Labor's Share in Sweden, 1850-2000

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Version 1.1, October 2012

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ABSTRACT

The size of labor's share of national income – the share that goes to labor incomes, not capital incomes – is an important indicator of income distribution, and one that often is available for a longer time than more complex measures such as the gini coefficient. For Sweden there is labor share data back to 1850, but so far no causal analyses have been made; instead, economists and economic historians seem to be content assuming that labor's share does not vary in any meaningful way over time, other than with business cycles. This paper, the first causal analysis of labor's share in Sweden, shows that labor's share does covary (positively) with welfare state generosity and (negatively) with imports as share of GDP. Labor's share in manufacturing also covaries negatively with unemployment. The paper also shows that labor's share went through several structural breaks in the period 1850-2000: one around 1920, one around 1950 and one in the late 1970s. After 1920 it started increasing, after 1950 it increasing coefficient became steeper, and after the late 1970s it has been falling together with labor strength.

KEYWORDS

Inequality, functional income distribution, Sweden

In economics as well as economic history, it is common to assume that factor prices – renumeration to capital and labour – reflect the factors' marginal productivity. Then labor's share is assumed not to vary systematically with social factors such as union density or generosity of the welfare state, in the long run (cf. Schön, 2008). Wage pushes lead to substitution of labour with capital, again pressing down labor's share. Changes in factor prices are determined by changes in factor quantities. However a growing research shows that this does not hold: social factors have impacts too (cf. Blanchard, 1997). In the last fifteen years, research interest in functional income distribution – the distribution of national income between capital and labour – has increased rapidly (cf. Atkinson, 2009). Above all many studies have used panel data to investigate the causes of movements in labor's share (for example Kristal, 2010). In the US there have also been since the 1980s a slow but steady stream of studies from a heterodox economic point of view on the development in that country (for example Kalleberg et al., 1984; Fichtenbaum, 2009). For Sweden, we have data on the functional income distribution going all the way back to 1850, but still there have been no causal analyses of the movements of labor's share. This paper seeks to remedy this lack. Most of the recent literature on labor's share uses datasets that go back to 1960 or 1970 or even later, whereas this paper has data back to 1850. This means that partly other explanations will be investigated: the period 1850-1960 contains industrialization of Sweden, the advent of democracy and other factors that are likely to influence labor's share but are not relevant in the typical samples going back to the 60s or 70s. Naturally, the data available for independent variables are also more scarce for such an early period, and so this paper will use historical narrative as well as some time-series econometrics to investigate the causes of movements in labor's share.

The paper is structured as follows. Section I gives an overview of the literature on functional income distribution in Sweden and a description of its development since 1850. Section II presents the dataset that will be used. The dependent variable, labor's share in the private sector 1850-2000, as well as several key independent variables come from the dataset of Edvinsson (2005). Section III contains the empirical investigation, which mainly builds on time series regressions, but also more qualitative discussion of variables that can not be included in regressions due to lack of data. The section also includes a look at structural breaks in the development of labor's share 1850-2000. Section IV concludes.

I. Functional income distribution in Sweden: what do we know?

The development of the functional income distribution in Sweden has been explored and described by several economic historians – notably, Schön (2001), Vikström (2002) and Edvinsson (2005). I want to argue, though, that the literature lacks an empirical analysis of the determinants of labor' share.

Lennart Schön in his textbook on Sweden's modern economic history (2001: 26-27, 498) sees the movements of labor's share in a Kondriatev cycle perspective: during expansive decades such as the 1880s, 1920s and 1960s labor's share increases and new consumption patterns develop. At the same time the higher labor's share increases incentives for rationalization and makes it tougher for weakly profitable companies. Then in the aftermath of structural crises – that each "development block" must meet, according to Schön's structural-analytic perspective – in the 1890s, 1930s and 1970s labor's share falls when companies with low or no profits are destroyed in the crisis and new directions with higher profitability become more important. On top of this, typically the profit squeezes involved in the structural crises are met politically by reforms to labour market institutions, devaluations and other reforms to increase profits and make the wheels of the economy rolling again (Schön, 2001: 498). I have no intention to argue against Schön's strucural-analytical perspective, but I do want to argue that his cyclical analysis is not enough (previous critiques of the cyclical theory include Lindmark and Vikström, 2004). To start with, a look at table 1 below shows that labor's share increases more in the 1910s than the supposedly expansive 1920s and more in the 1950s than in the 1960s, and decreases more in the 1900s than in the supposedly contractive 1890s and more in the 1990s than in the 1970s. The movement of labor's share in Sweden is not sufficiently captured just with reference to Kondriatev waves; other factors matter, and create other trends in the data. Schön (2004) has also discussed functional income distribution in the manufacturing sector 1870-2000 in a separate chapter. Here labor's share is related both to Kondriatev cycles and to the Kuznets curve – the famous economist's idea that in an industrializing country inequality first increases as fractions of the population move out of low-productive agriculture to manufacturing, and then decreases as the spoils of the highly productive manufacturing sector are spread across the population. Schön relates functional income distribution to the industrial development of Sweden, but does not investigate the matter econometrically.

Peter Vikström in his dissertation *The Big Picture* works with new national accounting data for the period 1870-1990. His data include a measure for labor's share, defined as compensation of employees divided by value added (Vikström, 2002: 45). However, Vikström has no discussion of the causes of labor's share's

movements over time, but rather focuses (Vikström, 2002: 96-99) on the contrasts between his labor share data and the previously available data from Jungenfelt (1966).

Rodney Edvinsson (2005) also developed new national accounting data in his dissertation, *Growth Accumulation Crisis*. His are the data I use here for labor's share. However, Edvinsson's (2005: 141-145) discussion of functional income distribution just like Vikström's sticks to description of the data and differences with earlier series and measures, and does not include causal analysis.

Economic historians influenced by neoclassical economics tend to see factor shares as determined by the respective marginal productivity of capital and labour (see e.g. Lindmark and Vikström, 2003: 72; Ljungberg, 2004: 4), but I want to take a broader analytical perspective, including power resources and class relations variables in the analysis, and in the first econometric analysis of labor's share in Sweden I will show the worth of this kind of perspective[1].

Description of labor's share's development

The development of labor's share over the period is shown in the diagram and table below. In table 1 we see two measures: labor's share in the private sector specifically. The private sector measure is the main dependent variable of this paper, and the manufacturing sector measure is an alternative specification that will be used in robustness checks below.

[1] Frankema's 2010 study of Argentina, Brazil and Mexico 1870-2000 is another newer example of such a perspective within economic history.

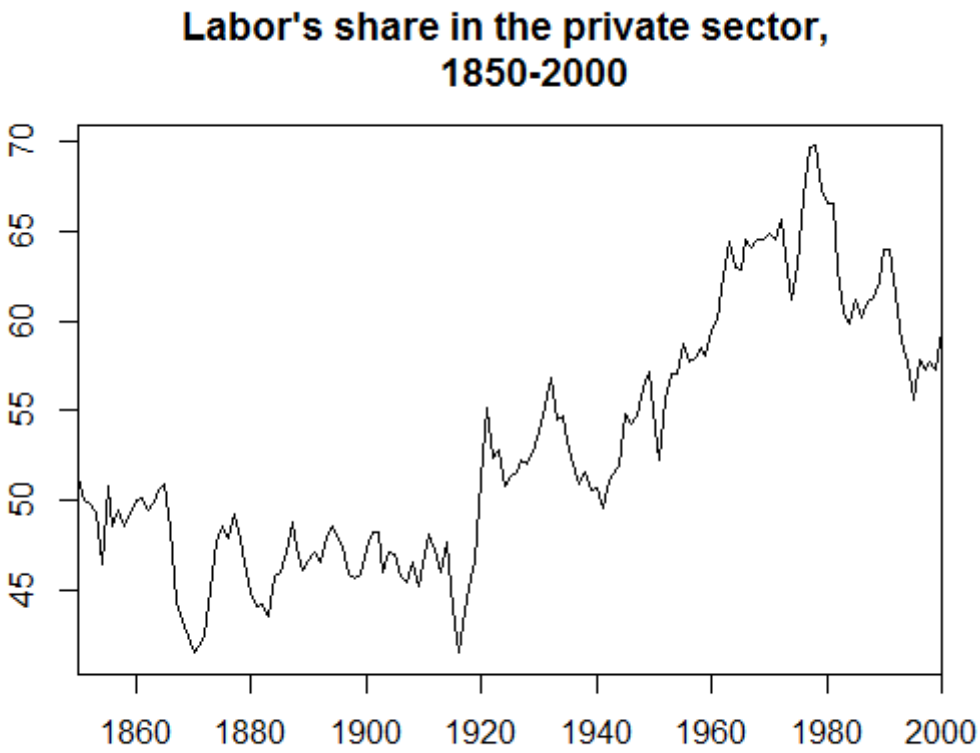


Table 1. Average yearly changes in labor's share, per decade

	Private sector	Manufacturing and crafts
1850s	-0.13	0.52
1860s	-0.86	-0.24
1870s	0.34	0.33
1880s	0.18	0.78
1890s	0.07	0.25
1900s	-0.03	0.05
1910s	0.42	-0.19
1920s	0.27	0.64
1930s	-0.31	-0.49
1940s	0.33	0.51
1950s	0.55	0.43
1960s	0.54	0.40
1970s	0.17	0.53
1980s	-0.25	-0.57
1990s	-0.44	-1.12

We see that the development is fairly trendless in the seventy or so first years of the period, after which it increases in two large leaps: one from 1921 to 1930, and one from 1945 to 1977. If we should say anything about the period 1850 to 1920 it is that labor's share decreases to a low point in 1870, after which it increases and finds a new steady state to vary around for fifty-odd years. Sweden saw a rapid population increase in 1800-1870 with increasing proletarianization and inequality (Sandberg and Steckel, 1997: 130; Martinius, 1977; Bengtsson and Dribe, 2002). The last great subsistence crisis in Sweden occurred in the late 1860s. After 1870 large-scale emigration, above all to the USA, increased real wages in Sweden (Prado, 2008: 31) as well as its Scandinavian neighbour Denmark (Greasley and Madsen, 2006) and another then poor country, Spain (Betrán and Pons, 2011), through a Heckscher-Ohlin style process where emigration made labour more scarce and then pushed up its price. (According to Grant, 2003 this effect was particularly strong in Scandinavia and some other small countries; cf. Huberman and Lewchuk, 2003: 6.) Among the 17 countries that Taylor and Williamson (1997: 29) look at, only Ireland, Italy and Norway saw larger outflows (measured as net migration per 1000 inhabitants) than Sweden in 1870-1910.

Labor's share falls back both after the 1921-30 increase and the 1945-77 increase, but not the previous levels: some of the increase stays. The long-run increase until the 1970s is similar to the Dutch development (Frankema, 2010). The lowest level of labor's share in the 20th century is in 1916, which also is the year when the top percentile's share of national income was at its highest. An export boom caused by Sweden standing outside of the First World War meant that companies' incomes increased very rapidly, at the same time as workers' bargaining power was very low. Labor's share decreased to its lowest level since the early 1870s and the savings quota reached record levels (Schön, 2001: 275, 284). However, labor unrest caused pro-worker reforms, the most important of which was the eight hour working day legislated in 1918 and universal suffrage in 1922. The labor historian Åmark (1986:99) talks about a "wave of protests and struggles" in Sweden during the First World War. The number of union members increased from 1914 to 1920 by 173 percent. Real hourly wages in manufacturing increased by 30 percent from 1918 to 1920, and in 1930 the average real wage in manufacturing was twice the level of 1918 (Schön, 2001: 301; cf. Prado, 2010: 493). The development of increasing worker militancy raising labor's share is very similar to the one in Denmark (Greasley and Madsen, 2006: 131-2). Denmark also saw the same working time reduction, from nine and a half hours to an eight hour day in 1919-20. In the wake of universal suffrage labor's share increased in Sweden, just like in Denmark and New Zeeland (Bohlin and Larsson, 2007; Bohlin et al, 2012). Universal suffrage meant among other things a strengthening of the working class and an important factor for its genesis was the threat against the ruling class of a socialist revolution, like in Russia (Acemoglu and Robinson, 2000). As capital owners have economic power resources in the form of their capital, but workers do not, the vote is

more important as a power resource to workers (Korpi, 1981). Norway also saw rapid real wage increases for workers in 1918-1922 (Grytten Honningdal, 2000). Lindert (1994, 1996) has shown that expanding the franchise increased social spending, which is redistributive and beneficial to workers.

The peak of labor's share in Sweden occurs in 1977-78, at 69.8 percent. This was a part of the OECD-wide working class offensive that caused profit squeezes in an array of countries, not only Sweden (Armstrong et al., 1984). Edvinsson (2010) has investigated the development of the profit rate in Sweden 1800-2000 and concluded that the heaviest profit crisis in Sweden in modern times was in 1978, a result conforming to the development of labor's share as well. The international literature points to several reasons for the profit squeeze of the 1970s; there is a debate between those who like Glyn (2007) find the profit squeeze being caused by labor militancy, and Brenner (2002) who instead argues that it was caused by increasing international competition in manufacturing due to the rise of East Asia and other newly industrializing countries. I prefer to stay agnostic as to which major explanation is the most important; they are anyway not mutually exclusive. Labor economists in Sweden have pointed to increasing unemployment insurance generosity and trade union militancy as causes of the Swedish profit squeeze (Gottfried, 2011). What about the reactions to the profit squeeze, then? As discussed above, Schön has pointed to that in the various profit crises he discusses – the 1890s, 1930s and 1970s – there is always a political response and some labour market reform. The most important immediate responses to the crisis of the late 1970s was a series of devaluations, the largest of which came with the new Social Democratic government in 1982; in then finance minister Kjell-Olof Feldt's (1991: 22-24, 69) words the first Social Democratic government ever being elected on the promise to increase profits. The Social Democrats saw industrial renewal as a top priority and since profit margins were catastrophically low in the early 1980s they had to be increased somehow; a large and surprising devaluation intended to erode Swedish real wages to increase profits and competitiveness of Swedish industry (cf. Schön, 2004: 36). This worked at least in the short run: from 1981 to 1985 labor's share in the private sector decreased by five percentage points, and in manufacturing by eleven percentage points. In 1982 the manufacturing sector broke out of the centralized wage bargaining system that had lasted since 1952, and the rest of the 1980s become a tug-of-war between unions on who could get the best wage increases (Elvander, 1986). This caused inflation and in the 1990s a new and more stable system of wage-setting was created, with the internationally competing manufacturing sector setting the norm for all other sectors' wage increases (Gottfries, 2011). In table 1 we see that labor's share fell more in the 1990s than in any other decade in the period 1850-2000: this is most likely a result of the new Swedish labour market regime with a wage-leading manufacturing sector with

conservative wage policy due to strong international competition, and a conservative independent central bank (cf. Hancké, 2012).

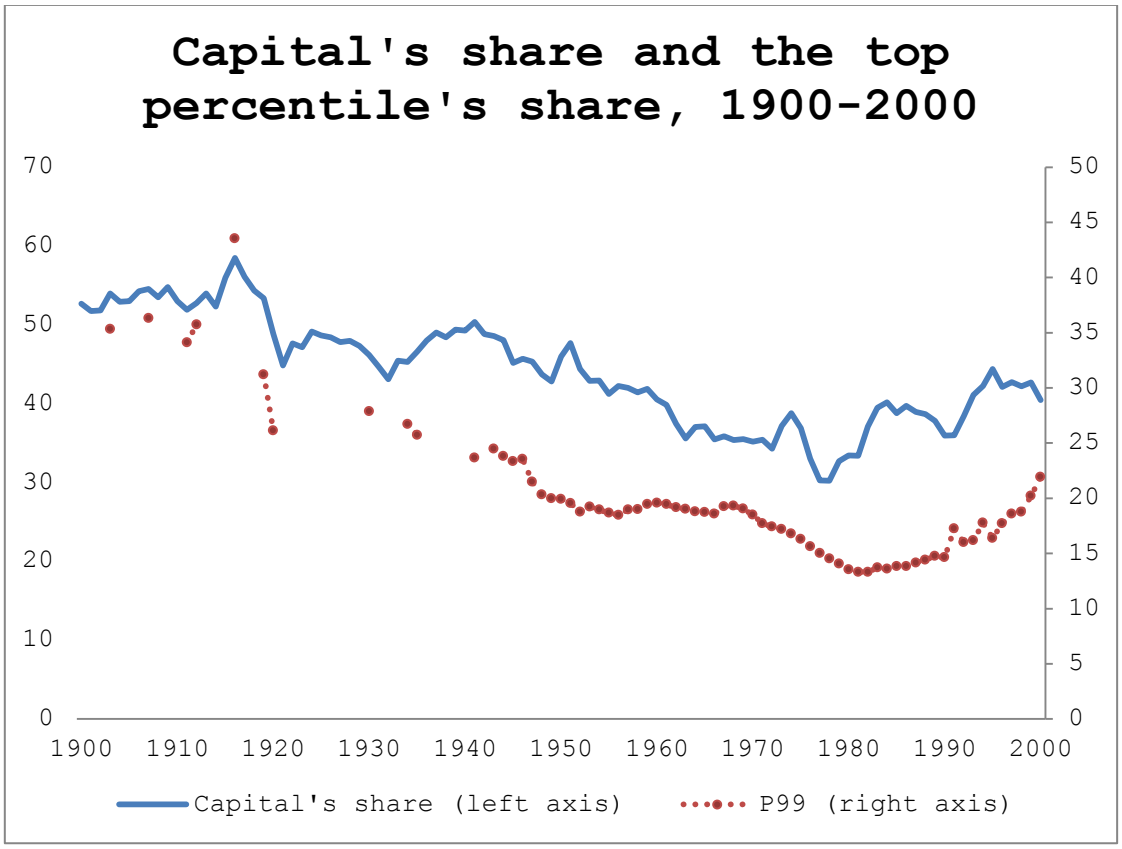
In table 1 we have seen the development of the entire private sector and the manufacturing sector separately. There are some notable divergences between the series, especially in the 1910s and 1920s. During world war 1 wages for agricultural laborers increased particularly strongly, while during the 1920s they lost out in relative terms to industrial laborers (Söderberg, 1991: 87).

The connection between top income shares and inequality/functional income distribution

Functional income distribution measures – labor share and capital share – are often seen as inequality measures. Whether this works – whether e.g. a higher capital's share means more inequality – depends on how concentrated capital ownership and therefore capital incomes are. Atkinson, Piketty and Saez (2011: 60) in a recent article point to that there are two scenarios: one where people basically either have labor income or capital income, and another where income classes are mixed in the population. In the first scenario – capitalists and workers – capital's share is indeed a good measure of inequality, and in the other scenario – people's capitalism – it is not. In reality this dichotomy does not exhaust the possible scenarios, of course, but they mark clear end points on a gliding scale. And it becomes an empirical question how good a measure of inequality capital's share is (cf. Prados de la Escosura, 2008: 293). The prominent economic historian Robert Allen (2005) states for 18th century Britain that capital's share is a good measure: "Ownership of land and capital were concentrated in industrializing Britain, so a rise in property income signals an increase in inequality." The economist Thomas Piketty (2003), on the other hand, has for the French 20th century pointed out that inequality of capital ownership decreased after World War II, so capital's share lost power as a measure of inequality. Between 1850 and 1914, Piketty says, a prominent place in French (or at least Parisian) society indeed was occupied by the idle "rentier" class depicted in the novels of Balzac or Proust. After 1945, however, ownership of capital was much more spread out and therefore the increase in capital's share in France in the 1980s and 1990s did not translate into much more inequality of incomes.

What about Sweden, then? The economists Roine and Waldenström (2008) have calculated the relevant measure: the correlation between capital's share and the top percentile's share of total incomes (labor and capital), for the period 1903-2004. In line with Piketty's results for France, they show that the correlation in Sweden is much stronger in the early part of the period – Swedish society is fairly well captured by the capitalists versus workers scenario mentioned above – than in the later part – Swedish society being more a "people's capitalism" type scenario. The correlation for

the two measures found by Roine and Waldenström is 0.94 for the years 1907-1950 but only 0.55 for the years 1951-2004. In the diagram below I reproduce the development for the two series. There are two differences to Roine and Waldenström's diagram. Capital's share here is only for the private sector, not the entire economy, and the series end in 2000 which is the final year with which this paper is concerned.



We see that the correlation is indeed quite strong, the series move together. Inequality increases slightly from 1903 to a peak in 1916 – the peak for the entire 20th century – then decreases in the early 1920s, finds a plateau until 1950, then decreases until 1980 and then starts increasing again. But the correlation is weaker in the later period, just as Roine and Waldenström find. For 1903-1950 the correlation is 0.91 and for 1951-2000 it is 0.42. This points to the decreasing inequality of capital ownership in Sweden since the mid-20th century (see Gustavsson et al., 2009; Roine and Waldenström, 2009). However, since ca 1980 wealth inequality has once again started rising in Sweden, and increasing capital gains have made a meaningful contribution to increasing income inequality in this country, unlike Anglo-Saxon countries (Roine and Waldenström, 2012). Hence, in the near future functional income distribution might get a renaissance as a measure of inequality.

II. Data and variables

The most important variable in the paper is the dependent variable: labor's share. I fetch this from Edvinsson's (2005) dataset, and calculate it as labor compensation divided by gross value added[2]. Labor compensation is wages and salaries as well as social benefits, hence my measure is "labor's share" and not the "wage share". Self-employed persons' incomes are included in labor's share. This variable's available years defines the beginning and end of the dataset: 1850 to 2000. In the econometric analysis I will also use labor's share only for the manufacturing sector, also from Edvinsson, and as a robustness check I will also use the alternative measure from Vikström (2002), which is available for the years 1870 to 1990. In table 2 labor's share and all the other variables are described.

Table 2. The dataset

	Source	N (years)	Mean	Min	Max	Standard deviation
Labor's share, private sector	Edvinsson	151 (1850-2000)	52.97	41.46	69.78	7.03
GDP growth	Edvinsson	151 (1850-2000)	2.74	-10.56	13.01	3.56
Inflation	SCB	1850-1999	2.93	-18.5	47	6.69
Imports as share of GDP	Edvinsson	151 (1850-2000)	22.51	6.05	38.5	5.97
Public consumption as share of GDP	Edvinsson	151 (1850-2000)	13.46	5.51	29.97	7.74
Share of employees in work conflict	Edvinsson	(1903-2000)	14.28	0.03	188.62	27.75
Unemployment	Molinder (1911-1957); OECD (1960-)	(1911-1957; 1960-2000)	6.32	1.18	26.6	5.59
Left government	Scheve and Stasavage	(1920-2000)	Dummy variable. Possible values: 0 and 1.			
Wage bargaining centralization	Scheve and Stasavage	(1900-2000)	Dummy variable. Possible values: 1, 2 and 3.			

[2] In Edvinssons's dataset the two variables are U. Wages and salaries (including social benefits) of employees (current factor values, million SEK) of various types of activities, and D. Nominal gross value added (in basic prices, million SEK) of different types of activities and of GDP. U divided by D gives labor's share.

Macroeconomic variables

Labor's share tends to fall in years with high growth and increase in years with low growth (Kristal, 2007) and so in specifications where the dependent variable labor's share is measured in levels, this is an important control. I include GDP growth from Edvinsson and it's from 1850 to 2000.

Inflation can have an impact on changes in labor's share if there is sticky wages and/or money illusion: workers can not or do not react to surprise inflation and can not adjust wages upwards, which means that with high inflation labor's share falls (cf. Schön, 2004: 37). However there is a problem with reverse causality here, since higher wages and labor share can lead to higher inflation. The source for this variable is Statistics Sweden, and it's available for the years 1850-1999.

Power resources and labour market institution variables

There are two main types of power resources variables: labour market variables, and political/welfare state variables.

The most important labour market variable is union density, a classical measure of working class/labor strength and mobilization. Studies with panel data (Kristal, 2010; Bengtsson, 2012) as well as on the US (Macpherson, 1990; Wallace et al, 1999) have shown that unions have a positive effect on labor's share. However, union density data are not available for a long period; the main series, from Visser, only begins in 1960. Therefore union density is not included in the regression analyses in this paper. Another indicator of labour market institutionalization however is wage bargaining centralization, and from Scheve and Stasavage (2009) we have data for this back to 1900. This is a trichotomous variable that takes value 1 for years in which wages are mainly set locally, 2 when they are mainly set sectorally, and 3 when mainly centrally. My hypothesis is that more centralization – a higher value of the variable – should be associated with a larger share for labor. This variable shows little varation so it won't be included in the regressions, but in a more descriptive discussion in section III. A classical measure of worker militancy is strike frequency, measured as number of strikes per a certain number of employees or as the share of employees involved in a strike in a given year. Edvinsson has data for the share of employees involved in work stoppage – strike or lockout – during a year. The conflict frequency – assumed to be made up mainly of strikes – can be seen as an indicator of working class activism and strength and thus hypothesized to increase labor's share (cf. Kristal, 2010).

Welfare state generosity is a central variable in power resource theory. A more generous welfare state is redistributive (Lindert, 1984) and benefits workers. Because it directly affects wage bargaining, the welfare state variable I would prefer is unemployment insurance generosity. However, we only have data for this in Sweden since 1930, and then only for every fifth year (Korpi and Palme, 2003). Therefore it will

not be included in the regressions in section III, but instead discussed in a more qualitative way. Another often used variable is public social expenditure as share of GDP (cf. Kwon and Pontusson, 2010; Stockhammer, 2012). However, this is typically only available since 1980. A similar variable that I do have data for since 1850 – thanks to Edvinsson – is public consumption as percentage of GDP. It is admittedly an imperfect measure of welfare state size and generosity, but available for a long period, and can be used as an indicator of welfare state generosity. Yet another political power resources variable is left government: left parties represent low-income workers and so left government should have a positive effect on labor's share (cf. Kwon and Pontusson, 2010). Scheve and Stasavage (2009) provide a dummy variable of left executive for Sweden since 1920, coded 1 for years when a left politician (in practice a Social Democrat) leads the government, and 0 when a non-left politician does so. Like the wage bargaining centralization variable from Scheve and Stasavage this too shows little variation so is not included in the regressions, but discussed separately.

Unemployment and trade openness

Unemployment is assumed to weaken workers' bargaining power, has a negative effect on wage development (Blanchflower and Oswald, 2005) and thus has a negative effect on labor's share (Glyn, 1997). Unfortunately there are no unemployment data for Sweden going further back than 1911, and the series that goes back to 1911 (and ends in 1957) measures unemployment only among union members, which slightly overstates the unemployment level (Molinder, 2012). I still use it as it's the longest series, and connect it to OECD's more reliable unemployment series for the years 1960-2000.

Another measure of the labour reserve available to capital is trade openness, typically measured as imports+exports as share of GDP or just imports's share. I use imports' share, which is another variable from Edvinsson and available from 1850. Increased trade – implicitly from low-wage countries – is expected to weaken workers' bargaining power in rich countries such as Sweden (Alderson and Nielsen, 2002).

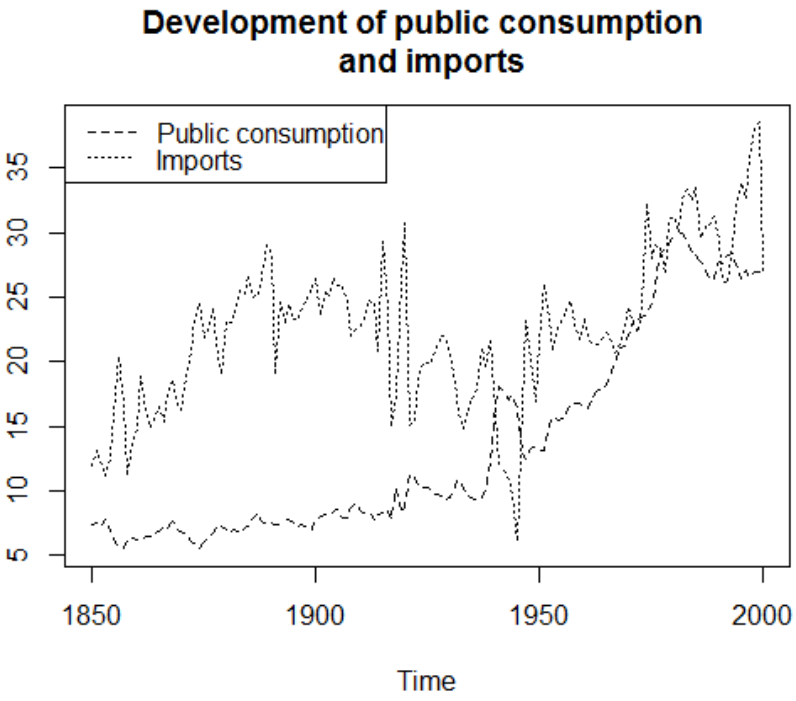
III. Econometric analysis

This section contains the empirical analysis of the paper, using the data and variables presented in the previous section. Since time series econometrics is a tricky business with many possible serious mistakes to be made, it is important to start with a discussion of model specification, so that the results will be robust and not spurious. After finding the right specification for my data, which is shown to be first differences or an ARIMA (0,1,0), I present and interpret the results. After this I discuss little

changing variables that can not be included in the regression models, and investigate structural breaks.

Model specification

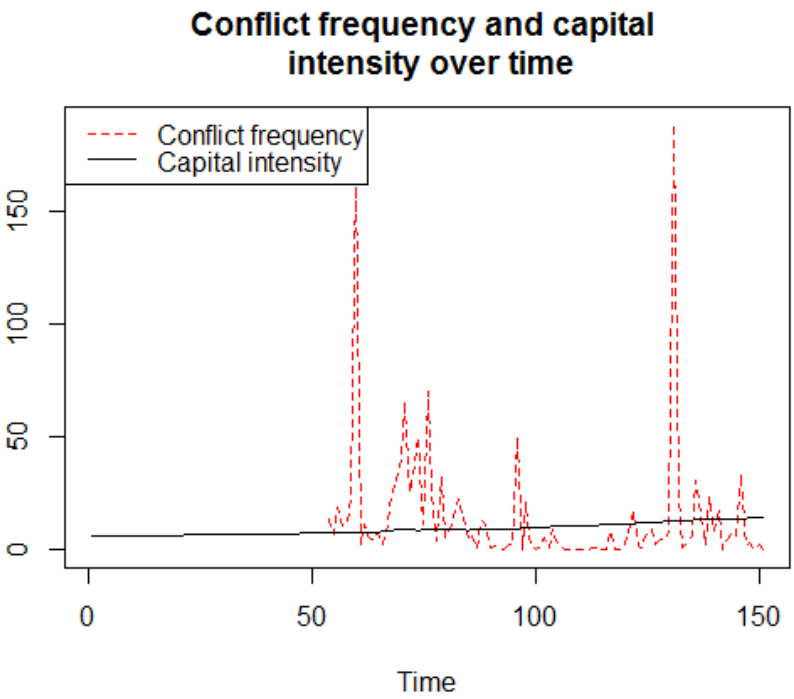
From diagram 1 above, the reader may suspect that the dependent variable labor's share is non-stationary. This suspicion is confirmed by an augmented Dickey-Fuller test[3] (Pfaff, 2009: 60). Some of the central independent variables are trended and non-stationary as well, as can be guessed by eyeball econometrics looking at the diagram below with the development of public consumption and imports, both as shares of GDP, 1850-2000.



The next question is then: is labor's share cointegrated with the independent variables? Nonstationary variables can have a common trend and then "move together" with a long-run equilibrium relationship. If this is true, an error correction model that can estimate both the long-run relationship and causes of short-run divergences from this relationship. I use the Engle-Granger two-step method to test for cointegration (Pfaff, 2009: 76). This means that I run a regression with labor's share as the dependent variable and my preferred independent variables – GDP growth, inflation, public consumption and imports. I extract the residuals from the estimated model and run an

[3] Calculated by the command adf.test in R. Result: Dickey-Fuller = -2.6816, Lag order = 5, p-value = 0.2924, with the null hypothesis being non-stationarity. The Phillips-Perron test (in R: pp.test) also shows that the variable is nonstationary.

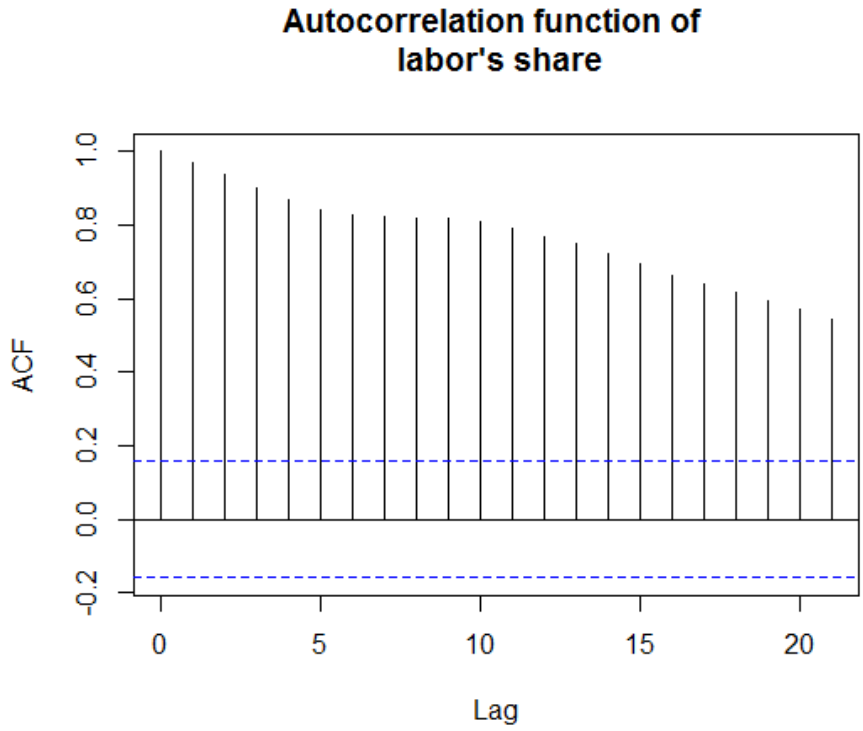
augmented Dickey-Fuller test on them. If they are found to be stationary, then the variables are cointegrated, since the "distance" between the variables does not trend over time. However, the ADF test shows that the variables aren't cointegrated[4].



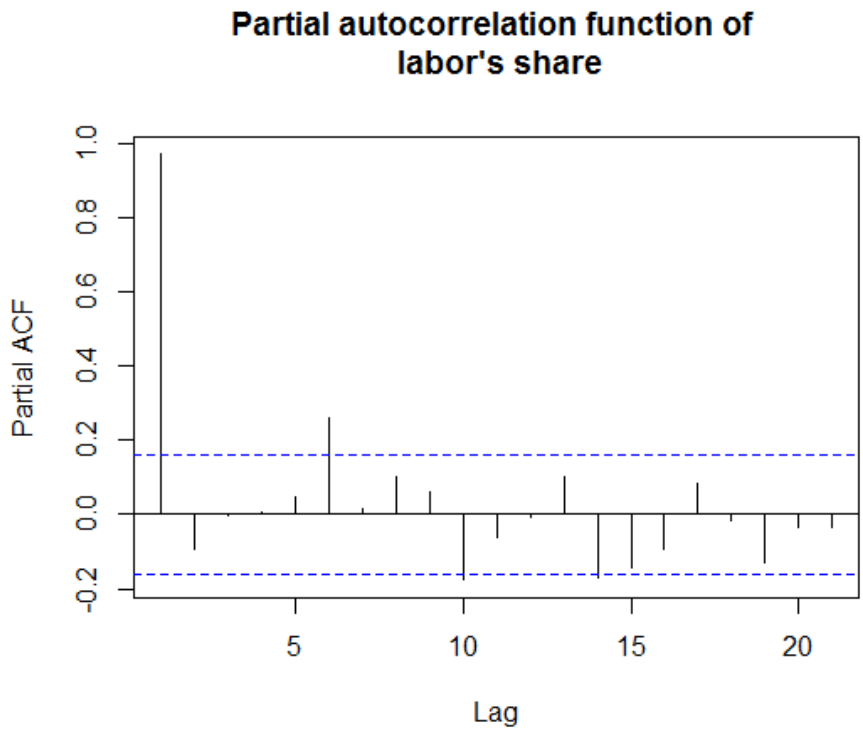
Recently, methodologists (Keele and De Boef, 2004) have argued that error correction models can and should be used also with data that isn't cointegrated. However, this is for stationary data. With my non-stationary data, I go forward by testing for the order of integration. I difference the labor's share series and run an ADF test on it. The test shows[5] that the differenced series is stationary, hence it is difference-stationary or $I(1)$ (Pfaff, 2009: 54). Appropriate model specifications are then ARIMA (p, 1, q) or simply a first differences specification.

How persistent is the series? I use autocorrelation function and the partial autocorrelation function to investigate the patterns. The ACF below shows that the series is very highly persistent – even after 20 years the ACF is significant. It is a long memory process.

[4] The problem with the Engle-Granger procedure is that it only allows for one cointegrating vector. A more flexible alternative is the Johansen procedure (Pfaff, 2009: 86).
[5] Dickey-Fuller = -6.5732, Lag order = 5, p-value = smaller than printed value (0.01).



The PACF shows a very different pattern: shocks do not have lasting effects.



Only one of the PACF:s is significant, and among twenty lags just by coincidence one lag should be significant at the 5% level. Therefore I interpret this PACF as that there is no moving average (MA) process going on in the labor's share series.

First differences results

The simplest model to use on this nonstationary series is a first differences model; as I have shown the series is $I(1)$ so it's sufficicent to difference it once to make it stationary. I estimate four different first differences models, with different sets of independent variables. The first FD model is a "structural model" and only includes two macroeconomic independent variables: GDP growth and inflation. GDP growth is expected to have a negative effect on labor's share because of sticky wages, and the same goes for inflation. This model covers all the years 1851-2000. The second model is "structural plus", with GDP growth, inflation, imports as share of GDP, and public consumption as share of GDP. All these variables come from Edvinsson and cover all the years 1850-2000. The form for this model is:

$$\Delta labor'share = \beta 1\, \Delta gdp\ growth + \beta 2\, \Delta inflation + \beta 3\, \Delta\ imports + \beta 4\, \Delta public\ consumption + \alpha\ intercept$$

The third model is a "political model", where the share of 1000 workers involved in strikes or lockouts during the year is included along with the previous mentioned variables. Since there is only work conflict data from 1903 on, this model only uses the time period 1904-2000. The fourth is another version of a political model but with unemployment and the four variables (+ intercept) from the quoted structural plus model above. As mentioned unemployment data is only available from 1911 and here N drops to 84. It is important to notice that this quite different time period 1912-1957 and 1960-2000 changes the content of the model compared to the structural models that contain the entire second half of the 19th century. The results are shown in table 3 below.

Table 3. First differences models, estimated with OLS				
	Structural model	Structural model plus	Political model 1: work conflicts	Political model 2: unemployment
GDP growth	0.02 (0.03)	-0.01 (0.02)	0.00 (0.03)	0.02 (0.04)
Inflation	-0.05 ** (0.02)	-0.05 ** (0.02)	-0.05 * (0.03)	-0.06 * (0.03)
Imports as share of GDP		-0.08 * (0.05)	-0.13 ** (0.06)	-0.13 ** (0.06)
Public consumption as share of GDP		0.44 ** (0.18)	0.36 * (0.19)	0.40 * (0.21)
Workers in conflict			-0.00 (0.00)	
Unemployment				-0.03 (0.08)
Intercept	0.04 (0.13)	-0.00 (0.13)	0.06 (0.16)	0.03 (0.18)
Adj R^2	0.02	0.10	0.15	0.16
N	149 (1851-2000)	149 (1851-2000)	95 (1905-2000)	84
*** = significant at 99% level, ** = significant at 95 % level, * = significant at 90 % level				

GDP growth does not have a significant effect in any of the specifications, contrary to specifications. Changes in inflation on the other hand consistently has a significant and negative effect, consistent with a "money illusion" interpretation where surprise inflation erodes real wages. Interpreting this is problematic though, as an argument could be made for reverse causation (Rudd and Whelan, 2005). Imports as a share of GDP constistently has a negative and significant effect

However, the dependent variable in the models above is labor's share in the entire private sector. The changes in this variable could be driven by structural changes – industrialization and decreasing importance of agriculture in the early part of the sample, and de-industrialization and increasing importance of the service sector in the late part, after 1970 or so[6]. Edvinsson's dataset provides labor's share data for separate sectors too, so as a robustness check I re-run the models above with labor's share for the manufacturing and crafts's sector as the dependent variable. These results are shown in table 4 below.

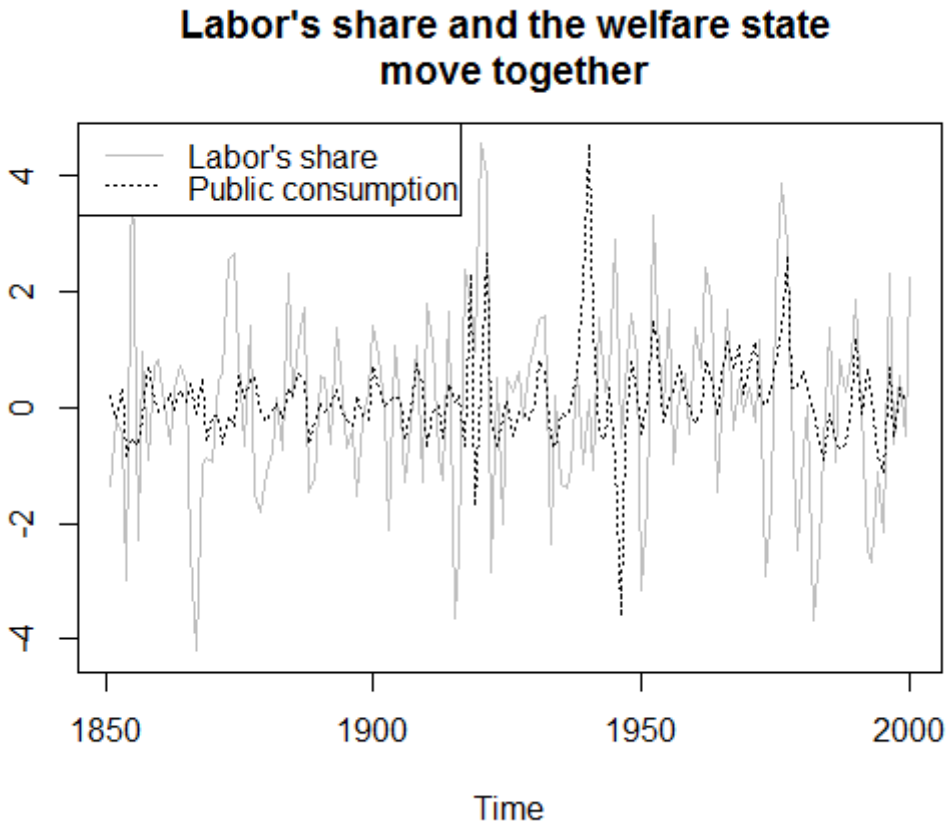
[6] As another robustness check controlling for structural change, I have re-run the models from table 3 with capital intensity, measured as net capital stock per employed (employees and self-employed), included as an independent variable. The main results hold up but public consumption loses its significance – it still has a strongly positive coefficient – in the two political models.

Table 4. Robustness check: manufacturing and crafts' sector labor's share as dependent variable. First differences models, estimated with OLS				
	Structural model	Structural model plus	Political model 1: work conflicts	Political model 2: unemployment
GDP growth	0.07 * (0.04)	0.02 (0.04)	0.08 (0.07)	0.15 * (0.08)
Inflation	-0.07 * (0.04)	-0.07 * (0.04)	-0.08 * (0.05)	-0.13 ** (0.05)
Imports as share of GDP		-0.14 * (0.07)	-0.13 (0.10)	-0.18 * (0.11)
Public consumption as share of GDP		0.92 *** (0.28)	1.02 *** (0.34)	1.22 *** (0.37)
Workers in conflict			-0.00 (0.00)	
Unemployment				-0.27 * (0.14)
Intercept	0.12 (0.21)	0.02 (0.20)	-0.18 (0.29)	-0.22 (0.32)
Adj R^2	0.03	0.16	0.19	0.22
N	149 (1851-2000)	149 (1851-2000)	95 (1905-2000)	84
*** = significant at 99% level, ** = significant at 95 % level, * = significant at 90 % level				

Broadly, the results are similar to the ones with the entire private sector's labor share[7]. Inflation has a negative effect and imports does as well; public consumption has a positive effect and workers in conflict doesn't have an effect at all. The differences in significance are that GDP growth becomes positive and significant in two of the models, and unemployment negative and significant. It is interesting that unemployment levels here has the expected negative effect on labor's share. Why is it significant here but not for labor's share in the private sector overall? Unemployment in the agricultural sector was very low, and the trade union sources giving data for unemployment in 1911-1957 probably disproportionally reports figures for urban workers (Molinder, 2012: 22). For urban workers, especially manufacturing workers, the "industrial reserve army" effect of unemployment might have a stronger on wage development and hence on labor's share. The coefficients for public consumption become insanely strong, around 1, and obviously this is in part a spurious correlation. This however is something I accept: given the data restrictions, I am aware of and allow that the public consumtion variable picks up effects of other non-included variables. What I can say from these

[7] Yet another robustness check is running the models with Vikström's (2002) measure of labor's share in the manufacturing sector as the dependent variable. The results here are slightly different. Public consumption still has a positive and significant effect in all specifications, but inflation loses its significance in two specifications and GDP growth has a positive and significant effect in all four variations. More substantively, the imports variable loses its significance.

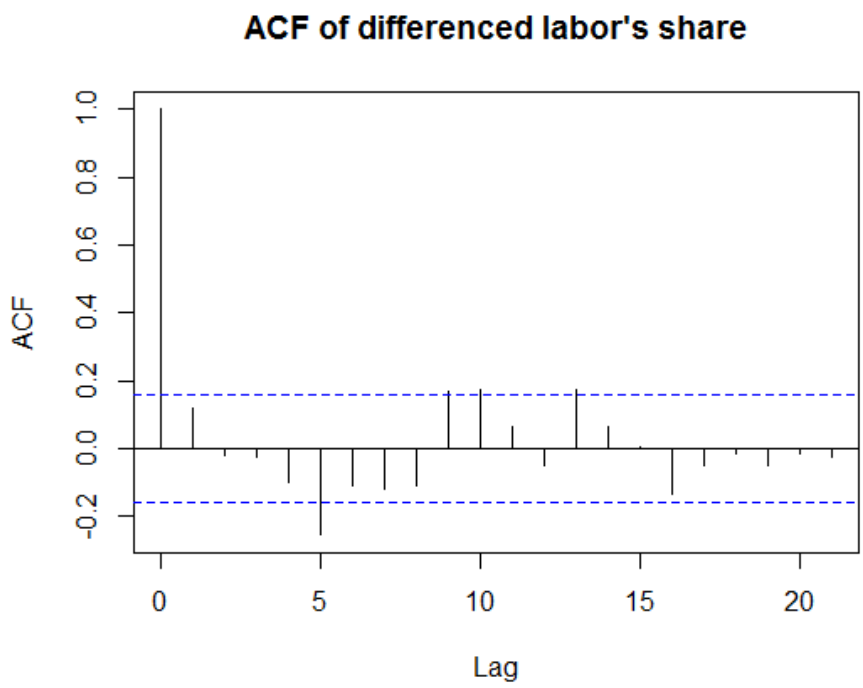
results is that labor's share in Sweden 1850-2000 moves together with – is correlated with – public consumption as share of GDP; they increase at the same time and decrease at the same time. However, this is not to say that more public consumption in itself causes a higher labor's share. But what is it in the data that drives the strong correlation that shines through in the regressions? The diagram below shows the differenced series for labor's share (in the entire private sector) and public consumption 1850-2000.

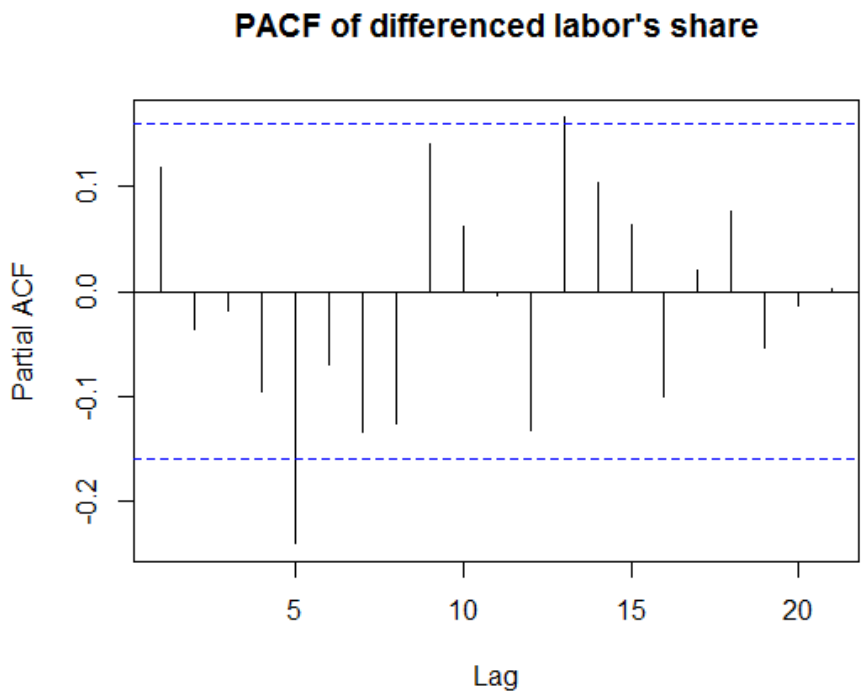


There are some interesting episodes here. One is the early 1920s when, as mentioned in section I, labor's share increased very rapidly. In this diagram we see that public consumption also increased quickly in those years. Another episode of large increases in public consumption is World War II, when labor's share also increased. The largest continous epoch of increasing public consumption is the 1950s and 1960s, when as we have seen also labor's share increased. In the 1990s, after the recession of 1991-93, both variables decrease until the last years of the decade. We should also note that increased public consumption implies increased taxation, and that increased taxation tends to have an equalizing effect (cf. Piketty, 2003; Atkinson et al., 2011). As Waldenström (2009: 21) notes: "the twentieth century experience, including a rapid growth of government, educational reforms and the introduction of progressive taxation, uniformly equalized societies".

Alternative specifications: ARIMA

So far, I have only used a first differences specification. Are the results robust to other specifications? I have shown that the variables are non-stationary, so specifications in levels are not useful, and they are not cointegrated so I can't use an error correction model. What other specification is useful for my nonstationary, non-cointegrated series? The dependent variable is as I have shown *I*(1) so an ARIMA (p,1,q) model is the right choice (cf. Shumway and Stoffer, 2006: 142). Which p:s – lags of autocorrelation, meaning lasting effects of the variables' past values – and q:s – lags in the errors, meaning lasting effects of previous shocks – should I choose? Again, it's worth inspecting the autocorrelation function and partial autocorrelation function, this time of the once differenced series (ibid: 144). These are shown below.





In the ACF plot we see that the differenced series is ridden of the strong autocorrelation that the original series had. Given that getting rid of the trend is the point of differencing, this is not surprising. In the PACF plot we see that there is more of an MA process going on. However, the first lag is not significant and neither are lags 2-4. Only lags 5 and 13 are significant. As stated before, this kind of pattern may well be random when it comes to 95 % confidence level significance testing. My conclusion is that the ARIMA specification that would be needed is simply an ARIMA (0, 1, 0) – simply a first differences model! I test this also by running the ARIMA (0,1,0) – the same model as the one in table 3 above but estimated with maximum likelihood instead of by OLS – and comparing the model fit to common ARIMA specifications (0,1,1) and (1,1,0). The more complex specifications do not improve the model fit, as measured by Akaike's Information Criterion[8], so I conclude that an ARIMA (0,1,0) is indeed the right specification. The results in terms of coefficients and standard errors are almost exactly the same – they differ at the third decimal – with the maximum likelihood-estimated ARIMA as with my FD specification, so I don't show them here.

Variables with little variation

In regression analysis, the included variables must vary rather much in the sample – over time, in this case – to be able to be modelled in a meaningful way (cf. Shalev, 2007). However, among two variables that I am interested in, left government and wage

[8] AIC for the (0,1,0) model is 556; for the (0,1,1) is 555 and for the (1,1,0) also 555.

bargaining, there is little change. In the 80 years with democratic government in my sample, Sweden had a Social Democratic government almost all of the time; the exceptions are 1922-31, 1976-81 and 1991-93. Similarly, wage bargaining system only changes a couple of times, notably with the centralization in 1953 and decentralization in 1982. The relevant variable left government does not change enough to be included in a first differences model, and the same goes for wage bargaining centralization. Therefore I test their possible effects – or at least associations – with changes in labor's share by looking at the average change in labor's share in years with and without left government, and in years with decentralized, sector-level or centralized wage bargaining systems.

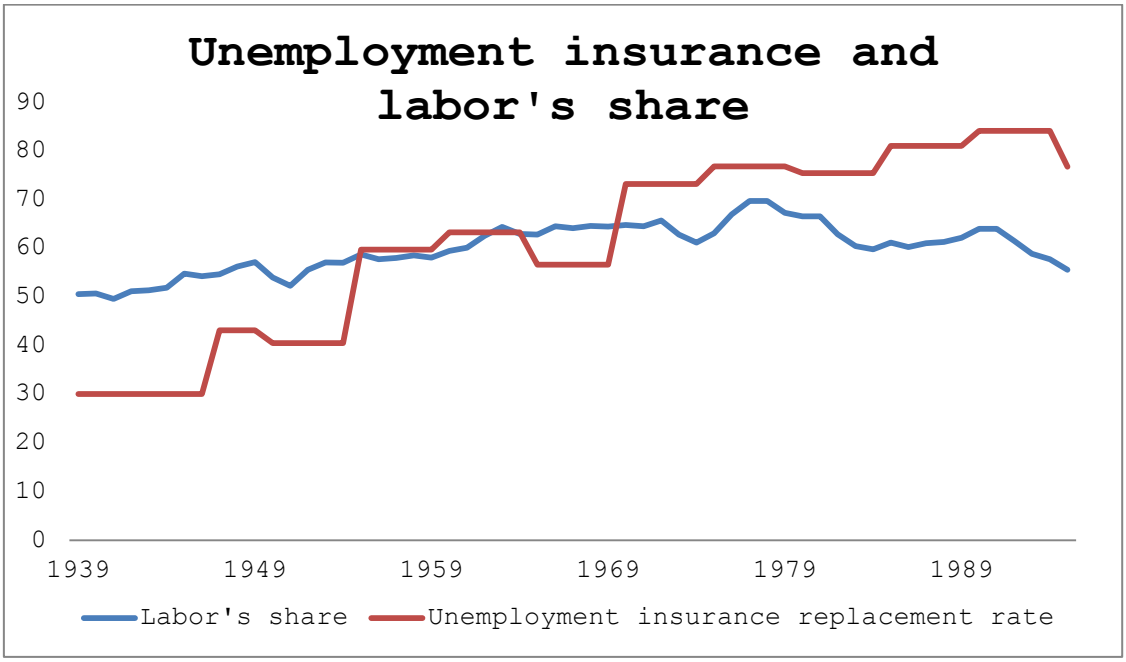
Regarding wage bargaining centralization, there is a common assumption in the literature that centralization in the post-war period served wage moderation which increased economic growth in European countries (Eichengreen and Iversen, 1999; Eichengreen and Vazquez, 1999). However, more recent research, not the least on Sweden, casts doubt on this. Bergström (2003, 38) points out that the trade union economists Rehn and Meidner, architects of the "Rehn-Meidner model" in the early 1950s explicitly rejected the analysis in the British Beveridge report that trade unions should "take responsibility" and heed to wage moderation. Rehn and Meidner claimed that this kind of "responsibility" was impossible for a trade union since wage increases for the members in fact is a raison d'etre for the union. Instead they proposed that the government should stand for the restrictive anti-inflationary element of policy, through tough fiscal policy. Alexopoulos and Cohen (2003) also show that the Swedish form of centralized wage bargaining – Rehn-Meidner – didn't imply wage moderation, and the economic historian Svanlund (2010) further shows that the wage share actually increased during centralization in the 1950s and 60s.

Table 5. Average yearly change in labor's share			
Government (N=81)		Wage bargaining (N=101)	
Left government	0.08	Decentralized	0.49
Not left government	-0.10	Sector level	-0.05
		Centralized	0.29

Scheve and Stasavage's (2009) data for wage bargaining centralization covers the period 1900-2000, and in table 5 we see that labor's share in the 20th century increased most in years with decentralized wage bargaining and the least in the years with sector level bargaining dominating. The left government variable covers 81 years. Only twelve years are coded as having a non-left government, in the other 69 years the prime minister was a Social Democrat. We see that labor's share overall decreased in the years with centre-right government, but this is obviously not enough data to draw strong conclusions. The wage bargaining variable is more interesting, considering that sector

level bargaining (which covers the years 1905-1952 and 1983-2000 in the sample) has the most negative labor share development. This goes well with Traxler and Brandl's (2010) argument that in countries with path bargaining – one sector, typically manufacturing exporters, setting the standard for other sectors' wage increases – sector level bargaining leads to decreased wage pressure.

Another power resources variable where there is not enough data for regression analysis, as mentioned in section II, is unemployment insurance generosity. The diagram below plots this variable together with labor's share, for the years 1939-1995.



It is certainly true that they both increase together from the mid-1940s to the mid-1970s, but then labor's share falls while unemployment insurance generosity continues to increase.

Structural changes?

Another way of looking at effects of one-off events is to look for structural breaks in the time series[9]. 1850-2000 is a long period with some serious changes going in in Swedish economy and society, so it's not unreasonable to expect some parameter instability in the regression models estimated above. A classical method for testing for structural breaks in time series analysis is the Chow test. The Chow test is an F test on a difference between the regression using the sample up to a given time point T, and a regression using the sample starting at T+1. The weakness of this test is that the break

[9] A recent application of structural breaks analysis to long-run income distribution is Roine and Waldenström, 2011.

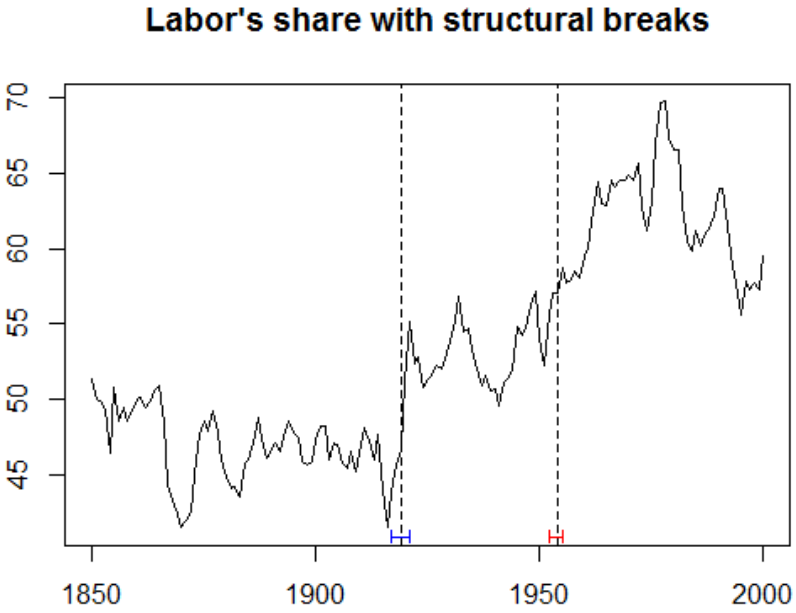
point that we want to test must be known beforehand. In the case of the Swedish labor share, possible suggestions are universal suffrage in 1922, the Saltsjöbaden agreement in 1938, or the centralization of wage bargaining in 1953. However, there is also a more flexible way of running these F-tests: performing it for every successive year in the sample, and then look at which years are significant as break points[10]. Zeileis et al (2002, 2005) have implemented the flexible structural breaks method developed by Bai and Perron (1998, 2003) in the statistical package R. I have used this to flexibly look for structural breaks in Sweden's labor share 1850-2000. In table 6 below we see the structural breaks found given five different assignments: with the existence of one to five breaks specified beforehand. The specifications' model fit can be compared using the Bayesian Information Criterion (BIC), and as a reference a specification without any structural breaks and just one trend is also included. For the best fitting model according to the BIC, the 95 percent confidence interval is included for the break points.

Table 6. Searching for structural breaks. 95 % confidence interval dates for best fitting model within parantheses

No. of breaks	0	1	2	3	4	5
Breaks found					1871	1871
					1896	1896
			1919 (1917, 1921)	1919		1919
		1951	1954 (1952,1955)	1956	1956	1956
				1978	1978	1978
BIC	1026	833	755	759	763	773

We see that the BIC falls significantly when going from no structural breaks to one break and also from one to two breaks. The best fitting specification is then the one with two structural breaks, one in 1919 and one in 1954. The series is plotted below with the two estimated breaks and their – quite narrow – confidence intervals.

[10] This function is implemented in the package strucchange in R (described in Zeileis et al 2002 and Zeileis et al 2005). The plots are from objects created with the command Fstats. The data in the tables are calculated with with the command breakpoints from the R package strucchange.

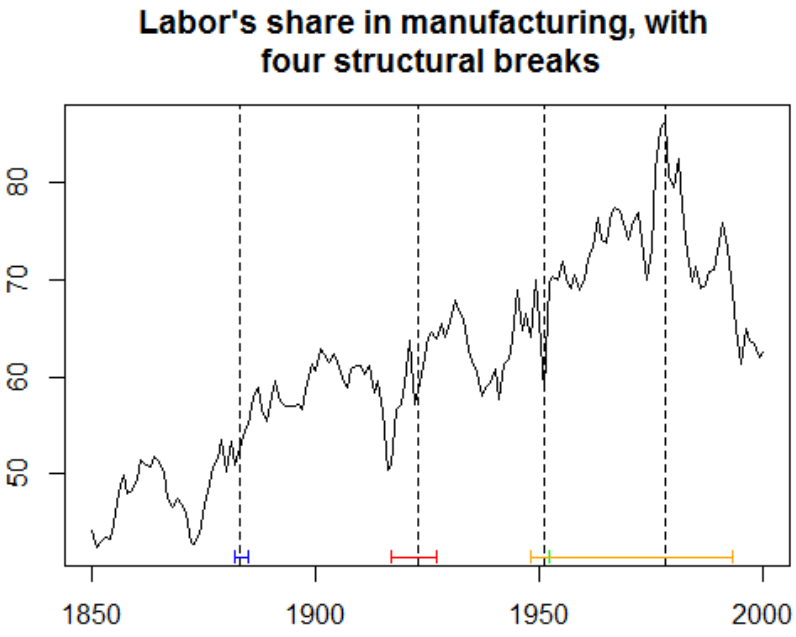


It is surprising that the best fitting specification does not find a structural break in the late 1970s, like the specifications with three to five breaks do. Perhaps this is due to that there is not that much data after the late 1970s in my sample so the uncertainty is larger for the 1970s break than for the 1919 and 1954 breaks. The break in 1919 – with a 95% confidence interval it occurred at least between 1917 and 1921 – is highly interesting as it coincides with the labor movement offensive discussed in section I, and the important reforms the eight hour working day and universal suffrage. It makes sense that the distribution of national income between labor and capital followed a different route after these momentous events than before (cf. Korpi, 1981).

Next I look for structural breaks in labor's share in the manufacturing sector; this sector might to some degree follow different macroeconomic patterns than labor's share in the entire economy. The results are shown in table 7.

Table 7. Searching for structural breaks: only manufacturing sector. 95 % confidence interval dates for best fitting model within parantheses						
No. of breaks	0	1	2	3	4	5
Breaks found			1883	1883	1883 (1882,1885)	1876
						1898
		1924		1923	1923 (1917, 1927)	1924
			1951	1951	1951 (1949, 1952)	1951
					1978 (1958, 1993)	1978
BIC	1134	1005	906	895	894	902

Here, the right number of structural breaks is higher: three or four. Both these specifications have the years 1883, 1923 and 1951 in common, and the latter specification adds year 1978, as we have noted the peak of labor's share in Sweden and the country's worst ever profit crisis (Edvinsson, 2010). However, the confidence interval for the 1978 break is quite wide, as we can see in the figure below.



The wide confidence interval for the late 70s break is probably just due to that this break comes close to the end of the sample: had the time series been a bit longer, I suspect that the 70s break would have been confirmed with greater confidence. The country going

out of the deep crisis of 1978 into a series of devaluations with the aim of increasing capital's share, is indeed an epochal event. In this series just like in the overall private sector series I find a break in the early 1920s, again confirming the importance of that epoch. The break in the first half of the 1950s, probably related to the centralization of wage bargaining, is present also here.

We can contrast the patterns found here with Roine and Waldenström's (2011: 841) finding of three structural breaks in the top percentile's share of national income in Sweden 1950-2000. Roine and Waldenström found one break in 1968, at which inequality started to rapidly decrease, one break in 1981 at which the top percentile's share found a plateau, and one in 1991 at which the top share once again started increasing rapidly. Their 1981 break corresponds to my 1978 break, while the 1968 and 1991 breaks are completely missing from the labor share series.

IV. Conclusions

This paper has inspected the development of labor's share of total incomes in the private sector in Sweden in 1850-2000. I have shown that labor's share in this period falls when imports increase, but increases when public expenditure increases. The first finding indicates a Heckscher-Ohlin type process where increased competition among workers decreases workers' share of the pie. The second finding indicates that the welfare state – a central power resource for the working class according to social theorists such as Esping-Andersen and Korpi – indeed increases workers' share of the pie. Or, possibly, these variables are themselves moved by a third omitted variable that represents working class power. On the other hand, unemployment has only found to have a negative effect on labor's share in manufacturing and not overall. And conflict frequency – strikes and lockouts – in the 20th century does not have any significant correlation with labor's share at all. The 1950s and 1960s with little conflict were better times for labor's share than the high-conflict 1920s and 1930s. Labor's share increased more in years with Social Democratic government than in years with centre-right government, but there are not enough years with the latter to draw any confident conclusions from this. The structural breaks investigation has shown that the distribution of national income between labor and capital changed its way once around 1920 with the advent of democracy and the eight hour working day, and once in the early 1950s with centralized wage bargaining and the classical Swedish model. The manufacturing series also shows a break in 1978: after the working class offensive of the 1970s, the left wave was broken and turned into the new climate of neoliberal globalization (Glyn, 2007). Overall, in this paper the perspective on functional income distribution where only structural factors such as Kondriatev cycles are seen to have an effect on the distribution, has been found wanting: social and political factors do matter.

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