change away from the 1870 structure, with a levelling out in the post-war period. The Finnish pattern is more dramatic, with considerable changes during the 1870s and the 1930s to 1940s. However, the comparative index in

the lower panel shows that for the industrial sector also, there is a pattern of divergence and convergence in economic structure.

Moreover, this pattern generally reflects the convergence phases with respect to economic growth. Structural change can be seen as the set of changes in the composition of demand, trade, production and factor use that takes place as per capita income increases.⁴⁰ We

⁴⁰ Chenery, H., Robinson, S. and Syrquin, M., *Industrialization and Growth. A Comparative Study*. New York: Published for the World Bank by Oxford University Press 1986.

therefore plotted the structural measure in the total economy level against real GDP per capita in each country. The result can be seen in diagram 6.

Diagram 6 *Structural change in the total economy and GDP per capita for Sweden and Finland, 1870-1990; GDP per capita in 1990 Geary-Khamis \$.*

Sources: Own estimates based on Hjerpe, R., National Accounts Historical Series, unpublished CD-ROM; Krantz, O., *Swedish Historical national accounts - Aggregated output series*, mimeo, Umeå University, 2001.

The diagram reveals that when the structural measures are plotted against GDP per capita instead of time, the pattern is very similar, which implies that the general economic structure corresponding to a certain income level is almost identical in both Sweden and Finland. This fact supports the notion that Sweden and Finland can be seen as similar when it comes to preferences and income elasticities. It increased the possibility that convergence between the two countries could be described as a neoclassical process also when the convergence of industrial output was focused.

3.3 Production factor input and technological change

The first parts of the empirical study showed that there was convergence between the two countries, particularly during the post-war period. Furthermore, it was concluded that convergence was plainly seen both at the total economy level, the manufacturing industry level and in economic structure. Since economic structure seemed to be determined by income levels, we could conclude that preferences and income elasticities were similar in the two countries, which in turn increased the chances for neo-classical convergence also in manufacturing industry. The details of the Finnish catching-up process are investigated in this section by a close examination of the relative developments of factor inputs, as well as partial productivity and multi-factor productivity measures within the manufacturing industry sector.

Labour input

When the developments of labour inputs are studied, it is evident from diagram 7 that the Swedish growth rate is markedly higher than the Finnish one between 1877 and 1900. This coincides with the 'classic' Swedish industrialization phase as has been described in numerous economic historical investigations. For Finland there is a distinct period of rapid growth during the early 1920s, which marks the "take-off phase" for a lengthy period of higher labour input growth rates as compared to Sweden.

Diagram 7 Indices of labour input in Swedish and Finnish manufacturing industries. 1870-1990.
Bottom panel: relative development of labour input Finland/Sweden. Index 1920 = 100.

Sources: Historical National Accounts for Finland; own estimates based on Gunnarsson, G., and Lindh, T., Swedish employment in the 1950s - Filling the lacuna, working article, Department of Economics, Uppsala University 1997; Jungenfelt, K. G., Lönernas andel av nationalinkomsten, mimeo, Nationalekonomiska institutionen, Uppsala Universitet 1959; Jungenfelt, K. G., Lönandelen och den ekonomiska utvecklingen, Stockholm: Industriens utredningsinstitut 1966; Schön, L, Industri och hantverk 1800-1980, Lund: Studentlitteratur, 1988.

Although the developments are temporarily offset by economic crises and the events of war, this sustained period lasts until the early 1980s. Sweden had by then experienced negative labour input growth rates since the mid-1960s, while Finland did not experience negative labour input growth rates until the mid-1970s. Thus, the relative development of labour inputs follows the expected pattern in the catching-up process.

Capital input

As shown in diagram 8, the relative development of the capital stocks reveals a pattern that is more surprising with respect to the catching-up process. The Swedish capital stock grows at higher rates from the beginning of the investigated period until the 1920s. This is in itself not unexpected, since it was particularly during these decades that Sweden took a temporary lead over Finland.

Finnish industrialisation is often dated to the inter-war period. This is shown in the rise of labour inputs from the 1920s and it is apparent that Finnish net capital formation was temporarily higher than the Swedish one during the 1920s.

It is, however, not until *the* mid-1950s that a sustained period of higher relative Finnish capital formation rates begins. Here, we expected that the Finnish capital formation would exceed *the* Swedish one by a degree comparable to the labour.

Diagram 8 *Indices of capital input in Swedish and Finnish manufacturing industries, 1870-1990. Bottom panel: relative development of capital input Finland/Sweden. Index 1920 = 100.*

Sources: Own estimates based on Hjerpe, R., *National Accounts Historical Series*. CD-ROM, Helsinki 2001; Jalava, J., Statistics Finland, Manufacturing industry investment volumes, 1920-1990, unpublished data; Schon, L., *Industri och hantverk 1800-1980*, Lund: Studentlitteratur 1988; Johansson, Ö, *The Gross Domestic Product of Sweden, and its Composition 1861-1955*. Stockholm: Almqvist & Wiksell 1967.

inputs. This is, however, not the case. The magnitude of the catching-up process with respect to capital formation is not as obvious as the divergence during the previous periods, and the growth rates converge again from the early 1980s. Here is an indication of an anomaly with respect to neo-classical convergence. Considering the relative developments of both labour inputs and capital stocks, we hypothesized that the catching-up process comprises either

extraordinary Finnish MFP-growth rates, or increased labour inputs with a substantial impact on the index of combined inputs.

Combined inputs and MFP

The relative movement of the combined inputs again reflects the divergence-convergence story, as seen in diagram 9.

Diagram 9 *Indices of combined inputs in Swedish and Finnish manufacturing industries, 1870-1990. Bottom panel: relative development of combined inputs Finland/Sweden. Index 1920 = 100.*

Sources: Own estimates based on Hjerpe, R., National Accounts Historical Series, unpublished CD-ROM; Jalava, J., Statistics Finland, Manufacturing industry investment volumes, 1920-1990, unpublished data; Schon, L., *Industri och hantverk 1800-1980*. Lund: Studentlitteratur 1988; Johansson, Ö., *The Gross Domestic Product of Sweden, and its Composition 1861-1955*, Stockholm: Almqvist & Wiksell 1967; Gunnarsson, G., and Lindh, T., *Swedish employment in the 1950s - Filling the lacuna*, working article, Department of Economics, Uppsala University 1997; Jungenfelt, K. G., *Lönernas andel av nationalinkomsten*, mimeo, Nationalekonomiska institutionen, Uppsala Universitet 1959; Jungenfelt, K. G., *Löneandelen: och den ekonomiska utvecklingen*. Stockholm: Industriens utredningsinstitut 1966.

From the beginning of the period until the 1920s, the growth rate of the combined inputs is higher in Sweden than in Finland. The whole inter-war period shows roughly the same growth patterns, but from the late 1940s the relative developments of the 1870-1920 period are reversed. Thus, the growth rates of factor inputs over the whole 1870-1990 period were roughly the same in both countries, which is a parallel to the development of the relative growth of industrial output volumes.

The similarities of the relative developments of industrial output and the combined factor inputs suggest that the MFP-growth rates should reveal very similar patterns in the both

countries. As can be seen from diagram 10 this is very much the case. Both countries, despite the common notion of Finnish backwardness, reveal the same basic pattern of increasing MFP.

Diagram 10 *Indices of MFP in Swedish and Finnish manufacturing industries, 1870-1990. Bottom panel: relative development of MFP Finland/Sweden. Index 1920 = 100.*

Sources: Own estimates based on Hjerpe, R., National Accounts Historical Series, unpublished CD-ROM; Jalava, J., Statistics Finland, Manufacturing industry investment volumes, 1920-1990, unpublished data; Schon, L., *Industri och hantverk 1800-1980*. Lund: Studentlitteratur 1988; Johansson, Ö., *The Gross Domestic Product of Sweden, and its Composition 1861-1955*, Stockholm: Almqvist & Wiksell 1967; Gunnarsson, G., and Lindh, T., *Swedish employment in the 1950s - Filling the lacuna*, working article, Department of Economics, Uppsala University 1997; Jungenfelt, K. G., *Lönernas andel av nationalinkomsten*, mimeo, Nationalekonomiska institutionen, Uppsala Universitet 1959; Jungenfelt, K. G., *Löneandelen: och den ekonomiska utvecklingen*. Stockholm: Industriens utredningsinstitut 1966.

It is evident that the Swedish MFP-growth rate increases during the early 1890s. The growth is, however, not sustained at that rate until approximately the 1920s. In the Finnish case, the exact timing is more difficult to determine due to more pronounced volatility in the series during the late 19th century. A similar periodization is, however, plausible also in the Finnish case.

Labour and Capital productivity

Concerning the development of labour productivity, the impression from diagram 11 is a general similarity in both countries. There are, however, some differences. First, and strangely, Finnish labour productivity was growing at slightly higher rates until

approximately 1900. Thereafter, via a substantial Swedish acceleration during the first two decades of the 20th

Diagram 11 *Indices of labour productivity in Swedish and Finnish manufacturing industries, 1870-1990. Bottom panel: relative development of labour productivity Finland/Sweden. Index 1920 = 100.*

Sources: Own estimates based on Hjerpe, R., National Accounts Historical Series, unpublished CD-ROM; Jalava, J., Statistics Finland, Manufacturing industry investment volumes, 1920-1990, unpublished data; Schon, L., *Industri och hantverk 1800-1980*. Lund: Studentlitteratur 1988; Johansson, Ö., *The Gross Domestic Product of Sweden, and its Composition 1861-1955*, Stockholm: Almqvist & Wiksell 1967; Gunnarsson, G., and Lindh, T., *Swedish employment in the 1950s - Filling the lacuna*, working article, Department of Economics, Uppsala University 1997; Jungenfelt, K. G., *Lönernas andel av nationalinkomsten*, mimeo, Nationalekonomiska institutionen, Uppsala Universitet 1959; Jungenfelt, K. G., *Löneandelen: och den ekonomiska utvecklingen*. Stockholm: Industriens utredningsinstitut 1966.

century, Finland experiences slightly lower productivity rates until the 1970s. Our general conclusion is, however, that labour productivity shows similar developments in both countries.

Again this observation raised some questions of importance. What factor caused this unexpectedly similar development? It could not have been a similarity in the development of the capital-to-labour ratio, since the rate of capital formation was fairly similar in both countries and labour inputs increased at considerably higher rates in Finland, especially during the critical period after 1920. Therefore, we concluded that capital productivity must have been higher in Finland than in Sweden.

Diagram 12 shows that the development of capital productivity is markedly different in the two countries. While Swedish capital productivity remains largely constant from the 1920s, the Finnish one shows a substantial improvement between 1920 and 1950.

Diagram 12 *Indices of capital productivity and in Swedish and Finnish manufacturing industries, 1870-1990. Bottom panel: relative development of labour productivity Finland/Sweden. Index 1920 = 100.*

Sources: Own estimates based on Hjerpe, R., National Accounts Historical Series, unpublished CD-ROM; Jalava, J., Statistics Finland, Manufacturing industry investment volumes, 1920-1990, unpublished data; Schon, L., *Industri och hantverk 1800-1980*. Lund: Studentlitteratur 1988; Johansson, Ö., *The Gross Domestic Product of Sweden, and its Composition 1861-1955*, Stockholm: Almqvist & Wiksell 1967; Gunnarsson, G., and Lindh, T., *Swedish employment in the 1950s - Filling the lacuna*, working article, Department of Economics, Uppsala University 1997; Jungenfelt, K. G., *Lönernas andel av nationalinkomsten*, mimeo, Nationalekonomiska institutionen, Uppsala Universitet 1959; Jungenfelt, K. G., *Löneandelen: och den ekonomiska utvecklingen*. Stockholm: Industriens utredningsinstitut 1966.

The relative development of capital productivity could only partly clarify the mysteries, since constant capital productivity was plainly seen in both countries during the post 1950-period. Capital productivity was, in other words, more or less constant in both countries during the most crucial catching-up phase. Clearly, an important part in the catching-up lay in the difference between partial and multi-factor productivity. Could this, in turn, somehow be related to institutions?

4. Conclusions

After the initial inspection of growth rates, structural change, partial and multifactor productivity and factor input growth rates, some stylised facts can be drawn concerning the catching-up process. To start with, catching-up involved not only a closing of the income gap

between the countries. It also meant convergence with respect to output structure. Naturally, since growth was unevenly distributed over time in the two countries this also applied to structural change. At times there were substantial differences in economic structure, but with respect to income these differences were markedly smaller. We hesitated to draw the conclusion, but it seemed evident that the time dimension (here considered as a dummy for all factors and dynamics that we are unaware of) is less important with respect to economic structure than incomes were.

The next step was a closer examination of the industrial growth processes in the both countries. A first conclusion from the growth study is that technological change, measured as MFP, has never been an important factor for explaining differences in industrial growth rates. In other words, Finland has never experienced a technological backwardness that subsequently could be exploited for reaching higher industrial growth rates. We therefore suggest that the traditional view of Finland as a backward country should be refined. Finland was only backward in the sense that the manufacturing industry constituted a smaller share in the economy as compared to Sweden, but the technological standard of the industrial plants that existed was probably more or less comparable to that of its Swedish counterparts.

Moreover, the similarities in MFP development are also compatible with the neo-classical assumption of technology as an internationally free good. It may therefore be argued that an ultimate factor that assured a successful Finnish catching-up story is that the country was part of a western European cultural context that ensured technological transfers. There are, however, some observations that may appear remarkable in the comparison.

As previously concluded, it is not only MFP that shows very similar development patterns. It is also true for labour productivity. Moreover, both countries follow the neo-classical rule that the ratio between labour productivity and capital intensity can be approximated as a constant. It is also true that the Finnish capital stock increases at a slightly higher rate than the Swedish one during the post-1950 period, but what seems puzzling is that this increase is not as high as the difference in output growth. If these facts are taken together it seems that something must be wrong. How could there be a catching-up process if: a) MFP increases at the same rate, b) labour productivity developments are similar and c) the increase of Finnish capital stock is not large enough to explain the catching-up in industrial output?

Certainly, the problem does not lie with a factor that we have not yet discussed; namely income distribution. Income shares represent the marginal productivity of each factor of production. Accordingly, differences in income distribution in Finland and Sweden are reflected in different weights of the factors of production in the combined factor indices.

The Finnish capital share (I-a) in equation (2) and (3)) is more or less 50% throughout the period, while the Swedish capital share falls from slightly less than 60% to approximately

35% during the post-war period. This means a considerably lower growth rate of the index of combined factor inputs as compared to a counterfactual case employing Finnish income shares. The difference in the development of the capital share is very important in this context. In order to illustrate the importance of changes in the income distribution, we undertook a counterfactual experiment, by estimating a hypothetical Swedish value added volume, using a counterfactual index with the Finnish labour and capital shares and the original Swedish MFP. Thus, we are assuming that the original MFP measure is a correct measure of shifts in production capacity.

This exercise showed that the Finnish catching-up would have been substantially weaker if the Swedish capital share had remained at roughly 50% of value added, as it did in Finland. As already pointed out, this is merely an illustration since the counterfactual case ignores the fact that falling capital shares mirror diminishing returns on capital. Thus, it must be the development of investments given the technological level and labour input that determined the change in Swedish functional income distribution. This still remains puzzling. Diminishing returns are certainly the mechanism through which neo-classical convergence works, but this unfolds through falling investment rates, not through falling capital shares. Therefore, we wondered, could there have been institutional arrangements in Sweden that accelerated convergence?

May institutional differences account for differences in the development of capital shares?

Eichengreen has pointed out that a set of institutions promoted the remarkably high growth in post-war Europe.⁴¹ In short, these institutions promoted wage moderation and high investments. For this closing discussion we hypothesise that Sweden implemented this European institutional framework with a high degree of determination. It included a complicated set of institutions designed as policy tools for Keynesian economic policy aiming at full employment, anti-inflationary policy, income equalization and the promotion of economic growth through structural change and rationalization. An even more direct goal was to increase tax revenues. Economic engineering could be a suitable term for this. Its central institutions were, as we see it, profit taxation, investment funds and what in Sweden is known as the 'solidaristic wage policy'. The investment funds allowed companies to save profits, exempt from taxation, in the central bank. This was a design to manage investments in a counter cyclical manner. Along with the high taxation of dividends (the popular term is double taxation) it has been suggested that these arrangements created a lock-in effect of

⁴¹ Eichengreen, B.. Institutions and economic growth: Europe after World War II, in *Economic Growth in Europe since 1945*, Crafts, N. and Toniolo, G. (eds). Cambridge, Cambridge University Press 1996; Eichengreen, B., Institutions and economic growth in postwar Europe, in *Productivity, Technology and Economic Growth*, van Ark, B., Kuipers, S. K. and Kuper, G. H. (eds). Boston: Dordrecht, London, Kluwer Academic Press 2000.

profits in the companies by discouraging the redistribution of profits through dividends.⁴² Thus, reinvestment was turned into a more attractive option for the corporation. The shareholders could expect an increase of the stock values. These tendencies may have been further reinforced by the 'solidaristic wage policy'.

The solidaristic wage policy meant in essence equal wages across the companies of an industrial branch regardless of profitability. Politically, it gained its legitimacy from wage equalization, but was probably even more a policy tool for efficiency through structural change and rationalization. It is not clear whether wage drift neutralised its effects, but it created - at least theoretically - excess profits in already profitable corporations and losses in companies that could not carry the 'solidaristic wage' cost. Since the 'solidaristic wage' level could not be set too high, because this would create substantial reduction of the production capacity when companies went out of business, it was an institution that moderated wages. And since the lion's share of production capacity was not squeezed out, a general outcome was - again theoretically - excess profits that preferably were reinvested.

The general view of the Swedish institutional setting as a variation of a wider model is also pointed out in the tradition on social corporatism in the Nordic countries.⁴³ This treats common features as a 'Nordic' model of social corporatism, with the focus on the institutionalization of the conflict between labour and capital. In this context, the Swedish and Finnish models are seen as variations of the 'Nordic' model, even if they have marked differences.

Attempts have also been made to trace the economic performance in the Nordic countries back to differences in the institutional setting or differences in the corporatist model.

Pekkarinen tries to assess the relationship between the different corporatist variations in Sweden, Norway and Finland and their post-war economic performance.⁴⁴ He concludes that the institutional settings in these countries have contributed positively, even if it is difficult to trace the exact causal relationships.

⁴² SOU 1989:34 *Reformerad fiiretagsbeskaccning: betiinkande av utredningen om reformerad [oretagsbeshatmingo* Stockholm: Allrnäanna förlaget 1989.

⁴³ For an overview and introduction to this research tradition see Pekkarinen, J., Pohiola, M. and Rowthorn, B. (eds), *Social Corporatism: A Superior Economic System?* Oxford: Clarendon Press 1992.

⁴⁴ Pekkarinen, J., Corporatism and Economic Performance in Sweden, Norway, and Finland, in Pekkarinen, J., Pohjola, M. & Rowthorn, B. [eds]. *Social Corporatism: A Superior Economic System?* Oxford: Clarendon Press 1992.

The positive view of the corporatist model, with a few precautionary remarks, is also put forward by Pohjola.⁴⁵ Even if the Finnish model in many aspects has been seen as part of a more general Nordic model, the Finnish model is markedly different from the Swedish one.⁴⁶

Perhaps most striking is the Finnish scepticism towards Keynesian economic politics and the 'economic engineering' that became highly developed in Sweden during the 1950s and 1960s.⁴⁷ As a clear contrast to Sweden, fiscal policy in Finland was seen as a series of independent actions, and not something that should be systematically connected to macro economic variables. In particular, unemployment was perceived as a separate problem in Finland, while in Sweden it was clearly

a part of the general economic policy. This means that even though a welfare system similar to the Swedish one also evolved in Finland, there were no counterparts to the investments funds, the 'solidaristic wage policy' and other related institutions of economic engineering, simply because they were not needed in the context of Finnish down-to-earth fiscal thought.

However, as we hypothesise, precisely because of this successful implementation of the investment promoting parts of the European institutional framework in Sweden, it contributed to an economic slow-down. The mechanism was exaggerated

investments that caused a premature fall in the marginal productivity of capital, reflected in falling capital shares. This may have been more acute in Sweden than in several other countries, if Sweden, due to the comparatively high incomes, was already near the point of naturally diminishing returns. In this version of the story, Finnish catching-up is not only a case of neo-classical mechanisms, but also a story of Swedish institutional arrangements that backfire while the intention was full employment and economic growth.

The hypothesis of over-investments could - if it is correct - change the focus on which particular institutions are relevant in a growth perspective. The welfare state as such seems more beside the point as compared to the successfully implemented, but misguided investment policy. This also suggests that a generous welfare policy does not have to be a disadvantage for today's industrializing countries, but that 'economic engineering' aiming at rising investment rates may be a hindrance. It may also be that the convergence was unavoidable from a Swedish perspective, however, the specific route it came to follow seems to have been influenced by institutional factors.

⁴⁵ Pohjola, M., Nordic Corporatism and Economic Performance: Labour Market Equality at the Expense of Productive Efficiency?, in Kauppinen, T. and Koykka, V. (eds), *Transformation of the Nordic Industrial Relations in the European Context*. Helsinki 1994.

⁴⁶ Kettunen, P., The Nordic Welfare State in Finland, *Scandinavian Journal of History*, vol. 26, no 3, 2001, 225-247.

⁴⁷ Pekkarinen, J. and Vartiainen, J., *Finlands ekonomiska politik. Den långa linjen 1918-2000*. Helsinki: Stiftelsen Fackföreningsrörelsens institut för ekonomisk forskning 2001, 105.