DOES R-G CAUSE WEALTH INEQUALITY? THE CASE OF THE UNITED STATES

¿LA R-G CAUSA LA DESIGUALDAD DE LA RIQUEZA? EL CASO DE ESTADOS UNIDOS

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Resumen: Piketty afirma que la brecha entre el rendimiento del capital y la tasa de crecimiento (r-g) gobierna la evolución de la desigualdad de la riqueza. Este documento evalúa su validez empírica utilizando un enfoque IV y casi un siglo de datos de Estados Unidos. Nuestros resultados pueden resumirse en dos: en primer lugar, las proporciones de riqueza no son estacionarias, lo que requiere primeras diferencias para obtener inferencias válidas de cualquier ejercicio econométrico. Esto es consistente con la línea de argumentación de Piketty y pone en duda los estudios sobre desigualdad que utilizan niveles de desigualdad sin mostrar el comportamiento tendencial de los datos. En segundo lugar, r-g desempeñó un papel importante en la evolución de la desigualdad de la riqueza durante el último siglo, tanto estadística como económicamente. En particular, r-g puede explicar más del 50% del aumento en la desigualdad de la riqueza desde finales de la década de 1970.

Abstract: Piketty claims that the gap between the return to capital and the growth rate (r-g) governs the evolution of wealth inequality. This paper assesses its empirical validity using an IV approach and almost one century of US data. Our results are twofold: First, wealth shares are nonstationary, necessitating first differences to draw a valid inference from any econometric exercise. This is consistent with Pikettys line of argumentation and casts doubt on studies on inequality that use inequality levels without showing the trending behavior of the data. Second, r-g played a significant role in the evolution of wealth inequality over the last century, both statistically and economically. In particular, r-g can explain over 50% of the increase in wealth inequality since the late 1970s.

Clasificación JEL/JEL Classification: E44, O11

Palabras clave/keywords: wealth inequality; r-g; Piketty; capital; desigualdad patrimonial

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1. Introduction

In recent decades, income inequality and wealth inequality have increased. This topic has received a great deal of attention in economic literature, both theoretical and empirical.[1] This spike in the literature on inequality reached its peak following the publication of *Capital in the Twenty-First Century* by Piketty (2014), which ignited a heated debate on the validity of the various hypotheses put forward in the book.[2]

Piketty projects that wealth inequality will increase into the 21st century, his hypothesis being that a larger gap between the return on capital/wealth and the growth rate (hereafter r-g) leads to a rise in wealth inequality.[3] The intuition is that the wealth trajectory of the wealthy is determined by r and that of the poor by g. The gap between r and g has been large in the recent past, and Piketty argues that it will remain so.

We use an IV approach and United States (US) data to determine whether a causal relation exists between r-g and wealth inequality. Wealth inequality is measured as the wealth share held by the wealthiest 1%.[4] The US is the only country for which a long-time series of wealth shares and r-g are available. To be precise, we use 84 years of data from 1928 to 2012. Our main data set stems from Saez and Zucman (2016), who use capitalized income data to back out the wealth shares of different percentiles and the percentile-specific returns on wealth and savings rates.

We find a positive and statistically significant relationship between r-g and wealth inequality that is quantitatively relevant. The average increase in r-g of some 4 percentage points from 1928-1976 to 1977-2011 is able to explain between 47 and 52 percent of the recent change in the wealth share of the top 1% (which fell by 0.42 percentage points per year on average between 1928 and 1976 and has

[1] Roine and Waldenström (2015) review the empirical increase in both inequality measurements and the literature that seeks to explain this development.

[2] Evidence of this are the 3000+ Google Scholar citations of his book within two years of its publication and the 1.5 million copies in French, English, German, Chinese, and Spanish sold as of January 2015, making it the all-time bestseller of academic publisher Harvard University Press.

[3] We follow Piketty and use capital and wealth as synonyms. An assessment of this highly disputable assumption is beyond the scope of this paper.

[4] We redo our empirical exercise for the 0.1% and 5% wealth percentiles to confirm our findings.

increased at an average annual rate of 0.47 percentage points ever since). Therefore, we believe it is essential to understand why the trajectory of r-g changed in recent decades in order to understand the rise in inequality during this period.

We wish to emphasize two caveats that are essential to obtain the correct econometric specification. First, we use the *change* in wealth inequality rather than its *level*. The reason is both theoretical and empirical. Theoretically, r-g is related to a change in wealth inequality, not its level. Empirically, wealth shares are nonstationary. The regression of a nonstationary variable on a stationary one may lead to an invalid inference.[5] The reason is that one cannot determine any observation as high or low for a nonstationary process as such a process is not mean reverting. Therefore, one cannot establish any meaningful geometric relationship between such a process and a stationary one that is mean reverting and hence whose observations can be described as high or low with respect to their mean. In order to draw a valid inference, we first apply differences to wealth shares. Then, both processes are mean reverting, and a geometric relationship between them can be established. We document that income shares in the US are also nonstationary. This calls for caution regarding the numerous results in the literature on levels of inequality that fail to account for the trending behavior of inequality.

Second, an IV specification is necessary due to endogeneity concerns, particularly reverse causality. There exists a large amount of literature that attempts to determine whether inequality fosters or impedes growth.[6] These studies suggest an issue of reverse-causality, though the literature is inconclusive as to the direction of the bias. We use an instrumental variable approach to control for the endogeneity problem. The instrument used is the defense news series developed by Ramey (2011). This series uses a narrative method to measure the expected discounted value of government spending changes due to foreign political events. It was originally created as an instrument to estimate the government spending multiplier.[7]

[5] See, for example, Banerjee *et al.* (1993), Sims *et al.* (1990), and, more importantly, Stewart (2011) for a discussion on unbalanced regressions.

[6] See Kuznets (1955), Persson and Tabellini (1994), Deininger and Squire (1998), Barro (2001), Barro (2000), Forbes (2000), and Easterly (2007), among others.

[7] The choice of the instrument can be explained using a twofold argument. First, and nontrivially, there does not exist any other macroeconomic instrument for such a long time horizon to the best of our knowledge. Second, and more

We develop Piketty's hypothesis theoretically to determine the correct empirical specification. First, there is a relation between the change in wealth inequality and r-g. Second, the savings rate should be included in the regression. Moreover, we find that inequality has a cyclical component which could bias the inference; we employ 3-year averages to account for cyclicality.

In both the ordinary least squares (OLS) and IV specifications, we find a positive and significant impact of the percentile-specific r-g on the change in the percentile wealth share (for the top 0.1%, 1%, and 5%). An extensive set of robustness checks confirms these results. The savings and marginal tax rates are also significant and display the expected signs. These findings are remarkable given the low number of observations (in most specifications, we are left with 28 observations).

Finally, we run separate regressions for r-g and g to observe whether the results are only driven by an effect of g on inequality. The R^2 of r-g is much higher than that of g alone. This implies that the results are not merely due to the effect of growth on wealth inequality but also to the important role played by the difference r-g.

This work relates to the influential book by Piketty (2014) and related articles by him and his coauthors, who gathered and estimated historical data on the evolution of wealth and income.[8] Importantly, Piketty (2015a) clarifies certain misreading of Piketty (2014) and emphasizes the fact that he does not hold the view that r-g is the only force that drives income inequality. Piketty and Zucman (2015) provide a more detailed analysis of the evolution of wealth inequality and the theory that relates r-g and wealth inequality. Saez and Zucman (2016) use the capitalization technique first developed by King (1927) and Stewart (1939) to estimate the distribution of US wealth since 1913. We rely mainly on their data set in our estimations. Jones (2015) highlights some of the key empirical facts of the research

importantly, the instrument composed by Ramey has proven its predictive power for the interest rate and growth rate in numerous papers by other authors. As we document in the appendix A.3, it does show explanatory power for the percentile-specific (r-g) variable. The series is available for the entire time horizon of our sample. First-stage results indicate that it is highly relevant. Furthermore, an array of robustness checks indicates that the instrument meets the exclusion restriction. Defense news only affects the change in wealth inequality via r-g.

[8] See, among others, Atkinson (1983, 1987), Piketty and Saez (2003, 2014), Atkinson *et al.* (2011), Alvaredo *et al.* (2013), Piketty and Zucman (2014, 2015), and Piketty (2015a, 2015b).

by Piketty and his coauthors, and comments on how these relate to macroeconomics and economic theory in general.

Numerous articles have tackled specific aspects of *Capital in the Twenty-First Century*. While Krugman (2014) and Solow (2017) provide mostly positive reviews, many scholars challenge one or several of the book's theories. As Krusell and Smith Jr (2015) note, Piketty advances two central hypotheses in his book. One considers the evolution of the capital-income ratio, and the other relates r-g to inequality. Although somewhat related, these theories have very distinct elements. Krusell and Smith Jr (2015) question the validity of the first hypothesis, whereas the present paper addresses the second.

Rognlie (2014) argues that empirically realistic diminishing returns to capital accumulation imply that the gap will decrease over time and claims that the observed non-decreasing returns to wealth accumulation in recent years are due primarily to the fact that housing wealth increased. Mankiw (2015: 43) argues that: "The first thing to say about Piketty's logic is that it will seem strange to any economist trained in the neoclassical theory of economic growth. The condition $r>g$ should be familiar. In the textbook Solow growth model, it arrives naturally as a steady-state condition as long as the economy does not save so much as to push the capital stock beyond the Golden Rule level [...]". Moreover, Mankiw (2015) claims that while Piketty's theory that a large r-g can increase inequality is true in principle, the differences in r and g required to cause an increase in wealth inequality greatly surpass those empirically observable (he suggests instead that r-g > 7% is necessary). In contrast, we analyze empirically whether the levels of r-g observed in the 20th century can explain changes in wealth inequality.

Ray (2015) argues that a large r-g does not necessarily lead to an increase in wealth inequality. Instead, he asserts that all that matters is the fraction of r that capitalists save, and the relevant equation would have to be $sr>g$, where s is the savings rate. He further argues that this only leads to increasing wealth inequality if capitalists represent the richest agents in the economy. Moreover, Milanovic (2016) argues that greater capital share and increased interpersonal inequality are not as simple and unambiguous as it seems and considers that, even when the positive relationship between the two exists, the strength of that relationship varies. While these objections are certainly true, it is indisputable that capitalists are proportionally overrepresented in the top wealth quintiles, as Piketty empirically shows. Furthermore, an increase in r-g tends to raise sr-g. However, we control for the quintile-specific savings rate in our analysis, as we agree with Ray (2015) on this issue.

One extensive critique of Piketty's theory is that of Acemoglu and Robinson (2015), who consider institutions to be the predominant factor in explaining inequality. It is difficult to always distinguish between these two mechanisms, as institutions play a significant role in the evolution of r-g. While an interesting topic of study, the role institutions play in the trajectory of r-g is beyond the scope of this paper. Acemoglu and Robinson (2015) argue that r-g is not related to inequality, as they find no positive relation between r-g and top *income* inequality. Their results beg three comments. First, Piketty argues that it is *wealth* inequality that is governed by r-g. *Income* inequality and *wealth* inequality are only closely related if the persistence in the income process is sufficiently strong. Second, the relevance of the proxies that Acemoglu and Robinson use for r, GDP growth rate, government bond yields,[9] and marginal product of capital could be questioned. The later proxy, marginal product of capital, seems to be the best, and when they use it, they find some evidence of a positive relation between r-g and inequality. Third, we find wealth and income shares to be non-stationary, which may imply that using inequality levels leads to an invalid inference.

The work most closely related to ours is that of Fuest *et al.* (2015), who aim to test the relation between r-g and wealth inequality and also find a positive relationship.[10] Instead of time series data, they use panel data, the advantage of this being that they have more observations, though at the cost of not having a common measure for the return to capital r. However, there are a few deficiencies regarding that article. In place of r, they use a financial development indicator as a proxy that is more of an institutional variable, and it is unclear whether financial development induces r to increase or decrease.[11] Furthermore, they regress the wealth share on g and their financial development indicator separately. Finally, in contrast to our work, they do not employ an instrumental variable approach and, therefore,

[9] Barkai (2020) argues that the relationship between capitalists' incomes and bond yields is quite weak.

[10] It is also worthwhile to mention that Bengtsson and Waldenström (2015) study the relationship between the capital share in national income and personal income inequality in nineteen countries (using a different dataset) and find sound evidence of a positive long-run dependence between these two variables.

[11] Roine *et al.* (2009) find a positive relationship between financial development and top income inequality. However, this does not necessarily imply a positive relation between financial development and r.

cannot address the endogeneity issue.

The remainder of the paper is structured as follows. In section 2 we develop Piketty's hypothesis analytically to provide a theoretical underpinning for our empirical specification. In section 3, we discuss the data sets employed and the trending behavior of the central variables. Section 4 contains the core results and a battery of robustness checks. Section 5 concludes.

2. Theoretical considerations

Piketty and his coauthors claim that the evolution of wealth inequality depends greatly on the evolution of *r-g*. The intuition is that r determines the earnings of the wealthy capitalist class and, thus, the growth rate of their wealth. In contrast, g determines the evolution of the wages and wealth of the average citizen who possesses almost no savings. We use a simple theoretical model to clarify the argument and our empirical specification.

Let us suppose there are two types of representative agents - workers and capitalists- at fractions ε and (1-ε). Workers live hand to mouth, i.e., they consume all their labor income I at any point in time.[12] Capitalists do not work, and their income consists exclusively of the net returns on their wealth, $(r-\delta)W_C$, where r denotes the return to capital, δ the depreciation rate, and W_C the capitalist's wealth. Let us assume that the savings rate s of capitalists is constant over time (as we show below, this is a rather heroic assumption).[13] Aggregate wealth, W^T, can be written as:

$$W^T = \varepsilon W^C + (1-\varepsilon) I$$

The wealth share of capitalists at any point in time is defined as:

$$\sigma^C = \frac{\varepsilon W_C}{W_T}$$

The change in time of this ratio is determined by:

$$\sigma^C = \varepsilon \left(\frac{W^C}{W^T} \right) = \varepsilon \frac{W^T W^C - W^C W^T}{(W^T)^2} = \frac{\varepsilon W^C}{W^T} \left(\frac{W^C}{W^C} - \frac{W^T}{W^T} \right),$$

[12] Saez and Zucman (2016) show that this is a rather realistic assumption.

[13] The data support the assumption of heterogeneous savings rates across wealth percentiles, as we document below.

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where X denotes the change of the variables X in time. Note that

$$\frac{W^C}{W^C} = s\left(r-\delta\right),$$

and similarly,

$$\frac{W^C}{W^T} = \frac{\varepsilon s(r-\delta)W^C + (1-\varepsilon)gI}{\varepsilon W^C + (1-\varepsilon)I}$$

where g denotes the growth rate of labor income and is assumed to be equal to GDP growth (which holds in standard growth theory). This implies that:

$$\sigma^C = \varepsilon(1-\varepsilon)\frac{W^C}{W^T}\frac{I}{W^T}(s(r-\delta)-g).$$

Hence, the necessary condition for wealth inequality to increase is:

$$\frac{W^C}{W^C} = s(r-\delta) > g$$

This inequality reveals two things: First, there is a relation between r-g and the change in wealth inequality, not the level of wealth inequality. Second, the savings rate alters the relation between r-g and wealth inequality. Therefore, if correlated with r-g, it needs to be considered to get unbiased estimates. Empirically, we find a statistically significant correlation of 0.42.

We do not aim to estimate this model structurally, as the model is far too simplistic. Many other factors influence the evolution of inequality, such as government policy, unemployment rates, trade, and so on. Importantly, the change in wealth share displays cyclical properties. We document this in the appendix (A.1). This leads to two concerns. First, the cyclicality augments the variance and thus may lead to erroneous inference. Second, any correlation found between the two variables can be due to a lurking variable driving the cycles of both. We take 3-year averages to account for the cyclicality.[14]

[14] This is the most standard approach in the growth literature. As a robustness check, we use moving averages and a Hodrick-Prescott filter.

3. Data

We employ the unique US dataset by Saez and Zucman (2016), who provide yearly wealth shares for different percentiles over a span of almost 100 years obtained using the capitalization technique.[15] The dataset also includes national growth rates, and both percentile-specific savings rates and returns to capital. In our central specification, we focus on the top 1% of wealth holders.[16] One drawback is that they only provide total real net returns on wealth from 1961 onwards. Therefore, we construct an approximate time series using the tax rate on capital provided by Piketty and Zucman (2014).[17] "Capitalists" (top 1% top rung) may accumulate more claims on productive capital both because the rate of return is higher -which boosts the resources available to save from and because their savings rate is higher. However, we emphasize that we do indeed use the percentile-specific savings rate. Saez and Zucman (2016) provide a unique US dataset that contains the percentile-specific savings rates required in our estimation. This is important to avoid the possible misunderstanding related to the fact that a regression of the change in wealth share on r-g and the aggregate savings rate would not warrant causality. To be sure, also the marginal tax rates and the returns on interest are percentile specific.[18]

We combine this dataset with additional data sources. As a control variable, we include the marginal income tax rate for the top wealth percentiles by combining the average income per wealth percentile provided by Saez and Zucman (2016) and a time series of the federal individual income tax rates history from the US.[19] The

[15] Very few countries provide long-horizon data on wealth shares. Piketty and Zucman (2015) document decennial averages in the 20th century for a small set of countries (France, the UK, the US, and Sweden), which are not sufficient to draw any trustworthy inference. Roine and Waldenström (2015) provide unbalanced data for 10 countries.

[16] We redo the exercise for the top 0.1% and 5% in the robustness sections.

[17] As a robustness check, we use total real gross return on wealth and real net capital gains, for which long-time series are provided by Saez and Zucman (2016).

[18] We thank an anonymous referee for pointing out this.

[19] The data is available at http://taxfoundation.org/article/us-federal-individual-income-taxrates-history-1913-2013-nominal-and-inflation-adjusted-brackets. We use Saez and Zucman (2016) to obtain the nominal income for each year, using the CPI. We also employ the difference between the top 1% and bottom 99% marginal tax rate as a robustness check.

marginal income tax rate serves as a proxy for government policies regarding redistribution.

We further incorporate the defense news series developed by Ramey (2011) as an instrumental variable in our analysis. When we test for the exclusion restriction, we include as alternative explanatory variables the unemployment rate, the share of government expenditure directed towards national defense purposes, and the ratio of democrats to republicans in parliament.[20]

An important issue is whether the variables are stationary or not. Only a balanced regression that uses processes with the same trending behavior makes it possible to draw valid inferences. The reason is that -in contrast to a stationary variable- one cannot determine a single observation of a nonstationary process as high or low, as such a process is not mean reverting. Thus, any inference drawn can be invalid when a nonstationary variable is regressed on a stationary variable (Stewart, 1939).[21]

There is consistent evidence of stationarity for all the variables save for wealth shares and marginal tax rates. For tax rates, the evidence is mixed, whereas for wealth shares, the tests provide evidence in favor of the unit-root hypothesis. The results are summarized in table 8 in the appendix and justify the proposal to first-difference the wealth shares.

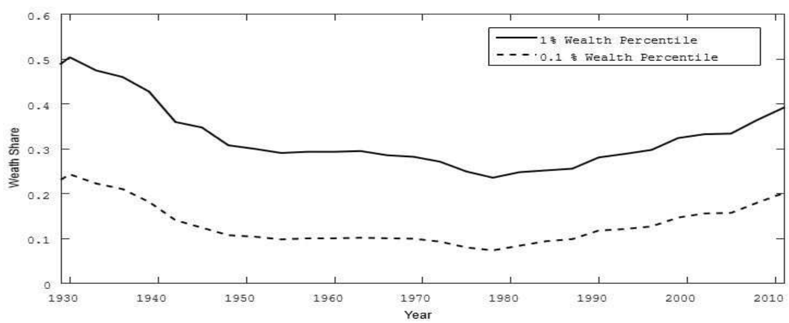
Theoretically, we find a relationship between the change in wealth shares and *r-g*. There is also considerable empirical evidence that wealth shares in the US behave as a nonstationary process, whilst the other variables of interest (growth rate, return to capital, savings rate, and tax rate) are stationary. We apply first differences to the wealth shares in order to be able to draw a valid inference, since the *change* in wealth shares is a stationary process. The results are summarized in table 8 in the appendix and justify the proposal to first-difference the wealth shares. We extend this result, test US income shares for stationarity, and again fail to reject the unit root hypothesis for income

[20] The ratio of Democrats to Republicans is based on the authors' own calculations. The other variables are retrieved from FRED, Federal Reserve Bank of St. Louis. The unemployment rate is a composite of the 3 series M0892AUSM156SNBR, M0892BUSM156SNBR, and M0892CUSM156NNBR. The military spending series is A824RE1A156NBEA.

[21] Known since Yule (1926), the phenomenon of spurious regressions was brought to econometrics by Granger and Newbold (1974) and theoretically discussed in Phillips (1986). For a review of the literature on spurious regressions in economics see Granger (2012).

shares. This casts doubt on an array of studies on income inequality that use the level of inequality as the dependent variable.

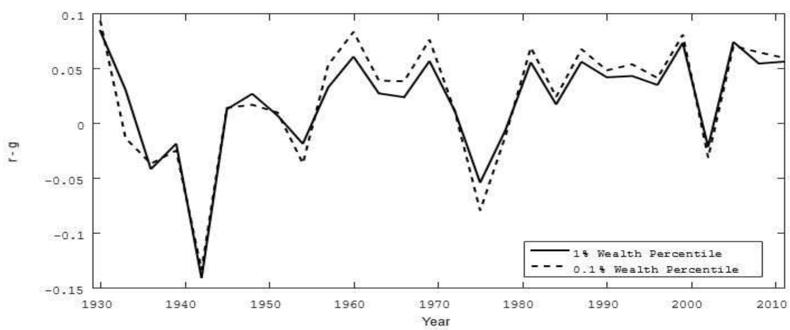
Figure 1
The wealth shares for different wealth percentiles



Source: Authors' elaboration with data of Saez and Zucman (2016).

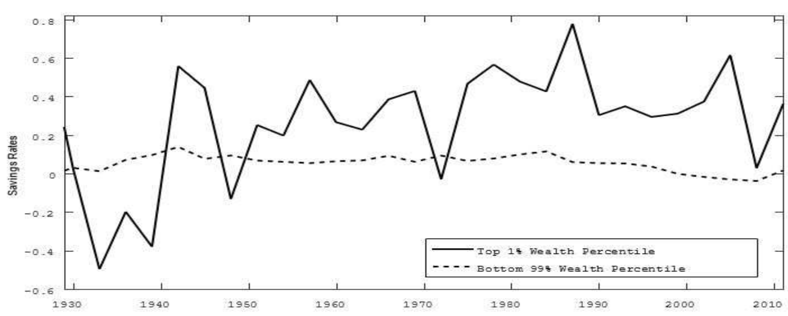
The central time series are depicted in figures 1 and 2. Simple 3-year averages are constructed as the average values of the periods 1928-1930, 1931-1933, 1934-1936,..., 2006-2008, 2009-2011. As a robustness check, we also use moving averages (average values of 1928-1930, 1929-1931, 1930-1932,, 2008-2010, 2009-2011) as well as Hodrick Prescott filters of the variables of interest. Figure 1 depicts the 3-year averages of the wealth share of the top 0.1% and 1%, which display a downward trend until the late 70s and an upward trend thereafter. More specifically, the wealth share of the top 1% dropped 0.416 percentage points on average each year between 1928 and 1978 and increased 0.473 percentage points per year from then on (the last observation dates from 2011). Figure 2 displays the respective 3-year averages of the percentile-specific *r-g*. This variable displays a lot of variation. On average, *r-g* rose over time. Prior to 1978, the average *r-g* was 0.5 percentage points for the top 1% before rising to 4.4 percentage points, where it has remained (on average) ever since. The respective increase for the top 0.1% (10%) is from 0.6 to 5.0 (0.5 to 4.0) percentage points. This is summarized in table 1.

Figure 2
The r-g for different wealth percentiles



Source: Authors' elaboration with data of Saez and Zucman (2016).

Figure 3
The savings rates for different wealth percentiles



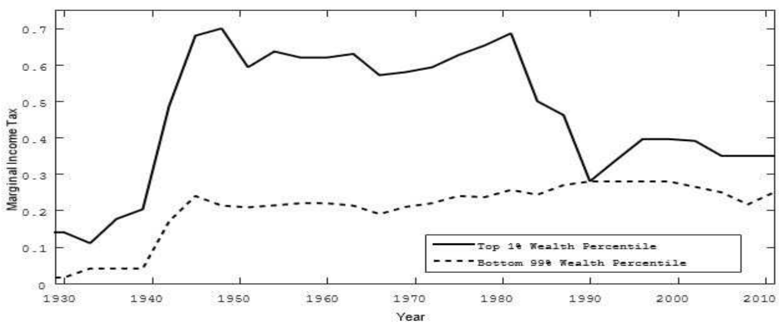
Source: Authors' elaboration with data of Saez and Zucman (2016).

Figures 3 and 4 show the 3-year averages of the savings and marginal income tax rate for the top 1% and bottom 99% of wealth holders. Both rates are nonconstant and differ significantly between the different wealth percentiles. We have shown theoretically that a non-constant savings rate influences wealth inequality and therefore has to be included in the empirical regressions. Similarly, a nonconstant marginal income tax rate has to be included.[22] The marginal

[22] Including a tax for capitalists in our theoretical model would simply change the necessary condition for wealth to increase to $\frac{\dot{W}^C}{W^C} = s(r-\delta)\,(1-\tau_C) > g$, where τ_C denotes the tax on capital.

income tax rate may measure a government's position towards redistribution.

Figure 4
The marginal income tax rate for different wealth percentiles



Source: Authors' elaboration with data of Saez and Zucman (2016).

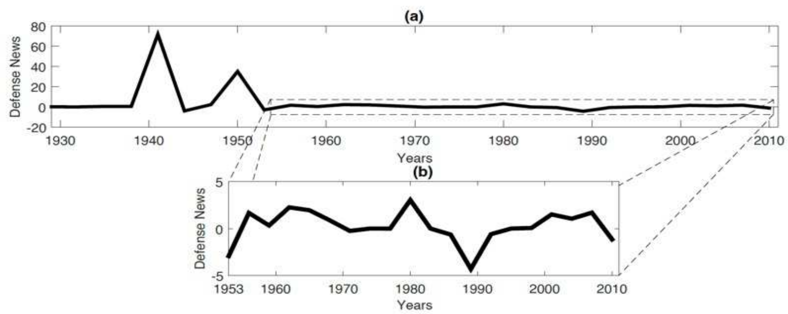
Table 1
Average r-g for different percentiles

	1928 - 1978	*1979 - 2011*
0.1% - Percentile	0.006	0.050
1% - Percentile	0.005	0.044
10% - Percentile	0.005	0.040

Source: Authors' elaboration with data of Saez and Zucman (2016).

Figure 5 displays the time series of our instrument *Defense News*. As mentioned, the series constructed by Ramey (2011) is a narrative of the expected discounted value of government spending changes due to foreign political events. The series is constructed by reading periodicals to gauge the public's expectations. It shows a great deal of variation dominated by two major war events, the Second World War and the Korean War. Panel (a) of figure 5 depicts the entire time horizon, whereas panel (b) focuses on the period after the Korean War to show that there is also substantial variation in those years.

Figure 5
The defense news time series



Source: Authors' elaboration with data of Ramey (2011).

4. Regression results

Before we document the results, let us focus on endogeneity concerns, particularly reverse causality concerns. The economic literature on the effect of inequality on growth is vast yet inconclusive.[23] Furthermore, wealth inequality can affect the rate of return r, as it influences supply and demand in the capital market. Hence, endogeneity concerns exist and may be addressed by an instrumental variable approach. Importantly, we cannot attach *a priori* a sign to the endogeneity bias as it is unclear whether greater inequality leads to a higher or lower r-g. Therefore, estimates from OLS regressions can be upward or downward-biased.

Our chosen instrument is the dataset on defense news provided by Ramey (2011). This dataset has been used as an exogenous instrument to identify the effects of government spending on growth. Defense news causes the government budget to increase, which serves as a stimulus for the entire economy. It is relevant, as shown by Ramey (2011) and our first-stage results. In our central specifications, we include three lags of our instrument as this specification delivers the highest adjusted R^2 and F-values. We show the regression results of

[23] See, for example, Kuznets (1955), Persson and Tabellini (1994), Deininger and Squire (1998), Barro (2001), Barro (2000), Forbes (2000), and Easterly (2007).

the first stage in the appendix in table 9.[24] This implies that there exists a relationship between defense news and *r-g*. However, there may be other channels that are affected by defense news and influence wealth inequality. For example, defense news may well affect military spending or unemployment rates and may influence inequality. In the robustness section, we exert several robustness checks indicating that the exclusion restriction is met.

Our two central regressions are:

$$\Delta\sigma_t^C = \alpha + \beta\left(r_t - g_t\right) + \varepsilon_t ,$$

and

$$\Delta\sigma_t^C = \alpha + \beta_1\left(r - g_t\right) + \beta_2 SavingsRate_t + \beta_3 MarginalTaxRate_t + \varepsilon_t$$

In the second specification, we include the savings and marginal income tax rates. We have shown that they should be included in a regression as they are non-constant over time and influence the relation between *r-g* and σ^C. We use further controls as robustness checks.

Table 2 presents our core regression results: the regression of the change in wealth percentile on the percentile-specific difference of return on capital and growth rate. In column 1, *r-g* is the only independent variable. The relation with changes in wealth inequality is positive and statistically significant at the 1% significance level.[25] In column 2, we add the percentile specific savings rate and the percentile specific marginal tax rate as controls to ensure that results are not driven by those variables. Three major events in recent US history are also included in column 3 (namely the 1929 Crash, US engagement in World War II, and the financial crisis of 2008). In both specifications, *r-g* remains significant at the 1% significance level.

[24] The regression results change only marginally if we use a different number of lags or no lags. These regression results are available from the authors upon request.

[25] We use robust standard errors in all our estimations to correct for potential heteroskedasticity.

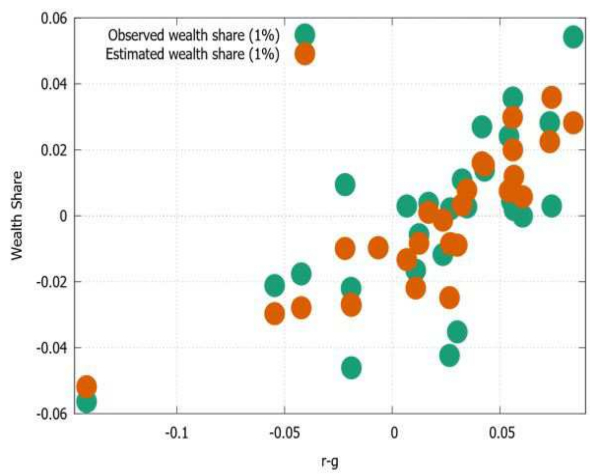
Table 2
Results for 1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (OLS)*	*2 (OLS)*	*3 (OLS)*	*4 (IV)*	*5 (IV)*	*6 (IV)*
r-g	0.3695***	0.3406***	0.2732***	0.3324***	0.3671***	0.3523***
	(0.0446)	(0.0483)	(0.061)	(0.03)	(0.0391)	(0.034)
Savings rate 1%		0.0364***	0.0366***		0.0360***	0.0351***
		(0.0129)	(0.0085)		(0.0131)	(0.0098)
Marginal tax rate 1%		-0.0482***	-0.0266*		-0.0470***	-0.0270*
		(0.0134)	(0.0141)		(0.0138)	(0.0145)
Crash 1929			0.1260***			0.1087***
			(0.0211)			(0.0175)
WW II USA			-0.0048			-0.0001
			(0.0054)			(0.0033)
Crisis 2008			0.0749***			0.0655***
			(0.0117)			(0.0099)
T	28	28	28	28	28	28
R^2	0.4945	0.6553	0.7745	0.4945	0.6544	0.7633
Adj. R^2	0.475	0.6122	0.71	0.475	0.6112	0.6957
F-Value	68.61	17.85	2857.38	122.91	42.12	7665.18
F-Value (1st Stage)				444.8	112.84	186.59
Hausman-test				χ^2 (1)= 0.2564 p-value= 0.6126	χ^2 (1)= 0.2439 p-value= 0.6214	χ^2 (1)= 3.1459 p-value= 0.0761
Sargan-test				LM= 4.3335 p-value= 0.2276	LM= 1.5513 p-value= 0.6705	LM= 2.7296 p-value= 0.4352

Notes: Constant excluded, robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01. Source: Authors' elaboration.

In all regressions, the R^2, the adjusted R^2, and the F-values are high, which indicates that the model is able to capture a large part of the variation in the change in wealth shares. As for our IV specifications, we fail to reject the null hypothesis of the Hausman test of endogeneity. This is not surprising, as we did argue that the endogeneity bias can go in either direction. In consequence, the different endogenous effects may cancel each other out. Therefore, the failure to reject the Hausman test does not imply that endogeneity is not a concern.

Figure 6
Scatter plot

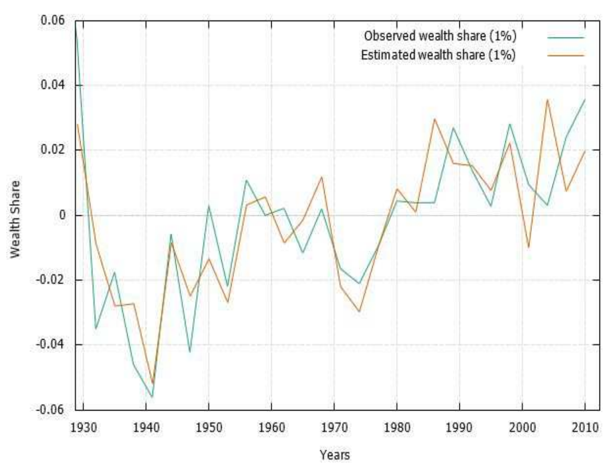


Source: Authors' elaboration.

The estimates on r-g are statistically significant and possess high economic relevance. Multiplying the stated long-term increase in r-g of 3.9 by the yearly β of 0.1073 to 0.1182 yields a projected change in wealth inequality of 0.419 to 0.461 percentage points. This is between 47 and 52 percent of the observed swing in wealth inequality. Hence, r-g can explain a large part of the evolution of US wealth inequality in the last decades. Figure 6 provides a scatterplot of the observed and predicted values. The x-axis depicts the 3-year averages of the 1%-percentile (r-g), whereas the y-axis displays the 3-year average of the change in wealth share of the 1%-percentile. The positive relationship between the two variables is visible both in the observed and estimated values. Notably, (r-g) is less able to explain changes in wealth shares when the latter experience large drops (the three observed drops in wealth share to the bottom right). Figure 7 shows the time series of observed and predicted changes in wealth share.

To determine the driving force behind the results, we want to see the predictive power of the growth rate alone, without the return on capital. Therefore, we run the IV regressions separately using either r-g or g alone and compare the explanatory power of both.[26] The results of this rat race are shown in table 3. While the growth rate alone is significant, a comparison of the R^2 clearly shows that it cannot explain anything close to the variation that r-g is able to explain. This provides convincing evidence that the channel r-g plays a significant role in the process of wealth inequality.

Figure 7
Goodness of fit



Source: Authors' elaboration.

[26] We cannot run a regression with both of the variables included due to the obvious problem of multicollinearity.

Table 3
Results for 1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1* (IV)	*2* (IV)	*3* (IV)	*4* (IV)
r-g	0.3324***		0.3671***	
	(0.03)		(0.0391)	
g		- 0.2898**		-0.4582***
		(0.1349)		(0.1131)
Savings rate 1%			0.0359***	0.0696***
			(0.0131)	(0.0229)
Marginal tax rate 1%			-0.0470***	-0.0699***
			(0.01389)	(0.0199)
T	28	28	28	28
R^2	0.4945	0.0287	0.6544	0.2972
Adj. R^2	0.475	-0.0087	0.6112	0.2093
F-value	122.91	4.62	42.12	9.01
F-Value (1st Stage)	444.8	194.52	112.84	155.45
Hausman-test	χ^2 (1) = 0.2564	χ^2 (1) = 2.6733	χ^2 (1) = 0.2439	χ^2 (1) = 5.8035
	p-value = 0.6126	p-value = 0.1020	p-value = 0.6214	p-value = 0.0160
Sargan-test	LM = 4.3335	LM = 4.1844	LM = 1.5513	LM = 2.2056
	p-value = 0.2276	p-value = 0.2422	p-value = 0.6705	p-value = 0.5308

Notes: Constant excluded, robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

4.1 *Robustness checks*

First, we redo the regression exercise for the top 0.1% instead of the top 1%. Accordingly, we use this wealth percentile's savings rate and marginal income tax. The results are depicted in table 10 and confirm those found above. In the OLS and IV specifications, *r*-*g* is positive and highly significant, the savings rate also has a positive impact, and the marginal tax rate has a negative one. The channel *r*-*g* is able to explain between 38 and 48 percent of the recent increase in wealth inequality (redoing the analogous calculation above), a slightly lower share.

Table 11 depicts the regression exercise using the top 5% wealth share. Unfortunately, there is no data for the 5% specific *r*-*g* available. Therefore, we use the top 10% specific *r*-*g*.[27] Again, *r*-*g* is positive and highly significant in all specifications. However, both the savings and the marginal tax rates are insignificant in these specifications. This comes as no surprise as both the savings and the marginal tax rates are closer to the mean for those agents. Again, the increase in *r*-*g* in recent decades is able to explain between 38 and 42 percent of the increase in wealth that experienced the top 5% wealth percentile.

Our results are not sensitive to including additional lags of the instrumental variable, defense news. In table 12, we include one and three lags of the instrument and show that the results are very similar. The choice of the lags we include is motivated by the F-statistics in the first stage (see table 12). Actually, the coefficients of the variables of interest do almost not change at all. These specifications also allow us to perform the Sargan test of endogeneity. The null hypothesis that the coefficient of the IV specification is equivalent to that of the OLS specification cannot be rejected. In various studies, lags of the independent variables are used instead of instruments to control for endogeneity. Although we clearly prefer the IV approach (as expectations on the evolution of wealth inequality may have an impact on contemporaneous growth and capital market demand and supply), we provide the results for those regressions in columns 5 and 6 of table 12. Again, *r*-*g* remains significant. The savings rate shows up significantly, whereas the marginal income tax rate does not.

In table 13, we use alternative conceptualizations for *r*-*g*. In particular, total real gross return on wealth and real net capital gains -for which long-time series are provided by Saez and Zucman (2016)- show similar significance and magnitude.

[27] The results are similar when using the top 1% specific *r*-*g* instead.

In columns 1 and 2 of table 14, we show that excluding either the savings rate or the marginal tax rate does not substantially change the coefficient of *r-g*. In columns 3 to 5, we use the relative savings rate and relative tax rate. More specifically, the savings rate of the top 1% is replaced by the difference in savings rate between the top 1 percent and bottom 99 percent, as differences in savings rates may have more explanatory power. Similarly, we replace the marginal tax rate with the difference between the top 1% and bottom 99% marginal tax rate. Including one or both of the relative rates does not change the significance or magnitude of *r-g*. Both the relative savings rate and the relative marginal tax rates are of similar magnitude as the absolute values.

We also use different concepts to control for cyclicality. Using either 3-year moving averages or a Hodrick-Prescott filter rather than 3-year averages provides qualitatively similar results (see table 15).[28] A clear advantage of these procedures is that we have more observations. The value of β is in a similar range (recall that in order to make the comparison, the ßs in table 15 need to be multiplied by 3 as we used 3-year averages in our main specification). The marginal tax rate loses significance in one HP specification. We have the exogeneity assumption using the Sargan test in 3 specifications. This comes as no surprise, given the large number of instruments.

In columns 1 and 2 of table 16, we show that allowing for a time trend does not change the significance or magnitude of *r-g*. In columns 3 and 4, we construct *sr-g* as our theoretical considerations predicted. While we know that the theoretical model was far too simplistic, the fact that *sr-g* results significant supports Piketty's *r-g* hypothesis.

We also address the issue of whether the instrument satisfies the exclusion restriction. The exclusion restriction can never be tested empirically. However, we included a few potential alternative mechanisms as to how defense news influences wealth inequality. Namely, we test whether the inclusion of the unemployment rate, the military spending, and the ratio between Democrats and Republicans change the coefficient of *r-g*. Conceivably, defense news changes unemployment due to more people entering the military, which may lead to a change in wealth inequality. Similarly, an increase in military spending may affect other social government expenditures which may affect inequality. At last, defense news may cause support among political

[28] We use 9 lags of the instrument in both specifications. When we use the Hodrick-Prescott filter, λ= 6.25, as suggested by Ravn and Uhlig (2002).

parties to shift, which may have an influence on inequality. The results are depicted in table 17. The inclusion of any of those variables or all three jointly does not affect the significance nor magnitude of the beta coefficient of *r-g*. This provides empirical support that the exclusion restriction is met, and wealth inequality is affected by defense news exclusively via *r-g*.

Finally, we replace the dependent variable, 1%-*percentile wealth share*, with the Gini index, as the later variable could be considered a better gauge of inequality. Using the Gini coefficient is therefore a valuable exercise.[29] The main finding, this is, evidence of a positive relationship between inequality and *r-g*, is sustained with the Gini index as the dependent variable. One problem with the Gini index in that respect is that there is not a clear choice as to which percentile to use for the savings and marginal tax rates. Therefore, we opted for the top 1% savings rate as our main result. All the robustness checks and a detailed discussion are relegated to the appendix.

5. Concluding remarks

We investigate empirically whether *r-g* causes an increase in wealth inequality. Using almost a century of US wealth data, together with percentile-specific returns to capital, we find that *r-g* plays a significant role in explaining the evolution of wealth inequality over the last century. The increase in *r-g* in recent decades can explain over 50% of the increase in wealth inequality.

However, this does not imply that a future rise in wealth inequality is inevitable. In order to reach that conclusion, one would have to expect the return to capital to remain at its high level of recent decades. Several papers challenge such a forecast (see, for example, Rognlie, 2014). It is important to understand the probable future trajectory of the return to capital to be able to anticipate whether new policies to reduce inequality are necessary (in that light, Atkinson (2014) proposes diverse policies aimed at reducing inequality). In order to draw conclusions on the likely future path of wealth inequality, an analysis of the causes of the increase in *r-g* in recent decades is required.

As an important side result of this paper, we find wealth shares and income shares in the US to be nonstationary. This is hardly surprising from a theoretical point of view, as ultimately, moral views

[29] We would like to thank an anonymous referee for pointing out this robustness check.

determine politics and redistribution, and a brief look at human history does not support the vision of moral views as stationary. This result is important as it questions the statistical validity of the findings in studies on inequality that use levels of inequality rather than first differences and fail to document the trending behavior of the variables.

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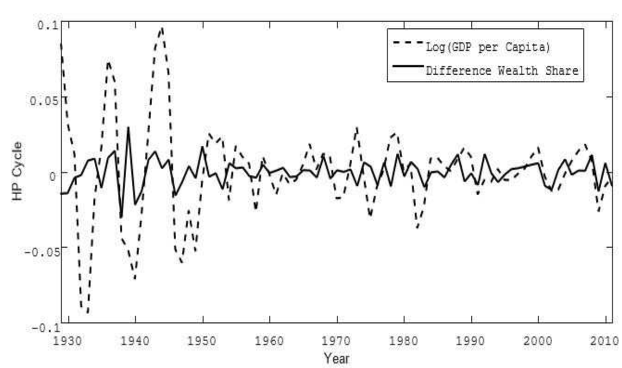
Appendix A

A.1 *Cyclicality*

Figure 8

Cycles. HP filter to the difference in wealth shares, and to the logarithm of GDP per capita



Source: Authors' elaboration.

In order to document the cyclicality of the change in wealth shares, we apply an HP filter to the difference in wealth shares, as well as to the logarithm of GDP per capita. Both graphs are depicted in figure 8. The cyclical component of the logarithm of GDP per capita is considered to represent business cycles. Hence, we show that the change in wealth shares has a cyclical component, as both graphs are correlated. The correlation coefficient is 0.30 and significant at the 0.01 significance level.

A.2 *Unit-root test results*

We apply the following unit-root tests:[30] the Augmented Dickey-Fuller test (ADF), the DF-GLS test, the Phillips-Perron test (PP), and the KPSS test. The null hypothesis of the first three is that the series behaves as a unit-root process. We also allow for a constant term in the auxiliary regression; thus, under the null, there is also a drift. The relevant alternative hypothesis is that the variable behaves as a stationary process. The ADF controls for autocorrelation through the inclusion of K lags, where K is selected by optimizing the Bayesian Information Criterion (BIC). The DF-GLS test controls for deterministic components (namely the constant term) via a GLS quasi-difference; the Phillips-Perron test controls for the autocorrelation via a nonparametric estimation of the long-run variance.

In contrast, the null hypothesis of the fourth test (the KPSS) is stationarity, whilst the relevant alternative is a unit root. Additionally, we also estimated the degree of persistence of the series through the Local Whittle Estimator (Whittle); the degree of persistence (usually labeled d) of a variable -let us say $x_t \sim I(d)$- is such that $(1-L)^{-d}x_t \sim I(0)$. Using the Whittle estimate, we test the null hypothesis $d = 0$. For all the tests, the superscripts *, **, and *** denote whether the null hypothesis is rejected at the 10%, 5%, and 1% levels, respectively. Table 4 provides the results of standard unit-root tests on yearly data, and table 5 provides the results for the same tests using three-year averages.

Since Perron (1989), it has been well-known that structural breaks substantially diminish the power of standard unit-root tests. We apply the testing procedure developed by Kapetanios (2005), which is an extended ADF test capable of controlling for up to five structural breaks. The Kapetanios (2005) test provides evidence that marginal tax rates follow (broken trend-) stationary processes. The test fails to reject the unit-root hypothesis for wealth shares.

[30] The full dataset and scripts are available upon request.

The Kapetanios test is a generalized ADF test with a constant term, trend, and up to five structural shifts in either the constant or the trend (in this case, we only allowed for breaks in the constant term and up to three breaks due to the shortness of the series). The null hypothesis remains unit root, whilst the alternative is broken-trend stationarity. Shifts are determined endogenously; critical values can be found in Kapetanios (2005). The results of this test are documented in table 6 for yearly data and in table 7 for three-year averages.

Table 4
Standard unit-root test results, yearly data

Variable	*Unit root test*				
	ADF	*DF-GLS*	*PP*	*KPSS*	*Whittle*
r (1 percentile)	-6.7084***	-5.2825***	-6.0941***	0.1091	-0.172
r (0.1 percentile)	-6.6839***	-5.4807***	-6.1957***	0.1063	-0.1333
g	3.1093	5.0967***	-6.0284***	0.07468	-0.1613
r-g (1 percentile)	-5.2040***	-5.6986***	-5.6870***	0.1908	-0.0567
r-g (0.1 percentile)	-4.7064***	-6.0274***	-6.0243***	0.1972	0.0155
Savings (1 percentile)	5.4879***	3.5796***	-5.4744***	0.5687**	0.2302*
Savings (0.1 percentile)	3.5064***	1.4424	-5.9609***	0.9699***	0.4673***
Wealth share (1 percentile)	1.3873	1.0899	-1.4019	0.9699***	1.2002***
Wealth share (0.1 percentile)	1.1498	-0.9854	-1.3848	0.7197**	1.2893***
Marginal tax rate (1 percentile)	-2.1953	-0.9457	-2.0116***	0.6433**	0.980***
Marginal tax rate (0.1 percentile)	-2.0423	-1.1149	-2.2552***	0.4391*	0.9017***
Defense news	-2.6357*	-2.1378**	-7.3757***	0.1683	-0.0397
Income share (1 percentile)	-2.0239	-0.9108	-1.1733	0.5505**	85376***
Income share (0.1 percentile)	-1.5693	-1.1343	-1.5656	0.5337**	80252***

Source: Authors' elaboration.

Table 5
Standard unit-root test results, 3-year average data

Variable	*Unit root test*				
	ADF	*DF-GLS*	*PP*	*KPSS*	*Whittle*
r (1 percentile)	-6.3699***	-1.8471*	-6.4354***	0.1334	0.2058
g	-1.4561	-4.9049***	-6.8064***	0.0825	-1.5318
r-g (1 percentile)	-4.5577***	-2.4303**	-4.5472***	0.1774	0.0033
Savings (1 percentile)	-1.6675	-0.2704	-3.9383**	0.4884**	0.2839
Wealth share (1 percentile)	-0.1960	-1.2050	-1.4636	0.4312*	1.2721***
Marginal tax rate (1 percentile)	-1.9488	-1.2644	-1.7545	0.2764	1.2623***
Defense news	-2.4825	-2.4444**	-6.5295***	0.1771	0.5635***
Income share (1 percentile)	-2.5746*	-0.8462	-1.1581	0.2531	1.6857***
Income share (0.1 percentile)	-2.6179*	-1.0215	-1.5849	0.2524	1.3532***

Source: Authors' elaboration.

Table 6
Unit-root test controlling for break results, yearly data

Variable	*Kapetanios UR test*			
	One break	*Two breaks*	*Three breaks*	*Break dates*
Marginal tax rate (1 percentile)	-6.1665***	-8.2196***	-8.8261***	1939, 1981, 1954
Marginal tax rate (0.1 percentile)	-4.9829***	-5.8426***	-6.3420***	1938, 1981, 1963
Marginal tax rate (90 percentile)	-5.9790***	-6.8404***	-7.2788***	1940, 1986, 2002
Defense news	-7.9117***	-9.0758***	-10.4706***	1950, 1939, 1944
Savings (0.01 percentile)	-6.2776***	-8.3038***	-9.0602***	1931, 1940, 1923

Table 6
(Continued)

Variable	*Kapetanios UR test*			
	One break	*Two breaks*	*Three breaks*	*Break dates*
Wealth share (0.1 percentile)	-2.4346	-3.3373	-4.7121	1939, 1923, 1998
Wealth share (0.01 percentile)	-2.4510	-3.3531	-3.8410	1937, 2002, 1986
Income share (0.1 percentile)	-2.9155	-4.0176	-4.8819	1936, 1986, 2002
Income share (0.01 percentile)	-3.1260	-4.1057	-5.1200	1986, 1936, 2002

Source: Authors' elaboration.

Table 7
Unit-root test controlling for break results, 3-year average data

Variable	*Kapetanios UR test*			
	One break	*Two breaks*	*Three breaks*	*Break dates*
Marginal tax rate (1 percentile)	-5.7702***	-8.0679***	-8.3231***	1939, 1981, 1954
Marginal tax rate (0.1 percentile)	-4.8943***	-6.2958***	-7.6143***	1944, 1986, 1968
Marginal tax rate (90 percentile)	-7.0634***	-8.0453***	-7.9242***	1938, 1983, 1962
Defense news	-7.591***	-7.7025***	-7.7044***	1936, 1951, 1915
Savings (0.1 percentile)	-4.5645	-6.0734***	-6.0218	1971, 1947, 1995
Wealth share (0.1 percentile)	-2.6545	-4.1979	-4.2092	1944, 1995, 1962

Table 7
(Continued)

Variable	*Kapetanios UR test*			
	One break	*Two breaks*	*Three breaks*	*Break dates*
Wealth share (0.01 percentile)	-2.2253	-2.8599	-3.055	1935, 1965, 1983
Income share (0.1 percentile)	-1.8776	-3.0681	-3.9365	1926, 1941, 1983
Income share (0.01 percentile)	-2.4367	-3.2825	-3.766	1929, 1947, 1983

Source: Authors' elaboration.

Table 8
Results of unit-root tests

Variable	*r*	*g*	*r-g*	*Income share*	*Wealth share*	*Savings rate*	*Marg. tax rate*
Stationary	Yes	Yes	Yes	No	No	Yes	Yes

Source: Authors' elaboration.

A.3 *First stage regressions*

Table 9 documents the results of the first stage regression exercise using three-year averages:

$$(r_t - g_t) = \alpha + \ \beta_0 SavingsRate_t + \ \beta_1 MarginalTaxRate_t$$
$$+\beta_3 DefenseNews_t + \beta_4 DefenseNews_{t-1} + \ldots + \varepsilon_t.$$

We document the results for the regressions that include between 0 and 3 lags of the Defense News variable. All specifications display substantial explanatory power, as the adjusted R^2 and F-values indicate. We use the instrument with 3 lags in our main specification and show the results with only 0 or 1 lag in the robustness section.

Table 9
First stage regressions for 1%-percentile r-g

Dependent variable: r-g	*1* (*OLS*)	*2* (*OLS*)	*3* (*OLS*)	*4* (*OLS*)
Defense news	-0.0020***	-0.0021***	-0.0021***	-0.0025***
	(0.0005)	(0.0005)	(0.0005)	(0.0001)
Defense news (-1)		-0.0005*	-0.0005	-0.0003
		(0.0003)	(0.0003)	(0.0003)
Defense news (-2)			0.0002	0.0006**
			(0.0003)	(0.0003)
Defense news (-3)				0.0012***
				(0.0002)
Savings rate 1%	0.0341*	0.0333*	0.0379**	0.0557***
	(0.0195)	(0.0177)	(0.0173)	(0.0162)
Marginal tax rate 1%	-0.0437	-0.0293	-0.0405	-0.0849*
	(0.0359)	(0.0415)	(0.0495)	(0.0441)
T	28	28	28	28
R^2	0.4265	0.4523	0.4559	0.5565
Adj. R^2	0.3549	0.357	0.3323	0.4297
F-value	6.62	10.64	10.24	154.06

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.05, **p<0.01, ***p<0.001.

Source: Authors' elaboration.

B. Empirical results of the robustness checks

Table 10
Results for 0.1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (OLS)*	*2 (OLS)*	*3 (OLS)*	*4 (IV)*	*5 (IV)*	*6 (IV)*
r-g	0.2402***	0.1909***	0.1446***	0.2234***	0.2063***	0.1791***
	(0.0489)	(0.0344)	(0.0298)	(0.0288)	(0.0155)	(0.0239)
Savings rate 0.1%		0.0079*	0.0105***		0.0075	0.0095***
		(0.0046)	(0.0031)		(0.0047)	(0.0033)
Marginal tax rate 0.1%		-0.0286***	-0.0134*		-0.0276***	-0.0129*
		(0.0064)	(0.0077)		(0.0069)	(0.0072)
Crash (1929)			0.1041***			0.0965***
			(0.0127)			(0.0126)
WW II USA			-0.0070**			-0.0053*
			(0.003)			(0.0028)
Crisis (2008)			0.0580***			0.0538***
			(0.0096)			(0.0101)
T	28	28	28	28	28	28
R^2	0.4926	0.638	0.7776	0.4926	0.637	0.7717
Adj. R^2	0.4731	0.5927	0.7141	0.4731	0.5916	0.7065
F-value	24.08	14.44	463.25	60.2	74.84	2598.77
F-value (1st stage)				105.15	143.44	387.31
Hausman-test				χ^2 (1)= 0.0791 p-value= 0.7785	χ^2 (1)= 0.1036 p-value= 0.7476	χ^2 (1)= 0.8771 p-value= 0.3490

Table 10
(Continued)

Dependent variable: Change in wealth share	*1 (OLS)*	*2 (OLS)*	*3 (OLS)*	*4 (IV)*	*5 (IV)*	*6 (IV)*
Sargan-test				LM= 2.1626 p-value= 0.5393	LM= 0.9404 p-value= 0.8157	LM= 1.4861 p-value= 0.6855

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

Table 11
Results for 5%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (OLS)*	*2 (OLS)*	*3 (OLS)*	*4 (IV)*	*5 (IV)*	*6 (IV)*
r-g (10%)	0.3158***	0.3019***	0.2833***	0.2646***	0.2597***	0.2590***
	(0.0483)	(0.0372)	(0.0462)	(0.056)	(0.0645)	(0.081)
Savings rate 5%		0.0137	0.0113		0.0113	0.0103
		(0.0145)	(0.0237)		(0.0155)	(0.0243)
Marginal tax rate 5%		0.0004	0.0057		0.002	0.0079
		(0.0245)	(0.033)		(0.0283)	(0.0375)
Crash (1929)			0.0185			0.0254
			(0.039)			(0.0526)
WW II USA			0.0005			-0.0004
			(0.0123)			(0.0113)
Crisis (2008)			0.0602***			0.0623***
			(0.0137)			(0.0171)

Table 11
(Continued)

Dependent variable: Change in wealth share	*1 (OLS)*	*2 (OLS)*	*3 (OLS)*	*4 (IV)*	*5 (IV)*	*6 (IV)*
T	28	28	28	28	28	28
R^2	0.4482	0.4667	0.5051	0.4482	0.4665	0.5041
Adj. R^2	0.427	0.3971	0.3566	0.427	0.3969	0.3554
F-value	42.66	22.1	3.95E+13	22.33	10.96	1.97E+14
F-value (1st stage)				146.78	119.81	172.41
Hausman-test				χ^2 (1)= 0.7004 p-value= 0.4027	χ^2 (1)= 0.4970 p-value= 0.4808	χ^2 (1)= 0.1500 p-value= 0.6985
Sargan-test				LM= 2.4807 p-value= 0.4788	LM= 2.8152 p-value= 0.4210	LM= 4.3097 p-value= 0.2299

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

Table 12
Results for 1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (IV)*	*2 (IV)*	*3 (IV)*	*4 (IV)*	*5 (OLS)*	*6 (OLS)*
r-g	0.3220***	0.3546***	0.327***	0.3469***	0.1450*	0.1372**
	(0.0415)	(0.0586)	(0.0444)	(0.0619)	(0.0763)	(0.0492)
Savings rate 1%		0.0361***		0.0363***		0.0389***
		(0.0131)		(0.0131)		(0.0114)
Marginal tax rate 1%		-0.0476***		-0.0479**		-0.0067
		(0.0141)		(0.0143)		(0.0203)

Table 12
(Continued)

Dependent variable: Change in wealth share	*1 (IV)*	*2 (IV)*	*3 (IV)*	*4 (IV)*	*5 (OLS)*	*6 (OLS)*
Instrument lags	0	0	1	1	Independent variables lagged	Independent variables lagged
T	28	28	28	28	27	27
R^2	0.4945	0.6552	0.4945	0.6544	0.0926	0.3343
Adj. R^2	0.475	0.6112	0.475	0.6112	0.0563	0.2475
F-value	60.21	16.61	54.48	16.16	3.62	6.29
Hausman-test	χ^2 (1)= 0.2906 p-value= 0.5899	χ^2 (1)= 0.0392 p-value= 0.8430	χ^2 (1)= 0.2574 p-value= 0.6119	χ^2 (1)= 0.0088 p-value= 0.9251		
Sargan-test			LM= 0.0322 p-value= 0.8577	LM= 0.1157 p-value= 0.7337		

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

Table 13
Results for 1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (IV)*	*2 (IV)*	*3 (IV)*	*4 (IV)*	*5 (IV)*	*6 (IV)*
r-g (gross)	0.3197***	0.3393***				
	(0.0352)	(0.0336)				

Table 13
(Continued)

Dependent variable: Change in wealth share	*1* (IV)	*2* (IV)	*3* (IV)	*4* (IV)	*5* (IV)	*6* (IV)
r-g (Capnet)			0.2749***	0.2936***		
			(0.03)	(0.0286)		
r-g (net)					0.2891***	0.1892***
					(0.0705)	(0.068)
Savings rate 1%		0.0282**		0.0337***		-0.01
		(0.0114)		(0.0129)		(0.014)
Marginal tax rate 1%		-0.0516***		-0.0368**		-0.0582***
		(0.0141)		(0.0154)		(0.0171)
T	28	28	28	28	17	17
R^2	0.4911	0.6299	0.4827	0.6182	0.3576	0.6376
Adj. R^2	0.4715	0.5836	0.4628	0.5705	0.3147	0.5539
F-value	82.31	49.39	84.21	52.34	16.8	11.36
F-value (1st stage)	105.36	88.67	137.21	75.14	1.58	3.82
Hausman-test	χ^2 (1)= 0.0874	χ^2 (1)= 1.6600	χ^2 (1)= 0.0009	χ^2 (1)= 0.9798	χ^2 (1)= 0.8998	χ^2 (1)= 1.0049
	p-value= 0.7675	p-value= 0.1976	p-value= 0.9757	p-value= 0.3223	p-value= 0.3428	p-value= 0.3161
Sargan-test	LM= 3.8486	LM= 0.4888	LM= 2.7706	LM= 1.0425	LM= 3.1471	LM= 1.2068
	p-value= 0.2783	p-value= 0.9214	p-value= 0.4284	p-value= 0.7910	p-value= 0.3695	p-value= 0.7514

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

Table 14
Results for 1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (IV)*	*2 (IV)*	*3 (IV)*	*4 (IV)*	*5 (IV)*
r-g	0.3670***	0.3165***	0.3572***	0.2928***	0.3279***
	(0.0273)	(0.029)			(0.034)
Savings rate 1%	0.0223**				
	(0.0093)				
Marginal tax rate 1%		-0.0196			
		(0.0245)			
Difference savings rate			0.0247***		0.0280***
			(0.0091)		(0.0106)
Difference tax rate				-0.0433**	-0.0471***
				(0.0206)	(0.0119)
T	28	28	28	28	28
R^2	0.5659	0.5103	0.5824	0.5469	0.6612
Adj. R^2	0.5312	0.4712	0.549	0.5106	0.6189
F-value	90.33	62.19	93.66	56.25	50.87
F-value (1st stage)	84.66	273.67	111.02	394.48	114.57
Hausman-test	χ^2 (1)= 0.0007 p-value= 0.9793	χ^2 (1)= 0.3760 p-value= 0.5397	χ^2 (1)= 0.0033 p-value= 0.9541	χ^2 (1)= 0.4086 p-value= 0.5227	χ^2 (1)= 0.0630 p-value= 0.8018
Sargan-test	LM= 3.9463 p-value= 0.2673	LM= 3.4528 p-value= 0.3269	LM= 3.7462 p-value= 0.2902	LM= 2.4762 p-value= 0.4796	LM= 1.7442 p-value= 0.6272

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

Table 15

Results for 1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (IV-MA)*	*2 (IV-MA)*	*3 (IV-MA)*	*4 (IV-HP)*	*5 (IV-HP)*	*6 (IV-HP)*
r-g	0.0619	0.0947***	0.0841**	0.1297***	0.1248***	0.1122***
	(0.0388)	(0.0288)	(0.0344)	(0.0273)	(0.0164)	(0.0246)
Savings rate 1%		0.0252***	0.0234***		0.0249***	0.0244***
		(0.005)	(0.0048)		(0.0043)	(0.0037)
Marginal tax rate 1%		-0.0127*	-0.0101*		-0.0082	-0.0086*
		(0.0068)	(0.0057)		(0.0065)	(0.005)
Crash (1929)			-0.0019			-0.0142***
			(0.0155)			(0.0019)
WW II USA			-0.0028			-0.0028
			(0.004)			(0.0021)
Crisis (2008)			0.0161***			0.0096***
			(0.0034)			(0.0011)
Instrument lags	9	9	9	9	9	9
T	84	84	84	82	82	82
R^2	0.135	0.4539	0.5052	0.3066	0.629	0.739
Adj. R^2	0.1245	0.4334	0.4667	0.298	0.6147	0.7181
F-value	2.54	9.89	15.03	22.63	46.73	19231.35
F-value (1st stage)	434.89	61.36	53.77	94.57	98.91	68.84
Hausman-test	χ^2 (1)= 1.3514 p-value= 0.2450	χ^2 (1)= 0.1865 p-value= 0.6658	χ^2 (1)= 1.3412 p-value= .2468	χ^2 (1)= 0.0495 p-value= 0.8239	χ^2 (1)= 0.0001 p-value= 0.9945	χ^2 (1)= 1.9346 p-value= 0.1643

Table 15
(Continued)

Dependent variable: Change in wealth share	*1 (IV-MA)*	*2 (IV-MA)*	*3 (IV-MA)*	*4 (IV-HP)*	*5 (IV-HP)*	*6 (IV-HP)*
Sargan-test	LM= 21.7093	LM= 12.7144	LM= 14.2899	LM= 23.33	LM= 11.49	LM= 26.32
	p-value = 0.0098	p-value= 0.1760	p-value= 0.1124	p-value= 0.0055	p-value= 0.3204	p-value= 0.0033

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

Table 16
Results for 1%-percentile wealth share regressions

Dependent variable: Change in wealth share	*1 (IV)*	*2 (IV)*	*3 (IV)*	*4 (IV)*
r-g	0.2558***	0.3508***		
	(0.047)	(0.0698)		
Year	0.0003**	0.0001		
	(0.0002)	(0.0002)		
sr-g			0.3103***	0.2939***
			(0.1018)	(0.1087)
Savings rate 1%		0.032		
		(0.0198)		
Marginal tax rate 1%		-0.0445**		-0.0231
		(0.0186)		(0.034)
T	28	28	28	28
R^2	0.562	0.6604	0.0704	0.0945

Table 16
(Continued)

Dependent variable: *Change in wealth share*	*1* *(IV)*	*2* *(IV)*	*3* *(IV)*	*4* *(IV)*
Adj. R^2	0.527	0.6013	0.0346	0.0221
F-value	76.04	44.34	9.3	4.85
F-value (1st stage)	464.73	45.61	211.91	234.31
Hausman-test	χ^2 (1)=	χ^2 (1)=	χ^2 (1)=	χ^2 (1)=
	0.5357	0.1756	2.0101	1.8885
	p-value=	p-value=	p-value=	p-value=
	0.4642	0.6752	0.1563	0.1694
Sargan-test	LM=	LM=	LM=	LM=
	2.9677	1.8117	3.8216	3.2822
	p-value=	p-value=	p-value=	p-value=
	0.3966	0.6124	0.2814	0.3501

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.

Table 17
Exclusion restriction - 1%-percentile wealth share regressions

Dependent variable: *Change in wealth share*	*1* *(IV)*	*2* *(IV)*	*3* *(IV)*	*4* *(IV)*
RmG_Rnetcon_1	0.3648***	0.3248***	0.3729***	0.3086***
	(0.043)	(0.032)	(0.0459)	(0.0537)
UnempRate	-0.0013*			-0.0018
	(0.0007)			(0.0012)
Share military spending		-0.0002		-0.0007
		(0.0003)		(0.0005)
Ratio Demo vs Repub			-0.0081	-0.0026
			(0.0054)	(0.0073)

Table 17
(Continued)

Dependent variable: *Change in wealth share*	*1* *(IV)*	*2* *(IV)*	*3* *(IV)*	*4* *(IV)*
T	28	28	28	28
R^2	0.5456	0.496	0.5298	0.5853
Adj. R^2	0.5092	0.4557	0.4921	0.5131
F-value	37.8	71.27	56.02	46.17
F-value (1st stage)	324.98	146.4	238.05	183.96
Hausman-test	χ^2 (1)=	χ^2 (1)=	χ^2 (1)=	χ^2 (1)=
	0.1909	0.2837	0.7007	0.1089
	p-value=	p-value=	p-value=	p-value=
	0.6622	0.5943	0.4026	0.7414
Sargan-test	LM=	LM=	LM=	LM=
	8.0631	4.2483	6.8825	7.6553
	p-value=	p-value=	p-value=	p-value=
	0.0447	0.2359	0.0757	0.0537

Notes: Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.
Source: Authors' elaboration.

C. Robustness check using a different inequality measure (Gini index)

The dependent variable, the Gini index, is built as in previous cases. This is, as 3-year averages of the US data; the variable is then first-differenced. Note that *r-g* has a positive impact on thechange of theGini index and is statistically significant at the 1% level in all six robust models.

Table 18
Results for Gini index regressions

Dependent variable: Gini 3-year averages	*1 (OLS)*	*2 (OLS)*	*3 (OLS)*	*4 (IV)*	*5 (IV)*	*6 (IV)*
r-g	0.2582***	0.2542***	0.2446***	0.2631***	0.2731***	0.2457***
	(0.0328)	(0.0350)	(0.0292)	(0.0409)	(0.0377)	(0.0302)
Savings rate 1%		0.02861	0.0202		0.0288	0.2021
		(0.0205)	(0.0163)		(0.0207)	(0.0164)
Marginal tax rate 1%		-0.03289*	-0.0167		-0.0324*	-0.0167
		(0.0172)	(0.0187)		(0.0171)	(0.0187)
Crash 1929			0.0295			0.2994
			(0.0199)			(0.0203)
WW II USA			-0.0001			-0.0001
			(0.0034)			(0.0033)
Crisis 2008			0.1021***			0.1021***
			(0.0128)			(0.0128)
T	28	28	28	28	28	28
R^2	0.3003	0.4191	0.6415	0.3003	0.4186	0.6415
Adj. R^2	0.2733	0.3465	0.5391	0.2733	0.346	0.5391
F-value	61.96	27.66	24.09	41.36	21.87	54813842
F-value (1st stage)				112.289	116.074	114.272
Hausman-test				χ^2 (1)= 0.0100 p-value= 0.9202	χ^2 (1)= 0.1822 p-value= 0.6694	χ^2 (1)= 0.0007 p-value= 0.9782
Sargan-test				LM= 3.7894 p-value= 0.2851	LM= 1.0344 p-value= 0.7929	LM= 3.4517 p-value= 0.3271

Notes: Constant excluded. Robust standard errors. Standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.

Source: Authors' elaboration.