DISCUSSION PAPER SERIES

DP14468
(v. 2)

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ECONOMIC HISTORY

FINANCIAL ECONOMICS

INTERNATIONAL MACROECONOMICS AND FINANCE

CEPR

ISSN 0265-8003

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Discussion Paper DP14468
First Published 04 March 2020
This Revision 12 August 2021

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www.cepr.org

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JEL Classification: E44, G10, N20, O16

Keywords: stock market capitalization, Equity issuance, corporate profits, wealth-to-income ratios, long-run trends

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Acknowledgements
This work was supported by the German Federal Research Ministry (BMBF) grant number 01UF1505. Part of the research was undertaken while the authors were at Bonn University. We would like to thank Michael Bordo, Can Gao, Jan Eeckhout, Leslie Hannah, Yueran Ma, Enrico Perotti, Björn Richter, Kristian Rydqvist, Moritz Schularick, Nikolaus Wolf, the participants of seminars at the University of Amsterdam, Bonn, Berlin School of Economics, CREI, SAFE, UPF, the 7th CEPR economic history symposium, Paris EHES congress, Oxford FRESH-UPIER meeting, 8th Eurhistock workshop and the EABH Institutional Investors conference for providing helpful comments. We are indebted to a large number of researchers who helped with individual country data. Francisco Amaral, Felix Rhiel, Thomas Schwarz and Maira Talha have provided excellent research assistance.

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This paper studies trends and drivers of long-run stock market growth. Between 1870 and 1990, advanced-economy stock market capitalization grew in line with GDP. But over recent decades, a historically unprecedented expansion saw market cap to GDP ratios triple and remain persistently high. While most historical stock market growth was driven by issuances, this recent expansion was fuelled by rising equity prices. We show that the key driver of this structural break was a profit shift towards listed firms, with listed firm profit shares in both GDP and capital income doubling and reaching their highest levels in 146 years.

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1. Introduction

The past three decades have seen several pronounced changes in the US corporate sector and the broader macroeconomy. While stock prices, market capitalization and corporate profits have all increased markedly, the labour share of income and the rate of economic growth have declined (Barkai, 2020; Greenwald, Lettau, and Ludvigson, 2021; Karabarbounis and Neiman, 2013). Without long-run cross-country data, however, one cannot tell whether these developments are a recent country-specific phenomenon, or are part of a broader secular trend. After all, Rajan and Zingales (2003) have shown that stock market cycles can be very long, with the 1990s increases in market capitalization being a reversal to the previously high levels of the early 1900s. Similarly, the recent labour share declines may be specific to the US (Gutiérrez and Piton, 2020), and increases in corporate profitability may represent mean-reversals following profit declines of the 1960s and 70s (Nordhaus, 1974; Feldstein and Summers, 1977; Barkai and Benzell, 2018).

This paper studies long-run trends in listed firms' market capitalization and their drivers. The unique advantage of focussing on listed companies is that we can obtain the high-quality data necessary for analysing corporate sector developments over very long time periods in many countries. For this purpose, we introduce a new integrated database covering stock market capitalization, equity issuance, stock prices, and listed firms' dividends and earnings in 17 advanced economies for years 1870 to 2016.[1] These series were constructed from a wide range of primary and secondary historical sources, with many of these previously unused or newly assembled using hand-collected archival data. Together with the extensive documentation in the online Data Appendix, they provide a new resource for researchers to study the development of the stock market, corporate profitability and equity finance throughout the last century and a half. The detail of our data also allows us to not only document the trends, but also to perform a detailed accounting decomposition of the drivers of long-run stock market growth.

We find that between 1870 and the 1980s, advanced-economy stock market capitalization grew in line with GDP, averaging to around one-third of output. Throughout this period, long-run stock market growth was driven by equity issuances while real capital gains were on average zero. After the 1980s, a sharp structural break took place with market cap to GDP ratios across advanced economies tripling and remaining persistently high. In contrast to the historical period, this recent growth acceleration was driven by rising stock prices while issuances actually slowed. The key driver behind these stock price increases was a profit shift away from other parts of the economy towards listed corporations, with listed firm profit growth far outstripping that in GDP and capital income. Our findings show that the post-1980s increases in US corporate profits and market capitalization are part of an unprecedented global expansion which goes above and beyond the well-documented increases in advanced-economy capital shares.

[1] The market capitalization and issuance data are newly assembled, and the stock price and dividend data are updated versions of those in Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019). Earnings data only cover the recent decades whereas all other series cover a long-run cross-section of countries.

Our findings speak to three pertinent issues in financial economics. The first of these concerns the long-run evolution of stock market size. Efforts to document the size of the listed equity market date back to at least to the 19th century, first conducted through surveys commissioned by wealthy financiers (Burdett, 1882; Green, 1887) and later through increasingly systematic efforts to map out the trends in different components of household wealth (Hoffmann, 1965; Roe, 1971; Goldsmith, 1985). The received wisdom is that both the stock market (Rajan and Zingales, 2003) and total wealth (Piketty and Zucman, 2014) were large in the early and late 20th century, and depressed in-between. We show that this is indeed the case, but the historical and the current stock market expansion are more different than they are alike, with the recent expansion being larger, more persistent and driven by different forces.

The second issue concerns the drivers of long-run stock market growth. Two literatures have addressed this question from different angles with the first focussing on the role of institutions and norms in facilitating household savings and market entry (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1997; Rajan and Zingales, 2003; Piketty and Zucman, 2014), and the second focussing on growth in profits and stock prices through increases in mark-ups (De Loecker, Eeckhout, and Unger, 2020; Corhay, Kung, and Schmid, 2020), declines in taxes (McGrattan and Prescott, 2005) and falls in the labour share (Greenwald et al., 2021). We show that the degree to which each of these views is applicable depends very much on context and the historical period studied. While norms, institutions and issuances are likely to have been key throughout history, the recent period is very unusual in that most of the stock market growth was driven by rising equity prices, fuelled by high listed firm profits which reflected a redistribution of income within capital.

The third issue relates to the scope and scale of the observed trends. Prior research has documented a number of secular trends for US corporations with some debate on their pervasiveness across countries and economic sectors: increases in corporate profits and concentration (Barkai, 2020, Philippon, 2019, De Loecker et al., 2020), falls in corporate issuance (or rising corporate savings; Gao, Ritter, and Zhu, 2013, Doidge, Karolyi, and Stulz, 2013, Armenter and Hnatkovska, 2017, Chen, Karabarbounis, and Neiman, 2017), and a rise and fall of the value added share of corporations (Jensen, 1997, Smith, Yagan, Zidar, and Zwick, 2019, Saez and Zucman, 2020). We show that the scope of the trends in both capitalization and listed profits is very broad, spanning the major advanced economies and economic sectors, and that their scale is historically unprecedented. The slowdown in corporate net equity issuance also extends beyond the US economy. That being said, the post-1980s trends do show some differences between countries with, for example, high equity issuances in Portugal, modest capitalization growth in the UK and Italy, and relatively strong stock market growth in Sweden and Switzerland. But the US is by no means an outlier, ranking around the middle of advanced economies in terms of magnitudes of the decline in issuances and increases in profits and capitalization.

Our detailed analysis starts by documenting long-run cross-country trends in stock market wealth. The first century of our data saw several pronounced cycles, with the median market cap to GDP ratio doubling between early 1890s and 1910, falling back to its 1880s levels after World War

1, increasing again in the 1950s and falling to near-historical lows after the 1970s stagflation. But all these cycles were largely mean-reverting: median stock market capitalization always eventually returned to its long-run level of around one-third of GDP, and the cross-country interquartile range stayed between 0.1 and 0.6 of GDP.

Over the last several decades, an unprecedented expansion saw the cross-country median market cap to GDP ratio increase from 0.2 in 1980 to 1 in 2000. Moreover, this surge in stock market wealth seems to have been persistent – despite sharp equity price corrections in the early 2000s and 2008–09, market cap to GDP ratios today remain around three times larger than the historical norm. These "big bang" increases in market capitalization took place in all 17 countries, and in each country bar one (Belgium), they represented the largest structural break in the market cap to GDP ratio during the entire 146-year historical time period. The observed long-run trends also underscore a rise in the global importance of the US equity market at the expense of the UK and France: while all three countries enjoyed roughly equal global market shares in the early 1900s, by the 1960s the US stock market accounted for close to 70% of the total 17-country capitalization.

Market capitalization growth can be driven by either quantities – i.e. equity issuances – or prices. We find that throughout the majority of the historical period, long-run capitalization growth was primarily quantity driven. Before 1985, real market capitalization grew by about 4% per year with the lion share of this growth accounted for by net equity issuance. Examining its drivers, we find that net issuance was higher when new markets were being established, and when the cost of equity was low relative to the cost of debt. While stock prices were volatile both over the short and medium run, before 1985 these cyclical fluctuations averaged out to around zero.

In contrast to these historical episodes, the post-1980s acceleration in stock market growth was accompanied by a slowdown in net equity issuance which was more than compensated for by sharp increases in real capital gains. We run two counterfactual exercises which confirm the importance of stock prices in driving the post-1985 increases in market capitalization. If we ignore the post-1985 changes in issuances by setting issuance levels to their pre-1985 average, the counterfactual evolution of stock market cap closely follows actual data up to 2000 and results in even larger capitalization increases afterwards. If we ignore the changes in prices by setting post-1985 capital gains to their historical average of around zero, the market cap to GDP ratio actually declines on the account of slowing issuance. In the cross-section, countries with the highest post-1985 capital gains also recorded the largest market capitalization increases during this time period.

But the fact that net issuance slowed and capital gains increased does not mean that all these capital gains accrued to firms already listed in the 1980s. On the contrary, we show that the slowdown in net issuance hides large gross movements between old and new listings, with the newly listed firm share generally increasing after 1980. Over the very long run, new listings follow a U-shaped pattern with large new listing waves in the early 1900s, very few new listings in the mid 20th century and a revival of new listings, especially in previously tightly regulated economies, during the 1980s and 1990s. This lends support to the Rajan and Zingales (2003) "great reversals" theory that links the mid-20th century stagnation in financial development to an increasing dominance of market incumbents at the expense of new firms.

To map out the deeper underlying drivers of the post-1980s increases in stock prices and capitalization, we use the dynamic Gordon growth model to decompose the market cap to GDP ratio into three components: the current ratio of listed firms' dividends to GDP (the *profit share* channel), *future growth* of dividends or earnings, and the rate at which these future cashflows to shareholders are discounted (the *discount rate* channel). Starting with the growth channel, we find that high market capitalization does not predict high future dividend growth at cyclical frequency. Combined with recent evidence of slowing long-run GDP growth and productivity in the US and globally (Fernald, 2015; Goldin, Koutroumpis, Lafond, and Winkler, 2021), this suggests that high growth expectations are unlikely to be driving the increases in market cap.

We further show that movements in discount rates can only explain a small share of the observed capitalization increases. Even though safe interest rates declined markedly during this period, an increase in the equity risk premium meant that the rate at which future equity cashflows are discounted has fallen by less than one percentage point after 1990 accounting for about 10% of the increase in market cap to GDP ratios. This finding is in line with several recent papers which document a stable rate of return on capital and increases in the equity premium, and connect these trends to increases in macroeconomic risk and shortages of safe assets (Gomme, Ravikumar, and Rupert, 2015; Caballero, Farhi, and Gourinchas, 2017a; Farhi and Gourio, 2018).

This leaves one other potential explanation of the post-1980s increases in market capitalization: an increase in the listed firms' profit share. We find that this channel is key. Between 1870 and 1990, dividends paid by listed firms fluctuated around the level of about 1.3% of GDP. The 1990s saw listed firm dividends and earnings double, with these increases continuing into the 2000s. Our counterfactual analysis shows that this channel alone can explain 75% of the post-1980s increases in the market cap to GDP ratio, and combined with the lower discount rate it can explain all of the capitalization increase. Digging into the drivers of this profit shift, we show that the profit increases were driven by increases in profit per unit of sales rather than increases in market shares (sales to gross output). This is in line with Gutiérrez and Philippon (2020) who show that there has not been a significant increase in the domestic and global market shares of dominant firms in recent decades.

We further show that these profit increases go above and beyond the recently documented declines in the labour share and increases in capital income relative to GDP (Karabarbounis and Neiman, 2013). The ratio of listed firms earnings to capital income has more than doubled since 1990, and those countries which experienced the largest capitalization increases during the big bang also recorded larger increases in the earnings-to-capital-income ratio. This means that the listed firm profit boom has, at least partially, come at the expense of other types of capital income.

We find that two key counterparts of the profit shift were declines in interest and tax expenses, which fell sharply after 1980 across advanced economies. The evidence on across-firm income redistribution is more mixed, with the US listed firm profitability increases happening alongside those of other businesses. The importance of lower interest and tax costs in fuelling listed firm profit growth helps explain why the post-1980s increases in profits and mark-ups have been accompanied by low levels of consumer price growth and steady or increasing unit labour costs (Syverson, 2019). Overall, this evidence suggests that within-capital-income shifts play an important role in shaping the distribution of wealth, and that interest rates can affect wealth not only directly through the discount rate, but also indirectly by changing corporate cashflows.

2. A new cross-country stock market database

This paper introduces a new long-run dataset on stock market size and its drivers. The central feature of these data is a new annual series of stock market capitalization covering 17 countries over years 1870 to 2016. The countries included are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. These are complemented with statistics on sources of market capitalization growth – issuances and capital gains – and the corresponding corporate fundamentals in the form of listed firm profits and dividends. Together, these data offer a new integrated assessment of stock market development and its underlying drivers over the long run.

Our market capitalization data measure the total market value of all ordinary shares of domestic companies listed on domestic exchanges at the end of each calendar year. We use a wide range of primary and secondary sources to construct these series, many of these new and previously unused. The secondary sources consist of financial history books and research articles, publications of stock exchanges, statistical agencies, central banks and trade bodies. Where reliable secondary sources are not available, we construct the capitalization measure by aggregating the total market values of individual stocks, using data on stock prices and number of shares or listed capital value from stock exchange bulletins and gazettes, stock exchange handbooks and companies' published accounts. Most of these primary source data were newly compiled through a series of archival visits to the respective countries' stock exchanges, central banks and national libraries, while some were also helpfully shared with us by other researchers. We generally produce annual estimates of capitalization, but for instances where these were not available, we obtain capitalization data for benchmark years and construct the annual series using changes in the book capital of listed companies and share prices. An extensive Data Appendix, Tables E.1–E.17 and Figures E.1–E.17 detail the sources used for each country, and compare our estimates to those in the existing literature.

Existing literature identifies four main challenges for deriving stock market capitalization estimates that are consistent across countries and over time. The first challenge is that the capitalization series should only cover ordinary shares and exclude other securities listed on the stock exchange such as preference shares and bonds (Hannah, 2018, offers a discussion of these issues in the early London Stock Exchange data). Some of the earlier statistical estimates bundle these different securities together, or sometimes only provide figures for both unlisted and listed equity liabilities. We therefore ensure that our estimates capture ordinary shares only, by constructing our own benchmark year estimates where necessary, and by using supplementary stock exchange data and research publications to make this distinction.

The second challenge is that the capitalization measure should sum the securities listed on all domestic stock exchanges, net of any cross listings. Wherever possible, we therefore rely on data that cover all the major stock exchanges in the country, constructing our own estimates from microdata when necessary, as in the case of the pre World War 1 German stock market cap (see Appendix Table E.7). It is, however, not always possible to obtain information on the capitalization of smaller stock exchanges, especially one that goes beyond benchmark years. For most countries in our sample, the bias from excluding smaller exchanges is small because by the late 19th century, stock markets in many countries were already quite centralised, and many securities that were chiefly traded on smaller markets were often also quoted on the main stock exchange. These issues are most important for the early US data, where several large regional exchanges and an active curb exchange were in operation (Sylla, 2006). For the US and several other countries we, therefore, rely on benchmark year estimates to proxy the size of regional and curb exchanges relative to the main market.

The third challenge relates to excluding foreign stocks. For most of our estimates, the foreign stock share is either well measured (e.g. in recent data) or small (as for most of the mid-20th century data), so the measurement issues mainly concern the large international stock exchanges in the early 20th century, in particular the London stock exchange. We use secondary sources to adjust the equity market capitalization for foreign stocks whenever necessary, such that the remaining biases should be small, with the most likely direction leading us to slightly overstate the domestic stock market capitalization in the financial center countries during the early 20th century. Appendix D.1 discusses the data issues associated with foreign listings in more detail.

The final challenge relates to the definition of a listing. On the one hand, as highlighted by Rydqvist and Guo (2020), in the early part of our sample many small shares that were listed on the exchange were traded very infrequently. On the other hand, some shares which were actively traded were traded in semi-official markets such as the New York Curb exchange. To be consistent across countries and time, we generally stick to the standard definition of the listing as being quoted on one of the stock exchanges in the country, i.e. being part of the stock listing – regardless of whether the stock is traded often or not. The one exception we make is the New York Curb exchange, where trading was conducted informally on the street before increasing formalisation of trading activities from the 1920s onwards (Garvy, 1944). Here we follow the typical approach of US financial historians (Sylla, 2006; O'Sullivan, 2007) and include the Curb exchange in our capitalization totals. Excluding the Curb exchange would reduce our US market capitalization estimates by around one-fifth for the pre-1920 period, based on data shared with us by Leslie Hannah and trading volume statistics in O'Sullivan (2007).

In addition to the market capitalization series, we construct estimates of, first, net equity issuance and capital gains, which allow us to decompose market cap movements into prices and quantities; second, the market value of new listings, which allows us to proxy the market share of newly listed firms; and third, listed firm profits and dividends which allow us to assess whether changes in market capitalization are driven by corporate fundamentals or discount rates.

Net equity issuance measures the market value of all new listings and secondary issues net of delistings and redemptions. These series are constructed from similar sources to our market capitalization data, with most of the estimates coming form hand-collected microdata, complemented by estimates of financial historians, statistical agencies and central banks, and international flow of funds data constructed by Richter and Diebold (2021). The main challenges when constructing the net issuance series lie in including all types of issuance, listings and delistings, and accounting for their market value. To this end, we seek to construct much of these series ourselves from microdata, but in some cases – as for example with some of the mid-20th century data for Germany – we combined data on the book value of issuance with estimates of the listed equity market-to-book ratio. Finally, we complement our net issuance data with an implied issuance estimate computed as the difference between market capitalization growth and the growth in the value-weighted equity price index (see Section 4 for more details). This proxy has the advantage that it should theoretically include all types of issuance, redemptions and delistings valued at market prices, but the disadvantage it is constructed as a residual and hence subject to larger measurement error.

The capital gains series are an updated version of the dataset in Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) extended to cover Canada and with the sources for all countries chosen to maximise consistency in coverage and timing with the market cap data, thus reducing the aforementioned measurement error in the implied issuance series. The series on the market value of new listings aim to capture the total end-year market value of all IPOs and direct listings during the calendar year. To construct these, we primarily rely on microdata, complemented by statistics on IPOs (for example, those in Chambers and Dimson, 2009; Kunz and Aggarwal, 1994). When we cannot measure the market value of new listings directly, we rely on supplementing and scaling the IPO proceeds and raw issuance data. The new listings series are available for five countries, with sources and estimation methods described in Data Appendix C.

Our data on profits and dividends of listed firms allow us to link movements in market capitalization to changes in the underlying firm fundamentals. We compute a long-run series of dividends paid by listed firms as the market capitalization times the dividend-price ratio from Jordà et al. (2019), with an additional new series for Canada. Since variation in payout ratios and means of compensating shareholders makes dividends an imperfect measure of total cashflows to shareholders (Grullon and Michaely, 2002), we complement these dividend data with estimates of listed company earnings obtained from Compustat Global and Compustat North America for the more recent period. The coverage of Compustat firms broadly matches that of our data, but for some of the early observations in the late 1980s and early 1990s we drop country-years with insufficient data (less than 30% of total market cap) and scale the other observations by the ratio of Compustat capitalization to our aggregate capitalization estimates.

The Data Appendix contains a detailed description of the sources for each of the three main new series – market capitalization, net issuance and market value of new listings – alongside a discussion of the various quality checks and comparison with existing estimates. In general, our market capitalization data are in line with previous country-specific estimates constructed by financial historians and statisticians. When it comes to cross-country estimates of Goldsmith (1985) our estimates are typically below his national balance sheet data, because the Goldsmith (1985) estimates often include unlisted stocks, preference shares or bonds in the capitalization total, whereas ours focus on listed ordinary shares only. Our estimates are sometimes above and sometimes below those of Rajan and Zingales (2003), depending on the specific country and time period.

Taken together, our paper provides the largest and most detailed database of stock market capitalization and the sources of its growth to date. These data allow us to study the long-run evolution of stock market size and perform detailed accounting decompositions of its drivers across a broad representative sample covering all major advanced economies.

3. Long-run trends in market capitalization

3.1. Aggregate and within-country trends

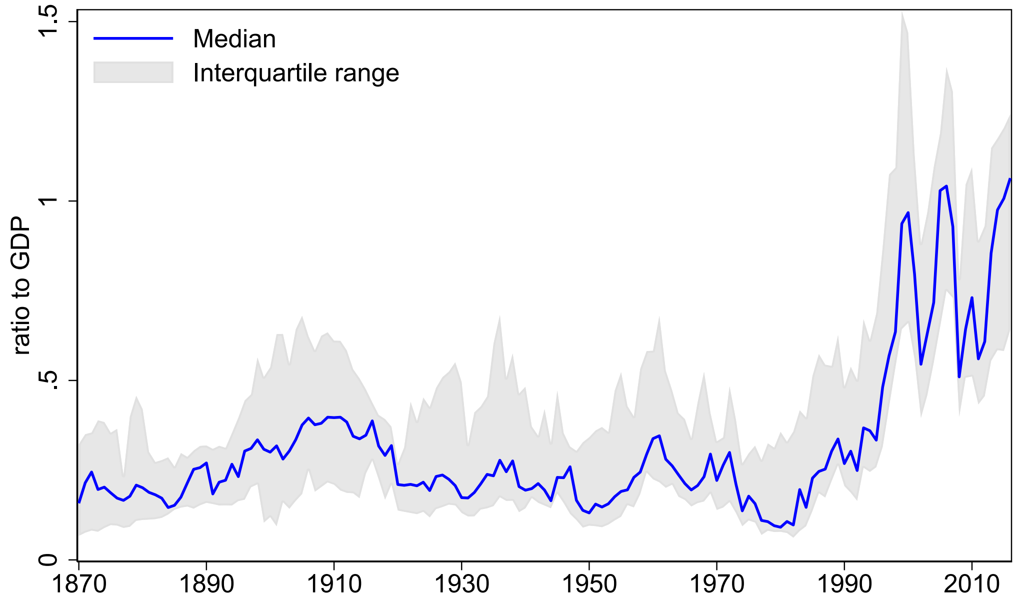
Figure 1 shows the ratio of stock market capitalization to GDP across the 17 economies in our sample for years 1870 to 2016. The solid blue line is the median, and the shaded area is the interquartile range of country-level data. The first century of our data saw several pronounced cycles, with the median market cap to GDP ratio doubling between early 1890s and 1910, falling back to its 1880s levels in the aftermath of World War 1, increasing again in the 1950s and falling to near-historical lows in the aftermath of the 1970s stagflation. But all these cycles were largely mean-reverting, with median stock market capitalization always eventually returning to its long-run average level of around one-third of GDP, and the cross-country interquartile range staying between 0.1 and 0.6 of GDP.

As a consequence, from the end of the industrial revolution and up until the late 1980s, the size of the stock market evolved broadly in line with GDP. Over the last several decades however, an unprecedented market expansion took place. The median market cap to GDP ratio increased from 0.2 in 1980 to 1 in 2000, with some countries' stock markets growing to three times the size of their domestic output. Moreover, this surge in stock market cap seems to have been persistent – despite sharp equity price corrections in the early 2000s and the Global Financial Crisis of 2008–09, market cap to GDP ratios today remain around three times larger than the historical norm. We loosely term this post-1980s market expansion as "the big bang".[2] The left-hand panel of Appendix Figure A.1 shows that this time series pattern – a century of variations around a stable mean followed by a sharp and persistent increase – holds regardless of how we aggregate the individual country data, though value-weighted average capitalization levels are higher throughout the sample and display larger cyclical variation than both the median and the unweighted cross-country mean.

Figure 2 shows that the same time series pattern is evident not only across, but also within

[2]Note that our terminology is simply a visual description of the time series pattern observed in the market capitalization data, and bears no connection to the "big bang" market reforms in the UK. Our use of this term does not imply that any of the observed rends were driven by market liberalisation.

Figure 1: *Stock market capitalization in advanced economies*



Stock market capitalization to GDP ratio, 17 countries. The solid line and the shaded area are, respectively, the median and interquartile range of the individual country capitalization ratios in each year.

individual countries. The solid black lines show the evolution of the market cap to GDP ratio in each country in our sample. In every single one of these countries, the stock market grew rapidly during the 1980s and 1990s and sustained this high level of capitalization thereafter. In almost every country, the capitalization ratios reached during the 1990s and sustained into the 2000s were much higher than any past historical peaks.

What exactly changed as a result of this post-1980s market expansion? How persistent was the observed increase in market capitalization, and how does the variation in market cap during the last three decades compare to the historical peaks and troughs? To help us answer these questions, we first test for structural breaks in each country's market capitalization time series using the Bai and Perron (2003) method. The vertical dashed lines in Figure 2 show the identified breaks in the mean of the market cap to GDP ratio time series, and the solid horizontal lines show the corresponding period-specific means. The red lines restrict the time series to at most one structural break, and the blue lines do not impose a limit on the number of breaks. When we restrict the time series to having at most one structural break, the recent market capitalization increase is identified as the most important shift in the mean market cap to GDP ratio in all countries bar one (Belgium). When we allow for multiple structural breaks, the structural mean shifts identified for the pre-1980 time period are both much smaller and less persistent, with the historical structural increases typically followed by similarly sized declines.

Without looking ahead into the future we cannot tell if the post-1980s mean shift is permanent, but it is already larger and more persistent than the other historical market capitalization increases both across and within countries. This does not, however, imply that any given post-1980s market

Figure 2: *Stock market cap to GDP ratio in individual countries*

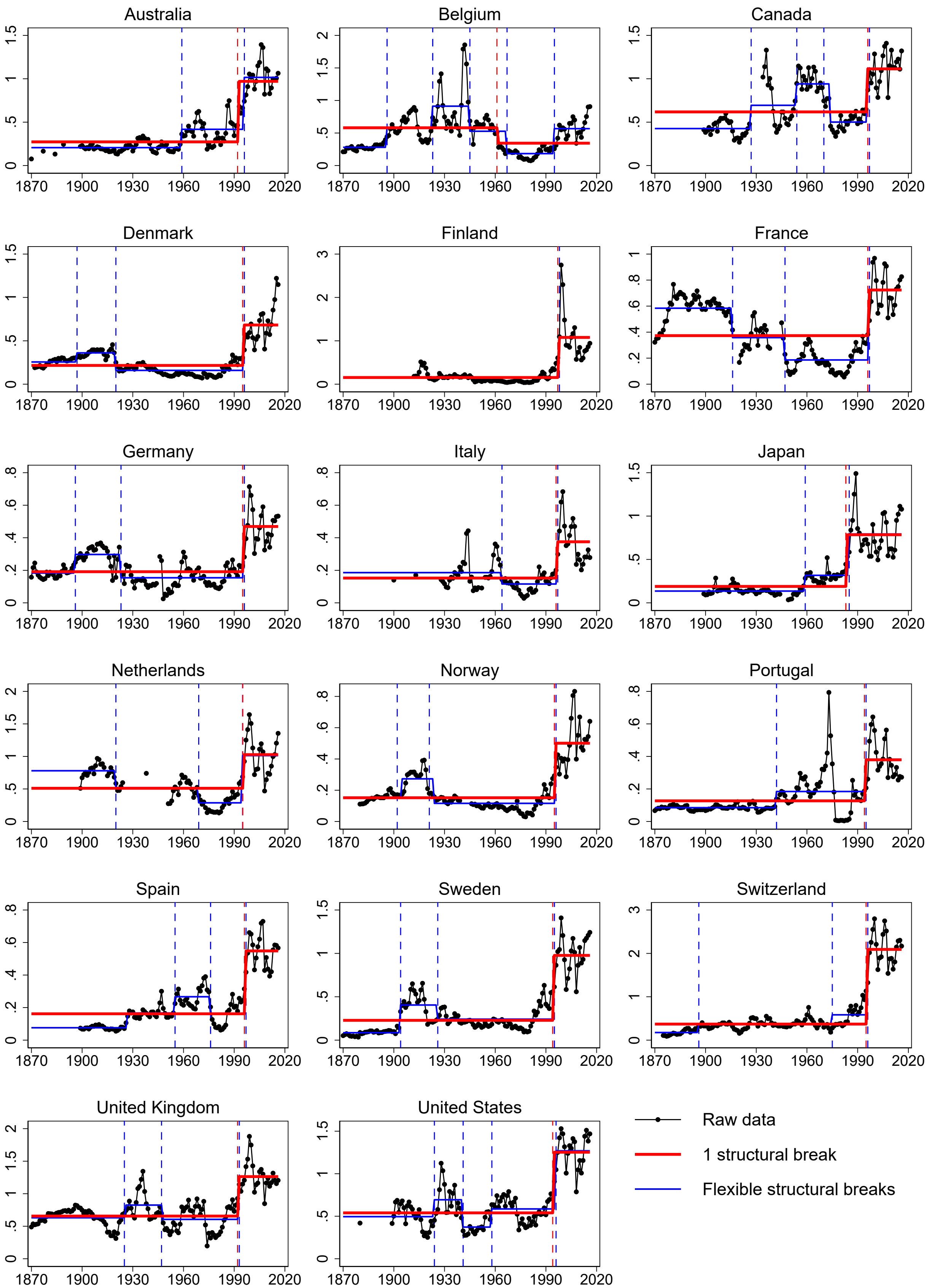
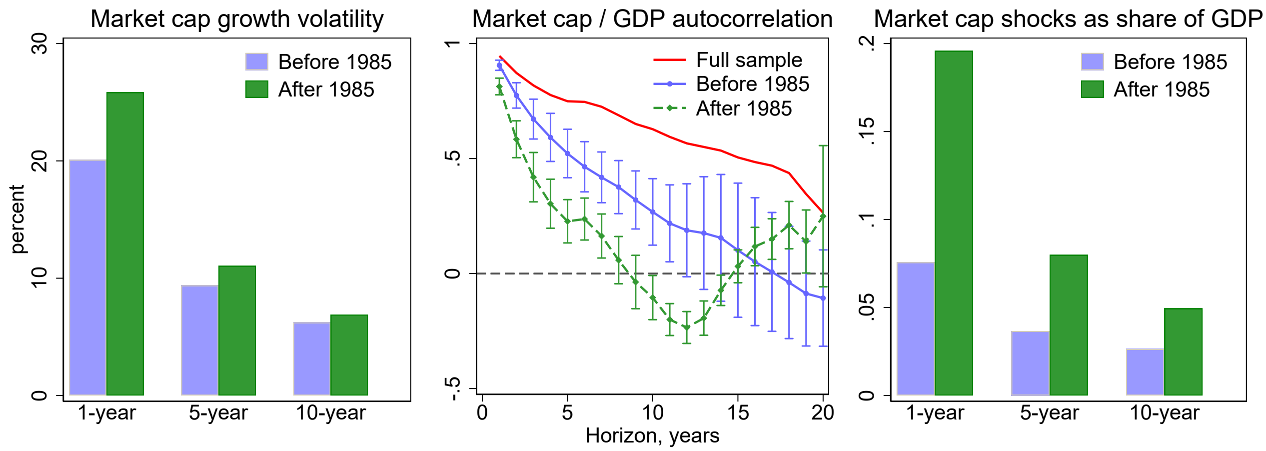


Figure 3: *Cyclical variation in market capitalization*



Left panel: standard deviation of annual, 5-year average and 10-year average log real market capitalization growth, calculated as $log(MCAP_t/CPI_t) - log(MCAP_{t-1}/CPI_{t-1})$. Middle panel: autocorrelation coefficient obtained by regressing the market cap to GDP ratio in year $t+h$ on the ratio in year t, for different horizons $h = \{1, 20\}$ years and subsamples. Error bars show 90% confidence bands. Right panel: standard deviation of year-on-year, average 5-year, and average 10-year changes in market capitalization as a share of GDP, calculated as $(MCAP_t - MCAP_{t-1})/GDP_{t-1}$.

peak is likely to be long-lasting: on the contrary, we have already observed much cyclical mean-reverting variation around this higher mean, with several pronounced cycles including the dot-com boom and bust in the late 1990s / early 2000s. Similarly, the period before the 1980s saw several short-run cycles alongside a long-run cycle consistent with the "great reversals" pattern identified by Rajan and Zingales (2003), with low mid-20th-century levels of capitalization surrounded by the 1900s and 1990s market peaks. We turn to analyse such cyclical variation next.

3.2. Market capitalization cycles

Figure 3 studies the volatility and persistence of market capitalization growth across different historical periods. The left-hand panel confirms that market capitalization displays substantial cyclical variation throughout history. The standard deviation of real market capitalization growth – the year-on-year change in market cap relative to previous year's market cap deflated by CPI – has been high both before and after 1985: around 20% for annual growth, and 7–10% for average growth over horizons of 5 to 10 years.

The variation in market capitalization also tends to be highly persistent. Not only does the growth volatility remain high at long horizons, but for the full sample (solid red line in the middle panel), the autocorrelation coefficient of the market cap to GDP ratio does not reach zero even at the 20-year horizon – largely because of the highly persistent shifts in the time series mean that occurred around the big bang. Within each of the pre- and post-1985 subsamples, market capitalization does tend to eventually revert to its sample-specific mean – with autocorrelation coefficients approaching zero over time – but it does so at a very slow pace, reaching zero at horizons of 7 to 15 years. The faster mean-reversion during the post-1985 period indicates that after the big bang, the cycles in market capitalization have become somewhat shorter, as for example evidenced by sharp capitalization increases during the 1990s dot-com boom followed by rapid declines during the subsequent market correction.

Even though the growth of market capitalization has not become substantially more volatile after the 1980s, market capitalization movements have become much bigger as a share of GDP as a consequence of the large level shift in stock market size. The right-hand panel of Figure 3 shows that the variation in market capitalization, when expressed as a share of GDP, has more than doubled between the pre-1985 and post-1985 time periods, both at short and long horizons. Whereas historically the standard deviation in stock market wealth was on the order of 2–7% of national income, depending on the horizon, now these shocks amount to 20% of GDP at one-year frequency, and remain large at longer horizons. Consequently, similarly-sized percentage movements in stock prices are now likely to have much larger wealth effects, and are hence more likely to influence household spending and real activity (Poterba, 2000; Coronado and Perozek, 2003; Chodorow-Reich, Nenov, and Simsek, 2021).

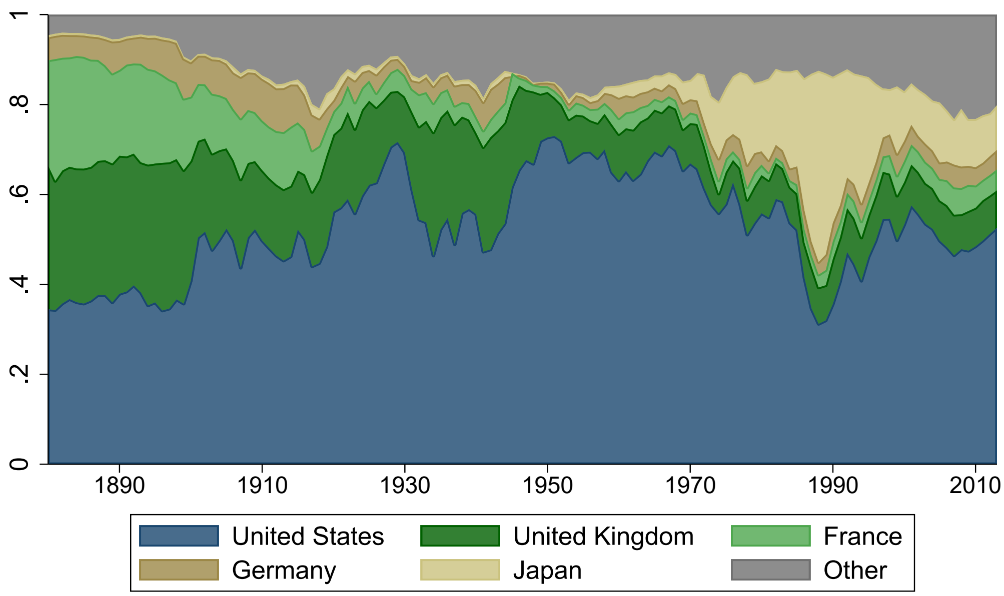
3.3. International and institutional comparisons

Existing literature has often focussed on capitalization differences across countries, and the associated links with institutional norms and financial development (Rajan and Zingales, 2003; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1997). The post-1980s increases in stock market wealth took place across the 17 advanced economies in our sample, but they were not of equal size everywhere. Figure 2 shows that while market cap in Switzerland and Finland increased almost sixfold, the increase in Belgium was relatively modest and increases in France and UK took market capitalization back to previously seen historical peaks rather than all-time historical records. The case of Portugal is also rather unique since the 1980s market expansion mainly represented the re-emergence of the stock market after its near disappearance in the aftermath of the Carnation Revolution of 1974. This means that when we look at the distribution of global market capitalization across countries, we may see some changes – and this exactly what our data show.

Figure 4 shows the share of each country's stock market in the total of our 17 economies. It reports separate shares for the US, UK, France, Germany and Japan and lumps the other 12 countries together. In 1880 capital markets were roughly equally divided between three major players: the United States, France and Great Britain. This distribution, however, changed markedly during the subsequent 50 years. While the US was able to quickly increase its market share between 1880 and 1930, the French stock market's global importance more or less vanished. The UK's market share also dwindled, albeit at a slower pace than France's. After the Second World War global equity markets became almost entirely dominated by the United States, with US equities accounting for roughly 70% of the advanced-economy market cap in 1950.[3]

[3]This dominance reflected the fact that the US stock market was relatively large in proportion to GDP

Figure 4: *Global market capitalization shares across advanced economies*



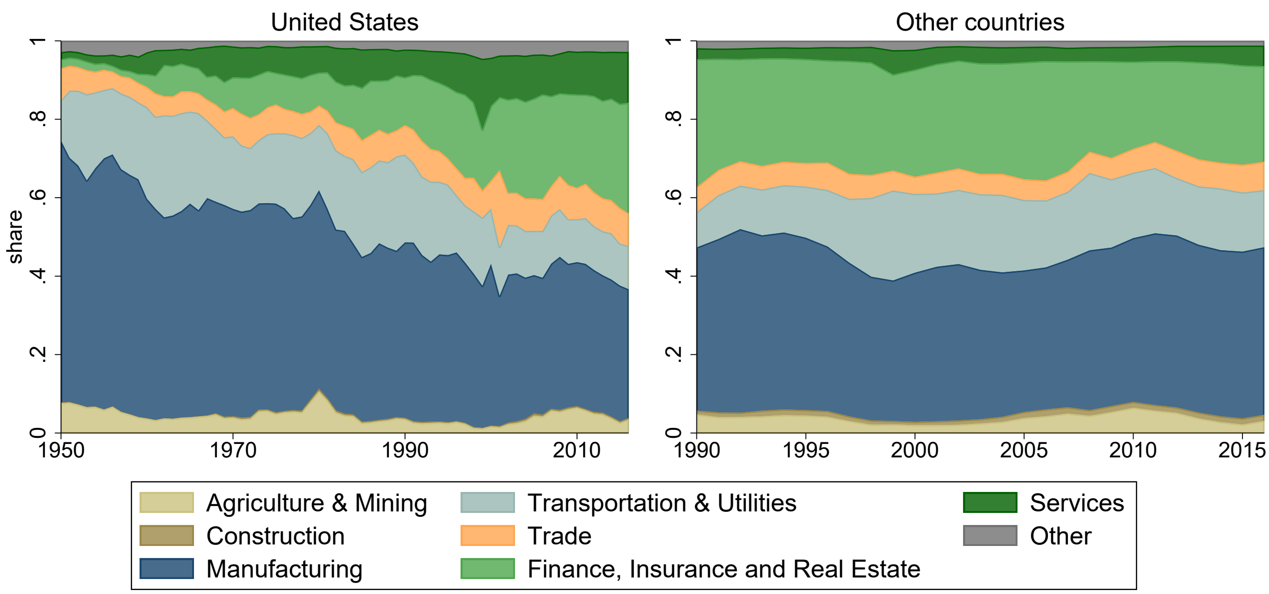
Shares of individual countries' capitalization in advanced-economy total. Capitalization shares are computed by transforming the domestic stock market capitalization into US dollars using historical exchange rates and dividing it by the sum of capitalizations of all 17 countries. Shares of the United States, the United Kingdom, France, Germany and Japan are shown separately. All other countries are combined together into one joint item. Since data for Japan start in 1899, we assume a constant market share equal to its 1899 value for the early historical period.

Even though the US stock market has lost some of its global importance over recent decades, its size is still comparable to that of the other 16 countries grouped together. New equity markets have gained importance, with other countries slowly catching up and Japan's market share expanding during the high growth era after World War 2 and even temporarily catching up to the US at the peak of the Japanese stock market bubble before a dramatic collapse. Capitalization of Japanese listed companies grew from 5% of the global market in 1970 to 40% in 1989, but fell back to around 10% thereafter. These market capitalization shares comparisons could be skewed by our exclusion of foreign companies listed on the country's exchange – an issue that we investigate in detail in Appendix D.1. We find that foreign listings are small from the UK, where total market capitalization of foreign equity is comparable in size to that of domestic equity. This means that the global market capitalization shares in Figure 4 understate the importance of London as a global financial center, particularly in the early 20th century.

The increase in stock market cap was common not only across countries, but also across different economic sectors. Figure 5 shows the shares of different industrial sectors in total market capitalization, computed using Compustat data going back to 1950 for the US (left-hand panel) and back to 1990 for the other countries in our sample (right-hand panel). US sectoral trends are

(Figure 2, as well as the fact that the US economy is large relative to the other countries in the sample, with the US GDP accounting for about 50% of the 17-country total.

Figure 5: *Sectoral market capitalization shares*



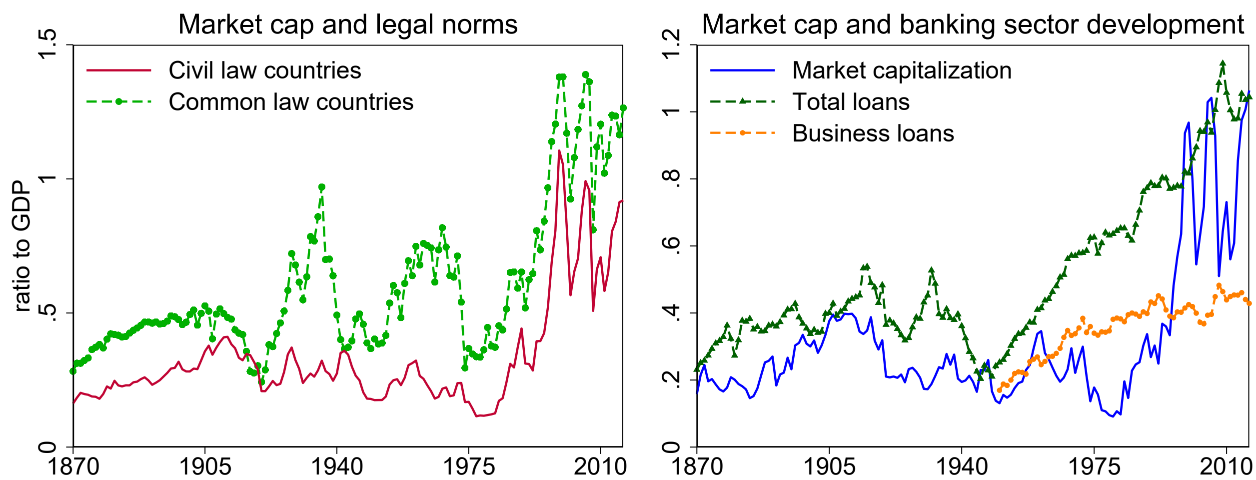
Market capitalization of firms in the specific sector divided by total market capitalization, data from Compustat Global and Compustat North America. Right-hand panel shows the unweighted cross-country averages of the respective sectoral shares.

characterised by a falling market share of manufacturing firms (dark blue area in Figure 5) and an increase in the market cap of financial and service companies (light and dark green areas in Figure 5). These trends, however, started before the 1980s and simply continued during the period of the big bang. For other countries in the sample (Figure 5 right-hand panel), sectoral shares have remained remarkably stable since the 1990s, with market capitalization of different industries increasing in tandem with one another.

To explore the connection between broader institutional characteristics and market size, the left-hand panel of Figure 6 displays the evolution of stock market capitalization separately for countries with common law legal systems (Britain, Canada, US and Australia) and those operating under civil law (the rest of our sample). La Porta et al. (1997) hypothesised that stock markets in common law countries tend to be more developed because of the more market-friendly legal norms. Consistent with the legal origins hypothesis, common law countries had a persistently higher market cap to GDP ratio. Nevertheless, the post-1980 increase in stock market cap "takes off" at a similar time and is similar in magnitude across both country groups.

The right-hand side of Figure 6 compares the evolution of market capitalization to that of two proxies for banking sector development – total credit to the non-financial sector (green triangles) and total non-financial business credit (orange circles). Over the very long run, both market capitalization and credit activity have grown faster than GDP. However both the timing and the duration of the late 20th century credit expansion are different to those in the stock market cap. Total credit starts increasing much earlier, and does so at a much slower pace than market capitalization. Moreover, the increase in business credit is much more modest than that in total credit, largely because much

Figure 6: *Market capitalization and measures of financial and institutional development*



Left-hand panel: median market cap to GDP ratios for two groups of countries. Common law countries are Australia, Canada, the UK and the US. Civil law countries are all other countries in our dataset. Right-hand panel: median market cap to GDP ratio and the ratios of total loans and total business loans to GDP.

of the secular increase in credit during the second half of the 20th century is driven by higher household mortgage debt (Jordà, Schularick, and Taylor, 2016). The post-1980s sharp increases in market capitalization happened at a time of relative stability in the total volume of business loans.

How do our estimates compare to existing literature? Our data Appendix includes detailed country level Figures E.1-E.17 that show our final estimates alongside those of previous researchers. Appendix Figure A.1 shows that our broad trends mirror those of Rajan and Zingales (2003) using all countries in their sample (dark triangles) or only those countries present in both ours and their datasets (light diamonds). Before the 1990s, our estimates are somewhat below those of Rajan and Zingales (2003), most likely because we are able to take advantage of recent work by financial historians (for example, López, Carreras, and Tafunell, 2005; Annaert, Buelens, and De Ceuster, 2012; Waldenström, 2014) and the raw stock listings data to attain an improved measure of the capitalization of ordinary domestic shares that excludes preference shares and nets out cross listings between exchanges when necessary. Nevertheless, the general pattern of high capitalization in 1910s and low capitalization throughout most of the 20th century and especially in the late 1970s and early 1980s is clearly visible across alternative estimates.

Existing studies often use market capitalization as a proxy for financial development, but the patterns in our data indicate a substantial divergence between stock market cap and other financial and institutional development proxies. One reason for this is that financial development and institutions are more likely to affect quantities of listed equity through factors such as entry costs and market access, whereas our market capitalization measure captures short and long run movements in equity prices as well as quantities. In order to gain a more discerned picture of the underlying drivers of stock market growth, we need to decompose it into changes in prices and quantities, and separately assess the drivers of this price and quantity variation as well as their relative importance through history. The integrated nature of our database, and the inclusion of consistent series of stock prices and quantities alongside those of capitalization, allow us to do exactly that.

4. Trends in prices and quantities of listed equity

4.1. Market capitalization growth decomposition

Market capitalization can grow through either quantities or prices of listed equity. Quantity variation typically corresponds to firms' financing decisions, market entry and exit, whereas changes in stock prices should be linked to changes in company profits and the discount rates used to capitalize the profit stream into valuations. Decomposing market capitalization growth into changes in prices and quantities, therefore, gives us a first pass at disentangling the drivers of the long-run trends in Section 3.

Our price-quantity decomposition follows the standard procedure in the studies of the US stock market and, more broadly, household wealth (for example Goyal and Welch, 2008; Bansal, Kiku, and Yaron, 2007; Piketty and Zucman, 2014; Blanco, Bauluz, and Martínez-Toledano, 2020). To fix ideas, note that total market capitalization $MCAP$ at time t is the sum of market capitalizations of each individual share i, in turn calculated as the share price P_i times the quantity of listed shares Q_i:

$$MCAP_t = \sum_{i=1}^{N_t} P_{i,t} Q_{i,t} \tag{1}$$

An increase in market capitalization can come about from share issuance by listed companies (higher Q), new companies entering the listing (higher N), or higher prices of existing listings P. Put differently, aggregate market capitalization is the sum of last year's capitalization $MCAP_{t-1}$ times the capital gain during the year, and the net equity issuance consisting of new listings and secondary issues net of delistings and redemptions:

$$MCAP_t = (1 + Capital\ gain_t) * MCAP_{t-1} + Net\ issuance_t \tag{2}$$

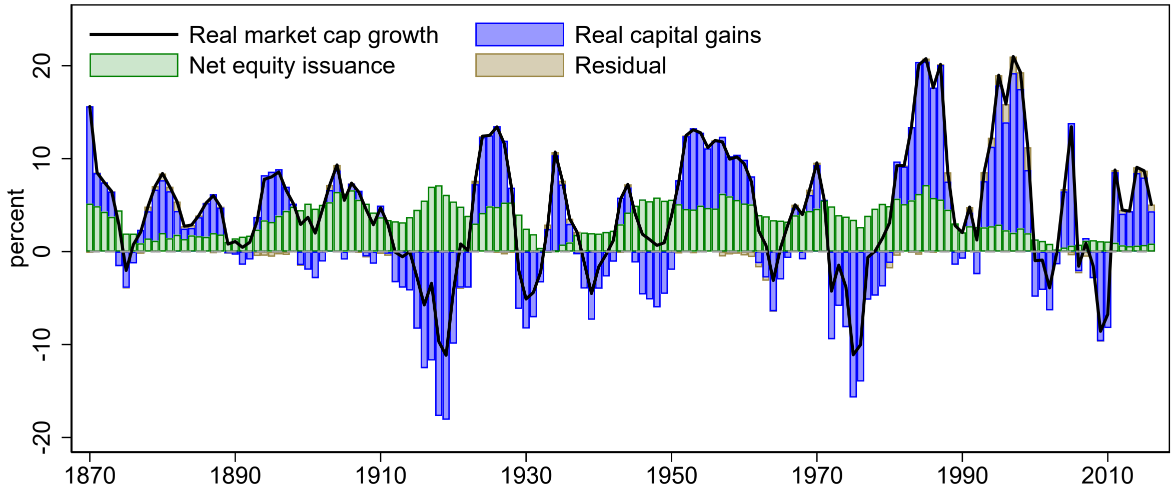
Dividing both sides by $MCAP_{t-1}$ and deflating by CPI, real market capitalization growth g^{MCAP} is the sum of the real capital gain cg_t and net issuance relative to the previous year's market cap iss_t:[4]

$$g_t^{MCAP} = cg_t + iss_t, \tag{3}$$
$$\text{where } g_t^{MCAP} = \frac{MCAP_t * CPI_{t-1}}{MCAP_{t-1} * CPI_t} - 1 \text{ and } iss_t = \frac{Net\ issuance_t}{MCAP_{t-1}}$$

The decomposition in equation (3) is a pure accounting exercise and does not rely on any

[4]Note that in equation (3), the market cap growth rate g and capital gain cg can be either nominal or real, but for ease of interpretation across time periods we perform the decomposition with real growth rates.

Figure 7: *Market capitalization growth decomposition*



Decomposition of real market cap growth into real capital gains and net issuance relative to previous year's market cap. Centered 5-year moving averages of yearly log growth rates. Unweighted averages of 17 countries. Country-level data winsorised at 1%. Real variables are deflated by CPI.

assumptions about the underlying sources of stock market wealth. Its different components can be estimated directly from the data. We observe market cap growth g and capital gains cg for all country-year observations in our sample, and for more than half of the observations we also observe actual net equity issuance. For countries and years where we do not have actual issuance data, we calculate it as the difference between market capitalization growth and equity capital gains.[5]

Figure 7 shows the decomposition of average cross-country market capitalization growth (solid black line) into real capital gains (dark blue bars) and issuances relative to market cap (light green bars) following equation (3). The components also include a small residual which comes about from either the log approximation or the differences between implied issuance (market capitalization minus capital gain) and actual issuance. All variables are smoothed using five-year moving averages of annual data. Stock prices are the main driver of cyclical variation in stock market cap: the stock market boom of the 1880s, the crashes during the world wars and the 1970s, and the 1990s dot com boom all had large impacts on real capitalization growth rates. Appendix Figure B.1 provides additional evidence on the volatility of the price and quantity component of market cap growth. It shows that capital gains are volatile with a standard deviation of about 20% annually, 9% over 5-years and still 6% after 10 years. Net issuance to market cap is on average about half as volatile as equity capital gains, but more persistent when looking at 5-year and 10-year intervals.

When it comes to long-run stock market growth, however, equity issuance is key. Table 1 summarises the mean changes in the market cap to GDP ratio and its components in the form of real capitalization growth, decomposed into issuances and capital gains, and the growth in real GDP over long periods of time. Column 1 covers the full sample, and columns 2–4 cover the three

[5]This approach is very similar to Goyal and Welch (2008) and Bansal et al. (2007), who calculate net issuance as the difference between CRSP market cap growth and value-weighted capital gains.

Table 1: *Market capitalization growth over long time periods*

	(1) Full sample	(2) Pre 1914	(3) 1914–1985	(4) Post 1985
Average change in $MCAP/GDP$	0.68	0.60	-0.03	2.24
Market cap growth decomposition:				
Real market cap growth ≈	4.61	4.49	3.71	6.64
Real capital gain	0.72	0.79	-0.69	3.65
+ Issuance to market cap	3.59	3.82	4.17	2.16
Real GDP growth	2.77	2.40	3.25	2.06

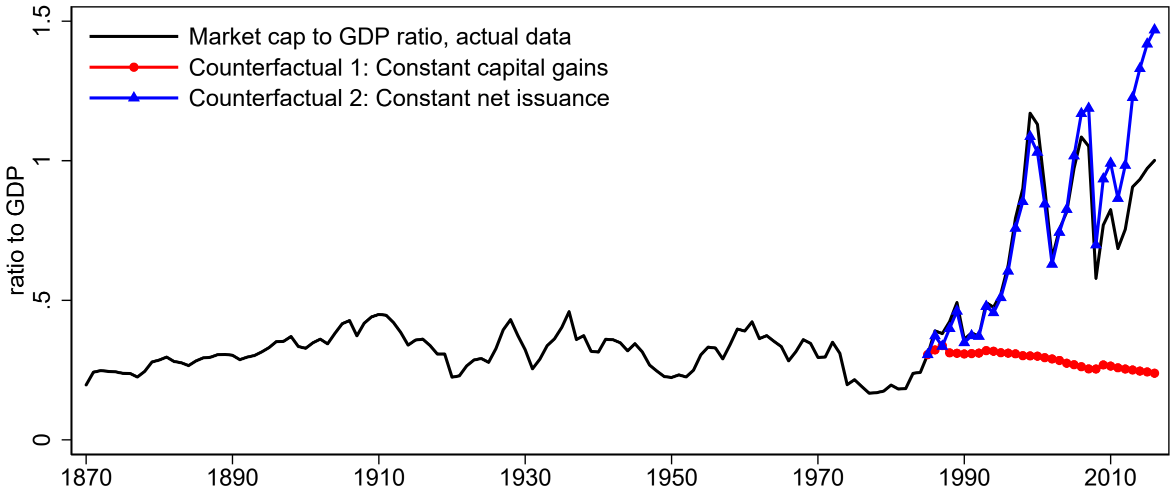
Top row: average annual change in the market cap to GDP ratio, percent of GDP. Middle rows: decomposition of real market cap growth into real equity capital gains and net equity issuance relative to previous year's market cap, in percentage points. Bottom row: year-on-year growth in real GDP. Underlying data are log growth rates in the pooled sample between the specified dates.

main distinct periods in the market capitalization trend: the pre WW I market expansion, the mid 20th century stagnation, and the post-1980s increase. The full sample averages confirm that issuance played a key role in fuelling market cap growth throughout history, amounting to about 3.6% of market cap per year, while real capital gains on average contributed less than 1 percentage point per year to market cap growth. Stock market cap to GDP ratios would actually have fallen over time without the continuous inflow of new capital.

Yet the era of predominantly issuance driven stock market growth seems to have come to an end. Column 4 of Table 1 and Figure 7 both show that the issuance component of market cap is gradually losing importance, only growing market cap by about 2.2% on average after 1985, and falling close to zero in recent years. Market cap growth over recent decades has been predominately price driven, with real capital gains amounting to about 3.7 ppts on average compared to the historical average of around zero. This new era is markedly different from the mid-20th century period during which the market cap to GDP ratio stagnated but net issuance remained above historical averages and the average real capital gain was negative.

The observed trends in equity issuance are not an artefact of our way of measuring these data. For around half the observations in our sample, we have data on actual net equity issuance, and for the other half we impute it as the difference between market cap growth and capital gains. For those countries where we have issuance data, both actual and implied issuance follow similar trends, with a somewhat larger issuance boom in implied issuance in the 1980s and 1990s, but a similarly sized fall in recent years (Appendix Figure B.2a). The larger implied issuance boom in the 1980s and 1990s is most likely because actual issuance does not fully account for revaluations of newly issued equity at market prices, while these are fully incorporated into implied issuance values. If we look at trends in equity issuance relative to GDP as opposed to market cap, the slowdown in issuance starts somewhat later as the rapid market expansion of the 1990s ensured that even though issuance accounted for a declining share of stock market growth, the increases in the market cap to

Figure 8: *Counterfactual evolution of market capitalization during the big bang*



Constant capital gains counterfactual forces the real capital gains during 1985–2016 to equal the pre-1985 average. Constant net issuance counterfactual forces net issuance relative to market cap during 1985–2016 to equal the pre-1985 average. Data are benchmarked so that the combined growth of the two counterfactuals between 1985 and 2016 equals the actual growth in observed market cap data. All data are unweighted averages of 17 countries.

GDP ratio meant that it kept growing relative to GDP (Appendix Figure B.2b).

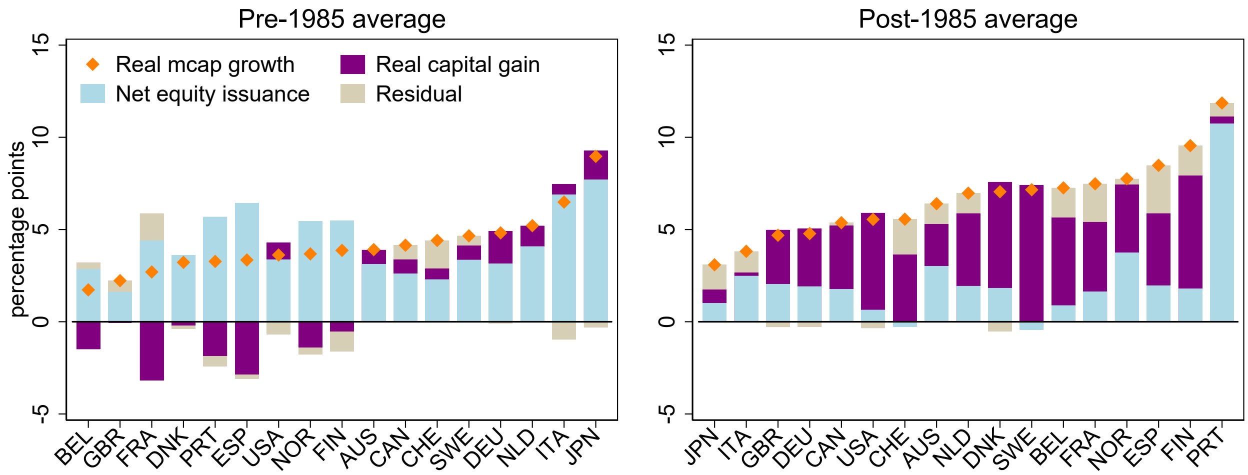
4.2. Decomposing the recent stock market expansion

This section zooms in on the relative contribution of price and quantity changes to the post-1980s acceleration in stock market growth. To assess this, the top panel of Figure 8 displays two counterfactual evolutions of the market cap to GDP ratio during this time period together with the actual data (solid black line). The first counterfactual, marked by red diamonds, shows what the market cap evolution after 1985 would have been if we fixed capital gains to their pre-1985 average. Under this scenario, all changes in the market cap to GDP ratio from 1985 onwards are attributable to changes in net issuance and real GDP growth. The second counterfactual (blue triangles) instead fixes issuances to their pre-1985 mean and attributes all the post-1985 variation in the market cap to GDP ratio to changes in real capital gains and real GDP growth. We benchmark the estimates so that the combined growth under the two counterfactual scenarios equals the actual growth in market cap over 1985–2016.[6]

Counterfactual 1 shows that taking the post-1985 increases in capital gains out of the data eliminates the big bang entirely. If real capital gains had remained at their historical average

[6]The benchmarking ensures that the different timing of the shocks to issuance and capital gains, and the correlation between the two, do not bias our findings. For example, after the burst of the 1980s Japanese bubble both issuance and capital gains were sharply negative, meaning that any subsequent growth took place from a very low base. Ignoring the correlation between these two shocks would overstate the counterfactual market cap growth under both scenarios. That being said, data for non-benchmarked counterfactuals show even higher market cap growth under counterfactual 2 of fixed issuance which further supports our findings; results available from authors upon request.

Figure 9: *Issuance and capital gains by country, before and after the big bang*



Averages of log growth rates for each country before and after 1985. The sum of the bars can deviate from the orange diamond because of the correlation between issuance and capital gains, and because of differences between implied and actual issuance. Net equity issuance is expressed as a share of previous year's market cap.

of around zero, the market cap to GDP ratio would have declined slightly due to the post-2000 slowdown in net equity issuance. Counterfactual 2 shows that fixing issuance to its historical levels results in a market cap trend that closely follows actual data until the early 2000s, and then results in an even stronger market expansion because this counterfactual eliminates the recent issuance slowdown from the trends.

Figure 9 shows that these aggregate trends are also reflected in country-level data. The left panel plots the average growth rate of market cap before 1985 decomposed into capital gains and issuance, and the right panel shows the average growth rate during the post-1985 market expansion. Almost all of the long-run growth in capitalization before 1985 was driven by issuances. But after 1985, the picture reverses with only the growth in the Portuguese stock market being issuance driven and the other countries being dominated by capital gains. The Portuguese case is, however, explained by country-specific events where the stock market more or less disappeared after the 1970s Carnation Revolution and reemerged throughout the 1980s (see also the case study in Appendix Figure B.5). Appendix Figure B.4 confirms that the largest post-1985 increases in the market cap to GDP ratio were observed in countries with the highest capital gains rather than those with the highest issuances. In addition, we estimate counterfactual market cap evolutions identical to Figure 8 for the individual countries in Appendix Figure B.3. The individual country counterfactuals are similar to the aggregate in Figure 8, with only Portugal and Australia experiencing substantial market growth under the fixed capital gain Counterfactual 1, and all countries bar Portugal experiencing much larger growth under the fixed issuance Counterfactual 2.

Figure 9 further shows that the post-1985 stock price increases in the US are representative of broader cross-country patterns, with a number of Nordic countries in particular experiencing even larger real capital gains. The positive contribution of the residual during the big bang period also, again, shows that revaluations of newly issued equity may have further accelerated this recent market cap growth. The slowdown in issuance is relatively more pronounced in the US, but it is by no means an outlier with all countries bar Portugal reporting low issuance levels, and both Switzerland and Sweden reporting issuance growth contributions smaller than that in the US.

One reason why issuances have slowed so much could be the increasing use of buybacks as means of compensating shareholders starting in the 1980s (Grullon and Michaely, 2002). Unlike dividends, buybacks reduce net equity issuance which means that the switch from dividends to buybacks could account for some of the issuance slowdown, and – since the use of buybacks started earlier and was more common in the US (Megginson and Von Eije, 2008) – some of the differences between the US and other countries. We quantify and discuss the contribution of buybacks to the growth decomposition trends in the Appendix Section D.2. We find that without the switch to buybacks, post-1980s issuances would have been somewhat higher and capital gains somewhat lower, especially in the US, but the general patterns of falling issuances and flows of new money into the stock market, and uncharacteristically high capital gains would have remained in place.

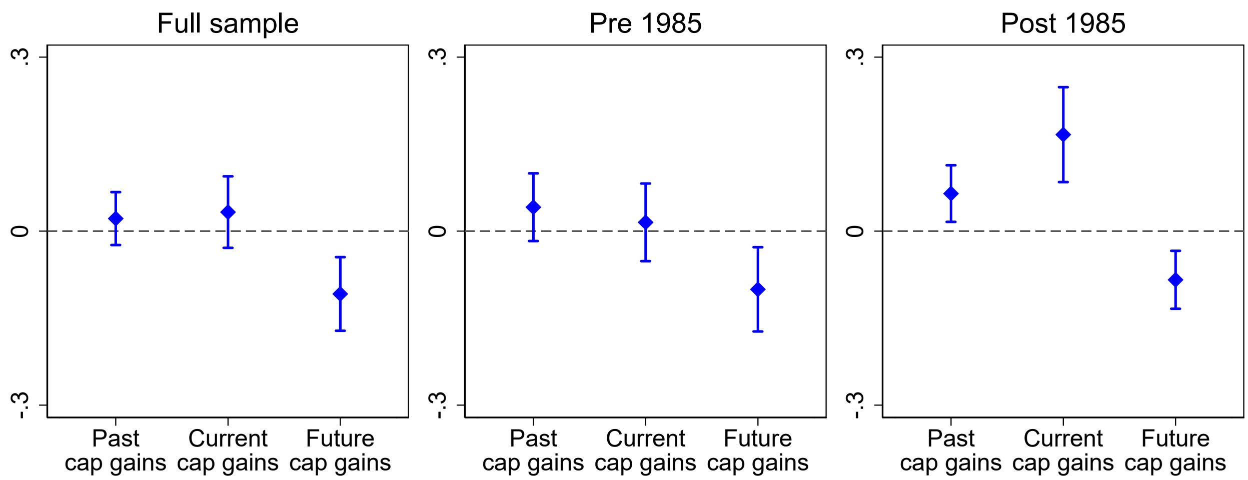
The analysis in this section further confirms that the last several decades have been highly unusual, with large capital gains accelerating stock market growth beyond that of the real economy despite a slowdown in issuances. That being said, issuances were a key driver of stock market growth historically and continued to positively contribute to market capitalization growth even after 1985. We investigate the cyclical properties and drivers of this issuance growth next.

4.3. Equity issuance cycles and determinants

The previous sections have shown that net issuance and capital gains follow different long-run trends, with issuances being high historically and relatively modest in recent years and real capital gains being low throughout history and high after 1980. It turns out that this disconnect between issuance and capital gains is true not only for the long, but also for the short run. Figure 10 plots the correlation between issuance (in year t) and past (years $t-4$ to t), present (year t) and future (years $t+1$ to $t+5$) real capital gains. Issuance and capital gain cycles do not move together: the correlation between past and current capital gains and issuance in the full sample is close to zero, and the correlation between current issuance and future capital gains is negative. This negative correlation confirms existing findings by Baker and Wurgler (2000, 2002) that companies tend to time the market and issue equity at market peaks. We also find that the procyclicality of equity issuance has become stronger in recent decades. Whereas before 1985 (Figure 10 middle panel) equity and past capital gains were uncorrelated, they have become positively correlated after 1985 (Figure 10 right panel).

The evidence in Figures 10 and 7 shows that both long and short-run variation in issuance is distinct from that in capital gains. Given the large cyclical volatility in stock prices, this makes it difficult to infer the time variation in quantities – and the associated changes in market access and financial development – from movements in market capitalization alone. Moreover, even the net

Figure 10: *Correlations between issuance and capital gains*



Correlation between equity issuance relative to market cap in year t, and real capital gain between years $t-4$ and t ("past cap gains"), year t (current cap gains) and years $t+1$ to $t+5$ (future cap gains), pooled data for the selected time periods. Error bars show the 90% confidence bands.

issuance figures may mask large compositional changes between gross and net issues, and between new and old firms. To shed more light on the underlying trends in issuance and their drivers, we focus the rest of our analysis in this section on the variation in net issuance and gross new listings. Table 2 investigates the drivers of issuance by regressing different issuance measures on selected country and time characteristics, economic growth, and the cost of issuance. Columns 1–3 stick to our baseline net issuance measure, columns 4–6 consider net issuance as a share of GDP instead of market cap, and columns 7–9 focus on gross new listings (IPOs plus direct listings) rather than net issues. A number of robust explanatory variables for net issuance stand out.

First, as suggested by the procyclicality of net issuance in Figure 10, all three of our proxies for issuance are strongly correlated with the relative costs of issuing debt and equity. We proxy the cost of issuing equity by the dividend-price ratio – with higher dividend yields indicating lower valuations and a higher cost of equity – and the cost of issuing debt by the corporate bond yield, with bond yield data taken from Kuvshinov (2021). A one percentage point increase in the dividend-price ratio predicts half a percentage point lower issuance relative to market cap (about 0.1 ppts lower relative to GDP) and 0.3–0.7 percentage points lower new listings relative to market cap. Higher corporate bond yields show similarly-sized effects in the opposite direction, with a higher cost of debt leading firms to obtain finance through equity markets. We also find some role for the business cycle. Issuance is positively correlated with GDP growth, but the effect seems stronger for firms already listed on the market than new listings, as evidenced by larger and more significant coefficients on GDP growth in columns 1–3 compared to columns 7–9.

Second, we investigate the role of institutional characteristics. We find that issuance bears little correspondence to legal norms: common law countries tend to have higher market capitalization (right panel of Figure 6) but lower net issuance and new listings (columns 1 and 7), perhaps because

Table 2: *Determinants of equity issuance*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent variable:								
	Net issuance / Market cap			Net issuance / GDP			New listings / Market Cap		
Market establishment	3.85*	4.13*	4.41	0.40	0.33	0.60	5.90**	6.19**	4.38
	(1.94)	(2.15)	(3.10)	(0.27)	(0.47)	(0.59)	(1.85)	(2.97)	(3.60)
Pre-1914 dummy	0.75	1.12		0.63**	0.59		0.22	-0.66	
	(1.08)	(1.10)		(0.28)	(0.41)		(0.37)	(0.66)	
1985–2000 dummy	-1.71***	-1.48*		0.09	-0.00		0.52	0.81	
	(0.53)	(0.85)		(0.25)	(0.22)		(0.24)	(0.59)	
Post-2000 dummy	-1.82***	-1.93***		-0.45*	-0.58**		0.50	0.42*	
	(0.58)	(0.71)		(0.26)	(0.24)		(0.28)	(0.23)	
Common law country	-1.18**			0.44***			-0.57		
	(0.49)			(0.13)			(0.37)		
Dividend-price ratio	-0.46	-0.49***	-0.52***	-0.09*	-0.13***	-0.15***	-0.29**	-0.31**	-0.68***
	(0.32)	(0.15)	(0.19)	(0.04)	(0.04)	(0.05)	(0.07)	(0.15)	(0.18)
Corporate bond yield	0.57**	0.45***	0.63***	0.02	0.00	0.02	0.29	0.18***	0.34***
	(0.24)	(0.13)	(0.24)	(0.03)	(0.03)	(0.05)	(0.13)	(0.06)	(0.11)
Real GDP growth	0.20***	0.18***	0.18**	0.05***	0.04*	0.05**	0.07	0.04	0.03
	(0.06)	(0.06)	(0.07)	(0.01)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)
Country fixed effects		✓	✓		✓	✓		✓	✓
Year fixed effects			✓			✓			✓
R^2	0.07	0.06	0.16	0.02	0.02	0.13	0.25	0.20	0.42
Observations	1771	1771	1771	1771	1771	1771	394	394	394

Dependent variables are in logs. Columns (1), (4) and (7) run a pooled OLS with country clustered standard errors, Columns (2), (5) and (8) add country fixed effects and columns (3), (6) and (9) additionally add year effects, with all panel specifications clustering standard errors by country and year and adjusing for autocorrelation. Market establishment equals 1 in the first decade of the country-specific market cap sample, and in the decade after a stock market was closed for a considerable time period (typically during a war or revolution). Common law countries are Australia, UK, Canada and USA. *, **, ***: Significant at 10%, 5% and 1% levels respectively.

the markets are already well established and a large share of the country's firms are already listed on the exchange. However, because capitalization in these countries tends to be large, their net issuance is larger as a share of GDP (column 4).

Third, we find some evidence that issuance is particularly high after the establishment of new equity markets and the reopening of a stock market. The positive coefficients on the market establishment dummy – set equal to 1 in the first decade of the market data, or after a prolonged market closure – suggest that when stock markets begin or resume operation, firms look to take advantage of these new funding opportunities to obtain equity finance. This effect is stronger for new listings (columns 7–9), but much larger as a share of market cap than GDP pertaining to the fact that during these times the country's stock market tends to be small. The significance of the market establishment dummy is lower with year fixed effects (columns 3, 6 and 9) because many markets in our sample were being established at similar time periods, reducing the cross-sectional variation in this measure. The prevalence of new markets being established helps explain the high issuance levels observed early on in the sample: conditional on the market establishment dummy, the pre WW I time period (Pre-1914 dummy) does not have significantly higher issuance. Appendix Figure B.5 shows shows several specific country case studies of market cap growth decomposition which highlight that issuance was the driving force of a number of historical market expansions, including market growth after the foundation of the Helsinki and Oslo stock exchanges, and the re-establishment of the Lisbon stock exchange after the Carnation Revolution.

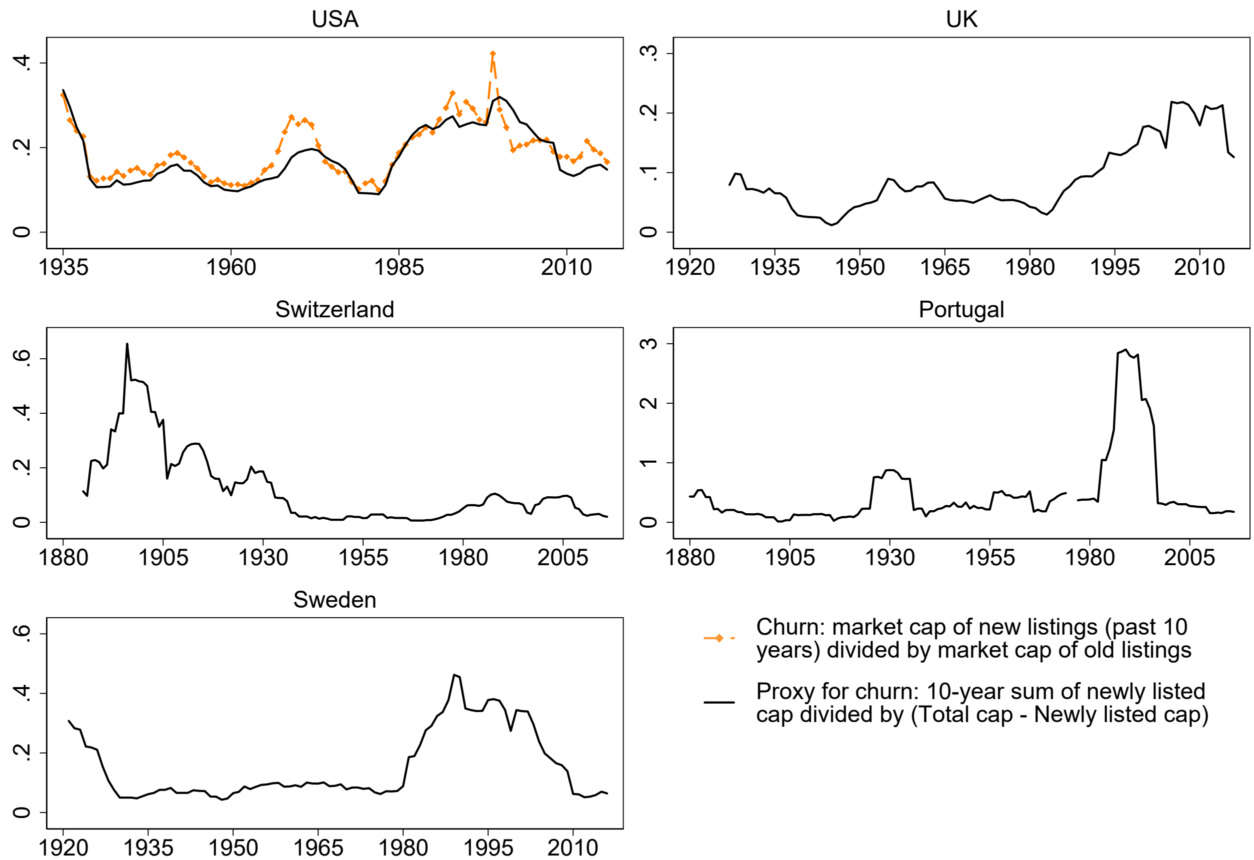
Finally, the time dummy coefficients in Table 2 confirm the broad secular trends evident in Figure 7: while the pre-1914 issuance was relatively strong or at least not unusually low, the post big bang decades saw low levels of issuance, especially conditional on the low cost of issuing equity during this period. But interestingly, the trend issuance slowdown is much less evident when it comes to new listings (Columns 7–8), suggesting that net and gross equity issuance may follow different time trends. After all, a post-1980s slowdown in net issuance does not necessarily imply that all the growth and capital gains accrued to firms already listed on the market in the early 1980s.

To further look into this, we construct a measure of churn – the market cap share of firms which were listed in the last 10 years – for five stock markets in our sample. There are two ways of measuring churn in our data. The most accurate method splits the current market capitalization into firms listed in the last 10 years and those listed beforehand, but the detail of the data only allow us to construct this measure for the US. For the other countries, we cannot track the capitalization of individual firms for long periods of time but we know the market cap of new listings taking place within each year. To calculate the second proxy for churn, we take the ratio of the market cap of new firms listed in one year to that of old firms, and sum these ratios over the period of 10 years. The second measure ignores post-listing growth differentials between new and old listings, but in practice these are small (see Appendix Table B.1 and Figure B.6) and in the US, the two churn measures are very close to each other (Figure 11 top-left panel).

Figure 11 shows the long-run evolution of the new listings market share in five different countries. We see substantial churn close to the stock market's establishment and in the early historical period more generally. The market share of firms listed in the last 10 years was high – around one-third of old listings – in the 1930s US, 1880s Switzerland, and 1920s Sweden. The mid 20th century saw very little entry from new firms despite relatively high net issuance, suggesting that most of the issuance throughout this period was from companies which were already listed. This supports the Rajan and Zingales (2003) "great reversals" theory that during this period of stagnation in market growth, stock markets were dominated by incumbents and there was little entry from new firms. Throughout this time period, the market share of new listings generally remained at or below 10% of the value of old listings.

The 1980s saw a pickup in the amount of new equity entering the markets, but the size of this pickup differed materially across countries. The more established markets of the US, UK and Switzerland recorded comparatively smaller increases in churn. Sweden and Portugal, however, saw large market entry and churn, much of it for institutional reasons. In Sweden, IPOs were not

Figure 11: *Churn in selected stock markets*



Churn is measured as the market capitalization of firms listed in the last 10 years relative to the market capitalization of other firms. For the US, we compute this ratio directly using CRSP data (dashed orange line). An alternative simpler proxy (black line) calculates churn as the sum of newly listed cap in each year divided by old listings' cap, summed over the preceding 10 years.

permitted until 1979, although firms could still list directly which is why the new listings for the pre-1979 period are above zero. Following market liberalization of the 1980s, there was a large surge in market entry and IPOs, as discussed by Rydqvist and Högholm (1995). In Portugal, after the stock market more or less disappeared in the immediate aftermath of the Carnation revolution, the eventual market re-establishment saw the market share of new firms become much larger than that of old firms, by a factor of about 3. Even for the US, where the pick-up in churn was not as strong as in these two countries, by 2015 around half of the total market capitalization was accounted for by firms listed after 1985 (Appendix Figure B.7).

While historical stock market growth was largely driven by issuances, the post-1980s market expansion was driven by large and persistent capital gains – on both old and newly listed equity – at the time of slowing net issuance. In the next section, we turn to study the potential forces behind this historically unusual phenomenon.

5. Drivers of the post-1980s stock market growth

This section explores the drivers of the persistent equity price increases that underpin the post-1980s expansion in stock market wealth. These drivers can be outlined within the framework of the dynamic Gordon growth model. We first note that the ratio of market capitalization to GDP is approximately equal to the ratio of aggregate dividends paid by listed firms to GDP, D^{agg}/GDP, times the average value-weighted price-dividend ratio of the stock market $\overline{P_t/D_t}$:

$$\frac{MCAP_t}{GDP_t} = \sum_{i=1}^{N_t} \left(\frac{Q_{i,t} D_{i,t}}{GDP_t} * \frac{P_{i,t}}{D_{i,t}} \right) \approx \frac{D_t^{agg}}{GDP_t} * \overline{P_t/D_t}, \tag{4}$$

where $D_t^{agg} = \sum_{i=1}^{N_t} Q_{i,t} D_{i,t}$. We can then take logs on both sides and apply the Campbell and Shiller (1988) decomposition to the log price-dividend ratio:

$$ln\left(\frac{MCAP_t}{GDP_t}\right) \approx ln\left(\frac{D_t^{agg}}{GDP_t}\right) + \mathbb{E}\left(\sum_{\tau=0}^{\infty} \rho^{\tau} (dg_{t+\tau+1} - r_{t+\tau+1})\right), \tag{5}$$

where dg is log real dividend growth, r is log real total return and $\rho = \frac{P/D}{1+P/D}$ is a linearisation constant. Intuitively, equation (5) is an approximate present value identity for the entire stock market. It tells us that the size of the stock market relative to the economy is determined by three factors.

The first factor is the *current profit share* of listed firms D^{agg}/GDP. If listed firms' profits and dividends constitute a large share of economic income, the size of the stock market – which reflects the present value of these profit and dividend streams – will also be large relative to the rest of the economy. The second factor is the *future profit growth* (or dividend growth) dg: stocks can be valued highly not only because profits are high today, but also if they are expected to be high in the future. The third factor r is the *discount rate* which capitalizes these future profits, with lower discount rates increasing the present value of the profit stream and leading to higher market capitalization.

We evaluate the relative importance of these three drivers using a two-step procedure. First, we look at the correlations between market capitalization and its three determinants. As we cannot measure return and dividend growth expectations directly, we follow existing literature (Campbell and Shiller, 1988; Cochrane, 2008) and run predictive regressions of future dividends and future returns on current market capitalization. If high market capitalization predicts low future stock returns or high future dividend growth, this means that r and dg are relevant drivers of fluctuations in the size of the stock market. These correlations tell us about which forces tend to drive the year-on-year growth in the market cap to GDP ratio, but they do not necessarily tell us what drives its long-run trend. To this end, in the second step we look at the trends in those variables which are correlated with market capitalization in the right direction in order to determine the contribution of these trends to the long-run evolution of market cap.

5.1. Market capitalization, future returns and dividends

Figure 12 plots the correlations of market capitalization with the three components of equation (5): the current share of dividends in GDP, future growth of dividends, and future returns. As in equation (5), all the variables are in logs, and we calculate present value discounted sums $\sum_{\tau=0}^{\infty} \rho^{\tau} dg_{t+\tau+1}$ and $\sum_{\tau=0}^{\infty} \rho^{\tau} r_{t+\tau+1}$ by taking realised returns and dividends between year t and 2016, and assuming returns and dividend growth are equal to the respective country-specific sample mean after 2016.[7] We also adjust market cap and dividends to GDP for structural breaks so that all variables are stationary to avoid potentially spurious correlations, and postpone the questions of time series trends until the second step of the analysis in Sections 5.2 and 5.3. Not adjusting for structural breaks, however, leads to similar results.

The correlation between market capitalization, dividend share in GDP and future returns is in line with the theoretical predictions of equation (5): a high market cap to GDP ratio means high current listed firm dividends relative to GDP, and low future equity returns. But market capitalization and future dividend growth are, if anything, correlated in the wrong direction: high market cap actually predicts low rather than high future dividend growth.

Table 3 further tests these relationships by running predictive regressions of the following form:

$$r_{j,t+1} = \alpha_j^r + \beta^r ln(MCAP_{j,t}/GDP_{j,t}) + u_{j,t}^r \quad (6)$$

$$dg_{j,t+1} = \alpha_j^{dg} + \beta^{dg} ln(MCAP_{j,t}/GDP_{j,t}) + u_{j,t}^{dg}, \quad (7)$$

where j is a country index, α is a country fixed effect, and u is a Driscoll and Kraay (1998) standard error clustered by country and year, and adjusted for serial autocorrelation.

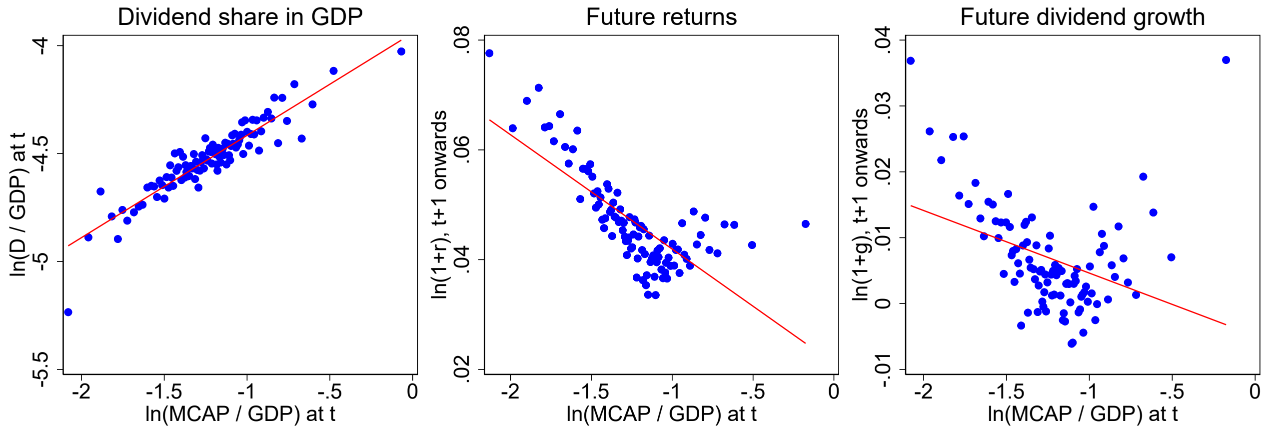
The Campbell and Shiller (1988) decomposition in equation (5) tells us that the regression coefficient on future returns β^r should be negative, and β^{dg} on dividend growth should be positive. In the data, β^r is negative and statistically and economically significant, with a 10 percentage point increase in the market cap to GDP ratio predicting roughly 4 percentage points lower returns one year ahead.[8] But market capitalization does not predict high future dividend growth: in some specifications the dividend predictability is negative, and in others it is statistically insignificant. These results hold if we restrict the sample to the post-1985 time period (columns 3–4), control for common cross-country variation using year fixed effects (columns 5–6), and look at longer horizon returns (columns 9–10). Return predictability reflects both future changes in the risk premium and the safe rate (columns 7–8), and remains significant but somewhat weaker when we do not adjust for structural breaks (columns 5–6), consistent with US evidence on other stock return predictors (Lettau and Van Nieuwerburgh, 2008).

Taken together, this means that market capitalization correlates with changes in the current

[7] In Figure 12, we annualise the discounted sums of r and g by multiplying them by $1 - \rho$.

[8] A 10 percentage point increase is roughly 25% in relative terms, meaning a $0.25 \times 0.151 \times 1.048 \approx 0.0396$ fall in real total return using the coefficients in column 1.

Figure 12: *Correlations between market cap, current dividend share, future returns, and future dividends*



Binned scatter plots of pooled full-sample data (17 countries, 1870–2016), 100 bins. Each point represents the group specific means of both variables after controlling for country fixed effects. All variables are winsorised at 1 percent level. Market cap to GDP and dividends to GDP are adjusted for structural breaks.

Table 3: *Stock market capitalization as a predictor of equity returns and dividends*

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline		Post-1985		Year effects	
	r_{t+1}	dg_{t+1}	r_{t+1}	dg_{t+1}	r_{t+1}	dg_{t+1}
$ln(MCAP_t/GDP_t)$	-0.151***	-0.076*	-0.210***	-0.023	-0.101***	-0.063
	(0.035)	(0.042)	(0.047)	(0.069)	(0.032)	(0.054)
R^2	0.064	0.013	0.098	0.001	0.517	0.219
Observations	1871	1871	492	492	1871	1871
	(7)	(8)	(9)	(10)	(11)	(12)
	Risk premia and safe rates		5-year returns		No structural Breaks	
	er_{t+1}	r^{safe}_{t+1}	$\bar{r}_{t+1,t+5}$	$\overline{dg}_{t+1,t+5}$	r_{t+1}	dg_{t+1}
$ln(MCAP_t/GDP_t)$	-0.129***	-0.046*	-0.100***	-0.047**	-0.039***	-0.009
	(0.031)	(0.025)	(0.025)	(0.020)	(0.011)	(0.015)
R^2	0.041	0.011	0.137	0.027	0.018	0.001
Observations	1871	1871	1791	1791	1871	1871

Market cap is adjusted for structural breaks. r is total real return, dg is real dividend growth, er is excess return and r^{safe} is real government bond return, all measured in logs. Regressions with country fixed effects. Columns (5) and (6) additionally add year fixed effects. Standard errors clustered by country and year and adjusted for autocorrelation are in parentheses. *, **, ***: Significant at 10%, 5% and 1% levels respectively.

profit share and future returns, but not with changes in future growth. Together with the evidence of declining productivity in the US and other advanced economies (Fernald, 2015; Goldin et al., 2021), this suggests that increases in future expected – but not yet realised – dividend growth are a rather unlikely driver of the big bang. Therefore, we focus our analysis on the other two drivers and investigate whether the post-1980s capitalization increases could have been driven by a lower equity discount rate (Section 5.2) or an increase in the dividend share of GDP (Section 5.3), and assess the relative contributions of these two factors (Section 5.4).

5.2. A declining discount rate

Safe interest rates have declined markedly over the long run (Schmelzing, 2020; Del Negro et al., 2019; Holston et al., 2017). Much of this decline happened after 1980, a similar time period to that of the market expansion during the big bang. This makes declining discount rates a natural candidate for explaining the cross-country market capitalization increases observed after the 1980s. But the relevant discount rate for equity is the sum of the safe rate and the market risk premium. Using the Gordon growth model we can calculate the equity discount rate $\mathbb{E}\left(R_{t+1}\right)$ as the sum of the expected dividend-price ratio and expected future cashflow growth:[9]

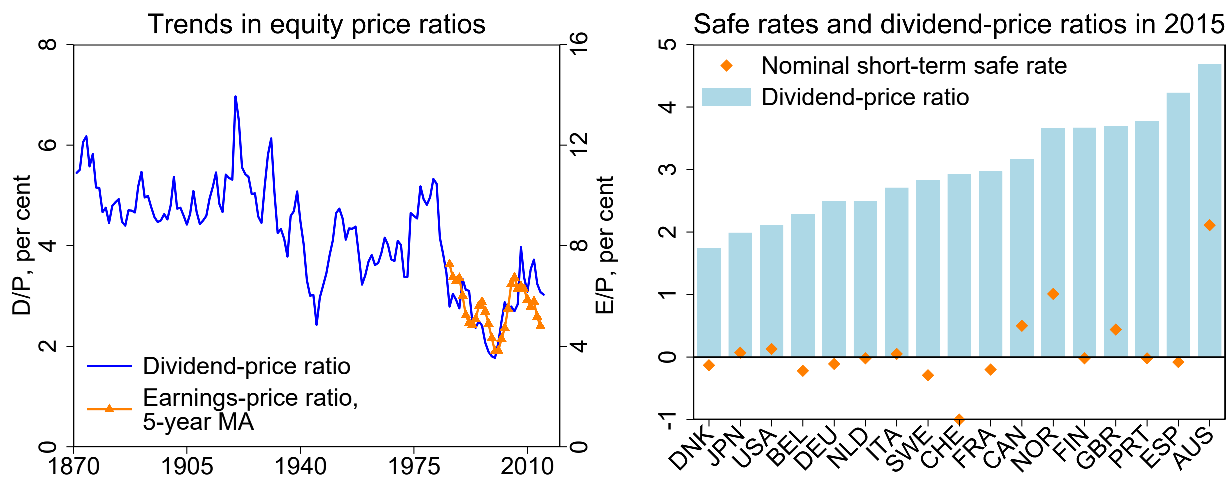
$$\mathbb{E}\left(R_{t+1}\right) = r^{safe} + \text{Risk premium} \approx \mathbb{E}\left(D_{t+1}/P_t\right) + \mathbb{E}\left(\tilde{g}_{i,t+2}\right) \tag{8}$$

The left-hand panel of Figure 13 plots the long-run trend in a simple proxy of the equity discount rate and a lower bound for the expected return on equities if expected cashflow growth is larger than zero – the dividend-price ratio D/P. The dividend-price ratio has declined over the long run, falling from 5% in the early 20th century to a low of 2% in 1990 before recovering to around 3% in 2016. Earnings-price ratios – which allow us to look through changes in corporate payout policy such as the increasing use of stock buybacks during recent decades (see Grullon and Michaely, 2002; Megginson and Von Eije, 2008, and Appendix D.2) – show a similar declining pattern from the 1980s onwards.

Still, these declines – especially the part that occurred after the 1980s – are not as marked as the decline in the safe rate, which fell from historically high levels in the aftermath of the 1970s stagflation to around zero. The right-hand panel of Figure 13 shows the level of the dividend-price ratio and the nominal safe rate in 2015. Assuming positive inflation, the nominal safe rate provides an upper-bound estimate of the real safe rate. For all the countries in our sample, the dividend-price ratio is much higher than the safe rate and the differences are substantial, on the order of magnitude of several percentage points. This suggests that even though the equity discount rate has decreased, equity risk premia are still sizeable and the discount rate is still relatively high.

[9] This is a levels version of the Campbell and Shiller (1988) decomposition derived by Blanchard (1993). Here $\tilde{g}_{i,t+2}$ is the annuity value of future dividend growth, calculated as $\tilde{g}_{t+2} = w_1 \mathbb{E} g_{t+2} + w_2 \mathbb{E} g_{t+3} + ... + w_\tau \mathbb{E} g_{t+\tau+1}$. $g_t = D_t/D_{t-1} - 1$ is the year-on-year cashflow growth and $w_t = (1+g)^{\tau-1}(r-g)/(1+r)^\tau$ are the weights, where g and r are the average dividend growth and return rates.

Figure 13: *Simple proxies for the risky and safe discount rate*



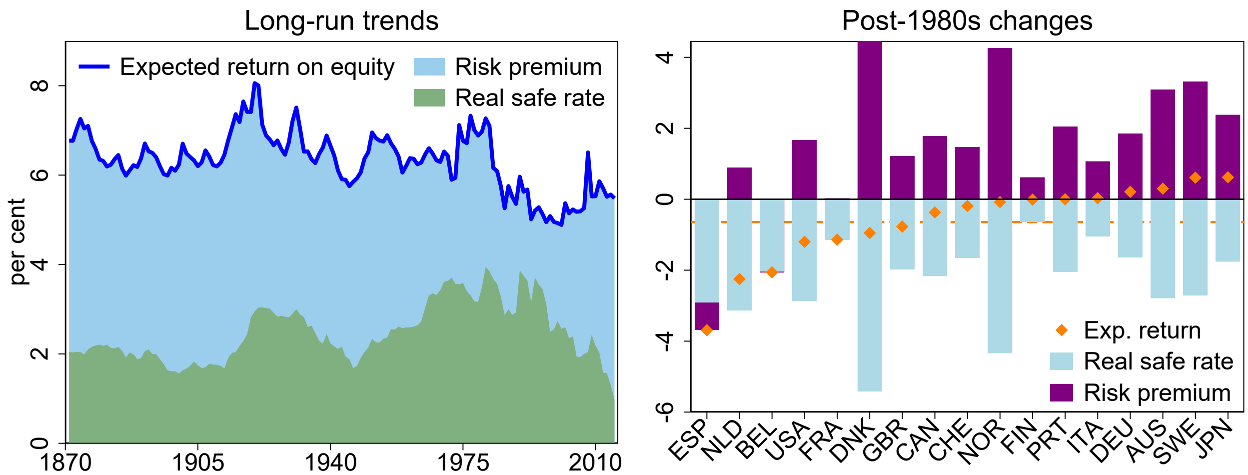
Left-hand panel shows unweighted averages of 17 countries, with earnings-price ratios calculated from firm-level microdata in Compustat Global and North America. Right-hand panel shows the level of the dividend-price ratio and nominal short-term interest rate in 2015.

In addition to studying trends and levels of the the raw data, we also estimate the expected return $\mathbb{E}(R)$ and the trend real safe rate r^{safe}. To do this, we first estimate expected cashflow growth by constructing a long-run forecast of future dividends. This forecast is the average of two proxies from Kuvshinov and Zimmermann (2021), the first of which forecasts future dividends using current asset valuations within a flexible time-varying VAR specification, and the second of which equates the long-run dividend growth rate to a long-run GDP growth forecast.[10] For the safe rate, we extend the Del Negro et al. (2019) estimates of the trend long-term real government bond yield to the 17 countries in our sample.

The resulting expected return estimate, pictured as the blue line in the left-hand panel of Figure 14, displays a similar trend to the dividend- and earnings-price ratios but a slightly smaller long-run decline due to moderate increases in the expected cashflow growth offsetting some of the decline in equity price ratios (equation (8)). Like with the dividend-price and earnings-price ratios, the post-1980s decline in the expected equity return is much smaller than that in the safe rate (dark green area). Correspondingly, the difference between the two, the equity risk premium (light blue area) has increased materially since 1990. These broad cross-country patterns are mirrored in country-level data. The right-hand panel of Figure 14 shows the change in the real safe rate (light blue bars) and the risk premium (dark purple bars) as well as their sum, the expected return (orange diamonds), between the 1980s and 2015. In all countries, the trend real safe rate has declined while in all bar

[10]We use average of these two forecasts to provide a balanced perspective. The trend decline of expected returns using the long-run GDP growth forecast is somewhat stronger than that using the VAR dividend forecast, since the dividend share in GDP has increased (Section 5.3), but it is not clear whether the dividend share will keep increasing over the longer run, hence our use as the GDP growth forecast as an additional metric. For more detail on the expected risky and safe return estimation, see Kuvshinov and Zimmermann (2021).

Figure 14: *Expected equity returns, safe rates and risk premia*



The expected equity return is the dividend-price ratio plus expected cashflow growth calculated as the average of a VAR forecast of future dividends and a forecast of long-run GDP growth. The safe rate is the trend long-term real government bond rate estimated using the Bayesian VAR method of Del Negro et al. (2019), and the risk premium is the difference between expected return and safe rate. See Kuvshinov and Zimmermann (2021) for more details. Left-hand panel shows trends in unweighted cross-country averages. Right-hand panel shows the differences between the levels in the 1980s and 2015.

three, the risk premium has increased. No country registers a large risk premium decline. These patterns hold regardless of the way we measure the expected risky and safe returns in the data.

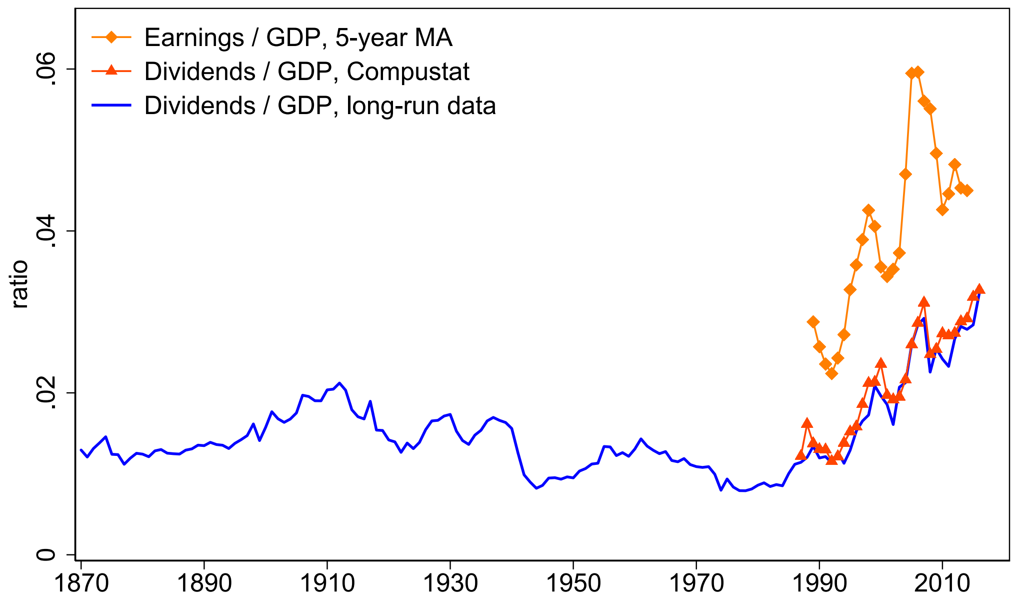
The post-1980s trends in risky and safe discount rates are consistent with existing evidence on the falling safe rate, stable return on productive capital, and a rising equity premium in the US (Summers and Rachel, 2019; Gomme et al., 2015; Caballero et al., 2017a). Existing literature offers several explanations for these trends, which center around either a higher demand or a lower supply of safe investments – both factors that would push down the safe rate and increase the risk premium (Farhi and Gourio, 2018; Kuvshinov and Zimmermann, 2021; Caballero, Farhi, and Gourinchas, 2017b). The increases in the market cap to GDP ratio may have actually contributed to the increases in demand for safety by increasing the volatility of equity wealth relative to income (right-hand panel of Figure 3), thereby increasing the risk exposures of equity investors and risk premia.

Taken together, these trends mean that even though low equity discount rates have contributed to the increases in market capitalization during the big bang, they are unlikely to be its main driver. We next explore a third potential driver of the post-1980s increases in market capitalization: a change in the profit share of listed firms.

5.3. A profit shift towards listed firms

Profits of US corporations have increased markedly over recent decades (Barkai, 2020). Our data allow us to put these recent US trends into a cross-country historical perspective, and show that the corporate profit boom is global, historically unprecedented, and a key driver of the post-1980s

Figure 15: *Listed firm profit share over the long run*



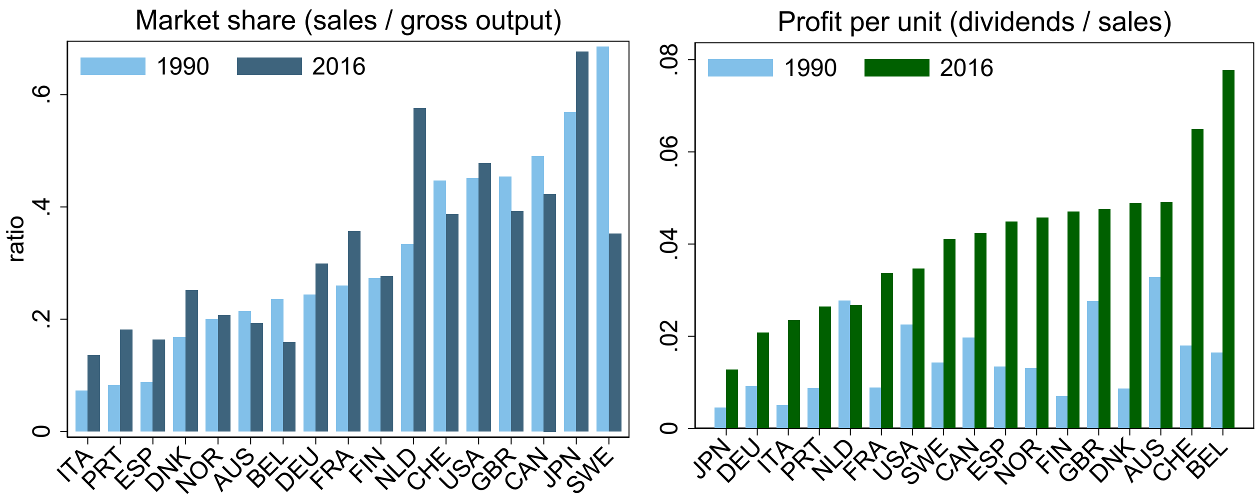
Unweighted averages of 17 countries. Profit data are aggregated up from Compustat Global and Compustat North America and cover all listed firms with non-missing values for market cap, dividends and earnings, scaled up to match our aggregate market cap data where necessary and dropping periods with insufficient coverage. Listed firm earnings are smoothed using a 5-year moving average.

increases in market capitalization. We further show that these increases have been driven by higher profit margins rather than market shares, and that the profits of listed firms have grown much faster than other types of capital income.

We start by examining long-run trends in the ratio of listed firm profits to GDP. The solid blue line in Figure 15 shows that the share of listed firm dividends in GDP has roughly tripled between the 1980s and today – an increase comparable to that in the market cap to GDP ratio. These recent increases are also mirrored in earnings data which allow us to look through the impact of changes in payout policy on the trends. The orange diamonds in Figure 15 show that measures of listed firms earnings, computed from Compustat Global and North America, display similar relative increases to dividends, measured either in our long-run data or in the same Compustat sample. Longer-run US data from Shiller (2015) show that the recent earnings increases are also unusually large and persistent relative to those observed historically (see Appendix Figure C.1). Appendix Figure C.2 further documents that these increases in earnings were not accompanied by significant changes in leverage.

As the next step we decompose the increase in listed firm profits to GDP into a quantity and a price component. A rise in profits can either come from rising market shares of listed firms, or a higher profit rate per unit of revenue. The left-hand panel of Figure 16 compares total sales of listed corporations in 1990 and 2016 to domestic gross output from national accounts in order to evaluate if listed corporations were able to grow their profits through an increase in market shares. While listed firms have gained in importance in some countries, they have lost market shares in others. We

Figure 16: *Listed firm sales and profit per sale in 1990 and 2016*

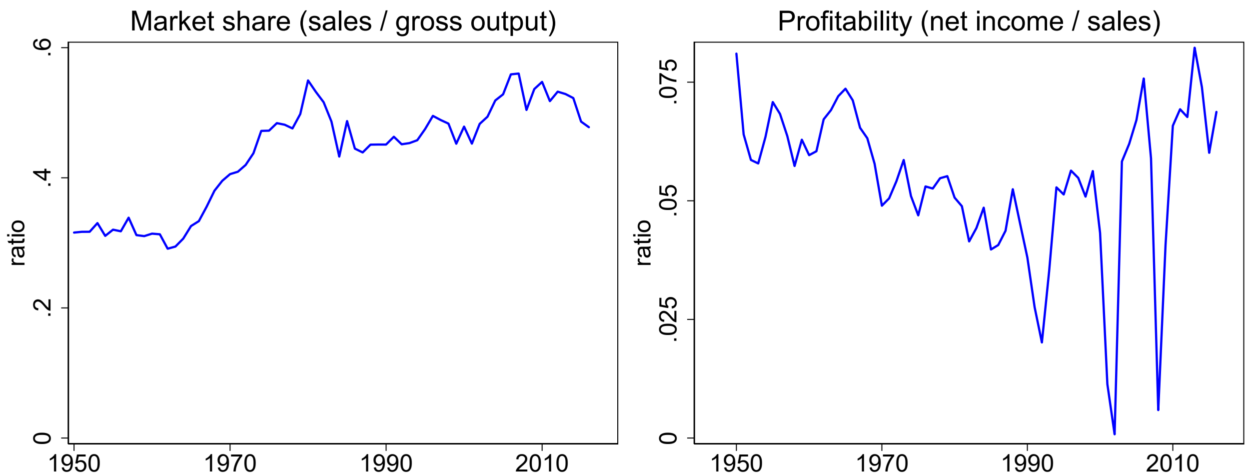


The left-hand panel shows the ratio of listed firm sales to the country's gross output across 17 countries in 1990 and 2016. Countries are sorted by the listed firm market share in 1990. We calculate total listed firm sales in Compustat and rescale it by the coverage ratio of Compustat to total market cap to account for coverage changes in Compustat. The Compustat coverage in Italy, Portugal, Spain and Sweden is still low in 1990, meaning that the 1990 figures for these countries should be interpreted with caution. For Portugal, we use 1994 data for the 1990 data point, as it is the first year with meaningful coverage. Gross output comes from the OECD STAN database, the EU KLEMS database and the BEA. The right-hand panel shows dividends per unit of sales of listed firms in 1990 and 2016. The data are aggregated to the country level by weighting firm level data from Compustat by total sales.

do not observe that listed firms have expanded their sales systematically relative to the gross output of their home economy. This finding aligns with Gutiérrez and Philippon (2019, 2020), who show that market leaders (stars) have not materially grown their market shares in the US and globally. Instead, the profit boom of listed corporations seems to be driven by an increase in profitability per unit of sales. The right-hand panel of Figure 16 shows the sales weighted average dividend per sale ratio in 1990 and 2016. We observe a strong increase in the profit margin of listed firms across advanced economies. This holds not only for the dividend-to-sales ratio, but also for other profitability measures such as net income to sales or market cap to sales (see Appendix Figure C.3) and across sectors of the economy (see Appendix Figure C.4). We conclude that the rise in listed firm profits relative to GDP is largely driven by an increase in the profit margin.

Prior research suggests that profit margins of US corporates have been high before (Traina, 2018; Barkai and Benzell, 2018). We replicate this result in the left-hand panel of Figure 17. The profit margin of listed firms in the US economy follows a U-shaped pattern, with high levels in the 1950s, low levels in the 1980s and 1990s, and high levels again today. Why did these high profit margins not translate into high profit shares and market capitalization during the 1950s? The reason for this is that, even though profit margins were high, listed firm sales were small relative to the rest of the economy. The right-hand panel of Figure 17 plots the evolution of the estimated market share of listed corporations in the United States, again measured using the sales to gross output ratio. Listed firms' market share was low in the 1950s at around one-third of gross output, increased in the 1960s

Figure 17: *Profitability and market shares of listed firms in the US*



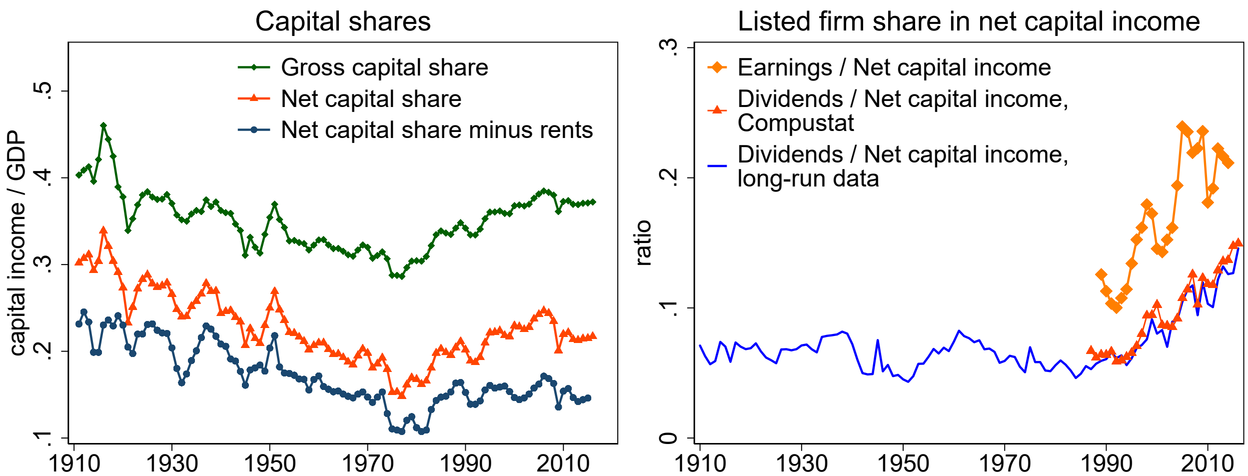
The left-hand panel shows the ratio of listed firm sales to gross output in the United States. The right-hand panel shows the sales-weighted average net income per unit of sales. Data cover all listed firms in the CRSP-Compustat Merged (CCM) dataset. To account for changes in coverage in the CCM database we rescale sales by the ratio of CCM mcap to aggregate market cap. This implicitly assumes that the CCM sales to mcap ratio is representative of all listed equities.

and 1970s and remained at around 50% of gross output throughout subsequent decades. The rising market share of listed firms was actually part of a much broader shift away from unincorporated businesses towards corporations (both C-Corporations and S-Corporations) in the US which took place between 1950 and 1980 (see the left-hand panel of Appendix Figure C.5). Thus, the negative impact of declining profit margins in the 1960s and 1970s was offset by the rising market share, with these two effects largely cancelling out to leave the listed firms profits and market capitalization shares and GDP stable throughout this time period.

The post-1990 increases in listed firm profits relative to GDP suggest that there has been a redistribution of income away from other sectors of the economy towards listed firms. This redistribution could have come about from either labour income or other forms of capital income. Karabarbounis and Neiman (2013) have shown that the share of labour income in GDP has fallen since the 1980s, and in a contemporaneous paper to ours, Greenwald et al. (2021) argue that the decline in the labour share is a key driver of the increase in US stock market capitalization. To investigate the contribution of this channel to the long-run cross-country increases in capitalization across countries, the left-hand panel of Figure 18 plots the long-run evolution of three different capital share measures for six advanced economies. The green diamond line shows the gross capital share, the orange triangle line adjusts this measure for depreciation and the blue square line additionally subtracts net rental income to give us an estimate of the non-housing net capital share – a measure that most closely tracks the income of total business capital. We take the gross and net capital shares from Bengtsson and Waldenström (2018), and use the balance sheet net rental income data from Jordà et al. (2019) to further adjust these for rents.

The trends suggest that changes in the capital share play relatively little role in explaining the

Figure 18: *Listed firm profits and capital income*



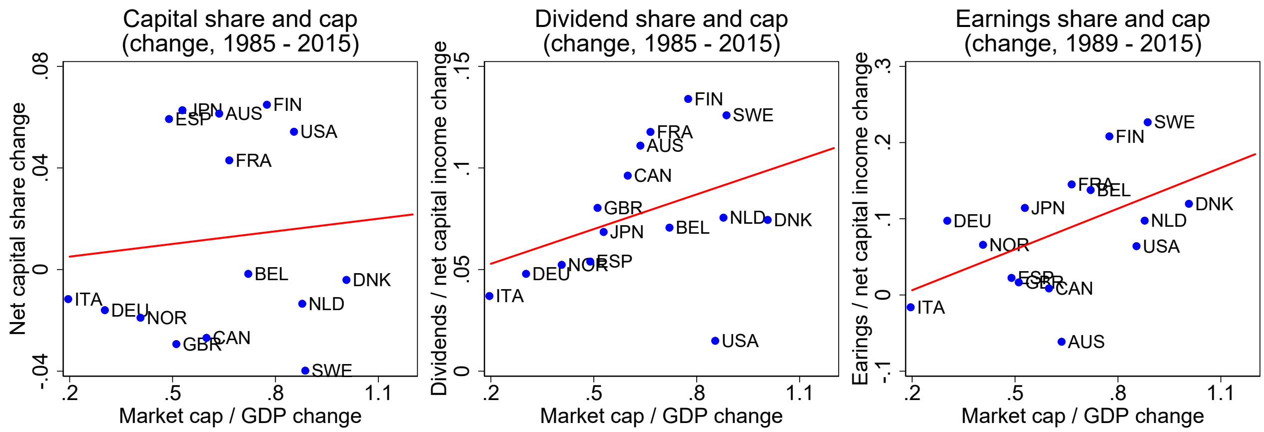
Unweighted cross-country averages. Data on gross and net capital income are from Bengtsson and Waldenström (2018) and cover Australia, France, Germany, Sweden, UK and US. Rents data are from Jordà et al. (2019). Profit data are aggregated up from Compustat Global and Compustat North America and cover all listed firms with non-missing values for market cap, dividends and earnings, scaled up to match our aggregate market cap data and dropping periods with insufficient coverage. Listed firm earnings are smoothed using a 5-year moving average.

rising listed firm profit share. While the gross capital share has indeed increased substantially since the 1980s, the net-of-housing net capital share has remained broadly flat, in line with evidence in Rognlie (2015) and Gutiérrez and Piton (2020). Furthermore, both gross and net capital shares, if anything, have declined slightly over the long run and were much higher during the late 1930s – a time of low market capitalization – than they are today. Correspondingly, the right-hand panel of Figure 18 shows that the ratio of listed firms' earnings to net capital income has increased markedly during the recent decades – rising from 10% in 1990 to 25% in 2015 – and that these increases are historically unprecedented with the ratio of listed dividends to capital income standing at an all-time historical high of 15%.

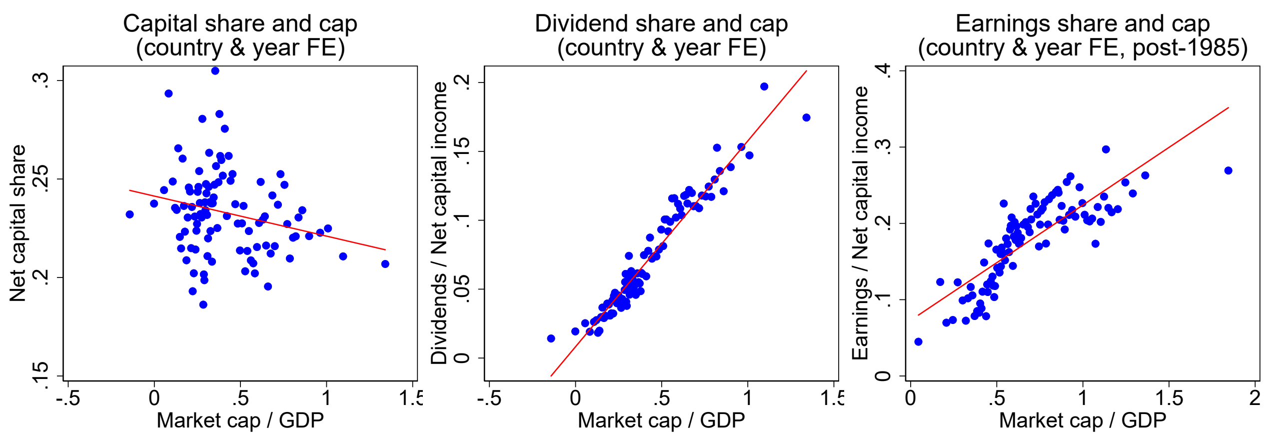
Within-capital-income shifts not only account for a large proportion of the time series trend, but also for cross-country differences in market capitalization increases during the big bang. Figure 19a shows that countries with the highest post-1980s market capitalization increases also recorded the largest shifts within capital income towards listed firm profits, but generally did not record larger increases in the capital share. The left panel shows that while the US recorded increases in both the capital share and market capitalization, many European countries such as Sweden and the Netherlands recorded historically unprecedented increases in market capitalization despite falling net capital shares. The middle and right panels show that country-level changes in dividend and earnings shares are positive in every country and strongly correlated with the magnitude of the increase in stock market cap. With the exception of the US, the patterns in earnings and dividend shares are very similar, while the US shows much larger increases in the earnings share because of

Figure 19: *Stock market capitalization, capital share, and profit share*

(a) *Post-1985 growth in market cap, capital share and profit share by country*



(b) *Correlations between market cap, capital share, and share of profits in capital income*



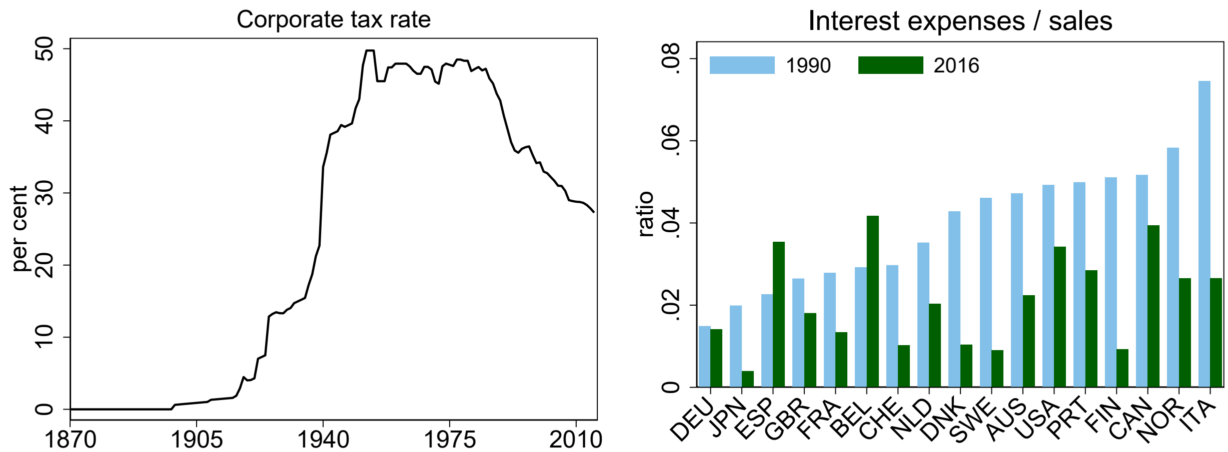
Note: Capital share is net capital income / GDP, from Bengtsson and Waldenström (2018) adjusted for rents using data in Jordà et al. (2019). Dividend share is listed firms' dividends / GDP. Earnings share is listed firms' earnings / GDP, averaged over 5 years (Compustat Global and North America data). Top panel: country-level changes in capital, dividend and earnings shares during the big bang. Earnings share change is for 1989–2016 to ensure consistency across countries Bottom panel: bin scatter plot, 100 bins, controlling for country and year fixed effects. Capital and dividend share for 1870–2016; earnings data for 1985–2016.

the more pronounced switch from dividends to buybacks as the means of shareholder compensation (Grullon and Michaely, 2002; Megginson and Von Eije, 2008, and Appendix D.2).

Figure 19b shows that this importance of within-capital-income shifts applies not only to the big bang, but also to the broader historical period. It displays binned scatter plots of market cap against, respectively, net capital share in GDP, listed firm dividend share in net capital income, and listed firm earnings share in net capital income, divided into 100 bins. To avoid spurious correlation, the plots control for country and year fixed effects, but removing these does not affect the results. Capital shares are uncorrelated with market capitalization, while dividend or profit shares and market cap are strongly positively correlated.

Which types of capital income might have fallen to compensate for the increase in listed firm

Figure 20: *Trends in corporate taxes and interest expenses*



Corporate taxes are from Jordà et al. (2019) and are an average of Australia, Canada, France, Germany, Japan and UK. Interest expenses and sales are sales-weighted averages of firm level data from Compustat Global and Compustat North America. The Compustat coverage in Italy, Portugal, Spain and Sweden is still low in 1990, meaning that the 1990 figures for these countries should be interpreted with caution. For Portugal, we use 1994 data instead of 1990 as it is the first year with meaningful coverage.

earnings? Our analysis suggests that falls in interest expenses and corporate taxes were key. Figure 20 shows the cross-country average corporate tax rate, and the post-1990 country-level changes in the interest expense to sales ratio. The left-hand panel shows that corporate tax rates have declined considerably after 1980, meaning that corporations could distribute more money to shareholders without necessarily making higher pre-tax profits. But even pre-tax listed firm profits have increased considerably, partly owing to large declines in costs in the form of interest expenses documented in the right-hand panel of Figure 20. One common feature of these two trends is that they have the potential to generate an increase in corporate profitability while leaving capital shares largely unaffected. These declines in costs also help explain how profit margins and markups may have risen at a time of low price growth and steady or growing unit labour costs (Syverson, 2019). A detailed capital income breakdown for the US shown in the Apendix Figure C.6 confirms that these tax and interest declines were the largest counterparts of the profit increases during the recent decades.[11]

When it comes to shifts from profits of unlisted firms, the existing evidence is more mixed. In the US, the increases in profits of listed firms happened alongside those of other businesses with profit margins of listed and unlisted corporations, and of different forms of business (C-Corporations, S-Corporations, Partnerships and Sole proprietorships) all increasing materially since the 1980s (see Appendix Figure C.7). In fact, Smith et al. (2019) identify the profit boom in unlisted "pass-through" businesses as one of the key drivers of income growth at the top of the income distribution. Outside of the US, countries registered much smaller increases in the total capital share and gross operating

[11]Such a breakdown of capital income is to our knowledge not available in countries that follow the SNA instead of the NIPA national accounts guidelines, which only reports gross operating surplus.

surplus to value added (Figure 19a and Gutiérrez and Philippon (2018)) and corporates did not lose market shares to non-corporate businesses (Saez and Zucman, 2020). These trends suggest that the growth and the profitability increases of unlisted businesses that we see in the US might be less pronounced in other countries.

To sum up, the big bang was accompanied by large increases in the *listed firm profit share* – the ratio of listed firms' earnings to GDP. These increases in profits were global, happened at a much faster pace than the economy-wide increase in capital shares, are comparable in size to those in market cap, and – especially in their cross-country scope – are historically unprecedented.

5.4. Accounting for the big bang

In this section, we quantify the contribution of individual drivers to the increases in the market cap to GDP ratio since the 1980s. To determine this, we run a simple counterfactual exercise of the following form: we allow either the profit share or the discount rate to vary with the actual trend observed in the data, but fix all the other market cap determinants at their 1980s levels. We then estimate the counterfactual market cap using a constant-growth Gordon model version of equation (5):

$$\frac{MCAP_t}{GDP_t} \approx \frac{D_t^{agg}}{GDP_t} * \frac{1}{\mathbb{E}(r_{t+1}) - \mathbb{E}(g_{t+1})} \tag{9}$$

To ascertain the relative importance of the different channels, we compare the counterfactual increase in market cap obtained by varying the profit share D/GDP or the discount rate $\mathbb{E}(r)$, and keeping other factors constant to the actual increase observed in the data. Throughout this counterfactual exercise, we fix expected dividend growth $\mathbb{E}(g)$ at its long-run mean level of 2.5% p.a.[12]

Table 4 shows the actual market cap to GDP ratio before and after the big bang in the top row and the counterfactual market cap levels under various scenarios in the bottom rows. Column 1 shows the actual and counterfactual market cap levels during the 1980s, the decade before the big bang. Column 2 shows the average level after the big bang, in 2015. Columns 3 and 4 show the resulting market cap increases. Starting with column 1, the average level of market cap in the 1980s was around 30% of GDP. During this period, dividends were around 1% of GDP and expected equity returns were on average 6.1%. Plugging these into equation (9) gives us a counterfactual market cap to GDP ratio of $1/(6.1 - 2.5) \approx 0.28$, close to the ratio of 0.3 in the data – a starting point for all our counterfactual scenarios.

Row 2 of Table 4 allows the profit share D/GDP to increase to its 2015 average of 2.8%, while keeping the discount rate constant at 6.1%. This gives us a $2.8/(6.1 - 2.5) \approx 0.78$ counterfactual level

[12]To calculate the full-sample mean, we first calculate the annuity value of real dividend growth $\tilde{g}_{t+2}$ in equation (8) as the discounted sum of all future dividend growth rates from $t+1$ onwards, setting the growth rate after 2016 to the sample mean. We then winsorise the data at the 1% level to reduce the influence of outliers, e.g. high growth rates from a very low base. Using non-winsorised or non-annuity based averages results in a higher g and hence makes us able to explain an even higher proportion of the big bang with the observed profit share and discount rate trends.

Table 4: *Contribution of shifts in profits and discount rates to the big bang*

	(1)	(2)	(3)	(4)
	1980 – 1989 average	2015	Change in MCAP/GDP	Share of increase in the data
Actual MCAP/GDP	0.30	0.97	0.67	
Counterfactuals:				
Profit shift only	0.28	0.78	0.50	75%
Discount rate decline only	0.28	0.34	0.06	9%
Combined	0.28	0.95	0.67	101%

Pooled averages, annual data for 17 countries. Counterfactual market cap is calculated as $\frac{D}{GDP} * \frac{1}{\mathbb{E}(r)-\mathbb{E}(g)}$, where D/GDP are dividends paid by all listed firms relative to GDP, $\mathbb{E}(r)$ is the expected return on equities, and $\mathbb{E}(g)$ is expected real dividend growth, set to sample average of 2.5%.

of market cap in 2015, and a 50% of GDP increase in market cap during the big bang – around 75% of the total. Row 3 allows the discount rate to fall from 6.1% to 5.5% while keeping dividends-to-GDP constant at 1%, which gives us a $1/(5.5-2.5) \approx 0.34$ counterfactual 2015 market cap level and a 6% of GDP increase, around 9% of the total. Together, these two factors amplify each other as higher cashflows are discounted at a lower rate. Allowing for both the profit shift and the discount rate decline in counterfactual 3 results in a $2.8/(5.5-2.5) \approx 0.95$ counterfactual 2015 market cap level, and an increase of 67% of GDP accounting for the entire observed increase in market cap during the big bang.[13]

6. Conclusion

This paper has introduced a new dataset of stock market capitalization and its drivers – issuances, prices, dividends, profits and discount rates – covering 17 advanced economies between years 1870 and 2016. These new data have allowed us to track the long-run evolution of stock market size and disentangle its underlying drivers. A high-level investigation of the data reveals two broad eras of stock market growth: the period before the 1980s, during which the stock market grew at the same long-run rate as GDP and this growth was driven by equity issuance; and the period after the 1980s during which capitalization growth accelerated far beyond that in GDP, with this acceleration driven by sharp persistent increases in stock prices at a time of slowing issuance.

We show that the key driver of these post-1980s increases in market capitalization is a profit shift away from other parts of the economy towards listed firms. This profit shift is driven by higher profit margins, goes well beyond the recently documented increases in capital income, and has been

[13]Note that starting the counterfactual scenario before the 1980s would somewhat increase the relative contribution of the fall in the discount rate because expected equity returns started falling before 1980 (Figure 14). Starting it later would increase the contribution of the profit shift relative to that of the discount rate. But regardless of the starting date, we are always able to explain almost all of the increase in market cap during the big bang, and the profit shift remains the dominant factor.

aided by falls in interest expenses and corporate taxes. These trends are consistent with broader patterns of increasing market power and profitability of large firms in the US and globally (Barkai, 2020; De Loecker et al., 2020; De Loecker and Eeckhout, 2018). We also show that low safe rates and falling discount rates have made a relatively small direct contribution to the big bang, but generated sizeable falls in interest expenses which provided an important indirect contribution to the observed increases in profits and, through this, the expansion in market cap.

References

Annaert, Jan, Frans Buelens, and Marc De Ceuster. 2012. New Belgian Stock Market Returns: 1832–1914. *Explorations in Economic History* 49(2): 189–204.

Armenter, Roc, and Viktoria Hnatkovska. 2017. Taxes and Capital Structure: Understanding Firms' Savings. *Journal of Monetary Economics* 87: 13–33.

Bai, Jushan, and Pierre Perron. 2003. Computation and Analysis of Multiple Structural Change Models. *Journal of Applied Econometrics* 18(1): 1–22.

Baker, Malcolm, and Jeffrey Wurgler. 2000. The Equity Share in New Issues and Aggregate Stock Returns. *Journal of Finance* 55(5): 2219–2257.

Baker, Malcolm, and Jeffrey Wurgler. 2002. Market Timing and Capital Structure. *Journal of Finance* 57(1): 1–32.

Bansal, Ravi, Dana Kiku, and Amir Yaron. 2007. A Note on the Economics and Statistics of Predictability: A Long Run Risks Perspective. No. 18, 2007 meeting papers, society for economic dynamics.

Barkai, Simcha. 2020. Declining Labor and Capital Shares. *Journal of Finance* 75(5): 2421–2463.

Barkai, Simcha, and Seth G. Benzell. 2018. 70 Years of US Corporate Profits. Stigler Center for the Study of the Economy and the State, New Working Paper Series 22.

Bengtsson, Erik, and Daniel Waldenström. 2018. Capital Shares and Income Inequality: Evidence from the Long Run. *Journal of Economic History* 78(3): 712–743.

Blanchard, Olivier J. 1993. Movements in the Equity Premium. *Brookings Papers on Economic Activity* 1993(2): 75–138.

Blanco, Miguel Artola, Luis Bauluz, and Clara Martínez-Toledano. 2020. Wealth in Spain 1900—2017 A Country of Two Lands. *Economic Journal* 131(633): 129–155.

Burdett, Henry C. 1882. *Burdett's Official Intelligence for 1882*. London: Spottiswoode.

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2017a. Rents, Technical Change, and Risk Premia Accounting for Secular Trends in Interest Rates, Returns on Capital, Earning Yields, and Factor Shares. *American Economic Review: Papers & Proceedings* 107(5): 614–20.

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2017b. The Safe Assets Shortage Conundrum. *Journal of Economic Perspectives* 31(3): 29–46.

Campbell, John Y., and Robert J. Shiller. 1988. The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors. *Review of Financial Studies* 1(3): 195–228.

Chambers, David, and Elroy Dimson. 2009. IPO Underpricing over the Very Long Run. *Journal of Finance* 64(3): 1407–1443.

Chen, Peter, Loukas Karabarbounis, and Brent Neiman. 2017. The Global Rise of Corporate Saving. *Journal of Monetary Economics* 89: 1–19.

Chodorow-Reich, Gabriel, Plamen T. Nenov, and Alp Simsek. 2021. Stock Market Wealth and the Real Economy: A Local Labor Market Approach. *American Economic Review* 111(5): 1613–1657.

Cochrane, John H. 2008. The Dog That Did Not Bark: A Defense of Return Predictability. *Review of Financial Studies* 21(4): 1533–1575.

Corhay, Alexandre, Howard Kung, and Lukas Schmid. 2020. Q: Risk, Rents, or Growth? Working paper.

Coronado, Julia, and Maria Perozek. 2003. Wealth Effects and the Consumption of Leisure: Retirement Decisions During the Stock Market Boom of the 1990s. Federal Reserve Board Finance and Economics Discussion Series 2003-2020.

De Loecker, Jan, and Jan Eeckhout. 2018. Global Market Power. NBER Working Paper 24768.

De Loecker, Jan, Jan Eeckhout, and Gabriel Unger. 2020. The Rise of Market Power and the Macroeconomic Implications. *Quarterly Journal of Economics* 135(2): 561–644.

Del Negro, Marco, Domenico Giannone, Marc P. Giannoni, and Andrea Tambalotti. 2019. Global Trends in Interest Rates. *Journal of International Economics* 118: 248–262.

Doidge, Craig, G. Andrew Karolyi, and René M. Stulz. 2013. The US Left Behind? Financial Globalization and the Rise of IPOs Outside the US. *Journal of Financial Economics* 110(3): 546–573.

Driscoll, John C, and Aart C Kraay. 1998. Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. *Review of Economics and Statistics* 80(4): 549–560.

Farhi, Emmanuel, and François Gourio. 2018. Accounting for Macro-Finance Trends: Market Power, Intangibles, and Risk Premia. *Brookings Papers on Economic Activity* 2018(2): 147–250.

Feldstein, Martin, and Lawrence Summers. 1977. Is the Rate of Profit Falling? *Brookings Papers on Economic Activity* 1977(1): 211–228.

Fernald, John G. 2015. Productivity and Potential Output before, during, and after the Great Recession. *NBER Macroeconomics Annual* 29: 1–51.

Gao, Xiaohui, Jay R. Ritter, and Zhongyan Zhu. 2013. Where Have All the IPOs Gone? *Journal of Financial and Quantitative Analysis* 48(6): 1663–1692.

Garvy, George. 1944. Rivals and Interlopers in the History of the New York Security Market. *Journal of Political Economy* 52(2): 128–143.

Goldin, Ian, Pantelis Koutroumpis, François Lafond, and Julian Winkler. 2021. Why is Productivity Slowing Down? Oxford Martin Working Paper Series on Economic and Technological Change 2021-6.

Goldsmith, Raymond W. 1985. *Comparative National Balance Sheets: A Study of Twenty Countries, 1688–1978*. Chicago, Ill.: University of Chicago Press.

Gomme, Paul, B. Ravikumar, and Peter Rupert. 2015. Secular Stagnation and Returns on Capital. *St Louis Federal Reserve Economic Synopses* (19).

Goyal, Amit, and Ivo Welch. 2008. A Comprehensive Look at the Empirical Performance of Equity Premium Prediction. *Review of Financial Studies* 21(4): 1455–1508.

Green, Theodor. 1887. Fondsbørsen. Nationaløkonomisk Tidsskrift 5.

Greenwald, Daniel L., Martin Lettau, and Sydney C. Ludvigson. 2021. How the Wealth Was Won: Factors Shares as Market Fundamentals. NBER Working Paper 25769.

Grullon, Gustavo, and Roni Michaely. 2002. Dividends, Share Repurchases, and the Substitution Hypothesis. *Journal of Finance* 57(4): 1649–1684.

Gutiérrez, Germán, and Thomas Philippon. 2019. Fading Stars. *American Economic Review: Papers & Proceedings* 109: 312–16.

Gutiérrez, Germán, and Thomas Philippon. 2020. Some Facts about Dominant Firms. NBER Working Paper 27985.

Gutiérrez, Germán, and Thomas Philippon. 2018. How European Markets Became Free: A Study of Institutional Drift. NBER Working Paper 24700.

Gutiérrez, Germán, and Sophie Piton. 2020. Revisiting the Global Decline of the (Non-housing) Labor Share. *American Economic Review: Insights* 2(3): 321–338.

Hannah, Leslie. 2018. The London Stock Exchange, 1869–1929: New Statistics for Old? *Economic History Review* 71(4): 1349–1356.

Hoffmann, Walther G. 1965. *Das Wachstum der Deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts*. Berlin: Springer.

Holston, Kathryn, Thomas Laubach, and John C. Williams. 2017. Measuring the Natural Rate of Interest: International Trends and Determinants. *Journal of International Economics* 108(S1): 59–75.

Jensen, Michael C. 1997. Eclipse of the Public Corporation. *Harvard Business Review (Sept.-Oct. 1989), revised* .

Jordà, Òscar, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, and Alan M. Taylor. 2019. The Rate of Return on Everything, 1870–2015. *Quarterly Journal of Economics* 134(3): 1225–1298.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor. 2016. The Great Mortgaging: Housing Finance, Crises and Business Cycles. *Economic Policy* 31(85): 107–152.

Karabarbounis, Loukas, and Brent Neiman. 2013. The Global Decline of the Labor Share. *Quarterly Journal of Economics* 129(1): 61–103.

Kunz, Roger M., and Reena Aggarwal. 1994. Why Initial Public Offerings are Underpriced: Evidence from Switzerland. *Journal of Banking and Finance* 18(4): 705–723. Special Issue on Non-US Financial Markets.

Kuvshinov, Dmitry. 2021. The Co-Movement Puzzle. Working paper.

Kuvshinov, Dmitry, and Kaspar Zimmermann. 2021. The Expected Return on Risky Assets: International Long-run Evidence. Working paper.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny. 1997. Legal Determinants of External Finance. *Journal of Finance* 52(3): 1131–1150.

Lettau, Martin, and Stijn Van Nieuwerburgh. 2008. Reconciling the Return Predictability Evidence. *Review of Financial Studies* 21(4): 1607–1652.

López, Carlos Barciela, Albert Carreras, and Xavier Tafunell. 2005. *Estadísticas Históricas De España: Siglos XIX–XX*. Madrid: Fundacion BBVA.

McGrattan, Ellen R., and Edward C. Prescott. 2005. Taxes, Regulations, and the Value of U.S. and U.K. Corporations. *Review of Economic Studies* 72(3): 767–796.

Megginson, William L., and Henk Von Eije. 2008. Dividends and Share Repurchases in the European Union. *Journal of Financial Economics* 89(2): 347 – 374.

Nordhaus, William D. 1974. The Falling Share of Profits. *Brookings Papers on Economic Activity* 1974(1): 169–217.

O'Sullivan, Mary. 2007. The Expansion of the U.S. Stock Market, 1885–1930: Historical Facts and Theoretical Fashions. *Enterprise & Society* 8(3): 489–542.

Philippon, Thomas. 2019. *The Great Reversal: How America Gave Up on Free Markets*. Cambridge, Mass.: Harvard University Press.

Piketty, Thomas, and Gabriel Zucman. 2014. Capital is Back: Wealth-Income Ratios in Rich Countries 1700–2010. *Quarterly Journal of Economics* 129(3): 1255–1310.

Poterba, James M. 2000. Stock Market Wealth and Consumption. *Journal of Economic Perspectives* 14(2): 99–118.

Rajan, Raghuram G., and Luigi Zingales. 2003. The Great Reversals: the Politics of Financial Development in the Twentieth Century. *Journal of Financial Economics* 69(1): 5–50.

Richter, Björn, and Lukas Diebold. 2021. When Two Become One: Foreign Capital and Household Credit Expansion. Working paper.

Roe, Alan. 1971. *The Financial Interdependence of the Economy, 1957–1966*. London: Chapman & Hall.

Rognlie, Matthew. 2015. Deciphering the Fall and Rise in the Net Capital Share. *Brookings Papers on Economic Activity* 46(1): 1–69.

Rydqvist, Kristian, and Rong Guo. 2020. Performance and Development of a Thin Stock Market: the Stockholm Stock Exchange 1912–2017. *Financial History Review* 28(1): 26–44.

Rydqvist, Kristian, and Kenneth Högholm. 1995. Going public in the 1980s: Evidence from Sweden. *European Financial Management* 1(3): 287–315.

Saez, Emmanuel, and Gabriel Zucman. 2020. Labor and Capital in American Businesses. Prelimiary slides.

Schmelzing, Paul. 2020. Eight Centuries of Global Real Interest Rates, R-G, and the 'Suprasecular' Decline, 1311–2018. Bank of England Staff Working Paper 845.

Shiller, Robert J. 2015. *Irrational Exuberance*. Princeton, N.J.: Princeton University Press.

Smith, Matthew, Danny Yagan, Owen Zidar, and Eric Zwick. 2019. Capitalists in the Twenty-first Century. *Quarterly Journal of Economics* 134(4): 1675–1745.

Summers, Lawrence H., and L. Rachel. 2019. On Falling Neutral Real Rates, Fiscal Policy and the Risk of Secular Stagnation. *Brookings Papers on Economic Activity* Conference Draft, March 7-8 2019.

Sylla, Richard. 2006. Schumpeter Redux: a Review of Raghuram G. Rajan and Luigi Zingales's Saving Capitalism from the Capitalists. *Journal of Economic Literature* 44(2): 391–404.

Syverson, Chad. 2019. Macroeconomics and Market Power: Context, Implications, and Open Questions. *Journal of Economic Perspectives* 33(3): 23–43.

Traina, James. 2018. Is Aggregate Market Power Increasing? Production Trends Using Financial Statements. Stigler Center for the Study of the Economy and the State, New Working Paper Series 17.

Waldenström, Daniel. 2014. Swedish Stock and Bond Returns, 1856–2012. In *Historical Monetary and Financial Statistics for Sweden, Volume 2: House Prices, Stock Returns, National Accounts and the Riksbank Balance Sheet, 1860-2012*, edited by Rodney Edvinsson, Tor Jacobson, and Daniel Waldenström, pp. 223–293. Stockholm: Sveriges Riksbank and Ekerlids förlag.

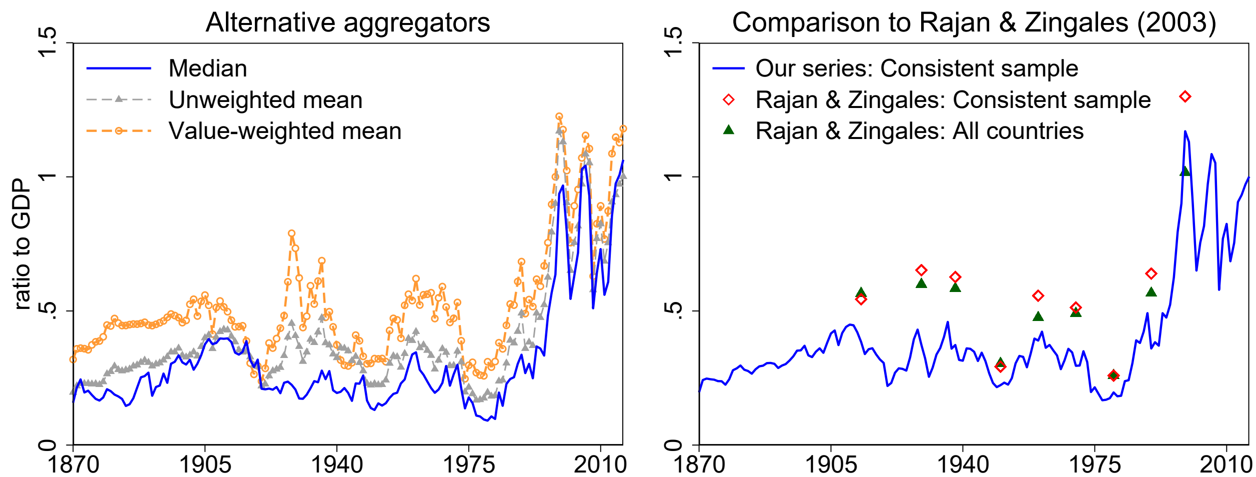
Online Appendix

The Big Bang: Stock Market Capitalization in the Long Run

Additional results

A. Trends in market capitalization: additional material

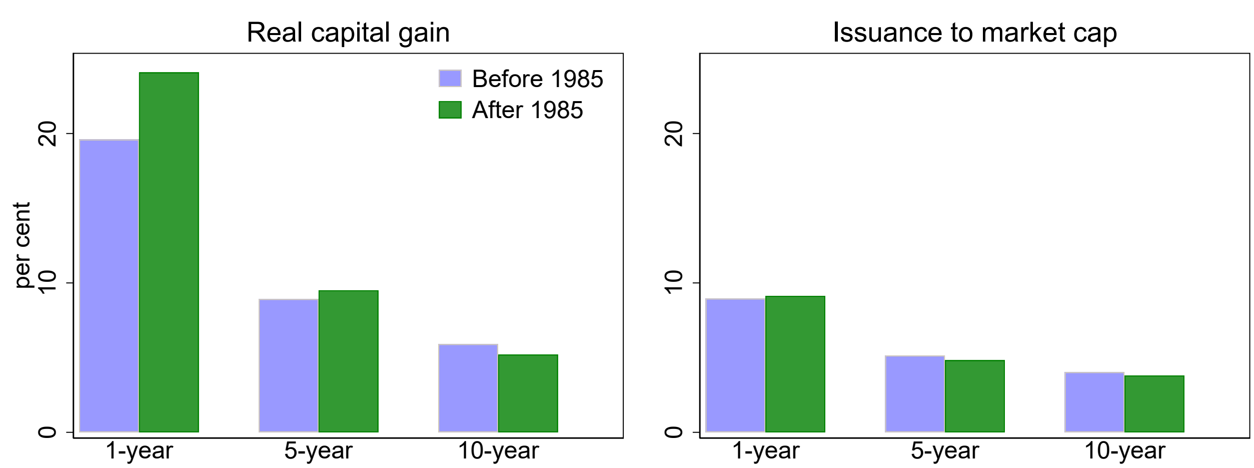
Figure A.1: *Alternative aggregators and comparison to alternative estimates*



Left-hand panel: value-weighted mean is calculated as the sum of market capitalization in all countries, converted to US dollars, divided by the sum of US dollar GDP for all countries with market cap data. Right-hand panel: Estimates in our data compared to those of Rajan and Zingales (2003), unweighted averages. The consistent sample includes all countries in our dataset apart from Finland, Portugal and Spain.

B. Trends in prices and quantities: additional material

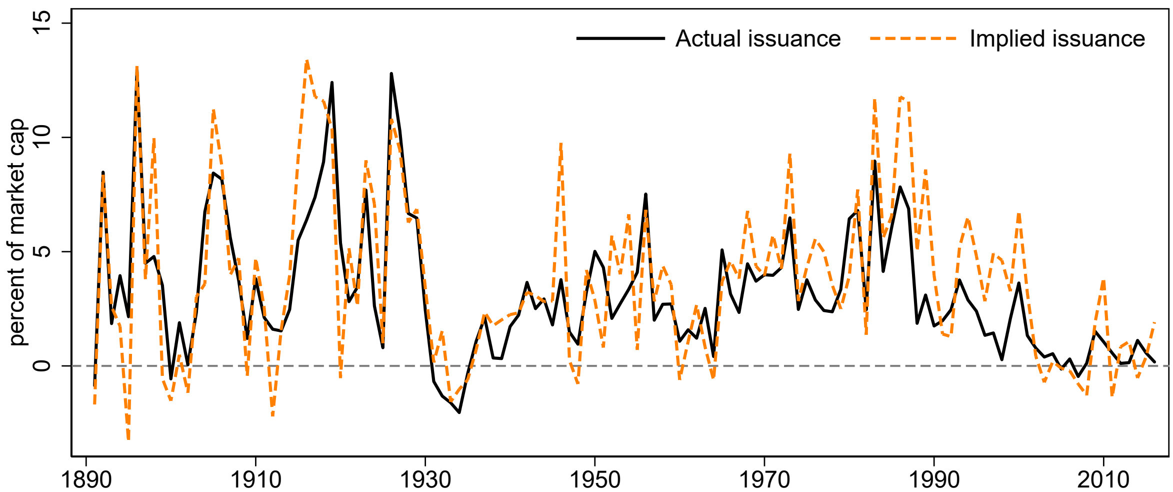
Figure B.1: *Volatility of the components of market cap growth*



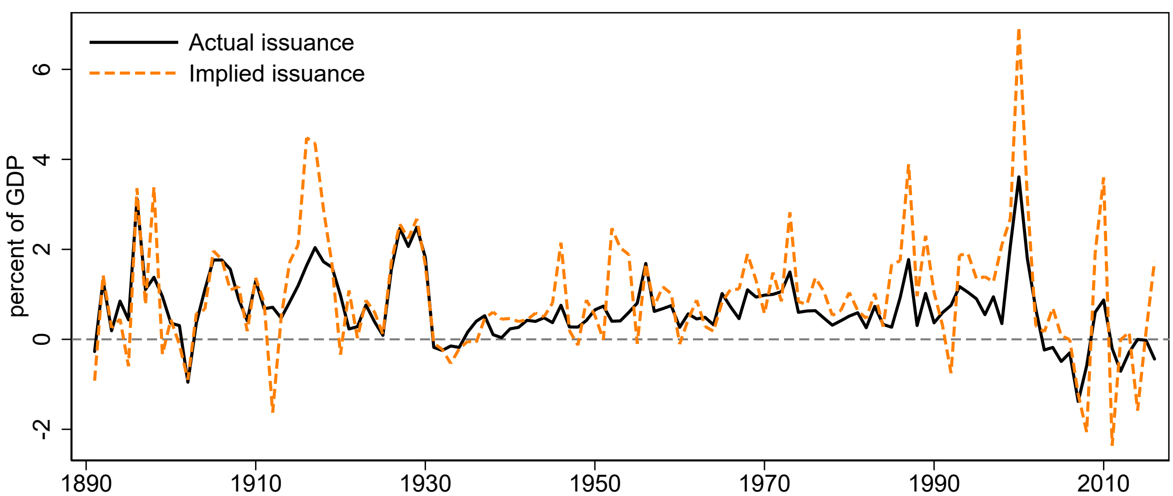
Standard deviation of annual, 5-year average and 10-year average log real equity capital gain and log issuance relative to previous year's market cap, pooled cross-country data.

Figure B.2: *Long-run trends in net equity issuance*

(a) *Net equity issuance relative to market cap*

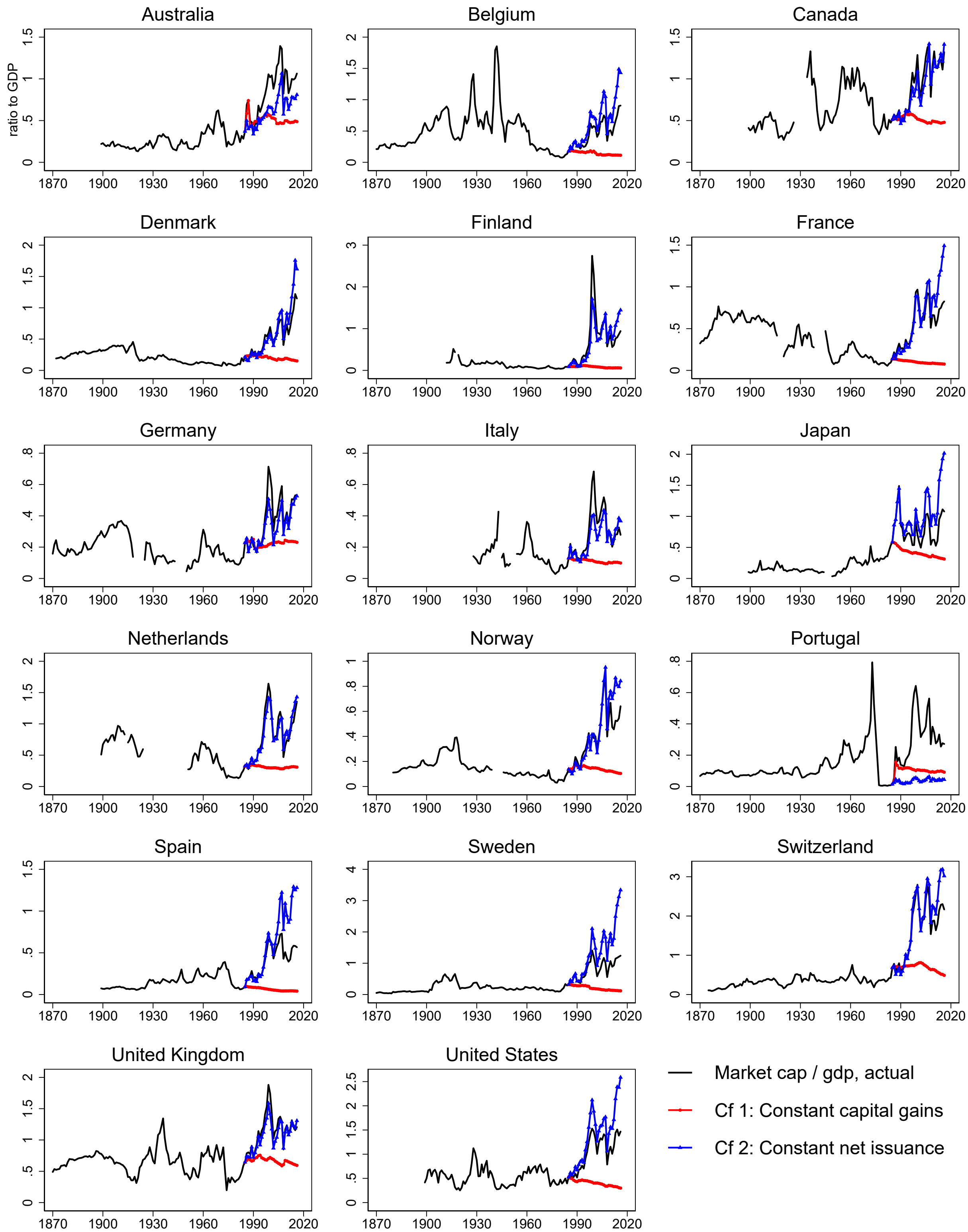


(b) *Net equity issuance relative to GDP*



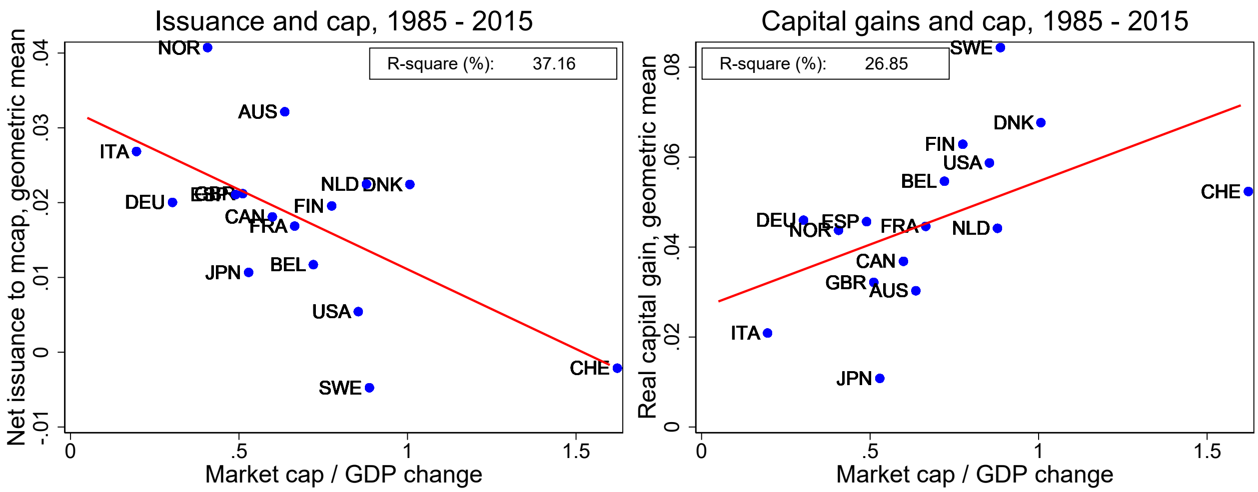
Net equity issuance during the year as percentage of previous year's market capitalization (top panel) and GDP (bottom panel). Unweighted averages of 9 countries: Canada, Germany, Finland, France, Portugal, Spain, Sweden, Switzerland and USA. Implied issuance is the difference between market cap growth and capital gain. Actual issuance is gross issues and new listings minus redemptions and delistings. Country-level data winsorised at 1%.

Figure B.3: *Counterfactual evolution of market cap in individual countries*



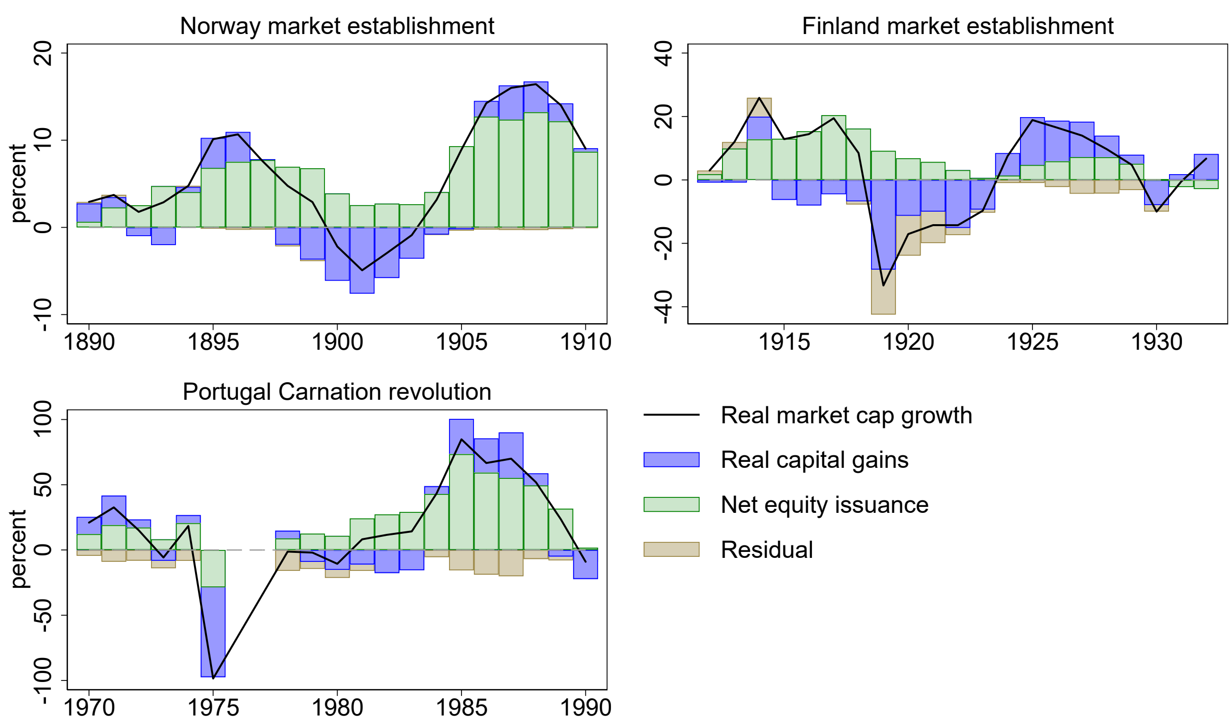
Counterfactual market cap to GDP ratio evolution during the big bang. Constant capital gains counterfactual forces the real capital gains during 1985–2016 to equal the pre-1985 average for the specific country. Constant net issuance counterfactual forces net issuance relative to market cap during 1985–2016 to equal the pre-1985 average. Data are benchmarked so that the combined growth of the two counterfactuals between 1985 and 2016 equals the actual growth in observed market cap data.

Figure B.4: *Country-level growth in market cap, issuance and capital gains during the big bang*



Country-level changes in market cap and average real capital gains and net issuance relative to previous year's market cap between 1985 and 2015. We omit Portgual for illustrative purposes due to its very high capitalization growth rates during the recovery from the Carnation revolution, but including it in the graph does not change the correlations.

Figure B.5: *Growth decomposition: individual country case studies*



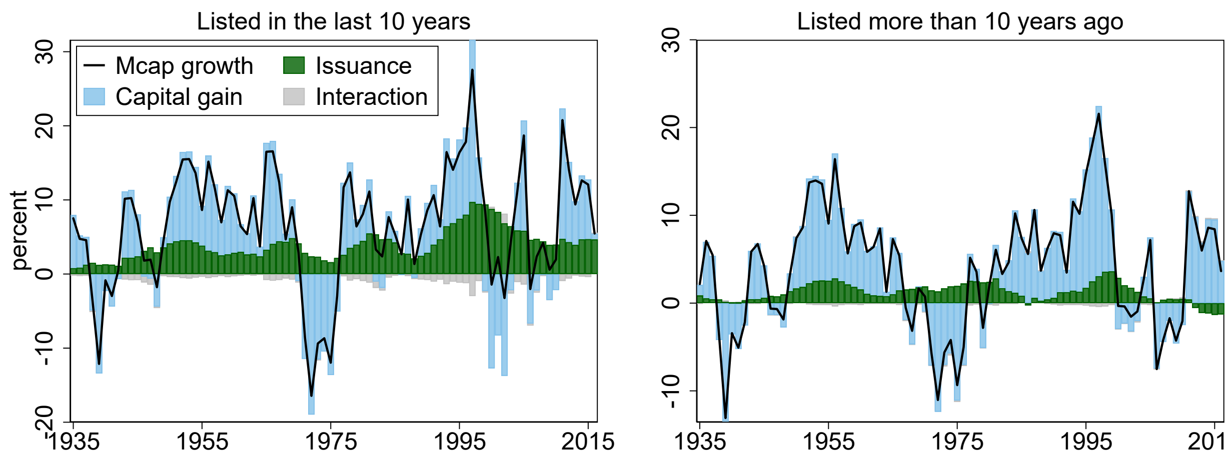
Decomposition of real market cap growth into real capital gains and net issuance relative to previous year's market cap. Centered 5-year moving averages. The Portuguese market cap growth and its components for 1975 capture the whole Carnation revolution period during which the market was closed (1975–1977) – using non-log growth rates for this period given the very large market decline – and the averages for other years exclude the revolution period.

Table B.1: *Average market cap growth of newly listed and other firms in the US*

	Pre 1985			Post 1985			Difference
	(1) New Listings	(2) Old Listings	(3) Difference (1) - (2)	(4) New Listings	(5) Old Listings	(6) Difference (4) - (5)	(7) Pre vs post (6) - (3)
Market cap growth ≈	5.03	3.01	2.02	9.23	6.25	2.98	0.96
Seasoned issuance	3.09	1.42	1.67***	5.44	0.92	4.52***	2.85***
+ Capital gains	2.52	1.76	0.76	4.25	5.52	-1.26	-2.03
+ Interaction	-0.41	-0.09	-0.32*	-0.55	-0.07	-0.48	-0.16
Observations	50	50		32	32		

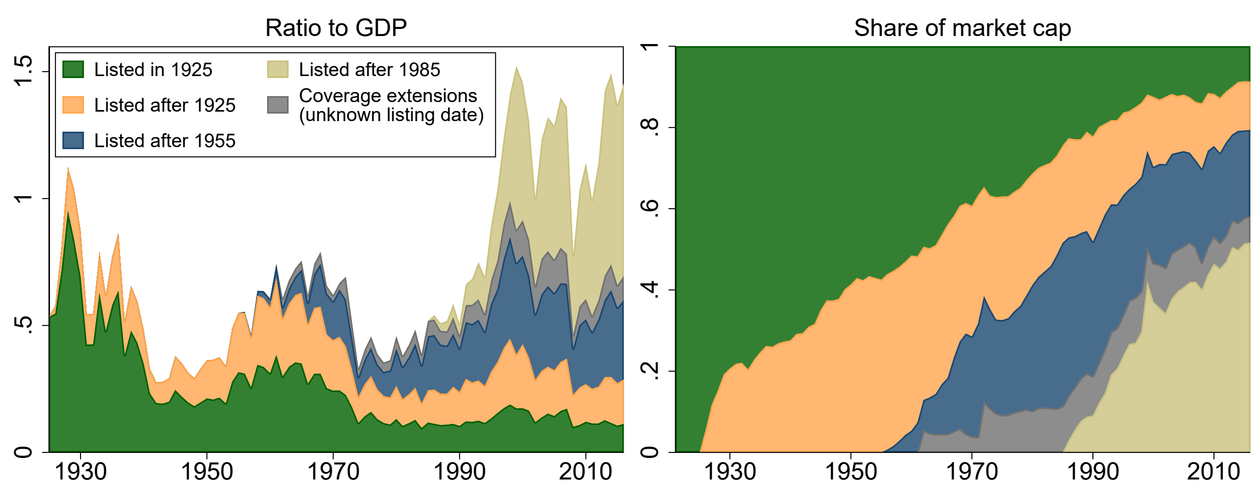
CRSP microdata collapsed to value-weighted annual observations (e.g. new listing market cap growth is the sum of the market cap of all newly listed firms in year t relative to market cap of the same firms at $t-1$, net of inflation). New listings are firms which are newly listed within the last 10 years, old listings are all other firms. *, **, ***: Significant at 10%, 5% and 1% levels respectively.

Figure B.6: *Market cap growth and its components, US newly listed vs other firms*



Data for the US sourced from CRSP and aggregated across individual firms. New listings are firms which are newly listed within the last 10 years, old listings are all other firms.

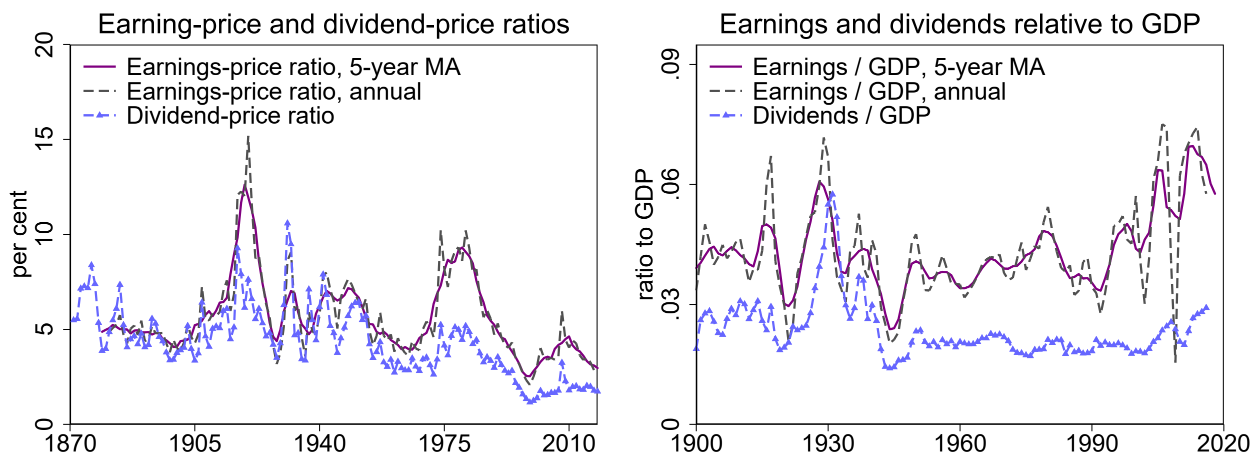
Figure B.7: *US market capitalization by listing date*



Market capitalization of firms listed on or before the specific date, as a share of GDP (left panel) – with aggregate CRSP capitalization scaled up to match our US total – and as share of total market cap (right panel).

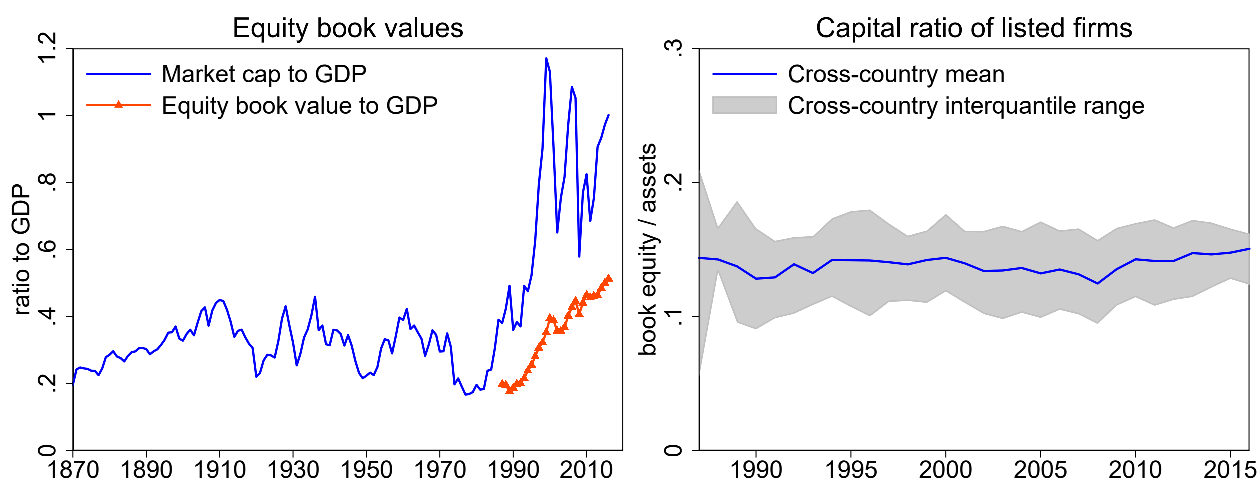
C. Drivers of the post-1980s market expansion: additional material

Figure C.1: *Earnings and dividends of listed firms in the US*



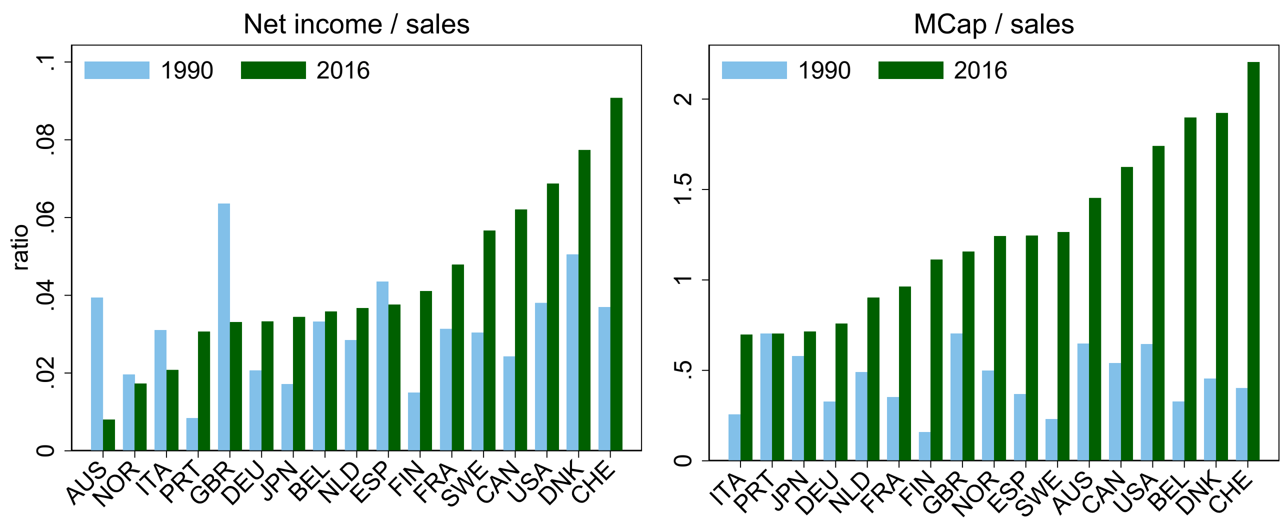
Left-hand panel: dividend-price ratio and the cyclically adjusted total return earnings-price ratio (inverse of P/E10 CAPE) from Shiller (2015), December values. Right-hand panel: earnings to GDP calculated as market cap to GDP times the earnings-price ratio.

Figure C.2: *Book equity values and firm leverage*



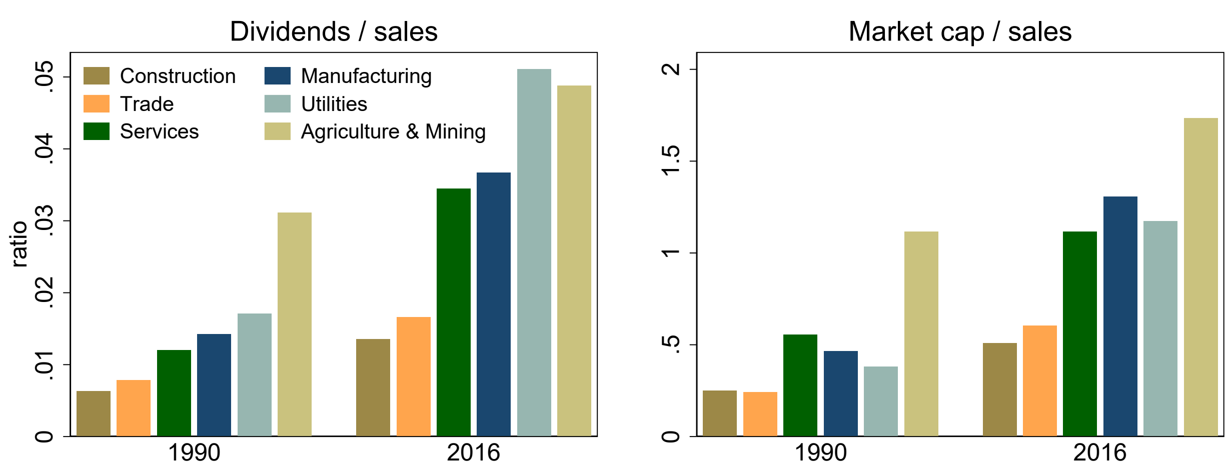
Left-hand panel: market and book value of listed firm equity, unweighted average of 17 countries. Right-hand panel: capital ratio of listed firms. The capital ratio is calculated by dividing book equity by total assets. Book equity and total assets data are aggregated up from Compustat Global and Compustat North America and cover all listed firms with non-missing values for market cap, dividends and earnings, scaled up to match our aggregate market cap data where necessary. We drop country-year observations at the beginning of the sample with less than than 30% of market cap covered. The data include both financial and non-financial firms. To arrive at the country-level mean, firm-level observations are weighted by total assets.

Figure C.3: *Alternative listed firm profitability measures in 1990 and 2016*



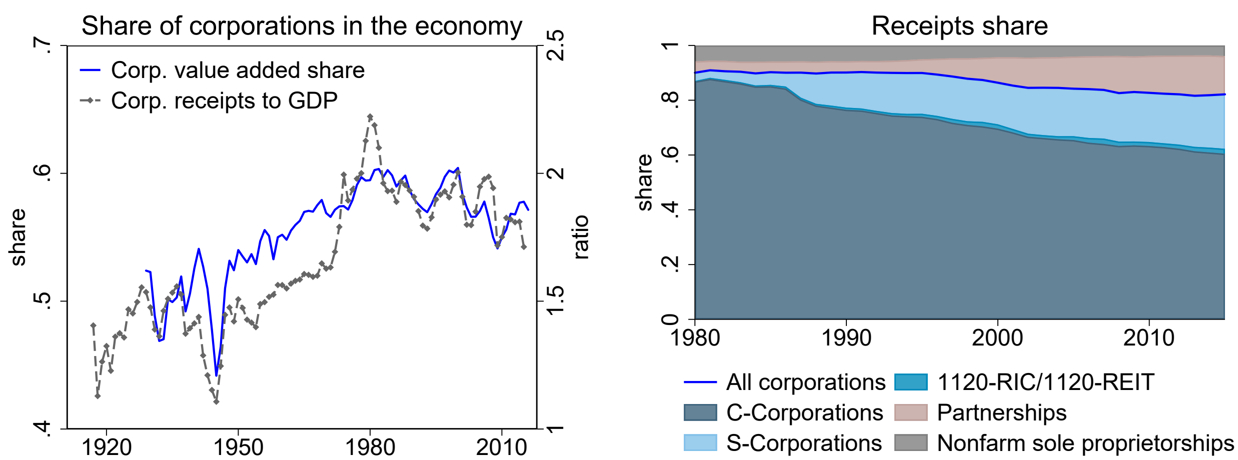
The figure shows sales-weighted profit (net income) per unit of sales and market cap per unit of sales in 1990 and 2016, computed from firm level data in Compustat Global and Compustat North America. The Compustat coverage in Italy, Portugal, Spain and Sweden is still low in 1990, meaning that the 1990 figures for these countries should be interpreted with caution. For Portugal, we use 1994 data instead of 1990 as it is the first year with meaningful coverage.

Figure C.4: *Changes in profitability of listed firms in different sectors*



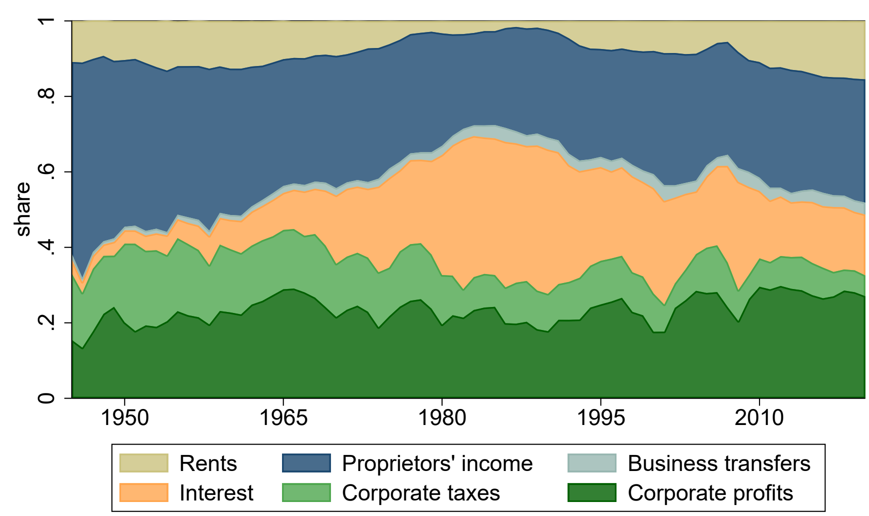
The figure shows the ratio of dividends to sales and market cap to sales across different economic sectors in 1990 and 2016. Sectors are sorted by the dividend to sales ratio in 1990. Compustat firm level data are aggregated to the sector level using SIC industry codes and sales weights in each country. Bars show the median level across the 17 countries.

Figure C.5: *Market shares by form of business in the United States*



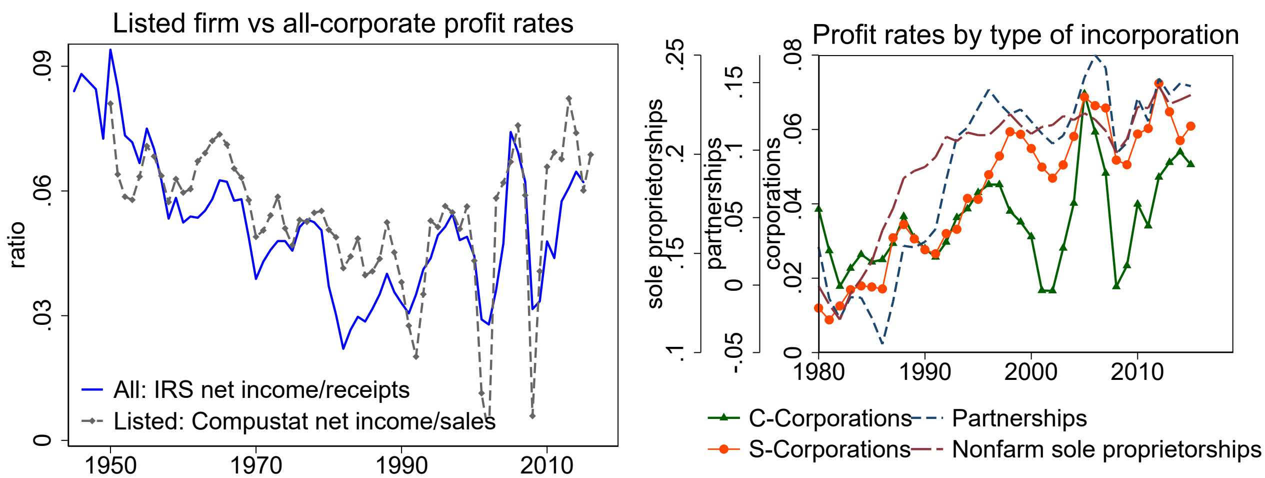
Left-hand panel shows the value added share of corporations (left axis) and the ratio of corporate receipts to GDP (right axis). Right-hand panel shows total receipt shares by form of business in the United States. Corporate value added data come from the BEA. Receipts data are from the IRS Statistics of Income.

Figure C.6: *Capital income decomposition in the US*



Capital income components are sourced from the BEA NIPA Table 1.10.

Figure C.7: *Profitability of listed firms relative to other business types in the United States*



The left-hand panel compares the profit rate of listed corporations to all corporations. The blue solid line shows the ratio of after-tax net income to total receipts by all corporations in the United States. Data come from IRS Statistics of Income Reports. The grey dashed line (diamonds) shows the net income per unit of sales of listed firms in CRSP-Compustat Merged database. The right-hand panel shows the ratio of net income to total receipts. The table uses different scales for each business type to abstract from level differences due to the differential treatment of capital and labor income in partnerships and sole proprietorships. Data are from the IRS and cover years 1980-2015.

Data appendix

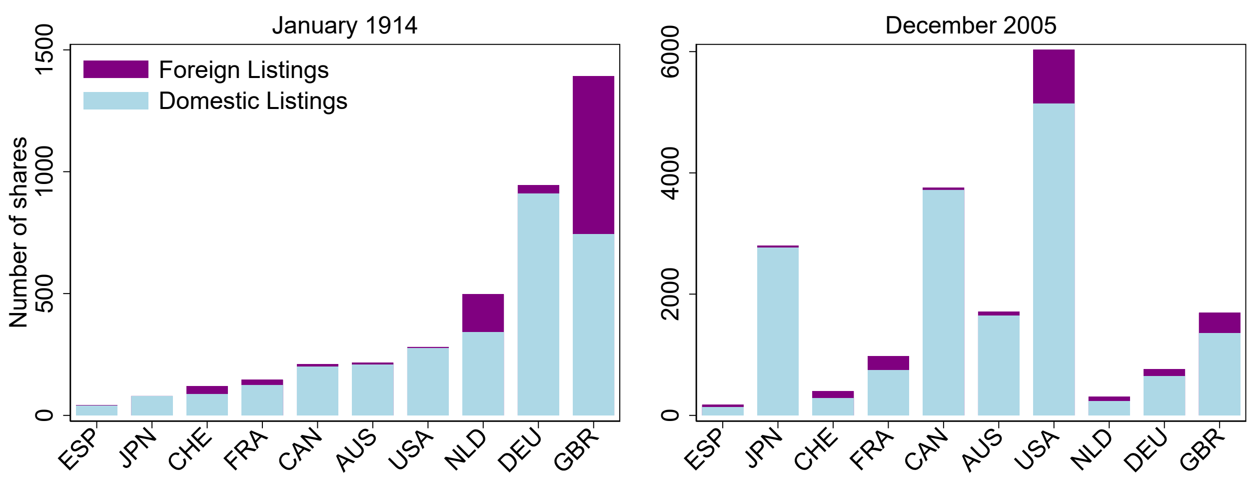
This section details the sources for our stock market data, and discusses potential data quality issues alongside a comparison to alternative estimates of stock market capitalization. Section D starts with analysis of the impact of two important definitional concepts on our data: excluding foreign listings, and the impact of the switch from buybacks to dividends on our market capitalization growth decomposition. Section E then details the data sources for each country and compares them to other existing estimates.

D. Further data quality checks

D.1 Foreign listings

Companies in countries with smaller or less developed capital markets may choose to raise funds in a global financial centre rather than the home country. This means that our domestic market capitalization figures may underestimate the size of listed equity finance for those smaller countries, and underestimate the market share of financial centres in global market cap. To see how much of an issue this might pose, Figure D.1 compares the number of foreign and domestic listed shares across the major exchanges in our dataset at two benchmark years: the pre-WW I market peak in 1913, and the post-big-bang peak in the 2000s, compiled using using data in Moore (2010b), Campbell, Grossman, and Turner (2021) and reports of the *World Federation of Exchanges*. Foreign listings are relatively unimportant for the vast majority of stock exchanges including those in a number of large economies with deep financial markets such as the US, Germany and France.[14] The big exception

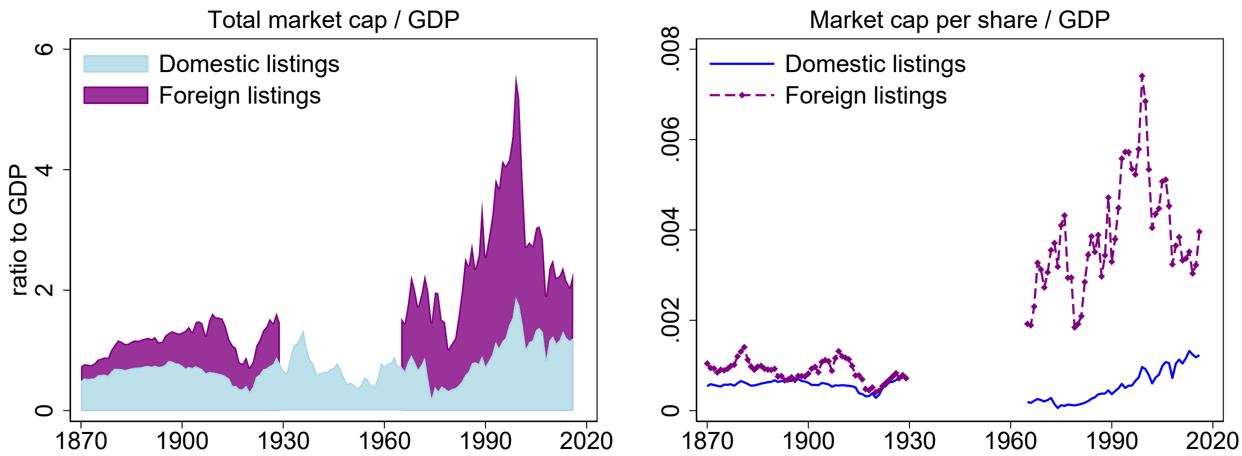
Figure D.1: *Foreign and domestic listings*



Number of listed shares issued by companies domiciled in the home country and abroad. If one firm issues multiple shares, these are all counted as separate listings. Data for 1914 are from Campbell et al. (2021) for the UK and Moore (2010b) for other countries, and cover the main stock exchange (e.g. NYSE) only. Data for 2005 are from reports of the *World Federation of Exchanges* and cover all major stock exchanges, with additional data used to attribute the relevant Euronext listings to Netherlands, Spain and France.

[14] Coincidentally, the same is not true for government bond markets: for example, Moore (2010b) shows that in January 1914, out of the 171 government bonds listed on the Amsterdam stock exchange 168 were those of foreign countries.

Figure D.2: *Foreign and domestic market capitalization in the UK*



Market cap per share to GDP (right-hand panel) is calculated as total market capitalization divided by the number of shares and divided again by GDP. Data from Campbell et al. (2021) for the pre-1930 period (both foreign and domestic listings are scaled up to match the Moore (2010b) aggregate, see Appendix C and Figure E.16 for more detail), and from the statistical reports and historical statistics of the *London Stock Exchange* for the post-1970 period.

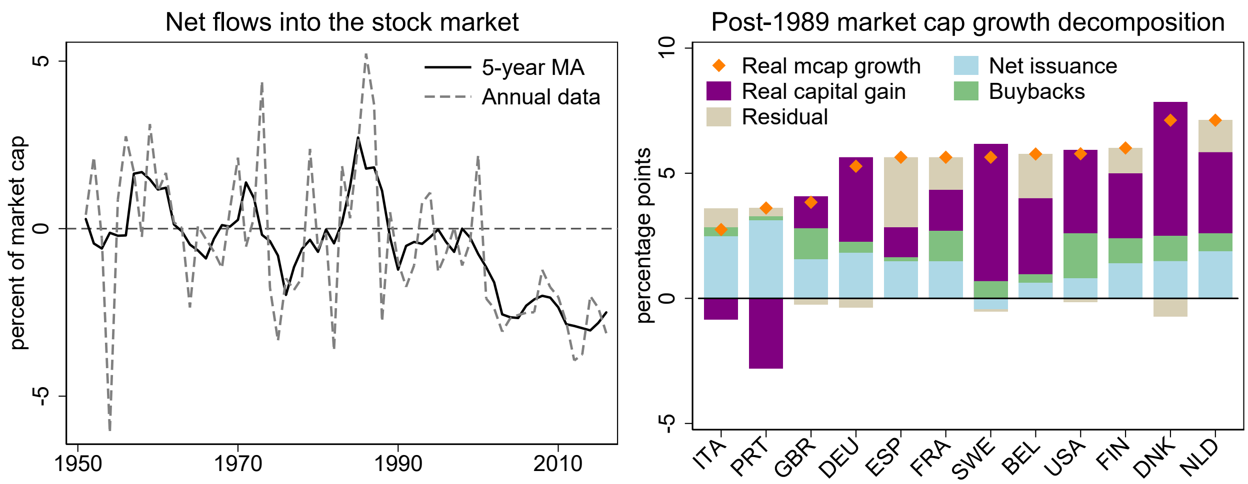
is the pre World War I London stock exchange, where almost half of listed shares were issued by foreign companies.

Figure D.2 looks at the long-run trends in the market capitalization of foreign equity listed in London in more detail, and shows that the capitalization of foreign companies is comparable to that of UK companies in both the early 20th century and mid to late 20th century, even exceeding the domestic market capitalization during the big bang. But whereas foreign companies listing in London during the pre World War I era of the first financial globalisation were relatively small, companies which list in London today are relatively large, with the average market capitalization of a foreign share 3–10 times that of an average British share. While historically these smaller foreign companies may have used the London stock exchange as their only source of equity finance, the foreign stocks listed on the LSE today belong to large companies which are likely to be also listed on their corresponding domestic exchanges. Altogether, this evidence suggests that the global market capitalization shares in Figure 4 understate the importance of London as a global financial center, particularly in the early 20th century.

D.2 Buybacks

Recent decades saw an increasing use of share buybacks as means of shareholder compensation in the US (Grullon and Michaely, 2002). Even though the use of buybacks outside of the US was limited during the 1980s and early 1990s, thereafter this method of compensating shareholders has also grown in importance in other countries (Megginson and Von Eije, 2008). From the perspective of the shareholder, the switch from dividends to buybacks is relatively neutral (tax advantages and disadvantages aside): they either get cash as dividend or in the form of a company-funded share repurchase scheme. But from the perspective of the market cap growth decomposition, this switch is not neutral: whereas dividend payments reduce the share price, buybacks reduce net issuance. It is therefore important to ascertain the role of this switch in shareholder compensation in driving the

Figure D.3: *The impact of buybacks on market cap growth decomposition*



Left-hand panel: net flows into the stock market is net issuance minus dividends paid by listed firms, relative to previous year's market cap; unweighted average of the 17 countries in our sample. Right-hand panel: averages of log growth rates for each country after 1989. We subtract buybacks (relative to previous year's market cap) from capital gains and leave net issuance the same as in our baseline decomposition. Buyback data for the US are from Boudoukh et al. (2007) and Zeng and Luk (2020). Buybacks for EU countries are from Megginson and Von Eije (2008), scaled up based on the ratio of dividends in the Megginson and Von Eije (2008) sample to total dividends paid in our sample. Since the Megginson and Von Eije (2008) data stop in 2005, European data after 2005 are a scaled version of the US data.

post-1980s net issuance slowdown documented in Figures 7 and B.2.

We do this in two ways. First, we calculate a measure of net capital flows into the stock market that – unlike net issuance – is unaffected by the switch from dividends to buybacks. This measure is the negative of the net payout yield in Boudoukh, Michaely, Richardson, and Roberts (2007), and is calculated as net issuance minus the dividend yield. It measures the net inflow of funds into the equity market: the amount of funds committed to new issuance minus the funds distributed in the form of dividends. The switch from dividends to buybacks has no effect on this broader measure, merely reducing one of its subcomponents at the expense of another. The left-hand panel of Figure D.3 shows the time trend in the net flows into the equity market after 1950, using simple unweighted cross-country averages. One can see that like net equity issuance, net flows of funds into the equity market declined materially over recent decades. This means that even according to this broader measure, the amount of funds raised through the stock market has decreased at the time that market cap growth accelerated rapidly.

Another way of assessing the impact of buybacks on our trends is to calculate the buyback yield – the ratio of stock buybacks to previous year's market cap and subtract it from the capital gain, identifying this as the third component of the market cap growth decomposition For the US, we use the buyback yield data from Boudoukh et al. (2007) which is calculated as the change in Treasury holdings in Compustat data – to proxy for buyback cashflows not earmarked for employee compensation – and switch to S & P data after 2007, with the S & P data scaled down slightly to match the series in Boudoukh et al. (2007) for overlapping years (since the S & P series likely include preference share buybacks and cashflows from employee compensation schemes). For the EU, we use the buyback estimates in Megginson and Von Eije (2008). However, the data in Megginson and Von Eije (2008) only include industrial companies and may therefore underestimate total buybacks, therefore we scale them up based on the ratio of total dividends paid across all countries in the Megginson and Von Eije (2008) sample to dividends paid for these countries in our data at benchmark years, resulting in a scaling up by a factor close to 2. We do not scale up the data for Finland since this would result in buyback yields similar or greater than those in the US, which given the limited use of buybacks in this country (see, for example Högholm and Högholm, 2017) appears unrealistic. Since the Megginson and Von Eije (2008) data cover the years 1989 to 2005, after 2005 we assume that the buybacks in each country evolve proportionately to the US, using the period 2000–2005 to compute the ratio by which to adjust the US buyback data.

The right-hand panel of Figure D.3 shows that buybacks accounted for close to 2% of market cap growth in the US, and between 0.5% and 1% of market cap growth in most other countries. Removing buybacks from capital gains and adding them to equity issuance – a possible counterfactual evolution of the growth components had the switch from dividends to buybacks not occurred – would have reduced the contribution of capital gains and increased the contribution of issuance to the big bang, but the general patterns of the issuance slowdown and the historically high and persistent capital gains would have remained in place.

E. Country-level data sources

This section details the sources for our estimates of market capitalization, net equity issuance and new listings data, and compares our market capitalization estimates to alternatives in existing literature. These alternative estimates are country specific, but we always compare our data to those of Goldsmith (1985) (sourced from La Porta et al., 2008) and Rajan and Zingales (2003) when available. Unless otherwise stated, all the annual market capitalization estimates reflect end-of-year values, while issuance and new listings cover the entire calendar year.

Australia

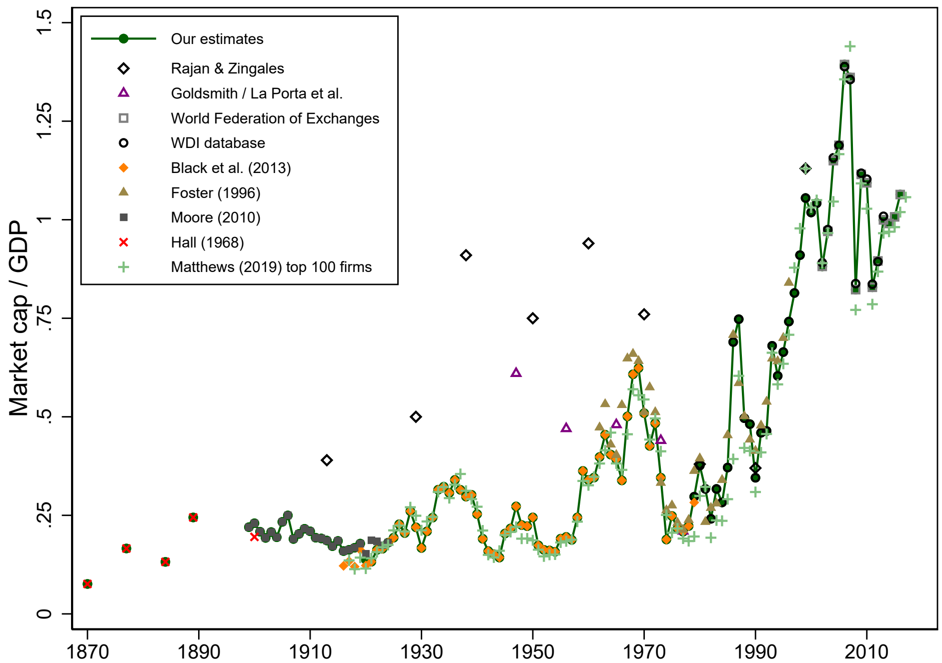
Table E.1: *Data sources: Australia*

Year	Data source
Stock market capitalization:	
1870–1889	Total capitalization of the Melbourne Stock Exchange, from Hall (1968)
1899–1924	Total capitalization of the Sydney Stock Exchange, from Moore (2010b). Converted to AUD using the exchange rates in Jordà et al. (2016).
1925–1978	Total capitalization of the Sydney Stock Exchange, from Black, Kirkwood, Williams, and Rai (2013).
1979–2013	Total capitalization of all Australian listed firms, shares listed on Australian exchanges. Source: World Bank *WDI database*. Almost identical to the Sydney cap in the 1970s; spliced with Black et al. (2013) data in 1979.
2014–2016	Total capitalization of all Australian listed firms, shares on Australian exchanges. Source: World Federation of Exchanges (WFE) *Statistical Reports*, various years.
Net equity issuance:	
1989–2016	Net flows of listed equity shares, all sectors, from the Australian Bureau of Statistics National Accounts: Finance and Wealth, Table 48.

Table E.1 documents the sources of our data for Australia, and Figure E.1 plots the resulting market capitalization series alongside alternative existing estimates. The Australian securities market has generally been dominated by two major stock exchanges, located in Sydney and Melbourne. Hall (1968) argued that the Melbourne stock exchange was dominant in the late 19th century, largely because of large capitalizations of stocks of mining companies, and the data in Black et al. (2013) and Lamberton (1958) suggest that the Sydney stock exchange became dominant in the early 20th century. Based on this, we use the Hall (1968) estimates of the Melbourne stock market capitalization for the 19th century data, and switch to the Sydney exchange in the 20th century, using estimates of Moore (2010b) and Black et al. (2013), which are also consistent with the RBA Historical Statistics data in Foster (1996) and the Mathews (2019) estimates of the capitalization of the top 100 firms on the Sydney stock exchange. From the 1970s onwards we switch to the total Australian firm capitalization estimates provided by the *World Federation of Exchanges* reports and the World Bank *WDI database*.

The main potential bias in the data for Australia comes from two sources: the fact that until the 1970s, we only have data for either the Sydney or the Melbourne exchange, not both; and the fact that these data include both foreign and domestic companies (again, up to the 1970s). These two biases

Figure E.1: *Australia: alternative stock market cap estimates*



do, however, largely seem to balance each other out: the total Australian exchange capitalization in the 1970s is very similar to that of the Sydney stock exchange, and Lamberton (1958) indicates that the Sydney stock exchange became the most important center for financial activity much earlier. Therefore we do not make any further adjustments to the early Australian data, which focus mostly on the Sydeny exchange, including both domestic and foreign companies.[15]

Our approach of focussing on the Melbourne cap in the late 19th century, and the Sydney cap in the 20th century is in line with that of Rajan and Zingales (2003). As Figure E.1 shows, however, our estimates of market capitalization are somewhat below those of both Rajan and Zingales (2003) and Goldsmith (1985), largely due to better available up-to-date statistics, for example from Black et al. (2013) and Moore (2010b).

We are grateful to the Reserve Bank of Australia, Anna Nietschke and Thomas Matthews for sharing data and providing helpful comments.

[15] As a side note, adding up the Hall (1968) and Moore (2010b) estimates for 1899 would grossly overestimate the total cap of Australian firms because it does not adjust for cross-listings.

Belgium

Table E.2: *Data sources: Belgium*

Year	Data source
Stock market capitalization:	
1870–2002	Total capitalization of all Belgian companies on the Brussels Stock exchange, SCOB Database. Data shared by Frans Buelens. See Annaert, Buelens, and De Ceuster (2012) for details.
2003–2016	Market capitalization of all Belgian companies listed in Belgium, from the *ECB Statistical Data Warehouse*, Security issues statistics.
Net equity issuance:	
1990–2016	Net equity issuance by all Belgian companies listed in Belgium, from the *ECB Statistical Data Warehouse*, Security issues statistics.

Figure E.2: *Belgium: alternative stock market cap estimates*

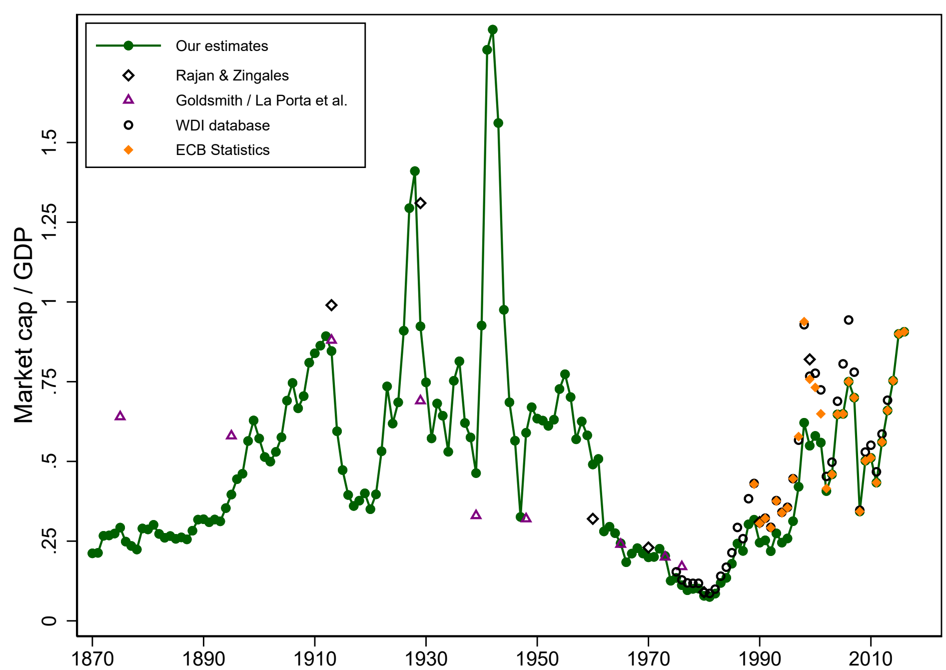


Table E.2 documents the sources of our data for Belgium, and Figure E.2 plots the resulting market capitalization series alongside alternative existing estimates. The historical data cover the Brussels stock exchange, which was the dominant stock exchange throughout the data coverage period in our paper, and are sourced from the security-level SCOB database (see Annaert et al., 2012, for the description). These data cover all companies with main economic activities in Belgium, that are listed on the Brussels stock exchange. Unlike other existing estimates, the capitalization is aggregated up from security-level data for each year, and does not rely on estimation or extrapolation. For the modern period, the SCOB estimates are similar to other commonly used sources such as the *WDI* database and the *ECB Statistical Data Warehouse* data. We use the ECB statistics for the modern period to ensure consistency with the net issuance and capital gains series in our database.

We are grateful to Frans Buelens for sharing the SCOB market capitalization data with us.

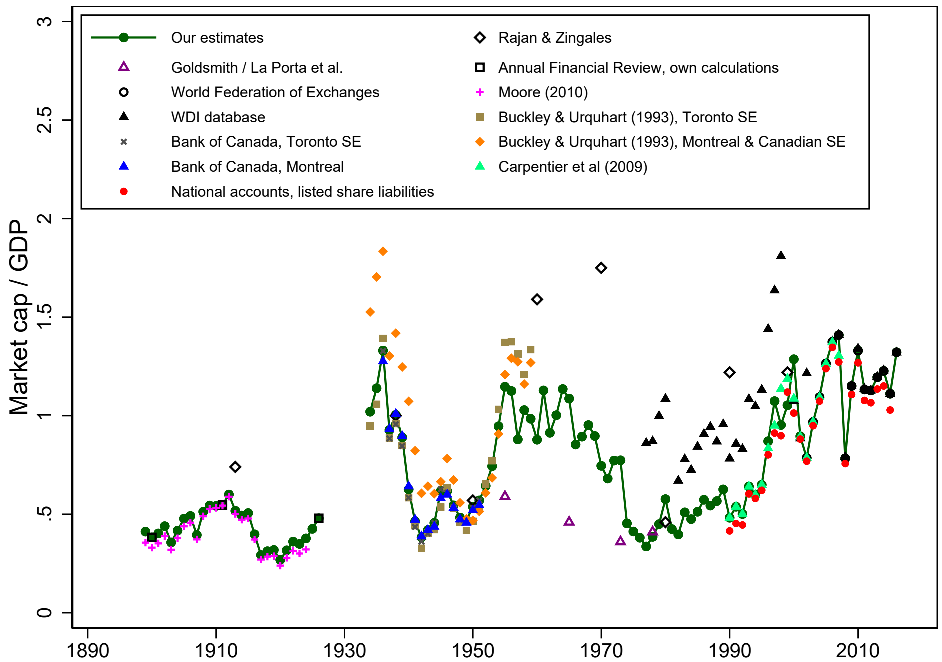
Canada

Table E.3: *Data sources: Canada*

Year	Data source
Stock market capitalization:	
1899–1926	Capitalization of all Canadian firms listed on foreign exchanges. Baseline data from Moore (2010b), scaled up using own calculations from microdata in the *Annual Financial Review* in years 1900, 1911 and 1926. The scaling accounts for firms missing from the listings in Moore (2010b) data, and exclusion of foreign firms. Market cap growth for 1924–1926 estimated using the change in the share price index and assumed net issuance of 1.2% of market cap (the average of observed issuance for 1937–2016, using data from the Bank of Canada *Statistical Summaries* (*Financial Supplement*, years 1964–1969) and *Banking and Financial Statistics* database.
1934–1953	Combined capitalization of the Toronto, Montreal and Canadian Stock Exchanges from Buckley and Urquhart (1993), scaled down to exclude cross-listings, foreign shares and preference shares, using the data on these scaling factors from our benchmark estimates based on data from the *Annual Financial Review*. The scaling factor is close to 2 (a halving of the gross series).
1954–1989	1990 capitalization extrapolated back using growth in share prices and net issuance of ordinary shares.
1990–1996	Total capitalization of all Canadian firms listed in Canada, adjusted for cross-listings, from Carpentier, L'Her, and Suret (2009).
1997–2001	2002 capitalization extrapolated back using using growth in share prices and net issuance of ordinary shares.
2002–2016	Total capitalization of all Canadian listed firms, shares listed on all Canadian exchanges, adjusted for cross-listings, from the World Federation of Exchanges (WFE) *Statistical Reports*, various years
Net equity issuance:	
1945–1969	Net issuance of ordinary shares from the Bank of Canada *Statistical Summaries*.
1970–1974	Net equity issuance (listed and unlisted) from the *OECD Financial Statistics*, sourced from Richter and Diebold (2021), scaled down using the ratio of listed to total equity issuance for the 1990s.
1975–2016	Net equity issuance of common stocks from the Bank of Canada statistics series V111900717 (for overlapping years, the data are very close to the issuance of listed shares from the *OECD Financial Statistics*).

Table E.3 documents the sources of our data for Canada, and Figure E.3 plots the resulting market capitalization series alongside alternative existing estimates. Constructing historical market capitalization estimates is especially challenging in the case of Canada, for several reasons. First, throughout the whole of our sample period, Canada has operated at least two large and active stock exchanges, in Toronto and Montreal. The capitalizations of these two exchanges have tended to quite similar, with Montreal slightly larger in the early historical period, and Toronto – in the latter. Many available statistics provide the gross total value of securities listed on each exchange. But most large companies were listed on both of these stock exchanges, which makes adjusting gross estimates for cross-listings especially important. Even in the modern data, including the estimates of Rajan

Figure E.3: *Canada: alternative stock market cap estimates*



and Zingales (2003) and the World Federation of Exchanges, the total Canadian capitalization was not adjusted for cross listings until year 2002, such that the totals often double-counted the shares of large cross-listed firms (Carpentier, L'Her, and Suret, 2009). Second, the Canadian industry and financial markets were internationally integrated with the US and UK due to geographical proximity and colonial-era ties. This makes the exclusion of foreign listings from calculations important. Further, a few Canadian firms were only listed on US exchanges or in London, meaning that they should be excluded from our data. Third, many statistics group together all "stocks" issued by Canadian firms, which include both ordinary and preference shares, whereas we want to capture ordinary shares only.

These measurement issues have created considerable variation across existing estimates of Canadian market cap. Carpentier, L'Her, and Suret (2009) argue that total market capitalization can be overstated by a factor of three even in some modern data sources, on the account of not fully netting the cross-listings. In historical data, the sources underlying the estimates of Rajan and Zingales (2003) (RZ) include Toronto only, Montreal only, and an unadjusted sum of the two at different dates. This results in market cap variation that is difficult to square with movements in capital gains or issuance: for example, between 1970 and 1980, the RZ estimate of the market cap to GDP ratio fell by a factor of four while the Goldsmith (1985) (GS) estimate increased between 1973 and 1978. At the same time, stock prices increased and issuance remained stable. Going further back in time, the direct market cap estimates for the 1930–1970 period, published by RZ, Buckley and Urquhart (1993) (BU) and the Bank of Canada *Statistical Summaries* Estimates are several times larger than those of GS. Conceptually, it is the GS estimate that should be larger because it includes unlisted as well as listed equity wealth. These differences largely come about because many of the official estimates do not net out cross-listed securities between Montreal and Toronto, and often include foreign firms and preference shares. For example, adding up the BU estimates of the Toronto and Montreal capitalization in the 1930s results in a market cap to GDP ratio of 400% right in the aftermath of the Great Depression.

To help deal with these issues, we rely on benchmarking and use of capital gains and net issuance data to ensure consistency. The benchmarks are constructed using the microdata on individual companies in the *Annual Financial Review* publication for years 1901, 1912 and 1927.[16] Because the *Annual Financial Review* only has each company enter once, this effectively adjusts for any cross listings. In addition, these data contain information on company headquarters and operations, as well as which exchanges the firm is listed on, allowing us to control for factors such as foreign ownership. For the purpose of this calculation, we include firms incorporated and governed from Canada, but with operations overseas, such as the various Mexican tramway companies which appear in the 1911 listing, but this has little bearing on our results. Net issuance data come from the various publications of the Bank of Canada and the *OECD Financial Statistics* (a cross-country equivalent of the flow of funds), sourced from Richter and Diebold (2021).

For both the early 20th century, and the recent decades, we are able to calculate the total capitalization of Canadian listed firms, with all the necessary adjustments, with a high degree of accuracy. The baseline data for the early series come from Moore (2010b), who uses stock listings data to compute the total cross-listings-adjusted capitalization of the Toronto and Montreal stock exchanges. Nonetheless, these data include foreign firms, and might not include securities of smaller companies or those listed on unofficial or curb exchanges. To account for this, we benchmark the Moore (2010b) data to our own benchmark-year estimates from the *Annual Financial Review*.

Given that the Moore (2010b) estimates for the 1920s are so far below those of BU and Bank of Canada *Statistical Summaries* in the 1930s, and the fact that stock price appreciation between late 1920s and early 1930s in Canada was very small due to the Great Depression, we construct our own estimates for the early period which enable us to benchmark the Moore (2010b) data. The benchmark estimates are close to the data from Moore (2010b) (see Figure E.3): around 15–20% higher for 1900 and 1926, and similar in size for 1911, due to a high number of foreign companies on the market during that year, which we adjust out but Moore (2010b) does not. Based on this, we scale up the Moore (2010b) data slightly to match the adjusted total, and bridge the 1924–1926 gap by using share price appreciation for those years, and an assumed net issuance that equals the long-run average in Canadian data.

For the recent period, the World Federation of Exchanges provide statistics which measure the adjusted total capitalization of all Canadian firms listed in Canada for years 2002–2016. Previous years' estimates from this source include some double-counting, so we do not use them. Instead, we extrapolate the 2002 WFE estimate back using data on capital gains and net issuance (published by the Bank of Canada, but the series are also close to the *OECD Financial Statistics* flow of funds estimates), and combine them with the series that adjusts from cross-listings from Carpentier et al. (2009).[17] The 1990 estimate from Carpentier et al. (2009) is roughly one-third of the unadjusted sum of the capitalization of all shares on all Canadian exchanges, which illustrates the importance of dealing with these double counting issues. Our estimates match up nicely with the national balance sheet estimates for the market value of listed equity liabilities of Canadian firms (Figure E.3, red diamonds), available from the national accounts data in the *CANSIM* database of the Bank of Canada.

We have several sources available to us for the period from 1934 to 1989: the estimates from the World Bank's *WDI Database* for the period 1975–2016, historical statistics data for 1934–1959 from BU, the estimates by the Bank of Canada in their *Statistical Summaries*, which are the underlying

[16] Capitalization data refer to the end of each respective previous calendar year, i.e. end-1900, end-1911 and end-1926.

[17] When extrapolating back using net issuance, we inflate the net issuance data by half the capital gain during the year to proxy the within-year capital appreciation of newly issued stocks.

source of the BU data, as well as the computations of RZ and GS. We also have data on net equity issuance which cover the period 1937–2016, and national balance sheet estimates of the total equity value of listed and unlisted Canadian firms. Some of these sources are, however, likely to contain a lot of measurement error. The *WDI Database* estimates before 2002 are highly noisy and, according to Carpentier et al. (2009), their underlying source – the WFE database – double- or triple-counts cross-listed securities for this period. The estimates of RZ change their exchange coverage over time and are also often gross of cross-listings, while the underlying definitions of the GS data are uncertain. As seen from Figure E.3, the data for all three of these sources are also rather noisy. Based on this, we decide not to use the WDI, RZ and GS data, and restrict ourselves to the estimates of BU, Bank of Canada, share prices and net issuance.

For the period 1954–1989, we extrapolate back the market capitalization value of 1990 using data on capital gains and net issuance. The trend is similar to that obtainable from the WDI data during the 1970s and 1980s, when the growth trend in the WDI data seems reasonably accurate, and definition of the series – consistent from year to year. This gives us confidence that our data track the underlying evolution of adjusted Canadian stock market cap during this time period. For the period before the 1970s, the growth in the series is generally similar to that of the Montreal- and Toronto-only series from the Bank of Canada *Statistical Summaries*. For the period before 1953, we use an adjusted version of the BU data. We use our *Annual National Review* benchmarks to scale down the series to account for cross-listings, and exclude foreign firms and preference shares. This adjusts the BU series down by a factor of roughly two. The value of the scaled-down series in 1954 is very similar to our main series based on net issuance and capital gains extrapolation, which is why we make the switch to the scaled BU series in year 1953.

Taken together, our estimates for Canada should go some way towards resolving the considerable uncertainty resulting from the wide range of existing estimates in Figure E.3. That being said, the severity of the potential measurement issues for Canada mean that, especially for the mid 20th century period, the series are likely to contain some measurement error.

Denmark

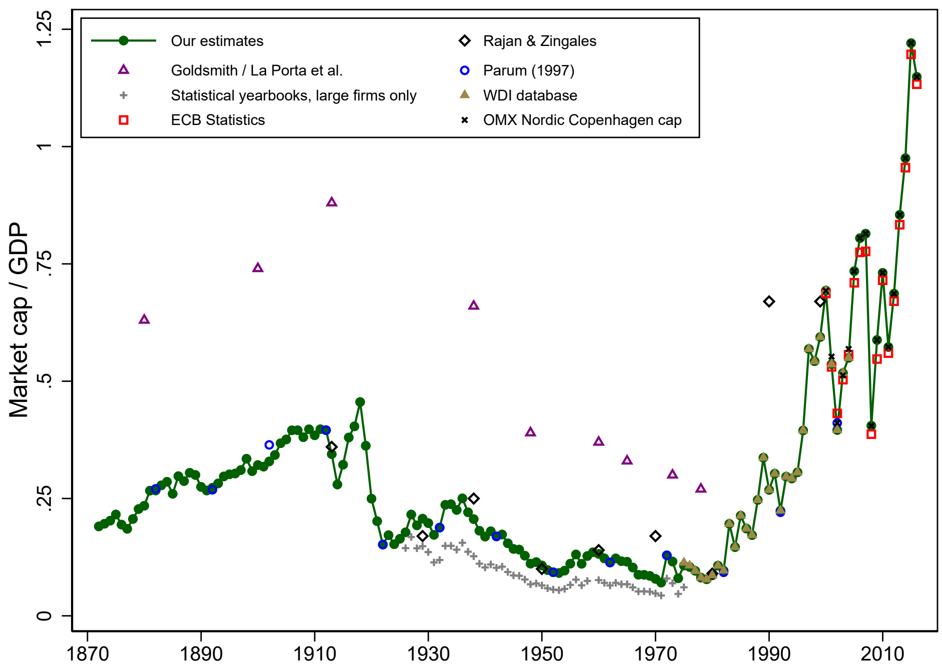
Table E.4: *Data sources: Denmark*

Year	Data source
Stock market capitalization:	
1872–1899	Total market cap of all Danish firms listed in Denmark, aggregated up from individual firms' capitalization in the Green's *Dankse Fonds of Aktier* yearbooks, various years. Ordinary shares only.
1900–1925	Total market cap of all Danish firms listed in Denmark, computed as previous years' market cap * the total book cap of listed firms * market-to-book ratio of listed firms, benchmarked to Parum (1997)'s decennial market cap estimates. Book cap of listed firms estimated as book cap of all firms from Hansen and Svendsen (1968) and *Statistical yearbooks* (various years), times share of listed firms estimates from own data in 1899 and Erichsen (1902). Parum's decennial estimates sourced from Abildgren (2006).
1926–1975	Market capitalization of large listed Danish firms, scaled up to match capitalization of all firms at decennial benchmarks. Data for all firms from Parum (1997). Data for large firms are from the listings in the *Statistical yearbooks*, various years, and contain 50–60 firms for each year.
1975–2004	Total capitalization of all Danish listed firms, shares listed on Danish exchanges, from World Bank's *WDI database*. Spliced with the scaled-up capitalization of largest firms over the years 1975–1977 (the two series are very similar).
2005–2016	Total capitalization of ordinary shares on the Copenhagen stock exchange, sourced from the OMX Nordic *Yearly Nordic Statistics*.
Net equity issuance:	
2003–2016	Net equity issuance by listed firms from the *OECD Financial Statistics*, sourced from Richter and Diebold (2021).

Table E.4 documents the sources of our data for Denmark, and Figure E.4 plots the resulting market capitalization series alongside alternative existing estimates. Long-run estimates of the total capitalization of Danish firms for the period 1882–2002 are available from Parum (1997) and Abildgren (2006). However, these data are computed at decennial frequency only. To fill the gaps, we construct our own estimates of the total stock market capitalization of ordinary shared of listed Danish firms for each year between 1872 and 1899 using statistics on individual firms' share prices and book capital in Green's *Dankse Fonds of Aktier*. Green's yearbooks contain data on all Danish listed firms at annual frequency.

For years 1900–1925, we combine benchmark year estimates from our own microdata and Parum (1997) with statistics on share prices and book capital of listed firms. We estimate listed firms' book capital using data on total capital of all firms, available in Hansen and Svendsen (1968) up to 1914 and yearly editions of the *Statistical Yearbooks* thereafter, and estimates of the proportion of firms listed in Erichsen (1902), as well as those computed by comparing the total book capital estimates with data on share prices and market cap at benchmark years. We compute the annual change in market capitalization as the change in total book capital of all firms, times the change in the share of firms listed, times the capital appreciation in the share price index (for 1900–1914, we also compute

Figure E.4: *Denmark: alternative stock market cap estimates*



the actual market-to-book of listed firms, and use that instead, but the estimation gives us similar numbers to using the share index). We then adjust the growth rates of capitalization in each year to match the data at benchmark dates. The main adjustment concerns the period 1915–1922, during which the book capital of all firms nearly doubled while the book capital of listed firms remained flat, presumably following sharp delistings during the banking crisis of the early 1920s. The trend in the book capital of all firms gives us the boom-bust dynamics of high capital issuance during the book of the late 1910s, and delisting during the early 1920s, which we then rescale to match the implied larger delistings by listed firms. For years 1923–1925, very little adjustment to growth rates is necessary.

From 1926 onwards, each yearly edition of the *Statistical yearbook* publishes a summary stock listings, which includes data on capital and market-to-book of all major listed firms in Denmark. We use these data to estimate total market capitalization by scaling it up to match the total cap in Parum (1997) at decennial benchmark periods, and scaling the growth rates in-between if necessary. It turns out that the large firms in the *Statistical yaerbook* listings, which number around 50–60 in total, consistently represent around half of the total Danish market cap, and track the aggregate data very well, so very little adjustment to growth rates is necessary to match the capitalization estimates for all firms at the benchmark years.

For the recent period, market capitalization estimates for all of Denmark, or the Copenhagen stock exchange are available from the World Bank's *World Development Indicators*, ECB *Statistical Data Warehouse* and the OMX Noric *Yearly Nordic Statistics*. We use a compbination of the *WDI* and *OMX Nordic* data for our estimates, but the data are similar to the estimates of the ECB. Even though the *OMX Nordic* data in principle only cover Copenhagen, and cover foreign as well as domestic firms, in practice these numbers follow total Danish capitalization estimates almost one-for-one, and we use these data rather than the ECB statistics to avoid potential measurement error when converting the ECB data from euros to kronas.

Our estimates are substantially below those of Goldsmith (1985), with the most likely reason for the upward bias in Goldsmith (1985)'s estimates being the inclusion of unlisted equities and debt securities. Our estimates are close to those of Rajan and Zingales (2003) for the respective benchmark years.

We would like to thank Kim Abildgren for helping us locate and interpret the historical data sources for Denmark.

Finland

Table E.5: *Data sources: Finland*

Year	Data source
Stock market capitalization:	
1912–1991	Total capitalization of all Finnish companies on the Helsinki Stock exchange, form Nyberg and Vaihekoski (2014a), kindly shared by Mika Vaihekoski.
1992–2017	Total capitalization of all Finnish firms, shares listed in Finland. Source: *ECB Statistical Data Warehouse*, Security issues statistics.
Net equity issuance:	
1913–1989	Change in the book value of listed equity, from Nyberg and Vaihekoski (2014a), kindly shared by Mika Vaihekoski.
1990–2016	Net equity issuance by all Finnish companies listed in Finland, from the *ECB Statistical Data Warehouse*, Security issues statistics.

Figure E.5: *Finland: alternative stock market cap estimates*

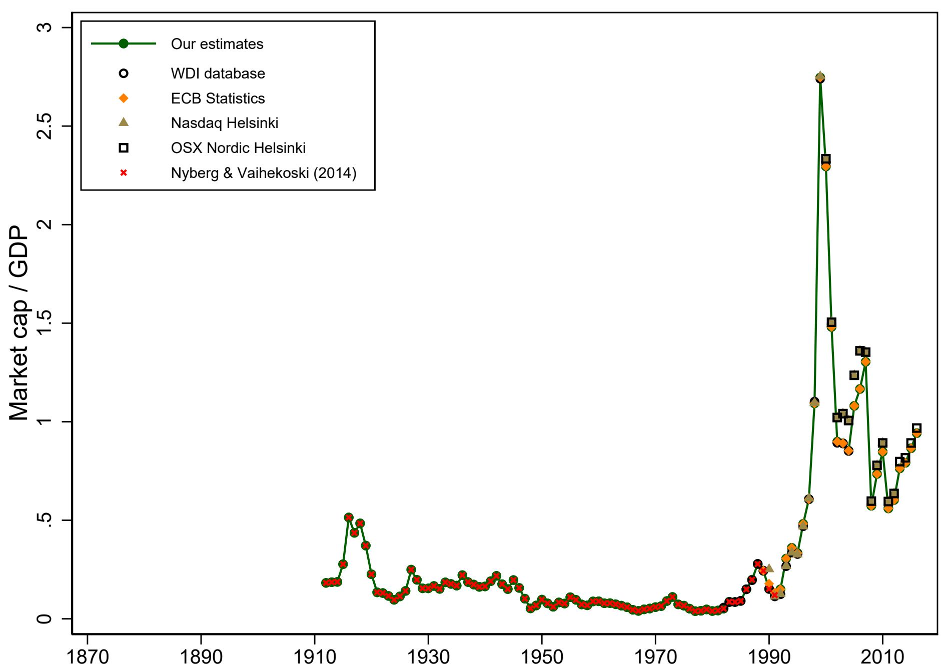


Table E.5 documents the sources of our data for Finland, and Figure E.5 plots the resulting market capitalization series alongside alternative existing estimates. The long-run data come from Nyberg and Vaihekoski (2014a), who have compiled a database of returns and capitalization on all stocks listed on the Helsinki exchange between its foundation in 1912 and 1991, when modern capitalization indices are available (see Nyberg and Vaihekoski, 2014b, 2011, for further details on the data). The

Nyberg and Vaihekoski (2014a) series are aggregated up from individual share-level data, obtained from a range of historical sources, and fit the modern day series well for the overlapping period, as shown in Figure E.5. The modern data from the ECB series are very close to Helsinki stock exchange capitalization estimates from Nasdaq and OMX Nordic (Figure E.5).

For net equity issuance, Nyberg and Vaihekoski (2014a) provide estimates of the total book value of listed stocks in each year. The change in this book value is our proxy for issuance, as it reflects the changes in stock market capitalization that are not driven by price appreciation. For more recent years, we use the net equity issuance statistics of the ECB.

We are grateful to Mika Vaihekoski for sharing data and providing help and support in locating the sources for Finland.

France

Table E.6: *Data sources: France*

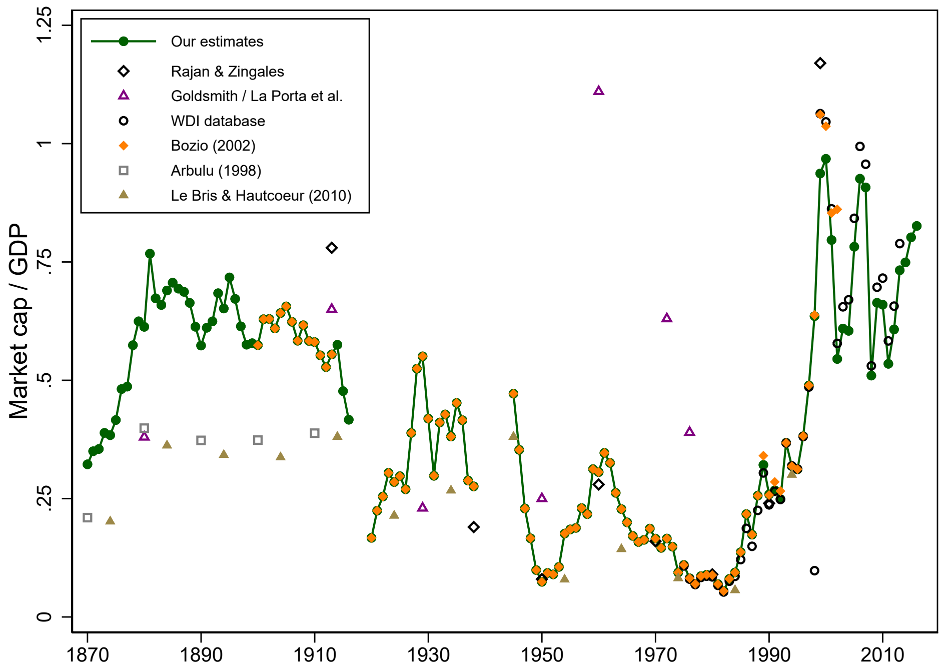
Year	Data source
Stock market capitalization:	
1870–1899	Stock market capitalization of the Paris stock exchange from Arbulu (1998) and Le Bris and Hautcoeur (2010), at roughly 5-year benchmarks, scaled up to proxy France total using data from Bozio (2002) (using the 1904 ratio between the Le Bris and Hautcoeur (2010) Paris series and Bozio (2002) France series as the benchmark), and year-to-year movements between the benchmark years estimated using changes in the capitalization of all French securities from Saint-Marc (1983).
1900–1988	Market capitalization of all shares of French companies listed on French stock exchanges, from Bozio (2002).
1989–2017	Total capitalization of all French firms, shares listed in France, from the *ECB Statistical Data Warehouse*, Security issues statistics.
Net equity issuance:	
1964–1989	Change in the book value of listed equity, from Bozio (2002), originally sourced from various editions of the *Année Boursière*.
1990–2016	Net equity issuance by all French companies listed in France, from the *ECB Statistical Data Warehouse*, Security issues statistics.

Table E.6 documents the sources of our data for France, and Figure E.6 plots the resulting market capitalization series alongside alternative existing estimates. Most of the data are drawn from the comprehensive study of Bozio (2002), which estimated the total capitalization of French shares listed on all French exchanges between 1900 and 2002. Between 1900 and 1963, Bozio (2002) relied on yearly capitalization of the *Cote Officielle* for the Parisian bourse, scaled up to match the total for France using data for all French stock exchanges at benchmark periods. After 1964, the Bozio (2002) data are a direct estimate of the total capitalization of all French stock exchanges. For the recent period, these data match up well with the series from the World Bank's *WDI Database*, and ECB *Statistical Data Warehouse*. We rely on the ECB data for the recent period. The Bozio (2002) and ECB data also offer direct estimates of net equity issuance, estimated as changes in the book value of listed equity capital for the former and actual net issues for the latter.

For the 19th century, we make use of benchmark year estimates for the total capitalization of the Parisian bourse, from the studies of Le Bris and Hautcoeur (2010) and Arbulu (1998). We scale up these data to proxy the capitalization of all French exchanges, using the ratio of Parisian to total French market cap in year 1904. This extrapolation, therefore, implicitly assumes that the market share of regional exchanges did not change too much during the late 19th century. It is possible that the regional exchanges were somewhat more important during this early period, in which case our data would somewhat understate the total French market cap.[18] In-between the benchmark years,

[18] Bozio (2002)'s estimates suggest that the relative importance of the Parisian stock exchange increased slightly between 1900 and 1913, remained roughly unchanged between 1913 and 1938, and spiked again after World War 2.

Figure E.6: *France: alternative stock market cap estimates*



we use the changes in Saint-Marc (1983)'s estimates of the total capitalization of French securities, computed by scaling up capital income data, to proxy the year-to-year movements in market cap during the late 19th century.

Figure E.6 also highlights the uncertainty around earlier market capitalization estimates, especially those of Goldsmith (1985), and also to some extent the Rajan and Zingales (2003) data: on average they tend to overstate the French stock market capitalization, perhaps by including securities which are not common stocks, which can often be the case with national balance sheet estimates such as those of Goldsmith (1985), or foreign securities. In the early 1960s, the Goldsmith (1985) market capitalization estimate is almost 5 times the size of the Rajan and Zingales (2003) estimate, with our estimate, derived from Bozio (2002) data in-between these two, but closer to those of Rajan and Zingales (2003).

We are grateful to Antoine Bozio for providing help in understanding the various sources for the French market capitalization data.

Germany

Table E.7: *Data sources: Germany*

Year	Data source
Stock market capitalization:	
1870–1871	1872 total German market cap extrapolated back using the growth in the capitalization of 30 largest German listed companies from Ronge (2002).
1872–1913	Market capitalization of all German firms listed on all major German exchanges (Berlin, Frankfurt, Hamburg, Cologne, Leipzig and Munich), adjusted for cross-listings, computed by authors from microdata helpfully shared by Christian Hirsch at the Frankfurt Center for Financial Studies. The underlying data are sourced from the regional financial newspapers and stock listings, namely: the *Berliner Börsen-Zeitung*, *Berliner Börsencourier* and *Neumann's Cours-Tabellen*; Frankfurt, Munich and Leipzig *Börsen-Kursblatt*; *Frankfurter Zeitung*, *Hamburgischer Correspondent*, *Kölnische Zeitung* and *Kölner Tageblatt*.
1914–1918	Capitalization of 30 largest German listed companies from Ronge (2002) scaled up to match all German listed companies (1913 used as benchmark year for scaling).
1919–1924	Total market capitalization of shares listed on the Berlin stock exchange from Moore (2010b), scaled up to match all of Germany and down to exclude foreign firms, using data for overlapping years between the Moore (2010b) and our all-Germany series in the early 20th century.
1925	Capitalization of 30 largest German listed companies from Ronge (2002) scaled up to match all German listed companies (1913 used as benchmark year for scaling).
1926–1943	Total capitalization of shares listed on the Berlin stock exchange from Deutsche Bundesbank (1976), scaled up to match all of Germany and down to exclude foreign firms, using data for overlapping years between Moore (2010b)'s Berlin series and our all-Germany series in the early 20th century.
1944–1950	Capitalization of 30 largest German listed companies from Ronge (2002) scaled up to match all German listed companies (1943 and 1950 used as benchmark years).
1951–1974	Total market cap of all German listed firms, shares listed on German exchanges, from Deutsche Bundesbank (1976). Spliced with the scaled-up Berlin series over years 1944–1950.
1975–1998	Total market cap of all German listed firms, shares listed on German exchanges, from World Bank's *WDI Database*.
1999–2017	Total market cap of all German listed firms, shares listed on German exchanges, from the Bundesbank database (series BBK01.WU0178).

Table E.7: *Data sources: Germany*

Year	Data source
Net equity issuance:	
1873–1914	Net equity issuance by all German firms listed on German exchanges, computed from microdata helpfully shared by Christian Hirsch at the Frankfurt Center for Financial Studies.
1926–1989	Change in the book value of listed equity, multiplied by the market-to-book of equity issuance. Listed equity book values are from Deutsche Bundesbank (1976) for the period before 1972, and from the 1991 *Wirtschaft und Statistik* yearbook of the *Statistiches Bundesamt* after 1972. Market-to-book data are from the March 2013 Handbook of the *Deutsches Aktieninstitut*. Before 1970 the market-to-book data cover gross issuance by all firms, and after 1970 they cover gross issuance by listed firms. Market-to-book before 1948 is set to equal the 1948–1957 average.
1990–2016	Net equity issuance by all German companies listed in Germany, from the *ECB Statistical Data Warehouse*, Security issues statistics.

Figure E.7: *Germany: alternative stock market cap estimates*

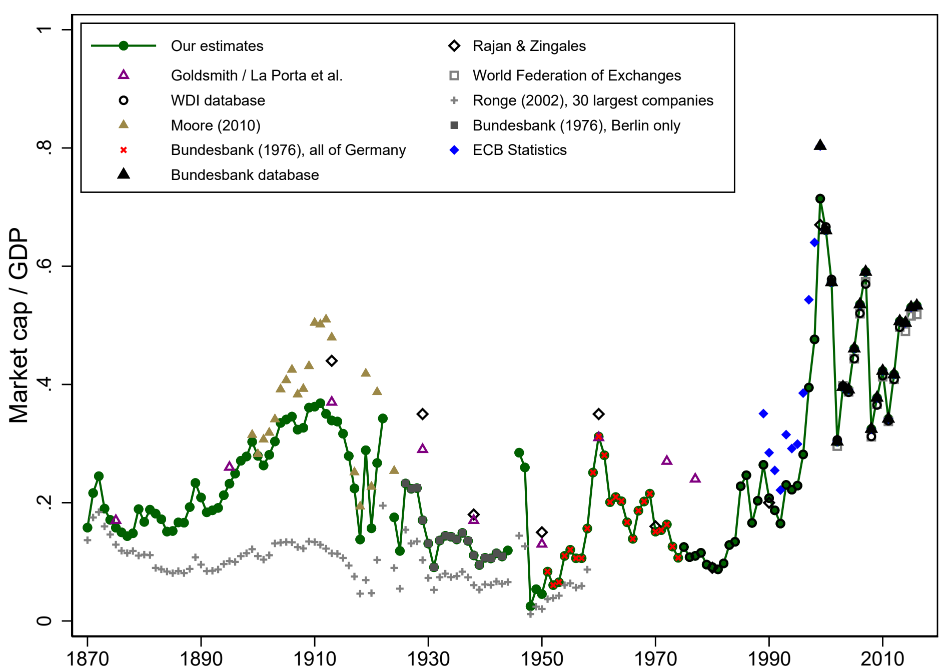


Table E.7 documents the sources of our data for Germany, and Figure E.7 plots the resulting market capitalization series alongside alternative existing estimates. For years 1873–1914, we construct our own best-practice estimate of the German stock market capitalization, using data on individual securities listed on all major German exchanges (Berlin, Frankfurt, Hamburg, Cologne, Leipzig and Munich), adjusted for cross-listings, and computed from microdata helpfully shared by Christian Hirsch at the Frankfurt Center for Financial Studies. Outside of these data, we rely on a number of proxies to construct the capitalization of all German companies listed in Germany from a variety of other sources. These proxies consist of the Ronge (2002) estimates of the capitalization of the largest 30 listed German companies, helpfully shared with us by Ulrich Ronge, and covering the period 1870–1958; and the total capitalization of the Berlin stock exchange computed by Moore (2010b) for years 1899–1924, and by Deutsche Bundesbank (1976) for years 1926–1943. We scale down the Berlin capitalization data to mimic the exclusion of foreign companies, and scale it up to mimic the inclusion of regional exchanges, by comparing the Berlin capitalization estimates to those for the whole of Germany for various benchmark years. Finally, we use the Ronge (2002) series to fill in the remaining gaps.

The different early-period series match up with each other rather well: for example, in the 1870s most of the total market cap can be accounted for by the 30 largest companies (the Ronge, 2002, estimates), and the top-30 share gradually decreases as new listed firms enter the market in the late 19th and early 20th centuries, before the market becoming more concentrated again during the interwar period and the 1930s. In the early 20th century, the total Berlin capitalization is actually somewhat larger than that of the German companies listed on all German exchanges, due to a large presence of foreign stocks, and the two measures (Berlin total vs all-Germany German companies) become very similar in the 1920s and 1930s as the share of foreign stocks drops after World War 1.

The post-1950 data cover all German company ordinary shares listed on German exchanges, and are sourced from the various Bundesbank publications, namely Deutsche Bundesbank (1976) and the online statistical database of the Bundesbank. These match up rather well with alternative estimates from the ECB database, the World Bank's *WDI database*, and data from the *World Federation of Exchanges*. Concerning the earlier estimates, both Rajan and Zingales (2003) and Goldsmith (1985) have tended to overestimate the size of the German stock market relative to GDP somewhat.

Our series of net equity issuance generally follows the market capitalization sources, with the pre-1914 series constructed from the microdata at the Frankfurt Center for Financial Studies and post-1990 data provided by the ECB. In-between these dates, we rely on changes in the book capital of listed firms provided by the

We are grateful to Christian Hirsch for sharing data, to Ulrich Ronge for sharing data and offering advice on the historical German seris, and to Carsten Burhop for helping us locate the historical data sources.

Italy

Table E.8: *Data sources: Italy*

Year	Data source
Stock market capitalization:	
1900, 1913	Total stock market capitalization of Italian firms, estimates from Musacchio (2010).
1928–1949	Total stock market capitalization of Italian firms, shares listed in Italy, aggregated from individual stock capitalizations published in Mediobanca (Various years).
1950–1988	Total stock market capitalization of Italian firms, shares listed in Italy, using aggregate estimates published in Mediobanca (Various years). No data for 1951.
1989–2016	Total capitalization of Italian firms, shares listed in Italy, from the *ECB Statistical Data Warehouse*, Security issues statistics.
Net equity issuance:	
1980–1988	Net equity issuance (listed and unlisted) from the *OECD Financial Statistics*, sourced from Richter and Diebold (2021), scaled down using the ratio of listed to total equity issuance for the 1990s.
1990–2016	Net equity issuance by all Italian companies listed in Italy, from the *ECB Statistical Data Warehouse*, Security issues statistics.

Figure E.8: *Italy: alternative stock market cap estimates*

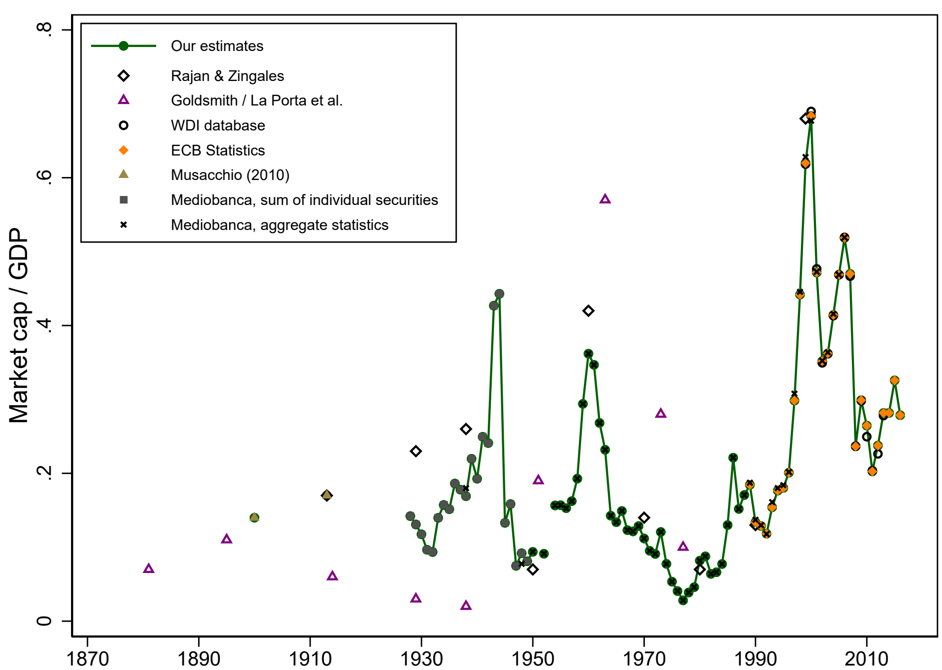


Table E.8 documents the sources of our data for Italy, and Figure E.8 plots the resulting market capitalization series alongside alternative existing estimates. Most of the data are sourced from the *Indici e Dati* publication, Mediobanca (Various years), which presents various aggregate and security-level statistics on Italian stocks and bonds, as well as further accounting data for the major Italian companies. For years 1928–1949, this publication publishes the market capitalization of individual Italian listed companies, and we compute our market cap measure as an aggregate of these security-level data. From 1950 onwards, *Indici e Dati* publishes aggregate market capitalization statistics relating to shares of all Italian firms listed on Italian exchanges, which becomes the main source of our data. Even though the individual security listings from the earlier years could miss out on some smaller firms, comparison of the two Mediobanca series (dark squares and x crosses in Figure E.8) suggests that these differences are, in practice, negligible. The later-years Mediobanca aggregate series match up well with alternative estimates from the World Bank's *WDI Database* and the ECB *Statistical Data Warehouse*. We use the ECB series for our estimates from 1989 onwards.

For the early years, we use Musacchio (2010) estimates of the Italian market capitalization in 1900 and 1913, with the 1913 estimate being the same as those of Rajan and Zingales (2003). We do not use the earlier Goldsmith (1985) estimates, because in years 1910, 1930 and 1940 these seem to vastly underestimate the size of the Italian stock market. The Rajan and Zingales (2003) estimates are, on average, somewhat higher than those in our paper.

We are grateful to Stefano Battilossi for providing helpful advice in locating the historical data sources for Italy.

Japan

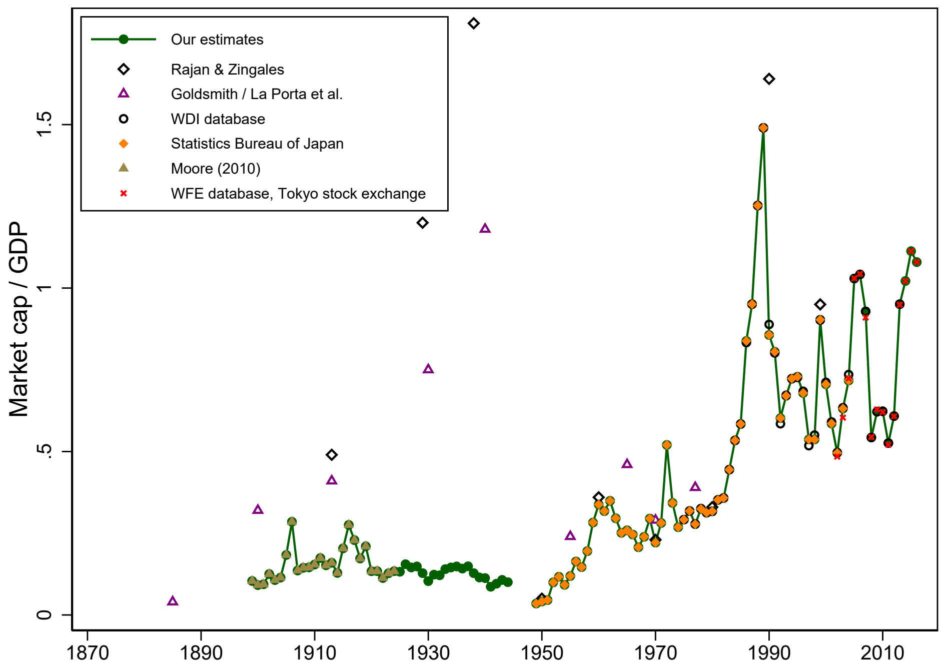
Table E.9: *Data sources: Japan*

Year	Data source
Stock market capitalization:	
1899–1924	Total capitalization of the Tokyo stock exchange from Moore (2010b).
1925–1945	The 1924 market capitalization extrapolated forward using changes in the book capital of business corporations from Bank of Japan (1966), and stock price growth from Jordà et al. (2019).
1948–2004	Total capitalization of the Tokyo stock exchange first and second sections, from the *Statistics Bureau of Japan* historical statistics, Tables 14-25a and 14-25b.
2005–2013	Total capitalization of Japanese firms' shares listed on Japanese exchanges, from World Bank's *WDI Database*.
2014–2016	Total capitalization of Japanese firms listed on the Tokyo stock exchange, from the *World Federation of Exchanges* statistical reports.
Net equity issuance:	
1945–1969	Net issuance of ordinary shares from the Bank of Canada *Statistical Summaries*.
1980–2016	Net equity issuance of listed firms from the *OECD Financial Statistics*, sourced from Richter and Diebold (2021). Data after 1995 are actual listed firm issuance, data before 1995 are issuance by all firms scaled down using the ratio of listed to total equity issuance for 1995–2005.

Table E.9 documents the sources of our data for Japan, and Figure E.9 plots the resulting market capitalization series alongside alternative existing estimates. For the early historical period, our main source are the Moore (2010b) estimates of the total capitalization of the Tokyo stock exchange. While these may somewhat understate the total capitalization of Japanese firms because they exclude regional exchanges, they may also overstate it via including foreign shares, with these two biases, to some extent, balancing against each other. The Moore (2010b) data cover the period 1899–1924. For the subsequent historical periods, we rely on book capital data that cover both listed and unlisted businesses, from Bank of Japan (1966), and stock price data from Jordà et al. (2019). For each year in the period 1925–1945, we estimate the change in market cap as the stock price change multiplied by the change in the book capital of listed firms. This implicitly assumes that the share of the book capital of listed firms relative to that of all firms remains relatively stable. Comparing the data on book capital with our market capitalization series, there is a rapid growth in book capital during the late 19th and early 20th century but the market capitalization and book capital growth seem to stabilise around 1910 and remain consistent throughout the period for which we have both independently sourced market cap and book capital series. Our final year estimate for 1945 is higher than the market capitalization in 1948, which makes sense given the large potential for delistings during the stock market closure of 1946–47.

Alternative estimates for the early period do exist, but they appear somewhat more noisy and less reliable than even our extrapolated data. The estimates of Rajan and Zingales (2003) and Goldsmith (1985) are not too far away from ours in the early 1900s, but report much higher capitalization during the 1930s and around World War 2. These very high capitalization ratios are, however,

Figure E.9: *Japan: alternative stock market cap estimates*



difficult to reconcile with other available data. The implied stock market expansion in the 1930s goes far beyond both the book capital growth and the increase in the share price index, implying new listings that far exceed the data reported for other periods and countries in our sample. The post World War 2 data, where our estimates, based on the Statistics Bureau of Japan historical statistics, are more consistent with those of Rajan and Zingales (2003) and Goldsmith (1985), again suggest a drop in market size that far exceeds that in the stock price index. Even though the Tokyo stock exchange was closed during years 1946–1947, the market capitalization ratios reported by Rajan and Zingales (2003) and Goldsmith (1985) in the 1940s are in the region of 1.2–1.8 of GDP, whereas those reported in the late 1940s and 1950s by both Statistics Bureau of Japan and Rajan and Zingales (2003) are closer to 0.035–0.05 of GDP. In light of these differences, we do not benchmark our series to the Rajan and Zingales (2003) and Goldsmith (1985) estimates, but without a doubt, there remains considerable uncertainty around all available estimates for the early period and in particular the 1930s and 1940s.

For the recent period, we use the Statistics Bureau of Japan estimates of the Tokyo stock exchange capitalization (both the 1st and 2nd sections) during the period 1949–2004, which match up rather well with the total capitalization of all Japanese listed firms reported in the World Bank's *WDI Database*. For the latest period, we use the *World Federation of Exchanges* capitalization of Japanese firms listed on the Tokyo exchange, which is similar to the *WDI Database* estimates. Even though *WFE* also provide estimates for the Osaka exchange capitalization, a comparison with *WDI* data suggests a high degree of cross-listings among the two exchanges, therefore we use the Tokyo only series for the most recent years. We complement these with net issuance data sourced from the OECD flow of funds in the *OECD Financial Statistics* (Richter and Diebold, 2021), kindly shared with us by Björn Richter.

Netherlands

Table E.10: *Data sources: Netherlands*

Year	Data source
Stock market capitalization:	
1899–1924	Total capitalization of the Amsterdam stock exchange from Moore (2010b), scaled down to proxy domestic firms only (using the proportion of domestic to foreign shares listed on the exchange in Moore, 2010b).
1938	Netherlands stock market cap estimate from Rajan and Zingales (2003).
1951–1974	Total capitalization of Dutch firms listed on the Amsterdam stock exchange from Central Bureau of Statistics (2010).
1975–1988	Total capitalization of Dutch firms' shares listed on Dutch exchanges, from World Bank's *WDI Database*.
1989–2017	Total capitalization of Dutch firms, shares listed in the Netherlands, from the *ECB Statistical Data Warehouse*, Security issues statistics. Spliced with WDI data for year 1989.
Net equity issuance:	
1990–2016	Net equity issuance by all Dutch companies listed in the Netherlands, from the *ECB Statistical Data Warehouse*, Security issues statistics.

Figure E.10: *Netherlands: alternative stock market cap estimates*

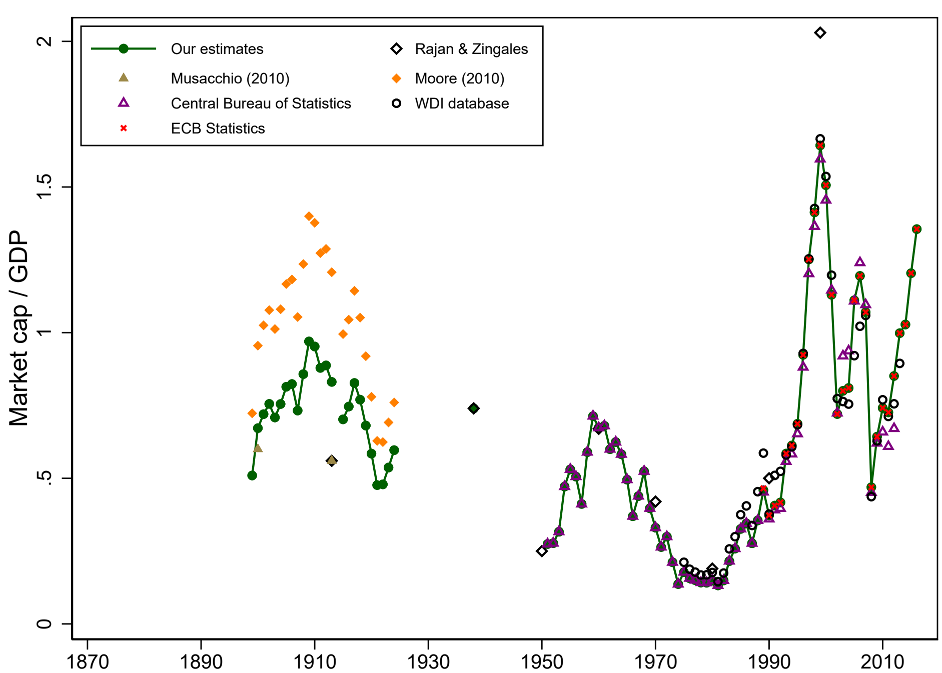


Table E.10 documents the sources of our data for the Netherlands, and Figure E.10 plots the resulting market capitalization series alongside alternative existing estimates. In the early period, our main source are the Moore (2010b) estimates of the total capitalization of the Amsterdam stock exchange. One issue, however, is that the Amsterdam exchange played an important role in the international financial system during this time period, and was used to trade many foreign as well as domestic stocks, as is clear from examining the stock exchange listings and the summary statistics on foreign and domestic listings in Moore (2010b). The total Amsterdam capitalization estimates in Moore (2010b) are, therefore, likely to substantially overstate the capitalization of Dutch firms. This also helps explain why the Moore (2010b) market cap estimates are higher than those of Rajan and Zingales (2003) and Musacchio (2010) for the early period, whereas our estimates for the later periods are broadly in line with those of Rajan and Zingales (2003). To adjust for this bias, we scale down the total capitalization of the Amsterdam exchange using the statistics on domestic and foreign shares listed in years 1899, 1909 and 1924 in Moore (2010b), calculating capitalization for this early period as total Amsterdam cap * number of Dutch shared listed / total number of shares listed. Depending on the relative size of the average capitalization of domestic and foreign shares, and the accuracy of estimates in-between the benchmark periods, these estimates could either somewhat over- or understate the total capitalization of Dutch firms.

For the post-1950 data, we rely on estimates of capitalization of Dutch firms listed on Dutch exchanges from three sources: the 111 year statistics Central Bureau of Statistics (2010), and the data from World Bank's *WDI database* and ECB's *Statistical Data Warehouse*. These estimates tend to be similar to each other, and to those of Rajan and Zingales (2003). In light of this data consistency among the different sources, we also make use of the Rajan and Zingales (2003) estimate of the 1938 Dutch stock market cap.

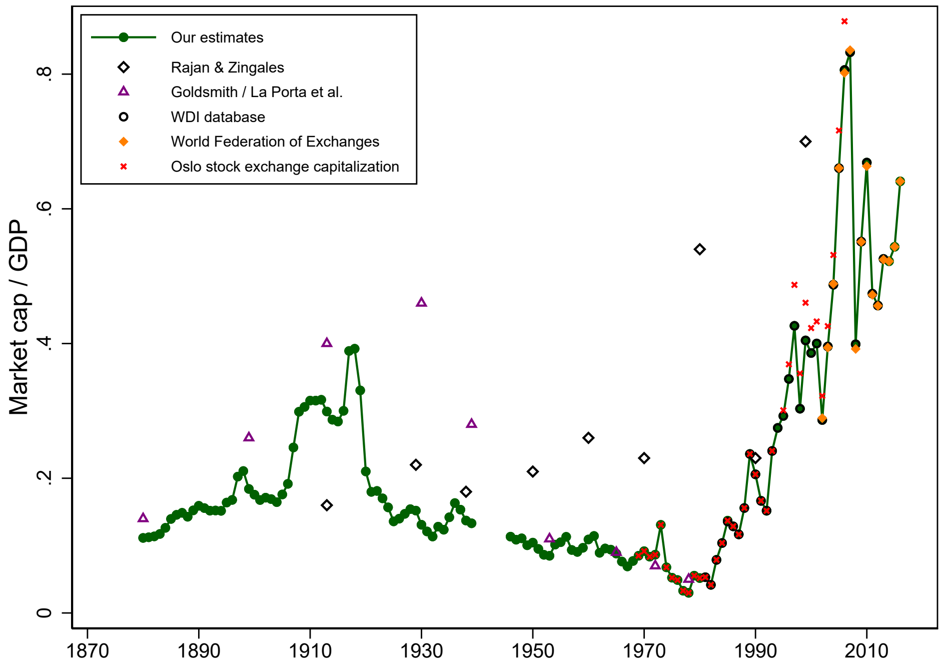
Norway

Table E.11: *Data sources: Norway*

Year	Data source
Stock market capitalization:	
1880–1899	Total market capitalization of all Norwegian listed firms' ordinary shares, own estimates using individual stock data in the *Kierulf handbook* and Oslo stock exchange listings.
1900–1918	Market to book of listed firms times an estimate of listed book capital. Changes in listed book capital proxied using changes in total book capital for years 1900–1911 and 1911–1917. The data for 1912 and 1918 are direct measures of the total market capitalization of Norwegian firms, computed in the same way as for the period 1880–1899. Microdata sourced from *Kierulf handbook* and Oslo *Kurslisten*; aggregate book capital data sourced from the statistical yearbooks, various years.
1919–1968	Estimate of the total capitalization of Norwegian firms, computed as share capital of all Norwegian firms * proxy for share of listed firms * market-to-book of listed firms. The share of listed firms calculated as listed book capital relative to book capital of all firms in 1918, and as market capitalization of Oslo stock exchange relative to market value of all firm equity in 1969, and interpolated in-between (the 1918 and 1969 listed firm shares are very similar). Sources: *Kierulf handbook*, Oslo *Kurslisten*, statistical yearbooks, various years.
1969–1993	Total capitalization of the Oslo stock exchange, data kindly shared by Daniel Waldenström.
1994–2013	Total capitalization of Norwegian firms' shares listed in Norway, from World Bank's *WDI Database*.
2014–2016	Total capitalization of Norwegian firms' shares listed in Norway, from *World Federation of Exchanges* (WFE) reports, various years.
Net equity issuance:	
1981–2016	Net equity issuance by listed firms from the *OECD Financial Statistics*, sourced from Richter and Diebold (2021). Data before 1996 are issuance by all firms (listed and unlisted) scaled down using the ratio of listed to total equity issuance for 1996–2006.

Table E.11 documents the sources of our data for Norway, and Figure E.11 plots the resulting market capitalization series alongside alternative existing estimates. For the early historical period, we construct our own estimates of stock market capitalization using data on individual stock prices and quantities, sourced from various issues of the *Kierulf handbook*, and the Oslo stock exchange listings. For the late 19th century, we compute market capitalization in this manner for each individual year, and for the early 20th century we compute capitalization at benchmark years and use changes in book capital of all companies and the market-to-book value of listed companies to calculate the year-on-year movements in market capitalization. Since the share of listed company capital relative to book capital of all companies varies little across the different benchmark years, this calculation ought to be fairly accurate. The data show a substantial stock market boom in the late 1910s, and the subsequent stock market crash of the early 1920s during which market capitalization more than

Figure E.11: *Norway: alternative stock market cap estimates*



halved.

For the modern period (1969 onwards), we start off by using the total capitalization of the Oslo stock exchange. Given the negligible presence of non-Norwegian companies on the exchange during this time period (which can be seen, for example, by comparing the *WDI* estimates for Norwegian firms with the Oslo exchange cap for overlapping years in Figure E.11), this acts as a good proxy for the total capitalization of Norwegian listed firms. In the 1990s and 2000s, we switch to using the *WDI* and *WFE* data, which focus on Norwegian firms only.

To link the 1969 and 1918 measures of stock market cap, we estimate market cap movements using changes in the book capital of all firms, the market-to-book value of listed firms, and a proxy for the proportion of the firms that are listed. The time between the 1920s bust and the 1980s marks a relatively stable period for the Norwegian stock market with, for example, the listed firm share growing by only 4 percentage points, from 30% in 1918 to 34% in 1969, which suggests that our estimates should have a relatively high degree of accuracy.

Taken together, our market capitalization estimates are substantially below those of Rajan and Zingales (2003), and show a pronounced boom-bust cycle that happened around the early 1920s banking crisis, that is not apparent in the Rajan and Zingales (2003) data. The estimates of Goldsmith (1985) are above ours for the early to mid 20th century period, but similar to ours after 1950.

The net equity issuance data come from the financial accounts digitized from historical publications of the *OECD Financial Statistics*, kindly shared with us by Björn Richter. We would like to thank Jan Tore Klovland for helping us locate and interpret the historical sources for the Norwegian stock price data, and the staff at the Oslo Nasjonalbiblioteket in Oslo for their help in locating the sources.

Portugal

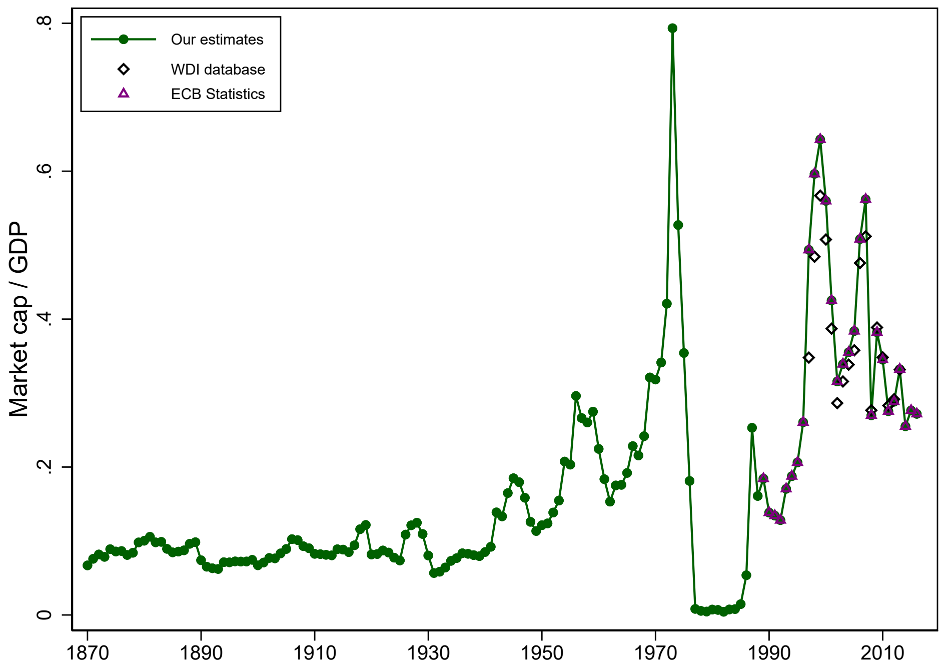
Table E.12: *Data sources: Portugal*

Year	Data source
Stock market capitalization:	
1870–1987	Total market capitalization of all Portuguese firms listed in Lisbon, own estimates using individual stock data and company published accounts. Sourced from *Diario do Governo*, *Boletim da Bolsa* and individual company accounts, various years. For years 1900–1925, we use changes in book capital for a subset of listed firms to estimate the changes in book capital of all listed firms. Market capitalization during the Carnation revolution related stock market closure in 1975–1976 is interpolated linearly using the data for 1974 and 1977.
1988	Splice own estimates constructed from microdata in the *Boletim da Bolsa* and the ECB series, using the average of 1987 cap * price growth, and 1989 cap / price growth.
1989–2017	Total capitalization of Portuguese firms, shares listed in Portugal, from the *ECB Statistical Data Warehouse*, Security issues statistics.
Net equity issuance:	
1871–1987	Net equity issuance (new listings plus secondary issues minus delistings and redemptions) computed from share-level microdata using the same sources as the stock market cap.
1990–2016	Net equity issuance by all Portuguese companies listed in Portugal, from the *ECB Statistical Data Warehouse*, Security issues statistics.
New listings:	
1871–1987	End-year market capitalization of newly listed firms, computed from share-level microdata, using the same sources as for stock market cap.
1988–2016	Net equity issuance scaled down by the ratio of net issuance to new listings for the pre-1988 period (around 0.8; also note that there are no negative net issuance observations during this period). Figures for 1988–1989 are set to equal the 1990s averages.

Table E.12 documents the sources of our data for Portugal, and Figure E.12 plots the resulting market capitalization series alongside alternative existing estimates. Very few estimates of the Portuguese market capitalization exist, particularly for the period before 1990. Therefore we construct our own data using the prices and quantities of each stock listed on the Lisbon stock exchange during this period, and aggregating the individual shares' market capitalization. Throughout, we exclude preference shares, foreign and colonial companies to arrive at a measure of domestic market capitalization. Even though a smaller stock exchange operated in Porto, data from the stock listings suggest that its size was very small relative to the Lisbon exchange; therefore our estimates provide a good measure of the total market capitalization of Portuguese listed firms.

Most of the early period data are sourced from the official stock exchange listing *Boletim da Bolsa*, available for years 1874 to 1987. This listing contains information on both stock prices and quantities. These data are complemented by stock listings and company balance sheets published in

Figure E.12: *Portugal: alternative stock market cap estimates*



the government newspaper *Diario do Governo*, and balance sheet data in the published accounts of limited companies. These additional sources are particularly important for the period 1900–1925, during which the official *Boletim* stopped publishing share quantity data. For these years, we use a subset of listed companies, for which we have published accounts data, to estimate the changes in share quantities for the entire market. Another approximation is undertaken during years 1975–1976, when the stock exchange was closed in the aftermath of the Carnation revolution. Stock market capitalization dropped almost twenty-fold between 1974 and 1977, and we interpolate this drop across the years during which the stock exchange was closed, so that it this negative shock is not absent from our data. After the shock of the Carnation revolution, the market stagnated during the 1970s before recovering rapidly in the late 1980s. As shown in Figure 9, Portugal is the only country in our sample that saw unusually high net issuances during this period – but these trends are rather specific to the recovery of the market from the turmoil associated with the 1970s revolution.

The modern data are sourced from the ECB *Statistical Data Warehouse*, and match up with our own estimated series, as well as the other modern-day series from the WDI, rather well.

We supplement the market capitalization series with estimates of net issuance and new listings based on the same microdata up to 1987, and based on a rescaling of the ECB net issuance series afterwards. For our historical data, net issuance and new listings are strongly positively correlated and similar in magnitude, which gives us some confidence that this estimation method should produce reasonably accurate results for the post-1987 time period. Both the net issuance and new listings series are dominated by the high issuance in the aftermath of the Carnation revolution, which saw high levels of entry and churn by newly listed firms.

We are grateful to Jose Rodrigues da Costa and Maria Eugenia Mata for help and advice in finding and interpreting the data sources for the historical Portuguese data. We are also grateful to staff at the Banco do Portugal archive for helpful advice and sharing data.

Spain

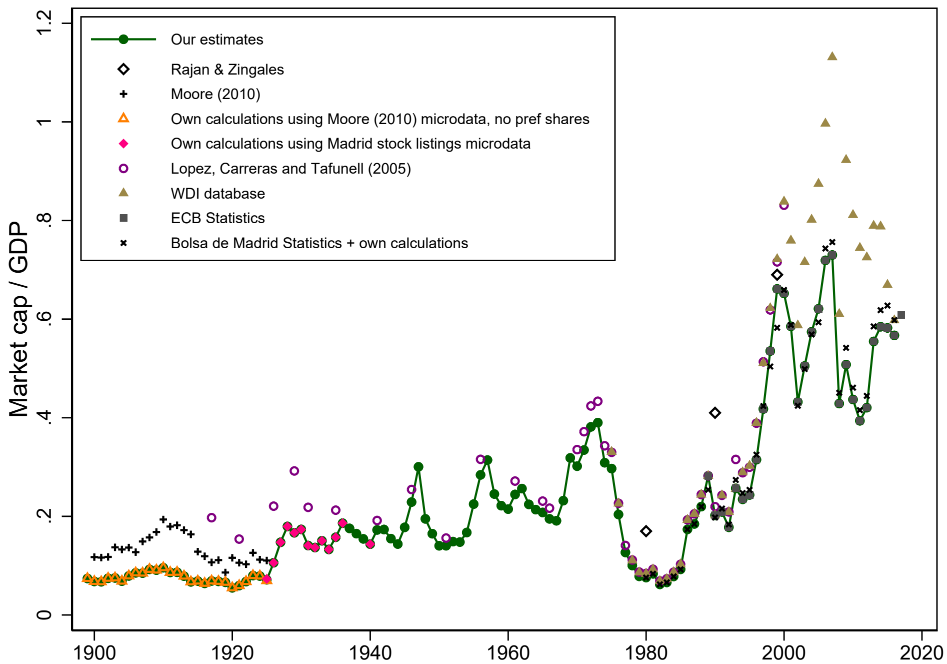
Table E.13: *Data sources: Spain*

Year	Data source
Stock market capitalization:	
1900–1924	Total market capitalization of all Spanish firms listed in Madrid, own estimates using microdata helpfully shared by Lyndon Moore. See Moore (2010b) and Moore (2010a) for the original source. We exclude preference shares from both our and Moore (2010b) microdata, with the resulting two series matching up very well.
1925–1936; 1940	Total market capitalization of all Spanish firms listed in Madrid, own estimates using microdata from the Madrid stock exchange listings, *Boletin de Cotization Oficial*, various years.
1941–1988	Total capitalization of the major Spanish stock exchanges from López, Carreras, and Tafunell (2005). Between 1941 and 1971, data are provided at 5-year benchmarks, with the in-between changes in market cap estimated using the changes in the stock price index from Jordà et al. (2019), and changes in the total book capital of Spanish firms from López et al. (2005). Data are scaled down slightly (factor of 0.9, based on the data from *Bolsa de Madrid*) to proxy for the exclusion of foreign companies.
1989–2017	Total capitalization of Spanish firms, shares listed in Spain, from the *ECB Statistical Data Warehouse*, Security issues statistics.
Net equity issuance:	
1900–1940	Net equity issuance (new listings plus secondary issues minus delistings and redemptions) computed from share-level microdata using the same sources as the stock market cap.
1970–1989	Change in the nominal value of listed stocks from López et al. (2005), scaled down to exclude foreign firms using the same factor as for market cap.
1990–2016	Net equity issuance by all Spanish companies listed in Spain, from the *ECB Statistical Data Warehouse*, Security issues statistics.

Table E.13 documents the sources of our data for Spain, and Figure E.13 plots the resulting market capitalization series alongside alternative existing estimates. For the early historical period, we construct estimates of total capitalization of ordinary shares of Spanish firms listed on the Madrid stock exchange by aggregating up the capitalizations of individual shares in the official Madrid stock list. The data on share prices and quantities for 1925–1941 were source directly from the official stock list, *Boletin de Cotization Oficial*. Microdata for the 1899–1924 period were helpfully shared with us by Lyndon Moore, and are a slightly updated version of the series in Moore (2010b), sourced from Moore (2010a).

The series in Moore (2010b) included some preference shares, which accounted for as much as half of the market during the early historical period. Excluding these from the data results in market capitalization estimates which are lower than those in Moore (2010b). The early López et al. (2005) estimates are higher than both our estimates and those of Moore (2010b), making it likely that they include both some preference shares and foreign shares. The importance of preference shares

Figure E.13: *Spain: alternative stock market cap estimates*



gradually declined during the 1920s, with these comprising about 20% of the market at the end of the Spanish Civil War. A notable market expansion took place during the 1920s, much of it driven by large stock price increases and some – by increased issuance. Our data, as well as the alternative series of Moore (2010b) and López et al. (2005), do not include the Barcelona stock exchange. The Barcelona stock exchange listings in the *La Vanguardia* newspaper do not contain information on quantities, but most stocks traded are also traded in Madrid, and the majority of trades were in government and corporate bonds rather than shares. This suggests that the bias from not including the Barcelona exchange is likely to be small.

During the Spanish civil war, the stock exchange was closed, hence the data for years 1937–1939 are missing, but we collect data on listings in 1936 and 1940 which show that market capitalization declined slightly, but the fall was not comparable to that following other large shocks in the sample, as for example the market decline during the Portuguese Carnation Revolution (Figure E.12). To make sure that omitting the Civil War does not upwardly bias our estimates of averages and growth during this period, we linearly interpolate the market cap to GDP ratio during the Civil War years.

From 1941 onwards, we use estimates of the total capitalization of the major Spanish exchanges – starting with Madrid, and later also including Barcelona, Bilbao and Valencia – provided by López et al. (2005). Before 1970, these are only available at 5-year benchmark periods. Because the López et al. (2005) data include foreign shares, we scale these estimates down slightly using modern-period data from the Bolsa de Madrid statistical publications, which suggest that the foreign listing share in Spain before late 1990s was small, leading to a scaling factor of 0.9. It is unclear whether the López et al. (2005) data include preference shares, but whereas this seems to be the case for the early historical period, by the 1930s and 1940 the differences between our ordinary-share-only and the López et al. (2005) series scaled down to exclude foreign shares are very small. Based on this, we do not make any further adjustment to exclude preference shares, which constituted around 20% of the market in 1940 but are likely to be excluded from the post-1940 López et al. (2005) data.

To estimate market cap evolution between benchmark years, we estimate the year-to-year changes in capitalization as the stock price growth times the change in the capital of all Spanish firms, using data from Jordà et al. (2019) and López et al. (2005) respectively, with the growth rates scaled up or down to match the capitalization at benchmark years. Accurate interpolation relies on the proportion of listed firms not fluctuating too much from year to year within the five-year benchmark periods. Given that book capital of listed firms does not vary dramatically from year to year in other time periods in the Spanish data, or in the data for other countries, the measurement error from this interpolation is unlikely to be large. From 1970 onwards, López et al. (2005) provide annual estimates of Spanish listed firms' market capitalization. The *WDI Database*, Bolsa de Madrid and the ECB *Statistical Data Warehouse* provide alternative estimates for the modern period. The WDI estimates for Spain, unfortunately, seem to suffer from considerable measurement error (after liaison with the WDI database staff some of these were fixed, but some seem to remain in place given the difference between the WDI series and all other estimates in Figure E.13). The *Bolsa de Madrid Statistics* estimates are accurate, but the share of foreign firms had to be proxied by us before year 2001. In light of this, we use the ECB series for the modern period, which are close to estimates provided by López et al. (2005) and Bolsa de Madrid.

The data on net issuance are computed from sources consistent with market cap: listings microdata for the pre-Civil-War period, López et al. (2005) for the mid 20th century, and the ECB *Statistical Data Warehouse* for the post-1990 period.

We would like to thank Lyndon Moore for sharing the microdata from the Madrid stock exchange for the early historical period as well as offering helpful advice, and Stefano Battilossi in helping locate the historical data sources.

Sweden

Table E.14: *Data sources: Sweden*

Year	Data source
Stock market capitalization:	
1870–1979	Total market capitalization of Swedish firms from Waldenström (2014). For 1927–1929, we interpolate the market cap growth using the growth in the Rydqvist and Guo (2020) series.
1980–2017	Total capitalization of Swedish firms listed on the Stockholm stock exchange from Rydqvist and Guo (2020), using data kindly shared by Kristian Rydqvist.
Net equity issuance:	
1912–2017	Net equity issuance (new listings plus secondary issues minus delistings) from the database in Rydqvist and Guo (2020), using data kindly shared by Kristian Rydqvist.
New listings:	
1912–2017	End-year market capitalization of newly listed firms from the database in Rydqvist and Guo (2020), using data kindly shared by Kristian Rydqvist.

Figure E.14: *Sweden: alternative stock market cap estimates*

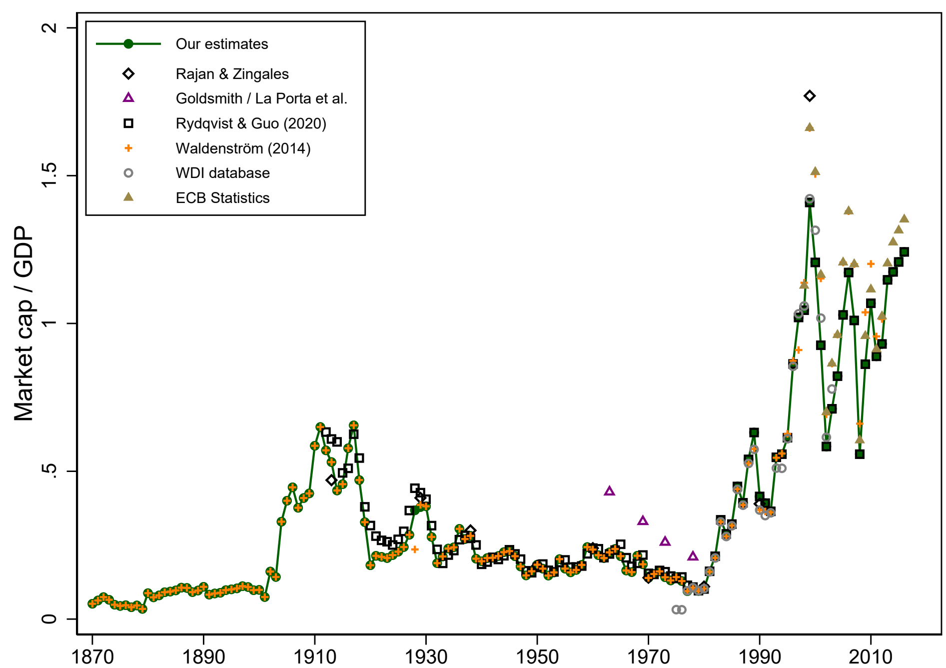


Table E.14 documents the sources of our data for Sweden, and Figure E.14 plots the resulting market capitalization series alongside alternative existing estimates. Two high-quality series of long-run

Swedish market capitalization are available from Waldenström (2014) and Rydqvist and Guo (2020). The Waldenström (2014) series go further back in time, whereas the Rydqvist and Guo (2020) series deal more carefully with those stocks which are traded very infrequently. Rydqvist and Guo (2020) also show that during the early period, most stocks on the exchange were in fact traded very infrequently. However, because most of the larger stocks were frequently traded, this has relatively little impact on the estimates of value-weighted return indices and on the aggregate stock market cap, which are the focus of our paper. Figure E.14 shows that the Waldenström (2014) and Rydqvist and Guo (2020) market capitalization series are very close to each other. For the modern period, we additionally have the estimates from the World bank's *WDI Database* and the ECB's *Statistical Data Warehouse*.

For the early period, we use the series of Waldenström (2014) since this is the only series available before 1912, and it matches up well with other data sources for overlapping years. We continue using these series for the mid 20th century since they align better with movements in the stock price index, therefore resulting in a more accurate price-quantity decomposition of movements in market cap. The growth in the Waldenström (2014) series for years 1927–1929, however, does not align with capital gains and issuance for these years, and we apply the growth rates of the Rydqvist and Guo (2020) series for these years instead. From 1980 onwards, we switch to the Rydqvist and Guo (2020) series which better align with the stock price movements for the modern period. None of these choices affect the long-run trends documented in the paper, but using a combination of sources rather than one of them makes our capital gain – issuance decompositions more accurate.

In addition to this, we construct a series on equity issuance and new listings from Rydqvist and Guo (2020) using data kindly shared with us by Kristian Rydqvist. The redemptions in the Swedish stock market are almost non-existent and almost entirely apply to preference rather than ordinary shares – so our net issuance measure consists of new listings plus secondary issues minus delistings. Our new listings measure is a mixture of direct listings and IPOs, but before 1979 these comprise entirely of direct listings due to legal limitations for IPO issuance on the Swedish stock exchange.

We are grateful to Kristian Rydqvist and Daniel Waldenström for sharing their data, providing helpful comments and helping us understand the drivers of market cap movements and the institutional details throughout the history of the Swedish stock exchange.

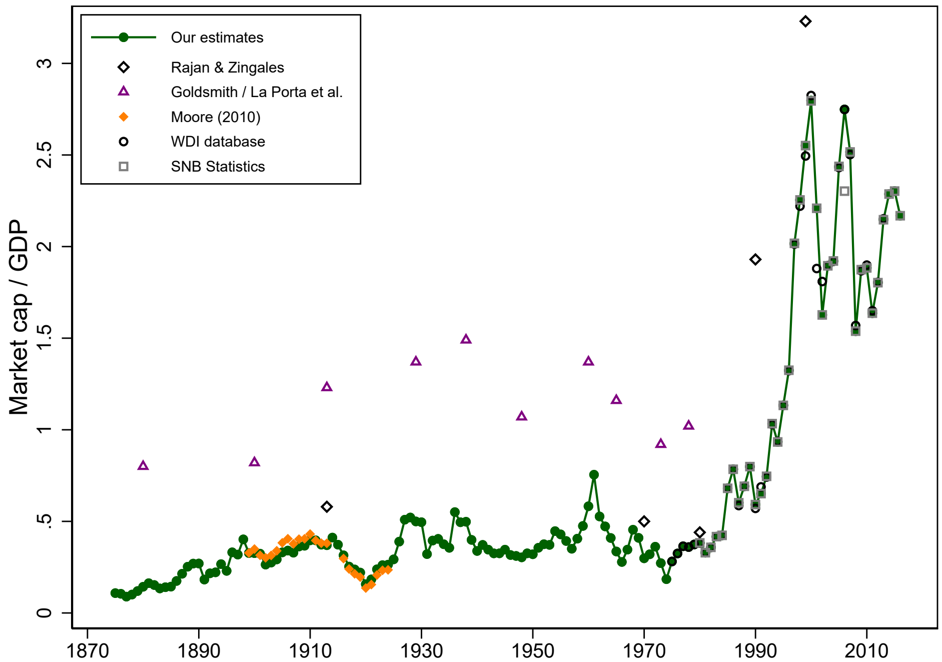
Switzerland

Table E.15: *Data sources: Switzerland*

Year	Data source
Stock market capitalization:	
1875–1970	Total market capitalization of all Swiss firms listed in Zurich, own estimates. For 1875–1898 and 1925–1970, we digitise the stock listings of the Zurich exchange (Kursblatt der Züricher Effektenbörse), complemented by data on individual company accounts, and compute the sum of capitalizations of all Swiss companies. For 1899–1925, we use microdata helpfully shared by Lyndon Moore (Moore, 2010a,b). We scale up the pre-1899 series to match the Lyndon Moore estimates. To match the WDI market cap value in 1975, we further scale up the annual cap growth rate by around 1 ppt.
1971–1974	1970 stock market cap extrapolated forward using net issuance data from the Swiss National Bank *Capital Market statistics*, with growth rates adjusted up by 1 ppt to match the 1975 WDI cap value.
1975–1979	Total capitalization of all Swiss listed firms, shares listed on Swiss exchanges, from the *WDI database*.
1980–2017	Total capitalization of the Swiss and Liechtenstein firms listed on the SIX (Swiss stock exchange), from the SNB *Capital Market Statistics*.
Net equity issuance:	
1876–1970	Net equity issuance (new listings plus secondary issues minus delistings and redemptions) computed from share-level microdata using the same sources as the stock market cap.
1971–2017	Net issuance by all Swiss listed firms from the SNB *Capital market Statistics*. Data before 1996 are gross issues minus redemptions. Data after 1996 are new issues plus secondary issues minus delistings and redemptions.
New listings:	
1876–1970	End-year market capitalization of newly listed firms, computed from share-level microdata, using the same sources as for stock market cap.
1971–1982	Gross issuance from the SNB *Capital Market Statistics* scaled down by the share of gross issues to new listings for the 1970s and 1980s.
1983–2017	End-year market capitalization of Swiss IPOs calculated from microdata kindly shared by Roger Kunz (see Kunz and Aggarwal, 1994, for the original source), scaled up to proxy for direct listings. The scaling factor is calculated by comparing the aggregate IPO market cap series with the new listings series from the *WFE*, published in the March 2013 Handbook of the *Deutsches Aktieninstitut* (factor of about 1.1).

Table E.15 documents the sources of our data for Switzerland, and Figure E.15 plots the resulting market capitalization series alongside alternative existing estimates. For the first 100 years of the series, we are able to construct estimates of Swiss stock market capitalization, issuance and new listings based on microdata on stocks listed on the Zurich stock exchange. Before 1899, the stock listings (Kursblatt) do not always have information on the number of shares, and we complement

Figure E.15: *Switzerland: alternative stock market cap estimates*



these with data on share capital from published accounts of individual Swiss companies. For those companies for which we do not have either number of shares or published accounts data, we assume their listed book capital growth follows that of other firms. Because the companies with missing book capital data mainly consist of smaller firms, the resulting estimates should give us a reasonably accurate representation of the evolution of listed book capital in Switzerland over time, and combined with the stock price data in the listings – of overall market cap.

For the 1899–1925 period, we construct these estimates from microdata kindly shared with us by Lyndon Moore (Moore, 2010a,b). The estimates are close to the Zurich total in Moore (2010b), but slightly below it due to the exclusion of foreign firms. These data have slightly better coverage than the early Kursblatt listings, and we scale up the pre-1900 capitalization series to match the Moore (2010b) data for overlapping years to account for this, by a factor of about 1.18. From 1926 onwards, we switch back to our own estimates based on the Kursblatt stock listings. These match up well with Lyndon Moore data, but are likely to slightly understate the annual growth of market cap, based on comparison with the *WDI* and SNB series for the 1970s and 1980s. To make sure our series are well aligned with the modern-day estimates, we scale up annual market cap growth by about 1 ppt during the 1925–1974 period. For the 1971–1974 period, we have data on stock prices and issuance but not for capitalization, so we construct the capitalization series using previous year's market cap, net issuance and capital gains, with the above-mentioned cap growth correction. The resulting estimates match up well with alternative sources for the 1970s.

The modern data are based on the statistics in the World Bank's *WDI Database*, and the *Capital Market Statistics* of the Swiss National Bank, both of which aim to capture all Swiss firms listed in Switzerland. The two series are close to each other, and we use the WDI series for the early years, switching to the SNB data when these become available.

We complement these data with estimates of net issues and new listings derived from the same data sources. For the first 95 years of our sample (1876–1970), these are constructed from the listings microdata digitised by us and the data helpfully shared by Lyndon Moore. For the post-1970 period, the SNB provide statistics on net issuance in their historical capital market statistics and the modern capital market database. The modern series has more detail and is more likely to correctly account for direct listings and delistings as well as capital issuance, so we switch to it in 1996 when these series become available, and use the historical statistics series for the years before. However, we cannot use these modern data to construct our measure of new listings, because they record very large gross movements in new listings and delistings, likely driven by minor reclassifications of already listed shares and mergers or acquisitions, rather than truly newly listed firms.

For the post-1983 period, we are able to construct our own new listings series based on historical IPO data helpfully shared with us by Roger Kunz. These data include statistics on each Swiss IPO on the Swiss stock exchanges between 1983 and 2017, as well as the free float proportion and end of first trading day share price. We construct an estimate of the end-year IPO market cap by dividing the number of issued shares by the free float percentage, multiplying it by the end-of-first-trading-day share price, and by a proxy for the stock price growth for the rest of the year derived from the aggregate stock index data. The resulting series may still underestimate new listings however, because they may not count direct listings and some specific types of shares of the listed company. To account for this, we benchmark these series to the aggregate new listings data provided by the *WFE*, which we are able to obtain from the March 2013 edition of the Handbook of the *Deutsches Aktieninstitut*. The year-on-year movements in the *WFE* series are likely to be less accurate than in the microdata-based series, but the average quantity of new listings is likely to be more accurate. By comparing the average quantity of these two series, we scale up the IPO market cap series by a factor of 1.1 to proxy for total new listings.

Compared to other sources, our estimates of Swiss stock market cap are substantially smaller than the early proxies from Goldsmith (1985), and are similar but slightly below the estimates of Rajan and Zingales (2003) at the corresponding benchmark years.

We would like to thank Lyndon Moore for sharing the microdata from the Zurich stock exchange and offering helpful advice, to Roger Kunz for sharing data and helping us understand the workings of the Swiss IPO market, and to Carmen Hofmann and Rebekka Schefer for helping locate the other historical sources.

United Kingdom

Table E.16: *Data sources: United Kingdom*

Year	Data source
Stock market capitalization:	
1870–1929	Total market capitalization of British firms listed on UK exchanges as reported in the *Investor Monthly Manual*, from Campbell, Grossman, and Turner (2021), scaled up to account for stocks not included in the IMM. The scaling is done by comparing with Moore (2010b) data for the London stock exchange, scaled up to proxy for provincial exchanges using data in Campbell, Rogers, and Turner (2016), at 5-year benchmarks between 1899 and 1924 (factor of 1.3–1.4). We would like to thank Richard Grossman for sharing the underlying data with us.
1930–1956	Extrapolate market cap growth using the growth in market value of equity of all UK firms (listed and unlisted) from Solomou and Weale (1997), with the aggregate growth rate adjusted to match the total value of quoted ordinary equity liabilities of UK firms in 1957, sourced from Roe (1971).
1957–1964	Total value of quoted ordinary equity liabilities of UK firms from Roe (1971).
1965–1994	Marked value of all UK and Irish companies listed on the London Stock Exchange, from *LSE Historical Statistics*. Spliced with the Roe (1971) data over the period 1965–1967.
1995–2004	Marked value of all UK companies listed on the London Stock Exchange, from *LSE Historical Statistics*.
2005–2006	Total capitalization of the UK firms listed at the London Stock Exchange, from the *World Federation of Exchanges* (WFE) reports, various years.
2007–2017	Marked capitalization of all UK listed firms, from the London Stock Exchange *Main Market Factsheets*, various years.
Net equity issuance:	
1870–1929	Change in the book value of British firms listed in the *Investor Monthly Manual*, using data from Campbell et al. (2021) kindly shared by Richard Grossman, scaled up by the same factor as the stock market cap.
2003–2017	Net issuance of ordinary listed shares by all UK firms, from the Bank of England Monetary & Financial Statistics.
New listings:	
1918–1999	IPO gross proceeds from Chambers and Dimson (2009) scaled up to proxy the total end-year market cap of IPOs, and direct introductions to the stock exchange. The scaling for market cap is based on proportion sold figures in Chambers and Dimson (2009), assumed to be 40% up to 1955 and 30% afterwards. The scaling up for introduction is done by comparing with data on market cap of all newly listed firms in the LSE *Main Market Factsheets* before 2004 (factor of about 1.1).
2000–2017	Market capitalization of all newly listed British firms from the LSE *Main Market Factsheets*.

Figure E.16: *United Kingdom: alternative stock market cap estimates*

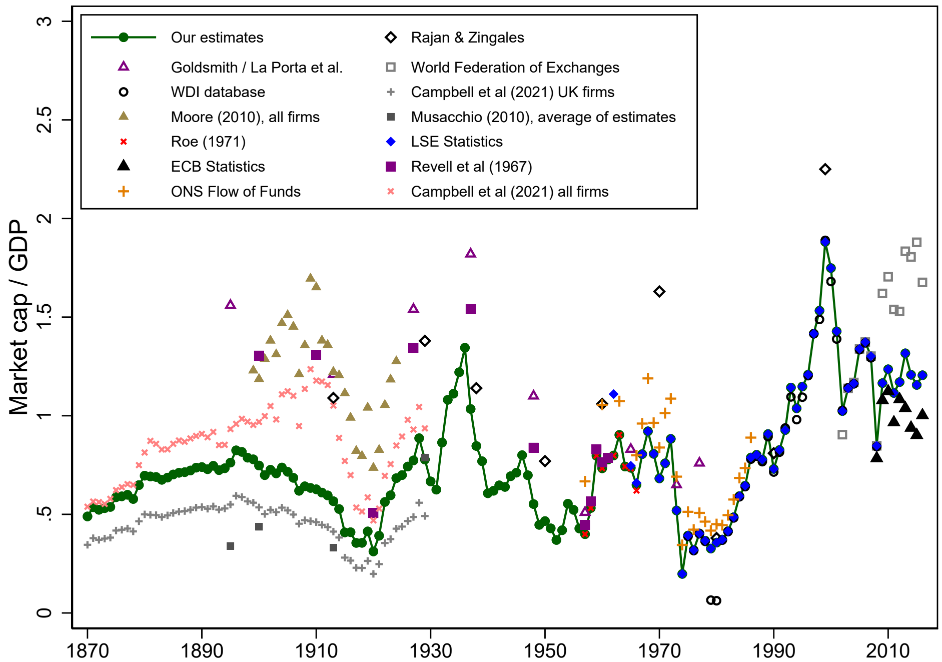


Table E.16 documents the sources of our data for the United Kingdom, and Figure E.16 plots the resulting market capitalization series alongside alternative existing estimates. The main difficulty in estimating the UK's stock market capitalization comes about from two sources. First, since London has been an active financial center throughout the historical period considered, with an especially active role in the 19th and early 20th centuries, many stocks listed in London are those of foreign companies and need to be excluded from the total. Second, especially in the 19th century, the UK had a number of active regional exchanges (Campbell, Rogers, and Turner, 2016), whose capitalization needs to be added to the total.

For the early years in our sample, Campbell, Grossman, and Turner (2021) provide an estimate of UK market capitalization that is very close to our desired definition: it includes all UK firms in the *Investor Monthly Manual* (IMM), which should in principle include both the London and provincial exchanges. However, the coverage of the IMM is incomplete, as shown in Campbell et al. (2021) and Hannah (2018) by comparing the total par value of stocks and bonds in the IMM with the par value of all UK-traded securities in various issues of the LSE *Official Intelligence*. The degree of coverage also varies over time. This means that we have to scale up the IMM-based series to proxy for all UK ordinary shares listed in the UK.

For the scaling, we use the series constructed by Moore (2010b) using stock listings in *The Economist*, *Money Market Review*, *The Times*, IMM, *The Mining manual* and the *Official Intelligence*. These series cover all shares listed on the London stock exchange, not just those of UK companies. But their total is larger than the UK and foreign total in the IMM calculated by Campbell et al. (2021) (the brown triangles vs grey crosses in Figure E.16). Therefore, we scale up the Campbell et al. (2021) UK-only figures using benchmark-year ratios between the all-share (UK and foreign) Campbell et al. (2021) and Moore (2010b) market capitalization estimates. However, the Moore (2010b) series are for London only and do not include provincial exchanges. This means that we have to scale the resulting total up to proxy for the time-varying importance of provincial exchanges, which we do by scaling it up by the ratio of all-UK to London-only equity and debt market capitalization in Campbell et al. (2016). Note that because the Campbell et al. (2016) data include preference shares and debt, we cannot use their estimates directly, and instead only use them for scaling purposes. The resulting early-period market capitalization series show a similar trend to the Campbell et al. (2021) data, but are larger in levels due to the above-mentioned inclusion of shares not listed in the IMM. They are below the estimates of substantially below those of Goldsmith (1985) and Rajan and Zingales (2003), whose proxies are much closer to the London total, unadjusted to exclude foreign shares. Our estimates are also above the benchmark-year estimates in Musacchio (2010).[19]

For the mid-20th century, we rely on estimates of the national wealth of the UK, published in a variety of sources, and in particular the part of wealth that is attributed to quoted UK shares. The early data are sourced from Solomou and Weale (1997), who publish a combined figure that includes the market value of both listed and unlisted UK firms. We use these series to capture market cap growth between years 1930 and 1957, for both of which we have estimates of the total listed equity wealth of UK firms. This gives us a value in 1957 which is slightly below the market value of quoted share liabilities of UK firms published in Roe (1971). Because the Roe (1971) estimates from the 1970s onwards align well with alternative data sources (e.g. the capitalization of UK firms estimated by the London Stock Exchange in the *LSE Historical Statistics*), we do not scale these series but rather slightly scale up the market cap growth between 1930 and 1957 so that the 1957 cap is equal to the Roe (1971) estimates. What stands out in these data is the UK stock market boom in the 1930s which saw market capitalization rise to as high as 1.5 times GDP – a value not observed again until the big bang in the 1990s. The growth in market capitalization in the 1930s was almost entirely driven by rising stock prices – consistent with evidence reported in Section 4 of this paper – and dissipated close to the onset of World War 2. Even though this boom was not apparent in the benchmark-year estimates of Goldsmith (1985) and Rajan and Zingales (2003), other annual estimates of UK equity prices and total wealth all show a similar boom-bust pattern in the 1930s.

For the second half of the 20th century and 21st century, we rely on official estimates of the capitalization of UK, or UK and Irish firms, provided by the London Stock Exchange. We use the UK and Irish capitalization provided in the *LSE Historical Statistics* between the 1960s and 1994. For the early 1960s, we stick to the Roe (1971) data, given that the LSE statistics estimate for 1962 seems to be an outlier not consistent with other series (Figure E.16). For 1995 onwards, we use data for UK firms only, with data before 2005 taken from the *LSE Historical Statistics*, and data after 2007 – from the LSE *Main Market Factsheets*, with the 2005–2006 gap plugged using the UK firms' London capitalization estimates provided by the *World Federation of Exchanges* (WFE) in their monthly statistical reports. A number of alternative estimates for this later period are shown in Figure E.16. These include national wealth estimates from the *Office for National Statistics*, World Bank's *WDI Database*, WFE reports and ECB's *Statistical Data Warehouse* data. These are generally close to our data and the estimates from the LSE, but overall seem somewhat less accurate, with outliers such as the WDI data for 1975–1976 making us prefer the LSE data overall. Our estimates of the capitalization for the 1980s are similar to those of Rajan and Zingales (2003), while those at the height of the dot-com boom in 1999 are somewhat below theirs.

We complement our estimates of total market capitalization with data on net issuances and new listings. The net issuance data are only available for the early historical period – calculated as the change in book capital of listed firms in Campbell et al. (2021) scaled by the same factor as market cap to proxy for firms not included in the IMM sample – and the post-2000 period from the Bank of England statistics. The new listings data are based on long-run series of IPO volumes and prices constructed by Chambers and Dimson (2009). We take the IPO gross proceeds and divide them

[19] Musacchio (2010) offers a range of estimates due to the difficulty of estimating early-period UK market capitalization data, with the dark squares in Figure E.16 showing the average of these.

by the proportion sold to proxy for the total capitalization of IPOs. The total proceeds data are provided by Chambers and Dimson (2009) on annual basis, but proportion sold is not published annually. However, Chambers and Dimson (2009) also show that proportion sold is higher in the earlier than later historical period. To account for this, we proxy proportion sold as 40% before 1955 and 30% afterwards (± 5 ppts of the historical average of 35% reported in Chambers and Dimson, 2009). Some new listings on the London Stock Exchange were also direct introductions rather than IPOs, and are not included in the Chambers and Dimson (2009) data. To account for these, we compare our proxy for the IPO market cap based on Chambers and Dimson (2009) with the total market value of new listings published in the LSE *Main Market Facthsheets*, for years where the data overlap and are broadly consistent with one another. As a result, we scale up the IPO cap series slightly by a factor of about 1.1.

The diversity of the UK market, its large size, and the need to account for foreign shares and regional exchanges, make estimating the UK's market capitalization a tricky task, illustrated by the large variety of alternative estimates in Figure E.16. The ability to draw on all this previous work, however, means that we are able to select those estimates that best fit a consistent definition of UK firms' listed market cap, and provide a historical series that maps the evolution of the size of the UK equity market with a reasonable degree of accuracy. We are grateful to Richard Grossman for providing helpful advice and sharing data, and to Leslie Hannah, David Chambers and John Turner for offering helpful feedback on the data and historical sources.

United States

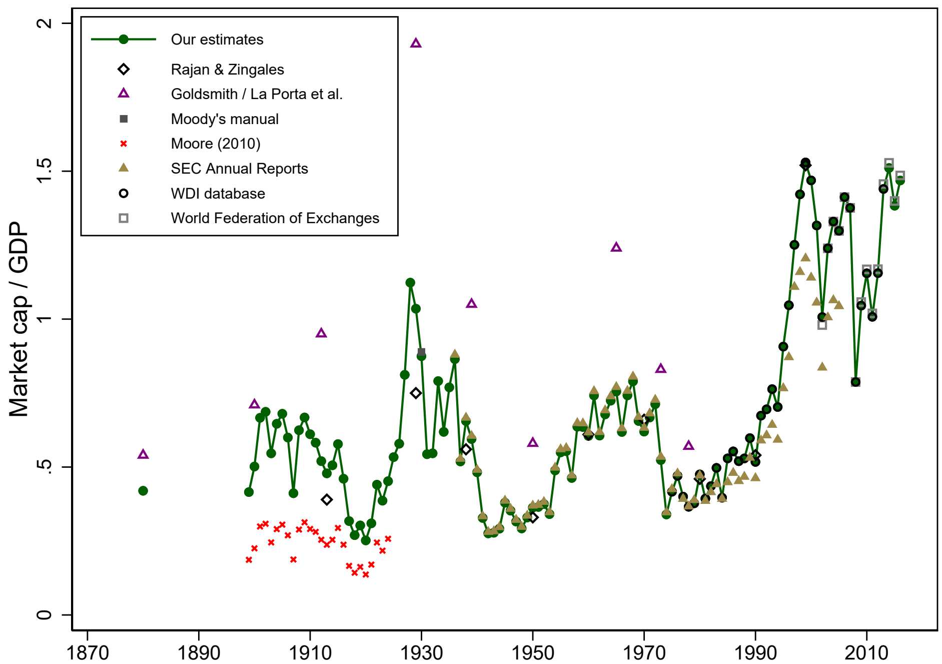
Table E.17: *Data sources: United States*

Year	Data source
Stock market capitalization:	
1880	Goldsmith (1985) estimate of total equity wealth, scaled down to proxy the market capitalization of US listed firms, using the ratio of overlapping data for 1900 as the scaling factor.
1899–1924	Total NYSE market capitalization scaled up to reflect all exchanges, and scaled down to exclude foreign stocks. NYSE data from Moore (2010b). Scaling done using the data on relative importance of the NYSE and other exchanges helpfully shared by Leslie Hannah, and the ratio of NYSE to total cap in the Moody's manual. Share of foreign firms calculated using *NYX* historical data.
1925–1935	Total equity wealth of US firms scaled down to capture listed shares only. Equity wealth data from Piketty, Saez, and Zucman (2018). Scaling done by benchmarking to our pre-1925 estimates, to Moody's total US capitalization in 1930, and to SEC's data on capitalization of all US exchanges in 1936.
1936–1975	Total market capitalization of all US exchanges, from the SEC's *Annual Reports*, scaled down slightly to exclude foreign firms. Share of foreign firms calculated using *NYSE Historical Statistics*, and by comparing the SEC and WDI data for the 1970s.
1976–2013	Total capitalization of all US listed firms, shares listed on US stock exchanges, from the World Bank's *WDI database*.
2014–2016	Total capitalization of all US listed firms, shares listed on US stock exchanges, from *World Federation of Exchanges* (WFE) reports, various years.
Net equity issuance:	
1926–2015	Net equity issuance by listed firms from Goyal and Welch (2008), data from Amit Goyal's webpage extended to 2015. Net issuance is calculated as the differences between value weighted cap growth and capital gain on the CRSP all share index.
2016–2017	Net equity issuance by listed firms from the *OECD Financial Statistics*, sourced from Richter and Diebold (2021).

Table E.17 documents the sources of our stock market capitalization data for the United States, and Figure E.17 plots the resulting series alongside alternative existing estimates. Most of the widely available estimates of US stock market capitalization refer to the New York stock exchange only, so the main challenge here reflects obtaining capitalization estimates that cover not only NYSE, but also other stock exchanges, and also adjusting estimates to exclude any foreign listings. Inclusion of non-NYSE stock exchanges is especially important for the early US data, with much of the trading taking place on the curb exchange and regional markets (Sylla, 2006; O'Sullivan, 2007).

Our early data use the Moore (2010b) estimates of the NYSE cap, scale these up to also account for other stock exchanges, and scale them down to exclude foreign listings. We rely on a number of benchmark year estimates to approximate the relative importance of the NYSE. The 1906 NYSE share was helpfully shared with us by Leslie Hannah, and amounts to around 44% in terms of book cap. By 1930, comparison of the total capitalization of US firms in Moody's manual to the NYSE

Figure E.17: *United States: alternative stock market cap estimates*



capitalization estimates indicates that the NYSE share reached more than 60%, and by late 1930s that share was larger than 80%, as suggested by data in the *SEC Annual Reports*. These broad trends are also consistent with turnover statistics of the different stock exchanges reported in O'Sullivan (2007). Before 1936 (the first year of the SEC data), we interpolate the NYSE share in-between benchmark years to obtain an annual proxy. As for the foreign share, based on the data from *NYX Historical Statistics*, this amounted to little over 2% in the mid 1920s. A similarly small foreign share is obtained by comparing the *SEC Annual Reports* and *WDI Database* estimates for the 1970s. Based on this, we adjust the Moore (2010b) NYSE-only estimates up substantially to approximate the inclusion of other exchanges, and account for the gradually increasing importance of the NYSE, and adjust them down slightly to proxy the exclusion of foreign ordinary shares. As a result, our market capitalization estimates in Figure E.17 are substantially above the NYSE capitalization in Moore (2010b), and are also higher than the Rajan and Zingales (2003) estimates which include regional exchanges but do not include the curb exchange, which was the largest non-NYSE market during this early period. We also use a market capitalization proxy for 1880, obtained by scaling down the Goldsmith (1985) data, which contain both listed and unlisted shares.

From 1936 onwards, estimates of total US market capitalization are available from the *SEC Annual Reports*. These include NYSE, Amex and regional exchanges. We adjust the estimates down very slightly to proxy the exclusion of foreign firms, and link the SEC series to the *WDI* data in the mid 1970s. For the modern period, we rely on a mixture of the *WDI* and *WFE* (World Federation of Exchanges) data, whose definition more precisely fits what we are after – namely, including all US company shares listed on US stock exchanges. To fill a small gap in the 1920s and 1930s, we use annual growth in the capitalization of all US firms (listed and unlisted), provided by Piketty, Saez, and Zucman (2018), to estimate market capitalization growth in-between benchmark years.

Taken together, our US market capitalization estimates are much smaller than the early data from Goldsmith (1985), which includes a mixture of listed and unlisted shares. They are above the estimates of Rajan and Zingales (2003) for the early period, thanks to our inclusion of the curb exchange, and similar to the Rajan and Zingales (2003) estimates for the more recent period.

We complement these with estimates on net equity issuance from CRSP data sourced from Goyal and Welch (2008), and for the most recent years from financial accounts data in the *OECD Financial Statistics*. Goyal and Welch (2008) estimate net issuance as the difference between the CRSP market cap growth and the value weighted price index. Because these two CRSP series are calculated on exactly the same underlying sample, they offer the best proxy of our desired issuance measure in equation (3). We effectively scale up their issuance to match our aggregate market cap series, therefore assuming that the listed firms not covered in the CRSP series (especially early on in the sample) issue equity at the same rate as those included in CRSP.

We would like to thank Leslie Hannah for sharing data and helping us locate and interpret the various historical sources for the US.

References

Abildgren, Kim. 2006. Monetary Trends and Business Cycles in Denmark 1875–2005: New Evidence Using the Framework of Financial Accounts for Organising Historical Financial Statistics. Danmarks Nationalbank Working Paper 43.

Annaert, Jan, Frans Buelens, and Marc De Ceuster. 2012. New Belgian Stock Market Returns: 1832–1914. *Explorations in Economic History* 49(2): 189–204.

Arbulu, Pedro. 1998. *Le marché Parisien des Actions au XIXe Siècle: Performance et Efficience d'un Marché Émergent*. Ph.D. thesis, Orléans.

Bank of Japan. 1966. *Hundred-Year Statistics of the Japanese Economy*.

Black, Susan, Joshua Kirkwood, Thomas Williams, and Alan Rai. 2013. A History of Australian Corporate Bonds. *Australian Economic History Review* 53(3): 292–317.

Boudoukh, Jacob, Roni Michaely, Matthew Richardson, and Michael R. Roberts. 2007. On the Importance of Measuring Payout Yield: Implications for Empirical Asset Pricing. *Journal of Finance* 62(2): 877–915.

Bozio, Antoine. 2002. *La Capitalisation Boursière en France au XXe Siècle*. Master's thesis, Ecole Normale Supérieure.

Buckley, Kenneth Arthur Haig, and Malcolm Charles Urquhart. 1993. *Historical Statistics of Canada*. Statistics Canada.

Campbell, Gareth, Richard S. Grossman, and John D. Turner. 2021. Before the Cult of Equity: the British Stock Market, 1829—1929. *European Review of Economic History* Heab003.

Campbell, Gareth, Meeghan Rogers, and John D. Turner. 2016. The Rise and Decline of the UK's Provincial Stock Markets, 1869-1929. QUCEH Working Paper 2016-03.

Carpentier, Cécile, Jean-François L'Her, and Jean-Marc Suret. 2009. On the Competitiveness of the Canadian Stock Market. *Banking & Finance Law Review* 24(2): 287.

Central Bureau of Statistics. 2010. *111 Jaar Statistiek in Tijdreeksen, 1899–2010*. Den Haag: Statistics Netherlands.

Chambers, David, and Elroy Dimson. 2009. IPO Underpricing over the Very Long Run. *Journal of Finance* 64(3): 1407–1443.

Deutsche Bundesbank. 1976. *Deutsches Geld-Und Bankwesen in Zahlen, 1876-1975*. Knapp.

Erichsen, Christian. 1902. Green's Danske Fonds og Aktier 1902. Udgivet og Redigeret af Holmer Green og Hendrik Stein. Nationaløkonomisk Tidsskrift 3.

Foster, Rob A. 1996. Australian Economic Statistics 1949–50 to 1994–95. Reserve Bank of Australia Occasional Paper 8.

Goldsmith, Raymond W. 1985. *Comparative National Balance Sheets: A Study of Twenty Countries, 1688–1978*. Chicago, Ill.: University of Chicago Press.

Goyal, Amit, and Ivo Welch. 2008. A Comprehensive Look at the Empirical Performance of Equity Premium Prediction. *Review of Financial Studies* 21(4): 1455–1508.

Grullon, Gustavo, and Roni Michaely. 2002. Dividends, Share Repurchases, and the Substitution Hypothesis. *Journal of Finance* 57(4): 1649–1684.

Hall, Alan Ross. 1968. *The Stock Exchange of Melbourne and the Victorian Economy 1852–1900*. Canberra, ACT: Australian National University Press.

Hannah, Leslie. 2018. The London Stock Exchange, 1869–1929: New Statistics for Old? *Economic History Review* 71(4): 1349–1356.

Hansen, Svend Aage, and Knud Erik Svendsen. 1968. *Dansk pengehistorie. 1: 1700–1914*. København: Danmarks Nationalbank.

Högholm, Kenneth, and Victor Högholm. 2017. Open Market Repurchase Programs – Evidence from Finland. *International Journal of Economics and Finance* 9(12): 13–23.

Jordà, Òscar, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, and Alan M. Taylor. 2019. The Rate of Return on Everything, 1870–2015. *Quarterly Journal of Economics* 134(3): 1225–1298.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor. 2016. Macrofinancial History and the New Business Cycle Facts. In *NBER Macroeconomics Annual 2016, Volume 31*, edited by Martin Eichenbaum, Jonathan A. Parker, pp. 213–263. Chicago, Ill.: University of Chicago Press.

Kunz, Roger M., and Reena Aggarwal. 1994. Why Initial Public Offerings are Underpriced: Evidence from Switzerland. *Journal of Banking and Finance* 18(4): 705–723. Special Issue on Non-US Financial Markets.

La Porta, Rafael, Florencio Lopez-de Silanes, and Andrei Shleifer. 2008. The Economic Consequences of Legal Origins. *Journal of Economic Literature* 46(2): 285–332.

Lamberton, Donald McLean. 1958. *Share Price Indices in Australia: An Examination of the Measurement and Significance of Changes in Share Prices, Together with New Indices for the Period July, 1936-December, 1957*. Law Book Company of Australia.

Le Bris, David, and Pierre-Cyrille Hautcoeur. 2010. A Challenge to Triumphant Optimists? A Blue Chips Index for the Paris Stock Exchange, 1854–2007. *Financial History Review* 17(2): 141–183.

López, Carlos Barciela, Albert Carreras, and Xavier Tafunell. 2005. *Estadísticas Históricas De España: Siglos XIX–XX*. Madrid: Fundacion BBVA.

Mathews, Thomas. 2019. A History of Australian Equities. RBA Research Discussion Paper RDP 2019-04.

Mediobanca. Various years. Indici e Dati Relativi ad Investimenti in Titoli Quotati.

Megginson, William L., and Henk Von Eije. 2008. Dividends and Share Repurchases in the European Union. *Journal of Financial Economics* 89(2): 347 – 374.

Moore, Lyndon. 2010a. Financial Market Liquidity, Returns and Market Growth: Evidence from Bolsa and Börse, 1902-–1925. *Financial History Review* 17(1): 73–98.

Moore, Lyndon. 2010b. World Financial Markets 1900–25. Working paper.

Musacchio, Aldo. 2010. Law and Finance c. 1900. NBER Working Paper 16216.

Nyberg, Peter M., and Mika Vaihekoski. 2011. Descriptive Analysis of Finnish Equity, Bond and Money Market Returns. Bank of Finland Discussion Paper Series 14/2011.

Nyberg, Peter M., and Mika Vaihekoski. 2014a. Descriptive Analysis of the Finnish Stock market: Part II. Bank of Finland Discussion Paper Series 10/2014.

Nyberg, Peter M., and Mika Vaihekoski. 2014b. Equity Premium in Finland and Long-Term Performance of the Finnish Equity and Money Markets. *Cliometrica* 8(2): 241–269.

O'Sullivan, Mary. 2007. The Expansion of the U.S. Stock Market, 1885–1930: Historical Facts and Theoretical Fashions. *Enterprise & Society* 8(3): 489–542.

Parum, Claus. 1997. Det Danske Organiserede Aktiemarked i Historisk Belysning. Copenhagen Business School Department of Finance Working Paper 97-6.

Piketty, Thomas, Emmanuel Saez, and Gabriel Zucman. 2018. Distributional National Accounts: Methods and Estimates for the United States. *Quarterly Journal of Economics* 133(2): 553–609.

Rajan, Raghuram G., and Luigi Zingales. 2003. The Great Reversals: the Politics of Financial Development in the Twentieth Century. *Journal of Financial Economics* 69(1): 5–50.

Richter, Björn, and Lukas Diebold. 2021. When Two Become One: Foreign Capital and Household Credit Expansion. Working paper.

Roe, Alan. 1971. *The Financial Interdependence of the Economy, 1957–1966*. London: Chapman & Hall.

Ronge, Ulrich. 2002. *Die Langfristige Rendite Deutscher Standardaktien: Konstruktion eines Historischen Aktienindex ab Ultimo 1870 bis Ultimo 1959*. Frankfurt am Main: Lang.

Rydqvist, Kristian, and Rong Guo. 2020. Performance and Development of a Thin Stock Market: the Stockholm Stock Exchange 1912–2017. *Financial History Review* 28(1): 26–44.

Saint-Marc, Michèle. 1983. *Histoire Monétaire de la France (1800–1980)*. Paris: Presses Universitaires de France.

Shiller, Robert J. 2015. *Irrational Exuberance*. Princeton, N.J.: Princeton University Press.

Solomou, Solomos, and Martin Weale. 1997. Personal Sector Wealth in the United Kingdom, 1920–1956. *Review of Income and Wealth* 43(3): 297–318.

Sylla, Richard. 2006. Schumpeter Redux: a Review of Raghuram G. Rajan and Luigi Zingales's Saving Capitalism from the Capitalists. *Journal of Economic Literature* 44(2): 391–404.

Waldenström, Daniel. 2014. Swedish Stock and Bond Returns, 1856–2012. In *Historical Monetary and Financial Statistics for Sweden, Volume 2: House Prices, Stock Returns, National Accounts and the Riksbank Balance Sheet, 1860-2012*, edited by Rodney Edvinsson, Tor Jacobson, and Daniel Waldenström, pp. 223–293. Stockholm: Sveriges Riksbank and Ekerlids förlag.

Zeng, Liyu, and Priscilla Luk. 2020. Examining Share Repurchasing and the S & P Buyback Indices in the US Market. S & P Global Research Note.