A Century of Rising Business Concentration around the World[*]

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Abstract

We collect long-run data on the firm size distribution in nine market-based economies in Asia, Europe, North America, and Oceania. Around the world, we observe prevalent increases in the concentration of production (e.g., sales share of the largest firms) over the past century, among these countries where we can find relatively comprehensive coverage for the population of companies. The evidence shows that rising production concentration is a pervasive phenomenon, not limited to the recent decades or to the United States. In a variety of countries, large firms have become increasingly dominant, and the span of control appears to expand.

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I Introduction

The extent to which production can be accomplished through organizations and planning is one of the longest running themes in the history of economics. In the two and a half centuries following Smith (1776)'s articulation of the invisible hand, mapping out the scope of the visible hand has been an inevitable inquiry (Marshall, 1890; Marx, 1867; Berle and Means, 1932; Hayek, 1945; Arrow, 1974; Lucas, 1978; Chandler, 1994). As Coase (1937) described vividly, in every society, we find "islands of conscious power in this ocean of unconscious co-operation like lumps of butter coagulating in a pail of buttermilk."

In this paper, we document that, among a variety of "free-market" economies with available data, production has become increasingly concentrated in the largest firms over the past century. The "lumps of butter" have been expanding. Such expansion has drawn much attention in recent years among researchers, policymakers, and the public. Our previous work shows that rising production concentration has been a longstanding feature in the U.S. throughout the 20th century (Kwon, Ma, and Zimmermann, 2024). This work shows that it is a prevalent feature around the world, not limited to either the recent years or the U.S. Although the precise mechanisms behind this phenomenon are challenging to establish definitively, the pervasiveness suggests that a full account needs to apply broadly across many settings (e.g., mechanisms tailored to the recent decades in the U.S. are incomplete).

We search "market-based" advanced economies for long-run data on the firm size distribution. We look for comprehensive coverage of the business population like the data we compile for the U.S. in Kwon, Ma, and Zimmermann (2024), especially given that public companies are few and heavily selected in many countries so stock market data have serious limitations. We have been able to find such data for the following countries. In most cases, the data are annual (with some occasional gaps). The countries vary in the exact details of the tabulations (e.g., the size measure), but share the broad framework of presenting the size distribution of businesses. We describe the data sources in detail in Section II. We summarize them below, and group countries where the data have similar features.

First, for Germany, we are able to find tabulations by size of sales covering all types of companies from the 1920s to the 2010s. The information comes from the sales tax statistics published by the statistical office. Similarly, for Austria, we are able to find tabulations by sales for all types of companies published by the statistical office starting in 1954.

Second, for Denmark and Switzerland, we are able to find tabulations of corporations by size of equity capital from the early 1900s to the 1980s, which come from corporate register data. Then starting in the late 20th century, both countries publish tabulations by size of sales covering all types of companies (not just corporations), which come from the business registry and value added tax returns.

Third, for the U.K., between 1958 and 1992, we are able to find tabulations of manufacturing firms by size of net output (akin to value added) from the Census of Production, and Prais (1976) provides additional estimates of the share of the 100 largest manufacturing enterprises by net output for selected years since 1909. Then starting in 1985, we can find tabulations of the number of businesses by turnover (sales) size published by the Great Britain Business Statistics Office.

Fourth, for Australia, we can find tabulations of corporations by size of taxable income since 1940 from Taxation Statistics. For Canada, we can find tabulations of corporations by size of taxable income from Taxation Statistics between 1944 and 1987.

Finally, for Singapore, we can find tabulations of corporations by size of assessed income since 1972, from the Yearbook of Statistics before 2004 and the Inland Revenue Authority of Singapore (IRAS) afterwards. For South Korea, thanks to data collected and shared by Choi et al. (2024), we observe the share of the largest 100 and 500 manufacturers by sales in total manufacturing gross output from the early 1970s to the early 2010s.

We estimate the share of top companies from the tabulations of firms by size bins. For instance, if the tabulations are by size of sales (net income), then we estimate the share of the largest firms by sales (net income) in overall sales (net income). For countries that have tabulations by net income, we need to restrict to firms with positive income. We estimate top shares using the generalized Pareto interpolation (Blanchet, Fournier, and Piketty, 2022), which fits a Pareto coefficient to each size bin and interpolates these Pareto coefficients. In Kwon, Ma, and Zimmermann (2024), we checked that the top shares estimates are over 0.99 correlated if we instead fit and interpolate lognormal distributions, or directly add up the top bins to a given number of businesses.

We start with the top 1% and the top 0.1% shares in Section III.A. The benchmark for evaluating the disparity of business size is the top % share in a number of models (Aghion et al., 2023; Hsieh and Rossi-Hansberg, 2023). Moreover, the top % share is portable across different countries that differ a lot in size.

In both Germany and Austria, we observe that top shares by sales have increased persistently over the 20th century. The share of the large 1% (0.1%) companies by sales was around 0.4 (0.2) in the 1920s, around 0.6 (0.4) by the 1970s, and around 0.7 (0.5) by the 2010s. In Denmark and Switzerland, we observe a general increase in the top 1% (0.1%) share by capital among corporations from around 0.4 (0.1) in the early 1900s to around 0.6 (0.35) by the 1980s, with a continued increase in the top 1% (0.1%) share by sales among all types of companies since the 1980s and 1990s. In the U.K., we are only able to find consistent long-run data for manufacturing, and we observe that the top 1% (0.1%) net output share increased from around 0.6 (0.3) in the late 1950s to around 0.7 (0.4) in the 1980s, and the top 1% (0.1%) sales share increased from

around 0.65 (0.4) in the mid 1980s to around 0.7 (0.5) by the early 2010s. This pattern is consistent with our findings in the U.S., where rising concentration in manufacturing was also stronger before the 1980s. For Australia and Canada, the top 1% (0.1%) net income share among corporations started from around 0.4 (0.2) in the 1940s, increased to around 0.6 (0.4) around the 1980s, and Australian data show continued increase to around 0.8 (0.6) by 2000 (after which the Australian top shares have been relatively flat and Canadian data currently end in 1987). For Singapore, the data start later in the early 1970s, and the top shares show upward trends too.

We then present the top N shares in Section III.B. The top N shares face several practical challenges. First, picking the right N across these different settings is challenging and somewhat arbitrary. For illustration, we use top 500 and top 5,000 for large countries, and top 100 and top 500 for small countries (except when the top bin is not granular enough). Second, the top N share is trickier in settings where we only have size tabulations for corporations (Australia, Canada, Singapore, as well as Denmark and Switzerland by size of equity capital). Specifically, in the U.S. data (Kwon, Ma, and Zimmermann, 2024), we observe that the top N share among all businesses, the top $x\%$ share among all businesses, and the top $x\%$ share among corporations have similar behavior, but the top N share among corporations can behave differently in settings that experience changes in the prevalence of corporations. The reason is that when corporations become more common, for example, the total size of corporations expands. As the result, the top N share among corporations can change artificially due to the expanded denominator (whereas the top $x\%$ share among corporations is not sensitive to the issue because the numerator adapts too). To minimize the impact of the changing prevalence of corporations versus noncorporations, we estimate the size of all businesses for the denominator (using proxies of the corporate share), and we have to assume that the largest firms are all corporations (which may underestimate the top shares).

We observe long-run increases in the top 500 (5,000) shares by sales in Germany and Austria, although the level here is less comparable across the two countries. We also observe long-run increases in the top 100 (500) shares by equity capital in Denmark and Switzerland, and then continuing increases in the top shares by sales in these countries in recent decades. For the U.K., the top 100 net output share in manufacturing increased until around the 1980s, and the long-run increase is even stronger if we extend the series back to 1909 using estimates by Prais (1976). In Australia and Canada, the top 500 (5,000) shares show similar long-run trends to those of the top percent shares. In Singapore, the top 500 (5,000) shares also increased. In Korea, the top 100 (500) share in manufacturing rose from around 20% (30%) to 45% (55%) from the early 1970s to the early 2010s.

A natural question is how to think about globalization, and whether we should analyze each country on its own. In the data, we are limited by the reporting convention of each country, and we cannot easily

aggregate across countries given their different types of tabulations. As shown above, in many countries we observe strong rising concentration before the age of globalization, when each economy was relatively independent. In Germany, Austria, and Denmark, the tabulations by sales are limited to domestic sales. Accordingly, the top shares we obtain in recent decades can understate the dominance of large firms in these settings, since large firms are more likely to have international sales.

A growing body of research has been interested in the concentration of control through common ownership, given the rise of large asset managers (e.g., Vanguard, BlackRock) that own a significant fraction of shares across multiple companies (see Schmalz (2018) and Backus, Conlon, and Sinkinson (2019) for reviews of the common ownership literature). Such common ownership driven by large asset managers is unlikely to affect most of our sample period (before index funds became prominent) and sample firms (the vast majority are not publicly listed).[1]

Literature review Our paper provides new facts about the long-run evolution of economic activities. Changes in production concentration have drawn much attention in recent research. Several influential papers highlight rising industry concentration in the U.S. since the 1980s (Autor et al., 2020; Covarrubias, Gutiérrez, and Philippon, 2020). Recent work using European data has focused on the post-2000 period, which has produced different findings depending on data analysis procedures (Bajgar et al., 2023; Gutierrez and Philippon, 2023; Kalemlİ-Özcan et al., 2024). Early studies also provide a few glimpses of production concentration in the initial decades of the 20th century, such as the shares of the top 100 or 200 firms in the U.S. and the U.K. for certain years (Means et al., 1939; Blair, Houghton, and Rose, 1946; Adelman, 1951; Kaplan, 1954; Collins and Preston, 1961; Federal Trade Commission, 1969; Prais, 1976).

The main precedent (to our knowledge) of comprehensive long-run data on the firm size distribution is our previous work (Kwon, Ma, and Zimmermann, 2024), which covers the U.S. from 1918 to 2018. A natural question is whether the long-run increase in production concentration is unique to the U.S. This paper documents that such long-run trends are present across different continents around the world. The pervasiveness of this phenomenon also suggests that it does not just arise from the policies or demographics of the U.S. More general economic forces might be at play.

More than 100 years ago, the opening sentence of Lenin (1916) proclaimed that "the remarkably rapid concentration of production in ever-larger enterprises are one of the most characteristic features of capitalism." Curiously, this statement seems to have merit in the data over the subsequent century. It might be possible that technological development has ameliorated the knowledge problem of society (Hayek,

[1] Some countries have holding companies or business groups that control multiple operating companies. Although it is difficult to verify the exact reporting details, the treatment in our data should be consistent over time since total sales relative to GDP are stable. If individual operating companies report separately rather than combined as a fully consolidated entity, then it would likely increase total sales to GDP (since intercompany sales are not netted out) and decrease top shares.

1945), so that production through large organizations has become increasingly feasible. It might also be possible that winner-take-all effects are becoming stronger (Lucas, 1978; Rosen, 1981).

It is important to note that our focus is the firm size distribution in the economy, not competition or market power.[2] It is well recognized that concentration is not a barometer for market power (Demsetz, 1973; Syverson, 2019). Relatedly, our focus is to document that the organization of production has changed substantially around the developed world over the long run, but we do not take a stance on whether the increasing dominance of large firms is good or bad.

II Data

II.A Sources and Coverage

Our large-scale data collection starts with major countries that approximate free-market economies. We search through official sources to look for systematic tabulations of firm size distributions. We have been able to obtain high quality data for the list of countries summarized in Table 1. The column "Size Bin Type" shows the size measure available in the tabulations. The column "Company Type" shows the types of companies covered, which would be either all types of companies (including corporations and noncorporations) or corporations. The column "Year" shows the time span. The frequency is mostly annual, except for occasional gaps (especially in early years). The column "Source" gives a brief summary of the source. We provide detailed information about the sources and variable definitions in Appendix IA2.

For the main results in Section III, we organize the countries into five groups broadly based on the similarity of data sources, size measures, or time span: 1) Germany and Austria, 2) Denmark and Switzerland, 3) United Kingdom, 4) Australia and Canada, and 5) Singapore and South Korea. We start with Germany, which offers comprehensive information for a long period of time. The data for Austria are similar to those for Germany, but start later. The data for Denmark and Switzerland are relatively similar to each other. Then we move to the commonwealth countries: U.K., Australia, and Canada, and the latter two have common features. Finally, we move to Asian countries where the development of the modern economy as well as the data publications started in the second half of the 20th century. We proceed in the same order in the following paragraphs.

[2] In addition, although economy-wide production concentration has been increasing, concentration in the market for a particular product or location may behave differently (Rossi-Hansberg, Sarte, and Trachter, 2021; Benkard, Yurukoglu, and Zhang, 2023; Hoberg and Phillips, 2023; Affeldt et al., 2021). For instance, it could decrease when large firms expand into more markets. It may also respond more to regulations at the product market level.

Table 1 – Sample Coverage

Country	Size Bin Type	Company Type	Year	Source
Australia	By net income	Corporations	1940-2020	See Table IA1
Austria	By sales	All	1954-2020	See Table IA2
Canada	By net income	Corporations	1944-1987	See Table IA3
Denmark	By capital By sales	Corporations All	1902-1983 1970-1999	See Table IA4
Germany	By sales	All	1924-2020	See Table IA5
Korea (manufacturing)	By sales	Corporations	1970-2011	Choi et al. (2024)
Singapore	By net income	Corporations	1972-2021	See Table IA6
Switzerland	By capital By sales	Corporations All	1901-1987 1995-2021	See Table IA7
UK (manufacturing)	By net output By sales	All All	1909-1992 1985-2013	See Table IA8

Notes: This table summarizes the sample coverage for each country.

Germany The German data offer size bins by sales for all types of companies, published by the German statistical office for a long period of time from the 1920s to the 2010s (see Table IA5 for detailed descriptions of the sources). We obtain physical copies of the publications before 1935 through the German National Library (Statistisches Reichsamt, 1928, 1931, 1932, 1938), and PDFs through the statistical library of the Statistisches Bundesamt afterwards (Statistisches Bundesamt, 1955-1961, 1962-1976, 1978-2011, 2012-2022); we then transcribe the data. The information in the size tabulations comes from the sales tax, which all firms have to pay if their sales exceed a pre-specified threshold. The threshold was 8,000 Deutsche Marks by 1956, 20,000 Deutsche Marks by 1980, and 17,500 Euros by 2003 (see Appendix IA2.5 for more details). The tabulations sort firms based on total sales (including both taxable and tax-exempt sales) in Germany. Sales from outside of Germany are not included. Before 1945, the tax statistics cover firms from the entire "German Reich." After 1945, the statistics cover West Germany. West Berlin is included from 1957 onward, the Saarland from 1960 onward, and East Germany from 1992 onward. Since the economy of East Germany was less than 10% that of West Germany around the time of the reunification (Maddison, 2006), this change does not have a material impact on total sales or top shares. Figure IA11 shows that total sales in our data relative to GDP does not have any time trend, which indicates that the coverage of the tax statistics over time is stable.

Austria The Austrian data also offer size bins by sales for all types of companies, published by the Austrian statistical office starting in 1954 (see Table IA2 for detailed descriptions of the sources). We obtain physical copies from the German National Library before 2012 (Österreichischen Statistischen Zentralamt,

1958; Österreichisches Statistisches Zentralamt, 1960-1980; Österreichischen Statistischen Zentralamt, 1977-1999; Statistik Österreich, 2000; Statistik Austria, 2001-2014), and PDFs from the website of Statistik Austria after 2012 (Statistik Austria, 2015-2023*a*); we then transcribe the data. The information in the size tabulations similarly comes from the sales tax, which all firms have to pay if their sales exceed a pre-specified threshold. It was roughly 1,500 Schillings in 1954, 40,000 Schillings in 1973, 30,000 Euros in 2018, and 35,000 Euros in 2020 (see Appendix IA2.2 for more details). The tabulations sort firms based on total sales (including both taxable and tax-exempt sales) in Austria. Sales from outside of Austria and exports are not included. Figure IA7 shows that total sales in our data relative to GDP does not have any time trend, which indicates that the coverage of the tax statistics over time is stable.

Denmark We use two types of tabulations for Denmark (see Table IA4 for detailed descriptions of the sources). First, between 1902 and 1983, Statistics Denmark published tabulations of corporations by size of equity capital based on corporate register data. The tabulations were regularly published in the Statistisk Årbog and in accompanying publications (with additional information) by Statistics Denmark. We obtain PDFs of these publications through Statistics Denmark (Danmarks Statistik, 1903-1975, 1928-1932, 1984-1987) and transcribe the data. In 1977, a minimum capital size requirement of 100,000 Kronors was introduced.

Second, from 1970 to 1999, Statistics Denmark published tabulations by sales that cover all types of companies (not just corporations), based on the business registry and value added tax returns (the value added tax was introduced in Denmark in 1967). These tabulations by sales were discontinued in 2000. We obtain PDFs through Statistics Denmark (Danmarks Statistik, 1973-1981, 1983-2001*b*) and transcribe the data. The tabulations by sales cover all types of businesses with sales above a minimum threshold. The threshold was 5,000 Kronors in 1970 and 20,000 Kronors starting in 1999. Sales from outside of Denmark are not included. Figure IA9 shows that total sales in our data relative to GDP does not have any time trend, which indicates that the coverage of the tax statistics over time is stable.

Switzerland We also use two types of tabulations for Switzerland (see Table IA7 for detailed descriptions of the sources). First, between 1901 and 1987, the Swiss Statistical Office published tabulations of corporations by size of equity capital, based on analyses of joint-stock companies recorded in the Business and Enterprise Register. We obtain PDFs from the Statistical Yearbook and special issues on joint stock corporations published by the Federal Statistical Office (Eidgenössisches Statistisches Amt, 1934, 1922-1986; Bundesamt für Statistik, 1988); we then transcribe the data. In 1937 a minimum capital requirement was introduced for newly formed corporations (corporations with less capital continued to operate, but gradually disappeared in the 1940s, and disappeared entirely by 1952).

Second, since 1995, the Swiss Tax Authority has an annual publication of value added tax statistics. We obtain PDFs from the Swiss Statistical Office (Eidgenössische Steuerverwaltung, 1997-2023) and transcribe the data. The Swiss tabulations by sales use total sales of Swiss firms, including their foreign sales. This is different from the tabulations by sales in Austria, Germany, and Denmark, which are restricted to domestic sales. Figure IA13 shows the coverage of the sales tabulations for Switzerland. The ratio of sales in our data relative to GDP has increased significantly between 1995 and 2020 (from roughly 2.5 to 5.5). This is likely due to the rise of foreign sales, which are present in the data for Switzerland but not in other by sales tabulations.

United Kingdom Our analysis for the UK focuses on manufacturing due to data availability. We use two types of tabulations (see Table IA8 for detailed descriptions of the sources). First, between 1958 and 1992, the Census of Production provides tabulations of firm size by net output for private sector enterprises employing 100 or more persons. It is reasonable to assume that the largest manufacturers in the numerator have more than 100 employees. We also collect information about the total number of enterprises and total net output in manufacturing from separate summary tables. We obtain PDFs from the LSE digital library (Board of Trade, 1960-1973; Department of Industry Business Statistics Office, 1973-1992), and transcribe the data. Prais (1976) provides additional estimates of the share of the 100 largest enterprises in manufacturing by net output for selected years since 1909.

Second, starting in 1985, we can find tabulations of the number of businesses by turnover (sales) size from the Size Analyses of United Kingdom Businesses published by the Great Britain Business Statistics Office. We obtain PDFs from inter-library loans and transcribe the data before 1998 (Office for National Statistics, 1985-1997), and download data in Excel spreadsheets from the Office for National Statistics afterwards (Office for National Statistics, 1998-2003, 2004-2021). These data are based on value added tax (VAT) returns submitted to HM Customs and Excise. They cover VAT-registered enterprises, and the registration has a time-varying minimum turnover threshold (enterprises below the VAT registration threshold are excluded before 1992 and are included afterwards if they have chosen to register voluntarily or not to de-register).

Australia For Australia, we have data on the population of corporations by size of taxable income since 1940 from Taxation Statistics (see Table IA1 for detailed descriptions of the sources). We obtain PDFs from the National Library of Australia until income year 1993-1994 (Australian Taxation Office, 1944-1961, 1962-1995) and transcribe the data, and download data in Excel spreadsheets from `data.gov.au` afterwards (Australian Taxation Office, 2012-2023). By and large, the data cover all corporations with positive taxable income. Non-resident corporations are also included in the tabulations.

Canada For Canada, we have data on corporations by size of taxable income between 1944 and 1987 from Taxation Statistics (see Table IA3 for detailed descriptions of the sources). We obtain physical books from the University of Chicago library (Department of National Revenue, 1944-1964, 1969-1987), and transcribe the data. The data cover almost all corporations that file a T2 Corporation income tax return. Before 1964, corporations with gross revenue less than $2,000 were generally excluded from the tabulations; from 1985 to 1987, corporations with assets less than $50,000 and sales less than $10,000 were excluded from the tabulations (see Appendix IA2.3 for more details). Non-resident corporations that carry on businesses in Canada are included.

Singapore For Singapore, we obtain tabulations of corporations by size of assessed income since 1972 (see Table IA6 for detailed descriptions of the sources). We transcribe tabulations from the Yearbook of Statistics for 1972 to 2004 (Singapore Department of Statistics, 1972-2004), and obtain data directly from the Inland Revenue Authority of Singapore (IRAS) since 2005 (Inland Revenue Authority of Singapore, 2005-2007, 2008-2022). The data include both resident and non-resident corporations.

South Korea Choi et al. (2024) collect data on the largest manufacturers in Korea, and kindly shared their estimates of the largest 100 and 500 manufacturers in total manufacturing gross output. Their data start in the 1970s and end in 2011. For 1972 to 1982, they digitize the historical Annual Reports of Korean Companies published by the Korea Productivity Center. For 1982 to 2011, they obtain data from KIS-VALUE, which covers firms with assets above 3 billion Korean Won, for whom reporting balance sheet data is mandatory.

II.B Estimating Top Shares

We estimate the share of top companies from size bins in the tabulations. Our baseline method uses the generalized Pareto interpolation (Blanchet, Fournier, and Piketty, 2022), which is also the baseline in Kwon, Ma, and Zimmermann (2024). This method is the standard approach developed to estimate household top income shares from income bins with a similar format (Blanchet, Fournier, and Piketty, 2022; Piketty and Saez, 2003). The generalized Pareto interpolation starts by calculating the inverted Pareto coefficient $b(p_i)$ for each bin threshold y_i, where p_i is the fraction of firms with size above y_i, and $b(p_i)$ is the ratio between the average size above y_i and the threshold y_i. It then fits a continuous curve of inverted Pareto coefficients. In Kwon, Ma, and Zimmermann (2024), we verified that the generalized Pareto interpolation gives almost identical results to interpolating lognormal curves, or directly adding up the top bins such that the number of businesses in these bins approximates a certain amount (e.g., top 1%).

Most tabulations provide both the number of companies and their total size for each size bin. In this

case, we can apply the generalized Pareto interpolation directly. In a few cases, such as U.K. data after 1985, the tabulations only show the number of companies in each size bin, but not their total size. In this case, we can still use the generalized Pareto interpolation, but estimates can be less precise. We use the average firm size (for all firms) to provide some additional disciplining information for the interpolation, which tends to improves the fit.

II.C Top Percent Shares and Top N Shares

We provide results using both top percent shares (e.g., top 1%) and top N shares.

Top percent shares We start with the top 1% and the top 0.1% shares in Section III.A. The benchmark for evaluating the disparity of business size is the top percent share in a number of models (Aghion et al., 2023; Hsieh and Rossi-Hansberg, 2023). Analyzing top percentiles is also the standard approach in research on household income and wealth inequality.

Moreover, the top percent share has several practical advantages. First, it is portable across different countries that differ a lot in size, and across different levels of aggregation (e.g., the overall economy versus a particular industry). In comparison, picking the right N across these different settings is challenging and likely arbitrary. Second, for countries where we only have tabulations among corporations, the total size of corporations in the denominator can change as the prevalence of corporations changes over time. For the top percent share, the numerator is allowed to expand (shrink) when corporations become more (less) common, so it is not sensitive to shifts in the prevalence of corporations. For the top N share, the numerator does not adjust, and the top N share among corporations can move around due to the changing prevalence of corporations. In Kwon, Ma, and Zimmermann (2024), we show that in the U.S., the top N share among all businesses, the top x% share among all businesses (with a corresponding percentile), and the top x% share among corporations have very similar behavior, whereas the top N share among corporations can behave differently in settings that experience changes in the prevalence of corporations.

One common concern about the top percent shares is that they might be affected by small and extraneous firms coming in or out of the sample (therefore changing the total number of firms). Specifically, if small and extraneous firms come in (out) of the data, the total number of firms in the top 1% will increase (decrease). Thus the top 1% share can increase (decrease), as the small firms have little impact on the total value of the denominator while the numerator will include more (fewer) firms. To make sure our results are not affected by this issue, we also calculate the top x% as a fraction of the top y% (e.g., the top 1% as a share of the top 10%), and present the results in Internet Appendix IA1. One can show that for Pareto distributions, this relative share only depends on x/y and the tail coefficient k. In other words, top 1%/top

$10\% = \text{top } 0.01N/\text{top } 0.1N$ is invariant to the total number of firms N.

Top N shares We present top N shares in Section III.B. We generally use top 500 and top 5,000 shares for large countries, and top 100 and top 500 shares for small countries except when the top bin is not granular enough. Fixing the same N across different settings is inevitably arbitrary, and it can make the levels harder to interpret and compare across settings. There is no clear optimal rule for choosing the right N, which is one limitation of this approach.

The top N share is relatively straightforward to implement in countries where we have tabulations for all types of companies. It is trickier in countries where we only have tabulations of corporations, as mentioned above. In this case, to minimize the impact of the changing prevalence of corporations versus noncorporations on the denominator, we use the estimated size of all businesses for the denominator of the top N share. Specifically, we start with the total size of corporations, and estimate the share of corporations in total businesses. We explain this procedure in detail when we present the top N shares in Section III.B.

III Main Facts

We present the main results for top business shares in this section. We start with top 1% and top 0.1% shares in Section III.A, and proceed to top N shares in Section III.B. To facilitate visualization, we use blue lines with circles for top shares by sales, green lines with triangles for top shares by net income, and red lines with diamonds for top shares by capital.

III.A Top Percent Shares

Figure 1, Panel A, shows the top 1% and top 0.1% share by size of sales in Germany. Figure 1, Panel B shows these series for Austria. In both cases, we observe steady increases of the top shares throughout the 20th century. The share of the large 1% (0.1%) companies by sales was around 0.4 (0.2) in the 1920s, around 0.6 (0.4) by the 1970s, and around 0.7 (0.5) by the 2010s.

Figure 2 turns to Denmark in Panel A and Switzerland in Panel B. Both countries have data on the size of corporations by equity capital until the 1980s (red line with diamonds), and the size of all types of companies by sales afterwards (blue line with circles). We observe a general increase in the top 1% (0.1%) share by capital among corporations from around 0.4 (0.1) in the early 1900s to around 0.6 (0.35) by the 1980s, and a continued increase in the top 1% (0.1%) share by sales among all types of companies since the

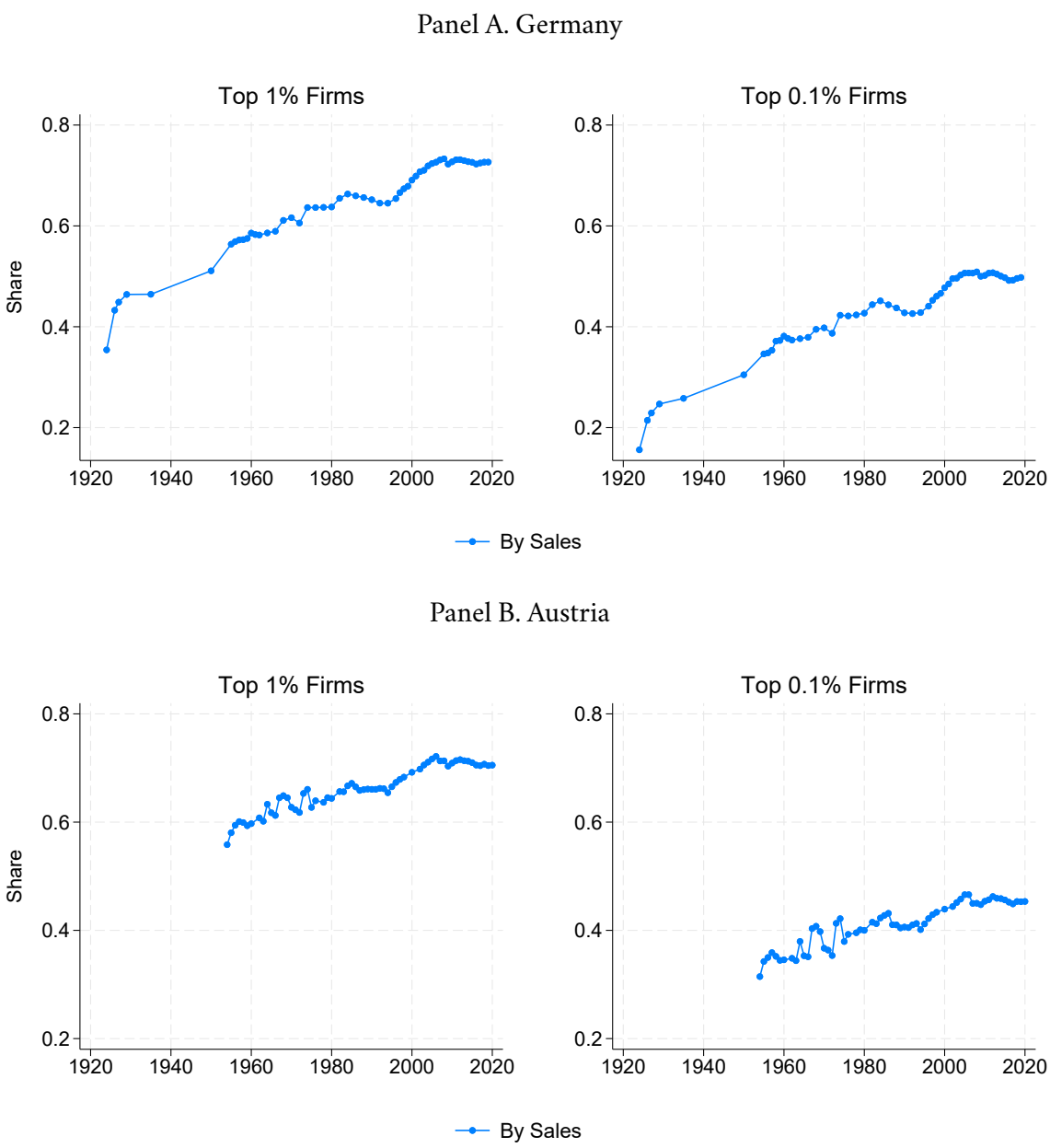


Figure 1. Germany and Austria: Top 1% and 0.1% Sales Share

Notes: This figure shows the sales shares of the top 1% (left panel) and the top 0.1% (right panel) companies by sales for Germany in Panel A and Austria in Panel B. See Internet Appendix IA2.2 and IA2.5 for details about variable construction.

1980s and 1990s. In the years where top shares by capital and by sales are both available (or the two series nearly overlap), their levels are fairly similar. For the recent decades, the increase of top shares by sales is stronger in Swiss data, possibly because the sales data for Switzerland include overseas sales (whereas those for Denmark do not) and the largest firms are more likely to expand internationally.

Figure 3 turns to the U.K., where we are only able to construct long time series of top shares consistently for manufacturing. The dark blue diamonds use tabulations of firm size by net output from the Census of

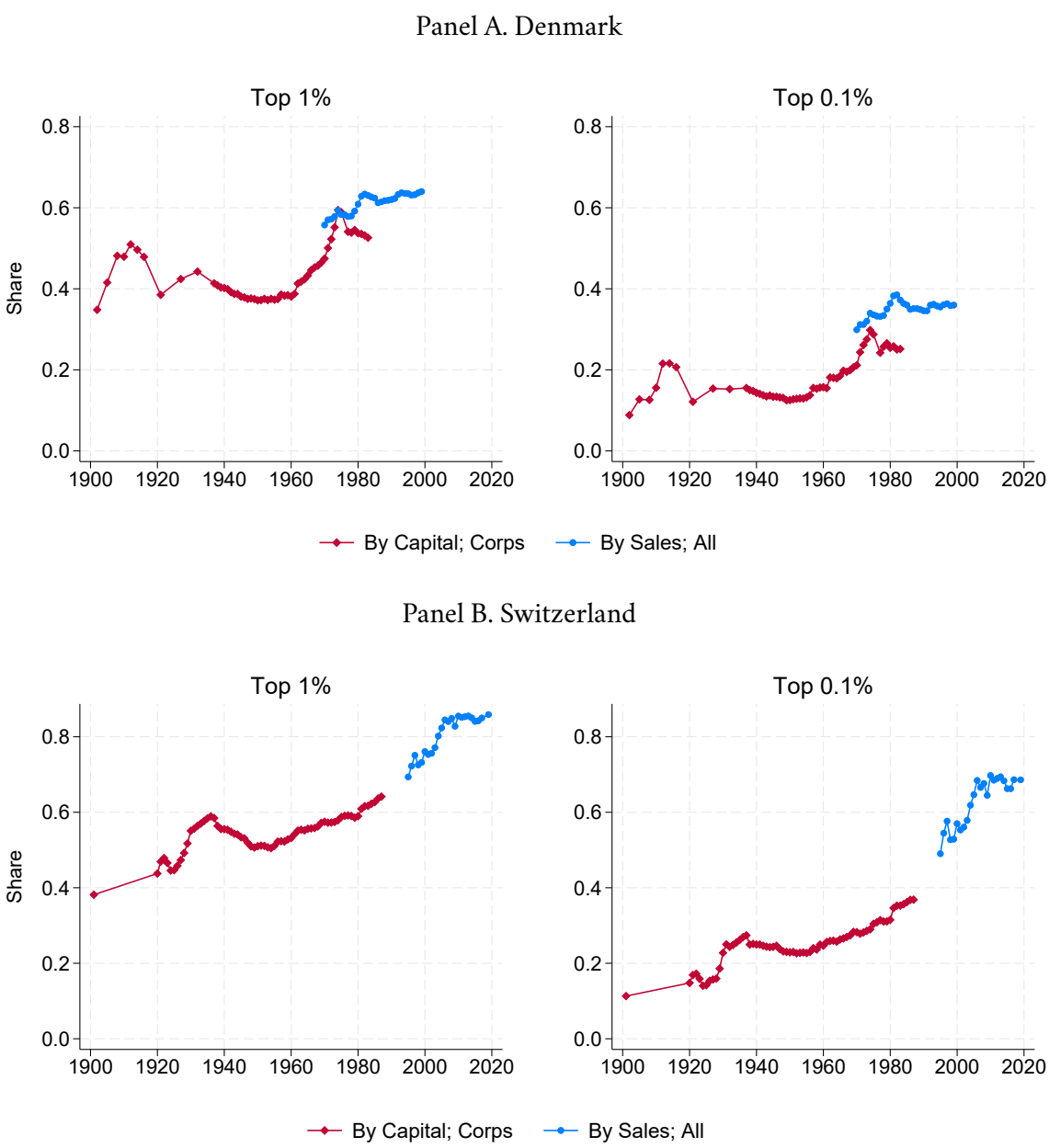


Figure 2. Denmark and Switzerland: Top 1% and 0.1% Share

Notes: The red line with diamonds shows the capital shares of the top 1% (left panel) and the top 0.1% (right panel) corporations by capital for Denmark in Panel A and Switzerland in Panel B. The blue line with circles shows the sales share of the top 1% (left panel) and the top 0.1% (right panel) companies by sales for Denmark in Panel A and Switzerland in Panel B. See Internet Appendix IA2.4 and IA2.7 for details about variable construction.

Production. The light blue circles use tabulations of size by sales form the Great Britain Business Statistics Office. In the latter case, the tabulations only present the number of firms in each size bin (as well as overall sales), but not sales by size bin. The algorithm of Blanchet, Fournier, and Piketty (2022) still allows us to estimate top shares in this case, but these estimates can be less precise. Therefore, we consider the top sales share estimates to be preliminary and suggestive. In Figure 3, we observe that the top 1% (0.1%) net output

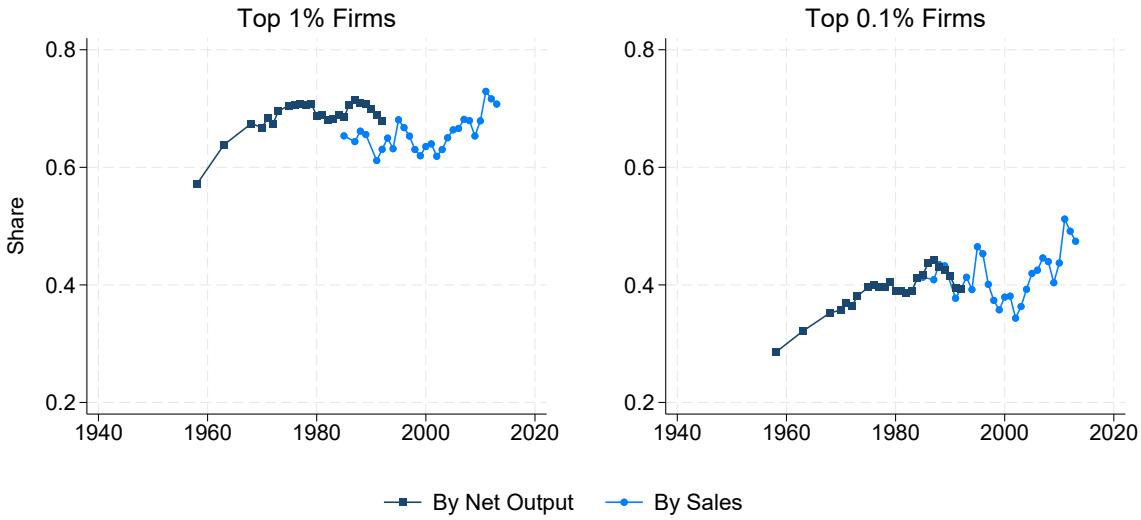


Figure 3. U.K. (Manufacturing): Top 1% and 0.1% Sales Share

Notes: The dark blue line with diamonds shows the net output shares of the top 1% (left panel) and the top 0.1% (right panel) British manufacturers by net output. The light blue line with circles shows the sales share of the top 1% (left panel) and the top 0.1% (right panel) British manufacturers by sales. See Internet Appendix IA2.8 for details about variable construction.

share increased from around 0.6 (0.3) in the late 1950s to around 0.7 (0.4) in the 1980s, and the top sales share increased mildly between the 1980s and the 2010s. The rise in top shares appears stronger before the 1980s. In our analyses of U.S. data, we also observe that rising top shares in manufacturing was stronger before the 1980s and weaker afterwards (Kwon, Ma, and Zimmermann, 2024).

Figure 4, Panel A, shows the results for Australia. Figure 4, Panel B, shows the results for Canada. Both countries have data on corporations by size of net income, and we need to restrict to businesses with positive net income. Both countries show rising top shares over the long run. The top 1% (0.1%) net income share among corporations started at around 0.4 (0.2) in the 1940s, increased to around 0.6 (0.4) around the 1980s, and Australian data show continued increase to around 0.8 (0.6) by 2000 (after which the Australian top shares have been relatively flat and Canadian data currently end in 1987).

Figure 5 shows the results for Singapore. Again here we have data on corporations by size of net income, and we need to restrict to businesses with positive net income. The top 1% (0.1%) net income share among corporations increased from around 0.4 (0.15) in the early 1970s to around 0.8 (0.6) in recent years.

III.B Top N Shares

The top N shares are relatively straightforward to implement in settings where we have data from all types of companies. It is trickier to implement in settings where we only have comprehensive data on corporations: Denmark and Switzerland in earlier years, as well as Australia, Canada, and Singapore. Two

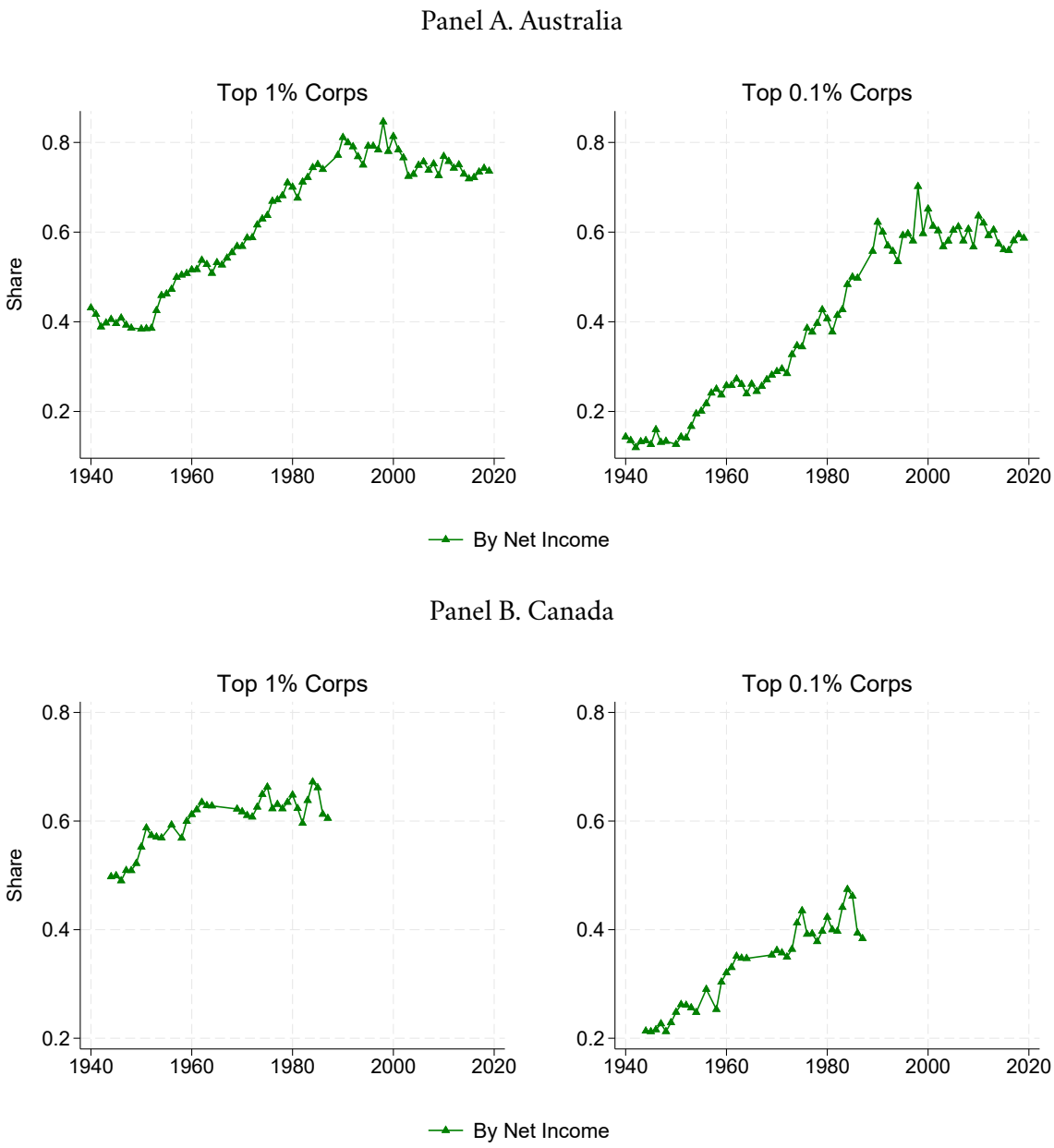


Figure 4. Australia and Canada: Top 1% and 0.1% Share

Notes: The green line with triangles shows the net income shares of the top 1% (left panel) and the top 0.1% (right panel) corporations by net income for Australia in Panel A and Canada in Panel B. See Internet Appendix IA2.1 and IA2.3 for details about variable construction.

issues arise in these settings.

First, for the denominator, the total size of corporations is affected by the changing prevalence of corporations (which tends to increase over time in most countries). For example, as corporations become more common, the denominator (the total size of corporations) expands. For the top percent share, the numerator is allowed to expand (shrink) when corporations become more (less) common, so it is not sensitive to shifts in the prevalence of corporations. For the top N share, the numerator does not adjust,

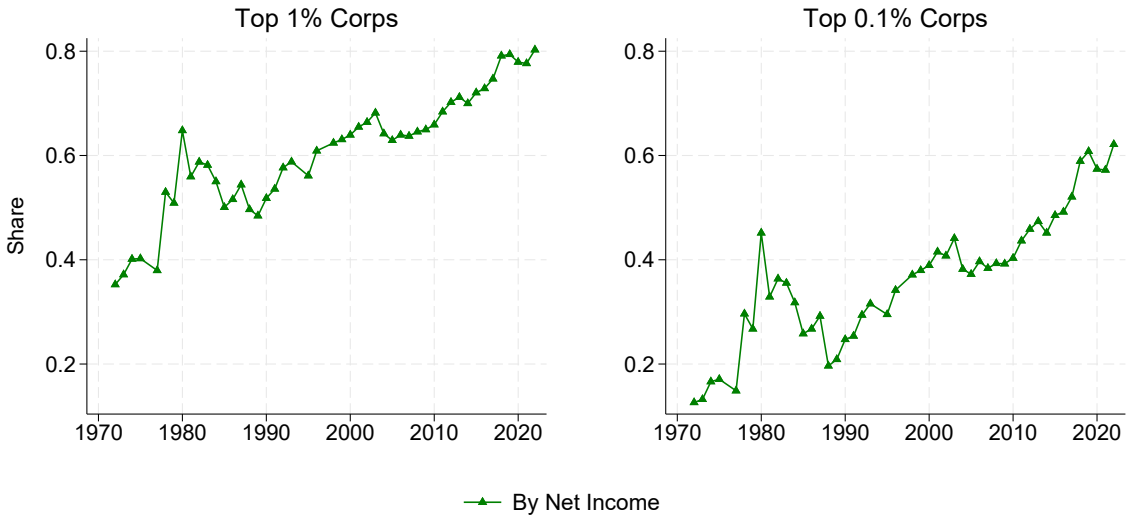


Figure 5. Singapore: Top 1% and 0.1% Share

Notes: The green line with triangles shows the net income shares of the top 1% (left panel) and the top 0.1% (right panel) corporations by net income for Singapore. See Internet Appendix IA2.1 and IA2.3 for details about variable construction.

and it can move around due to the changing prevalence of corporations. In Kwon, Ma, and Zimmermann (2024), we show that in the U.S., the top N share among all businesses, the top $x\%$ share among all businesses (with a corresponding percentile), and the top $x\%$ share among corporations have very similar behavior, whereas the top N share among corporations can behave differently in settings that experience changes in the prevalence of corporations.

To minimize the impact of the changing prevalence of corporations on the denominator, we use the estimated *the size of all businesses for the denominator of the top N share*. Specifically, we start with the total size of corporations, and estimate the share of corporations in total businesses. This denominator adjustment proceeds as follows:

- All countries with by net income tabulations (Australia, Canada, and Singapore): We estimate the share of corporate income in total business income. We use national accounts data to calculate the share of corporate capital income in total business capital income (corporate capital income plus mixed income). Figures IA6, IA8, and IA12 show the estimated corporate net income share for Australia, Canada, and Singapore, respectively.

- Denmark by capital tabulations: For 1948 to 1983, we use the share of corporate sales in total business sales available from Statistics Denmark and Census publications (Danmarks Statistik, 1984-1987). This assumes that the capital share of corporations in the economy is similar to their sales share. Before 1948, we are able to obtain estimates of the share of corporate employment in total business employment among industrials from the manufacturing census (Danmarks Statistik, 1908-1914,

1925-1948). Figure IA10 shows these two series. They are both available in 1948, in which case they align closely.

- Switzerland by capital tabulations: We can find the share of corporate employment in total business employment for benchmark years dating back to 1929 (Eidgenössischen Statistischen Amt, 1933-1998). We linearly interpolate the missing years. This assumes that the capital share of corporations in the economy is similar to their employment share. Before 1929, we rely on the proportion of joint stock corporations among all registered businesses from the Historical Statistics of Switzerland (Eidgenössisches Statistisches Amt, 1934). Figure IA14 shows these two series.

Second, for the numerator, we can only use the top N *corporations* in these settings. Accordingly, we may underestimate the top N share if some of the largest businesses are noncorporations.

As mentioned earlier, another challenge for the top N share is that we need to pick the N across different settings. The countries in our dataset differ substantially in size. We generally use top 500 and top 5,000 for the larger countries, and top 100 and top 500 for the smaller countries. We also take into consideration the granularity of the size bin tabulations. If the bins are coarse and the top bin contains a large number of companies, then we need to use a larger N.

Figure 6 starts with Germany and Austria. Both countries have data on size by sales for all types of companies, so the top N shares can be reliably estimated. We again observe that the top 500 and top 5,000 sales share among German and Austrian firm have increased over the long run.

Figure 7 turns to Denmark and Switzerland. Both countries have data on the size of all types of companies by sales in recent decades (blue line with circles), in which case the top N shares can be reliably estimated. Both countries have data on the size of corporations by capital until the 1980s (red line with diamonds). For the denominator, we estimate the size of all businesses using the procedures described above: we take the total size of corporations and divide by the estimated corporate share in total businesses. For the numerator, we can only draw from corporations (hence the label writes "Corps in All"). For Denmark, these two types of series have similar levels in years where they overlap. For Switzerland, the top N share by sales is higher, and the recent rise is stronger (like in Figure 2, possibly because the sales data for Switzerland include overseas sales whereas those for Denmark do not). In both countries, we continue to observe indications that top shares have increased over the long run.

Figure 8 shows the top N shares estimated among U.K. manufacturers. The left panel uses the top 100 share because Prais (1976) provides extended estimates for the share of the 100 largest enterprises in manufacturing net output from 1909 to 1970. Over that period, the estimated top 100 share increased from 16% to 40%. We use U.K. census data to extend the top 100 share in manufacturing net output to

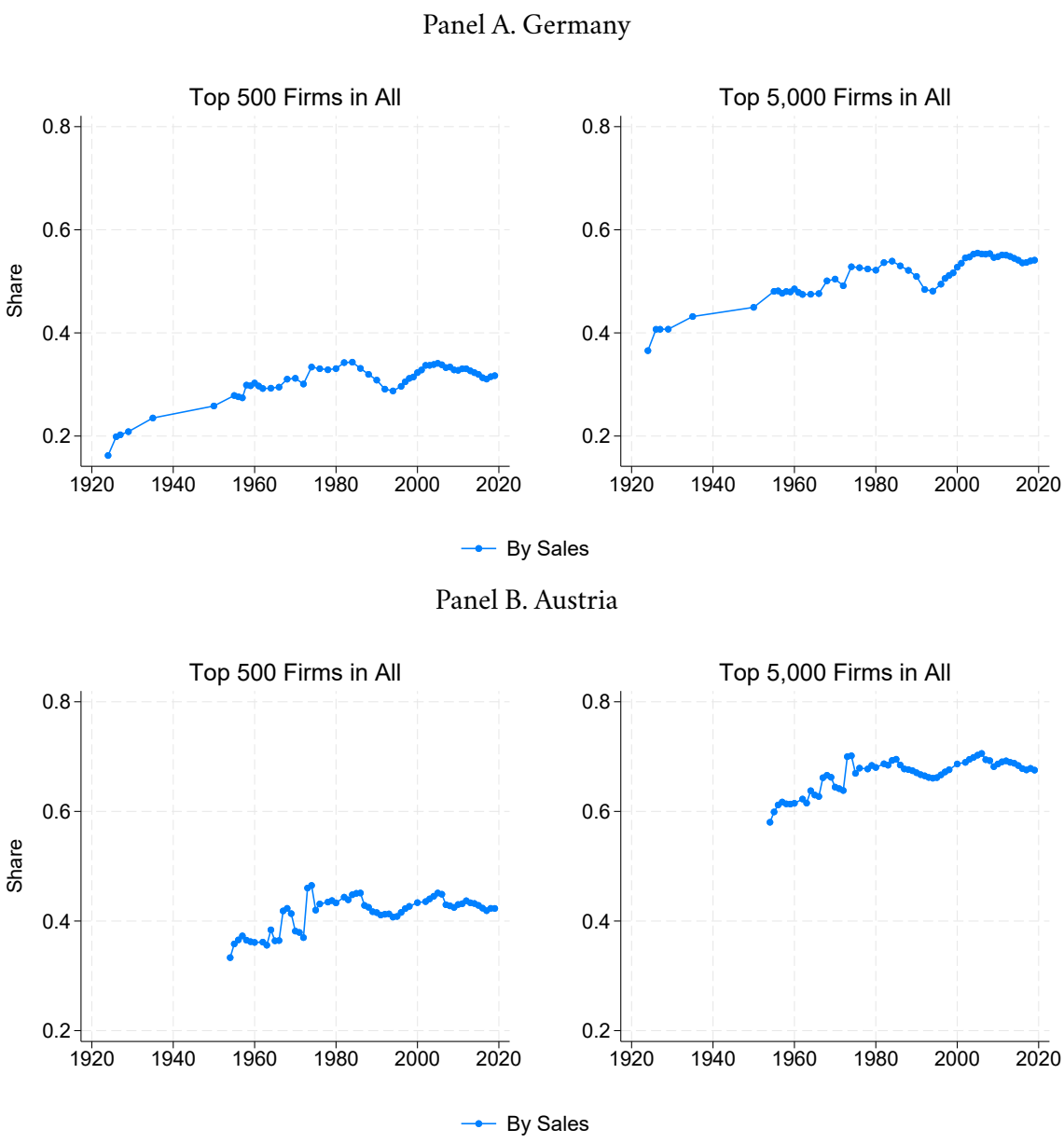


Figure 6. Germany and Austria: Top N Sales Share

Notes: This figure shows the sales shares of the top 500 (left panel) and the top 5,000 (right panel) companies by sales for Germany in Panel A and Austria in Panel B. See Internet Appendix IA2.2 and IA2.5 for details about variable construction.

1992. The top 100 share stayed around the same in those two decades. For the post-1985 period where we have size bins by sales, the tabulations are not granular enough to estimate the top 100 share. The right panel shows the estimated top 5,000 share by sales, together with the top 5,000 share by net output since 1958. We use the top 5,000 share here because the bins for the tabulations by sales are coarse. In addition, as mentioned earlier, these tabulations only present the number of firms in each bin (as well as the overall sales), but not sales by size bin. Therefore, we consider the top sales share estimates to be preliminary and suggestive. In Figure 8, like in Figure 3, the top share is relatively flat after the 1970s. These patterns are in

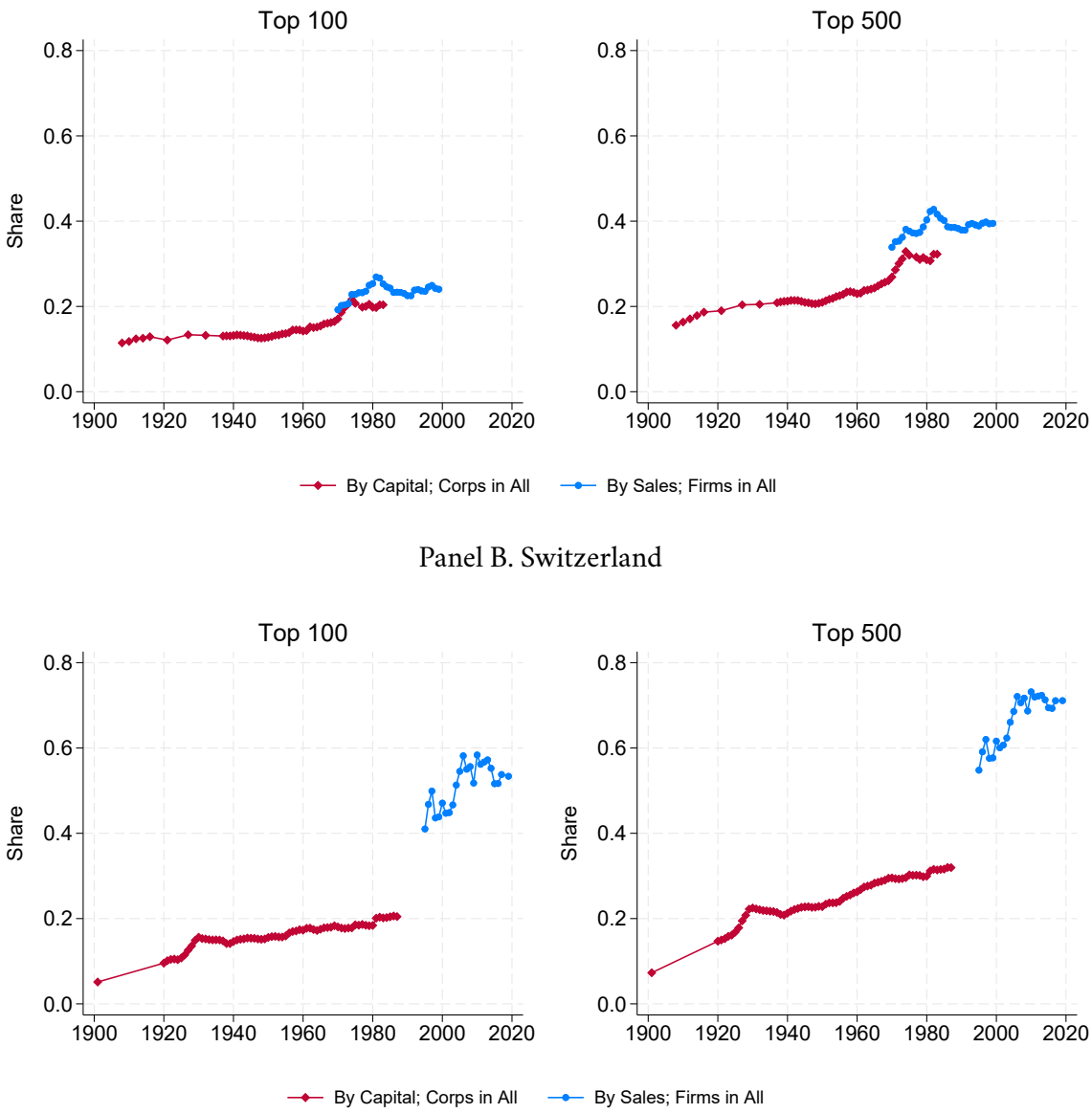


Figure 7. Denmark and Switzerland: Top N Share

Notes: The red line with diamonds shows the capital shares of the top 100 (left panel) and the top 500 (right panel) corporations by capital in estimated corporate and noncorporate capital for Denmark in Panel A and Switzerland in Panel B. The blue line with circles shows the sales share of the top 100 (left panel) and the top 500 (right panel) companies by sales for Denmark in Panel A and Switzerland in Panel B. See Internet Appendix IA2.4 and IA2.7 for details about variable construction.

line with what we observe in the U.S. manufacturing sector in Kwon, Ma, and Zimmermann (2024): the top share increased a fair amount before the 1980s and not much afterwards (after the 1970s/1980s, we primarily observe rising concentration in services and retail/wholesale trade in U.S. data).

Figure 9 turns to Australia and Canada. Both countries have data on the size of corporations by net income. As before, we restrict to corporations with positive net income. For the denominator, we estimate

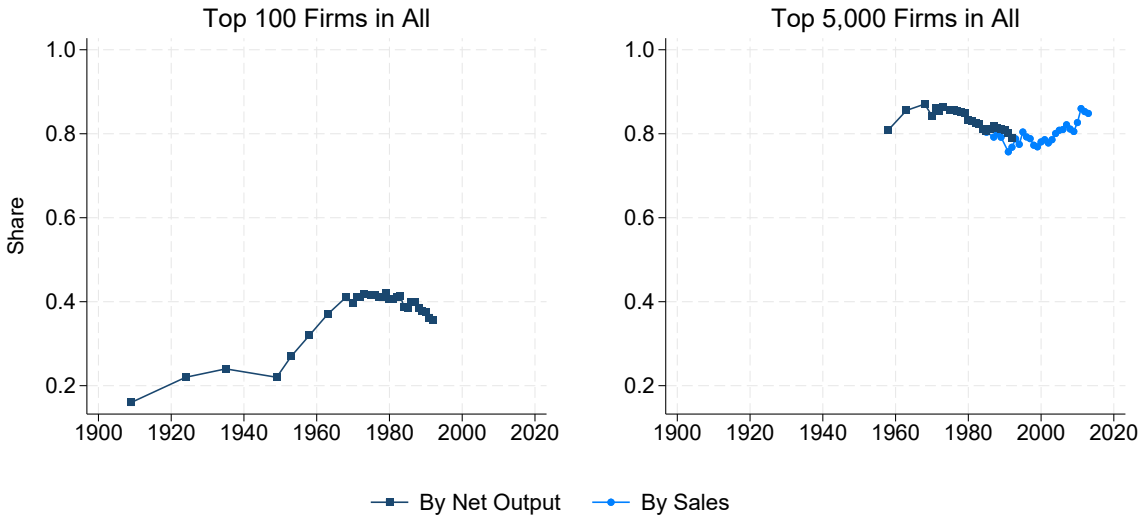


Figure 8. UK (Manufacturing): Top N Share

Notes: The dark blue line with diamonds shows the net output shares of the top 100 (left panel) and the top 5,000 (right panel) British manufacturers by net output. The light blue line with circles shows the sales share of the top 5,000 British manufacturers by sales. See Internet Appendix IA2.8 for details about variable construction.

the size of all businesses using the procedures described above: we take the total size of corporations and divide by the estimated corporate share in total businesses. For the numerator, we can only draw from corporations (hence the label writes "Corps in All"). We again observe rising top shares into the 1990s.

Finally, Panel A of Figure 10 presents results for Singapore. Similar to Australia and Canada, here we have data on the size of corporations by net income. For the denominator, we take the total size of corporations and divide by the estimated corporate share in total businesses. For the numerator, we can only draw from corporations (hence the label writes "Corps in All"). We observe rising top shares since the data started in the 1970s, and the trend continues in recent years. Here we use top 500 and top 5,000 because the top bin is relatively coarse in recent years.

Panel B of Figure 10 shows the share of the largest 100 and 500 manufacturers by sales in total manufacturing gross output in Korea, estimated by Choi et al. (2024). In these data, we observe that the top 100 (500) sales share in manufacturing increased from around 20% (30%) in the 1970s to around 45% (55%) by the early 2010s.

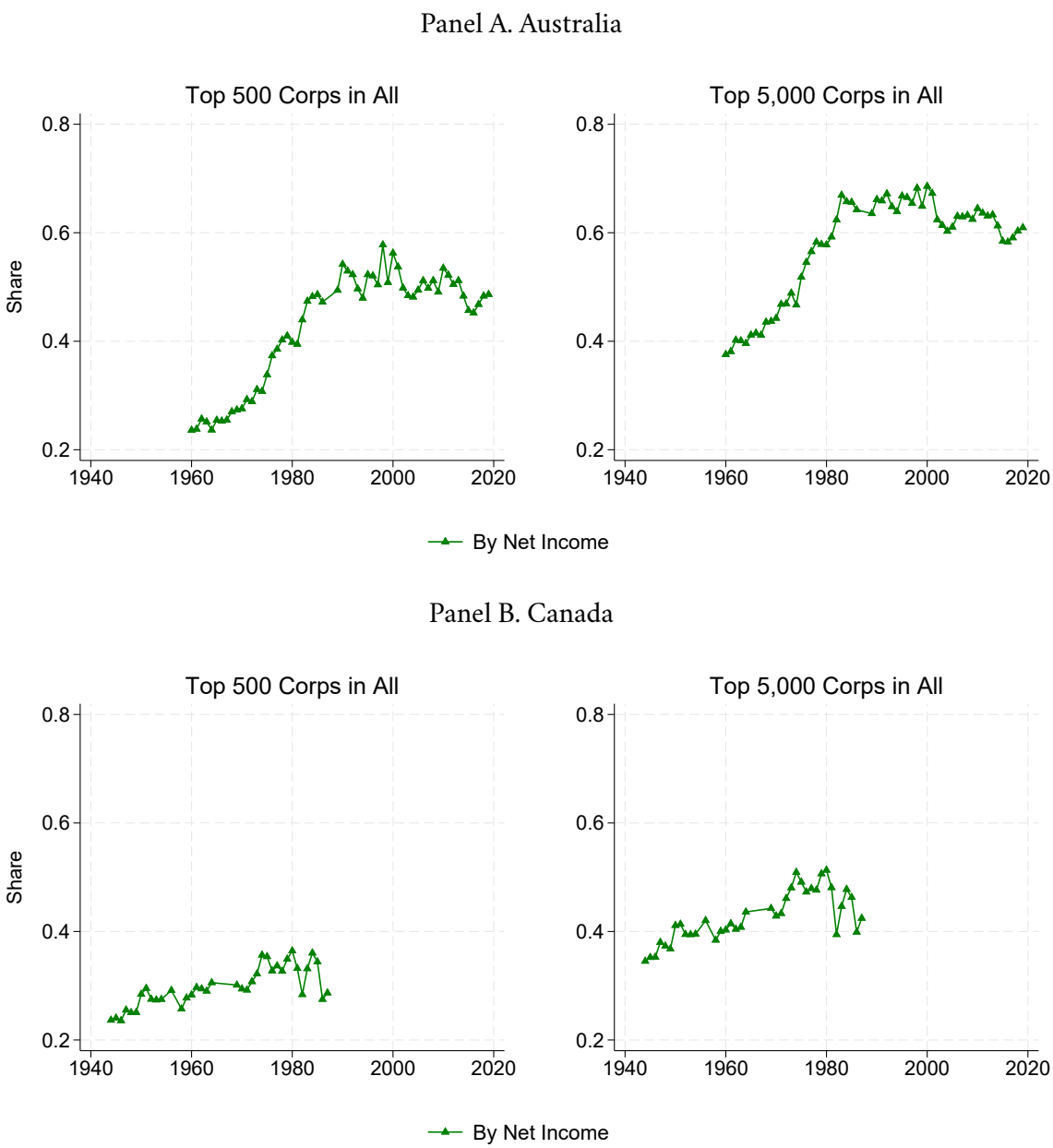


Figure 9. Australia and Canada: Top N Share

Notes: The green line with triangles shows the net income shares of the top 500 (left panel) and the top 5,000 (right panel) corporations by net income for Australia in Panel A and Canada in Panel B. See Internet Appendix IA2.1 and IA2.3 for details about variable construction.

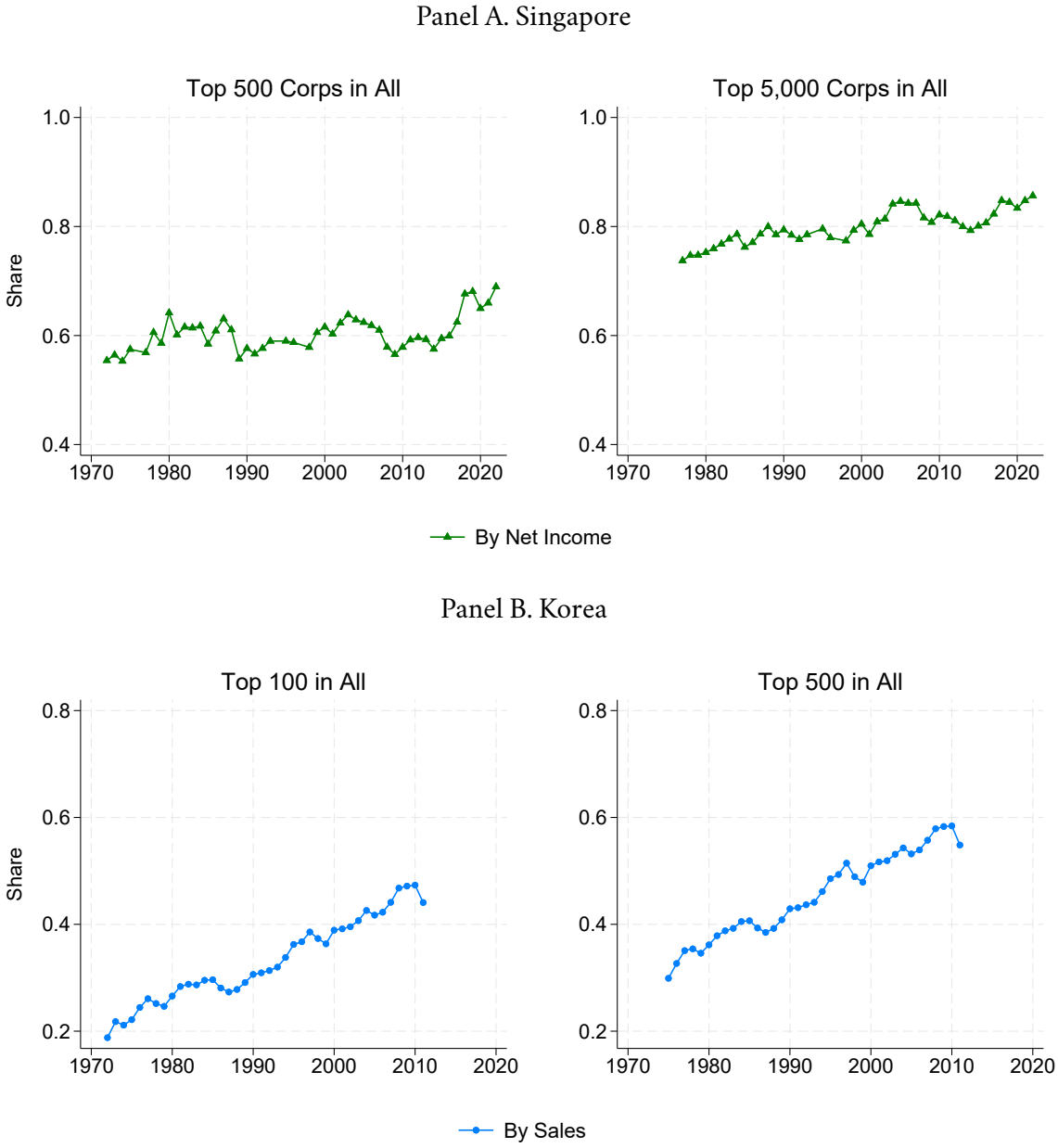


Figure 10. Singapore and Korea (Manufacturing): Top N Share

Notes: In Panel A, the green line with triangles shows the net income shares of the top 500 (left panel) and the top 5,000 (right panel) corporations by net income for Singapore. In Panel B, the blue line with circles shows the sales share of the largest 100 and 500 manufacturers by sales in total manufacturing gross output in Korea. See Internet Appendix IA2.6 and Choi et al. (2024) for details about variable construction.

IV Conclusion

We collect long-run data on the firm size distribution in a variety of countries with available information. We find that rising production concentration is a pervasive phenomenon. Large organizations have become more prominent in market-based economies around the world.

The pervasiveness of this phenomenon suggests that a full account about the underlying mechanisms needs to apply broadly, and mechanisms tailored to the recent decades about the U.S. can be incomplete. Over the past two centuries, several authors have hypothesized that technological or managerial development may lead to inevitable increases in the prominence of large organizations (Marx, 1867; Marshall, 1890; Lenin, 1916; Lucas, 1978). The long-run evidence from around the world makes it even more intriguing to contemplate their hypotheses, and to revisit the age-old question of organizing production through markets versus organizations (Coase, 1937; Hayek, 1945; Arrow, 1974).

A common question is whether the largest firms have stayed the same. The firm size tabulations that cover the entire economy do not disclose information about individual firms. Ma, Pugsley, and Zimmermann (2024) hand collect data about the identity of the largest firms in the U.S., Germany, and the U.K. They find that the individual companies at the top have changed substantially over time. In other words, the largest firms in the economy have become more prominent, but they are by and large not the same firms.

The rise of large organizations in production activities has a wide range of implications. Several studies point out that the firm size distribution affects the determinants of macroeconomic outcomes. In general, higher production concentration increases the aggregate impact of large firms' shocks (Gabaix, 2011), innovation (Braguinsky et al., 2023), operations and management (Berle and Means, 1932), and financing conditions (Crouzet and Mehrotra, 2020). The general public has also been concerned about the political power of the large firms, which poses another interesting question.

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Internet Appendix

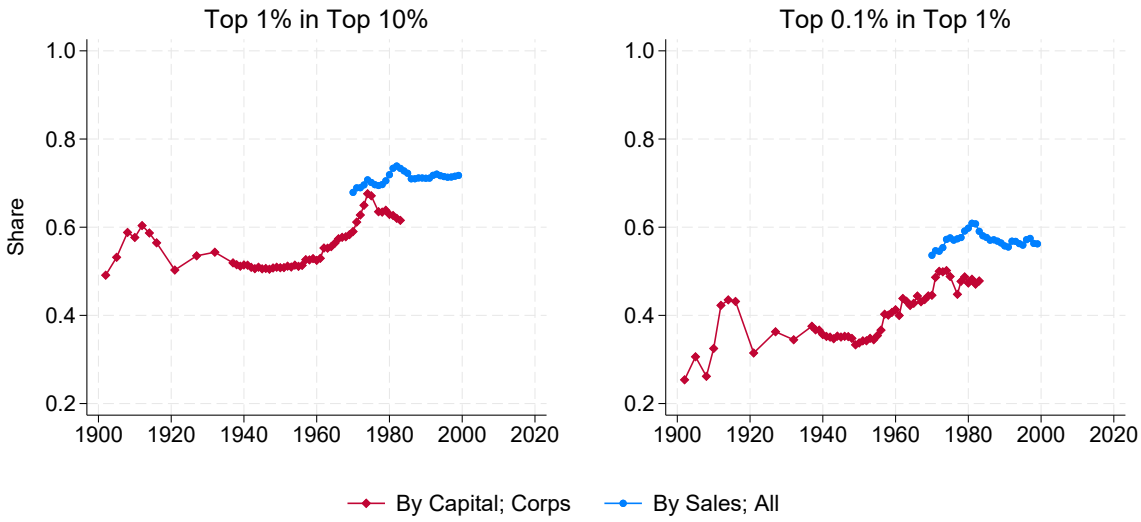
IA1 Additional Results



Figure IA1. Germany and Austria: Relative Top Shares

Notes: This figure shows the sales shares of the top 1% among the top 10% (left panel) and the top 0.1% among the top 1% (right panel) companies by sales for Germany in Panel A and Austria in Panel B. See Internet Appendix IA2.2 and IA2.5 for details about variable construction.

Panel A. Denmark



Panel B. Switzerland

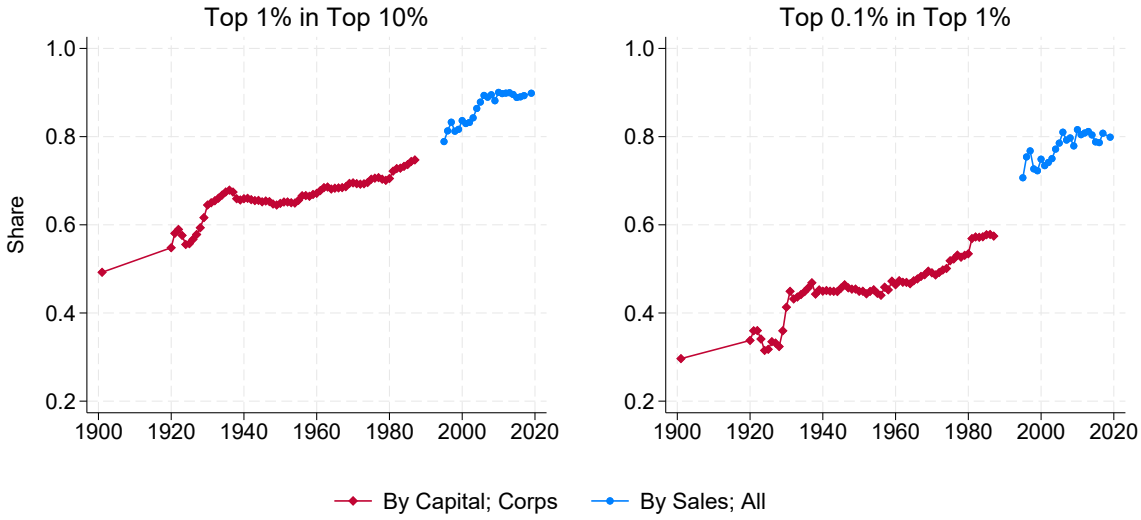


Figure IA2. Denmark and Switzerland: Relative Top Shares

Notes: The red line with diamonds shows the capital shares of the top 1% among the top 10% (left panel) and the top 0.1% among the top 1% (right panel) corporations by capital for Denmark in Panel A and Switzerland in Panel B. The blue line with circles shows the sales share of the top 1% among the top 10% (left panel) and the top 0.1% among the top 1% (right panel) companies by sales for Denmark in Panel A and Switzerland in Panel B. See Internet Appendix IA2.4 and IA2.7 for details about variable construction.

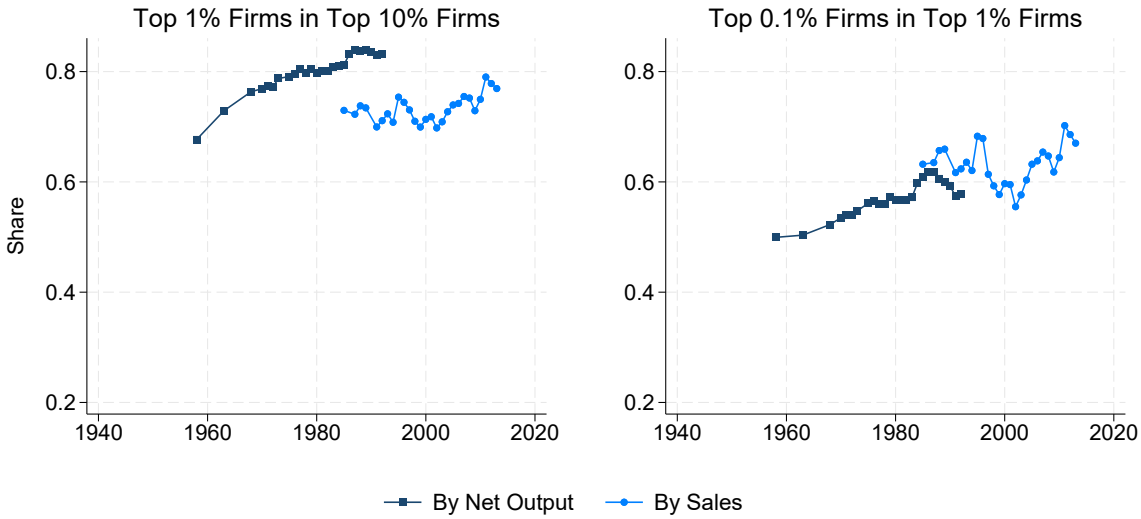
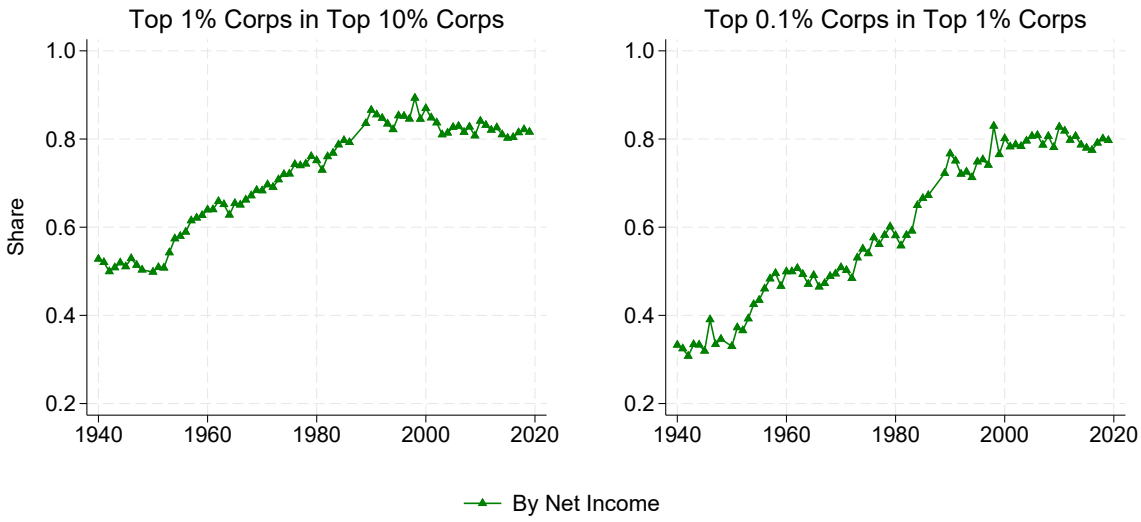


Figure IA3. U.K. (Manufacturing): Relative Top Shares

Notes: The dark blue line with diamonds shows the net output shares of the top 1% among the top 10% (left panel) and the top 0.1% among the top 1% (right panel) British manufacturers by net output. The light blue line with circles shows the sales share of the top 1% among the top 10% (left panel) and the top 0.1% among the top 1% (right panel) British manufacturers by sales. See Internet Appendix IA2.8 for details about variable construction.

Panel A. Australia



Panel B. Canada

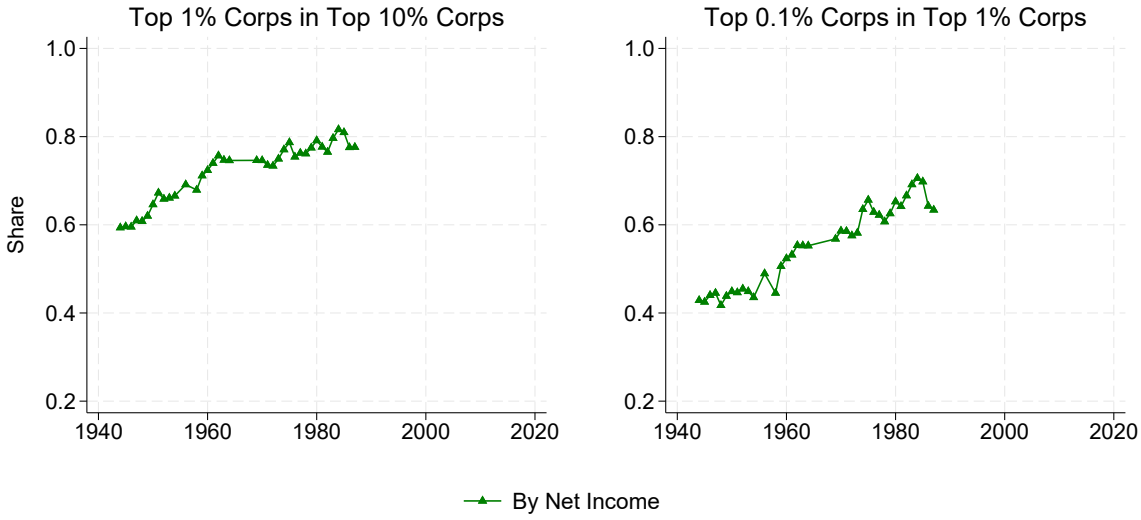


Figure IA4. Australia and Canada: Top 1% and 0.1% Share

Notes: The green line with triangles shows the net income shares of the top 1% among the top 10% (left panel) and the top 0.1% among the top 1% (right panel) corporations by net income for Australia in Panel A and Canada in Panel B. See Internet Appendix IA2.1 and IA2.3 for details about variable construction.

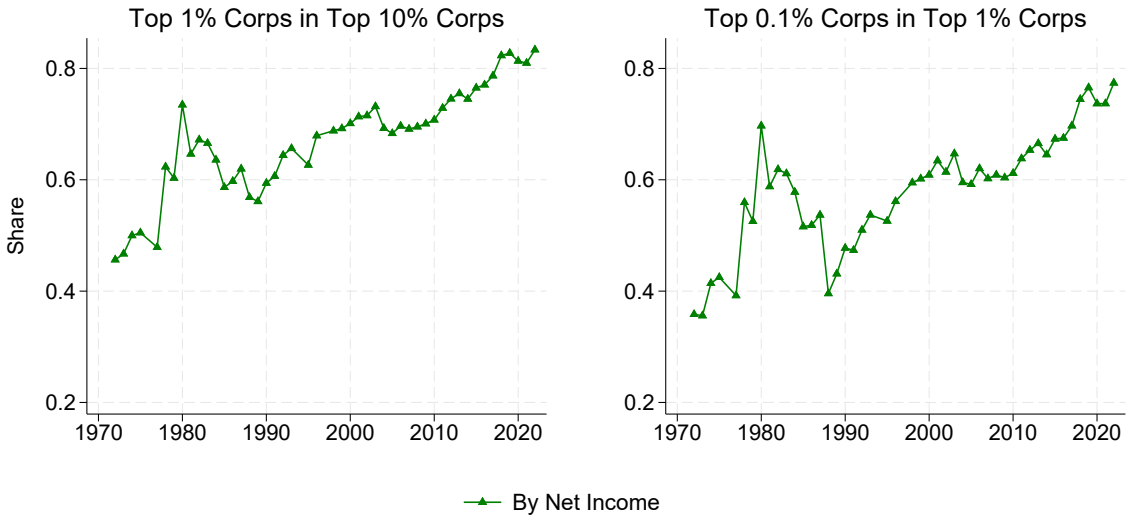


Figure IA5. Singapore: Relative Top Shares

Notes: The green line with triangles shows the net income shares of the top 1% among the top 10% (left panel) and the top 0.1% among the top 1% (right panel) corporations by net income for Singapore. See Internet Appendix IA2.1 and IA2.3 for details about variable construction.

IA2 Data Description by Country

IA2.1 Australia

Sources Table IA1 lists the sources that we use for Australia. We are able to find tabulations by size of taxable income starting in 1940. We obtain PDFs from the National Library of Australia until income year 1993-1994 (Australian Taxation Office, 1944-1961, 1962-1995) and transcribe the data, and download data in Excel spreadsheets from `data.gov.au` afterwards (Australian Taxation Office, 2012-2023).

Table IA1 – Australia: Data Sources

Type	Period	Source
Tabulations by net income	1940–1957	Australian Taxation Office (various years) *Report of the Commissioner of Taxation*.
	1958–2020	Australian Taxation Office (various years) *Taxation Statistics*. Digital files from 2004 onwards.

Notes: This table lists the sources of the Australian data.

Scope and variable definition By and large the data have all corporations with positive taxable income. We currently include both taxable and non-taxable corporations with positive taxable income for completeness, but the number of non-taxable corporations with positive taxable income is negligible.

Taxable income is defined as: the amount remaining after deducting from assessable income all deductions allowed under the Act. Such deductions include all normal business expenses, certain special deductions for expenditure of a capital nature and certain non-business deductions (Australian Taxation Office, 1962-1995).

Corporate share in net income Since the size tabulations for Australia are restricted to corporations, we need to obtain an estimate of the share of corporations in total net income (especially relevant for the top N shares in Section III.B). We approximate the corporate share in net income using the ratio of corporate gross operating surplus to corporate gross operating surplus plus mixed income of noncorporates, which is available since 1960 from the Australian Bureau of Statistics (Australian Bureau of Statistics, 2023). The resulting estimate is shown in Figure IA6.

Data construction

- Top x% net income share = Net income of top x% corporations by net income in a given year/Net income of corporations in a given year. Restricted to those with positive net income.
- Top x% net income share among top y% = Net income of top x% corporations by net income in a

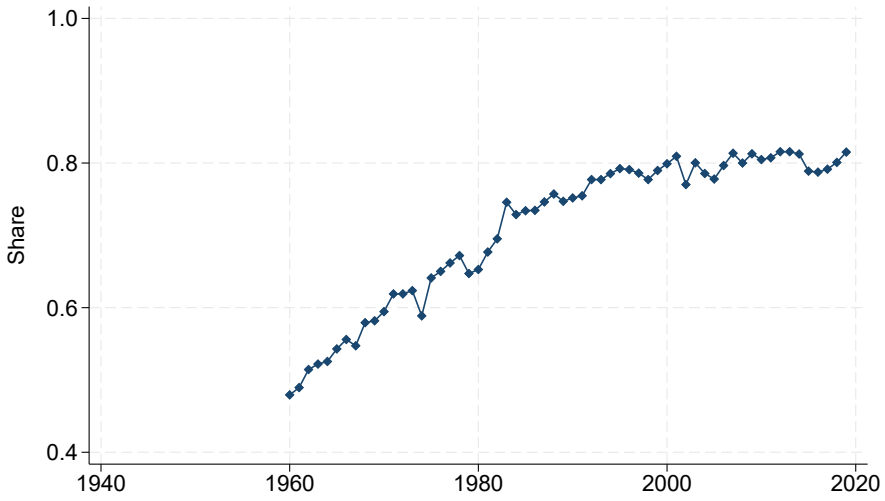


Figure IA6. Australia: Corporate Share Estimates

Notes: The figure shows trends in the corporate share for Australia. We use the ratio of corporate gross operating surplus to corporate gross operating surplus plus noncorporate mixed income.

given year/Net income of top y% corporations in a given year. Restricted to those with positive net income.

- Top N net income share = Net income of top N corporations by net income in a given year/Estimated net income of corporations and noncorporations in a given year (starting with net income of corporations and divide by estimated corporate share as discussed above). Restricted to those with positive net income.

IA2.2 Austria

Sources Table IA2 lists the sources that we use for Austria. We obtain physical copies from the German National Library before 2012 (Österreichischen Statistischen Zentralamt, 1958; Österreichisches Statistisches Zentralamt, 1960-1980; Österreichischen Statistischen Zentralamt, 1977-1999; Statistik Österreich, 2000; Statistik Austria, 2001-2014), and PDFs from the website of Statistik Austria after 2012 (Statistik Austria, 2015-2023*a*). We then transcribe the data.

The sales tax was introduced in Austria in 1923. In 1954, the Austrian statistical office (Österreichische Statistische Zentralamt, today Statistik Austria) published for the first time tabulations by total sales (Gesamtumsatz). The statistical office also publishes tabulations by size from the business tax (Gewerbesteuer) and corporate tax (Körperschaftssteuer). We focus on the sales tax because it includes all types of businesses, while the other taxes exclude sole proprietorships.

Sales tax statistics in Austria have two different underlying sources. "Voranmeldungen": pre-registrations that companies have to file at regular intervals during the year, and "Veranlagungen": final tax assessments

Table IA2 – Austria: Data Sources

Type	Period	Source
Tabulations by sales	1954-1957	Österreichisches Statistisches Zentralamt (various years) *Steuerstatistiken*.
	1960-1980	Österreichisches Statistisches Zentralamt (various years) *Statistisches Handbuch für die Republik Österreich*. Used to fill in gaps.
	1973-2020	Österreichisches Statistisches Zentralamt (various years) *Umsatzsteuerstatistik*. Renamed to Statistik Österreich (various years) *Statistik der Umsatzsteuer* in 1998.

Notes: This table lists the sources of the Austrian data.

from companies tax returns submitted at the end of the fiscal year. We use data based on "Veranlagungen." Pre-registration statistics are typically published faster than assessment statistics, but exclude firms that do not have to pre-register (because they were exempted by the tax code from filing pre-registrations; these are typically new or small companies). Since tax statistics based on tax returns are available throughout, we do not have to rely on pre-registrations.

Scope and variable definition Firms have to pay sales tax and submit sales tax returns if their sales exceed a pre-specified threshold. It was roughly 1,500 Schillings in 1954 (Österreichischen Statistischen Zentralamt, 1958), 40,000 Schillings in 1973 (Österreichischen Statistischen Zentralamt, 1977), 30,000 Euros in 2018 (Statistik Austria, 2021), and 35,000 Euros in 2020 (Statistik Austria, 2023*b*) (see Appendix IA2.2 for more details).

The statistics tabulate firms based on total sales (steuerbarer Umsatz) in Austria. This includes the provision of all goods and services that a business carries out in Austria. The 1973 statistics suggest that the tabulations include taxes until 1972, but exclude taxes from 1973 onwards. We need to check if this is also the case in the tax statistics as reported in the statistical yearbook.

Figure IA7 shows the coverage of the dataset. The left panel shows log total sales from the tabulations. The right panel shows the ratio of tabulated sales relative to GDP. The ratio fluctuates around two, which indicates that there is no systematic coverage increase or decrease of the tax statistics over time.

Data construction

- Top x% sales share = Sales of top x% companies by sales in a given year/All sales in a given year.
- Top x% sales share among top y% = Sales of top x% companies by sales in a given year/Sales of top y% companies by sales in a given year.
- Top N% sales share = Sales of top N companies by sales in a given year/All sales in a given year.

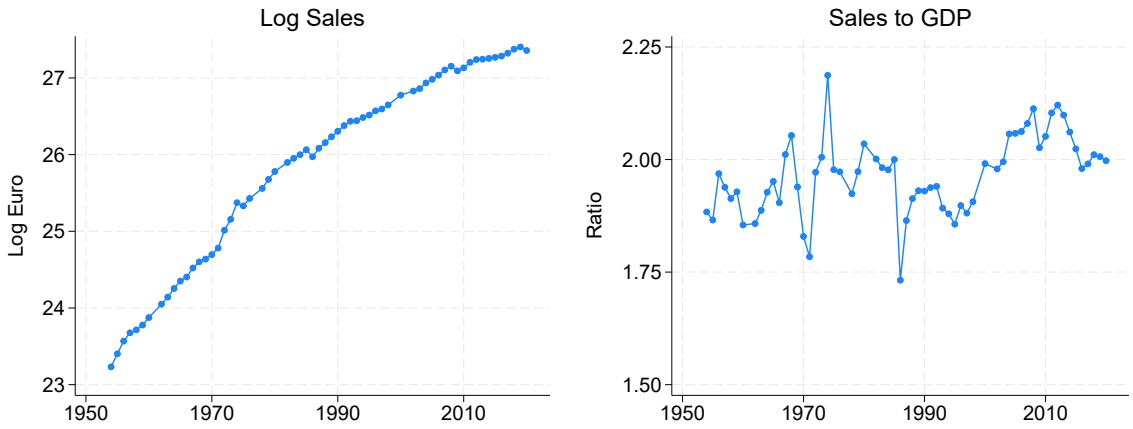


Figure IA7. Austria: Coverage of Sales in Tax Statistics

Notes: The left panel shows the log of all tabulated sales in our data. The right panel shows the ratio of tabulated sales to GDP.

Table IA3 – Canada: Data Sources

Type	Period	Source
Tabulations by net income	1944-1964	Revenue Canada (various years) *Taxation Statistics*.
	1969-1987	Revenue Canada (various years) *Corporation Taxation Statistics*.

Notes: This table lists the sources of the Canadian data.

IA2.3 Canada

Sources Table IA3 lists the sources that we use for Canada. Tabulations by size of net income come from "Taxation Statistics" from 1944 taxation year (published in 1946) to 1964 taxation year (published in 1966), and "Corporation Taxation Statistics" from 1969 to 1987. We obtain physical books from the University of Chicago library (Department of National Revenue, 1944-1964, 1969-1987), and transcribe the data.

Scope and variable definition Almost all companies that file T2 Corporation income tax return are covered. Companies that were not fully tabulated include but not limit to personal corporations, crown corporations, and credit unions, which are exempt from corporation tax under different Tax Act (Department of National Revenue, 1954). The "Taxation Statistics" years exclude banks and insurance companies (Department of National Revenue, 1954), which no longer seem to be the case in the "Corporation Taxation Statistics" years (Department of National Revenue, 1966). A non-resident corporation has to file a T2 return if, at any time in the year, one of the following situations applies:[3] 1) it carried on business in Canada; 2) it had a taxable capital gain; 3) it disposed of taxable Canadian property, unless the disposition meets all the exemption criteria.

[3]See more information here: https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/t4012/t2-corporation-income-tax-guide-before-you-start.html.

In some years, corporations below a certain threshold were excluded.

- From 1944 to 1947, corporations with gross revenue less than $1,000 were considered inactive companies and were excluded (with the exception of mining or oil development companies that spend over $1,000 on their property, and investment trusts with a balance sheet that shows cash or marketable securities having a value in excess of $25,000).
- From 1948 to 1964, corporations with gross revenue less than $2,000 were excluded (with the exception of mining or oil development companies that spend over $2,000 on their property, and investment trusts with a balance sheet that shows cash or marketable securities having a value in excess of $25,000).
- From 1969 to 1980, the publications do not explicitly mention size exclusion.
- From 1981 to 1984, corporations for which assets, equity, sales, profits before taxes, and taxable income are less than $25,000 are not in sampled, but estimates for them are included in the tabulations.
- From 1985 to 1987, corporations with assets less than $50,000 and sales less than $10,000 are considered inactive and excluded from both sampling and estimation.

The definition of "Taxable Income" remains unchanged throughout the different regimes. The 1946 publication defines net taxable income as "the current year profit less the prior year loss." This is very much in line with the 1987 publication, where taxable income is "the amount subject to income tax for the taxation year and consists of current year positive taxable income less prior year losses."

Corporate share in net income Since the size tabulations for Canada are restricted to corporations, we need to obtain an estimate of the share of corporations in total net income (especially relevant for the top N shares in Section III.B). We approximate the corporate share in net income using the ratio of corporate profits to corporate profits plus net income of unincorporated businesses (farm and non-farm), which is available for the entire sample period from Statistics Canada (Statistics Canada, 1960-2011) and Historical Statistics of Canada (Historical Statistics of Canada, 1926-1976). The resulting estimate is shown in Figure IA8.

Data construction

- Top x% net income share = Net income of top x% corporations by net income in a given year/Net income of corporations in a given year. Restricted to those with positive net income.
- Top x% net income share among top y% = Net income of top x% corporations by net income in a given year/Net income of top y% corporations by net income in a given year. Restricted to those with positive net income.

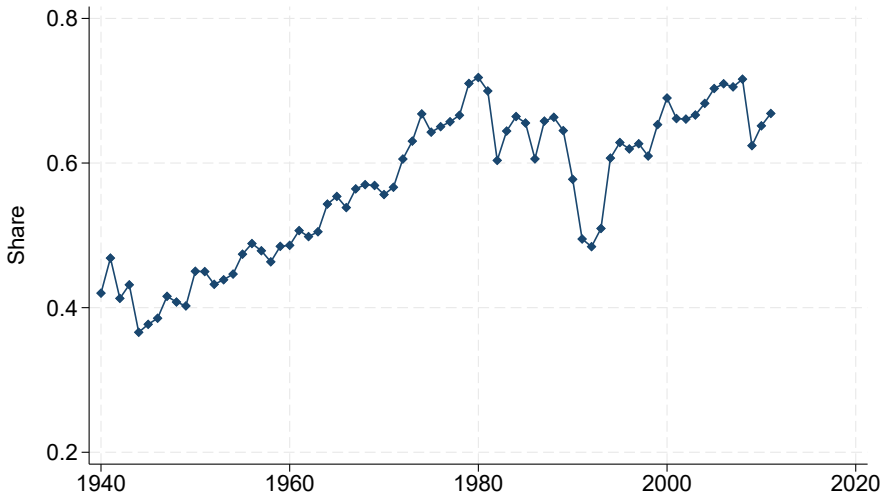


Figure IA8. Canada: Corporate Share Estimates

Notes: The figure shows trends in the corporate share for Canada. We use the ratio of corporate profits to corporate profits plus net income of unincorporated businesses (farm and non-farm).

- Top N net income share = Net income of top N corporations by net income in a given year/Estimated net income of corporations and noncorporations in a given year (starting with net income of corporations and divide by estimated corporate share as discussed above). Restricted to those with positive net income.

IA2.4 Denmark

Sources Table IA4 lists the sources that we use for Denmark. We draw on two types of tabulations to map out the long-run trend in business concentration. First, between 1902 and 1983, Statistics Denmark published tabulations of corporations by size of equity capital based on corporate register data. We obtain PDFs of these publications through Statistics Denmark (Danmarks Statistik, 1903-1975, 1928-1932, 1984-1987) and transcribe the data. Second, between 1970 and 1999, Statistics Denmark published tabulations by sales based on the business registry and value added tax returns (the value added tax was introduced in Denmark in 1967). These tabulations by sales were discontinued in 2000. We obtain PDFs through Statistics Denmark (Danmarks Statistik, 1973-1981, 1983-2001*b*) and transcribe the data.

Scope and variable definition The tabulations by capital are restricted to corporations. In 1977, a minimum capital size requirement of 100,000 Kronors was introduced (Danmarks Statistik, 1984-1987). The tabulations by sales cover all types of businesses with sales above a minimum threshold. The threshold was 5,000 Kronors in 1970 (Danmarks Statistik, 1973), and 20,000 Kronors starting in 1999 (Danmarks Statistik, 2001*c*). Public services are subject to the value added tax only when offered in competition with private enterprises.

Table IA4 – Denmark: Data Sources

Type	Period	Source
Tabulations by capital	1902-1975	Danmarks Statistik (various years) *Statistisk Aarbog*.
	1921-1932	Danmarks Statistik (various years) *Statistiske Meddelelser - Aktieselskaber*.
	1977-1983	Danmarks Statistik (various years) *Statistiske Efterretninger - Bestanden af aktieog anpartsselskaber*.
Tabulations by sales	1970-1999	Danmarks Statistik (various years) *Statistiske Efterretninger - Momsregistrerede virksomheder*.

Notes: This table lists the sources of the Danish data.

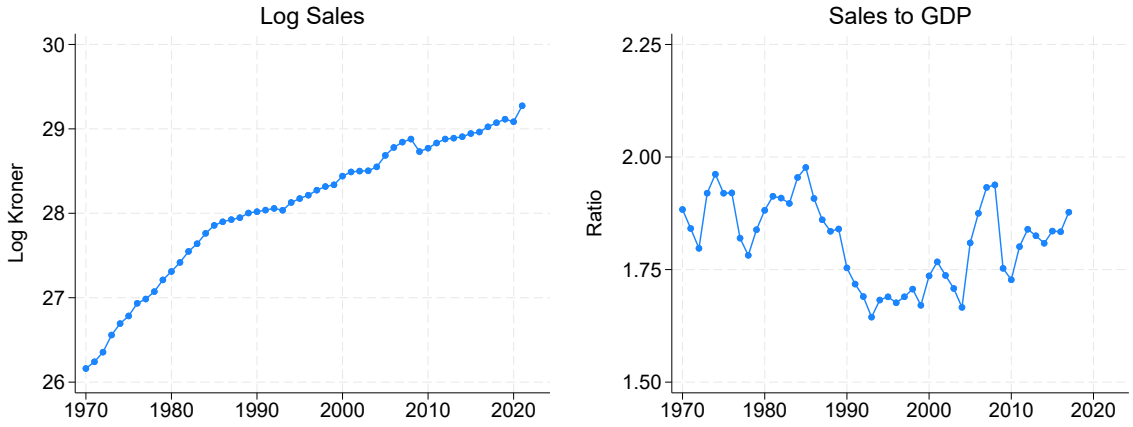


Figure IA9. Denmark: Coverage of Sales in Tax Statistics

Notes: The left panel shows the log of all tabulated sales in our data. The right panel shows the ratio of tabulated sales to GDP.

The Danish tabulations by capital uses the value of paid-in capital until 1964, and subscribed capital since 1965. Both concepts are comparable in magnitude (paid in capital in 1964: 7,972 million Kronors; subscribed capital in 1965: 8,622 million Kronors). The Danish tabulations by sales capture total domestic sales (including exports), but exclude other foreign activities of Danish companies (Danmarks Statistik, 2001*a*). Taxable sales include the provision of goods and most professional services in Denmark.[4] All amounts in the sales statistics are net of value added tax. Exports are tax exempt.

Figure IA9 shows the coverage of the sales tabulations. The left panel shows log total sales from the tabulations. The right panel shows the ratio of tabulated sales relative to GDP. The ratio fluctuates around two, which indicates that there is no systematic changes in the coverage of the tax statistics over time.

[4]Exceptions exist for certain sectors such as passenger transport, travel agencies, banking, finance, insurance, medical and dental treatment, and specific types of education. In real estate, the value added tax applies to construction and brokerage fees, while the sale value and rental income are generally exempt.

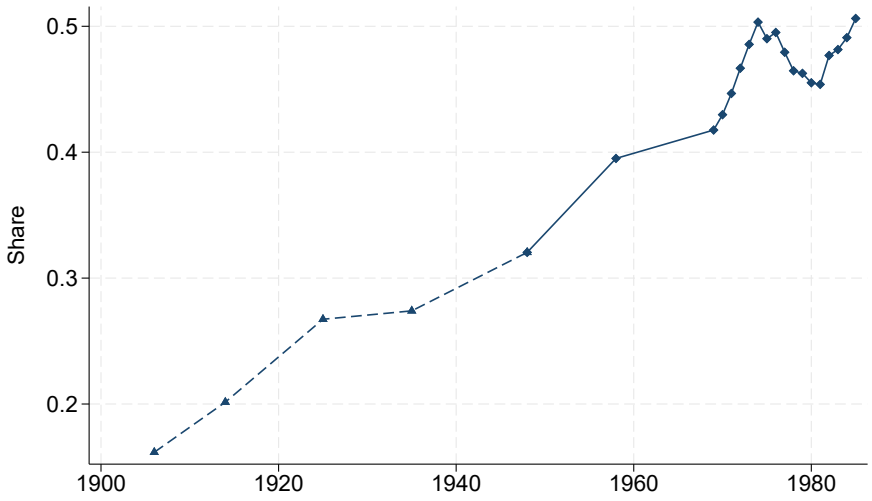


Figure IA10. Denmark: Corporate Share Estimates

Notes: The figure shows trends in the corporate share for Denmark. We use the sales share of corporations in total sales after 1948 (solid line with diamonds), and the employment share of industrial corporations among all industrial businesses before then (dashed line with triangles).

Corporate share in capital Since the tabulations by capital are restricted to corporations, we estimate the share of corporations in total capital (especially relevant for the top N shares in Section III.B). We estimate total capital by dividing total corporate capital by the "corporate share" in the economy. In recent years, we estimate the corporate share using the sales share of corporations in total sales, available from Statistics Denmark and Census publications (Danmarks Statistik, 1984-1987). This assumes that the capital share of corporations in the economy is similar to their sales share. In earlier years, we can obtain estimates of the corporate employment share for industrials (Danmarks Statistik, 1908-1914, 1925-1948).[5] The two estimates are both available in 1948, and align closely. We therefore use the employment share series to extend our corporate share series further back in time.

Data construction

- Top x% capital share = Capital of top x% corporations by capital in a given year/Capital of corporations in a given year.
- Top x% capital share among top y% = Capital of top x% corporations by capital in a given year/Capital of top y% corporations by capital in a given year
- Top N capital share = Capital of top N corporations by capital in a given year/Estimated capital of corporations and noncorporations in a given year (starting with capital of corporations and divide by estimated corporate share as discussed above).
- Top x% sales share = Sales of top x% companies by sales in a given year/All sales in a given year.

[5]The industrials sector includes construction, manufacturing, utilities, and mining.

Table IA5 – Germany: Data Sources

Type	Period	Source
Tabulations by sales	1924	Statistisches Reichsamt (1928) *Statistik des Deutschen Reichs Band 353 - Die Deutsche Umsatzbesteuerung nach dem Kriege*.
	1926-1929	Statistisches Reichsamt (various years) *Statistik des Deutschen Reichs Band 361 and 399 - Umsatz und Umsatzsteuer in Deutschland*.
	1935	Statistisches Reichsamt (1938) *Statistik des Deutschen Reichs Band 511 - Umsatzsteuerstatistik 1935.*
	1950-1959	Statistisches Bundesamt (various years) *Die Umsätze der Umsatzsteuerpflichtigen und deren Besteuerung*.
	1960-1974	Statistisches Bundesamt (various years) *Finanzen und Steuern Fachserie L Reihe 7 - Umsatzsteuer*.
	1976-2009	Statistisches Bundesamt (various years) *Finanzen und Steuern Fachserie 14 Reihe 8 - Umsatzsteuer*.
	2010-2020	Statistisches Bundesamt (various years) *Finanzen und Steuern Fachserie 14 Reihe 8.1 - Umsatzsteuerstatistik (Voranmeldungen)*.

Notes: This table lists the sources of the German data.

- Top $x\%$ sales share among top $y\%$ = Sales of top $x\%$ companies by sales in a given year/Sales of top $y\%$ companies by sales in a given year.
- Top $N\%$ sales share = Sales of top N companies by sales in a given year/All sales in a given year.

IA2.5 Germany

Sources Table IA5 lists the sources that we use for Germany. We obtain physical copies of the publications before 1935 through the German National Library (Statistisches Reichsamt, 1928, 1931, 1932, 1938), and PDFs through the statistical library of the Statistisches Bundesamt afterwards (Statistisches Bundesamt, 1955-1961, 1962-1976, 1978-2011, 2012-2022). We then transcribe the data.

The first revenue tax law in Germany was introduced in 1916 on the delivery of all goods. In 1918, the tax was expanded to cover all goods and services. Subsequently, in 1967, additional reform led to the transition to a value-added tax system. The German statistical offices produced and published regular reports on the sales tax based on submitted tax records including tabulations of businesses by size of sales since 1924.

Sales tax statistics in Germany have two different underlying sources. "Voranmeldungen": pre-registrations that companies have to file at regular intervals during the year, and "Veranlagungen": final tax assessments from companies tax returns submitted at the end of the fiscal year. The advantage of pre-registration statistics is that they can usually be published much faster than assessment statistics. The main difference

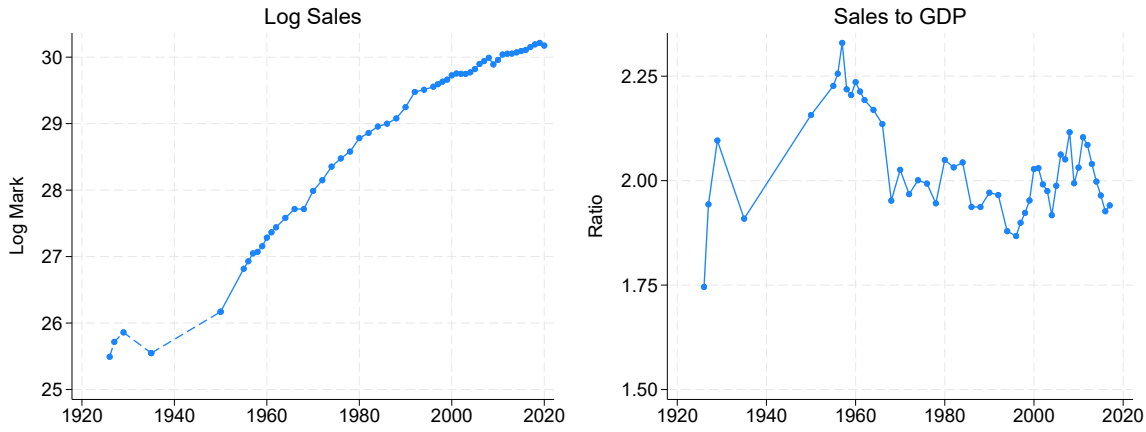


Figure IA11. Germany: Coverage of Sales in Tax Statistics

Notes: The left panel shows the log of all tabulated sales in our data. The right panel shows the ratio of tabulated sales to GDP. Data for East Germany are included from 1992 onward.

is that pre-registrations are only filed by firms that exceeded the revenue tax threshold in the previous year and thus exclude entrants and firms with sales below the exemption threshold in the previous year. Assessment statistics are available from 2006 onward and prior to 1950. For consistency, we use pre-registration statistics after 1950, and assessment statistics before 1950.

Scope and variable definition Firms have to pay sales tax if their sales exceed a pre-specified threshold. The threshold was 8,000 Deutsche Marks in 1956 (Statistisches Bundesamt, 1955-1961), 20,000 Deutsche Marks in 1980, and 17,500 Euros by 2003 (Statistisches Bundesamt, 1978-2011). Before 1945, the tax statistics encompass firms from the entire "German Reich." After 1945, the statistics cover West Germany. West Berlin is included from 1957 onward, the Saarland from 1960 onward, and East Germany from 1992 onward.

The tax statistics tabulate firms based on total sales (Gesamtumsatz / steuerbarer Umsatz) in Germany. This includes both taxable and tax exempt sales (steuerfreie Umsätze). Sales conducted outside of Germany or without payment for goods or services are not accounted for in the statistics. In addition, internal transactions within a tax group are non-taxable and not included. Imports are subject to sales tax (Einfuhrumsatzsteuer), but not covered by the statistics.

Figure IA11 shows the coverage of tabulated sales from the tax statistics. The left panel shows log sales over time. Log sales increase over time without obvious discontinuities. The integration of East Germany did not create a sizable discontinuity, as the West German economy was small relative to the East German economy. The level before and after World War II are not comparable due to the currency reform of 1948. The right panel shows the ratio of tabulated sales relative to GDP. The ratio fluctuates around two. Overall, these figures confirm that the tax statistics coverage of the economy did not change materially over time.

Data construction

Table IA6 – Singapore: Data Sources

Type	Period	Source
Tabulations by net income	1972-2004	Yearbook of Statistics, Singapore.
	2005-2022	Inland Revenue Authority of Singapore (IRAS).

Notes: This table lists the sources of the Singaporean data.

- Top x% sales share = Sales of top x% companies by sales in a given year/All sales in a given year.
- Top x% sales share among top y% = Sales of top x% companies by sales in a given year/Sales of top y% companies by sales in a given year.
- Top N% sales share = Sales of top N companies by sales in a given year/All sales in a given year.

IA2.6 Singapore

Sources Table IA6 lists the sources that we use for Singapore. To study concentration trends in Singapore, we obtain tabulations of corporations by net income (assessed income) since 1972. The data were prepared by the Inland Revenue Department before 1992, and by the Inland Revenue Authority of Singapore afterwards. We transcribe tabulations from the Yearbook of Statistics for 1972 to 2004 (Singapore Department of Statistics, 1972-2004), and obtain data directly from the Inland Revenue Authority of Singapore (IRAS) since 2005 (Inland Revenue Authority of Singapore, 2005-2007, 2008-2022).

Scope and variable definition The tabulations include resident and non-resident corporations. Initially, the data are tabulated by assessed income. From 2005 onward, tabulations are by chargeable income. There is no major discontinuity in the totals when the variable definition changes from assessed to chargeable income between 2004 and 2005.

Corporate share in net income Firm size tabulations for Singapore are restricted to firms subject to the corporate tax. Therefore, we need an estimate of the share of corporations (especially relevant for the top N shares in Section III.B). We can use data from national accounts from the Singapore Department of Statistics (Singapore Department of Statistics, 1985-2022) from 1985 onward, by taking the ratio of gross operating surplus of the corporate sector to gross operating surplus of the corporate and the personal sector (noncorporates). We use data on assessed income by legal form from the Yearbook of Statistics between 1972 and 1985, by taking the ratio of corporate assessed income to corporate plus noncorporate (partnership and sole proprietorship) assessed income (Singapore Department of Statistics, 1972-2004); we take five-year moving average of this series to make it more stable. The resulting corporate share series is shown in Figure IA12.

Data construction

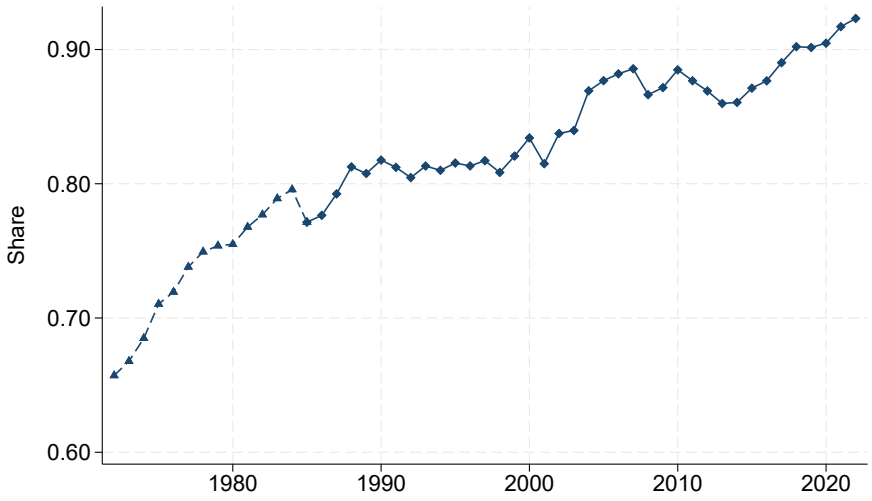


Figure IA12. Singapore: Corporate Share Estimates

Notes: The figure shows trends in the corporate share for Singapore. We use the ratio of corporate gross operating surplus to corporate gross operating surplus plus gross operating surplus of the personal sector since 1985 (solid line with diamonds), and the five-year moving average of corporate assessed income to corporate plus noncorporate (partnership and sole proprietorship) assessed income (dashed line with triangles) between 1972 and 1985.

- Top x% net income share = Net income of top x% corporations by net income in a given year/Net income of corporations in a given year. Restricted to those with positive net income.
- Top x% net income share among top y% = Net income of top x% corporations by net income in a given year/Net income of top y% corporations by net income in a given year. Restricted to those with positive net income.
- Top N net income share = Net income of top N corporations by net income in a given year/Estimated net income of corporations and noncorporations in a given year (starting with net income of corporations and divide by estimated corporate share as discussed above). Restricted to those with positive net income.

IA2.7 Switzerland

Sources Table IA7 lists the sources that we use for Switzerland. We draw on two types of tabulations to map out the long-run trend in business concentration. First, between 1901 and 1987, the Swiss Statistical Office (*Eidgenössisches Statistisches Amt*) published tabulations of corporations by size of equity capital, based on analyses of joint-stock companies recorded in the Business and Enterprise Register (*Betriebs- und Unternehmungsregister*).[6] We obtain PDFs from the Statistical Yearbook and special issues on joint stock corporations published by the Federal Statistical Office (Eidgenössisches Statistisches Amt, 1934,

[6]The entries in the register are based on information published in the Swiss Commercial Gazette (*Handelsamtsblatt*).

Table IA7 – Switzerland: Data Sources

Type	Period	Source
Tabulations by capital	1901-1930	Eidgenössisches Statistisches Amt (1934) *Statistische Quellenwerke der Schweiz / Heft 56 - Schweizerische Aktiengesellschaften 1921 bis 1933.*
	1921-1985	Eidgenössisches Statistisches Amt (various years) *Statistisches Jahrbuch der Schweiz.*
	1986-1987	Bundesamt für Statistik (1988) *Aktiengesellschaften in der Schweiz 1987; Amtliche Statistik der Schweiz, Nr. 200.*
Tabulations by sales	1995-2021	Eidgenössische Steuerverwaltung (various years) *Die Mehrwertsteuer in der Schweiz.*

Notes: This table lists the sources of the Swiss data.

1922-1986; Bundesamt für Statistik, 1988); we then transcribe the data. Second, since 1995, the Swiss Tax Authority (Eidgenössische Steuerverwaltung) has an annual publication of value added tax statistics (*Die Mehrwertsteuer in der Schweiz*). We obtain PDFs from the Swiss Statistical Office (Eidgenössische Steuerverwaltung, 1997-2023) and transcribe the data.

Scope and variable definition The tabulations by capital are restricted to corporations. In 1937 a minimum capital requirement was introduced for newly formed corporations (Federal Government of Switzerland, 1936). Corporations with less capital continued to operate, but gradually disappeared in the 1940s (Eidgenössisches Statistisches Amt, 1947), and disappeared entirely by 1952 (Eidgenössisches Statistisches Amt, 1953). The tabulations by sales cover all types of businesses with sales above a minimum threshold. The threshold was 75,000 Swiss Francs in 1995 (Eidgenössische Steuerverwaltung, 1997), and 100,000 Swiss Francs in 2010 (Eidgenössische Steuerverwaltung, 2013). However, there are many firms below the threshold still filing a value added tax return (for example, #66,665, or 17,8% of returns in 2015). The following areas of the economy are tax exempt: health, social welfare, education and training, culture and sports, rental of residential properties, financial transactions, insurance and some primary production. Sales in these areas are included in the statistics only if they are conducted by companies subject to the value added tax because they also generate taxable revenue in other areas. In such cases, these companies must report their total revenue (including the exempt revenue) on their tax return.

The Swiss tabulations by capital uses the value of issued shares, calculated by multiplying the nominal value of each share at issuance by the total number of shares. The Swiss tabulations by sales use total sales of Swiss firms, including their foreign sales. This is different from the tabulations by sales in Austria, Germany, and Denmark, which are restricted to domestic sales.

Figure IA13 shows the coverage of the sales tabulations. The left panel shows log total sales from the tabulations. The right panel shows the ratio of tabulated sales relative to GDP. This ratio has increased

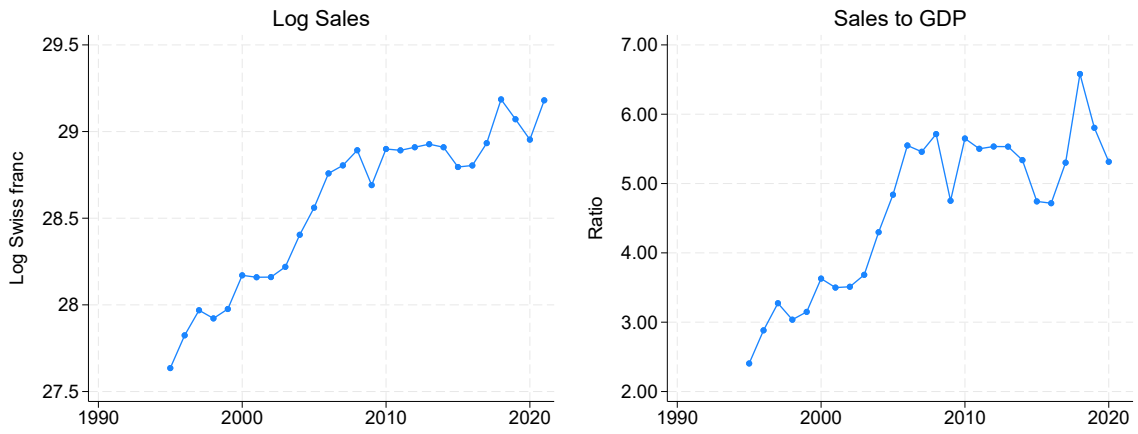


Figure IA13. Switzerland: Coverage of Sales in Tax Statistics

Notes: The left panel shows the log of all tabulated sales in our data. The right panel shows the ratio of tabulated sales to GDP.

significantly between 1995 and 2020 (from roughly 2.5 to 5.5). This is likely due to the rise of foreign sales, which are present in the data for Switzerland but not in other by sales tabulations.

Corporate share in capital Since the tabulations by capital are restricted to corporations, we need an estimate the share of corporations in total capital (especially relevant for the top N shares in Section III.B). For benchmark years, we can obtain data on the corporate employment share dating back to 1929 from the Federal Business Census (*Eidgenössische Betriebszählung*) (Eidgenössischen Statistischen Amt, 1933-1998). This assumes that the capital share of corporations in the economy is similar to their employment share. Before 1929, we rely on the proportion of joint stock corporations among all registered businesses obtained from the Historical Statistics of Switzerland. The resulting series is shown in Figure IA14.

Data construction

- Top x% capital share = Capital of top x% corporations by capital in a given year/Capital of corporations in a given year.
- Top x% capital share among top y% = Capital of top x% corporations by capital in a given year/Capital of top y% corporations by capital in a given year.
- Top N capital share = Capital of top N corporations by capital in a given year/Estimated capital of corporations and noncorporations in a given year (starting with capital of corporations and divide by estimated corporate share as discussed above).
- Top x% sales share = Sales of top x% companies by sales in a given year/All sales in a given year.
- Top x% sales share among top y% = Sales of top x% companies by sales in a given year/Sales of top y% companies by sales in a given year.
- Top N% sales share = Sales of top N companies by sales in a given year/All sales in a given year.

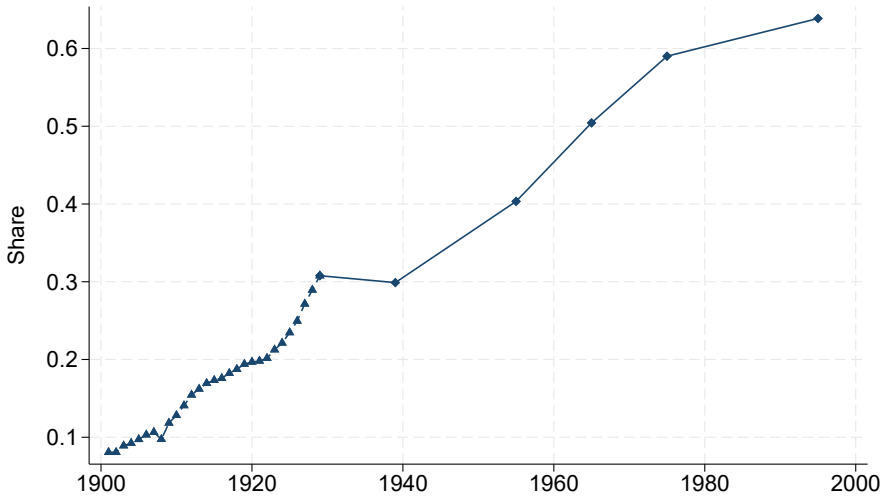


Figure IA14. Switzerland: Corporate Share Estimates

Notes: The figure shows trends in the corporate share for Switzerland. We use the corporate employment share after 1929 (solid line with diamonds), and the proportion of joint stock corporations among all registered businesses before then (dashed line with triangles).

IA2.8 United Kingdom

Sources Table IA8 lists the sources that we use for the United Kingdom. Our analysis for the UK focuses on manufacturing due to data availability in the early years. Starting in 1958, the Census of Production provides tabulations of firm size by net output. We obtain PDFs from the LSE digital library (Board of Trade, 1960-1973; Department of Industry Business Statistics Office, 1973-1992), and transcribe the data. Prais (1976) provides additional estimates of the share of the 100 largest enterprises in manufacturing by net output for selected years since 1909 (see Appendix A of Prais (1976) for details). Starting in 1985, we can find tabulations of the number of businesses by turnover (sales) size. We obtain PDFs from inter-library loans and transcribe the data before 1998 (Office for National Statistics, 1985-1997), and download data in Excel spreadsheets from the Office for National Statistics afterwards (Office for National Statistics, 1998-2003, 2004-2021). These data are based on value added tax (VAT) returns submitted to HM Customs and Excise (processed by the Central Statistical Office until 1995 and the Office for National Statistics thereafter).

Scope and variable definition The census tabulations by net output include private sector enterprises employing 100 or more persons. It is reasonable to assume that the largest manufacturers in the numerator have more than 100 employees. We supplement these tabulations with information about the total number of enterprises and total net output in manufacturing from separate summary tables to get the proper denominator. The census data do not include foreign establishments or non-industrial establishments

Table IA8 – U.K.: Data Sources

Type	Period	Source
Tabulations by net output	1909-1968	Prais (1976).
	1958-1992	Office for National Statistics (various years) *Census of Production - Summary Volumne*.
Tabulations by sales	1985-2021	Office for National Statistics (various years) *Size Analysis of United Kingdom Businesses*; from 2004 onwards called: *UK Businesses: Activity, Size and Location.*

Notes: This table lists the sources of the U.K. data.

of manufacturing firms.[7] The tabulations by turnover are based on VAT-registered enterprises, and the registration has a time-varying minimum turnover threshold, from £18,000 in 1985 to £73,000 in 2013 (Office for National Statistics, 1985-1997, 1998-2003, 2004-2021). Enterprises below the VAT registration threshold are excluded before 1992, and are included afterwards if they have chosen to register voluntarily or not to de-register (zero turnover firms are excluded before 2003 and included afterwards if their employment is non-zero).

For the census data (Board of Trade, 1960-1973; Department of Industry Business Statistics Office, 1973-1992), net output is defined as "the value added to materials by the process of production (including the margin on selling any merchanted or factored goods)." It is calculated as gross output − purchases adjusted for change in value of stocks of fuel and raw materials − payments for work given to other establishments − payments for transport − net amount of any duties, subsidies, allowances and levies payable. For the turnover data (Office for National Statistics, 1985-1997, 1998-2003, 2004-2021), they generally exclude VAT but include other taxes, such as the revenue duties on alcoholic drinks and tobacco. They represent total U.K. turnover, including exempt and zero-rated supplies.

Data construction

- Top x% net output share = Net output of top x% manufacturers by net output in a given year/All manufacturing net output in a given year.
- Top x% net output share among top y% = Net output of top x% manufacturers by net output in a given year/Net output of top y% manufacturers by net output in a given year.
- Top N% net output share = Net output of top N manufacturers by net output in a given year/All manufacturing net output in a given year.

[7]The 1958 census does not include an aggregate enterprise count. This is because there is no enterprise count for the smallest size category. We estimate the number of enterprises for that size group using the number of establishments in 1958 and the ratio of the number of establishments to enterprises in the smallest size group from 1963.

- Top $x\%$ sales share = Sales of top $x\%$ manufacturers by sales in a given year/All manufacturing sales in a given year.
- Top $x\%$ sales share among top $y\%$ = Sales of top $x\%$ manufacturers by sales in a given year/Sales of top $y\%$ manufacturers by sales in a given year.
- Top $N\%$ sales share = Sales of top N manufacturers by sales in a given year/All manufacturing sales in a given year.