Capital shares and income inequality: Evidence from the long run*

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Abstract

This paper studies the long-run relationship between the capital share in national income and top personal income shares. Using a newly constructed historical cross-country database on capital shares and top income data, we find evidence on a strong, positive link that has grown stronger over the past century. The connection is stronger in Anglo-Saxon countries, in the very top of the distribution, when top capital incomes predominate, when using distributed top national income shares, and when considering gross of depreciation capital shares. Out of-sample predictions of top shares using capital shares indicates several cases of over- or underestimation.

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1. Introduction

Much research over the past decades 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 Thomas Piketty (2014), 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, Peter Lindert (2014) takes stock 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] Branko 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 this discussion is that it pays little attention to the possibility that the link between factor shares and inequality is not stable, but instead dependent on a multitude of factors that can change over time along with the rest of society.[2] The theoretical models linking factor shares and income inequality actually show that the link is contingent on the production technology, the structure of personal incomes or the institutional context, all of which are factors that may – and do indeed – change over time.[3]

The importance of time for understanding the link between factor shares and inequality is also emphasized by recent empirical research showing how the balance between labor and capital varies across historical eras. 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, 2017). Looking at the micro level, studies of trends in the income distribution show that capital income became less important as an income source over the twentieth century but is now becoming more important

[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.

again in several countries, possibly contributing to the observed current secular increase in inequality (Atkinson and Piketty, 2007, 2010; Brandolini and Smeeding, 2009; Roine and Waldenström, 2015).

In this paper, we make two main contributions to the literature. First, we present a new database on historical wage and capital shares for 21 countries going back to at least the 1930s and in several cases the middle of the nineteenth century. These 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]

Our second contribution is to analyze empirically 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, Paul 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, Emilie Daudey and Cecilia García-Peñalosa (2007) and Daniele 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., Anna Fräßdorf, Markus M. Grabka and Johannes Schwarze (2011), Eva Schenkler and Kai Schmid (2013) and García-Peñalosa and Elsa 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 Olivier Blanchard (1997) and subsequent analyses of Andrea Bassanini and Thomas Manfredi (2012) and Loukas Karabarbounis and Brent 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. 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 an analytical framework that outlines the theoretical links between the capital share and top income shares as well the empirical methodology used. Section 3 describes our new capital share database, the top income data and the other variables used. Section 4 presents the main investigation, section 5 examines mechanisms that are behind the link and section 6 presents robustness checks and extensions. Section 7, finally 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). Anthony B. Atkinson and François 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) discusses this question and shows that if one defines λ as the relationship between wage income dispersion and capital income dispersion, i.e., $\lambda = V_k/V_w$, then a rise in the capital share will raise total income inequality when $\alpha > (1-\lambda\rho)/(1+\lambda^2-2\lambda\rho)$. Assuming that capital income is twice as dispersed as labor income, a rising capital share will increase 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

[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.

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 correlation is positive, an even lower capital share is required to make inequality rise under an increasing capital share. 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.

The relative importance of capital and wage income dispersion for how the relationship is also indicated by equation (1) with the main message being that capital income dispersion matters more. To see this most clearly, consider the extreme cases when either capital incomes or wage incomes are not dispersed at all. When wage income dispersion is zero and capital income dispersion positive, a rise in the capital share will increase overall income inequality but when capital income dispersion is zero the same rise will lower overall inequality.

Other models of the link between the capital share and inequality 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:

$$\ln IncomeIneq_{it} = \beta_0 + \beta_1 \ln CapitalShare_{it} + \varepsilon_{it} \ , \qquad (2)$$

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 equation 1) in value added 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]

In addition to the baseline equation (2), we also amend the projected relationship between the capital share and top income shares by accounting for the influence of other factors, some fixed and specific at the country level and others varying over time:

$$\ln IncomeIneq_{it} = \beta_0 + \beta_1 \ln CapitalShare_{it} + \boldsymbol{X}'_{\boldsymbol{it}}\delta + \mu_i + t + \varepsilon_{it} \ . \qquad (3)$$

In equation (3), we add $\boldsymbol{X_{it}}$ as a matrix of control variables, μ_i being country fixed effects that account for time-invariant and unobserved influences and t being a linear time trend common to all countries. The reason that our baseline estimations do not include any of the confounders in $\boldsymbol{X}$ is that we are primarily interested in the correlation between capital shares and income inequality. Including the additional controls shows how the relationship looks when being contingent on factors that determine either or both of the distributional outcomes in focus. 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 is 5-year averages rather than yearly observations because the latter tends to be quite noisy which may affect the estimations of the relationships of interest. In the Results Appendix we present all of the results using annual observations, and generally there is little

[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.

difference between the two cases. Including fixed country-effects is potentially important because most of the time series are consistent within countries, whereas the comparability across countries is lower. This also implies that the estimated relationship changes to be identified on within-country variation since the fixed effects demean the series.

3. Data

We introduce a new historical database on homogenously calculated capital shares covering 21 countries, adding 17 to the ones presented in the Piketty and Gabriel Zucman (2014) dataset. Along with data for Britain, the United States, France and Germany for which Piketty and Zucman present long-run series, we add, based on historical national accounts, capital shares for Denmark and Sweden since the mid-nineteenth century, Finland, Mexico and Spain since 1900, Japan since 1906, Norway since 1910, Australia and Italy since 1911, Argentina and Austria since 1913, Belgium, Brazil, Canada, and the Netherlands since the 1920s, Ireland since 1938, and New Zealand since 1939. Because we lack top income data for Austria, Belgium, Brazil, Italy (before 1974) and Mexico, these countries are not part of the analysis of the present study. However, the full database will be an important resource for further research on factor shares and historical macroeconomics.

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, there exist differences in these data series, of which two are particularly important. One concerns how to account for the incomes of the self-employed, a group whose incomes can be considered both as wages and as capital income. Since the share of self-employed among the economically active varies so much over time (not the least when agriculture's share of the economy shrinks), calculating factor shares without considering the self-employed can give quite misleading pictures of the factor share developments. (Cf. Kravis 1959, Elsby et al. 2013.) Factor share estimates should therefore be 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. Typically, the adjustment is made by counting one third of the self-employed incomes as capital income and the rest as income of their own labor.

A second measurement issue is whether to use estimates of capital shares *gross or net of capital depreciation*, i.e., if capital income should be related to gross value added or the value added net of costs accruing to the consumption of fixed assets. This question has been previous discussed by several authors, e.g., Andrew Glyn (2008), Benjamin Bridgman (2014), Piketty (2014), and Karabarbounis and Neiman (2014b). The majority among these scholars argue that the net capital share is a more appropriate measure if one wishes to study income flows reaching the final users, i.e., capital-owning households; Glyn (2008, p. 108) calls the net measure the appropriate measure if one wants to understand "who gets what". However, the estimation of net capital shares incurs the estimation of capital depreciation rates, which adds measurement uncertainty to the series. Capital depreciation can vary because of taxation incentives and the like; moreover, during turbulent episodes, capital depreciation can be highly volatile. For these reasons, a key advantage of our dataset is that for all countries but three (Argentina, Brazil and Mexico) we present both gross and net measures. This means that we can run all analyses with gross and net capital shares to ascertain that this measurement issue does not change the results.

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.[8]

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. 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 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.[9] Jesper Roine and Daniel 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 Salvatore 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,

[8] 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).

[9] 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.

stock market capitalization as share of GDP and government spending (central government spending as share of GDP). The sources for these variables are Roine, Jonas Vlachos and Waldenström (2009) and Roine and Waldenström (2015) and the references therein.

4. Main results

This section presents the main analysis of links between the functional and personal income distributions. We present evidence on the overall association, differentiating between different top groups, the role of top capital vs wage incomes and different measures of inequality.

4.1 Correlation evidence

We begin by depicting the long-run evolution of the net capital share and top percentile income shares in the 16 countries for which we have both data series. The patterns are not uniform across countries; there are substantial differences in levels, trends and in the degree of variability of the series. The net capital share lies mostly between 20 and 30 percent of value added, but one fifth of values are either below 15 percent or above 40 percent, signifying the large variation. The top 1 percent income share also varies over time, and in several countries there is a clear co-variation between the two series even though there are also cases where this is not the case.

[Figure 1 about here]

In order to get a more systematic sense of the association between capital shares and top income shares, Table 1 shows Pearson correlation coefficients by country for the entire time period as well as three sub-periods: pre-1945, 1950–1980, and post-1980. The main message is that the functional and personal income distributions are positively correlated. In 13 of the 16 countries, the correlation is 0.50 or higher and highly statistically significant. In the US, the correlation is only 0.28 (but higher for sub-periods). The two major outliers are Argentina, which has an insignificant negative correlation at –0.31, and Canada where the correlation is –0.37 and significant. 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]

4.2 Panel regressions: Baseline results

The next step is to panel regression analysis to examine the association between capital shares and top income shares. This gives more structure, allows us to hold country-specific influences constant, add constants or common time trends. Table 2 shows the baseline results from panel regressions of equation (2) using annual and 5-year averaged observations and separating results for net and gross capital shares.

Beginning with the net capital share results (panel a), over the whole country sample there is a positive and statistically significant coefficient between the logged top percentile income shares and logged net capital shares, at 0.732 and 0.998 in the annual and averaged samples, respectively. This conditional correlation is lower and even insignificantly different from zero in the pre-WWII era, whereas it is higher at around 0.5 in the postwar eras.

The table also shows the conditional correlations for three country groups: Anglo-Saxon (Australia, Canada, New Zealand, Ireland, UK, US), Continental European (France, Germany, The Netherlands) and the Nordic countries (Denmark, Finland, Norway, Sweden). Long-run coefficients are relatively similar across country groups, being positive and significant between 0.5 and 1.0, i.e., in the same neighborhood as the full-sample coefficients. Looking at the sub-periods, the groups appear to differ in their trends but standard errors are too large for any strong conclusions to be drawn. Continental European and Nordic countries exhibit fairly large and positive correlations in all sub-periods, with a tendency of falling coefficients over time where the lowest estimates are recorded in the post-1980 era. By contrast, Anglo-Saxon countries exhibit an increasing trend with the smallest coefficient recorded in the period before the Second World War and largest in the recent era.

Using gross capital shares (panel b) generate largely similar patterns but with larger estimated coefficients. In the full-country sample, the long-term coefficients are above unity, between 1.192 in the annual data and 1.395 in the five-year averaged data. The sub-period estimates are also higher when using gross capital shares. The largest difference is found in the post-1980 era when the gross capital share coefficient is 1.122 compared to the 0.522 for the net

capital share, and this is the one case when the difference is statistically significant.[10] Looking at country groups, we find the same pattern with a stronger association between gross capital shares and top income but there are few cases where the difference is statistically significant. Overall, the main result from this analysis is that while gross and net capital shares differ substantially in levels, their co-movements imply that their association with top income shares are relatively similar.

[Table 2 about here]

4.3 Heterogeneity across top income groups

A recurrent finding in the previous top income literature is that top income earners are not a homogenous crowd. In most countries, there are considerable differences in levels, trends and composition between the earners in the top percentile and those below in the top decile. Some studies have even found large differences within the top percentile. For this reason we rerun the panel regression analysis replacing the logged top 1 percent income share with the log of the 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.

Table 3 presents the results from this analysis, and they confirm that the heterogeneity within the income top carries over to the relationship between the capital share and top income shares. The long-term association over the entire twentieth century was 0.99 for the top percentile. For the Top10–1 it is 0.15, for the Top 1–0.1 it is 0.80 and for the Top 0.1 it 1.56, all significantly different from zero. Across the sub-periods, the pattern is the same, with the top percentile coefficients indicating a stronger relationship than for the lower part of the top decile and even of the top 0.1 percentile, but that the relationship is the strongest in the top 0.1 percentile group.

The table also shows the regression coefficients for different country-groups over the entire century as well as over the sub-periods. Once again, the pattern from the top percentile analysis carries over to the rest of the top groups, but much weaker so for the groups lower down in the top and much stronger in the absolute top. The association is the strongest in Anglo-Saxon

[10] Testing for the difference gives a t-statistic of 1.96 in the year-averaged sample and 2.44 in the annual sample.

countries, especially in the recent era, whereas it is the weakest in the Nordic countries.

[Table 3 about here]

5. Mechanism analysis

The analysis has so far been concerned with assessing long-term associations between the capital share and top shares of total incomes earned. Little has been said about the mechanisms behind this association. The theoretical model discussed in section 2, and in particular equation (1), offers hints to which these channels may be. The importance of household capital incomes is potentially large and the institutional context determining the ways in which individual incomes are formed and distributed could also matter. In this section, we examine some of the most important candidates of mechanisms at play.

5.1 The role of capital incomes in the top

The composition of top incomes has attracted much attention in the previous inequality literature. A main finding in Piketty (2001) and Piketty and Emmanuel Saez (2003), and discussed further and summarized in Roine and Waldenström (2015), is that capital incomes are not only more predominant in the incomes of top earners compared to the rest of the population but that this predominance keeps growing also within the income top. Figure 2 displays the long-run trend in the share of capital income of the top percentile's total income for seven countries. The picture shows how the role of capital incomes in the top has varied over time. Up until the World Wars it was the largest income source in most countries, but after the geopolitical shocks of the twentieth century and rise of high-taxation welfare states, capital owners have given way to high-paid salaried employees in the very top of the income distribution.[11] There are, however, notable exceptions 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 about here]

[11] 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).

We run panel regressions using variants of top capital incomes on a subset of countries for which detailed compositional information and present the results in Table 4.[12] The findings indicate an overall much stronger relationship when top capital incomes are used than when top wage incomes or top total incomes are used. In panel a, we examine the link using only top capital incomes vs. only top wage incomes, and the full-period coefficients are significantly different: 1.69 and 0.40, respectively. The sub-period analyses show the same pattern with a stronger link between top capital incomes and the capital share throughout. In panel b, we compare the top capital incomes with top total incomes on the same subset of countries, and we find once again that capital incomes make the relationship with the capital share stronger. Even though the full-period coefficients are not significantly different, they are different in their level and when one compares with the baseline coefficient in Table 2, where the standard error is smaller, one indeed gets a significant difference with the top capital income estimate. Lastly, panel c examines the effect of using top total incomes including realized capital gains for a smaller sample of countries for which such data are available.[13] The realized capital gains represent a particular kind 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. The results in panel c show no effect by including realized capital gains.

[Table 4 about here]

5.2 Top income shares in the distributed national accounts (DINA)

The imperfect overlap between the income definitions used in the functional and personal income distributions is potentially one of the key explanations to why the link is not stronger. The functional income distribution refers to shares of *national income*, i.e., the gross domestic

[12] 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.

[13] 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.

product adjusted for cross-border income flows and capital depreciation, and the personal income distribution instead refers to shares of *fiscal income*, i.e., the tax-assessed pre- or post-tax incomes reported to tax authorities and on personal income tax returns. Two recent studies try to overcome this definitional gap by analyzing the distributional national accounts (DINA) over the twentieth and twenty-first centuries: Piketty, Saez and Zucman (2016) on the U.S. and Bertrand Garbtini, Jonathan Goupille-Lebret and Piketty (2016) on France. These studies allocate the entire national income to the adult population by appending the already distributed fiscal incomes with estimated distributions of all other labor and capital incomes that are part of national income but not of tax-assessed income. In the case of top incomes, this addition concerns particularly non-assessed capital income which is primarily non-distributed corporate profits.

Figure 3 plots the capital share against the top percentile income share in the fiscal income distribution (our baseline) and the national income distribution (the DINA approach) for France and the U.S. since the beginning of the twentieth century. The correlation with the capital share is higher for the top national income percentile: 0.78 vs. 0.70 for France and 0.50 vs. 0.28 (recall Table 1) over the whole century. In the sub-periods, the DINA top share is in all cases and the largest difference is France post-1980 with 0.70 vs. 0.47.

[Figure 3 about here]

The implication of the findings using DINA top shares is that adding non-assessed capital income to the fiscal incomes strengthens the link between the capital share and inequality, but there is still not a perfect correlation. However, so far only two countries offer long-run DINA top shares and we can therefore not be more precise in the quantification of the effects.

5.3 Accounting for other determinants

The strong but still not perfect connection between the capital share and top income shares indicates that other factors matter in this relationship, thereby confirming what most theoretical models suggest. Table 5 examines how the relationship is affected by including other determinants of inequality. The results show that the estimated coefficient for the capital share falls from 0.99 in the baseline case to 0.47 when all covariates are included, including a common time trend and country fixed effects. This drop is not surprising since 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. The size of government as measured as central government spending over GDP has little influence on the relationship.[14] Having said this, it is still noteworthy that the relationship between the capital share and the top percentile income share holds up to all these controls, indicating a deep-seated link between the two income distributions.

[Table 6 about here]

6. Robustness and extensions

6.1 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 0.26 (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 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 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 over the different sub-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 5 is notably lower than the same results found above using much larger sample sizes.

[14] 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.

[Table 6 about here]

6.2 Predicting inequality from the capital share

Is the capital share a good predictor of inequality? This question has lurked in the background of much of the previous research on capital shares, going all the way back to Ricardo's famous remarks, but despite this there are few, if any, attempts to examine whether this has actually any empirical bearing. In this section, we take the question to the data using our new historical capital shares database. Specifically, we run panel regressions of the top 1 percent share on the capital share, and in some cases various control variables, but we leave out the country whose top income share is to be predicted. Such an "n–1" approach gives us out-of-sample predictions which can be used both to predict or "post-dict" back in time and to test the reliability of the top income shares produced in each of the countries.

Figure 4 displays graphically the result from the prediction regressions (solid lines based only on the capital share and dashed lines also use other control variables). The overall goodness of fit is a matter of discussion; in most eras the predicted and observed top shares are quite close to each other. The yearly variability is larger in the predicted series based only on the capital share whereas it is lower in the case where we also use other controls to predict. Adding controls does not notably improve the predictions.

An especially interesting pattern concerns the deviation between predicted and observed top shares. Examining the three sub-periods separately the following patterns emerge. First, in the pre-WWII era eight of the 16 countries have a predicted top share that is *lower* than the observed top share in WID. The difference is largest in France, Germany, Sweden, the UK and the US, where observed top shares are almost twice as large as the predicted ones. Second, in the early postwar era the predicted and observed shares are similar except in four countries where predicted shares are *higher*: Argentina, Australia, Japan and New Zealand. In all other countries, the predicted and observed shares are at the same level. Third, in the post-1980 era, predicted shares are *lower* in three countries (Australia, New Zealand and Finland), *higher* in two (Canada and the United States), and at about the same level in the other countries.

[Figure 4 about here]

The interpretation of these prediction results is, to some extent, in the eye of the beholder.

Almost every country has some period where the observed and predicted series diverge, which suggests that the capital share is not near being a perfect predictor of top income shares. On the other hand, the capital-share based predictions can be seen as an out of sample check of the validity of the estimated top income shares. We know that the fiscal statistics on which the top income shares rest leaves out some notable income flows, not least reinvested capital income, and the systematic deviations could therefore indicate systematic under- or overestimations of national top income shares. Interpreted in this way, our analysis indicates a need to revisit some of the presently used top income shares.

7. 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. 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.

However, we need to develop the mechanisms through which exogenous shocks jointly determine the functional income distribution and the personal income distribution.[15] 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. The new Capital Shares Database will be a useful resource in these endeavors and other related research on factor shares, income distribution and historical macroeconomics.

[15] 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: The capital share and top 1% income shares in 16 countries

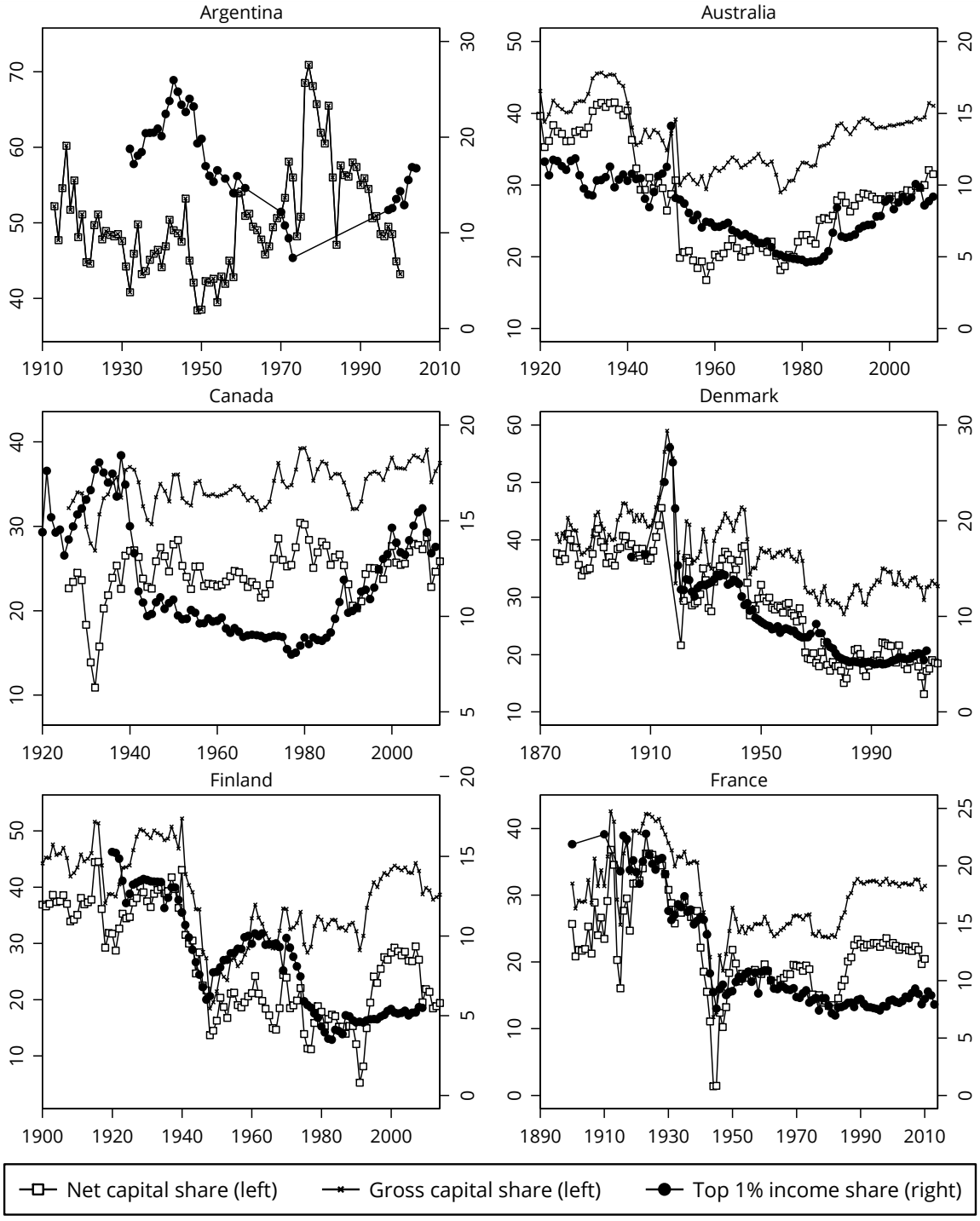


Figure 1 (cont'd): The capital share and top 1% income shares in 16 countries

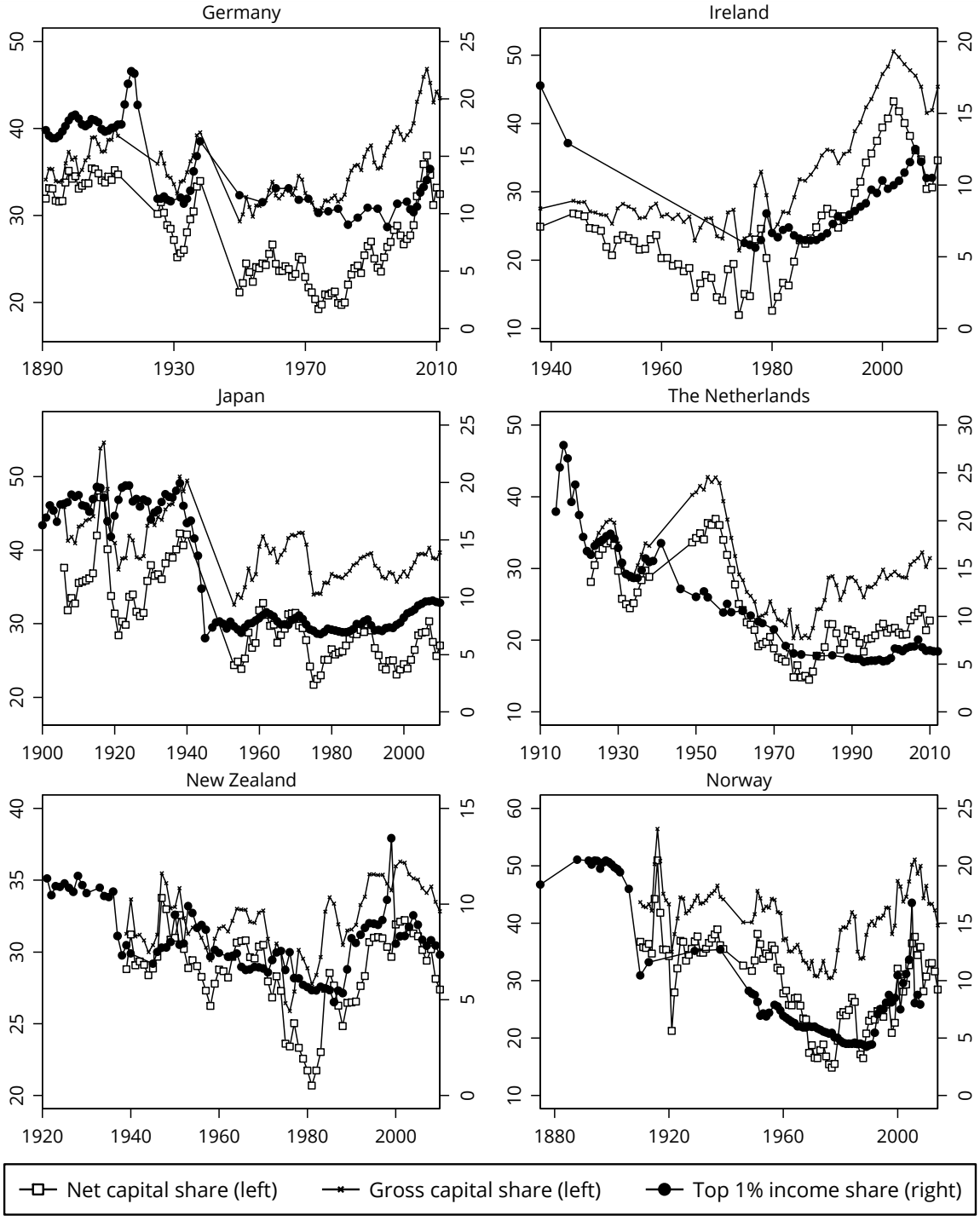
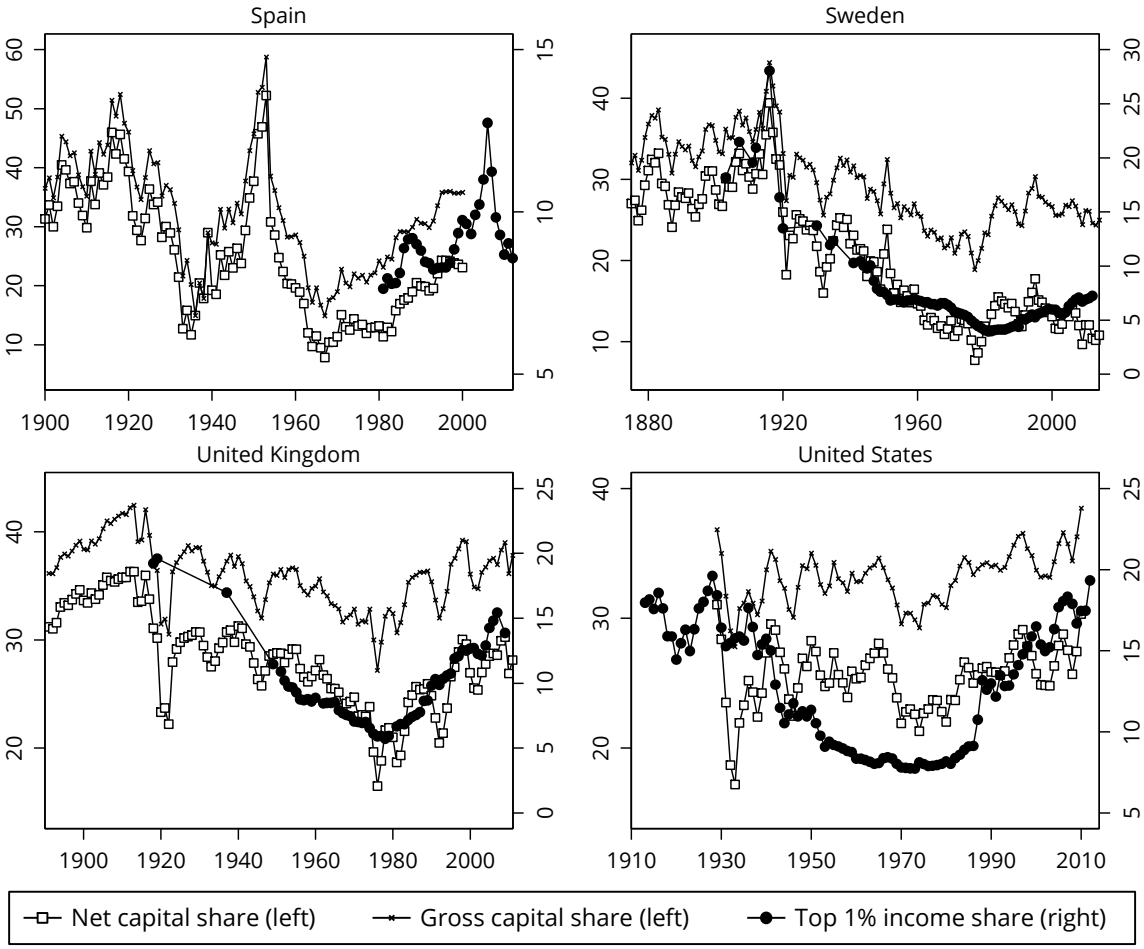
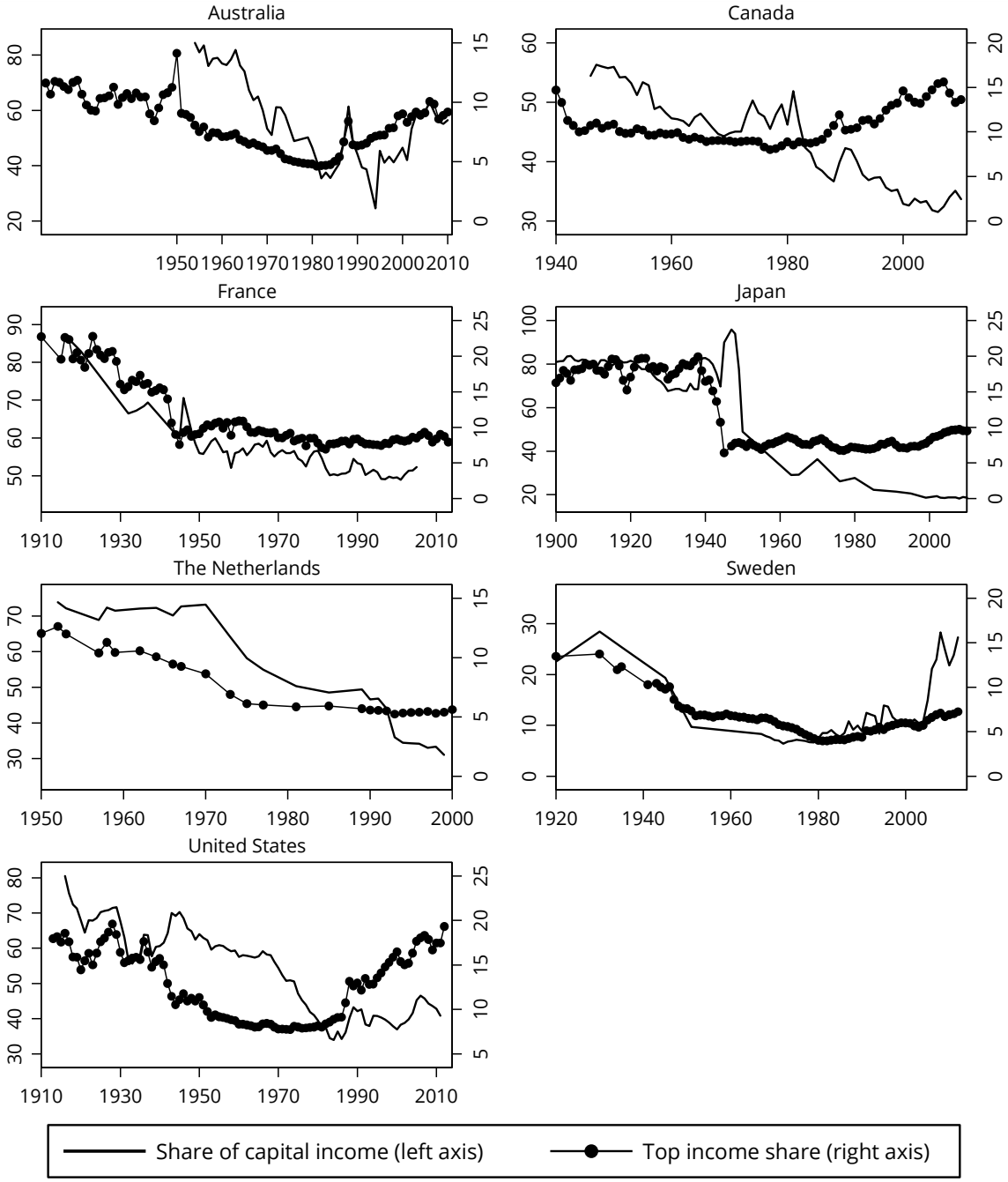


Figure 1 (cont'd): The capital share and top 1% income shares in 16 countries



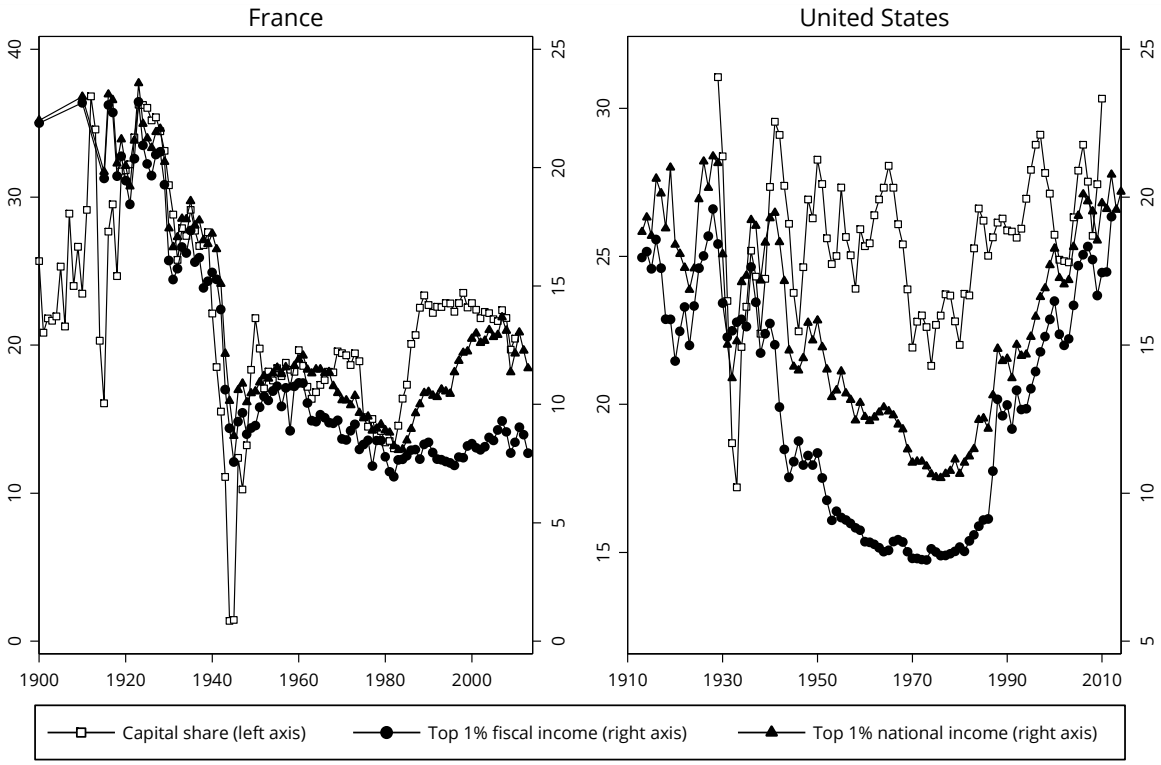
Note: "Capital share" denotes the aggregate share in national value added going to capital and "Top income share" denotes the top percentile's share of total income in the personal income distribution.
Source: Top income shares from the WID and capital shares from Bengtsson-Waldenström Capital Share Database.

Figure 2: Share of capital income in top 1% incomes



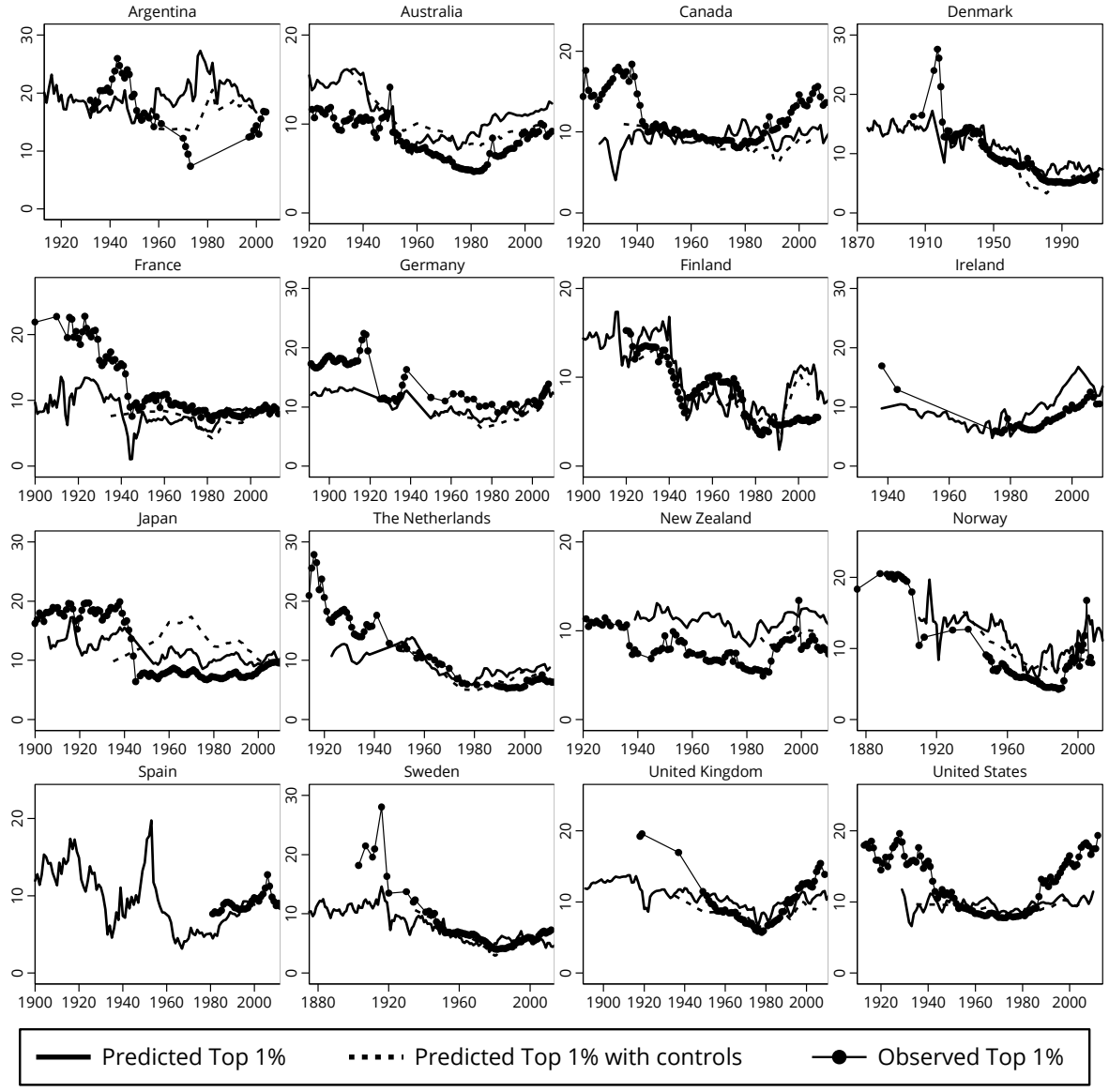
Note: "Share of capital income" denotes how large share of total income earned by the top percentile (ranked according to total income) that comes from capital income (interests and dividends). "Top income share" denotes the top percentile's share of total income in the whole population.
Source: Top income shares from the WID and capital income shares from Roine and Waldenström (2015).

Figure 3: Distributional national accounts top income shares



Note: "Capital share" denotes the aggregate share in national value added going to capital, "top 1 % fiscal income" denotes the top percentile's share of total tax-assessed income and "top 1 % national income" is the same share in national income.
Source: Top fiscal and national income shares from the WID and capital shares from Bengtsson-Waldenström Capital Share Database.

Figure 4: Using the capital share to predict top income shares



Note: See Figure 1 for definitions and sources.

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)	-0.31		-0.82***	-0.99*
		[35]		[13]	[4]
Australia	(1927–2008)	0.75***	-0.45	0.53**	0.86***
		[90]	[18]	[30]	[31]
Canada	(1926–2010)	-0.34**	-0.42	-0.13	0.06
		[85]	[13]	[30]	[31]
Denmark	(1903–2010)	0.88***	0.69***	0.74***	-0.30
		[90]	[20]	[28]	[31]
Finland	(1920–2010)	0.70***	-0.61**	0.52**	0.60***
		[90]	[19]	[30]	[30]
France	(1905–2009)	0.71***	0.24	0.37*	0.47**
		[98]	[26]	[30]	[31]
Germany	(1891–2008)	0.76***	0.88***	0.63	0.79***
		[58]	[35]	[8]	[15]
Ireland	(1900–2008)	0.62***		0.12	0.81***
		[36]		[5]	[30]
Japan	(1938–2009)	0.80***	0.15	0.86***	0.29
		[93]	[33]	[27]	[31]
Netherlands	(1906–2010)	0.78***	0.94***	0.90***	0.61**
		[54]	[16]	[14]	[24]
New Zealand	(1921–1999)	0.53***		0.36	0.66***
		[67]		[29]	[31]
Norway	(1922–2009)	0.67***	-0.47	0.87***	0.67***
		[63]	[4]	[29]	[29]
Spain	(1900–2012)	0.56*			0.56*
		[20]			[20]
Sweden	(1903–2012)	0.91***	0.93***	0.77***	-0.36*
		[81]	[10]	[30]	[33]
U.K.	(1929–2010)	0.73***		0.91***	0.74***
		[60]		[28]	[28]
USA	(1918–2009)	0.28*	0.70*	0.56**	0.61***
		[82]	[10]	[30]	[31]

Note: Pearson correlations for cases with at least 10 observations "Pre-WW2" denotes years before 1939, "Post-war-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 share and top income shares: Baseline relationship

	Annual observations				5-year period averages			
		Historical periods:				Historical periods		
	All years	Pre-WW2	Postwar-1979	1980-present	All years	Pre-WW2	Postwar-1979	1980-present
a) Net capital share								
All countries	0.74***	0.30	0.48***	0.47***	0.99***	0.40*	0.58***	0.60***
	(0.14)	(0.18)	(0.06)	(0.14)	(0.11)	(0.24)	(0.07)	(0.14)
	[1,102]	[215]	[361]	[430]	[268]	[62]	[83]	[100]
Anglo-Saxon	0.60***	-0.08	0.67***	0.83***	0.61**	-0.11	0.91***	0.92***
	(0.22)	(0.11)	(0.20)	(0.25)	(0.29)	(0.25)	(0.24)	(0.31)
	[420]	[45]	[152]	[182]	[94]	[13]	[31]	[40]
Continental	0.53***	0.62	0.61***	0.27***	0.87***	0.38	0.67***	0.32***
	(0.19)	(0.51)	(0.08)	(0.09)	(0.18)	(0.53)	(0.03)	(0.09)
	[230]	[77]	[52]	[90]	[65]	[19]	[18]	[25]
Nordic	0.86***	0.40	0.46***	0.27	1.04***	0.85***	0.54***	0.32
	(0.13)	(0.29)	(0.04)	(0.23)	(0.13)	(0.20)	(0.11)	(0.28)
	[324]	[53]	[117]	[123]	[78]	[21]	[24]	[26]
b) Gross capital share								
All countries	1.20***	0.51**	0.58***	1.09***	1.37***	0.44	0.69***	1.18***
	(0.22)	(0.22)	(0.17)	(0.21)	(0.26)	(0.34)	(0.11)	(0.22)
	[1,107]	[220]	[361]	[430]	[268]	[62]	[83]	[100]
Anglo-Saxon	1.13***	-0.17	1.03***	1.35***	1.05*	-0.21	1.78***	1.51***
	(0.31)	(0.33)	(0.33)	(0.40)	(0.57)	(0.58)	(0.31)	(0.53)
	[420]	[45]	[152]	[182]	[94]	[13]	[31]	[40]
Continental	0.98***	0.61*	0.71***	0.50***	1.14***	0.36	0.77***	0.59***
	(0.15)	(0.36)	(0.06)	(0.16)	(0.11)	(0.46)	(0.03)	(0.13)
	[230]	[77]	[52]	[90]	[65]	[19]	[18]	[25]
Nordic	1.25***	0.70**	0.61**	1.01*	1.24***	0.90**	0.66***	0.86
	(0.46)	(0.33)	(0.25)	(0.54)	(0.39)	(0.42)	(0.20)	(0.56)
	[329]	[58]	[117]	[123]	[78]	[21]	[24]	[26]

Note: Panel regression of logged top 1% income shares on logged capital shares (equation 1). Observations in brackets. Number of included countries: All countries (16), Anglo-Saxon (6), Continental European (4) and Nordic (4). Robust standard errors in parentheses. The ***, ** and * denote statistical significance at the 1-, 5-, and 10-percent levels, respectively.

Table 3: Intermediate top income groups

	Full period	Pre-WWII	Postwar-1979	1980-present
a) Top 10–1 % (P90–99)				
All countries	0.15***	-0.18	0.06**	0.08**
	(0.04)	(0.11)	(0.03)	(0.04)
	[227]	[41]	[72]	[96]
- Anglo-Saxon	0.02	-0.74	-0.08	0.04
	(0.06)	(0.48)	(0.07)	(0.05)
	[87]	[6]	[31]	[40]
- Continental	0.02	-0.64**	0.10**	0.09
	(0.08)	(0.30)	(0.05)	(0.11)
	[64]	[19]	[17]	[25]
- Nordic	0.21***	0.03	0.09***	0.08
	(0.04)	(0.05)	(0.02)	(0.05)
	[63]	[16]	[18]	[24]
b) Top 1–0.1 % (P99–99.9)				
All countries	0.80***	0.27	0.45***	0.47***
	(0.10)	(0.18)	(0.06)	(0.14)
	[236]	[57]	[75]	[83]
- Anglo-Saxon	0.58**	-0.22	0.81***	0.71*
	(0.24)	(0.21)	(0.18)	(0.42)
	[86]	[13]	[31]	[32]
- Continental	0.61***	-0.01	0.51***	0.16**
	(0.15)	(0.14)	(0.05)	(0.08)
	[60]	[19]	[16]	[22]
- Nordic	0.99***	0.72***	0.34***	0.25*
	(0.09)	(0.06)	(0.03)	(0.14)
	[59]	[16]	[18]	[20]
c) Top 0.1 % (P99.9–100)				
All countries	1.56***	0.73**	0.78***	1.06***
	(0.19)	(0.32)	(0.15)	(0.31)
	[250]	[61]	[83]	[83]
- Anglo-Saxon	1.61***	0.17	1.19***	1.78**
	(0.50)	(0.35)	(0.36)	(0.89)
	[96]	[17]	[35]	[32]
- Continental	1.15***	0.72	0.66**	0.53***
	(0.30)	(0.99)	(0.31)	(0.08)
	[64]	[19]	[20]	[22]
- Nordic	1.77***	1.46***	0.91***	0.60
	(0.08)	(0.23)	(0.05)	(0.44)
	[59]	[16]	[18]	[20]

Note: See Table 2 for details.

Table 4: The role of top capital and wage 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	1.69***	0.19	0.99***	0.75	0.40	-0.48*	0.29***	0.43
	(0.52)	(0.30)	(0.14)	(0.54)	(0.25)	(0.28)	(0.08)	(0.29)
	[108]	[17]	[39]	[45]	[108]	[17]	[39]	[45]
b) Total vs. capital incomes	Top 1% total incomes (when top capital incomes are observed)				Top 1% capital incomes			
Capital share	0.88***	0.26***	0.60***	0.62*	1.69***	0.19	0.99***	0.75
	(0.20)	(0.10)	(0.07)	(0.34)	(0.52)	(0.30)	(0.14)	(0.54)
	[108]	[17]	[39]	[45]	[108]	[17]	[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	1.16***	0.95***	0.54***	0.65***	1.04***	0.99***	0.59***	0.58***
	(0.12)	(0.26)	(0.03)	(0.23)	(0.10)	(0.17)	(0.05)	(0.21)
	[74]	[10]	[26]	[34]	[75]	[10]	[26]	[35]

Note: See Table 2 for details.

Table 5: Controlling for other factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline	+ Time	+ GDP/cap	+ Agrishare	+ Market Cap.	+ Gov. Spending	+ Country FE
Capital share	0.99***	0.71***	0.70***	0.66***	0.59***	0.46***	0.47**
	(0.11)	(0.09)	(0.09)	(0.12)	(0.09)	(0.16)	(0.16)
Time trend		-0.01***	-0.00	-0.01	-0.00	-0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
GDP per capita			-0.19**	-0.22*	-0.22*	-0.23	-0.24
			(0.09)	(0.13)	(0.13)	(0.15)	(0.16)
Agriculture share				-0.18***	-0.15***	-0.12**	-0.09
				(0.06)	(0.06)	(0.06)	(0.07)
Stock capital					0.08*	0.08	0.08
					(0.05)	(0.05)	(0.06)
Gov. spending						-0.26	-0.28
						(0.24)	(0.25)
Observations	268	268	266	221	184	183	183
No. of countries	16	16	16	15	14	14	14
R-squared	0.363	0.541	0.537	0.604	0.576	0.583	0.571

Note: Panel regressions with logged top income shares as dependent variable on logged capital shares and other logged controls (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	0.26***	-0.11	0.31***	0.23***
	(0.05)	(0.35)	(0.05)	(0.07)
	[165]	[10]	[66]	[84]
b) Dep.: Top 1% share				
Capital share	0.79***	0.02	0.62***	0.66***
(when Gini non-missing)	(0.10)	(0.27)	(0.09)	(0.20)
	[156]	[10]	[64]	[77]
c) Dep.: Top 10–1% share				
Capital share	0.06		0.04	0.12***
(when Gini non-missing)	(0.05)		(0.05)	(0.03)
	[132]		[53]	[73]
d) Dep.: Top 1% capital income				
Capital share	1.30**	0.44	1.04***	0.79
(when Gini non-missing)	(0.55)	(0.47)	(0.14)	(0.53)
	[82]	[5]	[33]	[42]

Note: See Table 2 and the main text for details.

RESULTS APPENDIX

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

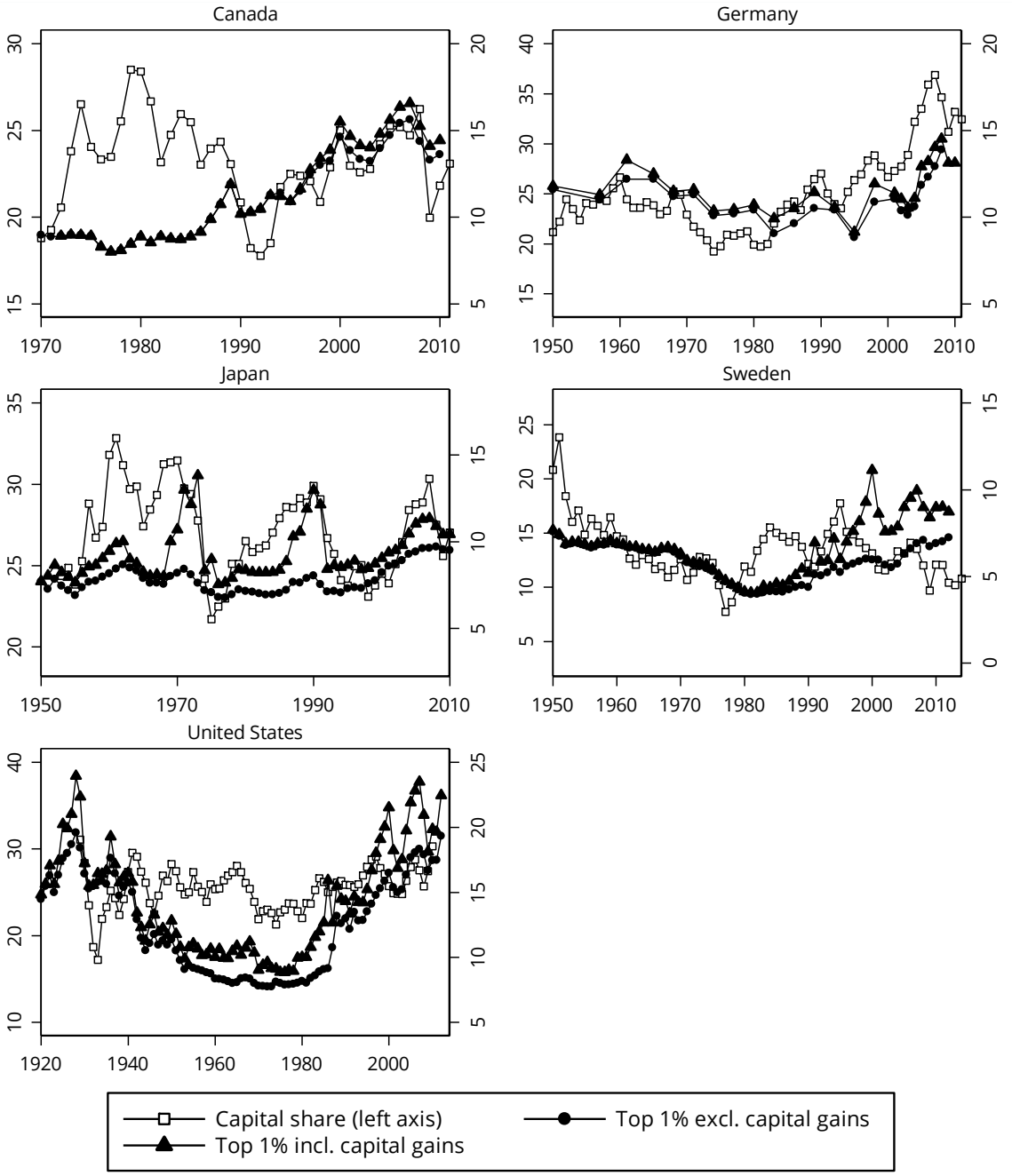


Table A3: Intermediate top income groups: Annual sample

	Full period	Pre-WWII	Postwar-1979	1980-present
a) Top 10–1 % (P90–99)				
All countries	0.10***	-0.20***	0.04*	0.05**
	(0.03)	(0.07)	(0.02)	(0.03)
	[910]	[117]	[309]	[416]
- Anglo-Saxon	0.04	-0.31***	-0.10**	0.02
	(0.03)	(0.03)	(0.04)	(0.04)
	[377]	[14]	[144]	[182]
- Continental	0.05**	-0.31***	0.11***	0.08
	(0.02)	(0.12)	(0.03)	(0.07)
	[222]	[70]	[51]	[90]
- Nordic	0.18***	-0.04	0.07***	0.06*
	(0.06)	(0.05)	(0.01)	(0.04)
	[253]	[33]	[87]	[113]
b) Top 1–0.1 % (P99–99.9)				
All countries	0.57***	0.18	0.38***	0.36**
	(0.14)	(0.13)	(0.06)	(0.14)
	[944]	[194]	[322]	[343]
- Anglo-Saxon	0.42*	-0.12	0.56***	0.58
	(0.23)	(0.10)	(0.17)	(0.37)
	[373]	[45]	[151]	[136]
- Continental	0.38***	0.40	0.43***	0.14**
	(0.14)	(0.28)	(0.09)	(0.07)
	[215]	[77]	[48]	[79]
- Nordic	0.84***	0.27*	0.33***	0.27
	(0.13)	(0.14)	(0.04)	(0.17)
	[228]	[32]	[83]	[93]
c) Top 0.1 % (P99.9–100)				
All countries	1.22***	0.57**	0.83***	0.87***
	(0.28)	(0.26)	(0.11)	(0.34)
	[1,006]	[217]	[345]	[343]
- Anglo-Saxon	1.32***	0.09	1.02***	1.46*
	(0.46)	(0.19)	(0.26)	(0.81)
	[427]	[68]	[166]	[136]
- Continental	0.79***	0.97	0.94***	0.45***
	(0.27)	(0.84)	(0.20)	(0.10)
	[223]	[77]	[56]	[79]
- Nordic	1.51***	0.94**	0.86***	0.71
	(0.07)	(0.45)	(0.04)	(0.70)
	[228]	[32]	[83]	[93]

Note: See Table 3 for details.

Table A4: The role of top capital and wage incomes: Annual sample

	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	0.89*	0.29	0.74***	0.34	0.29	-0.16	0.26***	0.35
	(0.52)	(0.30)	(0.14)	(0.59)	(0.21)	(0.32)	(0.10)	(0.23)
	[396]	[52]	[144]	[178]	[396]	[52]	[144]	[178]
b) Total vs. capital incomes	Top 1% total incomes (when top capital incomes are observed)				Top 1% capital incomes			
Capital share	0.53**	0.19*	0.47***	0.43	0.89*	0.29	0.74***	0.34
	(0.21)	(0.10)	(0.11)	(0.35)	(0.52)	(0.30)	(0.14)	(0.59)
	[396]	[52]	[144]	[178]	[396]	[52]	[144]	[178]
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	0.92***	0.72*	0.49***	0.35	0.85***	0.73**	0.53***	0.40
	(0.15)	(0.40)	(0.02)	(0.28)	(0.09)	(0.34)	(0.06)	(0.30)
	[283]	[20]	[103]	[141]	[285]	[20]	[103]	[143]

Note: See Table 4 for details.

Table A5a: Controlling for other factors: 5-year averages, constant sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline	+ Time	+ GDP/cap	+ Agrishare	+ Market Cap.	+ Gov. Spending	+ Country FE
Capital share	0.90***	0.71***	0.67***	0.67***	0.59***	0.46***	0.47**
	(0.09)	(0.09)	(0.11)	(0.11)	(0.09)	(0.16)	(0.16)
Time trend		-0.01***	-0.00	-0.01	-0.00	-0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
GDP per capita			-0.18	-0.19	-0.22*	-0.23	-0.24
			(0.15)	(0.14)	(0.13)	(0.15)	(0.16)
Agriculture share				-0.20***	-0.15***	-0.12**	-0.09
				(0.04)	(0.06)	(0.06)	(0.07)
Stock capital					0.08*	0.08	0.08
					(0.05)	(0.05)	(0.06)
Gov. spending						-0.26	-0.28
						(0.24)	(0.25)
Observations	183	183	183	183	183	183	183
No. of countries	14	14	14	14	14	14	14
R-squared	0.347	0.468	0.464	0.555	0.573	0.583	0.571

Note: See Table 5 and the text for details.

Table A5b: Controlling for other factors: Annual observations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline	+ Time	+ GDP/cap	+ Agrishare	+ Market Cap.	+ Gov. Spending	+ Country FE
Capital share	0.74***	0.54***	0.54***	0.53***	0.49***	0.26*	0.25*
	(0.14)	(0.11)	(0.09)	(0.14)	(0.14)	(0.15)	(0.14)
Time trend		-0.01***	0.00	-0.00	0.00	0.01	0.01
		(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
GDP per capita			-0.26**	-0.29*	-0.36	-0.24	-0.27
			(0.12)	(0.17)	(0.25)	(0.22)	(0.24)
Agriculture share				-0.18	-0.12	-0.05	-0.01
				(0.12)	(0.09)	(0.07)	(0.08)
Stock capital					0.07*	0.04	0.04
					(0.04)	(0.03)	(0.04)
Gov. spending						-0.72***	-0.74**
						(0.26)	(0.26)
Observations	1,102	1,102	1,086	488	402	393	393
No. of countries	16	16	16	15	14	14	14
R-squared	0.313	0.504	0.492	0.476	0.472	0.428	0.386

Note: See Table 5 and the text for details.

Table A5c: Controlling for other factors: Annual observations, constant sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline	+ Time	+ GDP/cap	+ Agrishare	+ Market Cap.	+ Gov. Spending	+ Country FE
Capital share	0.66***	0.63***	0.56***	0.56***	0.47***	0.26*	0.25*
	(0.12)	(0.14)	(0.16)	(0.17)	(0.14)	(0.15)	(0.14)
Time trend		-0.00	0.01	0.00	0.00	0.01	0.01
		(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
GDP per capita			-0.39	-0.36	-0.39	-0.24	-0.27
			(0.25)	(0.25)	(0.25)	(0.22)	(0.24)
Agriculture share				-0.16*	-0.10	-0.05	-0.01
				(0.09)	(0.09)	(0.07)	(0.08)
Stock capital					0.07*	0.04	0.04
					(0.04)	(0.03)	(0.04)
Gov. spending						-0.72***	-0.74**
						(0.26)	(0.26)
Observations	393	393	393	393	393	393	393
No. of countries	14	14	14	14	14	14	14
R-squared	0.337	0.344	0.300	0.432	0.436	0.428	0.386

Note: See Table 5 and the text for details.

Table A6: Using broader inequality measure: The Gini coefficient, Annual sample

	Full period	Pre-WW2	Postwar-1979	1980-present
a) Dep.: Gini coefficient	0.19***	-0.48	0.25***	0.20***
Capital share	(0.04)	(0.30)	(0.04)	(0.05)
	[516]	[25]	[167]	[306]
b) Dep.: Top 1% share	0.67***	-0.34***	0.59***	0.44**
Capital share	(0.08)	(0.11)	(0.07)	(0.22)
(when Gini non-missing)	[458]	[24]	[151]	[265]
c) Dep.: Top 10–1% share	0.08***		0.00	0.09***
Capital share	(0.03)		(0.06)	(0.02)
(when Gini non-missing)	[394]		[128]	[257]
d) Dep.: Top 1% capital income	0.57	0.02	0.81***	0.48
Capital share	(0.49)	(0.47)	(0.23)	(0.57)
(when Gini non-missing)	[215]	[5]	[68]	[136]
	0.19***	-0.48	0.25***	0.20***

Note: See Table 6 and the main text for details.

Table A7: Other historical eras: Annual and 5-year average observations

	Annual observations			5-year averages		
	Early incl. WW2	WWII + postwar	1990-pre-sent	Early incl. WW2	WWII + postwar	1990-pre-sent
All countries	0.29***	0.38***	0.31**	0.40*	0.64***	0.45***
	(0.07)	(0.12)	(0.15)	(0.11)	(0.24)	(0.07)
	[264]	[408]	[295]	[268]	[62]	[95]
- Anglo-Saxon	0.60***	-0.22***	0.76***	0.61**	-0.11	1.06***
	(0.22)	(0.07)	(0.18)	(0.16)	(0.29)	(0.25)
	[420]	[65]	[173]	[70]	[94]	[13]
- Continental	0.82***	0.53***	0.24***	0.93***	0.87***	0.38
	(0.10)	(0.19)	(0.02)	(0.26)	(0.15)	(0.18)
	[123]	[230]	[83]	[36]	[28]	[65]
- Nordic	0.20	0.62***	0.86***	0.64***	0.69***	1.04***
	(0.14)	(0.23)	(0.13)	(0.53)	(0.11)	(0.25)
	[57]	[64]	[324]	[19]	[20]	[17]

Note: See Table 2 and text for details.

Appendix to "Capital shares and income inequality: Evidence from the long run"[1]

Erik Bengtsson[†] and Daniel Waldenström[‡]

25 January 2017

Abstract

This Appendix discusses the data used in the paper. We begin by discussing definitions and measurement issues for capital shares, and then move on to a discussion of the national accounts data used for each country, along with a country-specific historiographical discussion on the development of factor shares.

[1] We are grateful to Jutta Bolt, Brian Easton, Ewout Frankema, Giacomo Gabbuti, Ester Gomes da Silva, Pedro Lains, Leandro Prados de la Escosura, Bill Rosenberg, Martin Shanahan, Marcel Timmer and Kristina Vikesund for information and discussions about data for various countries. Of course, the authors are solely responsible for all possible errors and misunderstandings.

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A1. Capital shares data

This section of the appendix discusses the capital shares data used in the paper. Section A1.1 introduces and discusses concepts and measurement and section A1.2 presents the twenty 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.

A1.1 Concepts and measurement

Functional income distribution divides national income in two types: labour income and capital income. (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:

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

Correspondingly, the capital share is some version of:[2]

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

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 data that we use in this paper come from national accounts. (For the history of national accounting, see Kenessey 1994; Bos 2003, ch. 2–4; and Vanoli 2005.) They were typically not produced by researchers concerned with income distribution, as we are. More often the issues at centre for the historical national accounts researcher is producing estimates of national product and income as a whole, i.e. the wealth of a nation. As is well known, gross domestic product (GDP) can be produced in three main ways: from the income side, from the production side,

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

and from the expenditure side. Income-side estimates build on estimates of the incomes of several social groups – especially employees, self-employed, and capital owners – to estimate national income. With income-side estimates of national income, therefore, the possibility of analysing income distribution arises almost as a by-product. Estimates of GDP with the production method instead estimates value added per sector in the economy, which then add up to GDP. And the expenditure method estimates GDP as a total of consumption, investment and net exports. In other words, only income-method national accounts, not production-method or expenditure-method, are useful for our purposes. In some cases, we use capital share estimates already made by other researchers; in most, we make our own estimates built on data on different types of income and total national income. To ascertain that our series for all of the countries are consistent and comparable, two major measurement issues need to be resolved. Firstly, how to treat the incomes of the self-employed, who are not purely capitalists nor purely employees. And secondly, how to handle capital depreciation. We will now discuss these two issues and then two minor issues – the inclusion of non-wage compensation in the wage share, and the difference between GDP at market prices and at factor cost.

The incomes of the self-employed is a classical problem in the functional income distribution literature.[3] Should they be accounted 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.[4] The importance of this correction has been shown

[3] 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).

[4] 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.

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).[5] The labour method of adjustment is also common, while the capital method is very uncommon.

The second major 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. For example, in response to the fact that the (gross) wage share has decreased in the United States since the 1970s, Bridgman (2014) asks whether "labor's loss" really equals "capital's gain". In the case of the US, he claims that it

[5] 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.

does not, since the capital share hasn't grown if one accounts for increases in capital depreciation and production taxes. Equally, Karabarbounis and Neiman (2014) point out that an increase in the (gross) capital share not necessarily means increased consumption power of capitalists, if the increase is consumed by increased capital depreciation. Since we are interested in the inequality implications of changes in factor shares, it is important to ascertain that the changes are not just driven by changes in capital depreciation. On the other hand, the criteria for companies' depreciation of their capital stock have changed over time and sometimes one can be sceptical towards the measurement of variations in depreciation over time. For these reasons, we use both gross and net measures of capital shares. We have been able to include capital depreciation and thus estimate both gross and net capital shares for 14 of our 19 countries: all but Argentina, Australia, Brazil, Mexico and New Zealand.

One could argue that another issue is how to treat non-wage compensation of employees. As has been pointed out, a "wage share" which really only includes wages and not non-wage compensation can often underestimate the welfare of employees and misrepresent its growth (Pessoa and Van Reenen 2012). 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 a problem for the present study.

The second minor measurement 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. We take care to use factor cost estimates of value added or national income; however, in the early data that we use for Canada we do not have access to estimates of indirect taxes and subsidies so there the market prices measure is used.

A1.2 Sources and data

A1.2.1 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[6] 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 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 in-between 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

[6] 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.

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).

A1.2.2 Australia

For Australia, the data situation is more troublesome than for most of the other countries in this paper. Butlin (1962), which covers the 1861–1939 period, is still the major work on historical national accounts, and it is much stronger on the production side than the income side. Maddock and McLean (1987, p. 4) in a survey of Australian economic history point out that Butlin's data "have been subjected to a variety of criticisms, but little development". Butlin does present

GDP and capital depreciation, but not much information on incomes.[7] The main official national accounts from the income side only begin in 1949 (Doughney 1997, p. 302). For these reasons, we must combine series from a couple of sources to construct the long-run capital shares that we want.

An important source is a paper by the economist Graham Richards (1978, Tables I, IV, V) which includes factor shares data for the manufacturing sector 1927–1968 and the entire economy 1949–68, building on the official National Accounts. (He stops in 1968 because of a change in his sources' sectoral classification in that year.) Adjustment for the self-employed is not possible based on Richards' data. It is also possible to estimate wage shares in manufacturing from 1907 to 1940 based on Butlin's (1984: table Aa31), building on series for sums of wages and salaries as well as the estimated value of production in the sector. Like Richards, Butlin does not provide information about the incomes of the self-employed. 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 which is not found in Richards'.

To adjust for the self-employed, we use data in Butlin (1984), which builds on Butlin (1974). Butlin (1984 table Aa33, Ab29) presents the number of self-employed and totally employed from 1911 to 1940 and from 1950 onwards. The share who are self-employed lies rather still around 25 per cent throughout the 1910s and 1920s, but declines somewhat during the 1930s, to 22 per cent in 1940. The share of self-employed then decreased further: to 19 per cent in 1950 and 17.2 per cent in 1960.

We have information of capital depreciation from 1861 to 1939 in Butlin (1962, table 12, with GDP estimates in table 2).[8] For the years that we are interested in, capital depreciation as a share of GDP increases from 5-6 per cent in the 1910s to 7-8 per cent in the 1930s. For 1960–2010 Piketty and Zucman (2013, appendix) provide national accounts including depreciation.

[7] 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. 452–3). 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 affect what we do.

[8] Butlin's capital depreciation figures have been considered to be quite imprecise (Boehm 1965, p. 210). As discussed in section A.1.1, measuring depreciation over long time periods is an uncertain venture.

We do not have figures for capital depreciation between 1940 and 1959, which makes imputation necessary. In the 1930s, capital depreciation was around 7-8 per cent of GDP, while in the 1960s it was around 15 per cent. In other words, it looks like capital depreciation grew markedly as a share of GDP between 1939 and 1960. This is reasonable given that manufacturing's share of GDP grew from 19 per cent in 1939 to 27 per cent in 1963 and that the 1950s and 1960s were a very expansive period for Australian industry (Maddock and McLean 1987, pp. 19–20). Fixed capital formation as a percentage of GDP increased from 14 per cent in the 1930s to 25 per cent in the 1950s and 26 per cent in the 1960s (Maddock and McLean 1987, p. 26). Given the increased industrial dynamism of the post-war period, it is not surprising that capital depreciation became a more important part of the economy. Based on this, for the years 1940–59 we linearly impute capital depreciation as a share of GDP based on Butlin's data for 1939 and Piketty and Zucman's for 1960.

Our compromise estimate for the long-run gross capital share in Australia is as follows. For 1911 to 1940 we use the wage and value added data from Butlin (1984, table Aa31) for manufacturing, and adjust for the share of self-employed by using the information for the whole economy in Butlin (1984, table Aa33 and Ab29) and assuming that the share of employed in manufacturing who are self-employed is one fourth of that in the total economy.[9] For 1941–1948 we use the wage and value added data for manufacturing in Richards (1978, tables I and II) and adjust for the share of self-employed in 1940, from Butlin (1984, table Aa33). For 1949 to 1959 we use wage and value added data for the whole economy from Richards (1978, table IV), adjusted for the share of self-employed in 1950 with data in Butlin (1984, table Ab29).[10] For the years 1960 to 2010 we use the Piketty and Zucman (2013) data and take gross operating surplus and one third of gross mixed income as share of total factor income.

For the long-run net capital share we also build on Butlin (1984) for 1911–40, Richards (1978) for 1941–59 and Piketty and Zucman (2013) for 1960–2010. Now we adjust the capital income post and the total income post by using the capital depreciation data in Butlin (1962) and Piketty and Zucman (2013) with imputations as discussed above.

[9] It is a well-known fact that the share of employed people who are self-employed is high in agriculture and low in manufacturing. See for example Richards (1978, p. 226) who points out that in 1967-68 only three per cent of those employed in Australian manufacturing were self-employed.

[10] Mixing manufacturing data with economy data is not ideal 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 linking is unusually complicated for Australia – we don't use as many sources for most of our long-run series – which merits attention. The linking of the gross series based on Butlin (1984) and Richards (1978), which we link in 1940–41, seems rather unproblematic: they build on the same official sources and for the overlapping years 1927–1940 only differ in levels by about one percentage point of GDP. They also show the same trends, with a slight bump in the capital share c. 1931–34 and not much movement for the rest of the 1930s. The correlation is 0.98. Moving from Richards (1978) for manufacturing to his data on the whole economy in 1949 is more complicated. The two series are quite different as the capital share in the whole economy is higher than in manufacturing around 1950, but lower in the late 1960s; in other words the two show different trends. Their correlation for 1949–68 is -0.44. For 1960–68 they also overlap with our calculations from Piketty and Zucman's (2013) data. This series just like the one based on Richards for the whole economy shows little movement in the 1960s; the correlation between them is 0.59. Therefore we believe that the series is good and we don't hesitate to use it for 1949–59. That it does not correlate well with the manufacturing series in the 1950s and 1960s is, we believe, reflecting what happened, and not a construct of the data. Richards (1978, p. 232) specifically discusses how the wage share in the total economy increased in the 1950s not the least because of a structural shift where the mining sector with low wage shares decreased as a share of the economy, while service sectors with high wage shares grew. The only problem is the linking point in 1949: at 33 per cent, the capital share for the whole economy is 3 percentage points lower than that in manufacturing. So as to not introduce an artificial break in 1949, for 1949–1951 we average the two series. Linking the Richards series to the Piketty and Zucman series in 1960 is less problematic as they both are for the whole economy and behave very similarly. There is a 1-2 percentage point level difference but not more.

There are a few studies of wage and capital shares in Australia. The low levels of profits in the mid-1970s motivated a string of studies: beyond Richards (1978) which we use for data, there is Dixon (1979) on manufacturing 1969–1977, Riach and Richards (1979) who look at the political economy of distribution in the 1970s, and Stegman (1980) who looks at the connection between factor shares, aggregate demand and growth. These 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. Richards' (1978) study was motivated by an alleged fall in profits during the Labour government which came to power in 1972, but he showed that important shifts in distribution

had happened earlier than that as well, not the least with a fall in the wage share in manufacturing in the 1960s. This fall was not sensitive to the control for capital consumption nor company taxation (Richards 1978, pp. 240–241). Elsewhere, Richards (1977) tried the neoclassical explanations of biased technological change; Whiteman (1988) provides a related analysis of Australian manufacturing from 1955 to 1982. The dissertation of Doughney (1997) studies profits and income distribution from 1949 to 1994 from a Marxist perspective. He finds (p. 314) that the capital share in private business is rather stable from 1949 to the mid-1960s (bar a one-year spike during the Korea inflation), falls from the mid-1960s to the late 1970s, and partly recovers after 1985. Cheek (1957) looks at profits and wage shares in manufacturing 1945–1955, and finds not so surprising business cycle fluctuations. Ville and Merrett (2006) estimate corporate profitability from 1901 to 1986.

A1.2.3 Austria

For Austria the historical capital shares data come from 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 WIFO estimates have "quasi-official" status (Chaloupek et al 2008, p. 33).[11] These data cover the years 1913, 1924–37 and 1948–63 (WIFO 1965, p. 39, table "Verteilung des Volkseinkommens Zu laufenden Preisen"). 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.

The WIFO study presents wages and salaries as one post but unfortunately it does not present incomes of the self-employed and corporate incomes separately, but rather as one post. (Plus separate posts for some rents but this is of no concern here.) To adjust for the incomes of the self-employed, we calculate the number of the self-employed as the number of employed less

[11] 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.

wage earners (From the table "Pro-Kopf-Einkommen, nominell" on p. 44), then calculate average income of a wage earner as the wage and salary sum divided by the number of wage earners, then apply this average income to the self-employed and take 65 per cent of that sum to the wage share and 35 per cent to the capital share.[12] In the National Accounts from the income side, they also present capital depreciation, which allows us to calculate gross and net capital shares. When calculating gross wage shares, we take the wage sum (including imputed labour incomes of the self-employed) divided by distributed income (Volkseinkommen) plus capital depreciation (Abschreibungen). The gross capital share is 100 less the gross wage share. For net shares, we ignore the depreciation variable and calculate the wage share as the adjusted wage sum divided by distributed income.

We link our calculations from the WIFO data to calculations from AMECO from 1960 on. For the overlapping years 1960–63 we use the average of the two series. For the gross series this appears to not be much of a problem, since the two underlying series are similar. Both show an increasing trend in the early 1960s, even though the AMECO series is at a higher level, around 75 per cent while the WIFO series is around 70 per cent. For the net estimates the gap between the two is even larger. The reason is that AMECO's estimate of the capital depreciation rate is higher. According to AMECO, consumption of fixed capital corresponded to about 15 per cent of national income in the 1960s. According to WIFO however capital depreciation corresponded only to about 10 per cent. For this reason the net capital share in AMECO is very low in the 1960s.

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.

[12] Note that the assumption then is that the total income of the self-employed corresponded to the average wage earner income. For example Prados de la Escosura and Roses (2009) assume instead that the labour income of the self-employed corresponds to the average wage-earner income. This assumption would yield higher total incomes of the self-employed and lower capital income in the Austrian case.

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).

A1.2.4 Belgium

For Belgium, Buyst (1997) presents comprehensive national accounts data for the 1920–1939 period; Peeters et al (2005) is a book-length presentation of the calculations. 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. With the Buyst data, capital incomes are calculated as the sum of "capital income to private persons", the growth of "capital reserves of companies" plus direct tax paid by companies, "interest on public debt", one third of "entrepreneurial income", and depreciation. The gross capital share is calculated as this capital income divided by GNP at factor cost. When calculating the net capital share, capital depreciation is left out at both sides of the equation. We use the Buyst data for 1920–1939 and AMECO data from 1960 onwards. 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.

A1.2.5 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.

A1.2.6 Canada

The official National Accounts data in Canada begin in 1926; the (construction of the) data from 1926 to 1959 are discussed in Goldberg (1964), while Crozier (n.d.) discuss the data for the 1926 to 1976 period. There are national accounts data going further back than 1926, especially Urquhart's (1986) study of GNP in Canada 1870 to 1926, but with one exception they do not provide nation-wide coverage from the income side. Crozier (n.d.) in a Statistics Canada publication provide national accounts data from the income side for the years 1919 to 1926.

We use income-side national accounts data for 1926 until 1976 from a 1983 Statistics Canada publication (Leacy 1983). 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). Capital consumption is reported separately, which makes it possible to do gross as well as net

estimates of factor shares. We link the proportionally adjusted gross capital shares series calculated from Leacy (1983) for the years 1926 to 1959 to calculations that we make with the national accounts data in Piketty and Zucman (2013, data appendix, excel sheet Canada, page DataCanada). Piketty and Zucman use official national accounts from Statistics Canada so the matching is good. We calculate gross capital income as the sum of (1) net corporate profits, (2) interest and misc. investment income, (3) one third of accrued net income of farm operators from farm production, (4) one third of net income of non-farm unincorporated business, and (5) capital depreciation. We calculate the gross capital share as gross capital income as share of net national income at factor cost plus capital depreciation. To calculate net capital shares, we use the same calculation but without the capital depreciation post on both sides of the equation. Since the 1960–2010 data presented by Piketty and Zucman as well as the 1926–1976 data originate from official national accounts, it is not surprising that the series link well. For the overlapping years 1960 to 1976 the correlation for the gross series is 0.93 and for the net series it is 0.98.

As mentioned, while the official national accounts begin in 1926, there are studies for the earlier period as well. 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. Urquhuart (1986) as mentioned presents extensive new GNP data for 1870–1926 but is concerned with GNP growth and its drivers (especially the issue of whether economic growth was led by exports of wheat and forestry products or if Canada had a dynamic manufacturing sector in the late nineteenth century). Therefore, he does not discuss distribution or national accounts from the income side. Crozier (n.d., series F166-F178) presents labour income sums per sector for the years 1919 to 1926, but unfortunately does not present the full national income accounts, with corresponding capital incomes and so on.

There is some research on the movements and determinants of factor shares in Canada. Hotson (1963) provided an analysis, typical of the 1960s, of the alleged "constancy of the wage share"; he uses Canadian data for 1926 to 1960. Goldberg (1964) provides a careful discussion for the period 1926 to 1958, with an in-depth look at different definitions (with and without factor payments to other countries, before and after tax, and so on). Goldberg finds an increase in the wage share from the second half of the 1920s to the second half of the 1950s, which seems to depend to a large degree on the decrease of number of self-employed and corresponding increase in the number of wage and salary earners – he does not adjust the wage share for the

labour incomes of the self-employed (pp. 213–215). When Goldberg looks only at the corporate sector, the increase in the wage share is much smaller, around 1–2 per cent (p. 226). Goldberg also examines the different cyclical behaviour of different income type, noting for example that wages and salaries are affected less by the business cycle than profits are (p. 255). Dagum (1988) discusses factor shares from 1926 to 1984. He finds that the wage share was quite low in the second half of the 1920s (around 55 per cent), was high during the Great Depression in the early 1930s as profits bottomed out, then fell back to World War Two, and then increased piecemeal from the second half of the 1940s until around 1970, when it peaked out at a high level (around 72 per cent). It then slightly fell back until the first half of the 1980s, a period when the share of interest in national income almost doubled (from 6 to 11 per cent). Beyond these more secular trends, he finds the expected countercyclical behaviour of the wage share and procyclical behaviour of the capital share. Buse (1982) studies the cyclical properties of income distribution in Canada from 1947 to 1978 and while factor shares are not his primary focus, he does find that increases in capital shares, which typically occur in business cycle upturns, increase inequality. Harrison (2009) explores why the median wage did not increased in line with productivity in Canada from 1980 to 2005, and in this study also goes into a discussion of the wage share and how it should be measured. Similarly, Fisher and Hostland (2002) discuss why real wages lagged productivity in Canada from 1994 to 2001. In the process, they also look at the wage share's development since 1926. They find that the wage share was historically low from 1927 to 1941 and historically high from 1966 to 1977. Using unit roots test, they cannot at the 95 per cent level of significance reject the null hypothesis of a unit root in the wage share series. From this, Fisher and Hostland (2002, p. 60) conclude that one cannot say that the factor shares always come back to their historical means; the recent decline in the wage share might be long-lasting. Regarding the causes of the fall in the wage share, they find that part of it is quite technical: an increase in the capital consumption allowances (Fisher and Hostland 2002, p. 65). Russell and Dufour (2007) provide another study of the recent decline of the wage share, more explicitly motivated by a concern with inequality. Morel (2006) is a sectoral take on the fall in the wage share since the 1990s.

Saez and Vaell (2005) in their top incomes study of Canada point to that the top income shares fluctuate around high levels in the 1920s and 1930s. Around World War Two, they drop dramatically. Saez and Vaell (2005, p. 837) explain this by (1) steeply increased taxes reducing net-of-tax capital incomes like dividends, and (2) pay compression. They chart an evolution of the top income earners post-1945 where this group is to a growing degree composed of top

wage earners, rather than capital owners. Their explanation is that post-1945 well-to-do did not construct as large fortunes as their pre-1945 counterparts, because of the stricter tax system.

A1.2.7 Denmark

As in many other countries, national accounting began in Denmark in the 1930s. The first Danish efforts, starting in 1935, to estimate national income and gross domestic product were influenced by the more advanced work on these issues in the neighbouring country Sweden. In the early post war years, Danish national accounting became fully integrated with that of the Anglophone world (Aukrust 1994, pp. 16, 29.) Regular production of national accounts began in 1948, due to the need for such information for the purpose of producing national budgets during the Marshall Plan period (Aukrust 1994, p. 32). Historical extensions backwards were made not the least by Bjerke and Ussing (1958) in their study of the 1870 to 1950 period. Building on such contributions and their followers, the central bank economist Kim Abildgren (2008: table A5) presents an estimated wage share series for Denmark in the 1875–2007 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, p. 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). To calculate the capital share after 2007, we use the growth rate of the gross capital share calculated from AMECO data ("Gross operating surplus: total economy: - Adjusted for imputed compensation of self-employed", series code UQGD, divided by "Gross national income at current prices", series code UVGN) to extrapolate from the 2007 value based on Abildgren data.

To calculate net capital shares, we use the capital depreciation rate from Kaergård (1991, table 3). Kaergård presents depreciation in 1929 Danish Crowns and we calculate the depreciation rate as related to GDP by using gross factor income from Hansen (1974), also in 1929 Danish Crowns. The Kaergård series covers the years 1876 to 1914 and 1921 to 1970. The series shows low depreciation rates in the 1870s and 1880s, around 5-6 per cent. In the 1890s it rises to 8-9 per cent, and in the 1920s, 30s and 40s it is typically around 10-11 per cent. It increases further to the 1950s and 1960s, around 14-15 per cent. We link this to capital depreciation from AMECO. For the overlapping years in the 1960s AMECO presents a rather stable level around

12-13 per cent, i.e. a bit lower than Kaergård. For the overlapping years 1960–70 we use an average of Kaergård's (1991) and AMECO's depreciation rates; then just AMECO. We apply the capital depreciation series to the gross factor income data from Abildgren (which essentially builds on Hansen) to get net GDP and we calculate net factor shares from this. For the years after 2007 we extrapolate using the growth in the net capital share as calculated from AMECO ("Net operating surplus: total economy :- Adjusted for imputed compensation of self-employed", series code UQND, divided by "National income at current prices", series code UVNN).

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 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.

A1.2.8 Finland

The first modern national accounts in Finland were created in 1943, for the years 1926–1938. Work on historical national accounts in a more comprehensive way started in 1959, inspired by Kuznets (Hjerppe 2006, p. 4). Work was done by economists in Statistics Finland and the Bank of Finland. They made ambitious plans to create full datasets for the 1900–1960 period, and after a while increased the ambition to cover the period since 1860. Not all of the work was finished, but it laid the ground for comprehensive historical national accounts published in the 1980s (Hjerppe 2006, p. 4).

Today, 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. She presents the necessary wage and salary sums (Hjerppe 1989, Appendix tables 12A and 12B) as well as the gross value added (Hjerppe 1989, Appendix table 4). Unfortunately for our purposes there are no separate estimates of entrepreneurial incomes. These are instead all included in the wage and salary sum, meaning that it is impossible from these data to estimate adjusted wage and capital shares. Furthermore, Hjerppe does not present estimates of capital consumption, which we would net to calculate the net capital share. The other relevant data set has been created by Tiainen (1994) in his doctoral dissertation, "Sources of Growth in Finland: Contribution of Labour Force, Capital and Total Productivity in the Years 1900–90". Tiainen's (appendix tables 18, 19, 20, 25, 27) is a very comprehensive historical national accounts data set; he presents value added, labour costs, imputed labour remuneration for the self-employed and capital depreciation per sector from 1900 to 1985.

We use Tiainen's rather than Hjerppe's because they are more detailed and therefore more flexible when we want to construct our series. 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. With the AMECO database we calculate the gross capital share as adjusted gross capital income (series UQGD) divide by gross factor income, which is the sum of gross capital income and adjusted labour income (series UWCD). The net capital share is adjusted net capital incomes ((series UQND) divided by net factor income (UQND+UWCD). The merging has been made simply by taking the Tiainen calculations for 1900–59, and the AMECO calculations for 1960–2010.

The capital share estimates based on Tiainen's data and based on AMECO data are quite similar for the overlapping years, 1960–1985. The correlation for the gross series is 0.79 and for the net series 0.75. With both estimates the gross level is around 35 per cent in the early 1960s, and then drops about five percentage points during the 1960s, with a recovery in 1969–70. Then there is a further drop in the early 1970s, which is revered in 1978–79. With both sources, the level in 1985 is a percentage point or two lower than in 1960. The net measure shows a bit more difference, with larger provisions for capital consumptions made by AMECO, meaning that the level is 1-4 percentage points lower for most of the years.

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. Jalava et al (2003) use Tiainen's data to study technological change and capital-labour substitution in Finland from 1902 to 2003.

A1.2.9 France

Piketty and Zucman (2013) recently have put tremendous work into reconstructing French national accounts, so we use their data. Their data for France is presented in a spreadsheet available for download from Piketty's web site (http://piketty.pse.ens.fr/fr/capitalisback). They present detailed national income accounts back to 1890 and we use the data in the table "DataFR1: Raw national accounts series for France 1890-2010". We calculate the gross capital income sum as the sum of net corporate profits, housing capital income, self-employment capital income, and capital depreciation.[13] We then calculate the gross capital share as the gross capital income sum divided by GDP at factor cost. The net capital income sum is the same as the above but without capital depreciation. The net capital share is then calculated as net capital income

[13] Piketty and Zucman on the other hand calculate factor shares of national income, i.e. they include net foreign capital and net foreign labor income.

divided by NDP at factor cost. The earliest estimated top income share for France is for 1905 and there are yearly estimates back to 1915.

A1.2.10 Germany

For Germany, our main source is Piketty and Zucman's (2014) Germany database, which compiles data from a host of historical national accounts research. German historical national accounts naturally have some break points, due to the drastic regime shifts that the country experienced. The data we build on can then be divided into one set of sources for the 1891 to 1938 period, and another for the 1950–2011 period.

For the pre-1950 period, Hoffmann's (1965) classic study still is the starting point[14], even though several adjustments have been made.[15] Piketty and Zucman (Germany spreadsheet, "DataDE1c: Raw 1850-1950 national accounts series for Germany") present the national income estimates by Hoffmann, and this slightly adjusted database (Piketty and Zucman 2013b: 78–79) is the starting point for our pre-1950 estimates. We use Hoffmann's capital income estimate, and add imputed labour incomes of the self-employed. These are calculated by taking the share of the self-employed among all employed, which again comes from Hoffmann, times total unadjusted labour income to approximate total income of the self-employed; we then assign one third of this income sum to the capital income post. We only have the share of self-employed for 1891–1907 and 1925–1938. From 1891 to 1907 the share decreases from 25 to 20 per cent. In 1925 it is 19 per cent, and stays around this level until the late 1930s when it decreases by a couple of percentage points. Based on the lack of change from 1907 to 1925, we believe it is safe to interpolate a 20 per cent level between those years. We also want to adjust for capital depreciation. There are no capital depreciation data for the 1890s but based on Ritschl and Spoerer (1997, table A.1) we estimate that the depreciation rate varies between 2.3 and 7.6 per cent of GDP 1901–1913, with an increasing trend. Based on this, we assume that capital depreciation was 3 per cent per year in the 1890s. For 1925–1938 we use the estimates by Ritschl (2002), as reported by Piketty and Zucman. In this period, capital depreciation corresponded to between 7.8 and 10.5 per cent of GDP. The resulting capital income sum is then divided by factor cost national income adjusted for capital depreciation. To calculate the net

[14] The data has been digitalized by the Historical Statistics project at the data provider GESIS (http://www.gesis.org/histat/).
[15] For example, Fremdling (1995: 78) claims that "the Hoffmann figures contain serious biases, if not even fundamental miscalculations".

capital share, we use the adjusted capital income sum as discussed above and divide it by national income.

There are no data for the Second World War years or the immediate postwar years. From 1950 to 2011 there are official National Accounts[16], and we use them as reported by Piketty and Zuman (2014) in their Germany spreadsheet, section "DataDE1: Raw national income accounts series for Germany 1970-today, linked with 1950-1970 income accounts from DateDE1b". We calculate the gross capital share as the capital income sum (including imputed capital incomes of the self-employed) plus capital depreciation, divided by factor-cost national income plus capital depreciation. The net capital share is calculated as the adjusted capital income sum divided by factor-cost national income.

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.

A1.2.11 Ireland

National accounting research from the income side in Ireland began with Kiernan (1933) for 1926 and McCarthy (1952) for 1938 and 1944–1949. Hughes (1975) later followed up with a more comprehensive and useful dataset. With Kiernan's (1933) data no correction for the self-employed is possible; Kiernan 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.[17] Early 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

[16] The German public statistics bureau began publishing National Accounts in 1928 (Jostock 1955). Hoffmann (1965) used these in his book. Cf. Statistiches Jahrbuch 2012, table 12.1.

[17] 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.

correction for this factor. The construction of the data for 1938 and 1944–49 is discussed in Linehan and Lucey (2000).

The first truly useful Irish data for our purposes comes from Hughes' (1975) presentation of national accounts data for 1938–1970. He presents estimates of domestic income for these years (Hughes 1975, p. 11), i.e. net income flows from abroad are not included. He presented net estimates, with the motivation that "a net is preferred to a gross concept because depreciation is regarded as an allowance for capital replacement and not as a return on capital" (Hughes 1975, p. 11). We calculate the net capital share as the share "income from property" plus one third of "income of independent traders", using the data in Hughes' Table 2. In 1960, we link this estimate to calculations (100-wage share) from AMECO data. 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.

To calculate the gross capital share, we need to information about capital depreciation that Hughes (1975) does not provide. Fortunately, McCarthy (1952, Table 1, p. 486) provides estimates of capital depreciation for the years 1938 and 1944–1949. Capital depreciation was very low, hovering between 1.8 and 2.6 per cent of GDP. This is perhaps not so surprising, given the agricultural nature of the Irish economy in this period. From 1960 onwards, the depreciation rate can be calculated from AMECO data. In 1960 it is 6.9 per cent of GDP. It then increases to a level around 10-11 per cent in the 1970s and 1980s, and in the 2000s it even reaches a level around 15 per cent. We use the McCarthy data for capital depreciation in 1938 and 1944–49 to calculate the gross wage share in these years. For 1950–59, we assume that the depreciation rate is 4.6 per cent of GDP, as a middle way between McCarthy's 2.3 per cent in 1949 and AMECO's 6.9 per cent in 1960.

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.[18]

[18] For Ireland, it has been pointed out that GDP can be problematic as the denominator when calculating factor shares, as there might be significant differences between GDP and GNP because of significant capital outflows

A1.2.12 Italy

In Italy, historical national accounting has experienced somewhat of a boom in the last ten years. In fact, the first coherent long-run historical factor share estimates for this country was presented by Andrew Glyn, in a chapter about factor shares in the *Oxford Handbook of Economic Inequality*, as late as 2008, as pointed out by Gabbuti (2016, p. 1). The Italian National Statistics Institute published already in 1957 a full set of national accounts back to the year of Italian unification in 1861 (Felice and Vecchi 2015, p. 511). However, they were not presented in a transparent manner and weren't regarded as up to international standards. Since the 1960s, different revisions have been made, including Rossi et al (1993), but the first comprehensive new analysis have been updated in a project coordinated by the Bank of Italy in connection to the 150 year anniversary of the Italian state. (Cf. Baffigi 2011.) Among other things, the new estimates have presented estimates of labour force and the capital stock back to 1861 (Giordano and Zollino 2015.)

Glyn's estimates built on wage data by Zamagni and GDP data by Rossi et al. (1993). We use Glyn's data to estimate capital shares of national income, gross and net, from 1911 to 2006. For the years 2007 to 2015, we extrapolate using the growth rates of gross and net capital share calculated from AMECO data. (Gross capital share is gross operating surplus, adjusted for the self-employed, divided by Gross national income; AMECO series UQGD and UVGN. Net capital share is net operating surplus, adjusted for the self-employed, divided by national income; AMECO series UQND and UVNN.) The Glyn series and the AMECO series are the same from the mid-1970s to the mid-1990s, but diverge slightly before and after that. In the 1960s, the trend is the same in both, but the level of the capital share is higher according to Gln's data, by about five percentage points. In both datasets the capital share rises slightly in the first years of the 1960s, falls between 1962 and 1964, then slightly increases again, then falls rather markedly

from foreign investment in the country 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). This seems to be a problem mostly for Ireland and mostly for levels of factor shares, not their changes (which is what we investigate with our fixed-effects models), so we have not made any adjustment for this issue.

around 1970. The correlation for the overlapping years 1960–2006 is 0.49 with the gross capital share and 0.41 with the net measure.

Gabbuti (2016) is working on new factor share estimates for Italy in the 1895 to 1945 period, updating Glyn's (2008) estimates using new value added estimates by Baffigi (2011) and new labour input estimates by Broadberry et al. (2011). (See also Giordano and Zollino 2015, pp. 190–191.) The new estimates show a slightly higher capital share during the 1910s and slightly lower c. 1925–1935. Given that the revision is ongoing, for now we use Glyn's estimates. There will be reasons to come back to the Italian series further along.

There are a few studies of the development of factor shares in Italy. Gabbuti's (2016) focus is the political economy of Fascism. The wage share falls rapidly during World War One, which is very similar to that happens in many other countries. Owever, it also bounces back quickly, to a rather high level in the early 1920s. 1919 to 1921 were in Italy even more than in other European countries years of labour conflict and an offensive of trade unions, which led to rapid wage increases. Gabbuti finds an important decrease in the wage share during Mussolini's regime. A string of researchers have observed and commented on the rise in the capital share since the 1970s (Torrini 2005; Giordano and Zollino 2015, p. 191)

A1.2.13 Japan

For Japan, there are factor share data back to 1906. Official data begin in 1950 and a large historical national accounts project in the 1960s and 1970s, summarized in English in Ohkawa and Shinohara (1979), added estimates from 1906 to 1940. There are no data for the 1940s because of war time disruption (cf. Ohkawa and Shinohara 1979, p. 72).

The Japanese factor share data are unusual in that they are from the beginning presented in terms of "distributed income". This is the sum of wage income, incomes of the self-employed, and corporate incomes and interest. In other words, unlike for most countries here to begin with we have net factor shares. The wage sum is presented including imputed labour incomes of the self-employed. We calculate the capital share as the residual, 100 less the wage share. All these data are for non-agriculture; Minami and Ono (1979, p. 205) who did the factor shares study in the Ohkawa and Shinohara project explicitly focused on non-agriculture because calculating factor shares in the agricultural sector is difficult. (See also Ohkawa 1968 for discussions of factor shares in Japan.) 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 post-war 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. We use the data from Ohkawa and Shinohara (1979, table A47) for 1906 to 1970 (missing 1940–49) and then link this series to capital share in national income from Piketty and Zucman (2014) from 1971 to 2010. For the overlapping years 1955 to 1970 the correlation between the Ohkawa and Shinohara series and the Piketty series is quite strong: 0.91. Piketty and Zucman have utilized the official National Accounts data so it is not surprising that their series is basically the same as the one we get from Ohkawa and Shinohara, who as mentioned also relied on official data from 1950 on.

To calculate the gross capital share, we use the same wage sum as used above. In the denominator we add provisions for consumption of fixed capital to the sum of distributed income, to get a gross income sum. Capital depreciation data come from Ohkawa and Shinohara's (1979) table A7 for the years 1906 to 1940 and table A8 from 1950 to 1970. For overlapping years in the 1930s the A7 series is a bit higher but the trend is precisely the same and as a share of GDP they are also very similar, rather constant throughout the 1930s at a level around 8-9 per cent. To bring the gross capital share series forward we link it to new gross estimates from Piketty and Zucman's data. Piketty and Zucman work with net capital shares but from the official National Accounts data contained in their Japan spreadsheet it is possible to calculate gross shares as well. In their "Japan Data" folder there is GDP, NDP and capital depreciation from 1955 to 2010 as well as net operating surplus, net mixed income and "Wages and social contributions paid by all domestic sectors". We calculate the gross capital income sum as the sum of net operating surplus, capital depreciation, and 35 per cent of net mixed income, i.e. using the proportional adjustment method. This capital income sum is then related to GDP. For the years where this series overlaps with our estimates from Ohkawa and Shinohara's data, 1955 to 1970, the series conform very well with each other. They both start around 33 per cent and increase to a level around 40 per cent in the 1960s; the correlation is 0.95. Thus, we find it unproblematic to link the two series. We use the estimates based on Ohkawa and Shinohara's data for 1906 to 1970 and the estimates based on the data in Piketty and Zucman for 1971 to 2010.

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). Ohkawa (1968) discusses factor shares from 1920 to the 1960s. Ohkawa points to that in general the capital share was quite high in Japan, union wage bargaining being held back (Ohkawa 1968, p. 186). This conforms well to Japanese capital shares at least before 1970 or so being among the higher in our cross-national data set. One exception to this rule is that he capital share decreased immediately after WW2 due to the dissolution of Zaibatsus and other political reforms (Ohkawa 1968, p. 180); we also see in our data, which lack the years 1941–52, that the capital share is much lower in 1953 than it was in 1940. Ohkawa points to a large and flexible supply of labour as a cause of the overall high capital share in Japan, but writing in the late 1960s, that labour supply is decreasing. This conforms very well with the rather drastic drop in the capital share that we find in the early 1970s, the biggest one in our Japanese data together with episodes around 1920, just after WW2, and during the economic crisis of the early 1990s. The latest study, which also includes an extensive literature review, is Okazaki (2016) who studies capital shares and income distribution in Japan in the first half of the twentieth century, using the same historical national accounts data that we use. Okazaki finds an increasing capital share and increasing income inequality, and that these two developments are related.

A1.2.14 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).

A1.2.15 The Netherlands

In the Netherlands, modern national accounting on a regular basis began in the 1930s (den Bakker 1994 and Bos 2006 for historical descriptions). During and after the Second World War, they increased in importance "for the purpose of planning economic recovery" (den Bakker 1994, p. 67). In 1933, the Dutch Central Bureau of Statistics (CBS) had published a national income study of 1929, interestingly enough at the request of the Supreme Labour Council, who were concerned with the effects on prices of wage increases (Bakker 1994, p. 69). There had also been scattered estimates of national income in 1908, 1914, 1919 and 1929–36 before the official, regular national accounts began to be produced at CBS under the leadership of Jan Tinbergen. This project started in 1937 and these official national accounts, which were built from the income side as was regular practice in those days, covered the years since 1921, which is still the starting point for the official series.[19]

We calculate factor shares from 1921 to 2010 from the official national accounts (National Accounts of the Netherlands 2010, table H 2, pp. 175-6).[20] The 1921–2010 series is available both gross and net. Both series are only available for the total economy, not sector-wise. It is not possible to make an adjustment for the self-employed with this data, as their incomes are not presented separately, but just in an "operating surplus/mixed income" post, i.e. together with all capital incomes. (The same is true for Bochove and Huitker's [1987, table H1] presentation of national accounts from the income side.)

To estimate adjusted capital shares, we need other sources for the self-employed and their incomes. We have fetched these from several sources. For the beginning of our period there are two alternative sources for the incomes of the self-employed. A Centraal Bureau voor de Statistiek, CBS (1948, table 39, "Nationaal inkomen naar productiefactoren") publication on national income from 1921 to 1939 present the incomes of the self-employed as a separate post (*Ondernemersinkomens*), for 1923–1939. Per this source this post is rather stable around 28 per cent throughout the interwar years. A 1941 CBS publication on the other hand presents the incomes of the self-employed for the years 1910 and 1938, calculated as a rest post (Centraal Bureau voor de Statistiek 1941, table 7). This source puts the share of the self-employed in national income as 34 per cent in 1910 and 20 per cent in 1938, implying a decrease in the self-employed

[19] Some other national accounts data go back to 1900; see Bochove and Huitker (1987, p. 1).
[20] Smits et al (2000) have factor shares estimates for 1807–1913 but since the top income data for the Netherlands only begin in 1914 their data are not interesting in the present context.

share, even though of course we do not know when between 1910 and 1938 the decrease occurred. Bakker and de Gijt (1994, p 17) in newer national accounts research estimate the share of self-employed in the labour force (that is, of persons, not share of income) as 20 per cent in 1920, 21.3 per cent in 1930 and 20.5 per cent in 1939. If we assume that there were no drastic changes in relative incomes between self-employed and the employed, then using the CBS (1948) data for the incomes of the self-employed seems reasonable. Therefore, we use these data. For 1949 to 1956 complete national income accounts are published in the National Accounts of 1958. We use the posts "incomes of agricultural enterprises" (*Inkomen uit landbouwbedrijf*) and "incomes from free professions" (*Inkomen uit vrije beroepen*) to calculate the incomes of the self-employed. They correspond to about 12-13 per cent of national income, without trend. Finally, for the years 1960 to 2010 we use AMECO to adjust for the self-employed. We use the capital shares calculated from the 2010 National Accounts and adjust these by the factor that differs the adjusted from the unadjusted capital share in the AMECO data. This factor fluctuates between 0.56 and 0.76, meaning that the adjusted capital share corresponds to between 56 and 76 per cent of the unadjusted capital share in the AMECO data. For the years 1957–59 we linearly interpolate between our 1956 estimate, the last with the 1958 National Accounts data, and 1960, the first year with the AMECO self-employed data.

There is some interesting literature on factor shares in the Netherlands. As mentioned above the official national accounts from the income side begin in 1921. Van Ark and de Jong (1996, Appendix Table C.1) on the other hand present a factor shares estimate for 1913. Their wage share includes imputed labour incomes of the self-employed. They then interpolate between 1913 and 1921 (see p. 46), giving their wage share series the unlikely shape of no down-turn during the war. De Meere (1983) describes a by now familiar pattern: "during WWI there was a dramatic widening of income differentials, which were subsequently more than reversed." He cites a contemporary observer: in "Amsterdam, too, nouveaux riches came as a result of the War, but also nouveaux pauvres; in Amsterdam, too, we had war-profiteers" (p. 16) He also points out that "For the Netherlands, between 1921 and 1972, Hartog and Veenbergen (1978) have found a negative correlation between the share of wages in national income and the distribution of income." De Meere calculates the unadjusted wage share in 1910 and 1921–39. The wage share is much higher in 1921 than in 1910, then partly falls back in the 1920s, which is also what our data show. He finds the expected negative correlation between wage share and income inequality for the 1921 to 1939 period. Jan Luiten van Zanden (2000) provides one of the few studies in economic history that differs from the common view of the postwar period

as one of wage restraint. Van Zanden uses national accounts data and shows that while there was indeed wage restraint and a falling wage share immediately after the Second World War (cf. van Ark and de Jong 1996, p. 48), during the strong economic growth of the 1960s the capital share falls rapidly. His finding of wage restraint in the late 1940s and early 1950s corresponds well to our finding of a historically high capital share in the early 1950s. We also replicate his finding of a drastically falling capital share during the 1960s. Salverda and Atkinson (2007) in their study of top incomes in the Netherlands look at capital and labour incomes. They point to that non-belligerent Netherlands saw very rapid inflation during WW1 and that "exorbitant profits were an important issue at the time and may have contributed to the initial increase in the top shares and relatively high level of the Dutch top shares compared to other countries" (p. 441). Their main finding is that top income shares decreased to the mid-1970s and then stayed flat. From 1952 on they have the composition of incomes, divided into income from labour, enterprise, other property (rents, dividends and interest), and other incomes (pensions and transfers). Top income earners get a much larger share of their income as capital income, although the share decreases over time. In total incomes, the capital share decreases from around 30 per cent in 1952 to around 10 per cent in the late 1990s; for the top 10 per cent the decrease is from around 60 per cent to about 15 and for the top 1 per cent from about 70 per cent to around 30 per cent (p. 450).

A1.2.16 New Zealand

The New Zealand statistical yearbooks started reporting national income in 1946.[21] That year's yearbook presented incomes for 1941–46 in "salaries and wages", "'other' income (including company income", and "social security benefits pensions, &c". In the following yearbook, 1947–49, the accounting is much more elaborate. Reference is explicitly made to the striking advances in recent years "of some form of national social accounting". For the years 1938–39 to 1949 this yearbook presents detailed national income accounts with the necessary information for calculating factor shares, gross and net. The series for 1939 to 1977 have been collected by Statistics New Zealand in what is now called the "Old National Accounts" (ONA) data set; this is available from the SNZ web site http://www.stats.govt.nz/infoshare/. The current National Accounts (which follow SNA 2008) present detailed national income accounts

[21] 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) The history of national accounting in NZ is told for example in the 1990 yearbook, section 26.

back to 1972. These present the necessary data on operating surplus, national income and consumption of fixed capital, but unfortunately does not separate the incomes of the self-employed from operating surplus in the strict sense.

To create our series from 1939 to 2010 we do as follows. For 1939 to 1977 we use the Old National Accounts. The capital income post is calculated as the sum of one third of the incomes of the self-employed and the whole of company income, "Trading Income of Public Authorities", interest on public debt, and capital depreciation. The gross capital share is then derived as this sum divided by national income at factor cost. The net capital share is calculated in the same way but without including capital depreciation. From 1978 to 2010 we use the SNAs. Here we calculate the gross capital share as operating surplus divided by national income. Since all incomes of the self-employed are included in operating surplus in the SNA data, we adjust the capital share by the factor by which the ONA capital share is larger than the SNA capital share for the overlapping years, from 1972 to 1977. The series are, except for the necessary level differences necessary since the SNA series includes all self-employed income while the ONA series only includes one third, very similar. Both show a slightly increasing capital share from 1972 to 1973, a standstill to 1974, a rapid fall in 1975, a slight further fall in 1976, and a slight rebound in 1977. The correlation is 0.88 for the gross series and 0.95 for the net series. The SNA series are typically 30-40 per cent higher and so we adjust the SNA data for 1978 to 2010 by this factor (divide the gross series by 1.4 and the net series by 1.3). Of course, our ad hoc adjustment to the SNA data builds on the assumption that the share of the self-employed does not change much. This seems a reasonable assumption. According to census data, in 1971, the self-employed as a share of all employed were 12.8 per cent; in 1976, 14.1 per cent; in 1986, 10.0 per cent, in 1991, 11.7 per cent, in 1996, 12.2 per cent, and in 2003, 11.5 per cent. (New Zealand Statistical Yearbook 1980; Yearbook 2000 Table 14.2; Yearbook 2006 table 14.07).

A series which goes even further back in time is the one presented by Hussey and Philpott (1969), unfortunately only for the agricultural sector, for the 1922 to 1967 period.[22] Agriculture was 25 per cent of GDP in 1918 and 23 per cent in 1939 (Lineham 1968, table 1a), so there data only for agriculture is not without interest. As agriculture's share of the economy decreases in the postwar period, naturally this data becomes less representative of the general economy. Hussey and Philpott present four series: total wages paid, Interest paid, Rents Paid, and total

[22] Philpott (1958) is a precursor; he presents the national accounts for agriculture for the years 1922 to 1956.

output. We have estimated the capital share as interest and rents as proportion of output. We link this series to the capital share of national income based on AMECO, which is available from 1960 onwards. 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. This is not surprising given that one series is for agriculture only while the other is for the total economy, but it presents problems when linking.

Woodfield (1972, p. 80) shows a wage share in manufacturing around 75 per cent in the second half of the 1920s, with a slight peak around 1930–31 with a subsequent decline to 70 per cent in the mid-1930s. It stays around this level until around 1960 where there is a sudden and short-lasting drop, then an equally sudden and short recovery, and then another fall in the first half of the 1960s, to around 65 per cent in 1968 when Woodfield's data end. Birks (1984) follows with a study of manufacturing from 1947–1974; however he uses the wage share solely for the purposes of understanding other variables.

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.[23] 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.

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 beginning of the 1980s saw a debate on this profit squeeze (Bertram 2001), quite similarly to the situation in Denmark (see discussion above). Saunders et al (1991) found that the rise in capital incomes in the 1980s was an important determinant of increasing income inequality. Krawczyk and Townsend (2015)

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

explore the relation between the capital share and inequality in New Zealand since 1945. They find that income distribution tilted in favour of capital from 1945 to the early 1950s, but after that completely turned around and had a labour-friendly trend until around 1980. They attribute this long trend to a labour-friendly political economy with a consensus around a strong welfare state (Krawczyk and Townsend 2015, pp. 11–12.)

A1.2.17 Norway

Norway has a strong tradition of national accounting and historical national accounts since the 1940s (Aukrust 1994; Grytten 2004, p. 242). The Norwegian Central Statistics Bureau, SSB, was cooperating with Simon Kuznets' international historical national accounts project, and was at this time at the forefront of research. This period has been described in later historical research (Kenessey 1994, pp. 4, 10; Aukrust 1994; Lie 2007; Halvorsen et al 2011). The first important publications for our purposes came in the early 1950s (see Aukrust 1952, 1957), providing detailed national income estimates for the 1930s, 1940s and early 1950s. 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. However, we want to go further back in time, with retained precision in that we want factor shares series adjusted for the incomes of the self-employed, and gross as well as net. Fortunately, there has been a new wave of historical national accounts research in Norway in the early twenty-first century.

To calculate factor shares in Norway, for 1910 to 1960 we take the wage sums from a string of newer historical national accounts studies: Hansen and Skoglund (2005, 2008a, 2008b). We use the newest GDP estimates, from Grytten (2004). For incomes of the self-employed we use the estimates for 1900, 1930, 1946, 1960 and 1968 from Bjerke, a leading figure in the previous generation of historical national accounts researchers (Bjerke 1972, table 1). For the incomes of the self-employed we interpolate between the years for which Bjerke provide estimates, and allocate 65 per cent to the wage share, i.e. using the proportional method.

Our adjusted calculations can be compared to SSB (1965) which provides estimates for 1930–39 and 1946–60. For 1930 to 1939 the total wage share/capital share estimates are almost exactly the same, but with slightly different components: the labour incomes of the self-employed

are larger according to our estimates and the wage and salary sum of employees lower. For 1946 to 1960 the SSB wage share estimate is 5 to 10 per cent higher than ours. For the overlapping year 1960 the SSB estimate is very high at 70 per cent, while our estimate is 59 per cent, and AMECO's is 64 per cent.

For capital depreciation, Statistisk Sentralbyrå (1965, table 50, pp. 350ff) provide figures from 1865 to 1961. From 1951 it can be calculated from PWT and from 1960 from AMECO. However the problem is that the SSB estimates for the 1950s look extremely high: the overlapping year at the beginning of the 1960s is around 25 per cent while AMECO's figure is around 15 per cent. The reason is that in the 1950s and 1960s, Norwegian national accounts included reparations and maintenance in the investments post in GDP (Halvorsen et al 2011, p. 79).[24] This means that investments and capital depreciation look very high. There are no new Norwegian estimates for these decades with the post-1970 definition of investments and capital depreciation, so to smoothen the transition from the definition used by SSB (1965) and the definition used by AMECO, we simply take the SSB series for the years 1910–39, then two thirds of it from 1946-59, then the AMECO figures from 1960 on.

A1.2.18 Spain

The economic historians Leandro Prados de la Escosura and Joan Roses (2009, 2010) have recently completed a great dataset on Historical National Accounts for Spain for the years 1850 to 2000. In their 2009 paper, they present factor shares. For the self-employed, they have assumed that these have a labour income equal to the average employee compensation in their industry (Prados de la Escosura and Roses 2009, p. 1080). They have calculated the adjusted wage share, then derived the land share as "the residual after deducting labor outlays from agricultural gross value added". The capital share has been calculated as a residual after subtracting the wage share and the land share from GDP at factor cost. In their 2010 paper, which is concerned with capital formation in Spain, they present estimates of capital depreciation. We use these to calculate the net factor share, which we calculate as the gross capital share less the share of capital depreciation in GDP. For the turbulent years of civil war 1936 to 1939, we have set capital depreciation to zero, as it implausibly was positive in the dataset. The Prados de la Escosura and Roses dataset allows one to calculate capital shares back to 1850, but since top

[24] Many thanks to Kristine Vikesund for pointing this out to us.

income shares are only available since 1933 (Alvarado and Saez 2008), we only look at the twentieth century.

Prados de la Escosura (2008) has discussed inequality in Spain from 1850 to 2000 in another paper, which especially looks as the ratio of wages to GDP – a simpler form of the wage share – as the inequality measure. (Beltrán Tapia and Martínez-Galarraga 2013 expand upon this analysis.) With this measure, he finds increasing inequality – GDP grows faster than workers' wages – in the late nineteenth and the early twentieth century, then decreasing inequality from World War One until the mid-1930s, then increasing inequality again. Inequality reaches a new peak around 1950, which is different to many other countries and related to the special political circumstances of the Franco regime which came to power in 1939. When the wage share increased during the interwar period, wage inequality also grew (Prados de la Escosura 2008, p. 294). Alvaredo and Saez (2009), looking at the top 0.01 per cent of the income distribution, found decreasing income inequality in the first two decades of the dictatorship; Prados de la Escosura (2008, citing a WP version of the Alvaredo and Saez paper) claims that the capital share increased during these years, but that capital ownership became less unequal, so that the increasing capital share failed to increase income inequality. Prados de la Escosura (2008, p. 303) finds the strength of trade unions and worker unrest as causing rising wages in the 1930s, which hurt capital incomes and increased social polarization in Spain. The Franco regime turned around this development, and the capital share increased. During the 1950s, the regime flirted with labour-friendly populism and wages increased rapidly, which decreased inequality.

A1.2.19 Sweden

Sweden has a strong tradition of historical national accounting since the 1930s, when the multi-researcher, multi-volume project "Wages, Cost of Living and National Income in Sweden, 1860–1930" was accomplished (see Aukrust 1994; Bohlin 2003, p. 74 and Lobell et al 2008, pp. 143–144 for discussion). The Swedish researchers were just as their Norwegian colleagues, as discussed above, a part of the internationally growing historical national accounts community (see Lie 2007). However they did not emphasize factor shares per se. Analyses especially of factor shares and their determinants only took off with Jungenfelt (1966), who built on data from the 1930s project as well as Johansson (1967). Later especially the economic historians Lennart Schön (2004) and Rodney Edvinsson (2005) have produced slightly differing historical national accounts, including factor shares, back to 1870 and 1850, respectively.

We estimate capital shares for Sweden for the years 1900–2000 from data in 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.[25]

There are a few studies of functional income distribution in Sweden. Jungenfelt (1966) analysed factor shares for the 1860–1950 period from a neoclassical perspective, focusing on two determinants of factor shares: elasticity of substitution between labour and capital, and technological change. He saw three periods in his data: first from the 1870s to the end of the 1890s without any trend, then a falling wage share from 1900 to the First World War, and then an increase in the wage share from the war until the mid-1920s. At the same time, Fridén (1965) analysed wage shares from 1948 to 1963. Schön (2004) who looks at the 1870 to 2000 period claims that the wage share in Sweden follows 40 year economic-structural cycles, increasing during the 1880s, 1920s and 1960s when new consumption patterns develop. Then, the high price of labour cause firms to rationalise production and the wage share falls in the 1890s, 1930s and 1970s, when important new inventions break through and profits increase again. 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.

A1.2.20 United Kingdom

For the U.K. as for France and Germany, we use Piketty and Zucman's (2014) dataset. In their UK spreadsheet, they present the national accounts since 1855 for four sectors: the corporate sector, the housing sector, the non-corporate sector, and the government sector. In addition, they present net foreign capital income flows and paid government interest separately. (The necessary data is in the table "DataUK1: Raw 1855-2010 national income accounts series for UK (income, expenditure, output, saving)".) To calculate the gross capital share we first calculate the gross capital income sum as the sum of capital income and capital depreciation in the corporate and housing sectors, one third of mixed income in the non-corporate sector, capital depreciation in the government sector, net foreign capital income inflow, and net government

[25] 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.

interest. We get the gross capital share by dividing this through national income, defined as gross value added of the four sectors plus net foreign income flows and net government interest. To calculate the net capital share, we use the same procedure but exclude capital depreciation on both sides of the equation.

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.

A1.2.21 United States

In the United States, national accounts started to be consistently produced at the National Bureau of Economic Research (NBER) in the 1920s. In 1921–22, NBER published national income estimates for 1909–18 and in 1930 Willford Isbell King (1930) of the NBER published *The National Income and Its Purchasing Power*, in which he revised the estimates for 1909–18 and presented new estimates for the 1920s. In the 1930s the Department of Commerce began publishing national income estimates, and in the 1940s also national product (Kane 2012). The most famous studies of this period were done by Simon Kuznets, who worked for both NBER and the Department of Commerce; in a string of publications throughout the 1930s he presented national income estimates back to 1919 (e.g. Kuznets 1937a and Kuznets, Epstein and Jenks 1941). During the Second World War, estimates of national product became key instruments for policy-making, in an age shaped by interventionism and influences from J.M Keynes (Kane 2012, pp. 13–14; cf. Carson 1975). Whereas the early national accounts by King and Kuznets had been from the income side, now national accounts from the expenditure side grew in influence. In 1947, the Department of Commerce created the National Income and Product Accounts (NIPAs), which expanded upon the previous GNP estimates by "creating a more complete system of economic accounts showing the income and expenditure transactions of individuals, businesses, and government." (Kane 2012, p. 14)

For our purposes, the NIPAs, now done by the Bureau of Economic Analysis (BEA) at the Department of Commerce, are still the most important source. (The history of the NIPAs are

told in Carson 1975 and Marcuss and Kane 2007.) The NIPA data cover the period since 1929. We use Piketty, Saez and Zucman's (2016) adaptation of the NIPA data, with data from King (1930) for 1913–19 and Kuznets (1937) for 1919–29. In Piketty, Saez and Zucman's excel sheet "AppendixTablesI(Macro).xls", they include the national accounts data that we need. The relevant data is in the sheet "DataIncome".

National income is here reported in the posts "Compensation of employees", "Proprietors' income", "Rental income of persons", "Corporate profits", "Net interest and misc. payments", and "Business current transfer payments (net)". To calculate the net capital share, we first take one third of proprietors' income and all rental income, corporate profits and net interest post to get to the capital income sum. This is then divided by national factor income to get the net capital share.

To calculate the gross capital share, we want to do the same calculation but with capital depreciation allowances included both in the capital income sum and the national income sum. However, Piketty, Saez and Zucman (2016) report capital depreciation only from 1929 on. And the early national accounts research by King (1930) and Kuznets (1937a) was focused on national income, not looking at capital depreciation. Warburton, who in 1934 was the first person to use the concept gross national product (Carson 1975, pp. 162–163) and who was a pioneer in national accounting from the production side, presented the first GNP estimate, including capital depreciation allowances, only in 1935 (Warburton 1935, Table II). He calculated depreciation rates for the years 1919, 1921, 1923, 1925, 1927 and 1929. Two years later Kuznets (1937b, Appendix table VIII) improved the estimates, providing new capital depreciation estimates for each year 1919–35. According to Warburton, capital depreciation fluctuated between 7.4 and 9.8 per cent of GNP from 1919 to 1929. Kuznets found slightly higher levels, from 10.1 to 12.8 per cent, with even higher rates in the 1930s, between 13 and 16 per cent of GNP. To calculate gross capital shares, we use Kuznets' (1937, Appendix Table VIII) capital depreciation data for 1919–28, and for the years 1913–1918 we assume that the ratio of capital depreciation to national income is the average of 1919–1922, which is 12.68 per cent. Net capital income plus capital depreciation divided by gross factor income (i.e., net factor income plus capital depreciation) is the gross capital share.

For the earlier periods, there are some estimates of factor shares, but these are more scattered and less reliable than the post-1913 data. 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 NIPA data, and therefore we only look at the post-1929 period.

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. Schuller (1953) investigates factor shares 1869–1948 with the aim to shed light on the role of bargaining power and market power of "quasifunctional classes of income-recipients". 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).

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

A1.2.22 Summary

Table 1 in the main text of the paper summarizes the main capital series for our 20 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.

We contribute to the literature by compiling – and to some degree creating – a host of historical capital shares for 20 countries, and providing the source critical and methodological discussion in this Appendix. In this way, the dataset will be useable for further research on determinants and effects of capital shares.[26]

A2. 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.

[26] In the future, we might add further countries to the Database. For now it does not seem central, as there are no reasons to expect that it will change the empirical results in the paper for which the Database is first used, but for further research more data will be interesting. Which could be the ways forward? 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. Giacomo Gabbuti has new work in progress on this issue. 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.

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