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ABSTRACT

Capital Shares and Income inequality: Evidence from the Long Run*

This paper investigates the relationship between the capital share in national income and personal income inequality over the long run. Using a new historical cross-country database on capital shares in 19 countries and data from the World Wealth and Income Database, we find strong long-run links between the aggregate role of capital in the economy and the size distribution of income. Over time, this dependence varies; it was strong both before the Second World War and in the early interwar era, but has grown to its highest levels in the period since 1980. The correlation is particularly strong in Anglo-Saxon and Nordic countries, in the very top of the distribution and when we only consider top capital incomes. Replacing top income shares with a broader measure of inequality (Gini coefficient), the positive relationship re-mains but becomes somewhat weaker.

JEL Classification: D30, N30

Keywords: wage share, top incomes, inequality, wealth, economic history

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1. Introduction

Much research over the past twenty years or so has been devoted to long-run economic inequality. In the most recent years, this research has been integrated with a focus on the distribution of income between capital and labor: the classical "functional income distribution". There are quite different predictions in the current literature as to the connection between functional income distribution and inequality in the personal income distribution. For Piketty (2014, ch. 7), the connection appears to be clear: capital income is more unequally distributed than labor income, so a transfer from labor income to capital income will increase inequality. Discussing Piketty's work, Lindert (2014) takes issue with this argument, arguing that in fact functional income distribution is an antiquated measure, related to the research of nineteenth century political economists and the production function research of the 1950s but irrelevant for understanding inequality.[1] Milanovic (2015) on the other hand argues that if capital ownership is equally distributed then egalitarians do not have to worry about increasing capital shares: it is only if capital ownership and income are highly unequally distributed that the capital share matters for income inequality.

What is striking with much of the past discussion is that it pays little attention to the possibility that the link between factor shares and inequality is not stable but instead contingent on a multitude of factors that can change along with the rest of society.[2] In fact, most of the theoretical models that suggest a positive relationship also indicate that the link tends to depend on the production technology, the structure of personal incomes or different institutional contexts, all of which have clear tendencies to change over time.[3] It is therefore natural to bring the time dimension into the analysis using long-run data.

The importance of time for understanding the link between factor shares and inequality is also indicated by recent empirical research, which has shown tremendous historical variation in the balance between labor and capital. At the aggregate level, capital-income ratios fluctuate grossly over time, and many Western countries are today experiencing levels not witnessed in over a century (Piketty and Zucman, 2014, 2015; Piketty, 2014, Waldenström, 2015). Looking at the micro level, studies of trends in the income distribution show that cap-

[1] Of course, Lindert is not alone in expressing skepticism towards a link between factor shares and income inequality, famous previous examples being Milton Friedman (1962, ch. 14) and Harold Lydall (1968, p 7).
[2] An exception is Roine and Waldenström (2008), who examined the role of the capital shares for the evolution of top income shares in Sweden over the twentieth century.
[3] See, e.g., Glyn (2009) or Atkinson (2009) for overviews.

ital income became less important as an income source over the twentieth century but is now becoming more important again in several countries, possibly contributing to the observed current secular increase in inequality (Atkinson and Piketty, 2007, 201 0; Brandolini and Smeeding, 2009; Roine and Waldenström, 2015).

In this paper, we make two main contributions. First, we present a new database with historical wage and capital shares for 19 countries going back to at least the 1930s and in some cases to the mid-nineteenth century. The series are compiled and homogenized from previous studies, e.g., Piketty's (2014) presentation of long-run data for France, Britain, Germany and the United States, but also from different countries' official historical national accounts.[4] We thereby extend the time span by several decades in comparison with existing cross-national datasets covering the period since the 1960s or 1970s.[5]

Second, we analyze the relationship between factor shares and income inequality by matching our new capital shares database with previously available long-run series of top income shares in the World Wealth and Income Database (WID). The specific focus on the long-run association between capital shares and inequality appears to be a specific contribution to this literature where, as we have seen, there is disagreement on what this relationship should be: positive, nil, or depending on context. In addition to estimating the long-run associations, our historical panel of countries also allows us to quantitatively assess whether the link has changed over time and if it differs between institutionally different groups of countries such as Anglo-Saxon, Continental European and Nordic countries. Furthermore, using evidence on capital and wage income components in the top income data, we investigate if the alleged link depends on the structure of personal incomes in the income elite; i.e., if the link grows stronger when we focus exclusively on the capital returns reaped by the top income earners. Finally, we consider if the link varies with different measures of inequality, both by examining the impact across different groups within the top income decile and when replacing top shares altogether by Gini coefficients that are available for a smaller group of countries.

Our study contributes to several previous areas of literature. One is the previous empirical literature on the link between factor shares and income inequality, which, due to the lack of

[4] See Appendix for an extensive presentation of the sources and methods used.
[5] The AMECO database from the European Commission provides wage share data back to 1960, and OECD's Structural Analysis Database has sectorial wage share data back to 1970. Karabarbounis and Neiman (2014a) provide a very encompassing dataset, including many developing countries, for the post-1970 period.

historical evidence, has been primarily focused on shorter-run correlations in either single countries or at the cross-country level. For example, Ryan (1996) studies postwar Britain and Adler and Smith (2013) study Germany in the 2000s, both finding a positive link between aggregate capital shares and the dispersion of household incomes. Looking across countries, Daudey and García-Peñalosa (2007) and Checchi and García-Peñalosa (2010) examine OECD countries between the 1970s and 1990s and find a robust positive relationship between capital shares and income inequality and attribute some of this to institutional differences in the labor market. Additionally, in micro-based analyses of cross-country data from the late twentieth century, a link has been found between the importance of capital income and overall inequality, e.g., Fräßdorf et al. (2011), Schenkler and Schmid (2013) and García-Peñalosa and Orgiazzi (2013). Our study also relates to the rather large research in economics and related subjects devoted to understanding the determinants of changes in factor shares; see, e.g., the seminal contribution by Blanchard (1997) and subsequent analyses of Bassanini and Manfredi (2012) and Karabarbounis and Neiman (2014a). Furthermore, we connect to the literature on long-run income inequality trends where much focus has been on the broader association between distribution and economic development and the role of institutional and structural changes. This literature has grown substantially in recent years largely due to the new data on top incomes (for overviews, see Atkinson and Piketty, 2007, 2010; Roine and Waldenström, 2015). Finally, as already hinted, our investigation has direct relevance for the investigation of capital-income ratios and their distributional consequences in the income and wealth distributions (Piketty and Zucman, 2014, 2015; Piketty, 2014; Waldenström, 2015). Factor shares represent one of the possible channels through which this process works, and we hope that our new database can spur further efforts to investigate this subject.

The remainder of the paper is structured as follows. Section 2 presents the analytical framework, outlining both the theoretical links and the empirical methodology used. Section 3 describes our new capital share database, the top income data and the other variables used. Section 4 contains our investigation, and Section 5 concludes.

2. Analytical framework

The capital share is defined as the share of national income distributed as capital income: interest, profits, dividends, and realized capital gains. Together with the wage share – the

share of employees in national income – it adds up to national income, if the incomes of the self-employed are allocated between capital share and wage share (see below).

An accounting-based association between the functional and personal income distributions has been analyzed many times in the previous literature. The results typically depend on the model choice or institutional context and it is fair to say that consensus over the shape of this link – and if it exists at all – has not been reached, as noted in our introduction (see Piketty, 2014; Lindert, 2014; Milanovic, 2015). Atkinson and Bourguignon (2000) and Atkinson (2009) approached the issue by using a standard two-factor production function, where total income is made up of either labor income or capital income, and capital's share of value added is α with wage share being $1-\alpha$.[6] Expressing income inequality in terms of the coefficient of variation, V_y, it is possible to decompose it into the equivalent inequalities of wages V_w and capital income V_k, the factor shares and the correlation between capital and labor income as ρ (recognizing that some income earners earn income from both labor and capital) as follows:

$$V_y^2 = (1-\alpha)V_w^2 + \alpha V_k^2 + 2(1-\alpha)\alpha\rho V_w V_k \ . \qquad (1)$$

In equation (1), it is obvious that there is a link between the capital share α and income inequality, but it is also clear that it is not linear. When, in fact, does a rising capital share spur inequality to rise? Atkinson (2009) shows that this happens when $\alpha > (1-\lambda\rho)/(1+\lambda^2-2\lambda\rho)$ for $\lambda = V_k/V_w$. If we assume that capital income is twice as dispersed as labor income, then a rising capital share raises inequality if the capital share is at least one half. In the pure class society with only workers and capitalists, perhaps close to what many Western countries experienced in the nineteenth century, the correlation may look different depending on how we think about income patterns. With a perfect trade-off between wages and capital income, then the correlation is perfectly negative ($\rho = -1$) and inequality increases with a rising capital share if $\alpha > 1/(1+\lambda)$. But if workers had income from capital while capitalists were pure rentiers and did not work at all, then the incomes would be uncorrelated ($\rho = 0$) and inequality increases when the rising capital share rises if $\alpha > 1/(1+\lambda^2)$, which is one fifth if capital income is twice as dispersed as wage income. In addition, if the correla-

[6] A third income category is income of the self-employed. This category is typically allocated to labor and capital income according to some presumption about how it is generated. How this is generally done in our data is discussed in the data section. In the Appendix we discuss how we do this precisely for each country.

tion is positive, an even lower capital share is required to make inequality rise under an increasing capital share. Overall, the main message of this model is that for plausible levels of the capital share and characterizations of personal incomes, one can expect the capital share and income inequality to be positively correlated.

In other models, extensions are offered that add realism but typically also complexity to the picture. For example, some models emphasize that workers are heterogeneous, particularly in terms of skill, and this can have implications for how increasing capital intensity affects inequality. Atkinson (2009) and Atkinson and Bourguignon (2015) discuss such models. In some of these models, productive capital is a true substitute for unskilled labor and a complement to skilled laborers, e.g., in the case where robots and computers crowd out low-skilled workers but make the high-skilled more productive. Although the ultimate distributional pass-through depends on many things, including factor flows, people's income composition and various institutional constraints (e.g., wage-setting institutions), it would not be far-fetched to expect that increasing capital shares should eventually imply rising inequality of personal incomes.

Our empirical assessment of the link between capital shares and top income shares is based on panel regressions. Assuming a log-linear relationship between the two variables of interest, we estimate the following regression equation:

$$\ln IncomeIneq_{it} = \beta_0 + \beta_1 \ln CapitalShare_{it} + \boldsymbol{X'_{it}}\delta + \mu_i + t + \varepsilon_{it} \ , \qquad (2)$$

where $IncomeIneq_{it}$ denotes income inequality, measured here as top income shares or Gini coefficients, in country i and time period t (either year or 5-year average), $CapitalShare_{it}$ is the capital share (i.e., α) in value added, $\boldsymbol{X_{it}}$ is a matrix of controls, μ_i are country fixed effects and ε_{it} is a random error term. The parameter of interest, $\hat{\beta}_1$, is the elasticity of income inequality with respect to the capital share, which means that it can interpreted as the percentage increase in inequality associated with a one-percent increase in the capital share.[7]

Our baseline estimations do not include any of the confounders in $\boldsymbol{X}$ because we are primari-

[7] We use log transformations since this facilitates direct comparisons between the different measures of income inequality and also because our capital shares vary in level across countries.

ly interested in the correlation between capital shares and income inequality. Including fixed country-effects is essential because most of the time series are consistent within countries, whereas the comparability across countries is lower (see the discussion in the data section). We include the additional controls in a separate analysis of how the relationship looks when being contingent on factors that determine either or both of distributional outcomes. GDP per capita accounts for the overall level of development whereas the employment share of agriculture reflects how far countries have come in the structural change and industrial transition. Stock market capitalization as share of GDP is a measure of the importance of private capital in the economy. Central government spending, finally, is aimed to capture the factors related to the growth of the public sector, which includes institutional development as well as political processes such as redistribution. The time period used in our main analysis is 5-year averages of the data rather than yearly values because the latter can be quite noisy. In the appendix we present all of the results using annual observations, and generally there is little difference between the two cases.

3. Data

We present a new database on long-run capital shares covering 19 countries, adding 15 to the ones presented in the Piketty and Zucman (2014) dataset. Along with data for Britain, the United States, France and Germany back to at least 1870 from Piketty (2014), we add, based on previous research and available sources on historical national accounts, the Netherlands since 1807, Denmark, Finland and Sweden since the mid-nineteenth century, Mexico since 1900, Japan since 1906, Argentina since 1911 and Austria since 1913, Australia, Belgium, Brazil, Canada, New Zealand and Norway since the 1920s, and Ireland since 1938.

There are several measurement issues when estimating factor shares (for a thorough discussion of these and discussion of the sources, see the Data Appendix). The capital share series are calculated using historical national accounts from the income side, including estimates for the income sums of employees and self-employed as well as various forms of capital incomes (corporate profits, rent, interest, dividends). Given the geographical and chronological scope of the database, naturally there are some differences in the measures, of which two are particularly important. One is how to account for the incomes of the self-employed, a

group whose incomes can be considered both as wages and as capital income.[8] Factor share estimates are typically adjusted for incomes of the self-employed by allocating some of it to the labor income sum and the rest to the capital income sum. This is often done by imputing a wage for each self-employed person equivalent to the average wage in the sector or economy, and counting the rest of self-employed incomes as capital income (see Appendix for details). We strive to use only adjusted series but so far the series for Australia, Austria, the Netherlands and Norway are unadjusted.

When examining the historical evidence, it is clear that the share of self-employed among the economically active has varied significantly over time (not least during industrialization, when the number of farmers decreases) and, of course, also between countries. Accounting for this variation empirically is key when calculating the capital share, and making assuming about fixed amounts of self-employed can lead to sever biases. Specifically, when the number of self-employed decreases and the corporate sector's share of the economy grows, the increase in the capital share will be overestimated (Kravis, 1959).

A second main measurement issue is whether to use gross or net estimates of capital shares, i.e., if capital income should be related to gross value added or net value added. This issue was brought up in the discussion about Piketty's *Capital in the 21st Century* (see for example Bridgman 2014 and Karabarbounis and Neiman 2014c). We have used both gross and net series: our series used so far for Britain, France, Germany and Japan are net and the others are gross. For now, to make the simple correction for cross-national variation in measurements, we use the fixed effects estimator to account for this issue to the extent that cross-country differences do not change over time. However, in the development of the paper, we will make more detailed estimates using only net shares for all countries as well as using only gross shares. For seven of the countries, we have both measures; for Japan, only net estimates; and for ten countries, only gross estimates.

Because we lack top income data for Austria, Belgium, Brazil and Mexico, these countries are not included in the section that looks at the correlation between capital shares and top income shares.

[8] The importance of this correction has recently been highlighted by Elsby et al. (2013).

Evidence on the historical evolution of the personal income distribution is generally scarce for most countries. We use one of the few consistent sources available, namely the recent World Top Incomes Database containing historical top income shares spanning most of the twentieth century for almost two dozen countries that are now industrialized (Atkinson and Piketty, 2007, 2010). A major advantage of using top income shares is that they are based on a homogenous source material, annual tax returns, and on methods that are specifically aimed at creating long-run comparability of the data series for each country. In fact, the series are primarily consistent within countries, whereas the cross-country comparability is more problematic. However, because we are primarily interested in within-country trends and include country fixed effects in our empirical analyses, we do not think that this problem poses serious problems to us.

A particular problem with these inequality data is that they exclude some of the incomes that are included in the national accounts series from which the capital share is calculated. In particular, companies' retained earnings do not show up on personal tax returns, and neither do reinvested dividends show up in mutual funds. This means that capital income is underestimated at the individual level. Furthermore, taxable labor earnings are incomplete in the income tax records because they typically do not include social security contributions. It is difficult to determine the impact of this measurement problem on our investigation, but most likely the problem has grown worse over time. At this point, we lack fully macro-consistent distributional income statistics, not least over the long run, and therefore can do little more than use the most appropriate data at our disposal.[9]

The top income data also contain information about the composition of incomes for some countries. Specifically, wages and salaries, rental income and dividends and self-employment income are reported for different groups in the top of the income distribution.[10] Self-employment income is for the most part included in labor earnings, but there are some deviations between countries in this regard. To the extent that these country-differences are constant over time, however, they do not affect our findings because they will be accounted

[9] Ideally, we would have coherent fiscal income totals to compare with the national income totals, but they are to our knowledge not currently available. Ongoing work on macro-consistent income distribution data thus seem a highly relevant way forward (see, e.g., Emmanuel Saez and Gabriel Zucman's project Distributional National Accounts, http://ineteconomics.org/grants-research-programs/grants/distributional-national-account).

[10] The countries for which compositional evidence exists are Australia, Canada, France, Japan, The Netherlands, Sweden and the U.S. An additional income source, realized capital gains, is sometimes also reported. We do not include them in this investigation.

for by our country fixed effects.

Measuring income inequality typically concerns using population-wide measures and not top income shares. In fact, top income shares, strictly speaking, do not meet all requirements that an inequality measure should meet; most importantly, Pigou-Dalton transfers from richer to poorer persons always lead to inequality reductions.[11] Roine and Waldenström (2015) discuss this issue and refer to evidence on a fairly large empirical congruence between top income shares and broader measures of income inequality. To address this issue, we have collected data on Gini coefficients available for some countries in the Atkinson and Morelli (2012) "Chartbook of economic inequality" database. Unfortunately, these historical Gini coefficients are worse in terms of country-time coverage and their comparability is therefore much lower than in the case of the top income shares. We combine different Gini coefficients from different datasets to create series that are as long as possible, and the final series are therefore uncertain and should be interpreted with some degree of caution.

Finally, we also include other variables in some of the analyses, aimed at accounting for relevant macroeconomic influences at play: GDP per capita, the employment share in agriculture, stock market capitalization as share of GDP and government spending (central government spending as share of GDP). The sources for these variables are Roine, Vlachos and Waldenström (2009) and Roine and Waldenström (2015) and the references therein.

4. The long-run evolution of capital shares

With our data set, we can investigate in a descriptive way whether capital shares and wage shares move in the same way in different countries. Figure 1 shows the time series patterns of the capital shares for the 15 countries included in the main analysis.

[Figure 1 about here]

There are several interesting hypotheses to test. Firstly, Robert Allen (2009) for Britain has shown that the capital share increases from 1800 to 1860, when wages do not grow in line with productivity. Around 1870, this is turned around, and instead the wage share increases

[11] Whenever such transfers are made within the top or the bottom groups, top shares will not change. However, if they are made from the top to the bottom groups, top shares will decrease along with overall inequality.

up to 1900. Allen calls this "Engels' Pause", referring to Friedrich Engels description of the misery of English workers in *The Condition of the Working Class in England*, which was published in 1845. According to Allen, around 1870, workers' living standards started increasing at a pace with general living standards, in contrast to the period that Engels described. Piketty (2014, p. 225) also follows Allen and finds a similar pattern in France. Looking at wages-to-GDP ratios, a very rough measure of the wage share, Bengtsson (2015b) finds similar patterns in Denmark, Norway and Sweden. However, inspecting the capital shares in our new database, we cannot find any strong support for such supposed regularity. Sweden experienced a fall in the capital share from 1870 to 1900, but we do not observe such trends in Denmark, Finland or Germany.

A second expectation from the existing literature is a very steep decrease in the capital share at the end of the First World War. Williamson (2015) has called the years around 1920 the beginning of the "Great Egalitarian Leveling", and of course in Piketty's (2014) analysis of long-run inequality, the two World Wars play an important role for income distribution. The results are mostly as expected. In Austria, we find that the capital share is much lower in 1924 than in 1913; in Denmark, we find a high point in 1916 and low point in 1921; in Finland, we find a high capital share in 1915–1917 and a rapid decrease in 1917–1923; in Sweden, the capital share is historically high in 1916 and drops quickly to a low in 1921; and in the UK, the capital share is historically low in 1920. The only country where data show something different is France, where the capital share decreases heavily already between 1913 and 1915, in contrast to most other countries, where profits were very high in the early war years (Arnold, 2014).

A third hypothesis comes from the economic history literature on the interwar period. Eichengreen (1994), Broadberry and Ritschl (1995) and others have contrasted the messy interwar period with the successful postwar period, which showed great economic performance in the industrialized countries, and have claimed that differences in labor relations is an important explanation. According to them, trade unions extracted as high wage increases as they could get during the interwar period, which dampened profits and investments, contributing to the bad economic performance of the 1920s and 1930s. We might then ask whether capital shares decreased during the 1920s. According to our data, this does not seem to be the general case. In Germany, just as in Broadberry and Ritschl's (1995) analysis, we do find a decrease in the capital share from the mid-1920s to 1930, and we find a similar

pattern in Canada. However, in Belgium, Denmark and the Netherlands, we find very low capital shares in 1920–1921, after the radical war time events discussed above, and an increasing trend during the rest of the 1920s. In France, as mentioned, the war time low of the capital share occurred already in 1914–1915, and then it increased until the late 1920s. This gives some cause to reconsider the established economic history on the interwar period from Eichengreen (1994). The difference in results here and in previous literature might be due to differences in the types of data used, and then triangulation should be possible. However, it might also be the case that Eichengreen's (1994, p. 884) perspective of "intense wage pressure" during the interwar period needs to be qualified and that this alleged wage pressure did not play such an important role for the weak economic performance of this period.

In Eichengreen's (1994, 2007) analysis, the postwar period is the counterpoint, when wage moderation helped cause the strong investment and GDP growth performance of the period. This analysis has been criticized by Hatton and Boyer (2005) and Bengtsson (2015a), who instead find high wage pressure during the 1950s and 1960s. Of course, Eichengreen's view of the postwar period is also contrary to Piketty's (2014), where it is instead stressed that capital incomes and capital valuation were suppressed by regulation and that for this reason capital shares reached their historical lows at exactly this point. Our data mostly support the Piketty view as opposed to the Eichengreen view. In Austria, Denmark (but only after the mid-1960s), France, Germany, Ireland, the Netherlands (from the mid-50s), Sweden, UK and the US, we find growing wage shares and decreasing capital shares in the 1950s and 1960s. In Canada, Finland and Norway (decreases only in the 1970s), conversely, capital shares are more constant. Most of the countries experience historically low capital shares in the 1970s or early 1980s; the exceptions are Austria, Finland and Ireland. We know from an ample literature (i.e., Karabarbounis and Neiman 2014) that capital shares have increased since 1980 across the majority of rich and developing countries, so we do not have to discuss that fact here, but it is striking that in Ireland this increasing trend for the capital share begins already in the early 1970s.

Altogether, our new dataset lends a great deal of support to Piketty's account of the long-run trends in the capital-labor income distribution. Most countries experienced rapid decreases in the capital share during the end of the First World War (although we may dispute why; see Acemoglu and Robinson, 2015), generally decreasing capital shares in the 1950s–1970s and then the opposite after 1980. The results for the late nineteenth century are more surprising

given the previous findings of Allen, 2009, Piketty, 2014, and Bengtsson 2015. We see a need for more research that makes careful distinctions between different factors and measurement issues that may influence the results.

5. Estimation results

We now move on to the issue of the link between functional and personal income distribution. Is the capital share a good predictor of inequality or not?

Table 1 shows the raw correlations between capital share and top income shares for all of the periods available as well as sub-divided into the pre-1945 period, the 1950–1980 period, and the post-1980 period. Overall, functional and personal income distributions are strongly and positively correlated. In 11 of the 15 countries in table 2, the correlation of the capital share and the top 1 percent income share for the whole period is 0.55 or higher. In the US, the correlation is only 0.25 (but higher for sub-periods), and in Finland only 0.18.[12] The two major outliers are Argentina and Canada, where the correlations are actually negative, at –0.31 and –0.45. Inspecting these two countries more closely does not reveal any obvious explanations. In Argentina, the negative correlation appears to be mainly driven by postwar observations, whereas the opposite is true for Canada, where the correlation is actually robustly positive in the post-1980 period.

[Table 1 about here]

Table 2 shows our baseline results: panel regressions of equation (2) using annual and averaged observations. Looking at the full set of countries and the full period, there is a positive and statistically significant correlation between the logged top percentile income shares and logged capital shares at 0.86 and 1.36 in the annual and averaged cases. Over time, the table shows that the correlation is lower in the pre-WWII and early postwar eras, whereas it is higher in the period since 1980.

The table also shows the conditional correlations for three country groups: Anglo-Saxon (Australia, New Zealand, Ireland, the U.K., the U.S.), Continental European (France, Ger-

[12] It should be noted that in this case the capital share series is only for industry. With the capital share for the whole economy during the interval 1900–2010, the simple correlation with the top percentile share is 0.43.

many, the Netherlands) and the Nordic countries (Denmark, Finland, Norway, Sweden). The groups differ quite clearly, with correlations being strongest in the Nordic and Anglo-Saxon countries and smaller, and often insignificant, among Continental European countries. Additionally, over time, the country groups differ. In the early era, the Nordic countries exhibit the largest correlation, approximately 1.7, whereas the correlation is only approximately 0.2 in the Anglo-Saxon countries. Between 1950 and 1980, the correlation is the highest among Continental countries, whereas it picks up after 1980 in the Anglo-Saxon and Nordic countries.

[Table 2 about here]

5.1 The role of top income composition

Next, we address the question of whether the composition of top incomes into wages and capital income has an impact on the relationship with capital shares. The structure of top incomes has attracted much attention in the earlier literature. In fact, one of the main findings of Piketty (2001) and Piketty and Saez (2003) precisely concerned the changing role of capital income in the top incomes. Up until the World Wars, capital income dominated the top incomes, generating an income elite of "coupon-clippers". However, after the geopolitical shocks of the twentieth century, high-income earners have become increasingly dominated by well-paid employees, notably corporate executives or managers in the financial sector.[13] There are, however, notable deviations from this trend if one looks across the Western world. For example, Roine and Waldenström (2008, 2012) show that in the case of Sweden, capital income has remained a predominant income source for the top earners and has even become more dominant in the last decades. Figure 2 depicts the trend in the share of capital income of the top percentile (ranked according to total income). It clearly shows both differences and similarities across countries.

[Figure 2 about here]

Table 3, panels A and B, examines a subset of countries for which detailed information exists about the composition of top incomes and if the correlation with the capital share differs

[13] Having said this, recent studies of top earners in the U.S. and Norway using the copula function find an increasing association between wage and capital income in the top in both countries (Aaberge et al. 2013, Atkinson and Lakner, 2013).

when either only top capital incomes or only top wage incomes are included.[14] The findings indicate an overall much stronger correlation when top capital incomes are used than when top wage incomes or top total incomes are used, 2.29 vs. 0.14 and 1.04. The result appears to be driven by postwar experiences, with correlations for capital income being just as high in the early and late postwar periods. However, top wage incomes are strongly correlated with the capital share in the post-1980 period, with a correlation of almost unity. The low correlation of top capital incomes before WWII is surprising given the larger role of those incomes to top incomes in many countries, but possibly this is simply an artifact of the limited number of observations. When the analysis is divided into country groups (reported in the appendix tables A1–A2), we see that top capital incomes are the most correlated with capital shares in the Nordic and Anglo-Saxon countries. The correlation of top wage incomes in recent times emanates primarily from the Anglo-Saxon countries, something which could be interpreted in the light of the tremendous salary increases for top managers documented for the U.S. (see Murphy, 1999).

Realized capital gains are a specific type of capital income that is not always included in the traditional income distribution analysis because the gains typically only become visible upon the sale of an asset. For this reason, capital gains are treated differently in tax laws in certain countries and not always reported on income tax returns. This said, conventional income definitions include capital gains, realized and unrealized, and it is therefore interesting to see whether they matter for the correlation with the capital share. To gauge the impact of realized capital gains on the estimated relationship, panel C in Table 3 presents regressions based on top percentile income shares, including capital gains for a smaller sample of countries for which such data are available.[15] The standard errors are wider because of the relatively restricted number of observations, but if one only looks at the point estimates, they seem to suggest that the conditional correlation with capital shares increases by roughly fifty percent when realized capital gains are counted compared to the case when they are excluded.

[Table 3 about here]

[14] Note that incomes are still ranked according to total income, and we thus have the same individuals in the top group for each country-year observation. The treatment of self-employment (or business) income in top incomes differs somewhat across countries, but in most cases it is classified as capital income (see further Roine and Waldenström, 2015).

[15] The WID only reports data on income shares including capital gains for seven countries in our sample. These series are shown in appendix Figure A1.

5.2 Are the patterns similar within the income top?

A finding in the previous top income literature is that there is a heterogeneity within the income top. For example, both the level of incomes and their trends over time differ markedly between earners in the lower part of the top decile and earners in the top percentile, and even between earners within the top percentile. We therefore rerun the same panel regression analysis but replace the logged top percentile income share with the logged top 10–1 percent income share (i.e., income earners between the 90th and 99th income percentiles), the top 1–0.1 percentile share (i.e., earners between the 99th and 99.9th income percentiles) and the top 0.1 percentile. The results in Table 4 suggest that the correlation grows stronger the higher up in the income distribution one gets. The full period conditional correlation grows from 0.12 for the bottom of the top decile to 1.06 for the bottom of the top percentile and 2.24 for the top 0.1 percentile. In fact, when removing the top percentile from the top decile (panel A), the link between personal top income shares and the capital share is relatively small and often statistically insignificantly different from zero. By contrast, in the top 0.1 percentile, the correlations are typically above unity, suggesting a strong feed-back from aggregate capital to top income inequality. The country-group differences are roughly in line with the overall patterns, with the Anglo-Saxon and Nordic countries standing out as having relatively strong dependencies.

[Table 4 about here]

5.3 The influence of other determinants

A related issue is whether the observed correlation patterns between capital shares and income inequality, as measured by top income shares, holds up when accounting for other determinants of inequality. Roine, Vlachos and Waldenström (2009) examined how the evolution of top income shares reflected the influence of various economic determinants, and in Table 5 we analyze such factors influence the link between top income shares and the capital share. The estimated coefficient for the capital share is reduced from being about 1.3 in our baseline case with only country fixed effects, down to 0.62 when all covariates are included. This is not surprising because we would expect that several of the controls have an influence on both the top income shares and the capital share. For example, transformation from the agrarian to the industrial society could benefit both high-income earners and increase the capital share if we consider that it conveys a higher productivity of capital management. The same reasoning holds for the aggregate importance of stock market capitalization. Notably,

the size of government as measured as central government spending over GDP has little influence on the relationship.[16]

[Table 6 about here]

5.4 Using broader measures of income inequality

A final analysis is to examine the role of measuring income inequality for the correlation. Table 6 shows the fixed-effects regression results when we replace the top income share with Gini coefficients, using the (more problematic) sample of long-run Gini series collected from Atkinson and Morelli (2014). The full period correlation using the Gini is a statistically significant 0.3 (panel A), a level that is much lower than what we found previously for the top percentile income share and also what we find in panel B using the exact same sample as in the Gini regressions. Notably, the Gini regression coefficient is roughly in line with what was found when using the bottom of the top decile in Table 5, i.e., when analyzing the top groups that consist mainly of high-wage earners with little wealth. Its link in panel C is though smaller, which seems to reflect the restricted sample size. Table D confirms, however, that the sample size restriction does not remove the strong link between top capital incomes and the capital share.

Looking across time periods, the Gini results are similar to those found for the top income shares, being lower in the early era and increasing towards the present. The low pre-WWII coefficients could be a result of sample composition because the top income coefficient in Table 6 is notably lower than the same results found above using much larger sample sizes.

[Table 6 about here]

Overall, however, the results above yield support for Piketty's (2014) assertion that the capital–labor split is an important determinant of inequality and contradict Lindert's (2014, p. 5) argument that wage and capital shares are not "good predictors of inequality, and continue to be poorly correlated with it over time and space." On the contrary, capital shares are in fact strongly correlated with inequality over time.

[16] In the appendix (Tables A7–A9), we show that this pattern holds when switching to a similar regression when holding the sample size constant across regressions or when using annual observations.

6. Concluding remarks

With our newly compiled long-run dataset, we have shown that capital shares and income inequality are strongly correlated, even if this relationship varies by region as well as between different time periods. However, we need to develop the mechanisms through which exogenous shocks jointly determine the functional income distribution and the personal income distribution.[17] This concerns wealth inequality and the distribution of different types of assets and should also include the connection between financial markets, wages, and inequality (as in Greenwald et al. 2014 and Lettau et al. 2015). We intend to pursue these questions and extensions in future research.

[17] Several recent papers do this in different ways. García-Peñalosa and Orgiazzi (2013), Dafermos and Papatheodorou (2015) and Karanassou, and Sala (2012) all do it from more or less heterodox perspectives. Piketty (2014, ch. 7) sketches the fundamental relationships.

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Figure 1: Capital shares and top 1% income shares in 15 countries.

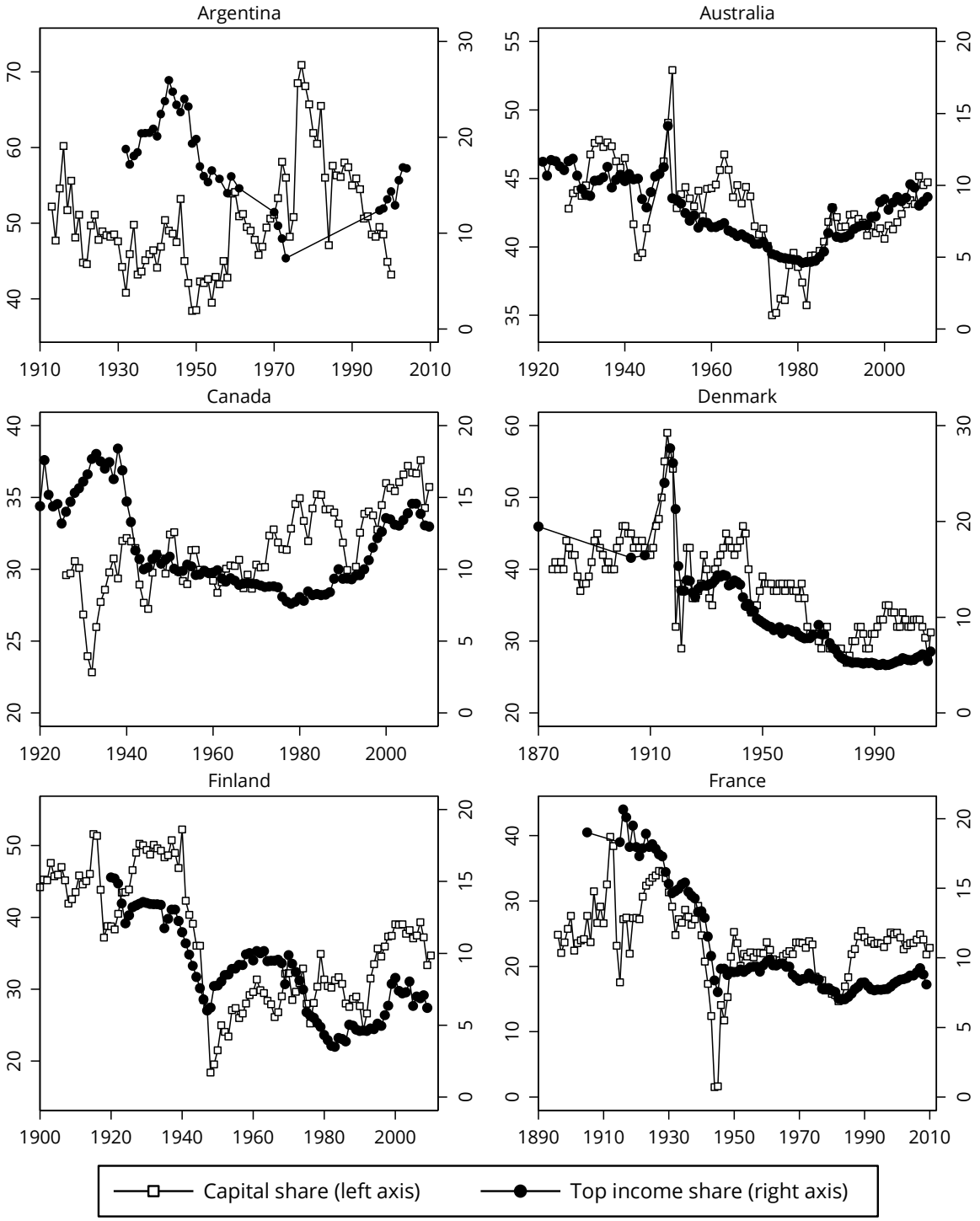
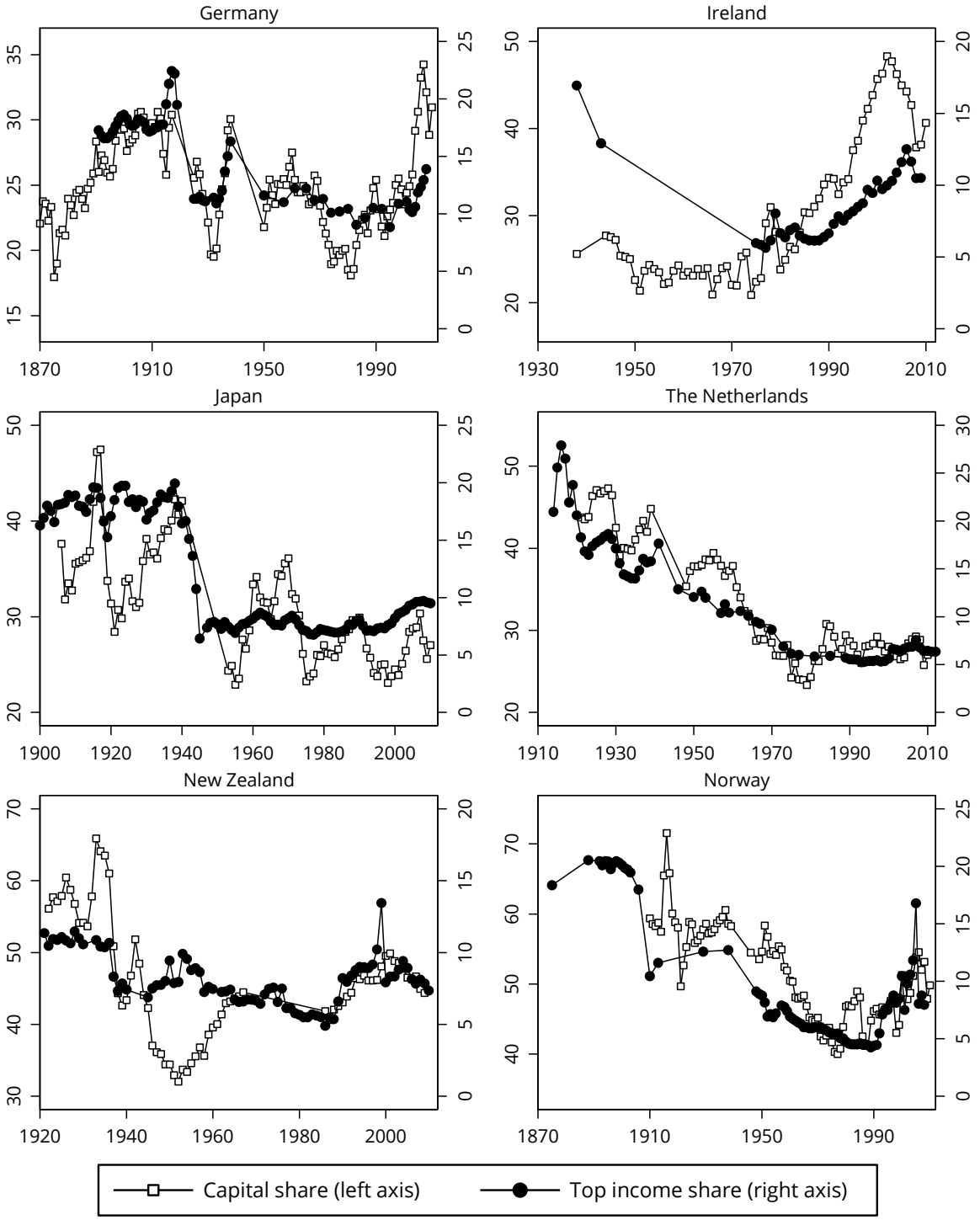
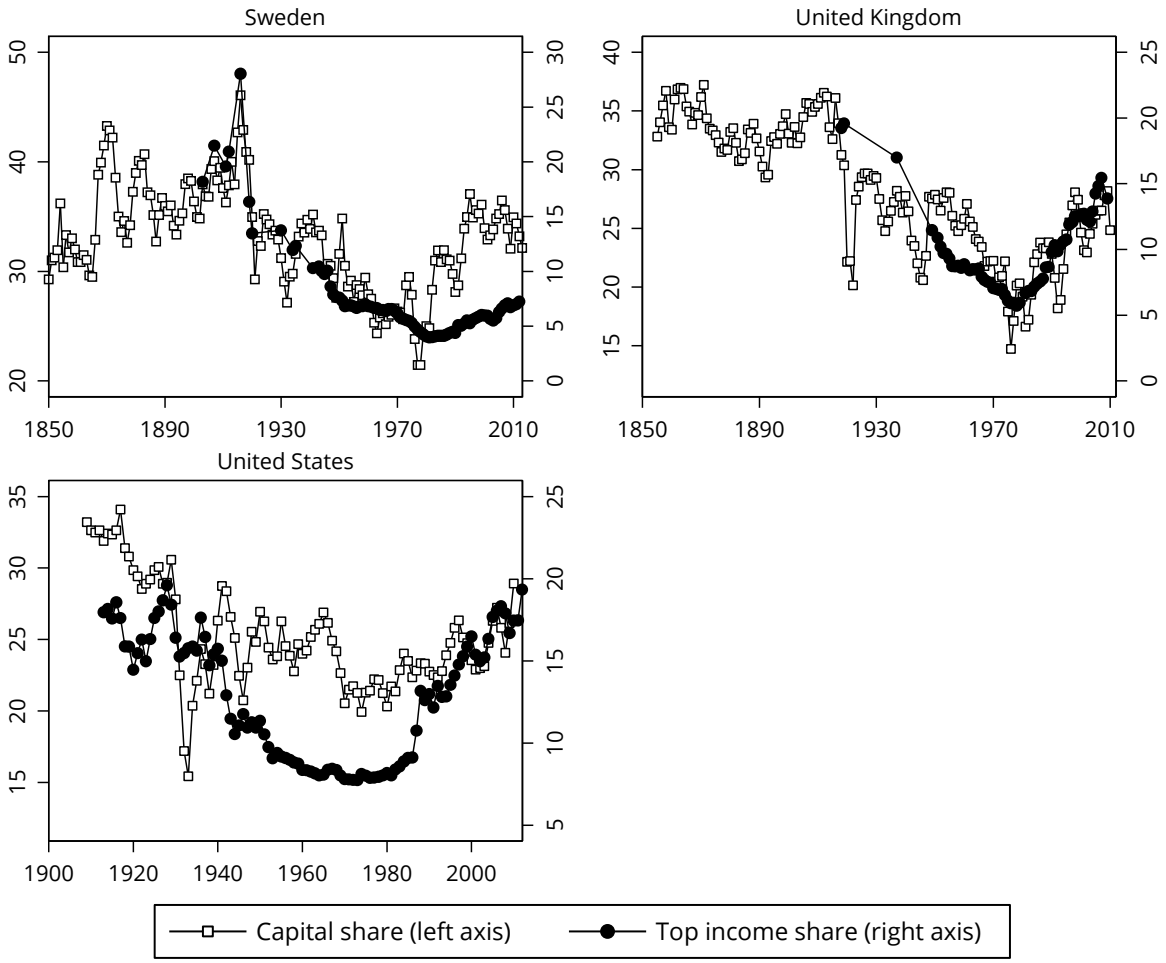


Figure 1 (cont'd): Capital shares and top 1% income shares: 15 countries.



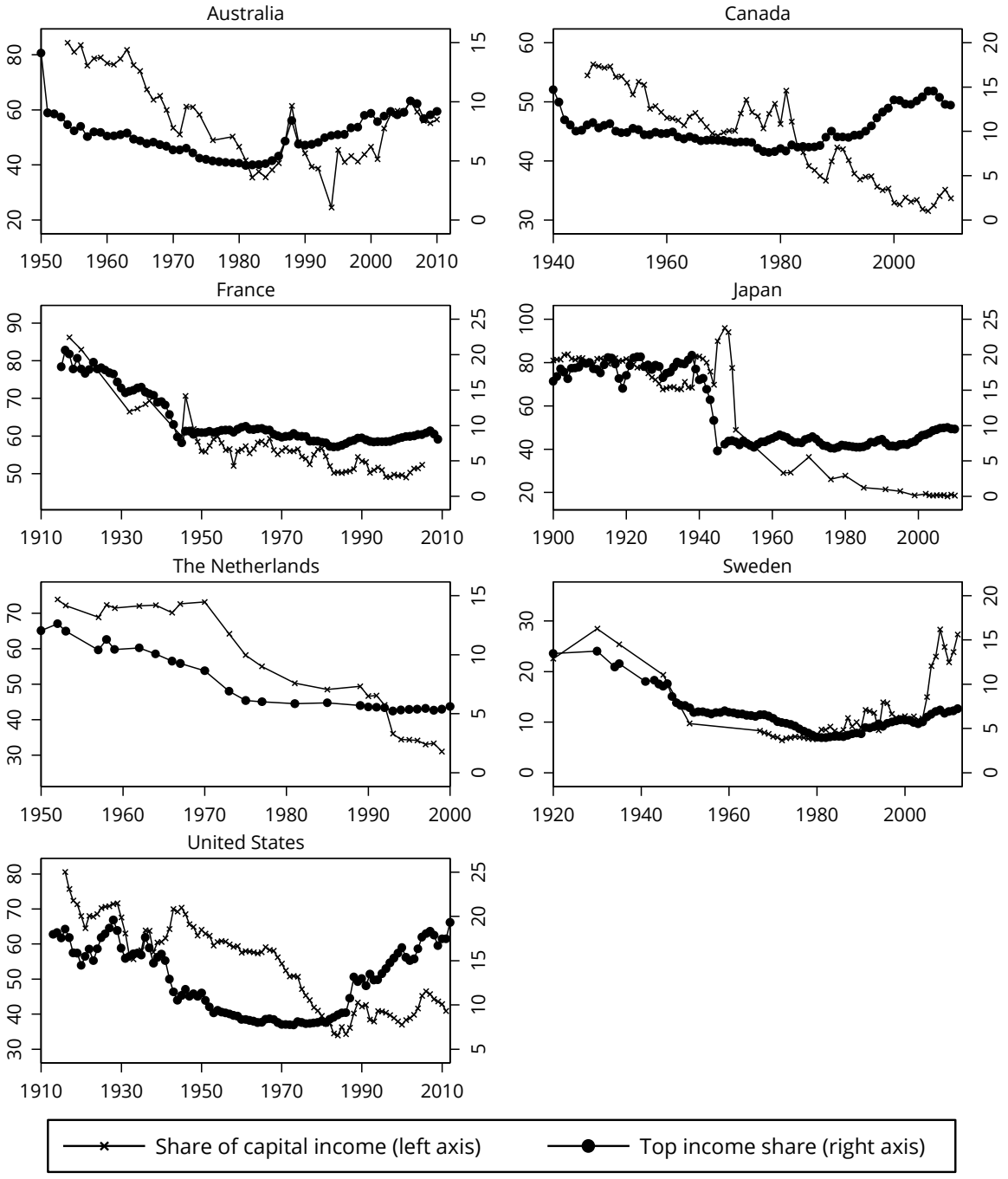
Note: "Capital share" denotes the aggregate share in national value added going to capital and "Top income share" denotes the top percentile's share of total income in the personal income distribution.

Figure 1 (cont'd): Capital shares and top 1% income shares: 15 countries.



Note: "Capital share" denotes the aggregate share in national value added going to capital and "Top income share" denotes the top percentile's share of total income in the personal income distribution.

Figure 2: Importance of capital income to top 1% incomes, 7 countries.



Note: "Share of capital income" denotes how large share of total income earned by the top percentile (ranked according to total income) that comes from capital income (interests and dividends). "Top income share" denotes the top percentile's share of total income in the whole population.

Table 1: Correlation of top incomes and capital shares by country.

	Time period	All years	Historical periods:		
			Pre-WW2	Postwar-1979	1980-present
Argentina	(1932–2000)	–0.384*	–0.200	–0.800**	–0.993**
		[35]	[7]	[13]	[4]
Australia	(1927–2008)	0.696***	–0.261	0.789***	0.787***
		[81]	[12]	[30]	[31]
Canada	(1926–2010)	–0.177	–0.422	–0.427*	0.561**
		[85]	[13]	[30]	[31]
Denmark	(1903–2010)	0.790***	0.647***	0.743***	–0.071
		[95]	[25]	[28]	[31]
Finland	(1920–2010)	0.539***	–0.569*	–0.104	0.781***
		[90]	[19]	[30]	[30]
France	(1905–2009)	0.395***	0.026	0.512**	0.693***
		[96]	[25]	[30]	[30]
Germany	(1891–2008)	0.666***	0.763***	0.736*	0.788***
		[62]	[39]	[8]	[15]
Ireland	(1900–2008)	0.625***		0.256	0.846***
		[36]		[5]	[30]
Japan	(1938–2009)	0.754***	0.119	0.796***	0.280
		[93]	[33]	[27]	[31]
Netherlands	(1906–2010)	0.952***	0.875***	0.939***	–0.001
		[57]	[18]	[14]	[24]
New Zealand	(1921–1999)	0.523***	0.742**	–0.787***	0.709***
		[63]	[15]	[17]	[24]
Norway	(1922–2009)	0.664***	–0.84	0.902***	0.581***
		[63]	[4]	[29]	[29]
Sweden	(1903–2012)	0.706***	0.909***	0.827***	0.877***
		[79]	[10]	[30]	[31]
U.K.	(1903–2010)	0.722***	0.927	0.905***	0.702***
		[60]	[3]	[28]	[28]
USA	(1918–2009)	0.469***	0.476*	0.575***	0.713***
		[98]	[26]	[30]	[31]

Note: Piecewise Pearson correlations. "Pre-WW2" denotes years before 1939, "Postwar-1979" years 1950–1979 and "1980–present" years since 1980. Number of observations in brackets. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table 2: Capital shares and top incomes: Basic estimation.

	Annual observations				5-year averages			
	Full period	Pre-WW2	Postwar-1979	1980-present	Full period	Pre-WW2	Postwar-1979	1980-present
All countries	0.880***	0.492**	0.576**	1.041***	1.331***	0.714**	0.719***	1.184***
	(0.284)	(0.203)	(0.196)	(0.169)	(0.245)	(0.292)	(0.218)	(0.209)
	[1,093]	[250]	[349]	[400]	[265]	[68]	[81]	[92]
- Anglo-Saxon	0.864**	0.214*	0.726	1.341***	0.889*	0.223*	0.815	1.530**
	(0.216)	(0.096)	(0.381)	(0.292)	(0.351)	(0.088)	(0.523)	(0.383)
	[423]	[70]	[140]	[175]	[96]	[19]	[29]	[38]
- Continental	0.541	0.697	0.795	0.372*	1.100	0.782	0.980*	0.392*
	(0.339)	(0.580)	(0.393)	(0.092)	(0.490)	(0.564)	(0.325)	(0.113)
	[215]	[82]	[52]	[69]	[59]	[18]	[18]	[19]
- Nordic	1.398**	0.900*	0.705*	1.256**	1.835**	1.483**	0.864**	1.518**
	(0.338)	(0.325)	(0.239)	(0.282)	(0.461)	(0.344)	(0.193)	(0.331)
	[327]	[58]	[117]	[121]	[79]	[22]	[24]	[26]

Note: Fixed-effect regression of logged top 1% income shares on logged capital shares. Observations are 5-year averages, number in brackets. Number of included countries: All countries (15), Anglo-Saxon (6), Continental European (3) and Nordic (4). Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table 3: The role of composition of top incomes.

	Full period	Pre-WW2	Postwar-1979	1980-present	Full period	Pre-WW2	Postwar-1979	1980-present
A) Capital vs. wage incomes	Top 1% capital incomes				Top 1% wage incomes			
Capital share	2.291**	0.125	1.456**	2.074*	0.142	–0.219	0.263	0.941**
	(0.883)	(0.435)	(0.449)	(0.913)	(0.283)	(0.475)	(0.350)	(0.286)
	[110]	[19]	[39]	[45]	[110]	[19]	[39]	[45]
B) Total vs. capital incomes	Top 1% total incomes (when top capital incomes are observed)				Top 1% capital incomes			
Capital share	1.035**	0.051	1.008***	1.217*	2.291**	0.125	1.456**	2.074*
	(0.382)	(0.135)	(0.264)	(0.583)	(0.883)	(0.435)	(0.449)	(0.913)
	[109]	[19]	[39]	[44]	[110]	[19]	[39]	[45]
C) Ex. vs. incl. capital gains	Top 1% incomes excl. capital gains (when top capital gains are observed)				Top 1% incomes incl. capital gains			
Capital share	1.555**	0.051	1.008***	1.291*	1.534*	0.127	1.476**	1.787
	(0.495)	(0.135)	(0.264)	(0.619)	(0.558)	(0.435)	(0.507)	(1.052)
	[77]	[19]	[39]	[45]	[78]	[19]	[39]	[45]

Note: Fixed-effect regressions of logged top income share on logged capital shares. Observations are 5-year averages, number in brackets. Panels A and B include seven countries and panel C five countries. Countries included: 7 in), Anglo-Saxon (3), Continental European (2) and Nordic (1). Robust standard errors in parentheses and "n.a." denotes that there are too few observations to calculate them. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table 4: Intermediate top incomes and capital shares.

	Full period	Pre-WWII	Postwar-1979	1980-present
A. Top 10–1 % (P90–99)				
All countries	0.152**	–0.238*	0.049	0.194**
	(0.066)	(0.117)	(0.063)	(0.072)
	[224]	[47]	[70]	[88]
- Anglo-Saxon	–0.037	–0.352**	–0.103	0.116
	(0.071)	((0.088))	((0.053))	((0.106))
	[89]	[12]	[29]	[38]
- Continental	0.137	–0.292	0.130	0.247
	(0.070)	(0.254)	(0.128)	(0.116)
	[58]	[18]	[17]	[19]
- Nordic	0.415**	–0.064	0.186*	0.286**
	(0.120)	(0.160)	(0.053)	(0.067)
	[64]	[17]	[18]	[24]
B. Top 1–0.1 % (P99–99.9)				
All countries	1.053***	0.387	0.610***	0.765***
	(0.226)	(0.241)	(0.175)	(0.188)
	[234]	[63]	[73]	[76]
- Anglo-Saxon	0.675*	–0.092	0.672	1.221**
	(0.281)	(0.058)	(0.458)	(0.329)
	[89]	[19]	[29]	[31]
- Continental	0.804	0.481	0.791*	0.292*
	(0.377)	(0.300)	(0.259)	(0.084)
	[54]	[18]	[16]	[16]
- Nordic	1.846**	1.178***	0.765***	0.962*
	(0.263)	(0.052)	(0.038)	(0.318)
	[60]	[17]	[18]	[20]
C. Top 0.1 % (P99.9–100)				
All countries	2.251***	1.234***	1.172***	1.857***
	(0.442)	(0.363)	(0.370)	(0.461)
	[244]	[67]	[77]	[76]
- Anglo-Saxon	1.813**	0.691***	1.065	2.842***
	(0.649)	(0.118)	(0.766)	(0.658)
	[99]	[23]	[33]	[31]
- Continental	1.626	1.252	1.497	0.638**
	(0.743)	(0.952)	(0.601)	(0.103)
	[54]	[18]	[16]	[16]
- Nordic	3.592***	2.636***	1.929**	2.652*
	(0.172)	(0.092)	(0.208)	(0.663)
	[60]	[17]	[18]	[20]

Note: Fixed-effect regression of logged top income shares on logged capital shares. Observations are in 5-year averages. Number of countries included: All countries (14), Anglo-Saxon (6), Continental European (3) and Nordic (3). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Controlling for other factors.

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	+ Trend	+ GDP/cap	+ Agrishare	+ Stock cap.	+ Gov. spend
Capital share	1.309***	0.891***	0.909***	0.855***	0.761***	0.622***
	(0.251)	(0.159)	(0.153)	(0.184)	(0.163)	(0.177)
Trend		–0.006***	0.000	0.001	–0.002	0.002
		(0.001)	(0.003)	(0.003)	(0.003)	(0.007)
GDP per capita			–0.274**	–0.305*	–0.185	–0.195
			(0.123)	(0.153)	(0.149)	(0.164)
Agriculture share				–0.017	–0.032*	–0.036**
				(0.015)	(0.018)	(0.015)
Stock capital					0.160***	0.149**
					(0.037)	(0.057)
Gov. spending						–0.300
						(0.195)
Observations	265	263	252	203	164	163
R-squared	0.367	0.606	0.630	0.559	0.561	0.617
No. of countries	15	15	14	14	14	14

Note: Fixed-effect regressions with logged top income shares as dependent variable on logged capital shares and other logged controls (see equation 2). "Agricultural share" denotes employment share in agriculture, "Stock capital" is total stock market capitalization as share of GDP and "Gov. spending" is central government spending as share in GDP. See text for sources. Observations are in 5-year averages. Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table 6: Using broader inequality measure: The Gini coefficient

	Full period	Pre-WW2	Postwar-1979	1980-present
A) Dep.: Gini coefficient				
Capital share	0.301***	–0.226	0.221**	0.356**
	(0.071)	(0.205)	(0.092)	(0.154)
	[163]	[11]	[64]	[83]
B) Dep.: Top 1% share				
Capital share	1.076***	0.057	0.615*	1.335***
(when Gini non-missing)	(0.173)	(0.181)	(0.290)	(0.346)
	[153]	[11]	[62]	[75]
C) Dep.: Top 10–1% share				
Capital share	–0.013	–0.394***	–0.008	0.258***
(when Gini non-missing)	(0.068)	(0.000)	(0.075)	(0.066)
	[129]	[4]	[51]	[71]
D) Dep.: Top 1% capital income				
Capital share	2.607***	0.317	1.774***	1.799
(when Gini non-missing)	(0.702)	(0.733)	(0.430)	(1.067)
	[83]	[6]	[33]	[42]

Note: Fixed-effect regressions of dependent variables in logs. Samples are the same in panels A–C, covering 13 countries. Observations are in 5-year averages. Robust standard errors are in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Appendix A Appendix figures and tables

Figure A1: Realized capital gains in top 1% incomes.

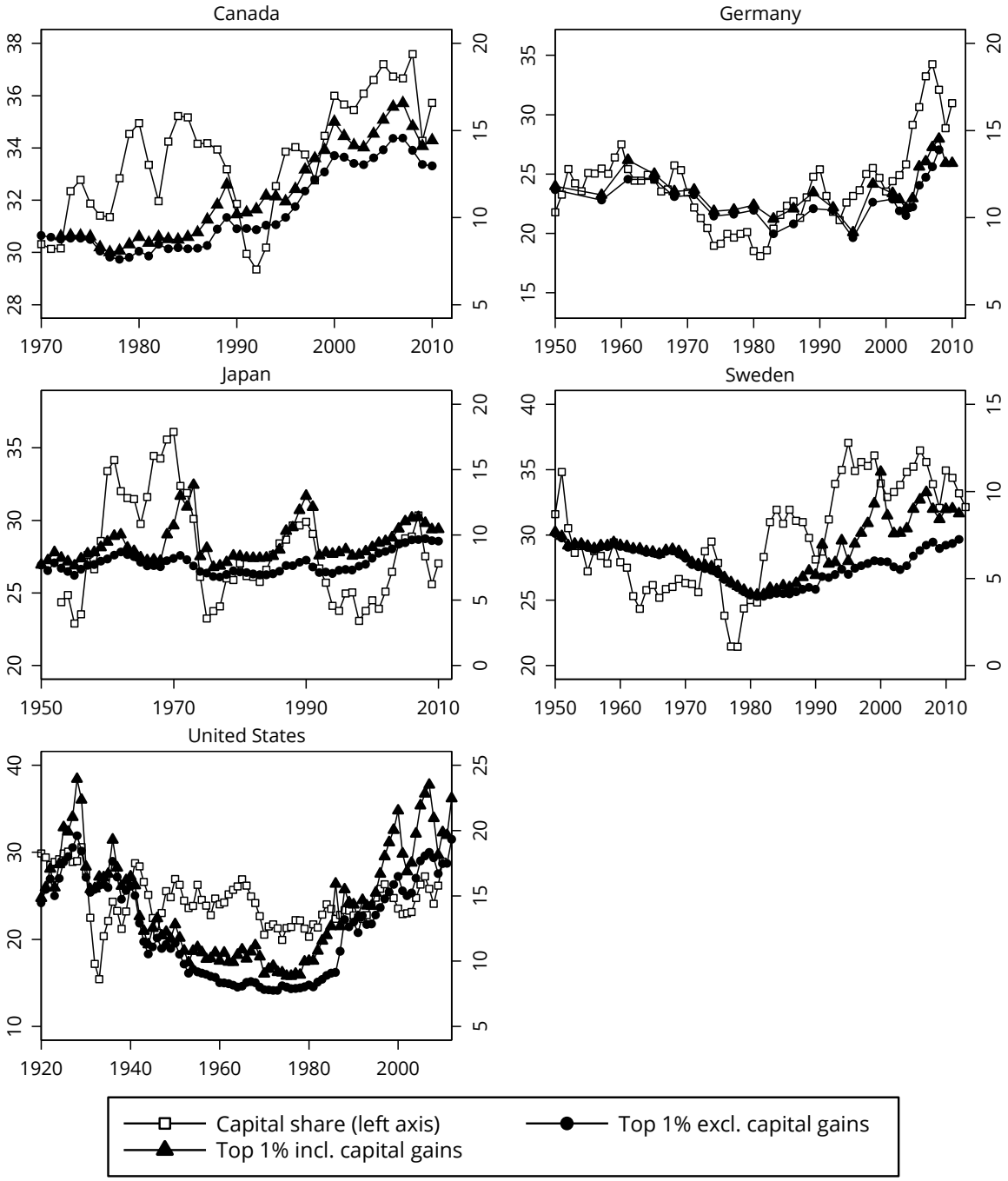


Table A1: Top capital incomes and top wage incomes (annual sample).

	Top 1% capital incomes				Top 1% wage incomes			
	Full period	Pre-WW2	Postwar-1979	1980-present	Full period	Pre-WW2	Postwar-1979	1980-present
A) 5-year averages								
All countries	2.291**	0.125	1.456**	2.074*	0.142	–0.219	0.263	0.941**
	(0.883)	(0.435)	(0.449)	(0.913)	(0.283)	(0.475)	(0.350)	(0.286)
	[110]	[19]	[39]	[45]	[110]	[19]	[39]	[45]
- Anglo-Saxon	2.028	0.648	2.874	3.141*	0.311	–0.759	–1.863	2.241**
	(0.792)	n.a.	(1.123)	(0.997)	(0.702)	n.a.	(0.831)	(0.390)
	[47]	[5]	[18]	[21]	[47]	[5]	[18]	[21]
- Continental	1.059	–1.153	1.443	0.170	0.266**	0.972	0.464	0.386**
	(0.509)	n.a.	(0.481)	(0.076)	(0.013)	n.a.	(0.150)	(0.024)
	[28]	[4]	[12]	[10]	[28]	[4]	[12]	[10]
- Nordic	3.684	–1.927	1.880	3.344	0.942	–0.108	0.960	0.832
	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	[15]	[3]	[4]	[7]	[15]	[3]	[4]	[7]
B) Annual observations								
All countries	1.237	0.390	1.296***	1.629*	0.083	–0.341	0.078	0.827**
	(0.781)	(0.239)	(0.305)	(0.736)	(0.154)	(0.363)	(0.285)	(0.260)
	[407]	[65]	[144]	[176]	[407]	[65]	[144]	[176]
- Anglo-Saxon	1.666	0.605	1.792	3.007	0.116	–0.667	–1.083	2.179***
	(0.600)	n.a.	(0.716)	(1.195)	(0.541)	n.a.	(0.480)	(0.198)
	[213]	[23]	[83]	[92]	[213]	[23]	[83]	[92]
- Continental	0.333	3.400	1.067	0.210	0.144**	–3.697	0.386	0.321**
	(0.295)	n.a.	(0.664)	(0.039)	(0.006)	n.a.	(0.181)	(0.025)
	[92]	[6]	[43]	[39]	[92]	[6]	[43]	[39]
- Nordic	2.477	–1.271	1.219	2.494	0.574	0.763	0.725	0.749
	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	[49]	[3]	[14]	[31]	[49]	[3]	[14]	[31]

Note: Fixed-effect regression of logged top 1% income shares on logged capital shares. Columns 1–4 use capital incomes in the top percentile and columns 5–8 use their wage incomes. The sample is the same in both cases. Observations are annual, number in brackets. Number of countries included: All countries (7), Anglo-Saxon (3), Continental European (2) and Nordic (1). Robust standard errors in parentheses and "n.a." denotes that there are too few observations to calculate them. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A2: Top capital incomes and capital shares (5-year averages sample)

	Top 1% total incomes (when top capital incomes are observed)				Top 1% capital incomes			
	Full period	Pre-WW2	Postwar-1979	1980-present	Full period	Pre-WW2	Postwar-1979	1980-present
A) 5-year averages								
All countries	1.035**	0.051	1.008***	1.217*	2.291**	0.125	1.456**	2.074*
	(0.382)	(0.135)	(0.264)	(0.583)	(0.883)	(0.435)	(0.449)	(0.913)
	[109]	[19]	[39]	[44]	[110]	[19]	[39]	[45]
- Anglo-Saxon	1.946	0.648	2.874	2.877*	2.028	0.648	2.874	3.141*
	(0.836)	n.a.	(1.123)	(0.907)	(0.792)	n.a.	(1.123)	(0.997)
	[46]	[5]	[18]	[20]	[47]	[5]	[18]	[21]
- Continental	1.030	–1.153	1.443	0.170	1.059	–1.153	1.443	0.170
	(0.518)	n.a.	(0.481)	(0.076)	(0.509)	n.a.	(0.481)	(0.076)
	[28]	[4]	[12]	[10]	[28]	[4]	[12]	[10]
- Nordic	3.794	–1.988	2.689	5.351	3.684	–1.927	1.880	3.344
	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	[15]	[3]	[4]	[7]	[15]	[3]	[4]	[7]
B) Annual observations								
All countries	0.615*	0.140**	0.744**	0.978**	1.237	0.390	1.296***	1.629*
	(0.307)	(0.041)	(0.203)	(0.349)	(0.781)	(0.239)	(0.305)	(0.736)
	[407]	[65]	[144]	[176]	[407]	[65]	[144]	[176]
- Anglo-Saxon	1.116**	0.168	0.649	2.609**	1.666	0.605	1.792	3.007
	(0.161)	n.a.	(0.443)	(0.447)	(0.600)	n.a.	(0.716)	(1.195)
	[213]	[23]	[83]	[92]	[213]	[23]	[83]	[92]
- Continental	0.267	1.715	0.819	0.259***	0.333	3.400	1.067	0.210
	(0.171)	n.a.	(0.504)	(0.003)	(0.295)	n.a.	(0.664)	(0.039)
	[92]	[6]	[43]	[39]	[92]	[6]	[43]	[39]
- Nordic	0.824	0.255	0.765	0.997	2.477	–1.271	1.219	2.494
	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	[49]	[3]	[14]	[31]	[49]	[3]	[14]	[31]

Note: Fixed-effect regression of logged top 1% income shares on logged capital shares. Columns 1–4 use total gross income of the top percentile and columns 5–8 use only their capital incomes. Sample is the same in both cases. Panel A has 5-year averages and Panel B annual observations, numbers in brackets. Number of countries included: All countries (7), Anglo-Saxon (3), Continental European (2) and Nordic (1). Robust standard errors in parentheses and "n.a." denotes that there are too few observations to calculate them. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A3: Realized capital gains in top incomes and capital shares (Annual sample).

	Top 1% incomes excl. capital gains (when top capital gains are observed)				Top 1% incomes incl. capital gains			
	Full period	Pre-WW2	Postwar-1979	1980-present	Full period	Pre-WW2	Postwar-1979	1980-present
Capital share	1.036**	0.140**	0.761**	1.058*	1.153**	0.391	1.333***	1.516
	(0.237)	(0.041)	(0.226)	(0.503)	(0.319)	(0.239)	(0.339)	(0.886)
	[299]	[65]	[144]	[178]	[301]	[65]	[144]	[178]

Note: Fixed-effect regression of logged top 1% income shares on logged capital shares. Sample is the same in both cases. Observations are yearly, their number in brackets. Seven countries included. Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A4: Intermediate top incomes and capital shares (annual sample)

	Full period	Pre-WWII	Postwar-1979	1980-present
A. Top 10–1 % (P90–99)				
All countries	0.101**	–0.205**	0.044	0.138**
	(0.038)	(0.088)	(0.047)	(0.057)
	[896]	[147]	[297]	[386]
- Anglo-Saxon	0.014	–0.203	–0.088	0.072
	(0.045)	((0.160))	((0.046))	((0.079))
	[379]	[38]	[132]	[175]
- Continental	0.085	–0.422**	0.121	0.186
	(0.033)	(0.090)	(0.099)	(0.084)
	[203]	[71]	[51]	[69]
- Nordic	0.305**	–0.044	0.162**	0.212*
	(0.092)	(0.032)	(0.035)	(0.072)
	[256]	[38]	[87]	[111]
B. Top 1–0.1 % (P99–99.9)				
All countries	0.632**	0.282	0.518***	0.664***
	(0.243)	(0.164)	(0.156)	(0.166)
	[933]	[229]	[310]	[311]
- Anglo-Saxon	0.598**	0.010	0.605	1.135**
	(0.230)	(0.106)	(0.328)	(0.298)
	[377]	[70]	[139]	[130]
- Continental	0.386	0.461	0.645	0.268*
	(0.231)	(0.324)	(0.328)	(0.083)
	[197]	[82]	[48]	[55]
- Nordic	1.421**	0.789**	0.700***	0.760
	(0.295)	(0.170)	(0.045)	(0.267)
	[231]	[37]	[83]	[91]
C. Top 0.1 % (P99.9–100)				
All countries	1.409**	0.858***	0.977**	1.646***
	(0.538)	(0.265)	(0.347)	(0.405)
	[988]	[252]	[326]	[311]
- Anglo-Saxon	1.572**	0.533***	0.936	2.673***
	(0.531)	(0.087)	(0.605)	(0.623)
	[431]	[93]	[154]	[130]
- Continental	0.790	1.069	1.244	0.589**
	(0.478)	(0.960)	(0.691)	(0.099)
	[198]	[82]	[49]	[55]
- Nordic	2.863***	1.714**	1.773**	2.152*
	(0.193)	(0.378)	(0.241)	(0.591)
	[231]	[37]	[83]	[91]

Note: Fixed-effect regression of logged top income shares on logged capital shares. Observations are annual, number in brackets. Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A5: Other time periods. Top incomes and capital shares

	Annual observations			5-year averages		
	Early incl. WW2	WWII + postwar	1990-present	Early incl. WW2	WWII + postwar	1990-present
All countries	0.361***	0.297	0.970***	0.778**	0.770***	1.021***
	(0.096)	(0.171)	(0.114)	(0.278)	(0.322)	(0.253)
	[300]	[393]	[280]	[253]	[66]	[91]
- Anglo-Saxon	0.270	0.709	1.094***	0.223*	0.953	1.161***
	(0.168)	(0.403)	(0.168)	(0.355)	(0.088)	(0.578)
	[90]	[158]	[122]	[95]	[19]	[34]
- Continental	0.319*	0.138	0.584**	0.884	0.786	0.688***
	(0.094)	(0.108)	(0.108)	(0.470)	(0.671)	(0.507)
	[89]	[57]	[52]	[55]	[17]	[20]
- Nordic	0.994*	0.755*	1.046**	1.642***	1.178***	1.128
	(0.325)	(0.287)	(0.247)	(0.166)	(0.274)	(0.115)
	[73]	[133]	[81]	[72]	[21]	[26]

Note: Fixed-effect regression of logged top income shares on logged capital shares. Number of observations in brackets. Number of included countries: All countries (7), Anglo-Saxon (3), Continental European (2) and Nordic (1). Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A6: Using broader inequality measure: The Gini coefficient (annual sample).

	Full period	Pre-WW2	Postwar-1979	1980-present
A) Dep.: Gini coefficient				
Capital share	0.220**	–0.474	0.195***	0.428***
	(0.073)	(0.259)	(0.061)	(0.100)
	[497]	[26]	[155]	[298]
B) Dep.: Top 1% share				
Capital share	0.952***	–0.351**	0.618**	1.343***
(when Gini non-missing)	(0.122)	(0.072)	(0.224)	(0.169)
	[442]	[25]	[139]	[260]
C) Dep.: Top 10–1% share				
Capital share	0.048	–0.407	–0.067	0.214***
(when Gini non-missing)	(0.050)	(0.000)	(0.055)	(0.054)
	[378]	[3]	[116]	[252]
*D) Dep.: Top 1% capital inc*ome				
Capital share	2.235***	–0.270	1.321***	2.425***
(when Gini non-missing)	(0.514)	(0.582)	(0.260)	(0.610)
	[216]	[6]	[68]	[136]

Note: Fixed-effect regressions of dependent variables in logs. Samples are the same in panels A–C, covering 13 countries. Observations are annual, numbers i brackets. Robust standard errors are in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A7: Controlling for other factors (5-year averages, balanced sample)

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	+ Trend	+ GDP/cap	+ Agrishare	+ Stock cap.	+ Gov. spend
Capital share	1.393***	1.197***	1.159***	1.146***	0.760***	0.622***
	(0.213)	(0.158)	(0.170)	(0.167)	(0.163)	(0.177)
Trend		–0.004**	0.001	0.000	–0.002	0.002
		(0.002)	(0.004)	(0.004)	(0.003)	(0.007)
GDP per capita			–0.255	–0.209	–0.185	–0.195
			(0.193)	(0.181)	(0.149)	(0.164)
Agriculture share				–0.028	–0.032*	–0.036**
				(0.020)	(0.018)	(0.015)
Stock capital					0.161***	0.149**
					(0.037)	(0.057)
Gov. spending						–0.300
						(0.195)
Observations	163	163	163	163	163	163
R-squared	0.330	0.441	0.466	0.474	0.560	0.617
No. of countries	14	14	14	14	14	14

Note: Fixed-effect regressions with logged top income shares as dependent variable on logged capital shares and other logged controls (see equation 2). "Agricultural share" denotes employment share in agriculture, "Stock capital" is total stock market capitalization as share of GDP and "Gov. spending" is central government spending as share in GDP. See text for sources. Observations are 5-year averages. Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A8: Controlling for other factors (annual, unbalanced sample)

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	+ Trend	+ GDP/cap	+ Agrishare	+ Stock cap.	+ Gov. spend
Capital share	0.860***	0.625***	0.622***	0.565**	0.400**	0.300**
	(0.283)	(0.193)	(0.160)	(0.226)	(0.161)	(0.133)
Trend		–0.007***	0.001	0.004	0.005	0.011
		(0.001)	(0.003)	(0.004)	(0.005)	(0.007)
GDP per capita			–0.323**	–0.353*	–0.368	–0.263
			(0.126)	(0.186)	(0.211)	(0.183)
Agriculture share				–0.055***	–0.043***	–0.027***
				(0.017)	(0.013)	(0.007)
Stock capital					0.164***	0.106**
					(0.035)	(0.046)
Gov. spending						–0.601*
						(0.281)
Observations	1,095	1,086	1,034	460	368	362
R-squared	0.255	0.518	0.537	0.300	0.402	0.468
No. of countries	15	15	14	14	14	14

Note: Fixed-effect regressions with logged top income shares as dependent variable on logged capital shares and other logged controls (see equation 2). "Agricultural share" denotes employment share in agriculture, "Stock capital" is total stock market capitalization as share of GDP and "Gov. spending" is central government spending as share in GDP. See text for sources. Observations are annual. Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table A9: Controlling for other factors (annual, balanced sample)

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	+ Trend	+ GDP/cap	+ Agrishare	+ Stock cap.	+ Gov. spend
Capital share	0.969***	0.962***	0.877***	0.836***	0.433**	0.300**
	(0.194)	(0.181)	(0.197)	(0.198)	(0.159)	(0.133)
Trend		0.001	0.011*	0.009*	0.007	0.011
		(0.002)	(0.006)	(0.005)	(0.005)	(0.007)
GDP per capita			–0.413	–0.368*	–0.383*	–0.263
			(0.242)	(0.204)	(0.199)	(0.183)
Agriculture share				–0.047**	–0.041***	–0.027***
				(0.018)	(0.013)	(0.007)
Stock capital					0.145***	0.106**
					(0.035)	(0.046)
Gov. spending						–0.601*
						(0.281)
Observations	362	362	362	362	362	362
R-squared	0.202	0.204	0.255	0.290	0.385	0.468
No. of countries	14	14	14	14	14	14

Note: Fixed-effect regressions with logged top income shares as dependent variable on logged capital shares and other logged controls (see equation 2). "Agricultural share" denotes employment share in agriculture, "Stock capital" is total stock market capitalization as share of GDP and "Gov. spending" is central government spending as share in GDP. See text for sources. Observations are annual. Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Appendix B

B1. Capital shares data

This section of the appendix discusses the capital shares data used in the paper. Section A1.1 discusses measurement issues and section A1.2 presents the 19 series and discusses the measurement and the sources. There we also summarize the literature on wage and capital shares before 1960. Since data availability for the post-1960 period is abundant we do not mention all studies for this period, but only in exceptional cases.

B1.1 Measurement issues

Functional income distribution divides national income in two types: labour income and capital income. We then get the wage share and the capital share. (The incomes of the self-employed is, as we will see, a tricky issue since it does not immediately correspond to any of these two categories.)

The concept of the wage share corresponds to some version of:

$$\frac{sum\ of\ employee\ compensation}{value\ added\ or\ GDP} \quad . \qquad (1)$$

Correspondingly, the capital share is some version of:[18]

$$\frac{Sum\ of\ capital\ incomes\ (interest, profits, dividends, realized\ capital\ gains)}{value\ added\ or\ GDP} \quad . \qquad (2)$$

Together, the wage share and the capital share equals 1 (or 100, depending on how you formulate it). Several measurement issues must be resolved.

The first issue is whether only wages or also other job benefits should be included in the wage share. Arguably they should be, as they are just another type of compensation for the work carried out. Social benefits can be thought of as preferable to wage increases for employees in some situations. For example, Pessoa and Van Reenen (2012) showed that non-wage compensation has been a very significant part of standard-of-living improvements for employees in UK and the US in the last decades. When the composition of the compensation package changes over time, comparing only wage sums over time gives a misleading impression of the distribution between employers and employees. In the older wage share literature of the 1950s and 1960s this kind of measurement was a problem as it shifted between papers – and some researchers only looked at wages, not salaries (cf. Phelps Brown and Hart 1952) – but today it does not pose much of a problem as all national accounts present "wage sums" including all types of compensation. This is then not much of a problem for the present study.

A second and much trickier issue is the incomes of the self-employed.[19] Should they be ac-

[18] The importance of capital gains for income inequality is an underestimated issue in the literature. But see Eisner (1980) and Roine and Waldenström (2012).

[19] A recent paper on the US claimed that a third of the measured decline in the wage share there the last couple of decades is caused by mismeasurements of the incomes of the self-employed (Elsby et al 2013).

counted for as capital income or as labour income, or as a mix of both? This issue was much debated in the literature in the 1950s and 1960s (Phelps-Brown and Hart 1952, Phillips 1960, Moroney 1966, Ferguson and Moroney 1969), and has also been in focus in the more recent literature (i.e. Krueger 1999, Gollin 2002, Freeman 2011). The central issue is: if the self-employed are ignored when calculating factor shares and their share of the economically active varies over time, then "naïve" estimates of capital or wage shares might give a misleading impression as a measured decrease (increase) might be caused by an increasing (decreasing) share self-employed in the economy, and not because of any substantial change in the distribution between capital and labour (cf. Kravis 1959). For this reason, the most used modern datasets on wage shares, such as the AMECO dataset from the European Commission, presents what they call the "adjusted wage share", which means that it is adjusted for the imputed labour incomes of the self-employed.[20] The importance of this correction has been shown in the literature with historical data for example by Phelps Brown and Hart (1952) and Feinstein (1968) who have showed that since the share of employees grew and the share of self-employed shrunk during the industrial revolution in Britain, this made the wage share automatically increase; Scitovsky (1964) made the same argument for the U.S and Jeck (1968) for Germany. However, in many cases the historical series cannot be adjusted for the self-employed incomes. Then it might be preferable to compare wages/employee compensation only to capital incomes, and ignore the group of self-employed altogether.

There are three different ways of adjusting for the self-employed (Kravis 1959, Haley 1968). The first is imputing a labour income of the self-employed equal to the average employee's remuneration, either in the specific sector or in the entire economy. The residual self-employed income is then treated as capital income. This is called the labour method of adjustment. The second is imputing a return to capital equal to the average return in the corporate sector, and treat the residual as labour income. This is called the capital method of adjustment. The third and least demanding method is assuming that the division between labour and capital income in the self-employed sector is either the same as in the corporate sector, or just to set a fixed distribution, typically 65-70 per cent labour income and 30-35 per cent capital income. This last adjustment method, the so-called proportional method, is used in several cases in this paper. It is the simplest one to make as one does not need series for average wage or average return to capital, and still has advocates (cf. Freeman 2011: 12).[21] The labour method of adjustment is also common, while the capital method is very uncommon.

The third measurement issue is whether to calculate wage and capital shares as shares of gross or net value added. The difference is that in net value added the consumption of fixed assets (depreciation of fixed capital) is subtracted from gross value added. It can be argued that the depreciation of capital is a necessity of production and therefore out of reach for the distributional struggle between capital and labour. On the other hand, the criteria for companies' depreciation of their capital stock have changed over time and sometimes one can be

[20] Lebergott (1964) on the other hand was very skeptical to such corrections. He meant that if we impute unchanged combinations of labour and capital incomes for the self-employed or changes in line with the rest of the economy, "we simply iterate what we know already". For this reason he argued that studies of wage shares should be confined to sectors where the share of self-employed is small, like manufacturing.

[21] With countries where the data end early we link those series to data from AMECO or OECD STAN. AMECO's adjusted wage share is calculated as 100 * [(compensation of employees / employees) / (GDP / employment)] I.e. it is an adjustment for the share of employees among the totally employed. It is also possible to get unadjusted wage shares from AMECO; in cases where we only have unadjusted wage shares for the previous periods this is used to make linkage of the series possible.
See http://ec.europa.eu/economy_finance/db_indicators/ameco/documents/list_of_variables.pdf for description.

sceptical towards the measurement of variations in depreciation over time. For these reasons, when possible we use both gross and net measures of capital shares, even if we start with gross shares.[22]

A fourth issue is whether value added, the denominator of the equation, is calculated at market prices or at factor cost. The difference is that the market prices concept includes indirect taxes and subsidies. These posts are not relevant to the distribution between capital and labour and so the factor cost measurement, where available, is preferable. However, not in all cases in this paper do we have access to estimates of indirect taxes and subsidies so in some cases GDP at market prices is used in the denominator.[23]

B1.2 Capital shares: the data we use and contextual discussion[24]

B1.2.1 Argentina

For Argentina, it is possible to estimate capital shares back to 1913 from data by the economic historian Ewout Frankema (2010). Frankema has calculated wage shares[25] for Argentina 1913–2000, Brazil 1920–2000 and Mexico 1900–2000, and we use all three series. We take simply 100 less the wage share as the capital share. That the capital income sum cannot be directly estimated is unfortunate, but as Frankema (2010, pp. 347–8) states, it is not possible with the sources available for Argentina over this long period.

The background of Frankema's paper is interesting for our purposes. The paper is a contribution to the literature on long-run inequality in Latin America, and follows upon an approach pioneered by Jeffrey Williamson, who in a series of papers has used the ratio of unskilled worker wage to GDP per capita or unskilled worker wage to land rent as measures of inequality. The logic of the wage/GDPc measure of inequality is that unskilled workers most likely are among the poorest groups in society, and so if the gap between their living standards (as measured by their wages) and the average living standards in society (as measured by GDP/capita) is large, then inequality is large. The approach is very similar to the national accounts factor shares approach taken here, but less data heavy: you only need a (representative) wage series and a GDP/capita estimate (see Frankema 2010 pp. 346–348 for discussion). The wage to land rent measure is even more straightforward as a measure of inequality: the logic is simply to compare the income of wage workers with the income of land owners, in other words a directly class-based income inequality measure (see Williamson 2002

[22] Note that Piketty (2014) uses net measures; see Bridgman (2014) and Karabarbounis and Neiman (2014) for critique and comments.

[23] Another issue is using GDP when there might be significant differences between GDP and GNP because of significant capital outflows from foreign investment in the country. This effect is obvious in Ireland where labour's share of GDP today is quite low. As Barry (2006, p. 1) notes, "GDP figures overstate Ireland's achievements as they include the massive profits recorded by foreign multinational corporations operating in Ireland /…/ Irish GDP is more than 20 percent higher than GNP, a difference not reflected in the data for any other EU country." The low corporate tax in Ireland means that "the transfer pricing activities of foreign-owned firms tend to produce the undesirable effect, from the perspective of labour share calculation, of artificially inflating estimates of the domestic returns to capital, in the form of inflated estimates of national product" (Flaherty and O'Riain 2013, p. 22). So far, we have not made any adjustment for this, but used value added/GDP.

[24] The only pre-World War Two estimate of wage shares in Africa that we know of is Bolt and Green (2015) for agriculture in colonial Malawi, then called Nyasaland, from 1900 to 1960. Trapp (2015) discusses difficulties with estimating wage and capital shares in developing countries.

[25] Where labor share, $Y_L = (e_r * y_{L,r}) + (e_{uf} * y_{L,uf}) + (e_{uif} * y_{L,\ uif)}$. e is the share of the labor force in rural (r), urban formal (uf) and urban informal (uif) sectors respectively. The y represents the average income in each sector.

for an important application of this method).

The wage-GDP and wage-land rent measures are both related in spirit to the factor share approach to inequality, but less data heavy. Frankema constructs his factor share estimates by estimating wage sums, sectoral employment shares and GDP per working person, using existing data. He uses existing wage series for different classes of workers and assumptions about 300 working days and 2400 working hours a year to estimate wage sums. Interpolation is used inbetween observations of wages. He also discusses the share of self-employment in total employment. Establishing sectoral employment shares for these Latin American countries in the long run is difficult but essential, and Frankema devotes much attention to the share in the informal economy. The labour force estimates are built mainly on censuses, with significant interpolation in-between. Because of the interpolations in wages and labour force estimates, Frankema (2010, p. 352, 358) points out that his data are not helpful for investigating short-run variations. We mainly use five year averages in our regressions, which makes sense not at least here.

The main substantive finding on factor shares in Frankema's study is that wage shares in Argentina, Brazil and Mexico peaked in the mid-20th century. For Argentina Frankema (2010, p. 359) finds a slowly increasing wage share from the 1910s to the 1950s, then a decrease to a low point in the mid-1970s, then an increasing trend again. He explains that: "The collapse of the labor income share in 1976 was the result of the attempt of the Videla regime to curb mounting inflation after its military coup in March of that year." (Frankema 2010, p. 359)

Frankema's long run factor shares study of Argentina, Brazil and Mexico is a fundamental and innovative one for this topic. Recently another important paper has been published on the topic, showing the increasing interest on long run factor shares: Astorga (2015) estimates factor shares for Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela from 1900 to 2011. A strength of his study is that he makes direct estimates of capital incomes, while in Frankema's study as we have seen this is calculated as a residual. However, the estimate of capital incomes is not unproblematic, as it builds on the incomes of top income earners, who in reality had both labour and capital incomes, but by Astorga out of necessity are treated as capital owners. Because of lack of direct capital incomes data, Astorga uses a pragmatic mix of different top-group income estimates (see Astorga 2015, pp. 10–11).

B1.2.2 Australia

For Australia, the economist Graham Richards (1978) presents data for the manufacturing sector 1926–1967 and the entire economy 1949–68.[26] The data are from the official National Accounts.[27] Adjustment for the self-employed is not possible. We use data for manufacturing for 1927–45 and the economy from Richards 1949–1959 and link these to estimated capital shares (100-unadjusted wage share) for the economy from AMECO.[28] For the overlapping years 1960–68 the correlation between Richards' data and AMECO data is only 0.29, indicating some discrepancies in the estimates. Mixing manufacturing data with economy

[26] Actually Richards presents data for 1926/27, 1927/28, and so on. Value for year 1948/49 presented at year 49 (same as top income and subsequent measures).
[27] Penn World Table nominally has data for Australia back to 1950 but these are very choppy; for example they are given as constant from 1950 to 1970, which indicates less actual observations and more inter- and extrapolation.
[28] I.e., Compensation of employees: total economy (UWCD) divided by Gross national income at current market prices (UVGN).

data is dubious but it seems fairly representative in this case. Using STAN data to calculate capital shares for the manufacturing sector 1970–2006 and comparing with economy series from AMECO, the correlation is 0.84. The lower level of the 1920s and 1930s compared to the post-war period also makes sense, as does the fairly strong correlation with the top percentile share for 1927–45 at 0.22.

A possible expansion on Australia is to use data from Butlin (1984: table Aa31). From Butlin it is possible to calculate unadjusted wage shares in manufacturing from 1907 to 1940. Butlin presents a sum of wages and salaries as well as the estimated value of production in the sector. There is no information about the incomes of the self-employed here. Comparing estimates from Butlin's data with Richards', we see more or less same values in 1927–28 and 1931 and a slightly decreasing trend in the 1930s, but a peak in 1931 with Butlin's data but not with Richards'. In Butlin's data we have the number of self-employed for the entire economy back to 1901 (table Aa33) and so if we assume that the share of self-employed is the same in manufacturing as in the economy overall we can adjust the wage share in manufacturing for the self-employed with the proportional adjustment method. To make net estimates calculations of depreciation are in Butlin (1962, table 12); these, however, are according to Butlin himself as well as commentators quite imprecise (Boehm 1965, p. 210) . As discussed in section A.1.1, measuring depreciation over long time periods is an uncertain venture. Recent surveys of Australian macroeconomic history state that Butlin's (1962) and Butlin's (1977) work from the 1960s and 1970s still are state of the art in Australian historical macroeconomic data (McLean 2005, pp. 45 2–3).[29] McLean points out that Butlin's (1977) estimates are improved compared to the earlier ones. A more specialized study of profits from 1901 to 1939 is provided by Merrett and Ville (2011); possibly this can be used to triangulate capital share estimates from Butlin's (1962) data. On the other hand there are very few studies of wage shares and capital shares per se. Except for Richards (1978) which we use for data, there is Dixon (1979) on manufacturing 1969–1977 and Stegman (1980) who looks at the connection between factor shares, aggregate demand and growth. Both are focusing on the short-run, motivated by the very low level of the capital share in the 1970s, and not very relevant to our long-run focus.

B1.2.3 Austria

For Austria there are capital shares data for nine years from 1913 to 1960, i.e. data that precede the easily accessible AMECO database. The data were presented in a national accounts study from 1965 by the Austrian Institute for Economic Research (Österreichischen Institut für Wirtschaftsforschung, WIFO). Modern official national accounting only began in Austria after 1945, but the estimates back to 1913 have "quasi-official" status (Chaloupek et al 2008, p. 33).[30] The WIFO (1965) study provides GDP estimates from the production side and discusses growth and structural change in detail, but also devotes much attention to national income accounts and the distribution between wage share and capital share. Previous to this study, there were scattered estimates by researchers, but the WIFO study raised the bar by making consistent estimates over fifty years and estimating national income from the ground up both for the expenditure side and the income side. Because of this they could compare the results with different methods to see that the results were sound.

[29] Haig (2001) mounts a challenge to Butlin's (1962) GDP estimates but the difference is mostly in the use of deflators. We use current prices so Haig's criticism of Butlin does not really affect what we do.

[30] Stiefel (1978, pp. 2–3) provides some critical discussion of the WIFO study's interwar estimates. Stiefel still classifies the WIFO study as a "fundamental" contribution to Austrian economic history research. Szesci (1970) studies factor shares in Austria from 1913 to 1967 but we haven't been able to get a copy of this study.

There are currently no top incomes data for Austria and so those capital shares data are here only used to investigate the development of capital and wage shares per se, not their correlation with inequality. WIFO (1965, pp. 11–12) point to a large increase in the wage share around World War One and that the inflation during the war years eroded the value of securities; "since then, there is practically no rentier class left in Austria", the WIFO report says. They find no important change in the interwar years and point to that rent control hampered the development of capital incomes.

During the post-war period, transfer of labour from agriculture to industry increased the wage share as the number of self-employed decreased. We have found very little literature on factor shares in Austria, but Bayer (1979) discusses the period from 1954 to 1975. Bayer also looks further back, reporting a wage share around 50 per cent before the First World War, then a rise to 60 per cent, a stand still until the Second World War, and an increasing trend in the post-war period, reaching 75 per cent in the mid-1970s. This is the unadjusted wage share; with adjustment for the self-employed, the rise is significantly reduced. Chaloupek et al (2008) discuss the wage share in Austria from 1945 to the mid-2000s, finding, much like Bayer (1979), an increasing trend to the 1970s and then a decrease, but that the increasing trend to the 1970s is eradicated if one takes into account the labour incomes of the self-employed. They also provide an interesting source-critical discussion of the national accounts data, namely on issues like part-time work, the incomes of the self-employed, and company profits, withheld and distributed. For the earlier period they refer to WIFO (1965).

B1.2.4 Belgium

For Belgium, Buyst (1997) presents comprehensive national accounts data for the 1920–1939 period. With these it is possible to calculate wage and capital shares gross and net and at market prices or factor cost. It is also possible to adjust for the self-employed, since their incomes are presented separately. There are no top incomes data for Belgium and so as with Austria the Belgian capital shares data are only used for their own sake.

B1.2.5 Brazil

For Brazil, Frankema (2010) presents capital share estimates for the period since 1920, using the same method as in the discussion of Argentina above. Frankema's wage share estimate for Brazil shows an increasing trend from about 1930 to the mid-1940s, during the Vargas period, and a stable high level from the mid-1940s to the early 1960s. Frankema (2010, p. 361) explains the decreasing trend before 1930s, during what in Brazil is called "the old republic", with the "relatively weak position of the labor movement in the country and the relatively strong position of the land-based elite". The populist Vargas regime of the 1930s and 1940s on the other hand explicitly sought support in the working class (cf. Frankema 2010, p. 363). Regarding the high level of the 1950s, he suggests that this might be an artefact of unrepresentative (too high) urban wage series (Frankema 2010, p. 362). Not surprisingly, the wage share falls during the military dictatorship after 1964. Maybe more surprisingly, it does not rebound after democratization in 1984. Frankema explains this with the combination of macro-economic instability, liberalization policies "which prioritized business profits over wages", and a rapid growth of the labour force (Frankema 2010, pp. 365–7; quote on p. 366).

There are few studies of wage and capital shares in Brazil but Colistete (2007) studies "Productivity, Wages, and Labor Politics in Brazil, 1945–1962". He claims that in contrast

to Europe with its "social compact for growth" in the post-war period, Brazil had very confrontational relations between unions and employers, without cooperation and with a distribution pattern favouring capital, as real wages trailed productivity.

B1.2.6 Canada

The historical National Accounts data in Canada used to estimate capital shares series cover 1926 until 1976 and come from a 1983 Statistics Canada publication (Leacy 1983). The national accounts begin in 1926 and the (construction of the) data from 1926 to 1959 are discussed in Goldberg (1964), with a comment by Leacy. Crozier (n.d.) discuss Canadian national accounts data for the 1926–1976 period. It is for the whole economy; the book does not present sector data. The numerator is the post "Wages, salaries, and supplementary labour income". The supplementary part includes "other expenditures by employers on labour account that can be regarded as payment for employees' services. Included here are employers' contributions to pension funds, employee welfare funds, unemployment insurance and workmen's compensation." It is possible to correct with the proportional method for the incomes of self-employed (more precisely, non-incorporated business) as their incomes are separate posts (farm and non-farm). The post capital consumption allowances and miscellaneous valuation adjustments is included in the capital income sum. We use gross national product at market prices as the denominator.[31] We link the proportionally adjusted series calculated from Leacy (1983) for the years 1926 to 1959 with data from AMECO for 1960–2010. The AMECO series is simply 100 less the adjusted wage share. The two series move very closely and the correlation between the two in 1960–76 is 0.53.

Before 1926 we have no factor shares data as it is but there are related studies, including British studies of the Canadian economy. Altman (1988) presents new estimates for value added and labour compensation in Quebec and Ontario from 1870 to 1910. Bertram and Percy (1979) has nation-wide real wages from 1900 to 1926. Urquhart (1986) presents national accounts from 1870 to 1926, when the official series begin.

B1.2.7 Denmark

For Denmark, the central bank economist Kim Abildgren (2008: table A5) presents an estimated wage share series for the 1875–2005 period. It's the wage share for the entire economy at factor cost, gross. The wage sum includes "an imputed compensation per self-employed person corresponding to the average wage sum for wage earners", i.e. the labour method of adjustment is used rather than the proportional method (Abildgren 2008: 28). The wage sum estimate builds on data from Statistics Denmark and from Pedersen (1978). A problematic factor is that the wage data used to calculate the wage sums before 1920 are only from the manufacturing sector. Nevertheless Abildgren's data are used until 2007 (100 less the wage share = the capital share) and then linked with 2008–2010 data from AMECO (also 100 less the wage share).

The focus of the study of Abildgren which we use for data is on monetary policy and its connection to wage bargaining, rather than on income distribution. Abildgren's (2008, p. 8) main comment on the wage share for the period from 1875 to 2007 is that "the wage share of

[31] The formula used is Corporation profits before taxes + Interest and miscellaneous investment income + 0.35*(Accrued net income of farm operators from farm production+Net income of non-farm unincorporated business, including rent)+Capital consumption allowances and miscellaneous valuation adjustments / Gross national product at market prices.

factor income has remained roughly unchanged at a level around 60-70 per cent, although with some local upward and downward trends". To this we might say that a ten percentage point difference in the wage share of GDP is quite large, and that this still is what Abildgren considers a "normal" span of variation.

There are a few medium run studies on factor shares in Denmark. Kongshoj Madsen and Koch (1976) and Pedersen (1978) discuss the development during the interwar period. Bjerke (1966) and Kongshoj Madsen (1975) discuss factor shares in the 1950s and 1960s. Bjerke finds a rather stable wage share in the 1950s but a "quite remarkable" (p. 21) increase in the early 1960s; Kongshoj Madsen shows that the wage share continued to increase later in the decade. His explanation is the strong wage pressure associated with full employment, ensuring that even though productivity growth was stronger than in the preceding decade, real wages increased even more. Greasley and Madsen (2006) compare wage growth in Denmark and New Zealand 1875 to 1939 and find that Danish wages increased more. The reason is not only better productivity growth but also open economy forces and trade union militancy around World War One which "influenced income distribution and especially favoured wages over property income in Denmark" (Greasley and Madsen 2006, p.116). Extraordinary real wage increases around World War One are discussed in much Danish literature too, and Milhoj (1954) in his study of wages in Denmark from 1914 to 1950 points out that something similar happened in 1945.

B1.2.8 Finland

For calculating historical capital shares in Finland, there are two relevant sets of historical national accounts data. One has been constructed by the economic historian Rita Hjerppe (1989), who presents data from 1865 to 1985. Unfortunately for our purposes Hjerppe only presents factor share estimates for the manufacturing sector. Hjerppe includes all entrepreneurial incomes in the wage share, meaning that it becomes quite high and the capital share rather low. Hjerppe's wage share estimates are quite different in levels – about five to ten percentage points – compared to the manufacturing sector estimates in OECD STAN, but the series move similarly for the overlapping years 1970 to 1985: the correlation is 0.94. Given the very different levels of the estimates however, linking the two series would be very problematic. The other data set has been created by Tiainen (1994) in his doctoral dissertation. Tiainen (appendix tables 18, 19, 20, 25, 27) presents value added, labour costs, imputed labour remuneration for the self-employed and capital depreciation per sector from 1900 to 1985.[32]

In our first version of our paper we used Hjerppe's data but in the newer version Tiainen's are used. We have estimated the capital share for the total economy – with adjustment for labor incomes of the self-employed – for 1900 to 1985, and have linked these estimates to estimates based on AMECO data. The merging has been made simply by taking the Tiainen calculations for 1900–59, the average of the Tiainen calculations and AMECO calculations for 1960–85, and the AMECO calculations for 1986–2010. The raw correlation between Hjerppe's capital share and the top 1 % for 1920–85 is 0.18, and with Tiainen's 1920–85 it is 0.43. The correlation between the net capital share of Tiainen and our calculation of the same thing from AMECO data from 1960–85 is 0.73 which is rather good, and for the gross comparison the correlation is 0.53, but the AMECO estimate is significantly lower. It appears that the reason is that labour incomes of the self-employed are a higher share of GDP

[32] In previous research Tiainen's data set has been used for example by Jalava et al (2003) who study technological change and capital-labour substitution in Finland from 1902 to 2003.

according to AMECO than according to Tiainen, possibly due to the different adjustments for this: Tiainen uses the labour method of adjustment while AMECO adjusts with the share of employees among the number of employed. This means that the capital share becomes lower in our estimates for 1960 onwards.

There is little literature on functional income distribution in Finland but Hannikainen and Heikkinen (2006, p. 173) use Hjerppe's data plus modern data from Statistics Finland, and claim that: "The share of wages declined notably in three crisis periods: during the First World War (and Civil War) years of the late 1910s, during and after the depression of the 1930s and during the depression of the 1990s. On the other hand, it rose after the Second World War, perhaps reflecting the strengthening of trade unions' positions in wage setting." Ripatti and Vilmunen (2001) studies the production function of the Finnish economy from 1975 to 2001 and find that an increase in the mark-up is the main explanation of the rising capital share. Furthermore, Luoma and Luoto (2010) analyse the production function of the Finnish economy over the 20th century.

B1.2.9 France

The longest French series comes from Piketty (2014), covering the period from 1820 to 2010. The public statistics bureau provides yearly data from 1949 onwards. Piketty's data is with national income at factor cost in the denominator and allows adjusting for the labour incomes of the self-employed. We use Piketty's series. The earliest estimated top income share for France is for 1905 and there are yearly estimates back to 1915.

B1.2.10 Germany

For Germany, we use capital share estimates from Piketty and Zucman (2014). The main reference for their series is Hoffmann (1965), a standard source in German economic history which has factor share estimates for 1850–1959.[33] These data present total wage incomes and total capital incomes at factor cost. It is not possible to adjust for the self-employed. These data are problematic; Fremdling (1995: 78) claims that "the Hoffmann figures contain serious biases, if not even fundamental miscalculations". For the period since 1925, the German public statistics bureau, Statistisches Bundesamt presents data, with a gap during the Second World War (*Statistiches Jahrbuch* 2012, table 12.1).[34] The series is for the total economy, includes all types of employee compensation, and including employer contributions to social insurance systems, and its denominator is national income. Piketty and Zucman's (2014) capital share data are presented in Table DE.3d: "Summary macro variables, 1870–2011 (annual series)". Their main source for the 1870–1914 period is Hoffmann, but some adjustments are made (Piketty and Zucman 2013b: 78–79). There is some literature on functional income distribution in Germany: Peffekoven (1965) and Ritschl (2004) discuss determinants of wage shares over the course of the 20th century, and Dinckelacker and Mattfeldt (n.d.) analyse profit rates from 1850 to 1913. Demeulemeester et al (2011) discuss wage sums from 1810 to 1989.

B1.2.11 Ireland

The earliest national accounts data for Ireland from the income side are Kiernan (1933) for

[33] The data has been digitalized by the Historical Statistics project at the data provider GESIS (http://www.gesis.org/histat/).
[34] The German public statistics bureau began publishing National Accounts in 1928 (Jostock 1955).

1926 and McCarthy (1952) for 1938 and 1944–1949. No correction for the self-employed is possible from this data. Kiernan (1933) includes all farmers in the wage-earner class and so the capital share that we can calculate with his data only builds on rents, profits and interest. This is 24 per cent. We may compare this with our estimate for 1938 based on the later study by Hughes (1975), 26 per cent. Maybe capital shares were really similar in 1926 and 1938? One way to look if this makes sense would be to compare with top income shares. However there are no top 1 or top 10 percent shares as early, only top 0.1 percent shares. This increases from 4.7 per cent in 1926 to 6.0 per cent in 1938, so moves the same way as the capital share. However comparisons based only on two isolated years are problematic; Bielenberg and Mahoney (1998), who also provide a thorough discussion of Kiernan (1933) and other early 20th century national accounts for Ireland, point out that 1926 was a rather bad year for the Irish economy. Given that profits tend to fall faster than wages during recessions, at least during the early stages, this might mean that the capital share of the Irish 1920s is underestimated when looking only at 1926. Follow-ups on Kiernan's paper estimated GDP from the expenditure side rather than the income side (see Duncan 1940) so are not useful for our purposes. McCarthy's (1952) data for 1938 and 1944–49 do not include separate estimates for the incomes of the self-employed, so do not allow correction for this factor. The construction of the data for 1938 and 1944–49 is discussed in Linehan and Lucey (2000). A 2010 symposium in *Irish Economic and Social History* also provides discussions by Cullen, Begley and Bielenberg on "The context and development of historical national accounts in Ireland", "Irish income tax returns as a source for GDP estimates for Ireland, 1853–1914", and "The current position and further options for developing historical national accounts for Ireland, 1850–1921" (Cullen et al 2010).

The first truly useful Irish data for our purposes comes from Hughes' (1975) presentation of national accounts data for 1938–1970. With Hughes' data it is possible to correct for the self-employed, for 1938 and the years after 1944. We use the proportional correction (65 per cent labour, 35 per cent capital) discussed in section A1.1 and link this adjusted series from Hughes' data 1938–1959 with data from AMECO (100-adjusted wage share) for 1960–. For the overlapping years 1960–70 the two series are quite similar (correlation 0.47), increasing slightly (two-three percentage points) 1960–66 and then falling back slightly 1966–68, and increasing slightly 1968–70.

There is little discussion of wage and capital shares in Ireland; one exception is Lane (1998) on the post-1987 period when wage shares decreased in a remarking way. A group of economic historians proposed a project that would estimate national income from 1850 to 1910 but so far this has not been funded (Dickson 2001). Cullen (2000) is a related study which discusses national income estimates for 1911 and possible backward extensions.

B1.2.12 Japan

For Japan, where we have top income data back to 1886, we link capital share estimates (as 100-wage share) for the non-agricultural sector for 1906 to 1955 from Ohkawa and Shinohara (1979, table A47) to capital share estimates in factor-price national income from Piketty and Zucman (2014) for 1955 to 2010. The earlier data are discussed in Minami and Ono (1979); see also Ohkawa (1968). The wage share is calculated as total wage income, including imputed labour incomes of the self-employed, as a share of distributed income, which is the sum of all wage income as above, corporate income and interest, and the imputed capital incomes of the self-employed. Then the capital share is calculated as the residual. Since the wage share is calculated as a share of distributed income, this is a net measure. Minami and

Ono (1979, p. 205) explicitly focused on non-agriculture because calculating factor shares in the agricultural sector is difficult. Labour incomes of the self-employed have been calculated using the labour method of adjustment (see section A.1.1.), imputing the average wage in the non-corporate sector for all self-employed, and counting the rest of their incomes as capital income. Minami and Oro (1979, p. 207) show with postwar data that for industry it doesn't make much difference whether the labour method or the capital method is used. In the service sector differences are bigger but unsystematic. For the overlapping years 1955 to 1970 the correlation between the Ohkawa and Shinohara series and the Piketty series is quite strong: 0.91. This despite that one figure is for non-agriculture and the other for the total economy and that in 1955 agriculture stood for 36 per cent of civilian employment; this figure rapidly dropped in the postwar period, to only 10 per cent in 1980 (OECD ALFS Summary Tables).

To calculate the gross capital share, we use the same wage sum as used above. We relate this to GDP at market prices less agriculture and government consumption (GDP from table A7, agriculture calculated from GDP using the share agriculture has of NDP according to table A10, government consumption according to table A1. This procedure is not ideal neither in its measurement of agriculture nor in its measurement of the government sector, and it is unfavourable that the GDP estimate is at market prices. Nevertheless, given the data that we have, it is what we can do.) Both capital shares rise from 1906 to 1917 and then fall drastically; the gross capital share increases continuously from 1923 to 1940 while the net measure is more stable. In the post-war period the gross measure is significantly higher. Both increase from 1955 to 1962, then fall back slightly. The correlation between the two is -0.06 which is a sign that the measurements are not perfect. The problems of the gross capital share estimation means that we do not use it yet; in the paper we only use the net estimate.

Regarding previous discussion of the evolution of the capital share in Japan, Minami and Oro (1979) find a decreasing wage share in the early 20th century, a jump up c. 1916–25, then a decline until WW2, and then a higher level in the 1950s and 1960s after a hole in the data during WW2. They point to that they lack data for some types of capital incomes: land and house rents, and imputed interest. For this reason, the estimate of wage and capital shares are more precise in industry than in the economy as a whole (p. 217).

B1.2.13 Mexico

For Mexico, we use Frankema's (2010) capital share estimate from 1900 to 2000. For methodology see discussion under Argentina above.

Frankema's series, which puts all income of the self-employed into the capital income share, varies between 20 and 50 per cent for the 1900 to 2000 time period. It declines c. 1900–1915, gthen increases steadily until the mid-1930s, then decrases again around 1940 and is at a low level in the 1940s and 1950s, and then finds a new high level in the 1960s and 1970s before decreasing heavily from the mid-1970s on, finding a historically low level at the end of the 1990s. The decrease in the wage share in the 1940s is quite idiosyncratic and seems to be driven by high wartime export incomes and high inflation which eroded real wages (Frankema 2010, p. 362). Frankema's (2010, p. 266) explanation for the fall from the mid-70s on is high inflation and a market-friendly shift in economic policy focusing on increasing competitiveness and profits, similarly to what happened in Brazil (see above).

B1.2.14 The Netherlands

For the Netherlands we calculate factor shares data from 1921 to 2010 from the national accounts of the public statistics bureau (*National accounts of the Netherlands 2010*, table H 2, pp. 175-6). Smits et al (2000) have data for 1807–1913 but since the top income data begin in 1914 this does not help us. The 1921–2010 series is available both gross and net and both at factor cost and at market prices. Both series are only available for the total economy, not sector-wise. It is not possible to make an adjustment for the self-employed, as their incomes are not presented separately, but just in a "operating surplus/mixed income" post, i.e. together with all capital incomes.

B1.2.15 New Zealand

For New Zealand, we have the necessary national accounts data for capital share estimates back to 1922.[35] Hussey and Philpott (1969) present these data, unfortunately only for the agricultural sector, for the 1922 to 1967 period.[36] They present four series: Estimate of total wages paid, Estimate of Interest paid, Estimate of Rents Paid, and Estimated total output. We have estimated the capital share as interest and rents as proportion of output. It is possible to link this series to "Gross operating surplus: total economy (UOGD)" divided by national income from AMECO. Unfortunately the two series show quite different trends in the overlapping years 1960–67: according to Hussey and Philpott (1969) capital share is increasing in agriculture in the 1960s, while according to AMECO data the capital share in the economy was falling in the 1960s. We need to do further work here to be able to link earlier and later estimates. Fisher (1930) in a very different project presents GDP from the income side for 1926, based on income tax data. He was interested in inequality but focused on size distribution rather than functional distribution. Similarly, Stephens (1937) estimated national income for 1925 to 1931; Chapple (1994) is a later study of the interwar period national income.[37] Lineham (1968) estimated GDP from the income side for 1919 to 1938 but frustratingly enough does not present the wage sums and value added data; instead he only presents the GDP estimates.[38]

As for discussions of the determinants and variations of factor shares in New Zealand, Woodfield (1973) discusses the wage share in manufacturing in the post-war period. Bertram (2001) discusses factor shares in New Zealand with the hypothesis that "the 1984 election marked the end of a long period of relative gains for labour at the expense of capital", and that labour market reforms after 1984 contributed to an increase in the capital share. In New Zealand the wage share increased drastically in the 1970s and the end of that decade and

[35] As in other countries the main method of historical national accounts here is to do them from the expenditure side. See Rankin (1992) on 1859 to 1939. Greasley and Oxley (2000) comment that there are GDP estimates back to 1859 even though their reliability is disputed. They also note that: "spot estimates for New Zealand national income have been made for the years 1865, 1898/99, 1902/03, 1925/26, 1932/33, and 1938/39" (p. 351-2)

[36] Philpott's (1958) "Capital, Income and Output in New Zealand Agriculture 1922-1956" is a precursor.

[37] Rankin (1994) provides a discussion of Chapple's paper, focusing partly on the relation between median earnings and GDP.

[38] One alternative way forward, maybe far-fetched, would to make a new estimate for capital incomes and relate that to national income. Dowie (1966) has capital stock for 1871-1900 which should be possible to link to capital stocks for the first half of the 20th century. Then one would need rate of return on capital. Greasley and Oxley (2005) have land rent to wage ratios for 1878-1939 and possibly spot estimates for rates of return – from Fisher (1930), Stephens (1937) or so – could be extrapolated using the land rent-wage ratio.
Possibly the official publication *Official Statistics of the Colony of New Zealand* could be used for the late 19th century.

beginning of the 1980s saw a debate on this profit squeeze (Bertram 2001), quite similarly to the situation in Denmark (see discussion above).

B1.2.16 Norway

In Norway national accounting began in the late 1940s, with work on data back to 1930 (Grytten 2004: 242). The first publications came in the early 1950s (cf. Aukrust 1952, 1957), and during the 1960s the national accounts were extended backwards to cover the entire period since 1865 (Statistisk Sentralbyrå 1965). From the early publications it is possible to calculate unadjusted wage shares for 1930–1955 (Aukrust 1957); from the SSB 1965 publication it is possible to calculate (proportionally) adjusted wage shares for the years 1930–1960, with the war years missing. It is also possible to make own estimates of the unadjusted wage share back to 1910, using the latest estimates of wage sums and GDP. Hansen and Skoglund (2005, 2008a, 2008b) have new estimates of wage sums that revise the previous estimates from the 1960s, and Grytten (2004) has a newer GDP series. In this paper we calculate our own unadjusted wage share series back to 1910, based on the data from Hansen and Skoglund and Grytten. This adds twenty years of data and increases the precision of the estimates compared to the adjusted series one can calculate back to 1930 based on the publications from the 1950s and 1960s (Aukrust 1957, Statistisk Sentralbyrå 1965); the drawback is (a) that no adjustment is made for the incomes of the self-employed and (b) that the denominator is GDP at market prices, not at factor cost. We link the unadjusted estimate for 1910–59 to unadjusted data from AMECO (100-unadjusted wage share).

B1.2.17 Sweden

For Sweden, we estimate capital shares 1900–2000 from Historical National Accounts data by Edvinsson (2005). We calculate the adjusted capital share of the whole economy 1900–2000 from Edvinsson's data. This is the adjusted capital share; gross surplus (which includes imputed capital income of self-employed) divided by GDP. We link this capital share series to an estimate from AMECO data for the years 2001–2010 (100 less adjusted wage share). The correlation between the Edvinsson estimate and the AMECO estimate for the overlapping years 1980–2000 is 0.95.[39]

There are a few studies of functional income distribution in Sweden. Schön (2004) who looks at the 1870 to 2000 period claims that it follows Kondriatev cycles while Bengtsson (2014), using data for 1900–2000, criticises this perspective, claiming that it lacks foundation in the data, and that a power oriented perspective explains the distribution better. Previously especially Jungenfelt (1966) studied long-run wage shares: he created data series and analysed them from a neoclassical perspective. Fridén (1965) analysed wage shares from 1948 to 1963.

B1.2.18 United Kingdom

For the U.K., annual capital share data are available from Piketty (2013: tableau UK.11a) for 1855–2010. The 1855–2010 series uses national income at factor cost in the denominator and allows one to include imputed labour incomes of the self-employed in the wage share. We use the series "Capital share in national income" from Table UK.11a: "Structure of national income in the U.K., 1855–2010: capital & labor shares in national income".

[39] The difference between them is probably due to a difference in the size of imputed labour incomes of the self-employed: after 1970 this increases quicker with Edvinsson's data than in AMECO.

There are surprisingly few long-run analyses of capital shares in the UK but Phelps Brown and Weber (1953) look at the 1870 to 1938 period, Feinstein (1968) does the analysis back to 1860, and Fiorio et al (2013) analyse 1950 to 2010. There is a sizeable heterodox economics literature on capital shares and profitability in the U.K., including Henley (1989) on the 1963 to 1985 period and Brown and Mohun (2011) on the interwar period. There are quite a few sectoral studies, including Cowling and Molho (1982) for the postwar period. Ryan (1996) looks at capital shares for the UK from 1947 to 1994 and relate them to inequality.

B1.2.19 United States

For the United States, capital share data is available from the Bureau of Economic Analysis (BEA) at the Department of Commerce going back to 1929.[40] BEA's National Income and Product Accounts Tables (NIPA) allows one to find the shares of national income for "wages and salaries" or "total employee compensation", as well as "corporate profits". The incomes of the self-employed are a category of its own. We calculate capital share in factor price national income excluding government interest payments and including capital share of self-employment income. There are two differences in method between our estimates and Piketty's. The first one is the type of adjustment for the labour incomes of the self-employed. We use the proportional adjustment with a 0.35–0.65 split; they assume that the split within the self-employed income sum is the same as in the corporate sector for the given year (Piketty and Zucman 2013b: 51). The second is that they use capital incomes as share of net value added while we use gross value added. A further challenge is to calculate wage and capital shares before the start of the official national accounts in 1929. Kravis (1959) has presented calculations for the 1900–1957 period, Phillips (1960) and Budd (1960) for every tenth year from 1850 to 1910. Robert F. Martin had more frequent wage share data for the 19th century in his book *National Income in the United States*, 1799–1938, and Johnson (1954) had data from 1850–1952. Lebergott (1964) and Haley (1968) provide critical discussion of the estimates. In general the data before 1929 are much less reliable than the BEA data, but it might still be worth looking at what can be done.

Given the importance of the United States for economic research and how often the US is used as a case for developing economic arguments and models, it is not surprising that there are quite a few studies of factor shares in this country. In the 1950s and 1960s a host of studies were devoted to this topic, under the influence of the classical theoretical debate on whether factor shares are stable or not – Solow's (1958) "skeptical note on the constancy of relative shares" was influential here – as well as practical concerns about fitting production functions empirically. Kerr (1954) is an example of a US study which takes its starting point in 1929 when the NIPA data begin, while Phillips (1960) takes a more historical approach, starting in 1850 and relying heavily on census data. Many studies in the 1960s focused on the industry level to explore the importance of factors such as capital intensity and unionization by looking at differences among industry sectors (e.g. Simler 1961, Moroney 1966, Ferguson and Moroney 1968). Keller (1973) provided an interesting economic history view of the 1920s, claiming that "the analysis of factor income shares is an excellent vehicle for uncovering important structural changes" (Keller 1973, p. 253). Schuller (1953) looks at the 1869 to 1948 period.

A second stream of factor share analyses for the US came in the 1970s and 1980s from

[40] There are earlier data available for the U.S., but perhaps not yearly; Phillips (1960) has data back until 1850, for every tenth year (census years) during the 19th century (cf. Budd 1960).

economists with Keynesian and Marxist perspectives. Examples of this approach are Weisskopf (1979) and Wolff (1986) who both discuss the post-1945 period from a Marxian perspective.

A third stream of US factor share research has come since the late 1990s with studies including Poterba (1998) on the period from 1959 to the 1990s and Krueger (1999) whose main focus is how to measure the wage share, but who also applies his discussion on the US since 1939, using NIPA data. Young (2010) uses sector data from 1958 to 1996 to demonstrate that, in line with Solow (1958) and contra the economics textbook claim that "the shares of labor and physical capital in national income are nearly constant," factor shares aren't stable over time. In the early 21st century there has been a stream of papers devoted particularly to the fall in the wage share (and the corresponding rise in the capital share) since the 1980s. Among them are Kristal (2013) who explores the role of computerization and unionization, and Elsby et al (2013) who show that the method for reporting of labour incomes of the self-employed might overstate the fall in the wage share.

B1.2.20 Summary

Appendix table 1 summarizes the main capital series for our 19 countries, with a focus on the differing definitions. The table gives information on year of coverage, source, sector, whether the series is adjusted for self-employed or not, and if the estimates consider capital depreciation or not. If nothing different is mentioned, then series which end before 2000 are linked to later day estimates from AMECO.

Please note that in the column "correction for self-employed", a "no" means that all incomes of the self-employed are counted as capital incomes, thereby overstating the "real" capital share compared to the ideal methodology discussed above. As we have some series without such a correction, naturally the levels are not always comparable.

There are (at least) two possible empirical ways forward in improving the data set. The first is to make our series more comparable and reliable in different ways. The second is to add more countries, even if this is unlikely to change the overall picture. Both are discussed below.

To enhance comparability and reliability of our series, the following are possible ways forward. For Australia before 1948 and Norway before 1930, series are for manufacturing only, and for New Zealand before 1960 they are for agriculture. If possible, it would be advantageous to add estimates for the whole economy. Furthermore, for Australia, Austria, Japan, the Netherlands and Norway before 1960 (1950 in the case of Japan) we have no estimates corrected for the self-employed. While this likely does not matter much in the manufacturing sector proper where the proportion of self-employed is low (cf. Lebergott 1964), we should be able to locate estimates of the number of self-employed and make adjustments for them. A third issue is that it would be preferable to work with the capital share both of gross and net value added. This is quite data demanding, but still preferable. The countries where we need to get the capital depreciation data to calculate net shares are Argentina, Australia, Austria, Brazil, Denmark, Finland, Mexico, and Norway.

Another question is to add more countries. We do not believe that this would change the results of the paper in a substantive way, but it would still be empirically interesting. For Belgium as discussed we have data for 1920 to 1939 but since we have no top income data

there we have not developed this; however, possibly more should be made with the case of Belgium, also incorporating data from Peeters et al (2005) and van Meerten (2003). For Israel, Fishelson (1974) analyses wage shares from 1952 to 1969. It might be possible to calculate wage shares for Italy back to 1920; see Bardini et al (1995) for discussion on historical national accounts there. Capital shares can be calculated for Russia from 1885 to 1913 from data in Gregory (1983). Prados de la Escosura and Roses (2009) have estimated factor shares for Spain back to 1850. Brenner et al (1991: 36) have data for Switzerland every tenth year back to 1910, but unadjusted for the self-employed, and Hartwig (2012) analyses wage shares back to 1950 from a Post Keynesian perspective. Rothschild (1972) in a report for the UN has data for the 1950 to 1965 period; possibly these data can be used for the 1950s.

For Norway and the United States the data series can also be extended further back in time. For Norway, where we now begin in 1910, work is being done to extend estimates back to the 1860s.[41] For the US, where we now begin in 1929 when the official NIPA data begin, as discussed above there are many un-official estimates before 1929 too.

B2. Top incomes data

As described in our paper, all our series on top income shares are collected from the World Wealth and Income Database, and they come from careful country analyses made by numerous researchers. For overviews of the sources, methodologies and problems related with sources and measurement approaches, see Atkinson and Piketty (2007, 2010), Leigh (2009), Atkinson, Saez and Piketty (2011) and Roine and Waldenström (2015). In our study we highlight some of these problems with specific attention to their relevance for our investigation.

[41] By Kristine Vikesund, PhD student at Statistics Norway.

Appendix Table B1. The nineteen series

	Years	Source	Sector	Correction for self-employed?	Gross or net
Argentina	1913–2000	Frankema	Whole economy	No	Gross
Australia	1926–27 1948–67	Richards	Manufacturing/ Whole economy	No	Gross
Austria	1913–1963	WIFO	Whole economy	No	Gross
Belgium	1920–1939	Buyst	Whole economy	Yes	Either
Brazil	1920–2000	Frankema	Whole economy	No	Gross
Canada	1926–1976	Leacy	Whole economy	Yes	either
Denmark	1875–2005	Abildgren	Whole economy	Yes	Gross
Finland	1860–1985 OR 1900–2010	Hjerppe, Tiainen	Manufacturing (H), whole economy (T)	In the wage share (H), yes, labour method (T)	Both
France	1820–2010	Piketty	Whole economy or corp. sector	Yes	Either
Germany	1870–2010	Piketty and Zucman	Whole economy	Yes	Either
Ireland	1938–1970	Hughes	Whole economy	Yes	Either
Japan	1906–55, 1950–2010	Ohkawa and Shinohara, Piketty	Non-agricultural, Whole economy	No (before 1950)	Either
Mexico	1900–2000	Frankema	Whole economy	No	Gross
The Netherlands	1807–1913 and 1921–2010	Smits et al and National Accounts	Whole economy	No	Either (NA)
New Zealand	1926–1968	Fisher, Stephens, Hussey and Philpott	Whole economy, agriculture (HP)	No	Gross
Norway	1927–1992, 1930–1955	Statistics Norway, Aukrust,	Industry (SN), whole economy (Aukrust)	No (both)	Gross (both)
Sweden	1850–2000	Edvinsson	Whole economy or per sector	Yes	Either
United Kingdom	1855–2010	Piketty	Whole economy	Yes	Either
United States	1929–2011	National Accounts	Whole economy	Yes	Gross/Either

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