Financial bubbles and income inequality

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Abstract

Using a sample of OECD countries, we explore the relationships between stock market bubbles and income inequality. Specifically, we test whether explosive growth in stock prices leads to increased concentration of income at the top of the distribution. Moreover, we investigate the possibility that increased income concentration at the top increases the incidence or severity of asset bubbles. Using instrumental variables techniques, we uncover a positive effect of asset bubbles on the share of income earned by those in the top 1% and top 0.1% of the income distribution. However, this effect is not present when capital gains are excluded from income, supporting the idea that the mechanical effect of bubbles on asset income is a dominant driver of their effect on top income inequality. On the other hand, we also find that concentration of income at the top is associated with an increase in bubbles, whether measured by incidence, duration, or intensity. Moreover, this finding remains when capital gains are excluded from income. Our results suggest that top income inequality, whatever its source, increases the demand for assets, setting the stage for abnormal growth in stock prices.

JEL Classification:

Keywords: Top income shares; bubbles and crashes; top tax rates.

1 Introduction

Increasing inequality, driven especially by increasing concentration of income and wealth among the very richest of individuals, has received much popular and academic attention. It is natural for social scientist to study both the causes and the consequences of this phenomenon. The role played by the concentration of capital income in rising inequality points to the possibility that part of the explanation for rising inequality lies in the performance of stock markets. Indeed Sarkar and Tuomala (2021) provide evidence that stock market bubbles lead to increases in the share of income held by those in the highest percentiles of the income distribution[1](see also Markiewicz and Raciborski (2022)). When a tsunami of excessive income is in the hands of the super rich, and given an environment enhanced by accomodating monetary policy, the super can rich invest more and more in asset markets. But does this accumulation of income and wealth lead to asset price bubbles? On the other hand, do asset price bubbles inflate income inequality? If the answer to both these question is positive, then policy makers need to be wary of a financial instability-inequality spiral. In this paper, we revisit the idea of stock market bubbles as a determinant of income inequality and ask whether there is evidence that income inequality also leads to stock market bubbles, so that the two phenomena are co-determined.

Figure 1 shows that periods of increased concentration of income in the top quantiles tend to coincide with the incidence of stock market bubbles and with the duration of those bubbles. While suggetive, Figure 1 does not allow one to draw firm conclusions about the relationship between bubbles and top income shares. Rising inequality and stock market bubbles are, individually, highly complex issues. Sarkar and Tuomala (2021) provide an overview of the determinants of concentration of income at the top, paying particular attention to the role of top marginal income tax rates in shaping the economic fortunes of the very rich. Piketty et al. (2014) also show that there is a clear correlation between the drop-in top marginal tax rates and the surge in top income shares. While knowledge of the relationship between asset bubbles and income concentration could prove

[1]Piketty and Saez (2007); Piketty et al. (2014) also suggests that bubbles seem to occur during a period when top income shares have rapidly increased in USA.

vital to understanding the channels through which assets price movements affect inequality and inform appropriate policy responses, this area remains, to the best of our knowledge, understudied.

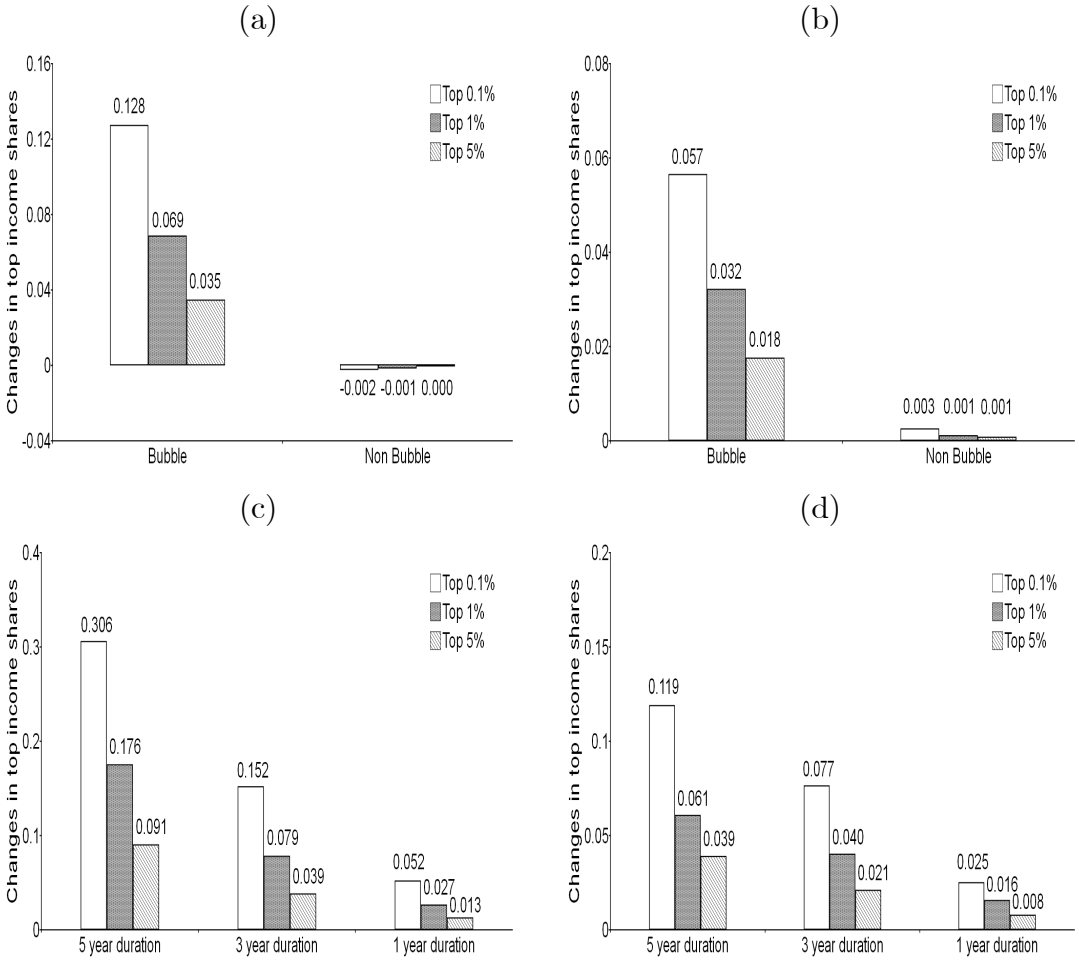

Figure 1: Mean of the changes in the log of top income shares with duration measuring the length of the bubble period. Figure 1(a) and (c) represent the case for the top income shares including capital gain and Figure 1(b) and (d) represent the case for the top income shares excluding capital gain.

There are many studies that try to explain the rise in inocme concentration at the top. Some works point to how globalization and technological advancements increase the rewards for white-collar workers and reduce pay for the blue-collar workers or lower-paid workers who work by operating machines. (see Gozgor and Ranjan (2017), Bergh and Nilsson (2010), Jaumotte et al. (2013), and Guellec and Paunov (2017) among others). Tridico (2018) also states that the increase in inequality over the past two decades is partly explained by an increase in finan-

cialization. Aghion et al. (2019) argue that patenting and top income inequality have followed a parallel evolution in the US and other developed countries over the past decades. According to their opinions, more innovation-led growth increases top income shares (which reflect innovation rents). There is also a well-established literature on the relationship between economic growth and income inequality, but still no consensus has been reached as some claim that economic growth is the main force behind the surge in top income inequality. Among those that claim the opposite are Sukiassyan (2007), Forbes (2000), and Banerjee and Duflo (2003). Some studies identify a bi-directional relationships between income inequality and other indicators of social and economic development (Fielding and Torres (2006), Lundberg and Squire (2003)). Our modeling approach follows Sarkar and Tuomala (2021) and introduces controls for these influences whlie explaining the effect of bubbles on the change in top income shares.

Informally, stock market price bubbles are the part of an increase in the prices of securities that cannot be explained by market fundamentals. (Shiller (1981)). This makes finding their determinants a tricky task. Most of the literature on bubbles focuses on their relationship with macroeconomic phenomena. Some of the theoretical and a few empirical works in this literature conclude that monetary policy should not respond to asset bubbles (Bernanke and Gertler (2001), Brunnermeier and Schnabel (2016)). Others show that central banks should act pre-emptively to prevent asset price bubbles from forming, by raising interest rates or decreasing money supplies to appropriate levels. (European Central Bank (2010), Blanchard et al. (2012)) However, little is known about the determinants of asset price bubbles and the empirical models related to it are somewhat sparse. Narayan et al. (2013) argue that the trading volume and share price volatility, a measure of market risk, have statistically significant effects on asset price bubbles (see also Topol (1991)). A small number of finance research also analyse the relationship between asset price bubbles and systemic risk and relate it with market liquidity (see, for example, Jarrow and Protter (2020) and Brunnermeier et al. (2020)).

In this paper, we add income concentration to the list of factors that can lead to stock market bubbles. Zhao et al. (2021) identify increasing inequality as a contributor to housing bubbles. In their anaysis, inequality induces a higher rate of

saving and a greater investment of those savings in housing assets. There is also an existing literature, motivated by Ranjan (2010), on the impact of income inequality on the incidence of financial crises, which reinforces the work of Schumpeter (1950). He argues that rising inequality, with the help of liberalising policies in credit markets, stimulates low-income households to borrow more and more to keep up with high social standards, which eventually sows the seeds for a financial crisis. Kumhof et al. (2015) develop a theoretical explanation to analyse the impact of changes in income inequality on financial crises. Kirschenmann et al. (2016) also show that changes in the top income shares contain relevant information to directly predict financial crises (see also Gu and Haung (2014) and Morelli and Atkinson (2015)). While crises and bubbles are distinct market phenomena, this literature does point to the impact of inequality on financial market stability. In that sense, it lends credence to the idea that the distribution of income influences the mix of asset holdings in an economy. We investigate here whethe an increased prevalence of stock market bubbles is among the effects of income inequality on asset markets.

The remainder of this paper is structued as follows. The next section outlines the empirical model and the estimation techniques we employ. This is followed by a some details on the construction of the variables we use. Section 4 contains our primary results. In Section 5, we check the robustness of our results by re-estimating using alternative measure of stock market bubbles. We focus attention on income from capital gains in Section 6. Section 7 offers concluding remarks. Some of the finer points of our data construction are presented in the appendices.

2 Data description

This section describes the data, and the definition of the variables whose sources are reported in Appendix A. The dependent variable top income shares, which could be a potential candidate for a measure of income inequality, are collected from the World Wealth and Income Database (WID) of the Paris School of Economics. Top 0.1% income share, top 1% income share, and top 5% income share are the preferred measures of top income inequality. The research analyses the simultaneous relationship between bubbles and income inequality, and at the same

time examines the role of bubbles in inflating income inequality by accumulating realised capital gain collected from the rising asset prices. Although top income shares excluding capital gain data is available for many countries for a long period of time, however, the main variable for the empirical analysis, top income shares including capital gain is available only for Canada, Germany, Japan, Spain and Sweden, and the USA. Most of the variables are available for some countries from 1960 to 2018 or an even greater period, but estimated bubble variables are available from the year of 1970. Due to the data limitation, the empirical analysis utilizes annual data and covers for the period of 1970 to 2018.

Stock market bubbles and stock market crashes are estimated by the Generalized Sup Augmented Dickey-Fuller test (GSADF) procedure, a statistical system proposed by Phillips et al. (2015). The idea of the GSADF procedure is based on the Random Walk Hypothesis of the asset prices and the proposed procedure assumes that the bubble injects an explosive component into asset prices, which triggers the asset prices to deviate from a random walk to an explosive regime. The moment of deviation from a random walk could be regarded as the origin or collapse of the explosive episodes. The estimated time series of the backward Sup Augmented Dickey-Fuller (BSADF) test against the 95% Sup Augmented Dickey-Fuller (SADF) critical value, obtained from Monte Carlo simulations with 2,000 replications, along with the real asset price index, is plotted to locate the origin or collapse of explosive episodes (see Phillips et al. (2015), and Sarkar and Tuomala (2021) for more details).

Appendix B.1 portrays the starting and ending points of explosive episodes of the quarterly real stock price indexes. These figures successfully detect the start and end dates of bubble periods in quarterly real stock price indexes, but the procedure proposed by Phillips et al. (2015) fails to recognize some of the well-known financial turmoils, at least for low frequency data that is perhaps not ideal for the GSADF test. That is why stock market crisis variables are collected from Carmen M. Reinhart's website, which uses the procedure detailed in Reinhart and Rogoff (2011). All nonoverlapping binary variables representing explosive episodes, along with other measures of bubble and crash variables which are continuous in nature from the peak-to-trough procedure (see Barro and Ursüa (2017)), are used

in the empirical analysis. Other variables like financial development, gross domestic product per capita, innovation, government expenditure, tax rate, population, stock market development, market risk, market liquidity, and a number of listed companies are used as control variables in the system of equations. There are a few missing values, and a linear interpolation technique that is used to fill out those gaps in the data.

Table 1 ABOUT HERE

Table 1 displays descriptive statistics for our variables. We identify 36 bubble-country pairs and 56 crash-country pairs, with bubbles lasting a little longer, on average, than crashes. As one might expect, capital gains income tends to be more highly concentrated among the very rich than does income from other sources.

3 Empirical model

We adapt the Sarkar and Tuomala (2021) model to allow for the possibility that financial instability may contribute to top income inequality while also being more likely to arise when incomes are more concentrated among the richest. Specifically, we employ a two-equation fixed effect panel model. The first equation, which describes the determinants of top income shares, denoted y_{it}, is as follows:

$$\begin{aligned}\Delta \log(y_{it}) = {} & \beta_1 + \beta_2 \text{ Bubble}_{it} + \beta_3 \text{ Crash}_{it} + \beta_4 \text{ Fin. dev}_{it} + \beta_5 \text{ GDPpc}_{it} \\ & + \beta_6 \text{ Innovation}_{it} + \beta_7 \text{ Govt. expenditure}_{it} + \beta_8 \text{ Openness}_{it} \\ & + \beta_9 \text{ Tax rate}_{it} + \beta_{10} \text{ Population}_{it} + \xi_i + t + u_{it} \end{aligned} \quad (1)$$

where $\Delta \log(y_{it}) = \log(y_{it}) - \log(y_{it-2})$.

Top income shares are highly persistent. The use of log differences creates some varation in the dependent variable, and allows us to avoid the problems associated with highly persistent time series. The version of equation (1) in Sarkar and Tuomala (2021) uses top income shares in level form. They conduct all of their analyses on the full set of countries in our data base and use unit root tests to rule out these diffculties. The updated subset of the data used in this research for which capital gains are excluded is too small for standard unit root tests to be

reliable[2]. Thus, we decide to err on the side of caution by differencing the data for in this case. To be consistent, we choose to do so for all specifications.

An indicator variable Bubble_{it} is equal to one if a market bubble is active in country i at time t, and zero otherwise. The indicator for a crash is defined similarly. We are interested in the coefficient values of stock market bubble and crash variables. The coefficient of bubble variable is expected to be positive, which simply means that the stock market bubble accelerates to elevate the income of the rich. The control variables are financial development (Fin.dev_{it}), gross domestic product per capita (GDPpc_{it}), innovation (Innovation_{it}), government expenditure ($\text{Govt.expenditure}_{it}$), trade openness ($\text{Openness}_{it}$), top marginal tax rate (Tax rate_{it}), and population (Population_{it}).

The second equation models bubble phenomena. Based on the existing bubble literature, the incidence of bubbles is modeled in the following way:

$$\begin{aligned}\text{Bubble}_{it} = \alpha_1 \Delta \log(y_{it}) + \alpha_2\ \text{Tax rate}_{it} + \alpha_3\ \text{S.market dev}_{it} + \alpha_4\ \text{Risk}_{it} \\ + \alpha_5\ \text{Market liqt}_{it} + \alpha_6\ \text{Companies}_{it} + \xi_i + t + e_{it} \qquad (2)\end{aligned}$$

The coefficient of $\Delta \log(y_{it})$, α_1, is expected to be positive, which means that accumulated income creates market instability and leads to bubbles in the financial markets. The inclusion of the top marginal tax rate (Tax rate_{it}) in equation (2) is motivated by the preferential treatment of capital gain income in may tax systems. Increases in the top income tax rate increase the value of these tax preferences, thereby increasing the incentive to provide income in the form of equities such as stock options rather than salaries, whenever possible. This, in turn, may put upward pressure on equity prices and exacerbate bubbles.

Our choice of other explanatory variables in equation (2) follows the literature, comprising a set of measures to control for the size and underlying volitility of stock markets. The variables are stock market development ($\text{Stock market dev}_{it}$), financial risk ($\text{Risk}_{it}$), market liquidity ($\text{Market liqt}_{it}$), and the number of listed companies (Companies_{it}). Fixed country effects are denoted by, ξ_i, the variable t captures time effects, and the variables u_{it} and e_{it} are traditional error terms.

[2]Dickey–Fuller test also applied on the level of top income shares excuding and including capital gain. Dickey–Fuller test fails to reject the hypothesis at 1% level of statistical significance that series of Top 0.1%, Top 1%, and Top 5% are not stationarity.

The proposed model, which can codetermine the effect of stock market bubbles on income inequality, and vice versa, and resolve the difficulties of interdependence between these variables, is estimated by the GMM (Generalised Method of Moments) method, along with pooled OLS and two stages least square (2SLS) estimation techniques. The Pooled OLS estimation technique is appropriate if there are no unobserved differences across countries, and no endogeneity exists in a panel data set. However, in the presence of endogeneity, instrumental variables (2SLS) and GMM are probably the most appropriate techniques available in literature. The GMM estimator is not only robust for the distribution of errors, but is also more efficient in the presence of arbitrary heteroscedasticity. During the estimation of the proposed model, lags of explanatory variables are used as instruments, and the Hansen's test of overidentification is utilized to verify their validity.

4 Empirical results

Tables 2 and 3 contain parameter estimates obtained from three estimation techniques: OLS, equation-by-equation instrumental variables, and three-stage least squares. Where used, our instruments are all the explanatory variables except for top income shares and the bubble indicator, along with lags of each of these variables. The signs and significances of our key variables do not vary across specifications, with the magnitude of the coeficients roughly similar for the two instrumental varaible estimators.

Table 2 show that stock market bubbles induce an increase in top income shares. This is in line with previous research and with intuition. In Table 3, we perform the same exercise of income excluding capital gains. We no longer find evidence of stock market bubbles affecting top income shares. This is consistent with a mechanical interpretation of the effect of bubbles on top income shares. The highest earners are also the most invested in stock markets. A bubble augments their capital gains, leading to increased income concentration at the top. This effect does not appear to spill over to other forms of income.

Also in Table 2, we see that income concentration is associated with an increased incidence of bubbles. As Table 3 demonstrates, this remains the case

when captial gains are excluded from inocme. It appears that increases in income concentration, whatever its source, can lead to stock market bubbles. This is consistent with the demand for securities increasing with the concentration of income, leading to upward pressuer on their prices. We also find that, as expected, the top statutory income tax rate is positively associated with bubbles. Among the other control variables, only the measure of stock market size appears to influence bubbles, with larger markets being more prone to explosive prices.

Absent in Tables 2 and 3 is evidence of any relationship between stock market crashes and income concentration. At first glance, this asymmetry is unexpected. Surely, stock market losses are cocentrated among those with the largest exposure to the markets, namely the very rich. However, it appears that, unlike the windfalls of market bubbles, the pains of market crashes travel down the income distribution in such a way that measures of concentration are largely unaffected. While the deleritous effects of market crises on macroeconomic performance and general economic well-being are welll documented, the effects of unburst bubbles elsewhere in economy remain, to the best of our knowledge, largely unstudied.

Tables 4 and 5 are the counterparts to Tables 2 and 3, using different lag lengths in the choice of instruments. The results are consistent across the choice of instruments. This provides an extra level of confidence in our results. At the very least, it gives a level of assurance that the temporal structure of the data does not introduce a layer of endogenity.

5 Alternative Measures of Bubbles

While our results are certainly suggestive of a two-way relationship between income inequality and financial market bubbles, one might worry that this impression results from the specific ways that we have measured the variables. In this section, we follow Sarkar and Tuomala (2021) by reestimating our models on alternative measures of financial bubbles. A long-lasting bubble may affect behavior in ways that temporary bubbles do not, as market participants may take the bubble to be a new trend rather than a temporary phenomeon. For this reason, it may be of interest to investigate how the duration of bubbles interacts with income inequality.

At the very least, one would expect that longer-lasting bubbles to increase income concentration at the top due to the cumulation of supra-normal returns. By the same token, the intensity of a bubble, measured by the amount of excesss returns, is likely to have a mechanical effect on income concentration. Given the evidence in the previous section that income concentration leads to stock market bubbles, it is natural to ask whether it also increases their duration and intensity.

Table 6 is the counterpart to Table 2, with bubbles measured by their duration, in years, rather than their incidence. The qualitative results are similar to those in Table 2, namely that top shares are increasing in the duration a stock market bubble and that increased top income shares are associated with longer market bubbles. Direct comparison of the coefficients across Tables 2 and 6 is not possible due to the different units of measurement. Table 7 repeats this analysis using a measure of excess return, introduced by Sarkar and Tuomala (2021), to measure bubble intensity. Once again, the familiar pattern of results emerges. Excess returns tend to line the pockets of the already rich and increased concentration of income appears to give rise to more intense stock market bubbles.

6 Concentration in Captial Gains

Without detailed knowledge of the distribution of incomes by source, it is impossible to the income concentration measures we have to determine the concentration in capital gains alone. However, it is possible to define a measure of change in the concentraton of captial gains income at the top by calculating the difference between the ratio of top income shares including capital gain, (for example Top 1% to Top 5%) and the same ratio excluding capital gain. Tables 8-10 repeat our analysis or this measure of concentration of captial gains. Table 8 shows that bubbles lead to increased concentration in captial gain income in the top 1% to top 5% of capital gains earners, but not as we move to the highest percentile. Tables 9 and 10 show that the impact of bubbles on the very top recipients of capital gains become stronger the longer its duration of a bubble and the greater its intensity. In line with our previous results, increased concentration of capital gain income leads to bubbles, whether measured by incidence, duration, or intensity.

7 Concluding remarks

In this paper, we have studied the possible two-way interaction between the concentration of income among the very rich and the occurence of stock market bubbles. Using a slightly different samples and estimation techniques, we have confirmed the results of Sarkar and Tuomala (2021) on the importance of bubbles in augmenting income concentration at the top of the distribution. This effect appears to operate primarily through increases in capital gains, as it is not apparant when capital gains are excluded from income. The impact of bubbles on the distribution of captial gains income itself appears to arise in longer, more intense bubbles. Moreover, our results also indicate that income concentration is an important determinant of stock market bubbles. This holds true even when capital gains are excluded from income. The most natural interpretation of this result is that concentration of income among the wealthy increases the demand for securities, thereby putting upward pressure on prices, setting the stage for explosive events.

Our results suggest that redistributive tax policy may have a role to play in preventing bubbles. Given the two-way relationship between inequality and bubbles, measures that deflate bubbles may also attenuate income inequality. Future research could include an investigation of the relative impacts of progressive taxes on financial markets, on the one hand, and the effects of capital market reguation on measured inequality, on the other.

We noted in passing that our findings also support the notion of an aysmmetry between bubbles (which show a marked relationship with increased inequality) and crashes (which do not). While a rising tide may raise a boats, our results suggest that an inflating bubble does not. This, too, seems worthy of further investigation.

A Appendix

A.1 Basic explanatory variables.

Table A1: Description of variables and data sources

Top 5%	Share of total income earned by those with the 5% highest incomes (P95-P100).	World Wealth and Income Database (https://wid.world)
Top 1%	Share of total income earned by those with the 1% highest incomes (P99-P100).	WID, Statistics Canada Table: 11-10-0055-01
Top 0.1%	Share of total income earned by those with the 0.1% highest incomes (P99.9-P100).	WID, Statistics Canada Table: 11-10-0055-01
Gross domestic product-PC	Log of real gross domestic product per capita. (constant 2011 US$)	http://www.ggdc.net
Innovation	Number of total patents granted at the United States Patent and Trademark Office (USPTO) per thousand of people.	OECD database
Real stock market price	Quarterly real stock-price composite index.	Global financial database
Stock market development	Stock market capitalization: market value of publicly listed stocks divided by GDP.	Roine et al (2009) and WB, FDS database
Financial development	T. market capitalization as the sum of bank deposits and stock market capitalization divided by GDP.	Roine et al (2009) and WB, FDS database
Tax rate	Top marginal tax: statutory tax rate for each available country.	Roine et al (2009), OECD database (Table 1.7)
Openness	Import plus export divided by GDP.	World Bank (WB) database
Government expenditure	Central govt. expenditure divided by GDP.	World Bank (WB) database
Stock market crash	It is a binary variable which takes the value of 1 for crash episodes and zero otherwise.	carmenreinhart.com, updated by peak-to-trough procedure (see Barro et al (2017))
Stock market bubble	It is a binary variable which takes the value of 1 for bubble episodes and zero otherwise.	Based on GSADF statistical method
Bubble/crash duration	Duration is defined by the year-to-burst of the explosive episodes in the asset markets.	Based on GSADF statistical carmenreinhart.com and peak-to-trough procedure
Population	Log of total population.	http://www.ggdc.net
Market liquidity	Stock market turnover ratio: the value of total shares traded divided by average real market capitalization is measured in percentage.	FSD database and WB
Market risk	Standard deviation of real stock market returns.	Global financial database and World Bank (WB) database
Number of companies	Log of number of publicly listed companies per thousand of population.	FSD database and WB

Table 1: Descriptive statistics of key variables.

Variable	Observations	Mean	Standard deviation	Manimum	Maximum
Top 5% including capital gain	252	23.728	5.146	13.320	38.820
Top 1% including capital gain	252	10.578	3.844	4.070	23.500
Top 0.1% including capital gain	252	3.928	2.286	0.790	12.280
Top 5% excluding capital gain	250	22.233	4.619	13.180	35.350
Top 1% excluding capital gain	250	9.172	3.202	3.970	18.880
Top 0.1% excluding capital gain	250	2.984	1.722	0.740	8.360
GDP per capita	252	10.293	0.300	9.539	10.921
Innovation	215	21.455	32.649	0.070	128.430
Stock market development	250	0.618	0.395	0.030	1.635
Financial development	241	1.388	0.651	0.507	3.125
Top marginal tax rate	252	0.534	0.131	0.280	0.870
Openness	252	0.448	0.207	0.107	0.925
Government expenditure	252	0.198	0.045	0.111	0.275
Stock market bubble	252	0.142	0.350	0.000	1.000
Stock market crash	252	0.222	0.416	0.000	1.000
Stock bubble duration	252	0.341	1.038	0.000	7.000
Stock crash duration	252	0.396	0.893	0.000	6.000
Market liquidity	229	0.795	0.697	0.039	6.229
Market risk	250	0.172	0.102	0.015	0.562
Positive cum return	252	0.197	0.257	0.000	1.415
Negative cum return	252	-0.082	0.136	-0.577	0.000
Population	252	10.936	1.131	8.999	12.700
No. of listed companies	229	7.717	0.804	6.250	9.375

Table 2: Simultaneous regression estimates for top income shares including capital gain. The regression estimates include Canada, Germany, Japan, Spain, Sweden, and USA.

	Top 1%			Top 0.1%		
	OLS estimation	IV estimation 2SLS	IV estimation GMM	OLS estimation	IV estimation 2SLS	IV estimation GMM
Top income sahres						
Stock market bubble	0.067***	0.130**	0.149***	0.153***	0.311***	0.350***
	(0.025)	(0.064)	(0.031)	(0.046)	(0.109)	(0.053)
Stock market crash	-0.010	0.005	0.003	-0.004	0.036	0.021
	(0.026)	(0.031)	(0.015)	(0.046)	(0.056)	(0.026)
Financial development	0.046	0.009	-0.011	0.045	-0.043	-0.053
	(0.053)	(0.065)	(0.036)	(0.093)	(0.111)	(0.059)
GDPpc	-0.267*	-0.251*	-0.207***	-0.306	-0.314	-0.318***
	(0.147)	(0.140)	(0.061)	(0.250)	(0.227)	(0.113)
Innovation	0.000	-0.000	-0.001	0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Government expenditure	0.105	0.031	-0.228	0.339	-0.067	0.058
	(0.896)	(0.891)	(0.374)	(1.425)	(1.409)	(0.577)
Openness	0.207	0.066	-0.004	0.259	-0.074	-0.073
	(0.200)	(0.236)	(0.127)	(0.321)	(0.382)	(0.215)
Tax rate	-0.086	-0.140	-0.192**	-0.048	-0.217	-0.288*
	(0.118)	(0.144)	(0.083)	(0.197)	(0.231)	(0.151)
Popupation	-0.446*	-0.416	-0.408***	-0.704**	-0.661	-0.525**
	(0.247)	(0.285)	(0.155)	(0.356)	(0.435)	(0.205)
Stock market bubble						
Top income shares	0.573***	0.942***	1.308***	0.428***	0.672***	0.889***
	(0.186)	(0.339)	(0.209)	(0.122)	(0.207)	(0.119)
Tax rate	1.248***	1.263***	0.805***	1.210***	1.209***	0.879***
	(0.387)	(0.399)	(0.230)	(0.376)	(0.381)	(0.224)
Stock market development	0.739***	0.723***	0.754***	0.723***	0.700***	0.680***
	(0.123)	(0.122)	(0.069)	(0.119)	(0.117)	(0.065)
Market risk	0.079	0.047	-0.006	0.066	0.033	0.002
	(0.301)	(0.294)	(0.174)	(0.290)	(0.281)	(0.151)
Market liquidity	0.027	0.022	-0.002	0.015	0.003	-0.019
	(0.058)	(0.063)	(0.039)	(0.058)	(0.062)	(0.042)
Number of companies	0.022	0.020	-0.040	0.023	0.022	-0.027
	(0.068)	(0.074)	(0.039)	(0.067)	(0.072)	(0.037)
Overid tests $\backsim \chi^2$, (df)						
T. income shares (24)		23.701			24.025	
S. market bubble (27)		25.515			24.833	
System (50)			46.647			46.296
No. of observations	195	189	189	195	189	189
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation of simultaneous regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 3: Simultaneous regression estimates for top income shares excluding capital gain. The regression estimates include Canada, Germany, Japan, Spain, Sweden, and USA.

	Top 1%			Top 0.1%		
	OLS	IV estimation		OLS	IV estimation	
	estimation	2SLS	GMM	estimation	2SLS	GMM
Top income sahres						
Stock market	0.027*	-0.015	-0.023	0.069***	0.028	0.009
bubble	(0.014)	(0.039)	(0.023)	(0.025)	(0.065)	(0.038)
Stock market	0.009	-0.003	-0.003	0.026	0.016	0.003
crash	(0.015)	(0.020)	(0.010)	(0.027)	(0.037)	(0.017)
Financial	-0.037	-0.019	-0.017	-0.052	-0.032	-0.021
development	(0.031)	(0.034)	(0.021)	(0.058)	(0.063)	(0.035)
GDPpc	-0.131	-0.094	-0.124**	-0.096	-0.057	-0.056
	(0.081)	(0.086)	(0.053)	(0.136)	(0.144)	(0.084)
Innovation	-0.001	-0.000	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Government	-0.123	0.138	-0.179	-0.199	0.054	0.033
expenditure	(0.464)	(0.498)	(0.314)	(0.765)	(0.826)	(0.500)
Openness	0.112	0.178	0.144*	0.031	0.089	0.134
	(0.120)	(0.140)	(0.076)	(0.192)	(0.224)	(0.131)
Tax rate	-0.189**	-0.121	-0.147***	-0.314**	-0.242*	-0.224**
	(0.082)	(0.101)	(0.052)	(0.130)	(0.143)	(0.091)
Popupation	-0.050	-0.030	-0.101	-0.286	-0.291	-0.408***
	(0.172)	(0.183)	(0.110)	(0.233)	(0.247)	(0.158)
Stock market bubble						
Top income	1.039***	1.655*	1.792***	0.657**	0.871	1.104***
shares	(0.397)	(0.871)	(0.509)	(0.266)	(0.595)	(0.365)
Tax rate	1.435***	1.546***	1.226***	1.443***	1.517***	1.153***
	(0.403)	(0.409)	(0.241)	(0.392)	(0.396)	(0.234)
Stock market	0.826***	0.867***	0.947***	0.809***	0.825***	0.880***
development	(0.131)	(0.155)	(0.078)	(0.131)	(0.156)	(0.085)
Market risk	0.073	0.028	-0.166	-0.006	-0.061	-0.198
	(0.309)	(0.311)	(0.197)	(0.303)	(0.313)	(0.202)
Market	0.029	0.026	0.005	0.029	0.028	0.007
liquidity	(0.058)	(0.063)	(0.046)	(0.059)	(0.062)	(0.043)
Number of	0.018	0.012	-0.061	0.008	0.001	-0.065
companies	(0.069)	(0.075)	(0.042)	(0.070)	(0.078)	(0.044)
Overid tests $\backsim \chi^2$, (df)						
T. income shares (24)		25.745			24.286	
S. market bubble (27)		29.090			28.997	
System (50)			50.119			49.777
No. of observations	195	189	189	195	189	189
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation of simultaneous regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 4: Simultaneous regression estimates for top income shares including capital gain at different lag differences. The regression estimates include Canada, Germany, Japan, Spain, Sweden, and USA.

	Top 1%			Top 0.1%		
	3 years lag	4 years lag	5 years lag	3 years lag	4 years lag	5 years lag
Top income sahres						
Stock market bubble	0.203***	0.210**	0.208**	0.438***	0.435***	0.451**
	(0.075)	(0.087)	(0.096)	(0.132)	(0.157)	(0.187)
Stock market crash	0.018	0.018	-0.022	0.056	0.049	-0.015
	(0.038)	(0.042)	(0.045)	(0.068)	(0.081)	(0.094)
Financial development	-0.014	0.000	0.024	-0.094	-0.049	-0.001
	(0.079)	(0.096)	(0.101)	(0.143)	(0.178)	(0.193)
GDPpc	-0.362**	-0.466**	-0.697**	-0.390	-0.473	-0.744
	(0.177)	(0.213)	(0.269)	(0.273)	(0.334)	(0.453)
Innovation	-0.001	-0.001	-0.002	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Government expenditure	-0.357	-0.476	-0.988	-0.611	-0.431	-1.133
	(1.099)	(1.212)	(1.294)	(1.712)	(1.952)	(2.288)
Openness	-0.011	0.022	-0.039	-0.263	-0.144	-0.308
	(0.275)	(0.322)	(0.344)	(0.473)	(0.583)	(0.655)
Tax rate	-0.225	-0.272	-0.453	-0.319	-0.322	-0.619
	(0.193)	(0.240)	(0.287)	(0.311)	(0.394)	(0.521)
Popupation	-0.515	-0.519	-0.302	-0.794	-0.935	-0.768
	(0.349)	(0.443)	(0.501)	(0.559)	(0.751)	(0.905)
Stock market bubble						
Top income shares	0.935***	0.881***	1.139***	0.636***	0.600***	0.755***
	(0.301)	(0.299)	(0.383)	(0.169)	(0.172)	(0.237)
Tax rate	1.239***	1.274***	1.383***	1.174***	1.196***	1.306***
	(0.414)	(0.439)	(0.497)	(0.399)	(0.423)	(0.484)
Stock market development	0.713***	0.699***	0.648***	0.686***	0.664***	0.589***
	(0.123)	(0.128)	(0.143)	(0.119)	(0.124)	(0.145)
Market risk	0.044	0.102	0.095	0.030	0.073	0.026
	(0.299)	(0.297)	(0.345)	(0.288)	(0.284)	(0.343)
Market liquidity	0.021	0.021	0.015	-0.003	-0.005	-0.023
	(0.061)	(0.063)	(0.069)	(0.058)	(0.059)	(0.068)
Number of companies	0.007	-0.009	-0.032	0.010	-0.005	-0.023
	(0.076)	(0.084)	(0.101)	(0.075)	(0.083)	(0.102)
Overid tests $\backsim \chi^2, (\text{df})$						
T. income shares (24)	16.970	13.839	16.502	20.962	19.601	20.496
S. market bubble (27)	23.363	22.925	21.921	23.938	23.412	22.988
No of observations	189	183	177	189	183	177
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation from Two-Stage least squares (2SLS) regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 5: Simultaneous regression estimates for top income shares excluding capital gain at different lag differences. The regression estimates include Canada, Germany, Japan, Spain, Sweden, and USA.

	Top 1%			Top 0.1%		
	3 years lag	4 years lag	5 years lag	3 years lag	4 years lag	5 years lag
Top income sahres						
Stock market bubble	0.013	0.026	0.067	0.071	0.047	0.102
	(0.049)	(0.052)	(0.053)	(0.080)	(0.083)	(0.082)
Stock market crash	0.009	0.012	0.009	0.044	0.036	0.028
	(0.022)	(0.023)	(0.021)	(0.037)	(0.039)	(0.039)
Financial development	-0.043	-0.055	-0.072	-0.098	-0.104	-0.130
	(0.039)	(0.046)	(0.051)	(0.069)	(0.076)	(0.080)
GDPpc	-0.177	-0.257*	-0.414**	-0.083	-0.137	-0.286
	(0.115)	(0.149)	(0.175)	(0.170)	(0.204)	(0.247)
Innovation	-0.001	-0.001*	-0.002***	-0.002	-0.002	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Government expenditure	-0.001	0.152	0.008	-0.306	0.156	0.287
	(0.632)	(0.744)	(0.833)	(0.946)	(1.059)	(1.185)
Openness	0.189	0.254	0.202	-0.027	0.065	-0.064
	(0.164)	(0.183)	(0.189)	(0.264)	(0.298)	(0.320)
Tax rate	-0.186	-0.203	-0.310*	-0.354**	-0.358*	-0.519**
	(0.134)	(0.158)	(0.177)	(0.173)	(0.211)	(0.252)
Popupation	-0.004	0.081	0.284	-0.232	-0.174	-0.009
	(0.231)	(0.282)	(0.314)	(0.319)	(0.412)	(0.493)
Stock market bubble						
Top income shares	1.530**	1.422**	1.440***	0.747	0.845*	1.255**
	(0.641)	(0.551)	(0.453)	(0.475)	(0.496)	(0.545)
Tax rate	1.557***	1.561***	1.624***	1.530***	1.635***	1.946***
	(0.421)	(0.444)	(0.494)	(0.425)	(0.433)	(0.535)
Stock market development	0.896***	0.904***	0.894***	0.850***	0.890***	0.961***
	(0.146)	(0.153)	(0.159)	(0.156)	(0.178)	(0.197)
Market risk	0.051	0.132	0.196	-0.028	0.024	0.042
	(0.309)	(0.313)	(0.345)	(0.307)	(0.306)	(0.349)
Market liquidity	0.029	0.034	0.039	0.027	0.025	0.016
	(0.063)	(0.066)	(0.069)	(0.061)	(0.064)	(0.075)
Number of companies	-0.004	-0.019	-0.033	-0.011	-0.029	-0.067
	(0.077)	(0.082)	(0.090)	(0.079)	(0.089)	(0.106)
Overid tests $\backsim \chi^2, (\text{df})$						
T. income shares (24)	22.081	23.732	25.173	20.687	20.882	20.145
S. market bubble (27)	24.074	21.753	20.773	25.347	23.411	21.307
No of observations	189	183	177	189	183	177
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation from Two-Stage least squares (2SLS) regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 6: Simultaneous regression estimates for top income shares including capital gain with duration of explosive episodes. The regression estimates include Canada, Germany, Japan, Spain, Sweden, and USA.

	Top 1%			Top 0.1%		
	OLS estimation	IV estimation 2SLS	IV estimation GMM	OLS estimation	IV estimation 2SLS	IV estimation GMM
Top income sahres						
Stock bubble duration	0.034***	0.046***	0.051***	0.067***	0.085***	0.096***
	(0.011)	(0.017)	(0.007)	(0.018)	(0.028)	(0.012)
Stock crash duration	0.004	0.005	0.001	0.007	0.009	0.003
	(0.010)	(0.010)	(0.004)	(0.018)	(0.017)	(0.007)
Financial development	-0.043	-0.087	-0.073**	-0.116	-0.181	-0.163***
	(0.068)	(0.078)	(0.036)	(0.111)	(0.123)	(0.062)
GDPpc	-0.220	-0.191	-0.173***	-0.221	-0.207	-0.252**
	(0.136)	(0.123)	(0.056)	(0.244)	(0.223)	(0.107)
Innovation	-0.001	-0.001	-0.001*	-0.001	-0.001	-0.002*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Government expenditure	0.201	0.294	0.129	0.605	0.616	0.552
	(0.846)	(0.836)	(0.373)	(1.330)	(1.288)	(0.595)
Openness	0.105	0.004	-0.046	0.084	-0.071	-0.146
	(0.214)	(0.225)	(0.109)	(0.335)	(0.352)	(0.182)
Tax rate	-0.041	-0.041	-0.072	0.054	0.034	-0.012
	(0.112)	(0.120)	(0.073)	(0.191)	(0.198)	(0.129)
Popupation	-0.204	-0.094	-0.309*	-0.229	-0.070	-0.238
	(0.285)	(0.319)	(0.161)	(0.409)	(0.464)	(0.259)
Stock bubble duration						
Top income shares	2.334***	4.228***	5.159***	1.540***	2.639***	3.107***
	(0.680)	(1.174)	(0.717)	(0.411)	(0.684)	(0.373)
Tax rate	2.508***	2.394**	1.901***	2.373***	2.181**	1.726***
	(0.886)	(0.986)	(0.623)	(0.869)	(0.946)	(0.599)
Stock market development	3.763***	3.723***	3.294***	3.718***	3.649***	3.094***
	(0.571)	(0.534)	(0.344)	(0.558)	(0.518)	(0.312)
Market risk	0.111	0.077	0.169	0.080	0.056	0.207
	(0.801)	(0.828)	(0.391)	(0.764)	(0.762)	(0.363)
Market liquidity	-0.075	-0.092	-0.065	-0.115	-0.159	-0.123
	(0.161)	(0.175)	(0.091)	(0.164)	(0.179)	(0.090)
Number of companies	-0.004	0.011	-0.013	0.001	0.023	-0.001
	(0.172)	(0.199)	(0.111)	(0.168)	(0.192)	(0.108)
Overid tests $\backsim \chi^2$, (df)						
T. income shares (24)		24.501			25.811	
S. market bubble (27)		27.952			27.216	
System (50)			46.497			46.598
No of observations	195	189	189	195	189	189
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation of simultaneous regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 7: Simultaneous regression estimates for top income shares including capital gain with cumulative asset returns. The regression estimates include Canada, Germany, Japan, Spain, Sweden, and USA.

	Top 1%			Top 0.1%		
	OLS	IV estimation		OLS	IV estimation	
	estimation	2SLS	GMM	estimation	2SLS	GMM
Top income sahres						
Positive	0.045	0.149*	0.240***	0.135**	0.269*	0.390***
cum.return	(0.035)	(0.085)	(0.043)	(0.060)	(0.141)	(0.073)
Negative	0.197	0.150	0.055	0.293	0.237	0.084
cum.return	(0.159)	(0.179)	(0.059)	(0.255)	(0.279)	(0.094)
Financial	0.077	0.039	-0.001	0.105	0.054	0.019
development	(0.053)	(0.064)	(0.027)	(0.094)	(0.110)	(0.048)
GDPpc	-0.193	-0.055	0.016	-0.148	0.033	0.057
	(0.140)	(0.149)	(0.072)	(0.241)	(0.256)	(0.121)
Innovation	0.001	0.000	0.000	0.001	0.001	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)
Government	0.132	0.296	0.374	0.437	0.615	0.827
expenditure	(0.846)	(0.936)	(0.306)	(1.348)	(1.471)	(0.505)
Openness	0.263	0.149	0.094	0.372	0.221	0.226
	(0.188)	(0.203)	(0.091)	(0.310)	(0.336)	(0.158)
Tax rate	-0.047	-0.055	-0.131	0.030	0.016	-0.055
	(0.118)	(0.129)	(0.080)	(0.207)	(0.213)	(0.141)
Popupation	-0.502**	-0.403	-0.314***	-0.753**	-0.634	-0.373**
	(0.249)	(0.289)	(0.119)	(0.376)	(0.440)	(0.188)
Positive cum return						
Top income	0.410**	1.168***	1.442***	0.304***	0.672***	0.853***
shares	(0.167)	(0.408)	(0.148)	(0.109)	(0.228)	(0.091)
Tax rate	0.527**	0.517*	0.553***	0.501**	0.462*	0.458***
	(0.232)	(0.275)	(0.167)	(0.235)	(0.276)	(0.167)
Stock market	0.187*	0.159	0.187***	0.176*	0.144	0.126*
development	(0.100)	(0.103)	(0.066)	(0.098)	(0.100)	(0.069)
Market risk	0.205	0.066	-0.114	0.196	0.066	-0.100
	(0.259)	(0.269)	(0.120)	(0.252)	(0.251)	(0.127)
Market	0.028	-0.009	-0.001	0.019	-0.024	-0.005
liquidity	(0.040)	(0.038)	(0.014)	(0.040)	(0.041)	(0.016)
Number of	-0.052	-0.087	-0.063*	-0.052	-0.083	-0.053
companies	(0.066)	(0.075)	(0.035)	(0.065)	(0.072)	(0.037)
Overid tests $\backsim \chi^2$, (df)						
T. income shares (24)		23.791			25.783	
S. market bubble (27)		31.911			32.214	
System (50)			52.360			54.307
No of observations	195	189	189	195	189	189
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation of simultaneous regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 8: Simultaneos regression estimates for top income shares of capital gain. Shares of capital gain of Top 1% is defined as the difference between the ratio of Top 1% to Top 5% shares of including capital gain, and the same ratio of excluding capital gain. Similarly, the shares of capital gain of Top 0.1% is defined as the difference between the ratio of Top 0.1% to Top 1% shares of including capital gain, and the same ratio of excluding capital gain.

	Top 5% to Top 1%			Top 1% to Top 0.1%		
	OLS	IV estimation		OLS	IV estimation	
	estimation	2SLS	GMM	estimation	2SLS	GMM
Shares of capital gain						
Stock market	0.193	0.570*	0.652***	0.281	0.382	0.367
bubble	(0.154)	(0.333)	(0.171)	(0.183)	(0.349)	(0.233)
Stock market	-0.052	0.043	0.048	0.030	0.063	-0.026
crash	(0.127)	(0.158)	(0.082)	(0.153)	(0.184)	(0.114)
Financial	0.081	-0.127	-0.079	0.046	-0.006	0.075
development	(0.223)	(0.281)	(0.153)	(0.257)	(0.341)	(0.207)
GDPpc	-0.571	-0.911	-0.860**	-0.290	-0.434	-0.382
	(0.738)	(0.629)	(0.389)	(0.740)	(0.742)	(0.416)
Innovation	0.004	0.002	0.002	0.006	0.005	0.008**
	(0.004)	(0.005)	(0.003)	(0.005)	(0.005)	(0.003)
Government	-1.306	-3.595	-2.562	2.431	1.365	2.745
expenditure	(3.823)	(3.738)	(1.886)	(4.486)	(4.683)	(2.521)
Openness	0.081	-0.747	-0.875	0.773	0.587	0.666
	(1.008)	(1.220)	(0.610)	(1.397)	(1.497)	(0.891)
Tax rate	0.363	-0.274	-0.382	0.899	0.594	0.115
	(0.591)	(0.627)	(0.371)	(0.724)	(0.724)	(0.476)
Popupation	-0.984	-0.499	-0.854	0.110	0.285	-0.414
	(1.203)	(1.412)	(0.644)	(1.583)	(1.715)	(0.900)
Stock market bubble						
Shares of	0.067	0.237**	0.308***	0.091**	0.138*	0.165***
capital gain	(0.059)	(0.116)	(0.050)	(0.046)	(0.075)	(0.039)
Tax rate	1.203***	1.125***	1.072***	1.148***	1.129***	0.941***
	(0.388)	(0.408)	(0.238)	(0.395)	(0.411)	(0.217)
Stock market	0.743***	0.692***	0.676***	0.739***	0.720***	0.747***
development	(0.133)	(0.133)	(0.074)	(0.130)	(0.133)	(0.069)
Market risk	0.119	0.141	0.141	0.118	0.112	0.096
	(0.306)	(0.293)	(0.178)	(0.310)	(0.302)	(0.203)
Market	0.032	0.020	0.008	0.025	0.017	-0.012
liquidity	(0.057)	(0.061)	(0.040)	(0.057)	(0.064)	(0.041)
Number of	0.037	0.072	0.064	0.046	0.056	0.044
companies	(0.070)	(0.072)	(0.041)	(0.070)	(0.074)	(0.039)
Overid tests $\backsim \chi^2$, (df)						
T. income shares (24)		22.574			23.051	
S. market bubble (27)		28.884			28.441	
System (50)			47.789			47.981
No of observations	195	189	189	193	187	187
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation of simultaneous regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 9: Simultaneos regression estimates for top income shares of capital gain with duration of explosive episodes. Shares of capital gain of Top 1% is defined as the difference between the ratio of Top 1% to Top 5% shares of including capital gain, and the same ratio of excluding capital gain. Similarly, the shares of capital gain of Top 0.1% is defined as the difference between the ratio of Top 0.1% to Top 1% shares of including capital gain, and the same ratio of excluding capital gain.

	Top 5% to Top 1%			Top 1% to Top 0.1%		
	OLS	IV estimation		OLS	IV estimation	
	estimation	2SLS	GMM	estimation	2SLS	GMM
Shares of capital gain						
Stock bubble	0.121***	0.141**	0.171***	0.079	0.097	0.133**
duration	(0.040)	(0.068)	(0.038)	(0.050)	(0.085)	(0.054)
Stock crash	0.005	0.006	0.013	-0.005	-0.005	-0.002
duration	(0.053)	(0.053)	(0.030)	(0.055)	(0.056)	(0.037)
Financial	-0.256	-0.327	-0.398**	-0.077	-0.142	-0.250
development	(0.243)	(0.307)	(0.177)	(0.311)	(0.420)	(0.274)
GDPpc	-0.422	-0.734	-0.556	-0.235	-0.373	0.032
	(0.740)	(0.653)	(0.403)	(0.790)	(0.808)	(0.460)
Innovation	0.002	0.001	-0.000	0.005	0.004	0.006
	(0.004)	(0.005)	(0.003)	(0.005)	(0.006)	(0.004)
Government	-1.077	-2.361	-0.848	3.103	2.324	5.169**
expenditure	(3.820)	(3.463)	(2.045)	(4.459)	(4.534)	(2.513)
Openness	-0.389	-0.641	-1.174**	0.738	0.612	0.648
	(1.044)	(1.075)	(0.566)	(1.446)	(1.416)	(0.824)
Tax rate	0.475	0.209	0.312	1.095	0.867	0.650
	(0.584)	(0.582)	(0.381)	(0.695)	(0.682)	(0.464)
Popupation	-0.128	0.450	0.001	0.630	0.965	0.285
	(1.261)	(1.415)	(0.772)	(1.619)	(1.905)	(1.139)
Stock bubble duration						
Shares of	0.332**	0.814**	0.891***	0.231**	0.487**	0.485***
capital gain	(0.144)	(0.386)	(0.157)	(0.107)	(0.242)	(0.103)
Tax rate	2.289**	1.915*	1.953***	2.346**	2.019*	2.136***
	(0.923)	(1.062)	(0.629)	(0.946)	(1.066)	(0.556)
Stock market	3.763***	3.651***	3.100***	3.795***	3.740***	3.325***
development	(0.606)	(0.579)	(0.366)	(0.627)	(0.629)	(0.398)
Market risk	0.279	0.463	0.710	0.232	0.341	0.786
	(0.847)	(0.872)	(0.454)	(0.885)	(0.932)	(0.480)
Market	-0.061	-0.080	-0.073	-0.076	-0.107	-0.122
liquidity	(0.164)	(0.183)	(0.102)	(0.172)	(0.199)	(0.106)
Number of	0.068	0.195	0.240*	0.071	0.153	0.187*
companies	(0.169)	(0.213)	(0.125)	(0.177)	(0.219)	(0.112)
Overid tests $\backsim \chi^2$, (df)						
T. income shares (24)		22.884			22.490	
S. market bubble (27)		29.367			25.510	
System (50)			48.139			45.427
No of observations	195	189	189	193	187	187
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation of simultaneous regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

Table 10: Simultaneous regression estimates for top income shares of capital gain with cumulative asset returns. Shares of capital gain of Top 1% is defined as the difference between the ratio of Top 1% to Top 5% shares of including capital gain, and the same ratio of excluding capital gain. Similarly, the shares of capital gain of Top 0.1% is defined as the difference between the ratio of Top 0.1% to Top 1% shares of including capital gain, and the same ratio of excluding capital gain.

	Top 5% to Top 1%			Top 1% to Top 0.1%		
	OLS	IV estimation		OLS	IV estimation	
	estimation	2SLS	GMM	estimation	2SLS	GMM
Shares of capital gain						
Positive	0.496***	0.887**	1.150***	0.570***	0.833*	0.996***
cum.return	(0.152)	(0.425)	(0.150)	(0.189)	(0.484)	(0.248)
Negative	0.682	0.350	0.287	0.726	0.645	0.678**
cum.return	(0.523)	(0.619)	(0.185)	(0.600)	(0.765)	(0.318)
Financial	0.082	-0.064	-0.136	0.090	-0.018	-0.009
development	(0.215)	(0.256)	(0.107)	(0.251)	(0.299)	(0.165)
GDPpc	-0.093	0.086	0.163	0.192	0.507	0.396
	(0.599)	(0.673)	(0.282)	(0.662)	(0.691)	(0.355)
Innovation	0.005	0.003	0.003*	0.006	0.005	0.006**
	(0.004)	(0.004)	(0.002)	(0.005)	(0.005)	(0.003)
Government	-1.738	-2.505	-0.653	2.251	2.214	2.111
expenditure	(3.415)	(3.317)	(1.250)	(4.192)	(4.046)	(1.848)
Openness	-0.166	-0.570	-0.410	0.547	0.353	0.196
	(0.991)	(1.022)	(0.398)	(1.283)	(1.222)	(0.580)
Tax rate	0.283	0.010	-0.112	0.812	0.619	0.240
	(0.601)	(0.652)	(0.398)	(0.669)	(0.686)	(0.436)
Popupation	-0.938	-0.204	-0.400	0.186	0.537	0.613
	(1.092)	(1.289)	(0.497)	(1.455)	(1.586)	(0.801)
Positive cumulative.return						
Shares of	0.117***	0.337***	0.382***	0.103***	0.189**	0.204***
capital gain	(0.044)	(0.110)	(0.033)	(0.032)	(0.074)	(0.018)
Tax rate	0.452*	0.323	0.395**	0.449*	0.375	0.336**
	(0.237)	(0.326)	(0.196)	(0.239)	(0.270)	(0.163)
Stock market	0.170*	0.108	0.096	0.175*	0.148	0.094
development	(0.101)	(0.106)	(0.069)	(0.099)	(0.103)	(0.064)
Market risk	0.239	0.190	0.127	0.231	0.143	0.067
	(0.245)	(0.248)	(0.105)	(0.254)	(0.237)	(0.121)
Market	0.025	-0.015	-0.003	0.016	-0.024	0.008
liquidity	(0.042)	(0.051)	(0.014)	(0.045)	(0.050)	(0.016)
Number of	-0.029	-0.014	-0.008	-0.022	-0.033	-0.015
companies	(0.062)	(0.068)	(0.034)	(0.061)	(0.064)	(0.033)
Overid tests $\backsim \chi^2$, (df)						
T. income shares (24)		20.261			19.525	
S. market bubble (27)		31.876			30.678	
System (50)			46.768			52.137
No of observations	195	189	189	193	187	187
Countries	6	6	6	6	6	6

NOTES: The table shows the coeffcients of the estimation of simultaneous regression with heteroscedasticity and autocorrelation adjusted standard errors in parentheses. The estimates include both time trend and time invariant country effects. Both time trend and time invariant country effects are not reported in the table. The asterisks ***, ** and * refer to 1%, 5% and 10% levels of significance respectively.

B Appendix

B.1 Date-stamping for real stock price index with lag order k is equal to 1

Table A2: Top income shares from World Wealth and Income Database. The sample periods of top income shares including capital gain are reported in brakets.

Variables	Canada	Germany	Japan	Sweden	Spain	USA
Top 5%	1972-2018	1971-2008[a]	1970-2010	1971-2013	1981-2012	1970-2018
	(1972-2018)	(1971-2010[a])	(1970-2010)	(1971-2013)	(1981-2012)	(1970-2018)
Top 1%	1972-2018	1971-2008[a]	1970-2010	1971-2013	1981-2012	1970-2018
	(1972-2018)	(1971-2010[a])	(1970-2010)	(1971-2013)	(1981-2012)	(1970-2018)
Top 0.1%	1972-2018	1971-2008[a]	1970-2010	1971-2013	1981-2012	1970-2018
	(1972-2018)	(1971-2010[a])	(1970-2010)	(1971-2013)	(1981-2012)	(1970-2018)
GDP-PC	1972-2018	1971-2010	1970-2010	1971-2013	1981-2012	1970-2018
Innovation	1977-2018	1977-2010	1977-2010	1977-2013	1981-2012	1977-2018
Real smkt price	1972-2015	1971-2010	1970-2010	1971-2013	1981-2012	1970-2015
Smkt dev	1972-2017	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Bank deposits	1972-2009	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Financial dev	1972-2009	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Tax rate	1972-2018	1971-2010	1970-2010	1971-2013	1981-2012	1970-2018
Openness	1972-2017	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Govt. exp	1972-2017	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Smkt crash	1972-2017	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Smkt bubble	1972-2017	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Population	1972-2018	1971-2010	1970-2010	1971-2013	1981-2012	1970-2018
Market liquidity	1975-2017	1975-2010	1975-2010	1975-2013	1981-2012	1975-2017
Market risk	1972-2017	1971-2010	1970-2010	1971-2013	1981-2012	1970-2017
Companies	1975-2017	1975-2010	1975-2010	1975-2013	1981-2012	1975-2017

[a]There are not more than five consecutive years with missing values in this subperiod. Linear interpolation could be used between these years while estimating the model.
Abbreviations: GDP-PC = Gross domestic product per capita, Real smkt price = Real sotck market price, Smkt dev= Stock market development, Financial dev = Financial development Govt. exp = Government expenditure, Smkt crash/bubble = Stock market bubble/crash, Companies = Number of companies.

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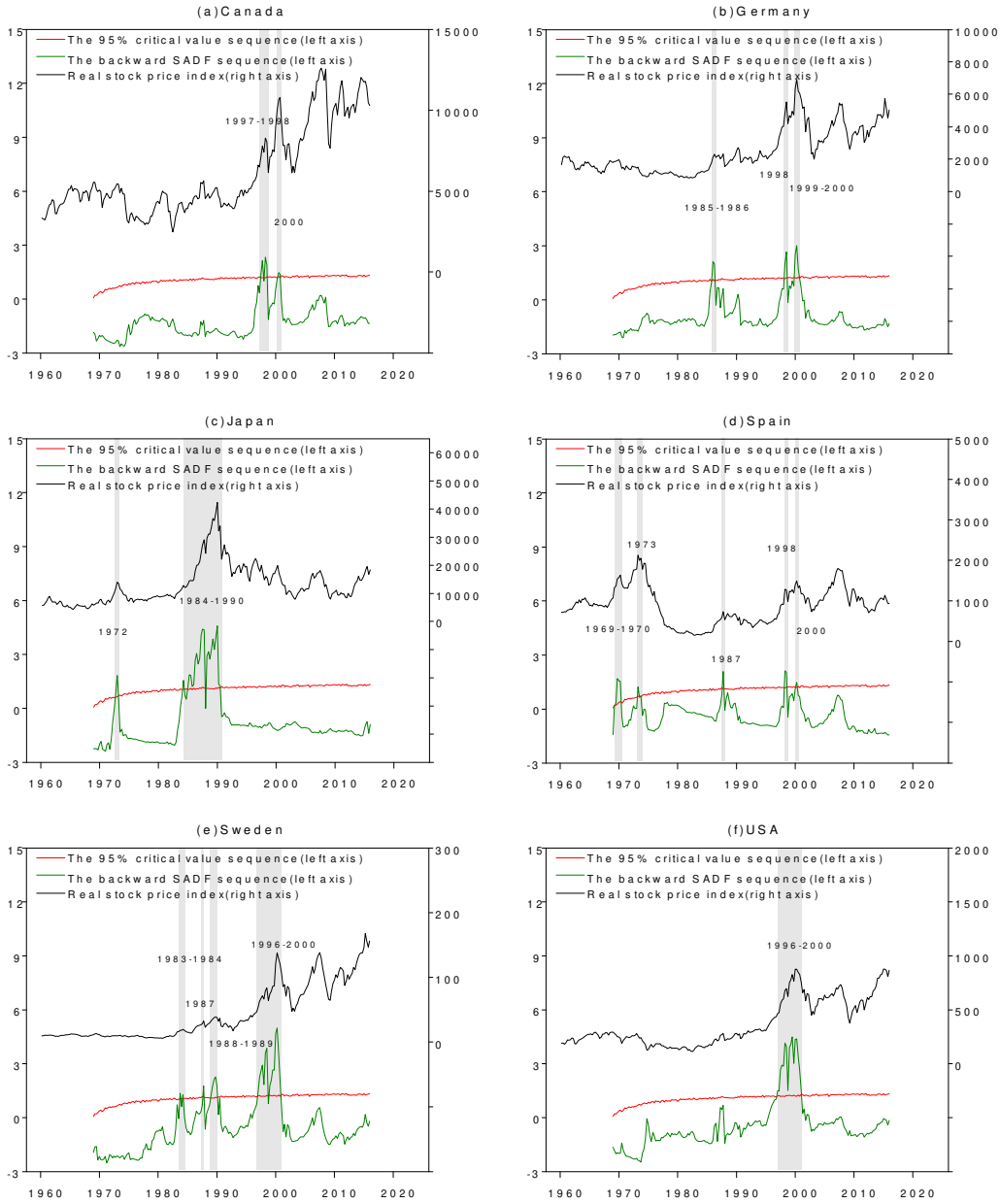

Figure 2: Date-stamping bubble periods in the real stock price index: the GSADF test.