# Wealth accumulation and its distribution in Uruguay:

## first estimates of the untold half of the story.

Public Policies and Development Master Thesis

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**Abstract**

Wealth accumulation and its distribution are arguably two of the key drivers of overall economic inequality, and of major importance in their own right. However, relatively little is known about them, particularly in the developing world. In this article, for the first time, a wealth to income ratio series for Uruguay is constructed and wealth distribution is estimated, based on the capitalization method. The capital incomes database used is a combination of tax micro-data, firms' tax records and household surveys, whilst aggregate national wealth is estimated based on a variety of data sources, since National Accounts' balance sheets do no exist. Main estimations refer to 2009-2014 and are extended based on secondary sources to 2000-2015. Results show that the wealth to income ratio is around 380% and slowly decreasing, whilst wealth inequality decreased over the period but remains in very high levels. Between 35 and 45% of national wealth is owned by the wealthiest 1% and the top 10%'s share is over 60-65%. The middle 40% owns just above 30%, whilst the bottom 50's share is only around 5%. Inequality estimations are triangulated with three other empirical approaches: a wealth household survey, personal wealth taxes and estimations based on the estate multiplier method, showing that wealth inequality estimations (both in level and trend) are consistent with these external evidence. The longer-run analysis indicates that negative growth episodes and capital gains have shaped the wealth to income ratio, which appears to be the driver of the changes in wealth distribution. These results are a part of a larger effort of Distributional National Accounts estimation for Uruguay and hence compatible with previous income distribution studies.

**Key words:** wealth distribution, wealth to income ratios, capitalization method, tax records, national accounts, developing countries, Uruguay.

**JEL classification:** D31, E01, E22

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# 1 Introduction

Much has been discussed about inequality in Latin America in light of the significant social, political and economical changes that the region has witnessed. Income inequality seems to have experienced a downturn since the early 2000s, in the context of vigorous economic growth and redistributive public policies (Cornia, 2014). Yet, it is still high compared with European countries, and the decreasing trend has stopped or even reversed in recent years (Gasparini et al., 2018). The question of whether this trend is the result of poor performance of household surveys is still ongoing, with mixed results depending on the country, as the evidence based on income tax records accumulates (Alvaredo and Londoño Velez, 2014; Alvaredo, 2010; Morgan, 2017; Atria et al., 2018; Burdín et al., 2015). However, the entire discussion has been related to only half of the story, that is, to what has happened to income distribution and income growth. Wealth accumulation and its distribution remain completely unexplored in the region, as in most of the developed world.

This disappointing absence of wealth related estimates does not result from the fact that wealth accumulation and its distribution are unimportant economic questions. To be sure, wealth is intrinsically relevant as it involves both economic resources and control over them. Wealth generates an income flow accrued by wealth holders, allowing consumption smoothing when income declines, typically in the face of economic downturns or retirement age (Davies and Shorrocks, 2000), and more importantly contributing to shape income distribution. Moreover, as Atkinson pointed out, "wealth is important because it gives not only income (interests, dividends and rent) but also security, freedom of maneuver, and economic and political power" (Atkinson, 1973, p.239)[1]. The reason why these key questions have not been properly addressed so far, is rather related to the staggering absence of adequate data.

In the developed world, much progress has been done in recent years. Based on National Accounts' balance sheets, wealth to income ratios[2] for many developed economies have been estimated, showing a significant increase in the last few decades (Piketty and Zucman, 2014). Wealth distribution, on the other hand, has been estimated using different methodologies in countries such as the United States (Saez and Zucman, 2016; Kopczuk, 2015), France (Garbinti et al., 2017), United Kingdom (Alvaredo et al., 2018) or Spain (Martínez Toledano, 2015), showing an increase in the case of United States and relative stability in the remaining ones. Is this a developed-world phenomenon, or is something similar happening elsewhere?

To contribute to answer this question, wealth aggregates and its distribution for Uruguay

[1] In a similar spirit, almost two hundred and fifty years ago, Adam Smith famously argued that "wealth, as Mr. Hobbes says, is power" (Smith, 1776).

[2] Wealth to income ratio is defined as the aggregate wealth of a country, expressed in terms of National Income, e.g. a wealth to income ratio of 500% indicates that the stock of wealth is equivalent to 5 times the National Income.

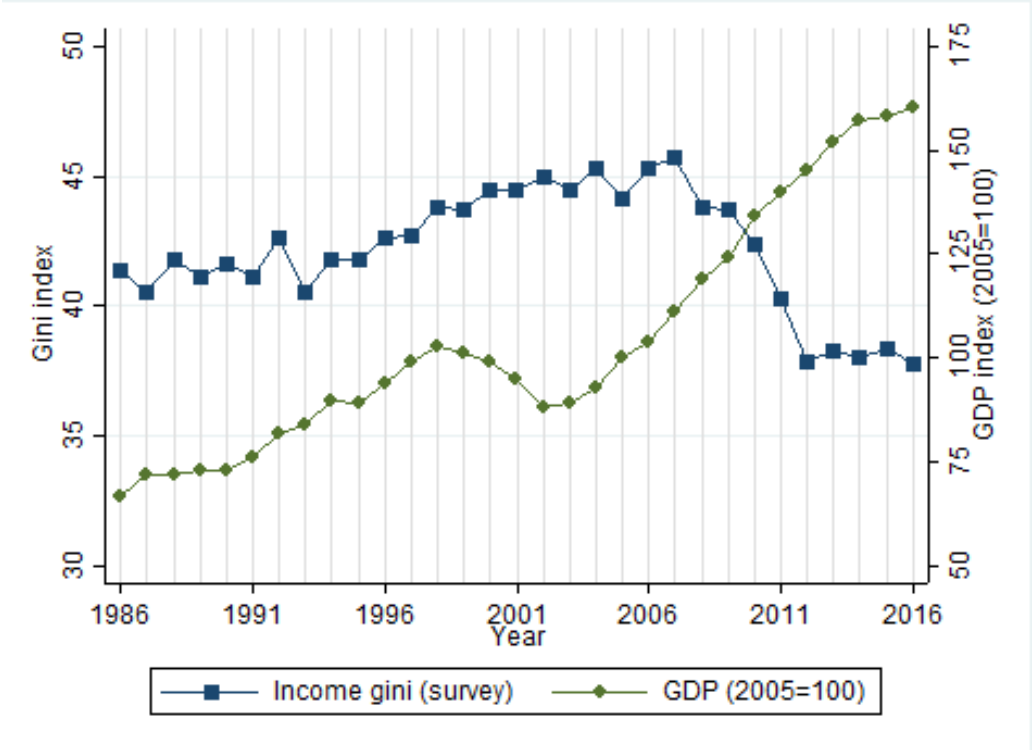
in the 2009-2014 period are estimated for the first time, based on the capitalization method, and extended to 2000-2015 based on secondary sources. Uruguay is a small[3] high income country, with low income inequality in the Latin American context but still high compared to developed countries[4]. After decades of unstable economic growth and recurrent economic crisis, it has sustained an average annual growth rate of around 4% for the last fifteen years, reaching a per-capita GDP of USD 21,625, around 40% above the Latin American average, but half the average of the OECD countries[5]. This economic growth, coupled with a series of relatively large reforms both in the labour market and in the tax and transfers system put in practice by a centre-left coalition in office since 2005, turned into a significant decline in income inequality. These reforms included a major raise in the minimum wage, the restoration of centralised, collective wage bargaining, an expansion of both coverage and amount of non contributory cash transfers schemes, and the introduction of progressive income taxation. Based on high-quality household surveys, studies have consistently shown[6] that income inequality experienced a rapid decline between 2008 and 2012 followed by a relative stagnation from 2013 onward (Figure 1). This income inequality decrease has been confirmed by the use of income tax records (Burdín et al., 2014, 2015), so the story presented in Figure 1 is an accurate one, yet incomplete.

Thus, the main objective of this article is to complete this story about growth and income inequality with estimations of wealth accumulation and wealth distribution. As in most of the developing world and even in many rich countries, there are no estimates of balance sheets from Uruguay's National Accounts. Hence, unlike similar studies such as Saez and Zucman (2016) for US, Martínez Toledano (2015) for Spain or Garbinti et al. (2017) for France, wealth to income ratios are estimated based on a wide range of secondary sources, including cadastral administrative data, prices of land and housing properties, firm's tax records, Central Bank financial data, among others. The capitalization method, on which the main distributional estimations are based, consists on estimating individual net wealth by capitalizing personal capital incomes, based on capitalization factors for each type of wealth that are equivalent to the inverse of their rate of return. Capital incomes are mainly drawn from a high quality tax records database –which covers 75% of adult population– combined with firm's tax records and household survey data. This capital incomes database is the core of the Distributional National Accounts (DINA) estimations for Uruguay's income distribution (De Rosa and Vilá, 2017).

In terms of wealth to income ratio, results show that it is around 380% and slowly decreasing, which is lower to what is observed in developed economies where it is around 500-700% (Piketty and Zucman, 2014). This estimates, although highly preliminary and subject to further improvement, are extremely important since there are no official aggregate wealth

[3]The population has around 3.400.000 people and remarkably stable over the last decades.
[4]The Gini index has now stabilised in 0.38.
[5]Values in PPP. https://data.worldbank.org/
[6]See for instance Cornia (2014).

Figure 1: Income inequality and growth in Uruguay, 1986-2015.




Notes: Gini index is based on Household Survey (*Encuesta Continua de Hogares*) and refers to per-capita household income. Similar trend is observed when considering inequality estimates such as the top 10% share. The survey is conducted by the National Statistics Institute (INE in its Spanish acronym). GDP data is produced by Uruguay's Central Bank (BCU in its Spanish acronym).

estimations for Uruguay, nor for most of the developing world. To better understand these results, however, it is necessary to adopt a long-term view. Based on National Accounts' data on growth and investment, and assuming a one-good model, a 1989-2015 wealth to income ratio series is built, showing that the wealth to income ratio seems to be slowly converging to its long term level of 350% (given by historical growth and investment averages), and that past increases were the result of negative growth episodes (two major economic crisis in 1982 and 2002) rather than of true wealth accumulation. Based on land-prices' series and a two-goods model framework, results show that this trend may have been amplified by a capital gains effect in recent years.

Wealth inequality decreased over the period 2009-2014, but remains in very high levels: around 40% of total wealth is owned by the wealthiest 1%, top 10%'s share is 60-65%, whilst 35% is owned by the "middle 40". Bottom 50%, on the other hand, owns virtually nothing (around 5%). These estimates would locate Uruguay as a relatively high wealth inequality country compared to France, closer to Spanish or US's estimates. Virtually all of the business and

financial wealth is owned by the top 10%, and around 80 and 90% by the top 1% respectively. Less than half of the real estate is owned by the "middle 40", and around 40% by the top 10%. In terms of wealth composition, around three quarters of Uruguay's wealth is real estate (including housing and land), which is the predominant type of wealth for 99% of individuals –if they have any. For the top 1%, between two thirds and three quarters of their wealth refers to business proprietorship, 15-20% is real estate and the rest is financial wealth (essentially deposits in the Uruguayan case).

Inequality estimates are triangulated with three other empirical approaches to provide greater certainty about the overall conclusions. Comparison of the main results with a Wealth Household Survey (*Encuesta Financiera de los Hogares Uruguayos*, EFHU) of 2012, which covers similar assets as the ones estimated with the capitalization method, shows very consistent results regarding wealth inequality level, that is, similar results for bottom 50%, middle 40% and top 10%, but lower levels –as expected– for the top 1%. As there is only one wealth survey, it is impossible to use it to assess the trend of wealth inequality. It is in turn possible to compare the evolution of the inequality in wealth's main component, i.e. real estate, based on other two empirical approaches: a wealth tax and estimations based on the estate multiplier method. These novel estimations entail results that are entirely consistent with the declining trend in real estate wealth inequality observed in capitalization method's estimations, which accounts for two thirds of total wealth, hence providing evidence that the declining trend in overall wealth inequality is also robust.

In order to better understand these results, again, it is necessary to take a wider window of analysis. To do so, wealth inequality is estimated for the 2000-2015 period based on capital incomes from the Household Survey and capitalization factors computed based on the capitalization factors of 2009-2014 and the wealth to income ratio extended series. These estimations, although imperfect, provide important insights of the likely evolution of wealth distribution over the period. The results of this analysis show that wealth inequality is falling after an increase caused by a a sharp spike in land prices, and more generally, that the wealth to income ratio is a key driver of wealth inequality.

The contribution of this article is threefold. First, it is a contribution to the wealth to income ratios estimation and and wealth accumulation literature (Piketty and Zucman, 2014; Artola et al., 2018; Artola and Estévez, 2017; Del Castillo, 2017), which in this case comes not from National Accounts but from own estimations. Second, it provides estimates of wealth distribution based on tax records for a developing country, which are entirely consistent with estate-multiplier-based estimations and data from a wealth survey and wealth tax records[7]. This makes these estimates fully comparable with the growing literature on wealth distribu-

[7]Early attempts of discussing wealth distribution can be found in Torche and Spilerman (2006) for Latin America and in Amarante et al. (2010).

tion (Saez and Zucman, 2016; Alvaredo et al., 2018; Martínez Toledano, 2015; Garbinti et al., 2017; Kopczuk, 2015). Moreover, it contributes to the methodological debate on the different empirical approaches for the estimation of wealth distribution and the relative drawbacks of the capitalization method (Kopczuk, 2015; Bricker et al., 2015; Fagereng et al., 2016; Saez and Zucman, 2016). Third, as wealth distribution estimations are built on a DINA-based capital incomes database, estimations are fully consistent with previous income distribution studies (De Rosa and Vilá, 2017) and with the DINA framework and guidelines (Alvaredo et al., 2016), hence allowing to compute the first full income and wealth Distributional National Accounts for a developing country and one of the firsts of the world[8].

The rest of the article is organised as follows. Section 2 presents the data sources used and the capitalization method, focusing on why it was chosen and its drawbacks, and describes the procedure undertaken for the wealth distribution estimations in the Uruguayan framework. The construction of the wealth to income ratio series is presented in section 3, including estimates for recent years and its likely evolution in the longer run. Wealth distribution estimates are presented in section 4, with a characterisation or wealth holders in terms of age, sex and location in the income distribution, and the extension of the inequality series. Triangulation with other empirical approaches is presented in section 5 and section 6 concludes.

[8]For more details, see https://wid.world/.

# 2 Data and methodology

In this section, after briefly discussing the concept of wealth in section 2.1, the methodology for the estimation of wealth distribution and its limitations are described in section 2.2. The main data sources used for the estimation, are described in section 2.3.

## 2.1 The concept of wealth

The concept of wealth used, which is the departure point of this study, is quite straightforward. In general terms, net wealth refers to assets minus liabilities over which ownership rights can be enforced and that provide economic benefits to their owners (Piketty and Zucman, 2015). This definition excludes "human capital", as it is not possible to buy it or sell it in the market. Notwithstanding, there is a wide range of assets that may fit this definition. Due to information restrictions, in this article the notion of net wealth will be restricted to real estate (that is, housing and land), business wealth and financial wealth. Pension plans and durable goods are therefore excluded. There are other important dimensions of the wealth definition that need to be explicit, such as the unit of analysis, the geographical scope and the method of valuation. In this study, as personal capital income data are capitalized, the unit of analysis refers to individuals. Moreover, due to the Uruguay's tax system, the geographical scope regards individuals who generate income in the country[9]. Finally, the valuation method is the market value since, as it will be explained bellow, assets value is estimated based on market prices.

In all cases, wealth refers to total national wealth, i.e. the sum of public and private wealth (Alvaredo et al., 2016). All wealth to income ratios and wealth distribution estimations will thus refer to this macroeconomic aggregate. Given data restrictions, which mainly refer to the complete absence of balance sheet in National Accounts, results are presented with a relatively high level of aggregation. Therefore, it has not been possible so far to distinguish between public and private wealth, or between institutional sectors within the latter.

## 2.2 The capitalization method

There is a set of possible methodologies and data sources that may be used to study personal wealth distribution: (i) data on estates at death, multiplied-up to yield estimates of the wealth of the living; (ii) wealth household surveys; (iii) wealth taxes data; (iv) "rich lists" or (v) the capitalization method.

The wealth distribution estimations in this article are based on the capitalization method,

[9]Tax data on dividends accrued by individuals off borders, as well as non-residents, was not available for this study.

recently applied by Saez and Zucman (2016) for the United States[10], and the remaining ones will be used (when possible), as robustness checks.

There are several reasons to choose the capitalization method as the methodological workhorse in this setting. First, it provides the best balance between asset and time coverage. As it is discussed in section 5, the wealth survey has information on a larger number of assets but only for one year, whilst the estate multiplier method presents a longer time span but only provides real estate distribution estimates. In any case, as it will be discussed below, adding more assets does not substantially change wealth distribution estimations in the wealth survey, and the estate multiplier method's estimations only add two years to the time series. Therefore, the capitalization method is better as it provides estimates of a complete wealth distribution estimation, both time and assets-wise. Second, as discussed in section 4.1, wealth is estimated based on capital incomes distribution, which are part of DINA-based income distribution estimates, hence providing a full individual income-wealth database, compatible with the DINA framework. This income-wealth database is an important product in its own right, since it allows to study the dynamics of income growth and distribution together with wealth distribution and accumulation. Finally, the capitalization method is likely to be better suited for top shares estimation (Piketty, 2015), which are particularly important in wealth distribution analysis.

The method consists on estimating individual net wealth by capitalizing personal capital incomes, using capitalization factors for each type of wealth which are equivalent to the inverse of their rate of return. Essentially, if for certain individual $i$, the amount of wealth $p$ that she owns ($w_{ip}$) yields ($r_p$) providing her with an income flow ($k_{ip}$) (eq. 1), then it is possible to trace back the wealth stock by applying a capitalization factor ($f_p$), equivalent to the inverse of its rate of return (eq. 2).

$$k_{ip} = r_p * w_{ip} \tag{1}$$

$$w_{ip} = k_{ip} * f_p \tag{2}$$

Being:

$$f_p = 1/r_p \tag{3}$$

The method has some important drawbacks. The most relevant one refers to the fact

[10]The method was originally proposed by Robert Giffen in 1913 (Fagereng et al., 2016), and applied for instance for the United Kingdom by Atkinson and Harrison (1978).

that it is assumed that for each type of wealth $w_p$, the capitalization factor $f_p$ is the same for all individuals. This may not be the case, as individuals may face different rates of return $r_p$, thus biasing the estimations. One possible bias is associated with idiosyncratic returns, that is, that identical individuals in terms of observable characteristics face different rates of return for the same assets. Furthermore, it is possible that returns are positively correlated with wealth, which is argued to be a "more serious concern" (Saez and Zucman, 2016). This may happen because higher income individuals are better informed and advised of investment opportunities, and so they are able to own safer and more profitable portfolios. If rates of return rates $r_p$ are larger for higher income individuals, then their capitalization factors $f_p$ would be lower, thus mechanically upwardly biasing wealth concentration at the top. The potential impact of these biases is discussed in Appendix B, showing that the problem increases as rates of return vary in wider ranges.

However, the most significant restriction for performing this procedure in the Uruguayan case is the absence of adequate National Accounts, since wealth aggregates estimations –the balance sheet– is not reported by the Central Bank (see section 2.3). Ideally, estimates of $r_p$ and $f_p$ should be estimated considering eq. 4, that is, estimating the rate of return of each type of wealth by comparing total wealth $W_p$ with the sum of the capital income flows.

$$f_p = W_p / K_p \tag{4}$$

Being:

$$W_p = \sum w_{ip}, K_p = \sum k_{ip} \tag{5}$$

This is what Saez and Zucman (2016) do for the United States, where $W_p$ aggregates are taken directly from their Flow of Funds (US' balance sheet). The most important advantage of this procedure is that it provides full micro-macro consistency between wealth distribution estimations and aggregate estimations (Alvaredo et al., 2016).

## 2.3 Data

For the estimation of both wealth to income ratios and wealth distribution, a wide variety of data sources was used. Some of them have been used in recent years, such as the income tax records, but some are completely novel and were gathered specifically for this study. The main challenge from a data view point, however, is to put all the small pieces together and re-construct the level and distribution of total wealth. The main data sources are depicted in Table 1 and commented bellow.

Table 1: Main data sources summary

| | Years | Source | Observations |
|---|---|---|---|
| Personal income tax data | 2009-2014 | DGI | 75% of adult population |
| Personal wealth tax data | 2009-2014 | DGI | Paid by less than 1% of indivs. |
| Firm's tax records | 2009-2014 | DGI | Univ. of copr. tax paying firms |
| Household survey | 1986-2016 | INE | Nationally representative |
| Wealth household survey | 2012 | UR/BCU/MEF | Nat. rep., high inc. over-sampled |
| National Accounts | 1988-2015 | BCU | No balance sheet |
| Cadastral administrative data | 2014 | DNC | Univ. of urban and rural prop. (cad. value) |
| Registry of decedent's property | 2007-2014 | DGR | Universe of owner decedents |
| Agricultural economic census | 2000-2015 | MGAP | Land prices by year./high geo. desegregation |
| Real estate market reports | 2009-2014 | INE | Housing price evolution |
| Demographic statistics | 2007-2014 | INE | Population totals decedents by age-sex |
| Financial sector data | 2009-2014 | BCU | Exchange rates and rates of return |

Notes: Acronyms in Spanish: *Dirección General Impositiva*, DGI; *Instituto Nacional de Estadísitica*, INE; *Banco Central del Uruguay*, BCU; *Dirección Nacional de Catastro*, DNC; *Dirección General de Registros*, DGR; *Ministerio de Ganadería, Agricultura y Pesca*, MGAP; *Universidad de la República*, UR; *Ministerio de Economía y Finanzas*, MEF

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**Personal income tax records.** The personal income tax record is a high quality administrative micro-database reported by the Tax Authority (*Dirección General Impositiva*, DGI) covering approximately 1,800,000 individuals, that is, around 75% of Uruguay's total adult population. In addition to individual labour incomes and pensions, it also contains information about age, gender and industry. Capital tax records in Uruguay refer to 12 capital income categories (taxed at flat rates of 7 or 12%), which may be aggregated in dividends and utilities, land and housing rent and financial incomes. The database also includes capital gains, which are taxed when the gain is realised.

**Personal wealth tax records.** The micro-database provides data on this relatively unimportant tax within the Uruguayan tax system, by which only real estate is taxed. It is a progressive real estate tax, with rates that originally ranged from 0.7% to 2.75%. However, the rates have a decreasing schedule which started in 2008 and ends in 2022, when a single tax rate of 0.1% will exist. In the period, rates ranged from approximately 0.7% to 1.85%.[11]. The enforcement is relatively low as compared to other taxes, and very few individuals actually pay it (some 8,500 individuals, less than 0.5% of the adults).

**Firms' tax records.** The micro-database is provided by the Uruguayan Tax Authority and it refers to the universe of firms under the corporate taxation scheme, which excludes very small businesses. Over 100,000 firms are are present in this database every year. Firms are

[11]For more details see art. 45, T. 14 of *Texto Ordenado 1996*.

complied to report their total assets and liabilities, as well as the amount of profits.

**Household Wealth Survey.** The Household Wealth Survey (EFHU in its Spanish acronym) is a relatively new and under-exploited survey. It was conducted by the Central Bank, the Ministry of Finance and Uruguay's National University (BCU, MEF and UR). It surveyed 3,490 households and it is representative of the whole country. It over-samples relatively richer households, from the fourth and fifth income quantiles and households with business property (Ferre et al., 2016). It includes all financial and non-financial assets and liabilities of households, and also provides information about their financial behaviour. There is until the moment only one wave, which gathered data for 2012.

**Household Income Survey.** The Household Survey (ECH in its Spanish acronym) is a comprehensive survey of households characteristics. It is conducted since 1981 by the National Institute of Statistics (INE). It is nationally representative since 1986, with a large sample of over 30,000 households[12]. It accounts for a detailed desegregation of income sources for each member of the household and the household as a whole. In particular, it includes owner occupied housing income, rents from real estate properties (both housing and land), profits in various types and interests from deposits and other financial assets.

**National Accounts.** National Accounts are produced by the Central Bank, covering –in their current publications– from 1988 onward. They include aggregate GDP and National Income, as well as data on savings and investment. From the perspective of the requirements of this study, there are tow major things it does not include. First, it does not include –and never has– a balance sheet, hence aggregate wealth of the country is completely unknown. Second, it does not present desegregated information by institutional sectors or by factor incomes, i.e. aggregate income data cannot be divided into government, household and corporate sectors, nor labour and capital shares can be computed. It represents the single most challenging data restriction for the adequate study of wealth to income ratios and its distribution.

**Cadaster data.** The cadaster micro-data base covers the universe of the country's real estate properties, both rural and urban. It is produced by the National Cadaster from the Ministry of Finance (DNC). It includes the cadastral value of the properties and the tax-base value computation. More importantly, it includes information of size and characteristics of the properties, hence allowing to compute their market value based on secondary sources.

**Registry of decedents' property.** This micro-database was constructed by the Na-

[12]Recall that Uruguay's population is around 3.400.000 individuals.

tional Registry Authority (DGR), especially for this research. It includes the properties of all owner decedents between 2007 and 2014. It covers around 3,000-4,000 individuals per year, from a total of approximately 30,000 decedents. The registry includes the date of birth of the individuals and, very importantly, the identification number of the property, which allows to match it with the cadastral information.

**Other data sources.** As depicted in Table 1, other data sources were used. These data sources are not micro-data but reports on prices of housing and land (with significant level of detail), financial rates of return and demographic statistics (total population, total number of decedents by age, etc.). They were used to help compute aggregate wealth in combination with the main data sources described above.

# 3 The wealth to income ratio

In this section, the wealth to income ratios for Uruguay in recent years are presented. Given the sever restrictions of data discussed in section 2.3, especially in terms of the complete absence of balance sheets from National Accounts, the focus is put in building a solid estimate of aggregate National Wealth. Within this aggregate, distinctions between different types of wealth and between institutional sectors' ownership are done whenever possible, as it is discussed in what follows, but they are imperfect and should be considered as tentative approximations. After computing the wealth to income ratios for the period 2009-2014, extended series for 2000-2015 and 1989-2015 are build based on accumulation models and secondary data sources.

## 3.1 The estimation of aggregate wealth

Aggregate wealth is estimated departing from three aggregate wealth types, which are in this case business wealth, real estate wealth and financial wealth. After these estimations, a number of corrections are done so as to arrive at a more accurate estimate of wealth to income ratio.

**Business wealth.** In the case of aggregate business wealth, it is computed directly using firms' tax records. This tax records include an aggregate variable that is equivalent to the value of total assets minus liabilities for each firm, which (after some accounting corrections) is the base for the computation of firm's wealth tax[13]. Therefore, the computation of net aggregate business wealth is straightforward.

This aggregate wealth actually includes different types of assets. It is not possible to distinguish directly from the the tax records exactly what are their different shares, but it is possible to present some approximations. The first and most important one refers to the share of real estate owned by firms. To do this, the share of private investment in real estate from National Accounts was used as a proxy of the share of real estate in firm's total wealth. The assumption is that, in the long run, the share of a given asset matches with the share of investment in that asset. This share is stable between 50-60% in the period, with an average of 56%, which was use to compute real estate owned by firms.

Another distinction that may be done is regarding the financial assets of the corporate sector. As firm's tax records do not include the share of financial assets and liabilities, the net financial result was used to approximate it. This income flow was capitalized by the inverse of the average financial rate of return published by the Central Bank (see bellow), of approximately 2.2%. When doing this, the resulting share of firm's financial wealth is very low, ranging between 1-3% depending on the year.

[13]Note that this is a different tax than Personal Wealth Tax described in section 2.3.

**Real estate wealth.** To compute aggregate estate wealth, the basic procedure was to take the cadastral micro-database, which as mentioned in section 2.3 covers the universe of rural and urban properties with their characteristics, and compute every property's value based on housing and land price reports. In the case of urban properties, the National Institute of Statistics publishes estimations of squared meter prices by type of property for Montevideo[14] and averages for the rest of the country. In the case of rural properties, its total value was computed by multiplying the number of hectares of each property by the average value of the hectare for each of the 19 departments of Uruguay[15].

The amount computed refers to total gross real estate wealth, owned by all institutional sectors. Thus, in order to approximate the net wealth, total amount of mortgages are subtracted based on the Wealth Household Survey, net real estate wealth is 96.3% of gross real estate. Finally, as in firm's balance sheets firm's real estate was already accounted for, it is therefore subtracted from real aggregate real estate in order to avoid duplicates.

**Financial Wealth.** In the case of financial wealth, unlike the previous ones, there is no single aggregate source that accounts for the universe of financial assets. However, given that Uruguay's capital market is highly underdeveloped (close to non-existent), it is relatively simple to compute the aggregate financial wealth. Net financial assets owned by the firms were already computed as a –very small– part of the assets covered in firm's tax records. The total amount of deposits owned by the public sector is published by the Central Bank and is almost negligible, representing around 2.5% of National Income. The financial assets owned by household sector, in turn, can be computed simply by capitalizing interest from deposits and financial assets of households by the inverse of the average rate of return, i.e. 2.2% as before[16]. The total amount of interests is the sum of all taxed and untaxed interests from tax records and the household survey (more on this in section 4.1), and so the computation of aggregate financial wealth owned by households is straightforward.

The final adjustments is to subtract from the total the public external debt with the rest of the world, as this is a liability of the government which should not be included in net aggregate wealth. It is important to note, in this point, that both in real estate wealth and business wealth, government's assets are included, since cadastral registries include government properties and so do firm's tax records. The summary of the resulting aggregate wealth and

[14]Montevideo is the capital city of Uruguay, where roughly half of the population lives.

[15]Departments are the main political divisions of the Uruguay territory.

[16]Deposits interest rates were used since they are the predominant type of financial asset. Other assets could be, for example, government bonds, but according to the wealth survey of 2012, these bonds represent 0.5% of total wealth.

its preliminary decomposition is presented in the following section.

## 3.2 Wealth to income ratio's recent evolution

The resulting wealth wealth aggregates are presented in Table 2. Note that aggregates presented do not reflect wealth by institutional sector nor by type of wealth, but a desegregation of aggregates computed in section 3.1 whenever it was possible, since the primary goal is to obtain the aggregate wealth level. Once again, it is necessary to stress that these results should be considered preliminary and subject to further improvement, since it is not possible to have fully reliable estimations until the Central Bank starts estimating and publishing the country's balance sheet. That being said, this estimation provide the first attempt to computing these highly important economic aggregates for recent years, for which essentially nothing is known in Uruguay[17] nor in most of the developing world.

Table 2: Wealth aggregates in terms of National Income (in %), 2009-2014

| Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Wealth in firms' tax records | 182 | 179 | 176 | 152 | 159 | 155 |
| Real estate wealth | 100 | 100 | 98 | 83 | 89 | 87 |
| Financial wealth | 2 | 6 | 2 | 1 | 3 | 2 |
| Other types of wealth | 80 | 73 | 75 | 68 | 67 | 66 |
| Real estate wealth (exc. firms) | 290 | 200 | 262 | 291 | 251 | 254 |
| Urban real estate | 193 | 126 | 181 | 195 | 174 | 180 |
| Rural real estate | 97 | 74 | 80 | 95 | 77 | 75 |
| Financial wealth (exc. firms) | 17 | 10 | 13 | 16 | 18 | 16 |
| Households' financial wealth | 15 | 8 | 11 | 14 | 16 | 14 |
| Government financial wealth | 2 | 2 | 2 | 2 | 2 | 2 |
| Government debt | -57 | -52 | -45 | -79 | -74 | -70 |
| Aggregate wealth in terms of National Income | 429 | 344 | 399 | 408 | 379 | 377 |

Source: own estimations based on data sources described in section 2.3. Notes: Wealth to income ratios computed as the sum of total net wealth owned by firms, net real estate not owned by firms and net financial assets not owned by firms, minus Government external debt. Decomposition between types of assets presented when possible.

In terms of the general composition of wealth, several points are worth mentioning. First, real estate wealth is by far the predominant type of wealth, representing in total 75-80% of total wealth. This is not surprising, given that Uruguay is a land abundant country with a primary-goods exports oriented production and very limited industrial development. Financial wealth,

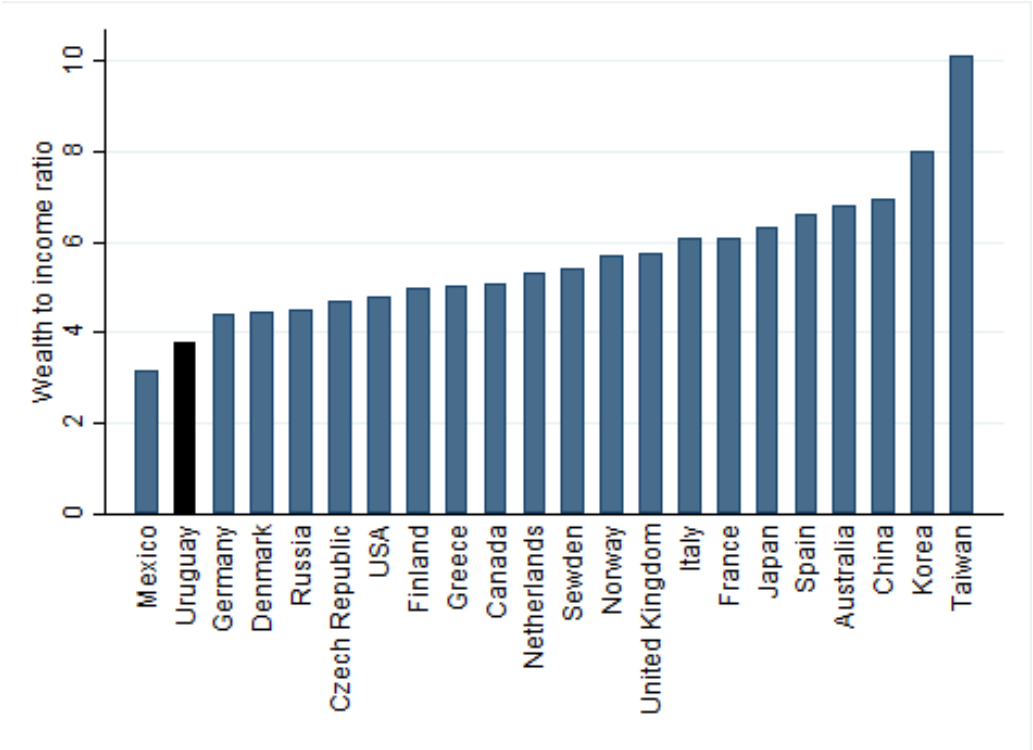
[17] There has recently been progress in estimating wealth to income ratios up to the first half of the XX$^{th}$ century, finding ratios of 300-500%, see Siniscalchi and Willebald (forthcoming).

on the other hand is very low, accounting for around 5% of total wealth. Other productive assets, which include machinery, equipment and livestock, represent the remaining wealth.

Within firms, most of wealth is also real estate (over 50%) and only a negligible part (as commented earlier) is financial wealth, the rest being machinery and other equipment. Real estate which is not owned by firms is on average around 50% higher than the one owned by firms. In the table, the distinction was made between rural and urban properties (urban real estate's share is around 65-70%), which is an approximation made departing from the share of total rural and urban properties values. Lastly, when considering financial wealth not owned by firms, it is owned essentially by households according to these estimates.

The resulting wealth to income ratio is approximately 380% and slowly decreasing in the period, from around 430%. This estimates are within the range of the existing estimates for other countries, in general terms lower than what is observed in the developed world, where they are in around 500-700% or higher (Piketty and Zucman, 2014; Artola et al., 2018; Artola and Estévez, 2017; Del Castillo, 2017), but higher than Mexico, where it is around 300% (see Figure 2).

Figure 2: Wealth to income ratios, international comparison.




Source: https://wid.world/.
Wealth to income ratios depicted for the last year available (2012-2014 in all cases except for Mexico, for which the last estimation refers to 2009).

Given the long term nature of the wealth-accumulation process, it is very difficult to analyse the wealth level, no to mention its evolution, from such a short term perspective. The absence of adequate data makes it extremely difficult to estimate long term series, but it is in turn possible to inquire in the general trends by considering the evolution of investment, growth, and capital gains.

## 3.3 Wealth to income ratio in a longer-run perspective

To better understand the wealth to income ratios estimated for 2009-2014, extended series are built by extrapolating 2012's estimation based on a one-good a two goods wealth accumulation models (Piketty and Zucman, 2014). In the first case, the one-good framework essentially assumes that there are no price effects and therefore wealth increases are the result of pure net savings accumulation. In this case, defining the wealth to income ratio as $\beta_{nt} = \frac{W_{nt}}{Y_{nt}}$, we have:

$$\beta_{nt+1} = \frac{1+g_{wst}}{1+g_t}\beta_{nt} \tag{6}$$

With

$$1 + g_{wst} = 1 + \frac{s_t}{\beta_{nt}} \tag{7}$$

and

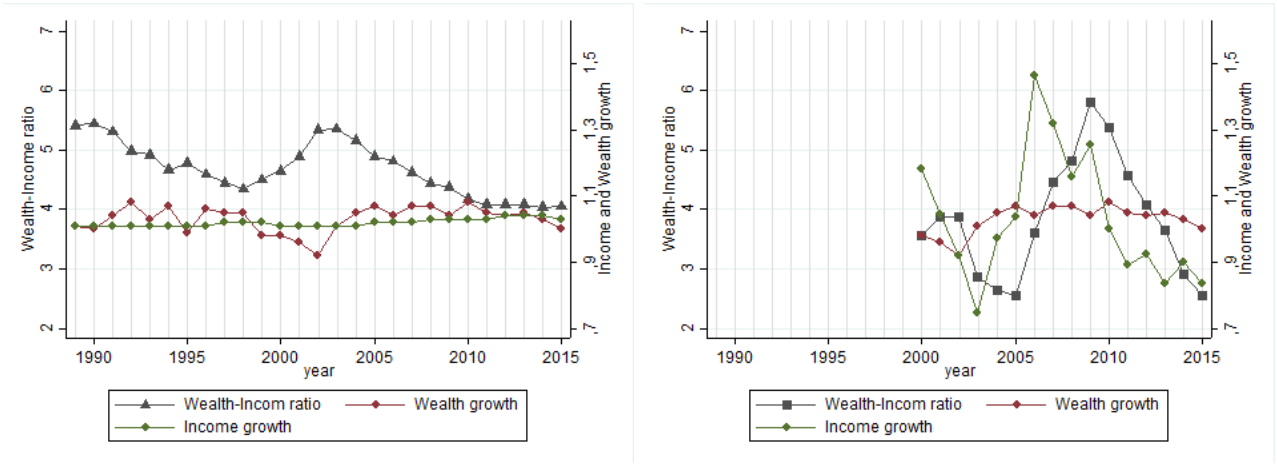
$$1 + g_t = \frac{Y_{t+1}}{Y_t} \tag{8}$$

The income growth component is hence given by $1+g_t$ and equals National Income growth, whilst the wealth growth component is given by $1+g_{wst}$[18] and is equivalent to net investment (a 8% depreciation rate was assumed throughout period), and both can be drawn from National Accounts. Panel (a) of Figure 3 depicts the evolution of these two components and the wealth to income evolution they entail, when fixing 2012's value. This analysis shows that, given investment an growth patterns, the wealth to income ratios observed are indeed declining and been doing so for over 10 years, after reaching a maximum of 535%. Interestingly, a very similar relative maximum was reached in 1990. By considering the evolution of the income and wealth growth components, it seems clear that the dynamic is mainly driven by the former: in the context of a relatively stable investment rate (relative to the existing wealth), what dominates the evolution of the wealth to income ratio is the growth of National Income. In this case, the massive economic crisis the country experienced in 2001-2003 (recall Figure 1), generated a

[18]It is worth noting that in equation 7, the investment is not only in terms of National Income but also divided by the existing wealth to income ratio. Moreover, investment data is used rather than savings, in order to account also for foreign investment.

sharp increase in the wealth to income ratio, which started to slowly decrease as growth rates became positive again. By the same token, it is very likely that the relative peak of 1990 is the product of the largest crisis of the second half of the XX$^{\text{th}}$ century, which occurred in 1982. Thus, in this framework, wealth to income ratios show two peaks in the period, and are now falling from quite high levels that were the product of the collapse of the GDP rather than of true accumulation.

Figure 3: Wealth to income ratio in Uruguay, methods comparison, 1989-2015.




(a) One-good model

(b) Two-goods model

Source: Table A.6.
Notes: Wealth to income ratio estimated by extrapolating 2012's estimation based on a one-good a two goods wealth accumulation model (Piketty and Zucman, 2014). Panel (a) considers a one-good framework, hence assuming that there are no price effects and therefore wealth increases are the result of pure net savings accumulation. Thus, if $\beta_{nt} = \frac{W_{nt}}{Y_{nt}}$, then $\beta_{nt+1} = \frac{1+g_{wst}}{1+g_t}\beta_{nt}$, with $1 + g_{wst} = 1 + \frac{s_t}{\beta_{nt}}$ and $1 + g_t = \frac{Y_{t+1}}{Y_t}$. The income growth component depicted is hence given by $1 + g_t$ and equals Income growth, whilst the wealth growth component is given by $1 + g_{wst}$ and is equivalent to net investment (assuming an 8% depreciation rate was assumed throughout period). Panel (b) assumes a two-goods model, in which $\beta_{nt+1} = \frac{(1+g_{wst})(1+q_t)}{1+g_t}\beta_{nt}$, with $1 + q_t$ being the capital-gains-induced wealth growth rate. In this exercise, it is the ratio of the Land price and Consumers prices indexes. Data produced by Uruguay's Central Bank, National Statistics Institute and Ministry of Agriculture.

Naturally, the one-good model framework is highly restrictive, and likely to be an accurate description of reality only in the very long run and when considering large economic entities (Piketty and Zucman, 2014)[19]. Unfortunately, the first assumption holds only partially, as the 1989-2015 is a long-enough window of analysis but can hardly be considered long run, and the second does not hold at all, since Uruguay does not stand out for its sheer numbers.

[19]They show that this framework predicts the wealth to income ratio over several decades and when considering, for instance, all European countries together.

Therefore, although the previous analysis provides important insights on the role of investment and growth on wealth accumulation in the long run, it is very likely that the short-run evolution is dominated by price effects.

If one considers a model in which accumulation is the result of a volume effect, as the one described above, but a price effect as well, in which the wealth to income ratio can also change as a result of changes in capital prices in relation to the remaining prices –i.e. capital gains–, then the model needs to be changed to account for this new component. In a two-goods model with capital goods and consumption goods, we have:

$$\beta_{nt+1} = \frac{(1+g_{wst})(1+q_t)}{1+g_t}\beta_{nt} \tag{9}$$

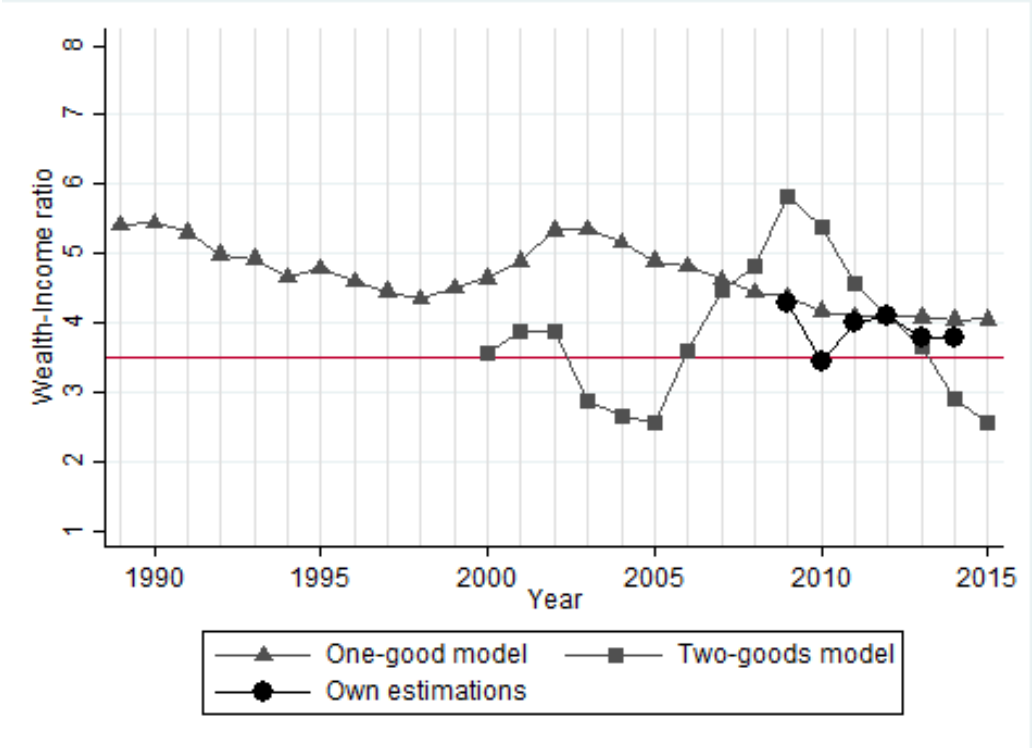
where $1 + q_t$ being the capital-gains-induced wealth growth rate, which should depict the evolution of the relative prices of capital. Unlike investment and growth series, there are no series of capital prices available so, as a proxy, land prices from 2000 onward were used in relation to the Consumers prices index[20]. Considering the land price index as a proxy of capital prices is a strong assumption, so this should be considered an illustrative exercise only. That being said, it is also true that in a land abundant country such as Uruguay the choice does have conceptual foundations. Panel (b) of Figure 3 depicts the evolution of the wealth to income under these assumptions, where the wealth-growth component is the same as before but corrected by $1 + q_t$, i.e the the capital-gains-induced wealth growth rate.

As expected, when including the capital-gains effect, the implicit evolution of the wealth to income ratio is less smooth, because prices may change faster in the short-run than volumes, which take longer to change. In this analysis, the wealth to income ratio is also falling, but the peak was reached in 2009-2010, with a level of 580%. The fall of land prices after the 2002 crisis seems to have offset the income collapse effect described above, hence lowering the wealth to income ratio. After 2005, the sharp increase of land prices and its latter downturn is mirrored by the wealth to income ratio, showing that the wealth to income ratio dynamics is dominated by price effects in this case, not by GDP growth. The sharp increase in land prices observed, was the result of the increase in exports taxing in Argentina and a massive political struggle between government and the agricultural business owners and political opposition, which triggered and outflow of agricultural investment (mainly in soy) to Uruguay. That created a price boom that disappeared as terms of trade trend's reverted (see Figure A.2). Under this framework, the wealth to income ratio reached a minimum of 250% in 2015.

The evolution of the wealth to income ratio estimated, as well as the extension of the series under both models are depicted in Figure 4. Several remarks are worth noting. First, in all cases, the evolution for the 2009-2014 period is decreasing, although at different speeds. This

[20]The implicit GDP deflator was also tried, yielding very similar results but with lower time coverage.

Figure 4: Wealth to income ratio in Uruguay, 1989-2015.




Source: Table A.6.
The figure depicts the estimations for 2009-20014 of the wealth to income ratio, and the extrapolations made based on one good and two-goods models (see Figure 3). By construction, all series estimates coincide in 2012. The horizontal line depicts, as a reference point, the long term wealth to income ratio, given by the historical ratio of investment-growth (around 350%).

means that the investment-growth official National Accounts' series, both with and without capital gains effects, is consistent with the downward trend estimated. Second, the figure also depicts the long term wealth to income ratio level. Under a one-good model framework, the wealth to income ratio converges asymptotically to the $s/g$ level. Considering 30 years averages of net investment and growth, then $\beta = 350\% = \frac{8.5\%}{2.4\%}$[21]. This level is only a reference point and by no means the *true* value of the wealth to income ratio, but it indicates that the lowering trend of wealth to income ratio seems to be converging to its long term level. Third, regardless of the level of wealth to income ratio, the two exercises performed do depict the likely role of investment, growth and capital gains in shaping the evolution of the wealth to income ratio.

[21] As before, a 8% depreciation rate is assumed throughout the period.

# 4 Wealth distribution

In this section, wealth distribution is estimated based on the capitalization method described in section 2.2. Section 4.1 presents the capital incomes data base on which the capitalization method is performed, in order to match wealth aggregates estimated in 3. Section 4.2 presents the main estimations of wealth distribution for recent years, which are extended further back time in section 4.3. Section 4.4 presents a characterisation of wealth holders.

## 4.1 The estimation of wealth distribution based on the capitalization method

### 4.1.1 The capital incomes database

The first step to perform the capitalization method, is to ensemble a data base with all capital incomes, accounting for the full adult population. The database used is estimated following DINA guidelines (Alvaredo et al., 2016) as much as possible, given Uruguay's data restriction regarding National Accounts. In this section, a summary of the procedure is presented, focusing on capital incomes distribution, but the full DINA-based income distribution estimation can be found in De Rosa and Vilá (2017).

**Taxed capital incomes.** The capital incomes database construction is a very important part of the estimation procedure since wealth distribution depends on capital income distribution. As stated before, the departure point is the tax returns database, which is complemented with household survey data and firms tax records in order to account for (i) untaxed capital incomes and (ii) non covered population.

All the available information in the income tax records are considered (see section 2.3), except for individuals with zero income or younger than 20 years old. As described above, this database covers all formal labour income (both taxed and untaxed), taxed and nominative capital incomes and pensions. Capital incomes include dividends in various forms, interests and rents (from both housing and land). Even though only capital incomes are capitalized, the remaining incomes (labour and pensions) are useful for the following steps of the procedure.

**Accounting for untaxed incomes and non-covered population.** Owner occupied housing rent, interests for deposits, "non nominative" dividends, and undistributed profits[22] are not accounted for in the tax records and need to be imputed.

[22] As will be explained below, only a fraction of undistributed profits are imputed to individuals.

There are different reasons why these capital incomes are not included in the tax data. Owner occupied housing rent is not taxed in the Uruguayan tax system, and hence it is not covered by the tax records. Non-nominative dividends -which represent approximately 40% of total dividends- are a type of taxed capital income for which, because of tax regulation, it is not possible to identify by whom they are accrued. Interests derived from bank deposits are subject to the bank secrecy act, and hence they are taxed at source and not at the individual level. Total amount of both non-nominative dividends and interests is reported by the Tax Authority (DGI).

A more delicate problem refers to undistributed profits. In Uruguay, very few individuals perceive incomes from firms in the form of dividends or other financial incomes. For instance, in the case of dividends, over the period 2009-2012 only 2,516 firms out of more than 90,000 that are subject to corporate tax, actually distributed profits to their owners. This entails that around 6,000 people received dividends or utilities over the period and barely over 800 received dividends every year (De Rosa et al., 2017). Uruguayan firm owners have alternative ways to withdraw profits. One of the favoured is to use banking accounts shared among firms and owners, whom withdraw profits as a loan from the firm and hence are virtually untaxed[23].

The capital incomes mentioned above are imputed based on two different criteria. Owner occupied rental income and interests are imputed based on the household survey as follows[24]: (i) individuals are sorted in the incomes tax base and in the survey in groups defined by: age, gender, type of formal and taxed incomes perceived, and income groups; (ii) informal and untaxed incomes from individuals in the survey in each group, are randomly assigned to their correspondent individuals in the income tax records; (iii) if in any given group there are more observations in the survey than in the tax records, after completing step (iii), the unassigned incomes are proportionally allocated among individuals in the corresponding tax-records' group. In this way, it is possible to combine taxed incomes from individuals of the tax records, with untaxed incomes from very similar individuals in the survey.

The second criteria applies to undistributed profits -in the sense described above- and non-nominative dividends. Imputing these incomes is difficult since a proxy for firms' ownership is needed. As mentioned above, dividends are probably an inaccurate choice in the Uruguayan case since very few firms actually distribute them and so they are extremely concentrated. Thus, as depicted in Table A.2, imputing large amount of incomes (such as the undistributed profits) proportionally only to dividends would entail imputing 87.5% to the top 1%, and 60% to the top 0.1%. An alternative assumption is to impute them proportionally to all taxed

[23]The problem has been noted by the government, and a new bill was passed in 2016 (see law 18,083 of 2007), which states that all profits for which no proof of re-investment in the firm is presented, will be considered distributed and therefore taxed.

[24]In the cases in which income is reported on the household basis and not separately recorded for each individual, typically owner occupied rental income, it split equally between all adults within the household.

capital incomes. By doing so, a number of relatively small capital incomes are added, and also real estate rent, which represents around 50% of total taxed capital income and it is less concentrated than the others. This rather "generous" imputation criterion entails assuming that people who invest in business capital also does so in real estate. This may be so in the Uruguayan case, were real estate investment is popular. In fact, looking at the wealth household survey, the correlation between real estate (excluding owner occupied housing) and business capital is 0.67. Thus, in order to avoid the risk of imputing large amounts of incomes based on an extremely concentrated distribution, and based on the evidence the alternative criterion is plausible, untaxed business incomes are imputed proportionally to all taxable capital income.

Finally, it is also necessary to account for individuals who are absent from the tax records. There is around 25% missing population in the tax records due to informality and inactivity of people in working age[25], which is a salient developing country feature. This population is incorporated using information from the household surveys. Observations are brought in with all their informal or untaxed capital incomes, as depicted in Table A.1. These include, essentially, interests from deposits, and owner occupied rental income. This population is adjusted by applying a factor to the survey weights (almost negligible), in order to match the number of adults in the database with the official population estimates based on the last census. In the end of the whole process, these incomes will represent 10% of total income in the capital incomes database. The resulting capital incomes distribution and composition are depicted in Figures A.1 and A.5, whilst imputed capital incomes are commented in Table A.3.

### 4.1.2 Rates of return and capitalization factors

In order to transform the capital incomes data base into a wealth data base, incomes need to be capitalized by the inverse of the rate of return of each asset. Thus, rates of return for business, financial and real estate wealth are needed in order to arrive to such a database.

Business rate of return is estimated straightforward from firms' tax records, since they provide total wealth and the total amount of profits of each firm. As total business incomes in the capital incomes database are equivalent to these profits, then rates of return (and capitalization factors) computed from firm's tax records yield by construction the total business wealth aggregates of section 3. Estimated rates of return are stable in the period and around 9-10%. In the case of real estate, total housing income (owner occupied housing income plus rents from housing and land) are compared with aggregate real estate wealth (excluding that owned by firms[26]). The resulting real estate rate of return is, again very stable and approximately 2.5-3%. Finally. in the case of financial assets return rates are drawn directly from

[25]Elderly people are covered, since pensions are formal and taxed.

[26]Part of this wealth is owned by the Government, but it was not possible to distinguish it, and therefore was treated for distributional purposes as part of household real estate.

Uruguayan Central Bank reports. Thus, it is computed as a weighted average of return rates of different duration deposits, resulting rate of return of 2.2%. Given the way aggregate financial wealth was computed (using this rate of return), it matches financial wealth of section 3 by construction. Finally, after capitalizing all capital incomes, capital gains from the tax records are directly added to individual's wealth.

Rates of return estimated are, in general terms, somewhat lower than in developed conturies (see for example online appendix of Saez and Zucman (2016)). Comparisons with developed economies are difficult since rates of return are affected by the functioning of the capital markets, which are virtually nonexistent in the Uruguayan case. Moreover, the capital incomes data base used has not been scaled up to match the aggregate capital incomes, since there are no official National Accounts statistics of labour and capital shares and therefore, in this study, it was decided not to incorporate more assumptions to the capital incomes data base construction[27], and therefore rates of return may be mechanically lower than the true ones. Note that this does not affect the wealth distribution estimates.

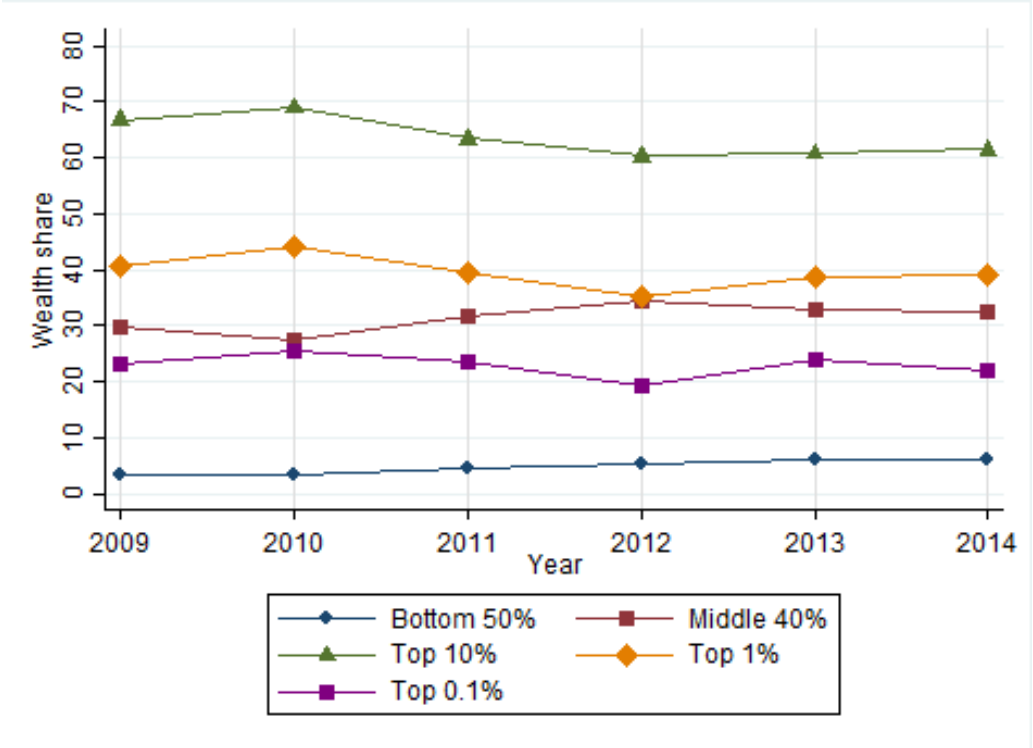
## 4.2 Wealth shares and wealth portfolio

After the discussion of wealth aggregates level and evolution, we now turn our attention to its distribution. In Figure 5, wealth shares' evolution is depicted for different wealth groups. Two main conclusions stand out. First and most important: wealth inequality is extremely high, with the top 10% total wealth share being over 60-65% (reaching almost 70% in its peak), whilst the middle 40% and bottom 50% own around 30-35% and 5% respectively. Breaking down the top 10% in smaller groups, it is possible to observe that most of the group's wealth is owned by the wealthiest 1%. The top 1% share is around 40%, and the top 0.1% owns 20-25% of total wealth. The second conclusion is that it seems to be declining, at least when considering the decrease in he the top 10% and the increase in the bottom 50%. The share of the top 1% seems to remain in the same level in 2014 as it had at the beginning of the period. This shares entail that the top 1% owns more wealth that the entire middle 40% (which is by definition 40 times larger), and top 0.1% share is 4-5 times larger than the share of the poorest half of the population.

As a reference, these estimates are similar to what is found, based on the same methodology, for countries such as US or Spain, but much higher than France. In the case of US, Saez and Zucman (2016) estimated that the wealthiest 0.1% owned around 22% of total net wealth in 2012, whilst the top 1% share is close to 42%. In Spain, capitalization method estimations show that the top 1% wealth share is around 40%, whilst the top 10% share is 65-75% (Martínez

[27]The full DINA database estimation and description, properly scaled so that it matches National Income, can be found in De Rosa and Vilá (2017).

Figure 5: Wealth shares in Uruguay, 2009-2014.




Source: Table A.7.
Notes: Wealth distribution's estimation based on the capitalization method, for adult population of 20 and more. Full estimations by type of wealth and synthetic inequality index depicted in Table A.7. Density functions by type of wealth and wealth thresholds for top fractiles depicted in Figure A.3 and Table 3 respectively.

Toledano, 2015). Finally in France, the top 1% share is 20-25%, and the top 10 share is 55% (Garbinti et al., 2017). Slightly lower wealth inequality is found –somewhat surprisingly– in the Mexican case, although results are not strictly comparable since the methodologies are not the same (Del Castillo, 2017). When compared to the income distribution, DINA-based estimations show that the top 1% and top 10% shares are 19% and 45% in 2014 (De Rosa and Vilá, 2017), which means that the top 10% share of wealth is over 30% higher and top 1% share twice as high.

As for the decline in wealth inequality observed, some remarks are worth noting. First, the window of analysis is extremely short so conclusions regarding trends should be taken with extreme caution. This, which is true for any distribution, is particularly so in this analysis, in which estimations do seem a slightly unstable, considering that, for example, 2011 shows quite higher concentration, and the exact opposite happens to 2012. To fully understand this downward trend, it is necessary to widen the time span, which is done in section 4.3.

Wealth inequality varies significantly across different types of wealth, as depicted in Table A.7. In this analysis, we consider real estate, financial and business wealth directly owned by individuals, i.e. the result of capitalizing their real estate, financial and business incomes. Note that, within their business wealth, there is also financial and especially real estate that they own through firms (recall Table 2). Two concentration profiles emerge: in the first one, business and financial wealth show extreme concentration in top fractiles, whilst real estate and capital gains are less unequally distributed. Practically all business and financial wealth is owned by the top 10%, and the vast majority of it (more than 90 and 75-80% respectively) by the top 1%. Top 0.1% business and financial wealth shares are 55-60%. Even considering the caution with which these estimates should be read, it appears to be the case that the bulk of Uruguay's productive assets is owned by very few individuals[28]. In the second group, in which the most important type of wealth is real estate, inequality is much smaller, for two main reasons. First, the middle 40 owns half of total real estate and the bottom 50's share is almost 5-10%. Thus, in sharp contrast with the business and financial wealth, the top 10% real estate share is for most years 40-45%. Second, inequality within this groups is significantly smaller than in the other types of wealth, the top 1% owns one fourth of top 10's real estate, and something similar happens within the top 1%.

This translates, as well, into to very different wealth portfolio profiles, depicted in Table A.8. For the 99% of the population, the only type of wealth they own –if they own any– is real estate. Indeed, if we consider the bottom 50, the middle 40 or the top 10% excluding the wealthiest 1%, the real estate share is always above 80-85%, being almost 100% for the bottom 90%. It is only in the top 1% where financial and specially business wealth irrupt, turning wealth composition upside-down[29]. For the top 1%, for instance, business wealth represents 70-80% of their wealth portfolio, whilst it is above 80% for the wealthiest 0.1%. This extreme concentration determines that business wealth contribution to overall wealth inequality is very high. Performing a simple Shorroks' decomposition (Shorrocks, 1982), the combination of business and financial wealth accounts for over 80% of overall inequality in most cases, 70-85% of which is explained solely by the former (see Table A.9).

## 4.3 Wealth inequality in a longer-run perspective

### 4.3.1 The extension of the wealth inequality series

As in the case of wealth to income ratio, to better understand the contemporaneous level of wealth concentration and especially its evolution, it is important to consider a longer perspective. Unfortunately, given the absence of tax records (both from firms and individuals), it is

[28]It is worth noting that, as established in section 2, non residents are not included in this computations.
[29]It is also possible to observe this in the wealth density function by source, see Figure A.3

difficult to extend the series in the same way as what was performed for 2009-2014. However, given the importance of such an exercise, in this section wealth inequality series is extended based on available data.

Thus, wealth inequality is computed based on household surveys' capital incomes. Although the household survey is available since the early 1980s, this exercise was performed from 2000 onward since, up to the year 2000, profits are not properly recorded and hence that period is not considered. The same capital incomes as in the capitalization methods' estimates were considered, that is business income (profits), real estate income (both from owner occupied housing, land and other real estate) and financial incomes (mainly deposits).

These incomes were capitalized based on the following criteria: (i) capitalization factors were computed so that aggregate wealth matches capital-gains adjusted series of wealth to income ratio depicted in panel (b) of Figure 3; (ii) rates of return' structure among assets was maintained, so as to assure that the relation between the capitalization factors computed for the 2009-2014 estimations was kept. Different criteria, such as using a single rate of return for all assets to match aggregate wealth, using the same rates of return than in the 2009-2014 (and hence not forcing the match with wealth aggregates estimations) and using the one good model interpolation instead of the capital-gains adjusted series were performed, yielding very similar results.

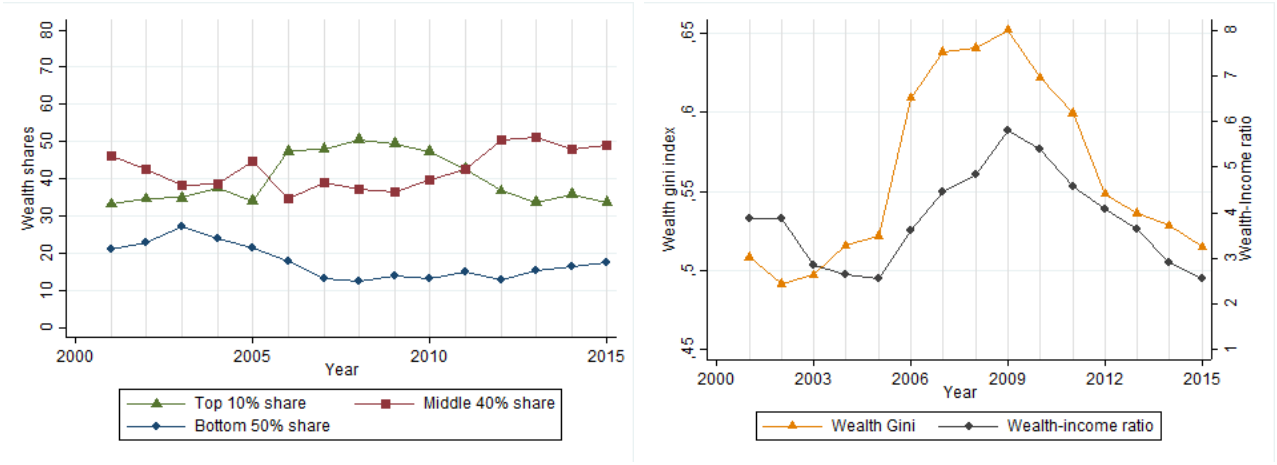
This analysis presents some obvious drawbacks. The first and most important is that these estimates, being computed based on capital incomes from the household survey, do not depict an accurate description of wealth inequality level, and therefore, as expected, wealth inequality is much lower than the previous estimates. Moreover, they are computed so as to mach a wealth to income ratio series that already was an interpolation based on secondary data sources. Therefore, this estimates should be taken with caution. Nevertheless, they present the strong advantage of allowing to go further back in time, and hence they do provide some important insights about the likely evolution on a wider window of analysis. Results are shown in Figure 6. In panel (a), wealth shares for bottom 50%, middle 40% and top 10% are depicted[30], whilst panel (b) presents the evolution of the Gini index vis-à-vis the wealth to income ratio.

### 4.3.2 The downturn in wealth inequality

Figure 6 depicts some trends in wealth inequality that are very important to understand the current levels of wealth concentrations and its evolution. Several remarks are worth making. First, the extended series shows for recent years a downward trend, just like the capitalization method's estimates for 2009-2014, which is clear both when considering the Gini index or the top 10%'s share. Second, this downward trend appears to be the return to early 2000s levels of

[30]Top 1% shares are not depicted since the survey shows a poor performance for very top fractiles.

Figure 6: Wealth inequality and wealth to income ratio, 2000-2015.




(a) Wealth shares

(b) Gini index and wealth to income ratio

Source: Table A.13.
Notes: Estimations performed based on capital incomes from Household Survey (*Encuesta Continua de Hogares*), capitalized with capitalization factors computed to match wealth to income ratio series of Table A.6 (capital-gains adjusted series) and keeping rates of return' structure among assets. Corresponding wealth to inome ratio also depicted.

wealth inequality, after a significant increase in the second half of the decade. Third, and most important, changes in wealth inequality seem to be driven, or a least be contemporaneous, with changes in wealth to income ratio.

This analysis indicates that the falling wealth inequality observed in the capitalization method's estimations depicted in section 4, is actually part of a longer process of return to wealth inequity levels of the early 2000s, after the somewhat noisy effects of the crisis, and especially of the increase in inequality after the spike in capital prices. The main mechanism behind the recent observed downturn appears to be a value-effect, considering that wealth to income ratios fell in recent years due to the return to positive growth rates but, more importantly, to a decrease in capital prices[31]. If this decrease in capital prices affected wealthier individuals relatively more, which seems likely considering their different wealth portfolios described in section 4.2, then a downturn in asset prices may lead to a reduction of wealth inequality.

There may be other reasons behind this evolution, although they are probably not as determinant. The period around the economic crisis of the early 2000s is difficult to analyse since there was massive bankruptcies, high inflation and savings destruction. In this context, the middle 40% seems to have been particularly affected. The economic recovery and the increase of the wealth to income ratio, lead to an increase in wealth inequality, which is clear when

[31]Recall that land prices were used as a proxy of capital prices, see section 3.3.

looking at the top 10%. Even though wide-scoped income distribution policies were adopted after 2005, as described in section 1, there were no major wealth re-distribution policies, at least not regarding taxation. In fact, the only wealth tax that existed, which is a small progressive tax on real estate (see section 2.3), actually started to reduce its progressivity and distributive potential since 2007, when it was decided that the tax should slowly be taken out to fully disappear by the early 2020s[32]. Moreover, there is no inheritance tax, only a flat tax on wealth transfers which taxes estates. Regarding incomes, capital income taxation introduced in 2007 is not progressive, unlike labour income and pensions taxation. Moreover, the reduction of income inequality depicted in 1, although contemporaneous, is unlikely to have played a role since changes in income distribution may affect wealth distribution but only in the long run.

Therefore, the explanation is unlikely to be related with taxes or incomes dynamics. There are two other factors that may be at play. First, the housing policy deployed since 2005, although not extremely ambitious, was indeed targeted towards the poorest and middle income households, which may be behind the increase in the bottom 90% share. The other reason could be associated with the restoration of the centralised collective wage bargaining and the increase in employment, which resulted in an increase in the labour share (De Rosa et al., 2017). This changed the relative power of workers, and the national organisation of unions saw its number of affiliates increase up to a total of over 400.000[33] workers, out of a total population of 3,400,000. It is possible that the re-composition of the balance of power after 2005 had an impact on the value of capital as well and therefore on wealth distribution, but this is highly tentative and indeed very hard to assess.

## 4.4 Wealth owners characterisation

Information on individuals in the tax records is used to characterise wealth holders. In Figure 7, average wealth by sex and age groups is depicted. Wealth tends to increase up to retirement age, to slightly decrease afterwards. This suggests that we are not in the presence of a clear life-cycle pattern, although it is not possible to be certain since it is cross section data.

Mean wealth is higher for men in all age groups, but particularly in the 40-60 year old interval. It is interesting to observe how the difference increases as age grows, until approximately 60 years old, point in which both groups start to converge. This may be explained by the fact that women tend to live longer than men and they also may inherit their partners wealth when they die[34].

[32]This was part of a comprehensive tax reform that introduced progressive labour income and pensions taxation and flat tax for capital incomes. The wealth tax, which was part of the old tax system, was left mainly as a control tax.

[33]It dates back to 1961 and is called PIT-CNT. It gathers all unions of the country under a single organisation. See https://www.pitcnt.uy/.

[34]In Table A.14 it may be observed how the proportion of women grows steadily from around 45% in the

Figure 7: Average wealth by sex and age groups.


Notes: Pooled data for years 2009-2014. Wealth averages for five-year age groups and sex. Individuals over 20 years old. Exchange rates to US dollars taken June 30$^{th}$ of each year (data from National Statistics Institute, INE in its Spanish acronym). Similar results for each year depicted in Figure A.4.

Inequality within age groups tends to increase up to the retirement age, lowering afterwards, in the context of monotonously increasing wealth ownership (see Tables A.15 and A.16). The evolution of wealth inequality by age groups, therefore, appears to be explained by the type of wealth each group owns. Thus, business and financial wealth ownership (highly concentrated) rises in the middle ages and lowers thereafter, whilst real estate ownership keeps increasing throughout life. Given its less unequal distribution, the real estate ownership constant increase somewhat offsets the unequalising effect of business and financial wealth.

Table 3 depicts information on wealth thresholds necessary to be part of top fractiles. The first thing to note is the rapidly increasing level of the thresholds, which is particularly clear when comparing top 1%'s and top 0.1%' thresholds. The other interesting thing is that, even within very wealthy groups, wealth level do not seem to be extremely high, which is part of the explanations of why there are no Uruguayans in *Rich Lists*.

first age group until over 65% in the older one.

Table 3: Wealth thresholds in Uruguay, 2009-2014

| Wealh fractiles | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Top 0.1% | 4056.96 | 4777.58 | 6085.88 | 6344.48 | 6645.50 | 7588.85 |
| Top 1% | 588.14 | 592.58 | 737.71 | 770.95 | 728.29 | 822.47 |
| Top 10% | 84.91 | 75.18 | 119.48 | 144.10 | 136.28 | 136.02 |

Notes: Thresholds expressed thousand US dollars, taken June 30$^{th}$ of each year. As an example, to be part of Uruguay's wealthiest 1% in 2012, estimates show that US$ 770.000 of total wealth are necessary.

Finally, it is possible to analyse if individuals are located in the same positions in wealth and income distributions at the micro-level. Given that wealth is estimated by capitalizing incomes, the question of why the two distributions differ may arise. Wealth and income distributions may not match for two reasons: (i) capitalized incomes are just a part of the income distribution, which includes in particular labour incomes and pensions, among others; (ii) heterogeneity in rates of return for different types of wealth, entails that individuals with the same total capital income but different composition present different estimated wealth as well.

Table 4: Wealth to income matching percentage, 2009-2014.

| Wealh fractiles | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Bottom 50% | 71.09 | 71.32 | 68.34 | 71.47 | 67.87 | 66.28 |
| Middle 40% | 56.61 | 58.08 | 53.76 | 57.09 | 52.98 | 51.71 |
| Top 10% (exc. top 1%) | 45.67 | 43.97 | 37.33 | 38.15 | 34.56 | 36.51 |
| Top 1% (exc. top 0.1%) | 61.84 | 67.70 | 57.14 | 60.21 | 57.28 | 63.49 |
| Top 0.1% | 87.48 | 91.86 | 87.66 | 89.80 | 89.72 | 90.42 |
| Average | 62.94 | 63.55 | 59.64 | 62.64 | 58.84 | 57.77 |

Notes: Income refers to total incomes (including capital incomes, labour incomes, pensions and other incomes). In each row, the percentage of individuals belonging to the same group in the wealth and income distributions is depicted (e.g. 90.42% of individuals in the top 0.1% of the income distribution of 2014, also belong to the top 0.1% of the wealth distribution).

In Table 4, the proportion of individuals in each wealth group who belong to the corresponding group in the income distribution is depicted. On average, around 60% of the individuals belong to the same wealth and incomes groups, which shows that the overlapping is considerable but not perfect. For the top 1% and especially for the top 0.1%, the matching is very high, with 85-90% match for the later, meaning that 9 of ten individuals in the far end tail of the wealth distribution are also top earners. These results are consistent with findings by Sanroman and Santos (2017) based on the wealth survey.

# 5 Triangulation with other evidence

As it was described above, there are two main conclusions from the distributional analysis, that is, that wealth concentration is high and falling. Both conclusions will be contrasted, as much as possible, with data sources and methodologies that are independent from the capitalization method. The level of wealth inequality is compared with the wealth household survey, whilst its evolution is contrasted with evidence based on wealth tax and the estate multiplier method.

## 5.1 The level of wealth inequality: comparison with the wealth household survey.

In 2012, the first -and only- household wealth survey of Uruguay was carried out (see section 2.3), which has not been systematically used for wealth distributional analysis yet. As described in section 2.3, it includes similar assets than the ones considered in the capitalization methods estimations, hence providing an important insight on wealth distribution and an key data source to contrast capitalization method-based estimations. However, the comparison with the capitalization methods' estimations is not straightforward. The wealth survey includes more assets than the capitalization method and, more importantly, refers to household wealth, whilst capitalization method's estimates refer to National Wealth. That being said, it is still an important reference point.

In Table 5, wealth shares are depicted for different wealth definitions and units of analysis. In the first column, estimation from the capitalization method are shown; in the second one, household wealth distribution of "total net wealth" is depicted; whilst in the third column "comparable net wealth" is presented, which considers the same assets as in the capitalization method estimations. In the final column, per-adult comparable wealth distribution is depicted.

The first thing to note is that the second and third columns present remarkably similar estimates. The second column takes into account not only financial wealth, business wealth and real estate, but also durable goods and jewellery, whilst the third one only considers the first three. This reflects that, according to the survey, these assets excluded from the capitalization method estimations do not have a significant impact on wealth distribution. Thus, from now on only the comparable wealth definition of the survey is considered. The third column depicts per adult wealth shares which show, as expected, more wealth concentration than household based estimates, both relative to the top 10% and the top 1%.

It is interesting to note that, in general terms, capitalization method's estimates are remarkably similar to the household distribution of wealth, at least when considering large groups such as the bottom 50%, the middle 40% and the top 10%. The bottom 50% owns roughly between 0-5%, whilst the middle 40% owns 32-37%. Hence, both the capitalization

Table 5: Wealth shares: Wealth Survey vs Capitalization Method (in %), 2012.

| Wealth fractiles | Capit. method | Tot. hous. net wealth | Tot. hous. net wealth(*) | Per adult net wealth(*) |
|---|---|---|---|---|
| Bottom 50% | 4.95 | 4.92 | 3.58 | 0.03 |
| Middle 40% | 31.41 | 36.96 | 36.68 | 30.94 |
| Top 10% | 63.63 | 58.11 | 59.74 | 69.03 |
| Top 10% (exc. top 1%) | 23.55 | 32.16 | 32.68 | 36.94 |
| Top 1% | 40.08 | 25.95 | 27.06 | 32.09 |

Notes: (*) same assets as in the capitalization method estimations (real estate, business wealth and financial wealth). The second column (with no *) includes durable goods as well. In all cases, liabilities are subtracted. Top 0.1% is not depicted given the survey's reduced sample size.

method and the household wealth survey tell the same story for the bottom 90%. Within the top 10%, in general terms the capitalization method estimates shows a more concentrated distribution towards the top 1% . Thus, when considering the top 1%, the concentration is larger in the capitalization method estimations by 15 percentage points. However, it is better to compare capitalization method's estimates with per-adult wealth distribution. In this case, the top 10% is –somewhat surprisingly– 6 percentage points larger in the survey, whilst the top 1% is 8 points lower. Therefore, regardless of the unit of analysis, the top 1% share is larger in the capitalization method than in the survey. This is expected, considering results of similar studies (see for instance Saez and Zucman (2016) or Martínez Toledano (2015)). But, in terms of other top shares, such as the top 10%, the concentration is similar or even larger in the survey[35].

This comparison with the wealth survey is reassuring, in the sense that the extreme levels of inequality are similar or even conservative when considering the top 10% share, and consistent when considering the top 1%, since it is larger in the capitalization method but not by very much. Therefore, it does not seem to be the case that wealth inequality has been overestimated because of the capitalization method. Wealth inequality estimations are, in any case, conservative.

As for the distribution by asset type and wealth composition, general survey-based conclusions are again consistent with capitalization factors' estimations. Fractiles' shares are depicted in Table 6, showing extreme concentration of business and financial wealth in the top 10%, similarly to capitalization method's estimations. Within the top 10%, business wealth is concentrated in top 1% (86.3%, very similar to the 91.4% of the capitalization method), whilst half of the financial wealth is owned by the first 9% of the tenth decile, being 16% in capitaliza-

[35]This may be related as well with the fact that, in the capitalization method's estimations, 2012 represents the lowest concentration point of the series.

tion method. In the case of real estate, survey-based estimations show a higher concentration profile than the capitalization method, with more than half of total real estate owned by the top 10% and one fifth by the top 1% (42.65% and 10.46% respectively in capitalization method).

Table 6: Wealth shares: Wealth Survey vs Capitalization Method by assets (in %), 2012.

| Wealth fractiles | Business wealth (cap.) | Business wealth (surv.) | Financial wealth (cap.) | Financial wealth (surv.) | Real estate (cap.) | Real estate (surv.) |
|---|---|---|---|---|---|---|
| Bottom 50% | 0.06 | 0.00 | 0.36 | 0.00 | 7.77 | 3.64 |
| Middle 40% | 0.44 | 0.00 | 1.56 | 4.71 | 49.58 | 41.88 |
| Top 10% | 99.49 | 100.00 | 98.07 | 95.29 | 42.65 | 54.48 |
| Top 10% (exc. top 1%) | 8.11 | 13.70 | 15.99 | 50.42 | 32.18 | 33.78 |
| Top 1% | 91.38 | 86.30 | 82.09 | 44.87 | 10.46 | 20.69 |

Notes: In all cases, estimations refer to comparable assets (minus liabilities) and per adult wealth. Top 0.1% is not depicted given the survey's reduced sample size.

Wealth portfolios by wealth group are depicted in Table 7, and even though the shares are not the same, they show the same clear predominance of real estate and a very low share of financial wealth. Basically, financial wealth share is equally low, but the survey's real estate share is roughly 20 percentage points higher, compensated by a lower business wealth share. As for the asset portfolio of different wealth groups, the conclusions are very similar to the ones presented in section 4. For the bottom 99% of the population, the predominant type of wealth -if they have any- is real estate, whilst the rest, and very specially business wealth, become a significant part of the portfolio for the richest 1%.

Table 7: Wealth composition: Wealth Survey vs Capitalization Method (in %), 2012.

| Wealth fractiles | Business wealth (cap.) | Business wealth (surv.) | Real estate (cap.) | Real estate (surv.) | Financial wealth (cap.) | Financial wealth (surv.) |
|---|---|---|---|---|---|---|
| Bottom 50% | 0.42 | 5.70 | 98.65 | 83.71 | 0.25 | 10.59 |
| Middle 40% | 0.48 | 2.72 | 99.19 | 93.78 | 0.17 | 3.50 |
| Top 10% | 52.51 | 21.44 | 42.12 | 73.34 | 5.22 | 5.22 |
| Top 90-99% | 11.57 | 6.94 | 85.89 | 85.65 | 2.30 | 7.41 |
| Top 1% | 76.56 | 38.95 | 16.41 | 58.48 | 6.93 | 2.57 |
| Average | 33.58 | 14.01 | 62.85 | 81.21 | 3.39 | 4.78 |

Notes: Capitalization method rows do not add up 100% because capital gains were not included in the table. In all cases, estimations refer to comparable assets (minus liabilities) and per adult wealth. Top 0.1% is not depicted given the survey's reduced sample size.

## 5.2 The evolution of wealth inequality: Inherited wealth and wealth tax.

Comparison with the wealth survey is very informative since it provides a clear picture of wealth distribution at a given point in time, but as there has only been one survey so far, it does not allow to assess the evolution of wealth distribution. Even though there is no other empirical approach that provides estimates of the evolution of total wealth distribution, it is possible to estimate the evolution of real estate (both housing and land), which as commented before represent up to 80% of total wealth.

The first and most important comparison is with estimates based on the estate multiplier method. For these estimations, a database with deceased population and the value of their total real estate from 2007 to 2014 was built, based on administrative data on both the registry of properties and cadaster values. The merger of this databases, allows to have, for each year, the universe of the deceased owners with the cadastral value of their real estate property, both rural and urban. This novel database allows for a new and completely orthogonal estimation or real estate distribution, but also of inherited real estate.

We begin by analysing the distribution of inherited wealth. To do so, given that the data base includes all deceased owners with the value of their properties, it is only necessary to consider the total number of deceased by year in order to estimate top shares of real estate distribution (Table A.10). Distribution of inherited real estate is depicted in Figure 8, showing an extreme concentration of inherited real estate. Virtually all inherited wealth is owned by the top 10% of the deceased population, whilst the top 1% and 0.1% shares are around 50 and 15% respectively (and slightly increasing).

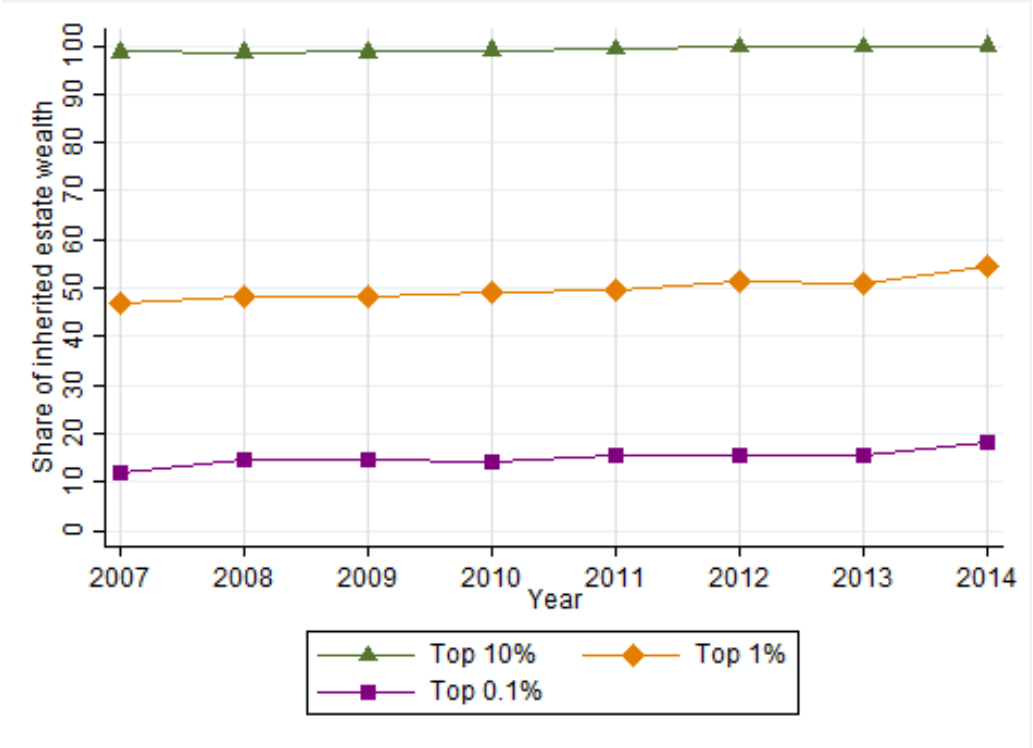
However, what is more interesting given the article's objective is the evolution of the distribution of real estate among the entire population. To do so, we need to weight every individual in our database by the inverse of the probability of passing, given by the mortality rates, which is the essence of the estate multiplier method. Unfortunately, the database only has information on the age of the deceased, and so the mortality rates are only an approximation[36]. By expanding the deceased population using estate multipliers by age, and considering now as population control total the entire adult population, and as aggregate wealth the total cadastral value of real estate[37], we are able to compute real estate distribution estimations among the living population.

The resulting estimations are shown in panel (a) of Figure 9, whilst capitalization method's

[36]Ideally, we would need mortality rates also by sex and wealth level (or a proxy of it such as income or even education).

[37]In this case, differently from what was done for the estimation of the capitalization factors, cadastral values were not adjusted to market values, as it was not the objective in this case to estimate aggregate real estate wealth (only its distribution), and the adjustment would only introduce more noise to the estimations.

Figure 8: Inherited real estate wealth in Uruguay, 2007-2014.

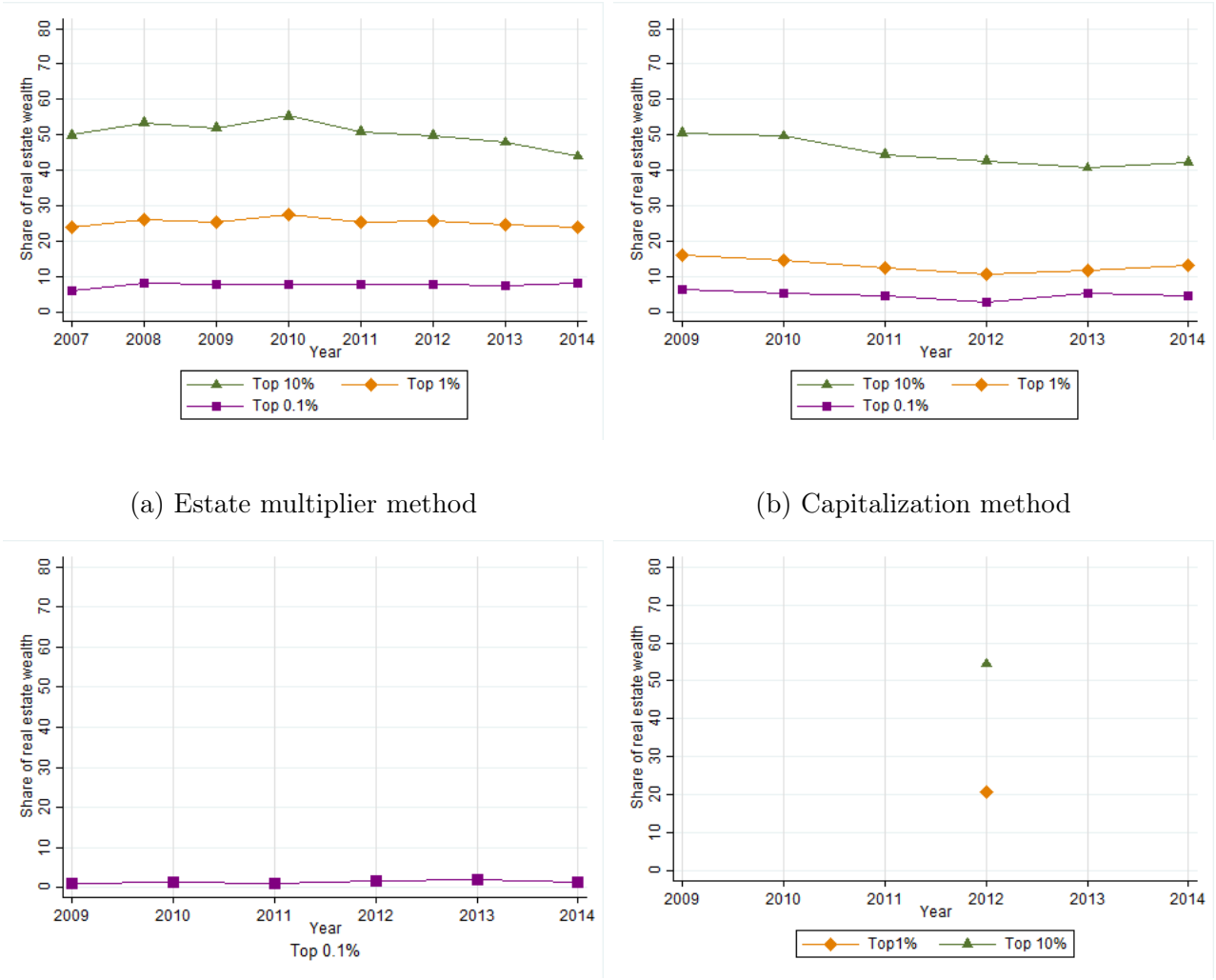



Source: Table A.10.
Notes: Estimations based on cadastral data (*Dirección Nacional de Catastro*) and administrative registry of property (*Dirección General de Registros*). After the combination of both sources, the resulting database presents a complete registry of all deceased owners by year, with all their properties and cadastral value. Total number of deceased population provided by National Institute of Statistics.

real estate distribution's estimates are depicted in panel (b). The first conclusion that can be drawn from the comparison is that trend are downwards in both cases, in particular when considering the top 10% share (higher fractiles show a relative stability). Considering that real estate represents the vast majority of total wealth (both considering the capitalization method and the wealth survey), this is very important since it provides evidence that the trend in overall wealth distribution is robust to the empirical approach. Secondly, also in terms of levels there are important similarities. Top 10% share in both figures are virtually identical. However, for top fractiles (especially the top 1%), the estate method shows more concentration. Considering this result and what was concluded with the survey-based estiamations in Table 7, which are also depicted in panel (d), it seems to be the case that real estate top fractiles' estimations in the capitalization method are indeed conservative[38].

[38]This is likely to be related with the imputation of owner occupied housing rent from the household survey to the tax income database, described in section 2, or (more likely) to the fact that this incomes in the survey underestimate true inequality of real estate incomes.

Figure 9: Real estate shares (in %) by method/data-source.




(a) Estate multiplier method

(b) Capitalization method

(c) Based on wealth tax

(d) Wealth Household Survey

Source: Table A.12.
Notes: Real estate includes housing and land. Capitalization method, Estate multiplier method and Wealth household survey panels, replicate results of Tables A.7, A.11 and 6 respectively. Rural and urban properties are taxed by the wealth tax on a progressive scale, with rates ranging from 0.75% to around 2.5%, depending on the year (since it is a tax meant to gradually disappear).

Another possible concentration robustness check is to compare the results with the wealth-tax data (*Impuesto al patrimonio*). As commented in section 2.3, this tax is payed by very few people, however, it is possible to use it compare at least the top 0.1% of real estates' distribution, as this population share represents 2,400 individuals. To do this, individuals from the tax records are sorted by their underlying real estate according to the wealth tax they pay,

and the top 0.1%' share is computed comparing the fratiles' total real estate wealth to total survey's real estate. This share is stable around 1-1.5%, much lower than in the remaining methods. This was expected since there are incentives to miss report the true value of housing, so in any case the difference could be interpreted as the level of tax evasion and avoidance. From a comparison perspective, the share is very stable, just like in panels (a) and (b).

The precedent analysis hence provides additional evidence that wealth concentration may be indeed falling, or in any case that nothing indicates that the opposite trend is true. Moreover, the extremes levels of inequality found with the capitalization method approach are confirmed. Therefore, the main conclusions regarding wealth distribution seem to resist the comparison with these external data sources.

# 6 Concluding remarks

In this article, for the first, a wealth to income ratio series for Uruguay is constructed and wealth distribution is estimated, based on the capitalization method. It hence contributes to a rapidly expanding wealth accumulation and inequality literature, since most of the estimations up until the present refer exclusively to the developed world.

Until now, most of what was known in terms of general trends of income growth and its distribution in the Uruguayan case could be summarised by Figure 1. It represented a relatively accurate yet incomplete story, since it only referred to incomes but it did not say anything about wealth accumulation or its distribution. This study is a contribution to start understanding the untold half of the story. What can we say about it? The narrative about growth and crisis with increasing income inequality, followed by a vigorous economic recovery and falling concentration of income, should be complemented with one of low and decreasing wealth to income ratios and high but decreasing wealth concentration. Wealth to income ratios, which are lower than what we observe in the developed world, are falling as the result of the combined effect of the return to high income growth rates –after the last economic crisis– and falling capital prices. Wealth inequality, high and comparable with very unequal countries such as the US or Spain, is also falling, and the most likely explanation seems to be related to the drop in the wealth to income ratio, which appears to drive the changes in wealth concentration both in recent years and further back in time.

Scarcity of reliable data is the single most important restriction for the analysis of wealth in almost every country. In the Uruguayan framework, as well as in most of the developing world, the complete absence of wealth aggregates estimations posed an important information restriction. Wealth aggregates are one of the key starting points of the capitalization method from a data viewpoint, as they are necessary for the estimations of rates of return that assure full micro-macro consistency. Therefore, this study had to start from one step behind and estimate wealth to income ratios. Based on those results and a combination of tax micro data, firm's tax records and household surveys, wealth distribution was estimated.

Regarding wealth to income evolution, estimations based on a variety of reliable sources for the 2009-2014 period, indicate that it is around 380% and falling. These estimations, although still imperfect and subject to further improvement, are very important since until the moment no such fundamental statistics existed. One-good and two-goods models with data on investment, growth and capital prices were used to interpolate the series and get a better sense of its likely long-term evolution. This analysis suggests that the decrease in the wealth to income ratio observed is in fact part of a longer declining process after the massive economic crisis of the early 2000s, in which the ratio peaked to very high levels of over 500%. Interestingly, a very similar pattern emerges from the previous economic crisis of the early

1980s. When considering the effect of capital gains (which could be done from 2000 on), results show that capital prices did play a major role in shaping the trend of wealth to income ratio, leading to a spike in the second half of the 2000s decade, and a decrease afterwards. Thus, the observed decline in wealth to income ratio is the product of both the return to positive growth rates after the 2002 crisis, and of the fall of capital prices following the peak in the late 2000s. The wealth to income ratio seems to be converging now to its long-term value, which judging by historical investment and growth rates, is around 350%.

In terms of wealth distribution, the degree of concentration is indeed very high, with a top 10% share of over 60-65% and a bottom 50% owning practically nothing. This high level of wealth inequality is very similar to what the wealth survey shows for 2012, hence in any case providing a conservative estimate of the true wealth concentration. The downward trend observed also arises –at least in its real estate component– in estimates based on the estate multiplier method. This triangulation with other evidence is reassuring, in the sense that both level and trend of wealth inequality estimated based on the capitalization method, are consistent with orthogonal data sources. As the period of analysis is very short, it is again interesting to try to take a longer-run view. Thus, based on household surveys, the wealth to income ratios interpolation and the rates of return estimated, a 2000-2015 wealth inequality series was built. Although it does not depict accurately the level of inequality, it does provide some valuable insights regarding its trend. In particular, it shows that the fall in wealth inequality observed from 2009 to 2014, is part of the return to early 2000s wealth inequality level after an increase in the late 2000s. Interestingly, this analysis suggests that changes in wealth distribution were shaped by the changes in the wealth to income ratio.

The full income and wealth narrative that starts to emerge is indeed very complex. Given the co-determination of these economic variables, it is very difficult to establish clear causalities, but it seems to be the case that the downturn in wealth inequality was driven by different factors than the decrease in income inequality, i.e. the fall in wealth to income ratios rather than distributive and redistributive policies. Future research will focus on analysing the joint distribution of these four key economic variables within the Distributional National Accounts framework, which is now possible for the first time.

Despite the decreasing trend in wealth concentration, the most salient fact is that wealth inequality is still extremely high, in particular for types of wealth that can be more easily associated with the notion of capital. In fact, business and financial wealth concentration is startling. The vast majority of those assets are owned by the wealthiest 1% or even smaller fractiles such as the top 0.1%. Given Uruguay's reduced population, this means that less than 2,500 individuals control more than half of the country's private productive assets, and hence considerable economic and political power. If scholars so apart in time such as Adam Smith and Tony Atkinson were right in considering that wealth and power are intimately related,

these results entail a huge concentration of the latter as well. Thus, from a political economy viewpoint, this imposes a serious obstacle that should be taken into account if wealth and income inequality are to be brought down.

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# A Appendix: complementary Tables and Figures

## A.1 Capital incomes database construction

Table A.1: Tax and survey combined database

| | Number of adults | % of total population |
|---|---|---|
| Total population* | 2.410.384 | 75,1 |
| Population in tax records | 1.810.433 | 44,8 |
| Labour income | 1.080.182 | 1,1 |
| Labour and capital income | 26.536 | 3,0 |
| Labour income and pensions | 72.031 | 0,2 |
| Labour, capital income and pensions | 4.117 | 23,4 |
| Pensions | 563.178 | 0.29 |
| Pensions and capital income | 24.147 | 1,0 |
| Only capital income | 27.455 | 1,1 |
| Population with zero income | 12.787 | 0,5 |
| Non earners and informal-untaxed incomes earners from survey | 614.893 | 25,5 |
| Non earners adjusted | 599.951 | 24.9 |

Source: own elaboration. Notes: Number of earners by income source is depicted in the first panel. Number of non-earners and individuals with exclusively informal or untaxed incomes from household survey, and its adjustment to match total population of 20 years or more, is depicted in the second panel. (*) Official population projections. Estimations refer to 2012 as an example, almost identical results for remaining years (De Rosa and Vilá, 2017)

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Table A.2: Distribution of taxable capital incomes and dividiends.

| Wealth fractile | Total taxable capital income | Dividends |
|---|---|---|
| Bottom 90% | 16.2% | 1.9% |
| Top 10% | 83.8% | 98.1% |
| Top 1% | 56.9% | 87.5% |
| Top 0.1% | 33.7% | 60.3% |

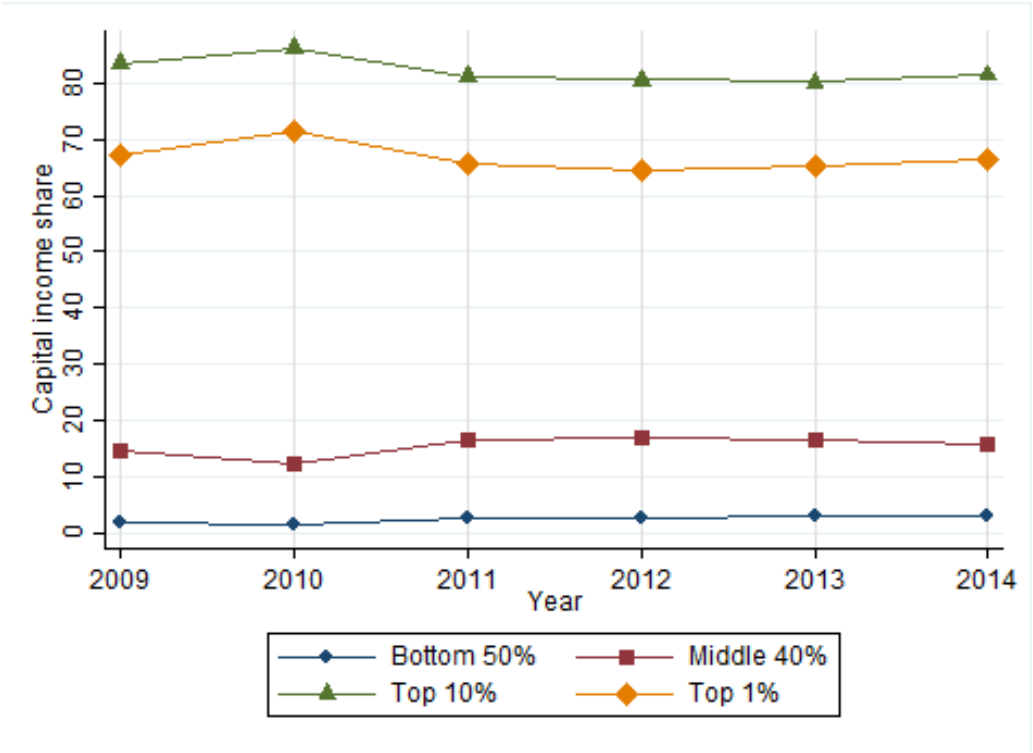
Source: own elaboration based on DGI. First column depicts distribution of the sum of all taxed capital incomes, whilst the second depicts the distributions of dividends. Estimations refer to 2012.

Table A.3: Capital incomes in tax records and imputed, 2009-2014.

| Wealth fractiles | Total cap. income | Business income | Financial income | Real est. income |
|---|---|---|---|---|
| 2009 | | | | |
| In tax records | 5.35 | 2.07 | 16.70 | 11.55 |
| Imputed | 94.65 | 97.93 | 83.30 | 88.45 |
| 2010 | | | | |
| In tax records | 4.89 | 2.30 | 25.76 | 11.40 |
| Imputed | 95.11 | 97.70 | 74.24 | 88.60 |
| 2011 | | | | |
| In tax records | 6.68 | 3.86 | 43.83 | 11.07 |
| Imputed | 93.32 | 96.14 | 56.17 | 88.93 |
| 2012 | | | | |
| In tax records | 6.23 | 4.12 | 28.84 | 9.43 |
| Imputed | 93.77 | 95.88 | 71.16 | 90.57 |
| 2013 | | | | |
| In tax records | 7.31 | 4.32 | 31.96 | 12.30 |
| Imputed | 92.69 | 95.68 | 68.04 | 87.70 |
| 2014 | | | | |
| In tax records | 7.80 | 4.84 | 38.81 | 12.99 |
| Imputed | 92.20 | 95.16 | 61.19 | 87.01 |

Notes: Taxable capital incomes are reported by DGI on individual basis. Imputed capital incomes refer to untaxed income flows, which are imputed based on Household Income Survey and Firm's tax records. Business incomes are essentially dividends, financial incomes are interests from deposits, whilst real estate income refer to owner occupied rental income, rents perceived for other real estate properties and land. The large amount of imputed capital incomes is the result of, essentially, the imputation of undistributed profits and owner occupied housing rent. In the first case, imputation was performed in order to replicate, as much as possible, the observed capital incomes tax database distribution. In the case of owner occupied housing rent, the distribution mirrors the one observed in the household. Therefore, even though imputation percentage is high, in all cases it can be traced back to well known distributions.

Figure A.1: Capital income shares in Uruguay, 2009-2014.




Source: Table A.4.
Notes: Capital incomes include taxed incomes and imputed incomes (from surveys and Firms' tax records). Total capital incomes are equivalent to the sum of all taxed business capital incomes (distributed and undistributed profits), real estate incomes (from land, real estate and own occupied housing) and financial incomes (mainly incomes from deposits). Capital incomes were not scaled up to match the aggregate capital incomes, since there are no official National Accounts statistics of labour and capital shares and therefore, in this study, no such correction was performed. The full DINA database estimation and description, properly scaled so that it matches National Income, can be found in De Rosa and Vilá (2017)

Table A.4: Capital income distribution by source, 2009-2014.

| Wealth fractiles | Total cap. income | Business income | Financial income | Real est. inc. |
|---|---|---|---|---|
| 2009 | | | | |
| Bottom 50% | 1.64 | 0.00 | 0.00 | 4.88 |
| Middle 40% | 14.72 | 0.00 | 0.00 | 43.99 |
| Top 10% | 83.64 | 100.00 | 100.00 | 51.13 |
| Top 10% (exc. 1%) | 16.57 | 6.66 | 6.91 | 33.00 |
| Top 1% | 67.07 | 93.34 | 93.09 | 18.14 |
| Top 1% (exc. .01%) | 25.50 | 33.98 | 35.56 | 11.06 |
| Top 0.1% | 41.57 | 59.36 | 57.54 | 7.07 |
| Gini | 89.26 | 99.53 | 99.50 | 69.07 |
| 2010 | | | | |
| Bottom 50% | 1.49 | 0.00 | 0.00 | 5.39 |
| Middle 40% | 12.16 | 0.00 | 0.00 | 44.26 |
| Top 10% | 86.36 | 100.00 | 100.00 | 50.35 |
| Top 10% (exc. 1%) | 14.72 | 6.85 | 6.98 | 33.09 |
| Top 1% | 71.63 | 93.15 | 93.02 | 17.26 |
| Top 1% (exc. .01%) | 26.71 | 33.43 | 37.91 | 10.74 |
| Top 0.1% | 44.92 | 59.72 | 55.11 | 6.52 |
| Gini | 90.88 | 99.53 | 99.48 | 68.26 |
| 2011 | | | | |
| Bottom 50% | 2.42 | 0.00 | 0.00 | 7.05 |
| Middle 40% | 16.38 | 0.00 | 0.00 | 47.93 |
| Top 10% | 81.20 | 100.00 | 100.00 | 45.02 |
| Top 10% (exc. 1%) | 15.60 | 7.12 | 4.17 | 30.79 |
| Top 1% | 65.60 | 92.88 | 95.83 | 14.23 |
| Top 1% (exc. .01%) | 23.79 | 31.97 | 24.30 | 8.64 |
| Top 0.1% | 41.81 | 60.92 | 71.53 | 5.59 |
| Gini | 87.41 | 99.53 | 99.68 | 64.22 |
| 2012 | | | | |
| Bottom 50% | 2.62 | 0.00 | 0.00 | 7.63 |
| Middle 40% | 16.75 | 0.00 | 0.00 | 49.02 |
| Top 10% | 80.63 | 100.00 | 100.00 | 43.35 |
| Top 10% (exc. 1%) | 16.15 | 7.96 | 8.91 | 31.20 |
| Top 1% | 64.48 | 92.04 | 91.09 | 12.15 |
| Top 1% (exc. .01%) | 26.08 | 35.50 | 33.85 | 8.36 |
| Top 0.1% | 38.40 | 56.54 | 57.23 | 3.79 |
| Gini | 86.93 | 99.47 | 99.44 | 62.88 |
| 2013 | | | | |
| Bottom 50% | 3.10 | 0.00 | 0.00 | 9.03 |
| Middle 40% | 16.63 | 0.00 | 0.00 | 49.18 |
| Top 10% | 80.27 | 100.00 | 100.00 | 41.79 |
| Top 10% (exc. 1%) | 14.80 | 7.88 | 8.18 | 28.19 |
| Top 1% | 65.47 | 92.12 | 91.82 | 13.60 |
| Top 1% (exc. .01%) | 22.69 | 30.79 | 28.42 | 7.23 |
| Top 0.1% | 42.78 | 61.33 | 63.40 | 6.36 |
| Gini | 86.38 | 99.51 | 99.49 | 60.91 |
| 2014 | | | | |
| Bottom 50% | 2.93 | 0.00 | 0.00 | 9.01 |
| Middle 40% | 15.52 | 0.00 | 0.00 | 48.07 |
| Top 10% | 81.55 | 100.00 | 100.00 | 42.93 |
| Top 10% (exc. 1%) | 15.19 | 8.66 | 8.15 | 28.31 |
| Top 1% | 66.36 | 91.34 | 91.85 | 14.62 |
| Top 1% (exc. .01%) | 26.17 | 34.51 | 28.07 | 8.59 |
| Top 0.1% | 40.19 | 56.83 | 63.78 | 6.03 |
| Gini | 87.12 | 99.45 | 99.48 | 61.43 |

Notes: Capital incomes include taxed incomes and imputed incomes (from surveys and Firms' tax records). Total capital incomes are equivalent to the sum of all taxed business capital incomes (distributed and undistributed profits), real estate incomes (from land, real estate and own occupied housing) and financial incomes (mainly incomes from deposits).

Table A.5: Capital incomes composition, 2009-2014.

| Wealth fractiles | Business wealth | Financial wealth | Real estate |
|---|---|---|---|
| 2009 | | | |
| Bottom 50% | 1.64 | 0.00 | 0.00 |
| Middle 40% | 14.72 | 0.00 | 0.00 |
| Top 10% | 83.64 | 100.00 | 100.00 |
| Top 10% (exc. 1%) | 16.57 | 6.66 | 6.91 |
| Top 1% | 67.07 | 93.34 | 93.09 |
| Top 1% (exc. .01%) | 25.50 | 33.98 | 35.56 |
| Top 0.1% | 41.57 | 59.36 | 57.54 |
| Average | 89.26 | 99.53 | 99.50 |
| 2010 | | | |
| Bottom 50% | 1.49 | 0.00 | 0.00 |
| Middle 40% | 12.16 | 0.00 | 0.00 |
| Top 10% | 86.36 | 100.00 | 100.00 |
| Top 10% (exc. 1%) | 14.72 | 6.85 | 6.98 |
| Top 1% | 71.63 | 93.15 | 93.02 |
| Top 1% (exc. .01%) | 26.71 | 33.43 | 37.91 |
| Top 0.1% | 44.92 | 59.72 | 55.11 |
| Average | 90.88 | 99.53 | 99.48 |
| 2011 | | | |
| Bottom 50% | 2.42 | 0.00 | 0.00 |
| Middle 40% | 16.38 | 0.00 | 0.00 |
| Top 10% | 81.20 | 100.00 | 100.00 |
| Top 10% (exc. 1%) | 15.60 | 7.12 | 4.17 |
| Top 1% | 65.60 | 92.88 | 95.83 |
| Top 1% (exc. .01%) | 23.79 | 31.97 | 24.30 |
| Top 0.1% | 41.81 | 60.92 | 71.53 |
| Average | 87.41 | 99.53 | 99.68 |
| 2012 | | | |
| Bottom 50% | 2.62 | 0.00 | 0.00 |
| Middle 40% | 16.75 | 0.00 | 0.00 |
| Top 10% | 80.63 | 100.00 | 100.00 |
| Top 10% (exc. 1%) | 16.15 | 7.96 | 8.91 |
| Top 1% | 64.48 | 92.04 | 91.09 |
| Top 1% (exc. .01%) | 26.08 | 35.50 | 33.85 |
| Top 0.1% | 38.40 | 56.54 | 57.23 |
| Average | 86.93 | 99.47 | 99.44 |
| 2013 | | | |
| Bottom 50% | 3.10 | 0.00 | 0.00 |
| Middle 40% | 16.63 | 0.00 | 0.00 |
| Top 10% | 80.27 | 100.00 | 100.00 |
| Top 10% (exc. 1%) | 14.80 | 7.88 | 8.18 |
| Top 1% | 65.47 | 92.12 | 91.82 |
| Top 1% (exc. .01%) | 22.69 | 30.79 | 28.42 |
| Top 0.1% | 42.78 | 61.33 | 63.40 |
| Average | 86.38 | 99.51 | 99.49 |
| 2014 | | | |
| Bottom 50% | 2.93 | 0.00 | 0.00 |
| Middle 40% | 15.52 | 0.00 | 0.00 |
| Top 10% | 81.55 | 100.00 | 100.00 |
| Top 10% (exc. 1%) | 15.19 | 8.66 | 8.15 |
| Top 1% | 66.36 | 91.34 | 91.85 |
| Top 1% (exc. .01%) | 26.17 | 34.51 | 28.07 |
| Top 0.1% | 40.19 | 56.83 | 63.78 |
| Average | 87.12 | 99.45 | 99.48 |

Notes: Capital incomes include taxed incomes and imputed incomes (from surveys and Firms' tax records). Same incomes as the ones depicted in A.1.

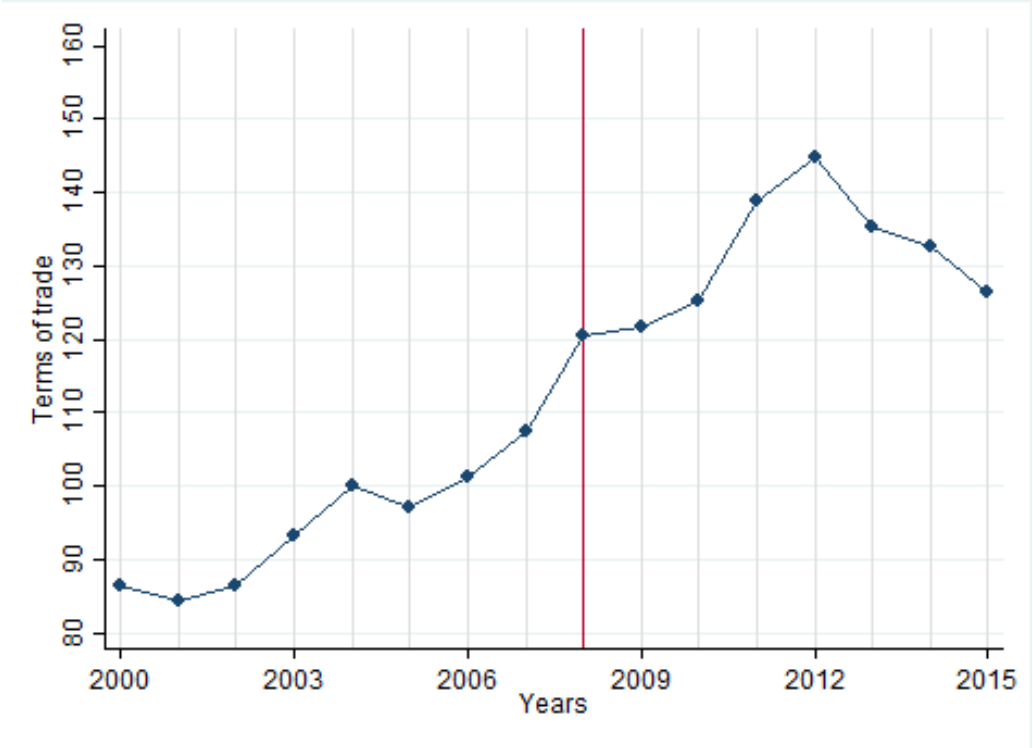
## A.2 Wealth to income ratio

Table A.6: Wealth to income ratio in Uruguay, methods comparison, 1989-2015.

| Year | Wealth-Income (one-good model) | $1+g_{wst}$ | $1+g_t$ | Wealth-Income (two-goods model) | $(1+g_{wst})(1+q_t)$ | $1+g_t$ | Own estim. |
|---|---|---|---|---|---|---|---|
| 1989 | 5.41 | 1.01 | 1.01 | . | . | . | . |
| 1990 | 5.44 | 1.00 | 1.01 | . | . | . | . |
| 1991 | 5.31 | 1.04 | 1.01 | . | . | . | . |
| 1992 | 4.98 | 1.08 | 1.01 | . | . | . | . |
| 1993 | 4.92 | 1.03 | 1.01 | . | . | . | . |
| 1994 | 4.66 | 1.07 | 1.01 | . | . | . | . |
| 1995 | 4.78 | 0.99 | 1.01 | . | . | . | . |
| 1996 | 4.59 | 1.06 | 1.01 | . | . | . | . |
| 1997 | 4.45 | 1.05 | 1.02 | . | . | . | . |
| 1998 | 4.34 | 1.05 | 1.02 | . | . | . | . |
| 1999 | 4.50 | 0.98 | 1.02 | . | . | . | . |
| 2000 | 4.65 | 0.98 | 1.01 | 3.56 | 0.98 | 1.18 | . |
| 2001 | 4.89 | 0.96 | 1.01 | 3.87 | 0.96 | 1.05 | . |
| 2002 | 5.34 | 0.92 | 1.01 | 3.86 | 0.92 | 0.92 | . |
| 2003 | 5.35 | 1.01 | 1.01 | 2.86 | 1.01 | 0.75 | . |
| 2004 | 5.16 | 1.05 | 1.01 | 2.65 | 1.05 | 0.97 | . |
| 2005 | 4.89 | 1.07 | 1.02 | 2.55 | 1.07 | 1.04 | . |
| 2006 | 4.81 | 1.04 | 1.02 | 3.60 | 1.04 | 1.47 | . |
| 2007 | 4.62 | 1.07 | 1.02 | 4.46 | 1.07 | 1.32 | . |
| 2008 | 4.44 | 1.07 | 1.03 | 4.82 | 1.07 | 1.16 | . |
| 2009 | 4.37 | 1.04 | 1.03 | 5.81 | 1.04 | 1.26 | 4.29 |
| 2010 | 4.17 | 1.08 | 1.03 | 5.38 | 1.08 | 1.00 | 3.44 |
| 2011 | 4.08 | 1.05 | 1.03 | 4.57 | 1.05 | 0.89 | 3.99 |
| 2012 | 4.08 | 1.04 | 1.04 | 4.08 | 1.04 | 0.92 | 4.08 |
| 2013 | 4.08 | 1.05 | 1.04 | 3.64 | 1.05 | 0.84 | 3.79 |
| 2014 | 4.04 | 1.03 | 1.04 | 2.91 | 1.03 | 0.90 | 3.77 |
| 2015 | 4.05 | 1.00 | 1.03 | 2.54 | 1.00 | 0.84 | . |

Notes: Wealth to income ratio estimated by extrapolating 2012's estimation based on a one-good wealth accumulation model (Piketty & Zucman, 2014).For the one-good model, if $\beta_{nt} = \frac{W_{nt}}{Y_{nt}}$, then $\beta_{nt+1} = \frac{1+g_{wst}}{1+g_t}\beta_{nt}$, with $1+g_{wst} = 1+\frac{s_t}{\beta_{nt}}$ and $1+g_t = \frac{Y_{t+1}}{Y_t}$. The income growth component depicted is hence given by $1+g_t$ and equals Income growth, whilst the wealth growth component is given by $1+g_{wst}$ and is equivalent to net investment (assuming an 8% depreciation rate was assumed throughout period). In the case of the two-goods model, in which $\beta_{nt+1} = \frac{(1+g_{wst})(1+q_t)}{1+g_t}\beta_{nt}$, with $1+q_t$ being the capital-gains-induced wealth growth rate. In this exercise, it is the ratio of the Land price and Consumers prices indexes. Data produced by Uruguay's Central Bank, National Statistics Institute and Ministry of Agriculture.

Figure A.2: Terms of trade in Argentina, 2000-2015.




Source: National Institute of Statistics and Census of Argentina (INDEC in its Spanish acronym).
Notes: Terms of trade of Argentina depicted, showing a pattern that matches the evolution of land prices in Uruguay. The vertical line indicates the announcement of increases in agricultural exports tax by the Argentinian government and the beginning of a long political struggle between government and agricultural business owners and political opposition. Base year 2004=100.

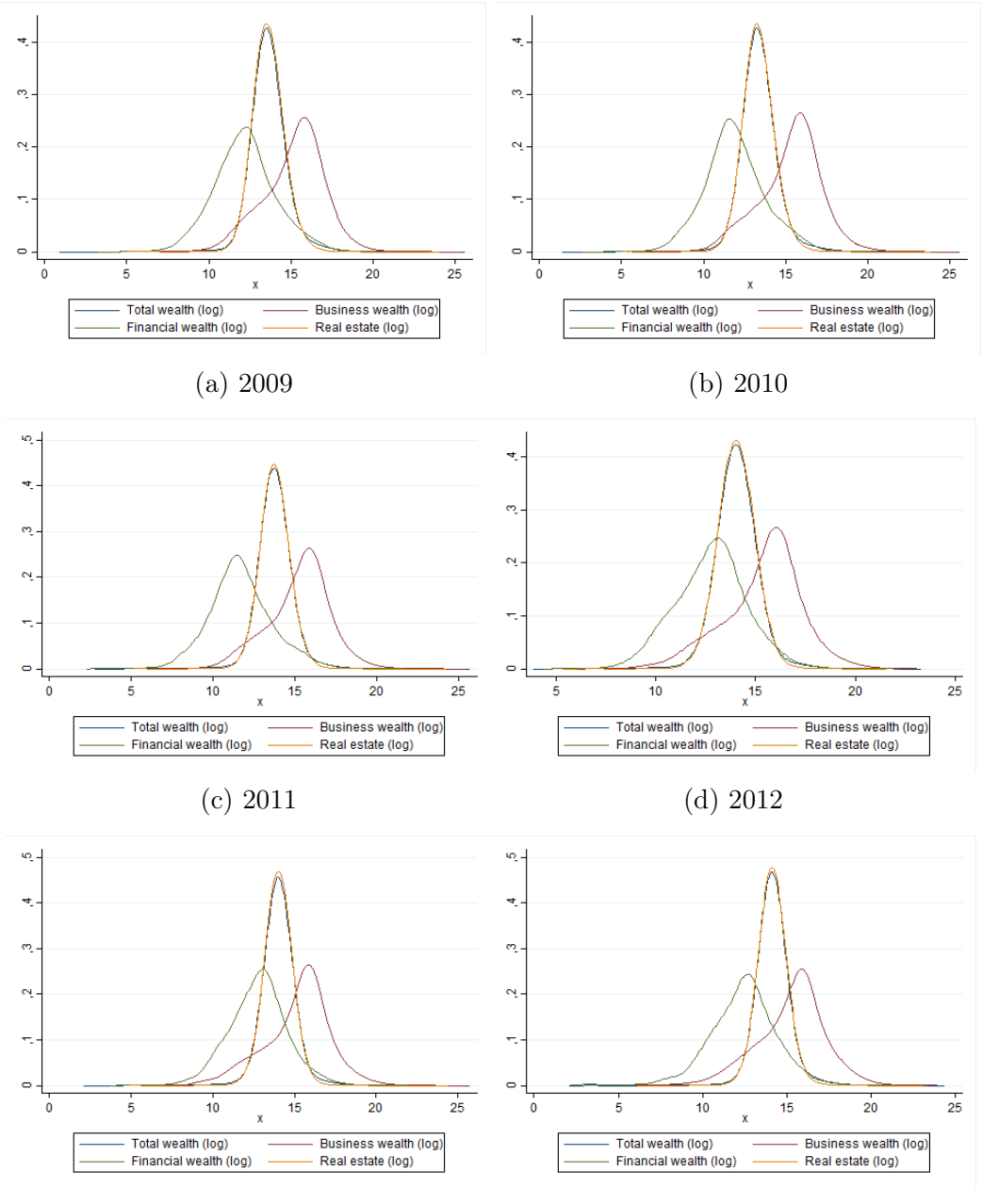
## A.3 Wealth distribution

Table A.7: Wealth distribution by type of wealth in Uruguay, 2009-2014.

| Wealth fractiles | Total wealth | Business wealth | Financial wealth | Real estate | Capital gains |
|---|---|---|---|---|---|
| 2009 | | | | | |
| Bottom 50% | 3.02 | 0.04 | 0.30 | 4.99 | 19.50 |
| Middle 40% | 26.80 | 0.37 | 1.79 | 44.53 | 31.81 |
| Top 10% | 70.18 | 99.60 | 97.91 | 50.48 | 48.68 |
| Top 10% (exc. 1%) | 24.57 | 8.48 | 21.34 | 34.66 | 34.05 |
| Top 1% | 45.60 | 91.11 | 76.57 | 15.82 | 14.64 |
| Top 1% (exc. .01%) | 19.06 | 32.11 | 42.10 | 9.70 | 11.21 |
| Top 0.1% | 26.54 | 59.00 | 34.47 | 6.12 | 3.43 |
| Gini | 80.82 | 99.53 | 99.50 | 69.07 | 99.54 |
| 2010 | | | | | |
| Bottom 50% | 2.88 | 0.02 | 0.32 | 5.53 | 15.62 |
| Middle 40% | 23.25 | 0.25 | 2.41 | 44.81 | 29.19 |
| Top 10% | 73.87 | 99.73 | 97.27 | 49.66 | 55.19 |
| Top 10% (exc. 1%) | 22.13 | 7.58 | 25.21 | 34.96 | 35.34 |
| Top 1% | 51.73 | 92.16 | 72.06 | 14.71 | 19.85 |
| Top 1% (exc. .01%) | 20.78 | 32.52 | 39.26 | 9.40 | 16.77 |
| Top 0.1% | 30.95 | 59.64 | 32.80 | 5.31 | 3.09 |
| Gini | 82.95 | 99.53 | 99.48 | 68.26 | 99.51 |
| 2011 | | | | | |
| Bottom 50% | 4.23 | 0.04 | 0.49 | 7.19 | 14.19 |
| Middle 40% | 28.29 | 0.34 | 1.49 | 48.43 | 23.21 |
| Top 10% | 67.48 | 99.62 | 98.01 | 44.38 | 62.60 |
| Top 10% (exc. 1%) | 21.93 | 7.52 | 15.74 | 31.89 | 27.42 |
| Top 1% | 45.54 | 92.10 | 82.27 | 12.49 | 35.18 |
| Top 1% (exc. .01%) | 17.83 | 31.75 | 27.50 | 8.01 | 15.15 |
| Top 0.1% | 27.72 | 60.35 | 54.77 | 4.48 | 20.03 |
| Gini | 78.53 | 99.53 | 99.68 | 64.22 | 99.59 |
| 2012 | | | | | |
| Bottom 50% | 4.95 | 0.06 | 0.36 | 7.77 | 18.40 |
| Middle 40% | 31.41 | 0.44 | 1.56 | 49.58 | 29.10 |
| Top 10% | 63.63 | 99.49 | 98.07 | 42.65 | 52.50 |
| Top 10% (exc. 1%) | 23.55 | 8.11 | 15.99 | 32.18 | 31.53 |
| Top 1% | 40.08 | 91.38 | 82.09 | 10.46 | 20.97 |
| Top 1% (exc. .01%) | 17.79 | 35.06 | 31.45 | 7.83 | 17.17 |
| Top 0.1% | 22.29 | 56.32 | 50.64 | 2.64 | 3.80 |
| Gini | 75.90 | 99.47 | 99.44 | 62.88 | 99.55 |
| 2013 | | | | | |
| Bottom 50% | 5.54 | 0.11 | 0.45 | 9.30 | 17.30 |
| Middle 40% | 29.50 | 0.48 | 1.15 | 49.96 | 21.52 |
| Top 10% | 64.96 | 99.41 | 98.40 | 40.74 | 61.18 |
| Top 10% (exc. 1%) | 20.44 | 7.93 | 10.81 | 29.04 | 27.21 |
| Top 1% | 44.51 | 91.47 | 87.59 | 11.71 | 33.97 |
| Top 1% (exc. .01%) | 16.41 | 30.37 | 30.48 | 6.51 | 27.15 |
| Top 0.1% | 28.10 | 61.11 | 57.11 | 5.19 | 6.82 |
| Gini | 76.15 | 99.51 | 99.49 | 60.91 | 99.65 |
| 2014 | | | | | |
| Bottom 50% | 5.55 | 0.08 | 0.56 | 9.17 | 13.65 |
| Middle 40% | 29.13 | 0.42 | 1.51 | 48.50 | 20.79 |
| Top 10% | 65.32 | 99.49 | 97.93 | 42.33 | 65.56 |
| Top 10% (exc. 1%) | 21.14 | 8.79 | 13.80 | 29.13 | 26.51 |
| Top 1% | 44.18 | 90.70 | 84.14 | 13.20 | 39.05 |
| Top 1% (exc. .01%) | 18.81 | 34.21 | 31.00 | 8.62 | 19.45 |
| Top 0.1% | 25.36 | 56.49 | 53.13 | 4.58 | 19.60 |
| Gini | 76.24 | 99.45 | 99.48 | 61.43 | 99.68 |

Notes: Wealth distribution's estimation based on the capitalization method, for adult population of 20 and more. Real estate includes both housing and land; Business wealth refers to the property of Firms (directly held or through equities); Financial wealth refers to (essentially) deposits; and Capital gains are (taxed) increases in the value of assets.

Figure A.3: Wealth density function by wealth type, 2009-2014.




(a) 2009 (b) 2010

(c) 2011 (d) 2012

(e) 2013 (f) 2014

Notes: Wealth distribution's estimation based on the capitalization method, for adult population of 20 and more. Real estate includes both housing and land; Business wealth refers to the property of Firms (directly held or through equities); Financial wealth refers to (essentially) deposits; and Capital gains are (taxed) increases in the value of assets.

Table A.8: Wealth portfolios, 2009-2014.

| Wealth fractiles | Business wealth | Financial wealth | Real estate | Capital gains |
|---|---|---|---|---|
| 2009 | | | | |
| Bottom 50% | 0.44 | 0.35 | 98.46 | 0.75 |
| Middle 40% | 0.50 | 0.23 | 99.13 | 0.14 |
| Top 10% | 52.18 | 4.83 | 42.91 | 0.08 |
| Top 10% (exc. 1%) | 12.69 | 3.00 | 84.14 | 0.16 |
| Top 1% | 73.46 | 5.81 | 20.70 | 0.04 |
| Top 1% (exc. .01%) | 61.94 | 7.64 | 30.35 | 0.07 |
| Top 0.1% | 81.73 | 4.49 | 13.76 | 0.02 |
| Average | 36.77 | 3.46 | 59.66 | 0.12 |
| 2010 | | | | |
| Bottom 50% | 0.32 | 0.28 | 98.39 | 1.01 |
| Middle 40% | 0.49 | 0.26 | 99.02 | 0.23 |
| Top 10% | 62.03 | 3.29 | 34.54 | 0.14 |
| Top 10% (exc. 1%) | 15.73 | 2.85 | 81.13 | 0.30 |
| Top 1% | 81.84 | 3.48 | 14.61 | 0.07 |
| Top 1% (exc. .01%) | 71.89 | 4.72 | 23.24 | 0.15 |
| Top 0.1% | 88.53 | 2.65 | 8.81 | 0.02 |
| Average | 45.94 | 2.50 | 51.37 | 0.19 |
| 2011 | | | | |
| Bottom 50% | 0.41 | 0.35 | 98.43 | 0.81 |
| Middle 40% | 0.46 | 0.16 | 99.18 | 0.20 |
| Top 10% | 57.34 | 4.34 | 38.10 | 0.23 |
| Top 10% (exc. 1%) | 13.32 | 2.14 | 84.24 | 0.30 |
| Top 1% | 78.54 | 5.39 | 15.88 | 0.19 |
| Top 1% (exc. .01%) | 69.17 | 4.60 | 26.02 | 0.21 |
| Top 0.1% | 84.56 | 5.90 | 9.36 | 0.18 |
| Average | 38.84 | 2.98 | 57.93 | 0.24 |
| 2012 | | | | |
| Bottom 50% | 0.42 | 0.25 | 98.65 | 0.68 |
| Middle 40% | 0.48 | 0.17 | 99.19 | 0.17 |
| Top 10% | 52.51 | 5.22 | 42.12 | 0.15 |
| Top 10% (exc. 1%) | 11.57 | 2.30 | 85.89 | 0.25 |
| Top 1% | 76.56 | 6.93 | 16.41 | 0.10 |
| Top 1% (exc. .01%) | 66.18 | 5.99 | 27.65 | 0.18 |
| Top 0.1% | 84.85 | 7.69 | 7.43 | 0.03 |
| Average | 33.58 | 3.39 | 62.85 | 0.18 |
| 2013 | | | | |
| Bottom 50% | 0.75 | 0.34 | 98.09 | 0.82 |
| Middle 40% | 0.61 | 0.16 | 99.04 | 0.19 |
| Top 10% | 56.70 | 6.37 | 36.68 | 0.25 |
| Top 10% (exc. 1%) | 14.37 | 2.22 | 83.05 | 0.35 |
| Top 1% | 76.14 | 8.28 | 15.38 | 0.20 |
| Top 1% (exc. .01%) | 68.55 | 7.81 | 23.20 | 0.44 |
| Top 0.1% | 80.58 | 8.55 | 10.80 | 0.06 |
| Average | 37.05 | 4.21 | 58.48 | 0.26 |
| 2014 | | | | |
| Bottom 50% | 0.55 | 0.38 | 98.44 | 0.63 |
| Middle 40% | 0.53 | 0.20 | 99.09 | 0.18 |
| Top 10% | 55.44 | 5.72 | 38.58 | 0.26 |
| Top 10% (exc. 1%) | 15.14 | 2.49 | 82.05 | 0.32 |
| Top 1% | 74.73 | 7.27 | 17.78 | 0.22 |
| Top 1% (exc. .01%) | 66.18 | 6.29 | 27.27 | 0.26 |
| Top 0.1% | 81.06 | 7.99 | 10.75 | 0.20 |
| Average | 36.40 | 3.82 | 59.53 | 0.25 |

Notes: Wealth distribution's estimation based on the capitalization method, for adult population of 20 and more. Real estate includes both housing and land owned directly by individuals; Business wealth refers to the property of Firms (directly held or through equities, which include also financial and real estate wealth); Financial wealth refers to (essentially) deposits; and Capital gains are (taxed) increases in the value of assets.

Table A.9: Wealth's Shorrocks' decomposition, 2009-2014.

| Wealth type | Inequality contribution | Share in portfolio |
|---|---|---|
| 2009 | | |
| Business wealth | 77.76 | 36.77 |
| Financial wealth | 2.10 | 3.46 |
| Real estate | 20.14 | 59.66 |
| Capital gains | 0.00 | 0.12 |
| 2010 | | |
| Business wealth | 82.36 | 45.94 |
| Financial wealth | 1.26 | 2.50 |
| Real estate | 16.38 | 51.37 |
| Capital gains | 0.00 | 0.19 |
| 2011 | | |
| Business wealth | 77.18 | 38.84 |
| Financial wealth | 1.86 | 2.98 |
| Real estate | 20.95 | 57.93 |
| Capital gains | 0.01 | 0.24 |
| 2012 | | |
| Business wealth | 85.05 | 33.58 |
| Financial wealth | 10.55 | 3.39 |
| Real estate | 4.38 | 62.85 |
| Capital gains | 0.02 | 0.18 |
| 2013 | | |
| Business wealth | 70.58 | 37.05 |
| Financial wealth | 5.99 | 4.21 |
| Real estate | 23.43 | 58.48 |
| Capital gains | 0.00 | 0.26 |
| 2014 | | |
| Business wealth | 73.45 | 36.40 |
| Financial wealth | 14.70 | 3.82 |
| Real estate | 11.79 | 59.53 |
| Capital gains | 0.06 | 0.25 |

Notes: Decomposition based on Shorroks (1982). Wealth distribution's estimation based on the capitalization method, for adult population of 20 and more. Real estate includes both housing and land owned directly by individuals; Business wealth refers to the property of Firms (directly held or through equities, which include also financial and real estate wealth); Financial wealth refers to (essentially) deposits; and Capital gains are (taxed) increases in the value of assets.

## A.4 Triangulation with other evidence

Table A.10: Inherited real estate wealth distribution in Uruguay, 2007-2014

| Wealth fractiles | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|
| Top 10% | 98.81 | 98.61 | 98.77 | 99.09 | 99.30 | 99.71 | 99.81 | 100.00 |
| Top 1% | 46.95 | 48.19 | 48.24 | 49.18 | 49.50 | 51.38 | 51.03 | 54.71 |
| Top 0.1% | 11.81 | 14.70 | 14.43 | 14.04 | 15.31 | 15.46 | 15.41 | 18.19 |
| Deceased own. | 4202.00 | 4034.00 | 4000.00 | 4056.00 | 3941.00 | 3697.00 | 3536.00 | 3014.00 |
| Prop. dec. owners | 12.84 | 13.24 | 12.89 | 12.53 | 12.15 | 11.37 | 11.10 | 9.59 |

Notes: Estimations based on cadaster data (*Dirección Nacional de Catastro*) and administrative registry of property (*Dirección General de Registros*). After the combination of both sources, the resulting database presents a complete registry of all deceased owners by year, with all their properties and cadastral value. Total number of deceased population provided by National Institute of Statistics.

Table A.11: Real estate wealth in Uruguay (estate multiplier method, in %), 2007-2014.

| Wealth fractiles | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|
| Top 10% | 49.96 | 53.42 | 51.92 | 55.33 | 50.87 | 49.77 | 47.92 | 43.94 |
| Top 1% | 23.74 | 26.11 | 25.35 | 27.46 | 25.36 | 25.65 | 24.50 | 24.04 |
| Top 0.1% | 5.97 | 7.97 | 7.58 | 7.84 | 7.85 | 7.72 | 7.40 | 7.99 |

Notes: Estimations based on cadaster data (*Dirección Nacional de Catastro*) and administrative registry of property (*Dirección General de Registros*). After the combination of both sources, the resulting database presents a complete registry of all deceased owners by year, with all their properties and cadastral value. Total number of deceased population provided by National Institute of Statistics. Population of deceased weighted based on age mortality rates (as mortality rate of 2012 is missing, the average of 2011-2013 was used).

Table A.12: Real estate shares (in %) by method/data-source.

| Wealth fractiles/est. method | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|
| Capitalization method | | | | | | | | |
| Bottom 50% | . | . | 4.99 | 5.53 | 7.19 | 7.77 | 9.30 | 9.17 |
| Middle 40% | . | . | 44.53 | 44.81 | 48.43 | 49.58 | 49.96 | 48.50 |
| Top 10% | . | . | 50.48 | 49.66 | 44.38 | 42.65 | 40.74 | 42.33 |
| Top 1% | . | . | 15.82 | 14.71 | 12.49 | 10.46 | 11.71 | 13.20 |
| Top 0.1% | . | . | 6.12 | 5.31 | 4.48 | 2.64 | 5.19 | 4.58 |
| Estate multiplier method | | | | | | | | |
| Bottom 50% | . | . | . | . | . | . | . | . |
| Middle 40% | . | . | . | . | . | . | . | . |
| Top 10% | 49.96 | 53.42 | 51.92 | 55.33 | 50.87 | 49.77 | 47.92 | 43.94 |
| Top 1% | 23.74 | 26.11 | 25.35 | 27.46 | 25.36 | 25.65 | 24.50 | 24.04 |
| Top 0.1% | 5.97 | 7.97 | 7.58 | 7.84 | 7.85 | 7.72 | 7.40 | 7.99 |
| Wealth tax | | | | | | | | |
| Bottom 50% | . | . | . | . | . | . | . | . |
| Middle 40% | . | . | . | . | . | . | . | . |
| Top 10% | . | . | . | . | . | . | . | . |
| Top 1% | . | . | . | . | . | . | . | . |
| Top 0.1% | . | . | 1.03 | 1.55 | 1.23 | 1.68 | 1.95 | 1.46 |
| Survey | | | | | | | | |
| Bottom 50% | . | . | . | . | . | 3.64 | . | . |
| Middle 40% | . | . | . | . | . | 41.88 | . | . |
| Top 10% | . | . | . | . | . | 54.48 | . | . |
| Top 1% | . | . | . | . | . | 20.69 | . | . |
| Top 0.1% | . | . | . | . | . | . | . | . |

Notes: Real estate includes housing and land. Capitalization method, Estate multiplier method and Wealth household survey panels, replicate results of Tables A.7, A.11 and 6 respectively. Rural and urban properties are taxed by the wealth tax on a progressive scale, from 0.75% to around 2.5%, depending on the year (since it is a tax meant to gradually disappear).

Table A.13: Wealth inequality based on Household Survey, 2001-2015 (in %).

| Year | Top 10% | Middle 40% | Bottom 50% | Gini index |
|---|---|---|---|---|
| 2001 | 33.14 | 45.96 | 20.89 | 0.51 |
| 2002 | 34.63 | 42.56 | 22.81 | 0.49 |
| 2003 | 34.84 | 38.20 | 26.96 | 0.50 |
| 2004 | 37.50 | 38.58 | 23.92 | 0.52 |
| 2005 | 34.07 | 44.52 | 21.41 | 0.52 |
| 2006 | 47.40 | 34.68 | 17.92 | 0.61 |
| 2007 | 47.94 | 39.05 | 13.01 | 0.64 |
| 2008 | 50.52 | 37.23 | 12.25 | 0.64 |
| 2009 | 49.46 | 36.55 | 13.98 | 0.65 |
| 2010 | 47.26 | 39.61 | 13.13 | 0.62 |
| 2011 | 42.65 | 42.45 | 14.90 | 0.60 |
| 2012 | 36.78 | 50.35 | 12.87 | 0.55 |
| 2013 | 33.68 | 51.06 | 15.26 | 0.54 |
| 2014 | 35.75 | 48.01 | 16.24 | 0.53 |
| 2015 | 33.62 | 49.14 | 17.24 | 0.51 |

Notes: Estimations performed based on capital incomes from Household Survey (*Encuesta Continua de Hogares*), capitalized with capitalization factors computed to match wealth to income ratio series of Table A.6 (capital-gains adjusted series) and keeping rates of return' structure among assets.

## A.5 Characterisation of wealth owners

Table A.14: Proportion of women (in %) by age group.

| Age group | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| 20-24 | 54.42 | 56.13 | 55.01 | 44.82 | 41.53 | 44.98 |
| 25-29 | 41.96 | 44.07 | 43.93 | 46.08 | 44.54 | 44.70 |
| 30-34 | 43.55 | 45.42 | 45.01 | 47.32 | 45.61 | 46.35 |
| 35-39 | 44.50 | 46.33 | 45.81 | 48.17 | 46.00 | 47.33 |
| 40-44 | 45.11 | 46.89 | 46.41 | 48.96 | 46.72 | 48.51 |
| 45-49 | 46.41 | 47.45 | 46.97 | 49.83 | 47.48 | 49.23 |
| 50-54 | 47.10 | 48.12 | 47.74 | 50.11 | 48.15 | 49.78 |
| 55-59 | 48.18 | 48.79 | 48.43 | 50.90 | 48.89 | 50.17 |
| 60-64 | 49.80 | 49.95 | 49.80 | 52.31 | 50.30 | 51.05 |
| 65-69 | 51.67 | 51.91 | 51.74 | 53.04 | 52.13 | 52.28 |
| 70-79 | 53.28 | 53.29 | 53.03 | 56.94 | 53.03 | 53.12 |
| 80+ | 57.63 | 57.39 | 57.14 | 66.77 | 56.75 | 56.56 |

Source: Own elaboration based on tax incomes records.

Table A.15: Wealth inequality and wealth ownership (in %) by age groups, 2009-2011.

| Age groups | Gini index | Total wealth | Businsess wealth | Finanacial wealth | Real estate wealth | Capital gains |
|---|---|---|---|---|---|---|
| 2009 | | | | | | |
| 20-24 | 0.30 | 0.81 | 76.42 | 23.80 | 26.00 | 62.55 |
| 25-29 | 0.53 | 0.85 | 40.31 | 0.44 | 0.94 | 40.00 |
| 30-34 | 0.32 | 0.77 | 50.80 | 0.82 | 1.78 | 50.23 |
| 35-39 | 0.31 | 0.75 | 54.84 | 1.35 | 2.75 | 54.04 |
| 40-44 | 0.38 | 0.77 | 62.13 | 2.42 | 3.56 | 61.03 |
| 45-49 | 0.41 | 0.79 | 64.98 | 3.29 | 4.33 | 63.79 |
| 50-54 | 0.42 | 0.79 | 65.98 | 3.96 | 5.16 | 64.65 |
| 55-59 | 0.48 | 0.82 | 69.91 | 4.48 | 5.83 | 68.66 |
| 60-64 | 0.50 | 0.84 | 70.22 | 4.88 | 6.08 | 68.96 |
| 65-69 | 0.48 | 0.86 | 67.16 | 4.96 | 5.84 | 65.89 |
| 70-79 | 0.44 | 0.84 | 60.67 | 4.90 | 5.77 | 59.18 |
| 80+ | 0.38 | 0.80 | 63.85 | 4.21 | 5.19 | 62.59 |
| 2010 | | | | | | |
| 20-24 | 0.29 | 0.79 | 79.21 | 25.13 | 26.81 | 61.59 |
| 25-29 | 0.31 | 0.76 | 44.34 | 0.44 | 0.83 | 44.06 |
| 30-34 | 0.39 | 0.79 | 54.32 | 0.88 | 1.61 | 53.79 |
| 35-39 | 0.37 | 0.76 | 56.60 | 1.43 | 2.38 | 55.77 |
| 40-44 | 0.46 | 0.80 | 64.86 | 2.56 | 3.55 | 63.73 |
| 45-49 | 0.49 | 0.82 | 67.35 | 3.50 | 4.56 | 66.06 |
| 50-54 | 0.49 | 0.83 | 67.68 | 4.13 | 5.27 | 66.22 |
| 55-59 | 0.53 | 0.85 | 69.34 | 4.62 | 5.91 | 67.90 |
| 60-64 | 0.58 | 0.88 | 68.82 | 5.00 | 6.13 | 67.32 |
| 65-69 | 0.56 | 0.89 | 65.46 | 4.86 | 5.68 | 63.81 |
| 70-79 | 0.49 | 0.86 | 59.70 | 4.78 | 5.55 | 57.91 |
| 80+ | 0.43 | 0.82 | 62.72 | 4.12 | 4.87 | 61.37 |
| 2011 | | | | | | |
| 20-24 | 0.27 | 0.78 | 80.69 | 24.55 | 25.59 | 58.12 |
| 25-29 | 0.25 | 0.73 | 45.49 | 0.43 | 0.95 | 45.15 |
| 30-34 | 0.31 | 0.74 | 56.16 | 0.88 | 1.70 | 55.58 |
| 35-39 | 0.32 | 0.72 | 59.45 | 1.50 | 2.57 | 58.55 |
| 40-44 | 0.38 | 0.75 | 67.34 | 2.51 | 3.47 | 66.11 |
| 45-49 | 0.45 | 0.79 | 69.77 | 3.54 | 4.57 | 68.23 |
| 50-54 | 0.45 | 0.78 | 70.33 | 4.35 | 5.48 | 68.62 |
| 55-59 | 0.58 | 0.84 | 73.39 | 4.87 | 6.21 | 71.77 |
| 60-64 | 0.55 | 0.83 | 73.87 | 5.15 | 6.36 | 72.19 |
| 65-69 | 0.47 | 0.81 | 74.76 | 5.17 | 6.13 | 73.12 |
| 70-79 | 0.44 | 0.79 | 72.32 | 4.99 | 5.96 | 70.67 |
| 80+ | 0.37 | 0.74 | 73.78 | 4.35 | 5.36 | 72.58 |

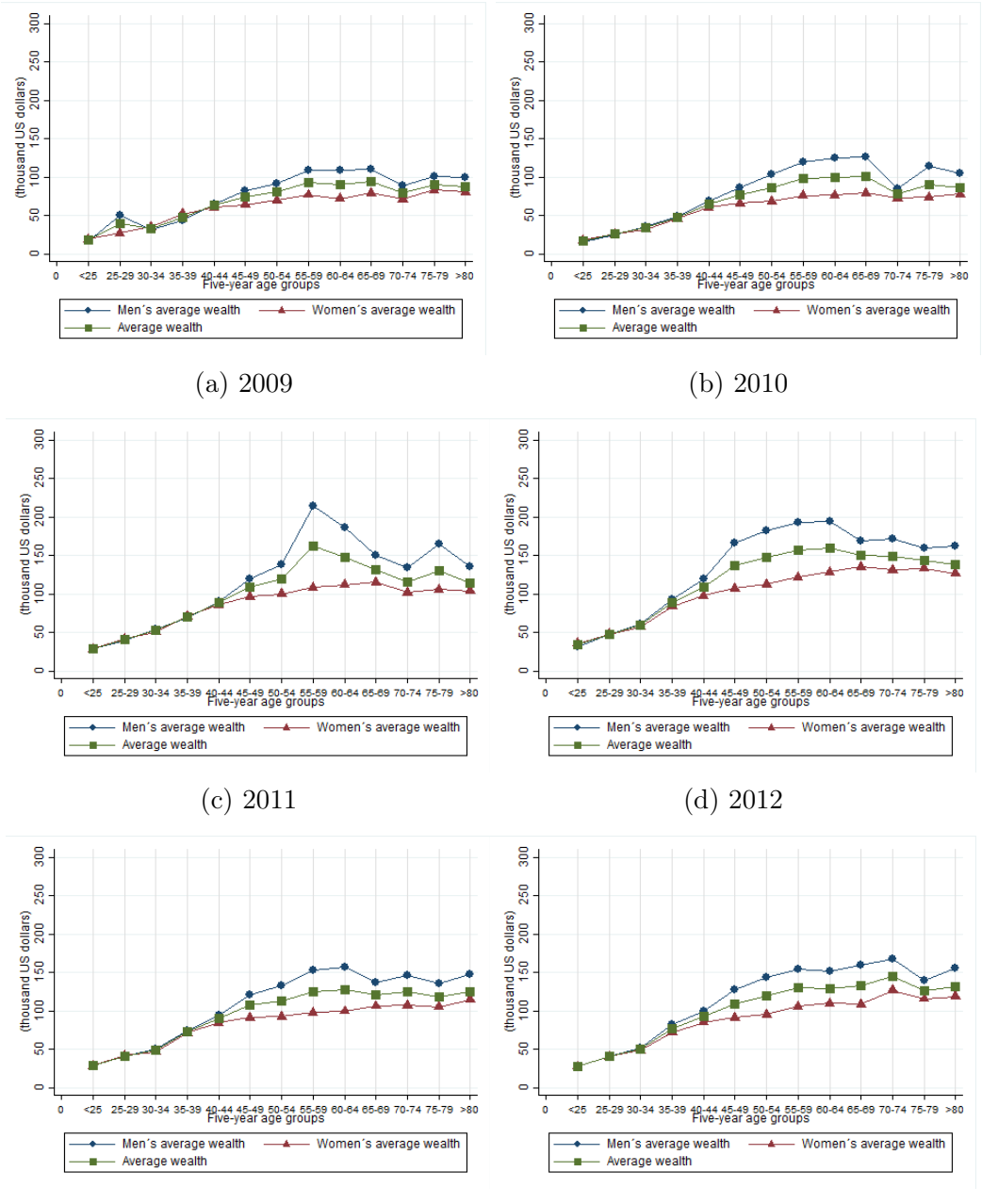
Notes: The first column depicts the Gini index for total wealth. The remaining columns depict % of wealth ownership by type of wealth.

Table A.16: Wealth inequality and wealth ownership (in %) by age groups, 2012-2014.

| Age groups | Gini index | Total wealth | Businsess wealth | Finanacial wealth | Real estate wealth | Capital gains |
|---|---|---|---|---|---|---|
| 2012 | | | | | | |
| 20-24 | 0.22 | 0.75 | 47.79 | 0.46 | 0.85 | 47.46 |
| 25-29 | 0.21 | 0.70 | 58.20 | 0.89 | 1.58 | 57.57 |
| 30-34 | 0.27 | 0.72 | 60.63 | 1.48 | 2.39 | 59.65 |
| 35-39 | 0.32 | 0.71 | 68.77 | 2.51 | 3.20 | 67.42 |
| 40-44 | 0.36 | 0.73 | 71.02 | 3.70 | 4.32 | 69.30 |
| 45-49 | 0.44 | 0.78 | 71.95 | 4.64 | 5.33 | 69.97 |
| 50-54 | 0.46 | 0.77 | 75.04 | 4.99 | 6.01 | 73.22 |
| 55-59 | 0.47 | 0.79 | 75.48 | 5.32 | 6.37 | 73.57 |
| 60-64 | 0.49 | 0.80 | 75.50 | 5.23 | 6.13 | 73.73 |
| 65-69 | 0.44 | 0.79 | 74.07 | 5.15 | 5.95 | 72.32 |
| 70-79 | 0.42 | 0.76 | 76.04 | 4.55 | 5.33 | 74.84 |
| 80+ | 0.34 | 0.72 | 76.60 | 4.74 | 5.53 | 75.74 |
| 2013 | | | | | | |
| 20-24 | 0.14 | 0.71 | 92.76 | 70.88 | 71.39 | 69.72 |
| 25-29 | 0.18 | 0.68 | 48.67 | 0.27 | 0.65 | 48.42 |
| 30-34 | 0.22 | 0.69 | 58.56 | 0.70 | 1.31 | 58.05 |
| 35-39 | 0.27 | 0.67 | 60.64 | 1.08 | 1.94 | 59.75 |
| 40-44 | 0.34 | 0.70 | 68.87 | 1.76 | 2.40 | 67.72 |
| 45-49 | 0.41 | 0.74 | 71.38 | 2.45 | 3.06 | 69.97 |
| 50-54 | 0.41 | 0.72 | 71.74 | 3.23 | 3.91 | 70.09 |
| 55-59 | 0.46 | 0.75 | 76.42 | 3.48 | 4.47 | 74.78 |
| 60-64 | 0.49 | 0.77 | 76.98 | 3.77 | 4.76 | 75.29 |
| 65-69 | 0.41 | 0.76 | 76.49 | 4.05 | 4.94 | 74.63 |
| 70-79 | 0.38 | 0.74 | 74.13 | 4.24 | 4.88 | 72.29 |
| 80+ | 0.34 | 0.70 | 76.15 | 4.17 | 4.81 | 74.60 |
| 2014 | | | | | | |
| 20-24 | 0.14 | 0.71 | 92.12 | 73.56 | 73.95 | 73.69 |
| 25-29 | 0.17 | 0.67 | 47.57 | 0.28 | 0.90 | 47.25 |
| 30-34 | 0.24 | 0.70 | 57.81 | 0.67 | 1.63 | 57.22 |
| 35-39 | 0.30 | 0.69 | 60.05 | 1.16 | 2.36 | 59.12 |
| 40-44 | 0.35 | 0.71 | 68.49 | 1.80 | 2.99 | 67.61 |
| 45-49 | 0.41 | 0.75 | 70.83 | 2.64 | 3.88 | 69.84 |
| 50-54 | 0.42 | 0.73 | 71.23 | 3.49 | 4.75 | 70.10 |
| 55-59 | 0.44 | 0.75 | 76.01 | 3.80 | 5.24 | 74.96 |
| 60-64 | 0.46 | 0.77 | 76.91 | 4.09 | 5.54 | 75.83 |
| 65-69 | 0.45 | 0.78 | 77.20 | 4.26 | 5.36 | 76.07 |
| 70-79 | 0.44 | 0.76 | 74.37 | 4.51 | 5.75 | 73.19 |
| 80+ | 0.37 | 0.72 | 75.89 | 4.41 | 5.63 | 74.98 |

Notes: The first column depicts the Gini index for total wealth. The remaining columns depict % of wealth ownership by type of wealth.

Figure A.4: Average wealth by sex and age, 2009-2014.




(a) 2009

(b) 2010

(c) 2011

(d) 2012

(e) 2013

(f) 2016

Notes: Wealth averages for five-year age groups and sex. Individuals over 20 years old. Exchange rates to US dollars taken June 30$^{th}$ of each year (data from National Institute of Statistics).

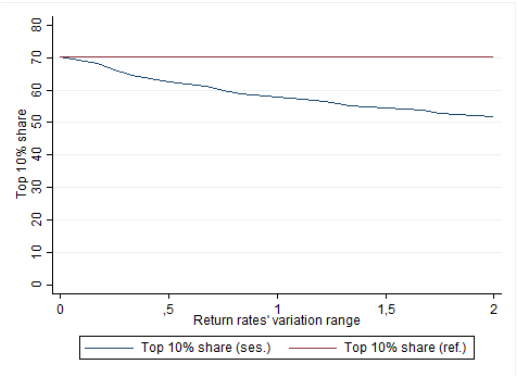
# B Appendix: Sensitivity analysis

## B.1 Wealth correlated returns' sensitivity analysis

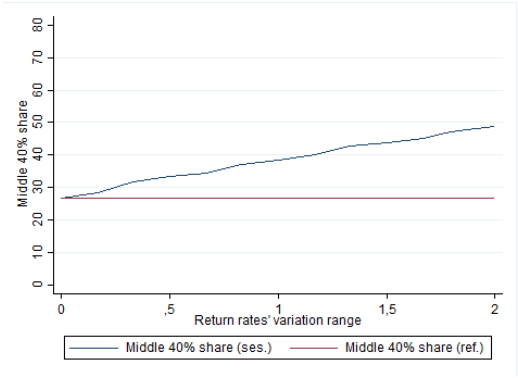
One of the most important drawbacks of the capitalization method refers to the assumption that rates of return -for each type of wealth- are identical for every individual. As explained in section 2.2, this may not be the case since identical individuals in terms of observable characteristics may face different rates of return (idiosyncratic returns), or rates of return may be positively correlated with wealth. The first one is probably not very important since the effects of idiosyncratic returns are likely to cancel out, but the second one may be more serious.

In Saez and Zucman (2016), this assumption is tested based on data on *Foundations*, for which both wealth and capital income flows are observable, concluding that the capitalization method "works well", at least in that context. In this study a different approach is used to put to test this key assumption. To assess the impact of identical rates of return assumption, a simple sensitivity tests is performed. Increasing rates of return are computed for the bottom 50%, the middle 40%, the top 10% (excluding the wealthiest 1%) and for the top 1%. The rates are computed such that aggregate wealth, remains the same. In Figures B.1 to B.6, the results of this exercise are presented, showing ever increasing differences in rates of return of the bottom 50% and the top 1%. As expected, results show that, if rates are actually correlated with wealth, then top shares are overestimated, and this problem is more serious the greater the distance. With over 2 percentage points distance between poor and the very rich, the overestimation in this very simple exercise can be up to 15%.

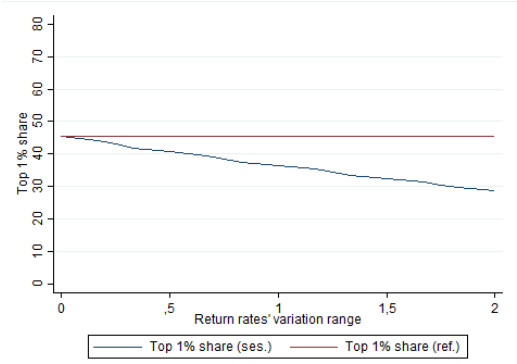
Figure B.1: Wealth correlated returns' sensitivity analysis, 2009.



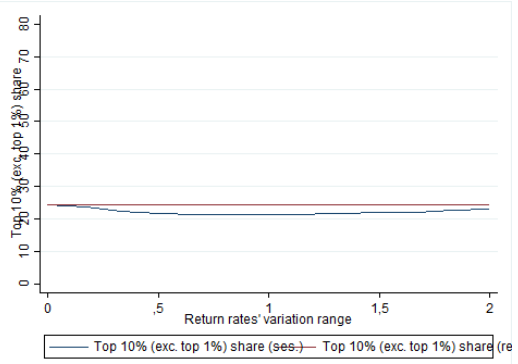

(a) Top 10% share's 95% confidence interval



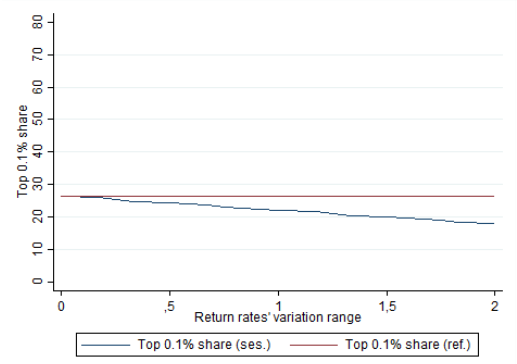

(b) Middle 40% share's 95% confidence interval



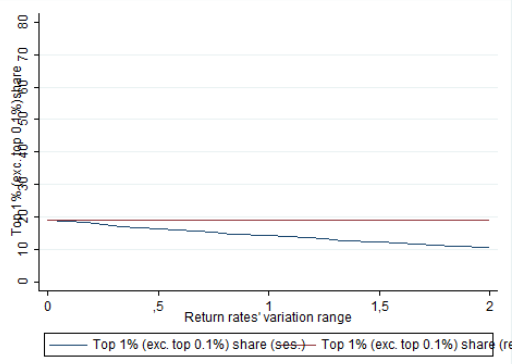

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval



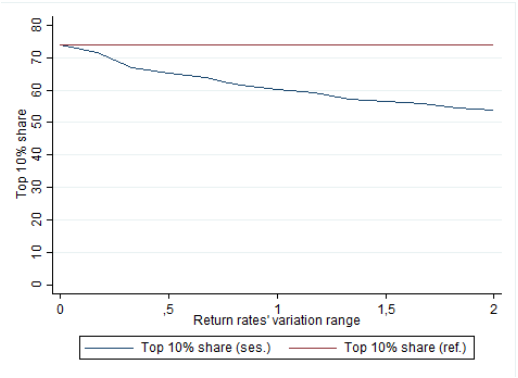

(e) Top 0.1% share's 95% confidence interval



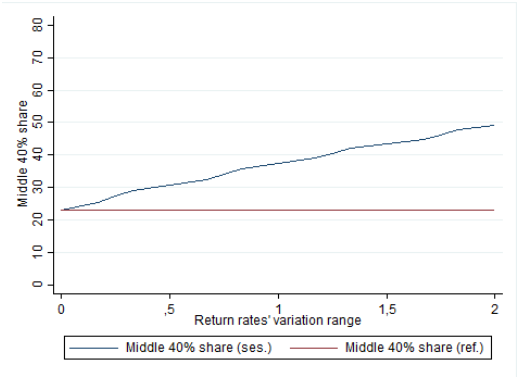

(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Source: Table B.17.
Notes: The x-axis column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are increasing for with capital incomes share, i.e. increasing shares for bottom 50%, middle 40%, top 10% (exc. top 1%) and top 1%. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest groups.

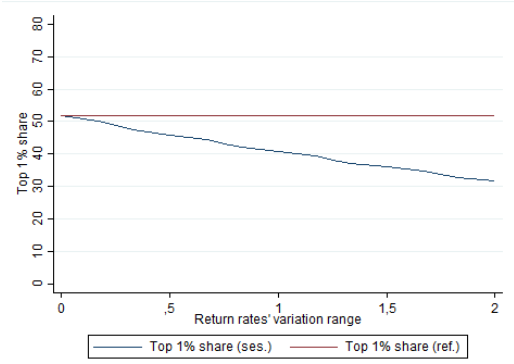
Figure B.2: Wealth correlated returns' sensitivity analysis, 2010.



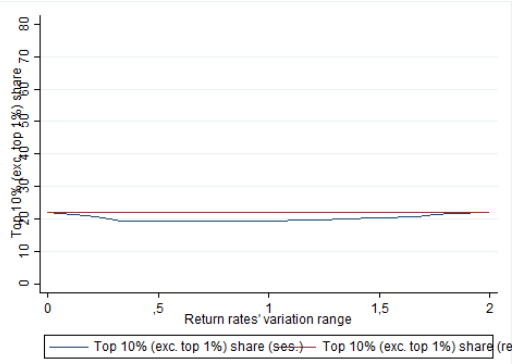

(a) Top 10% share's 95% confidence interval



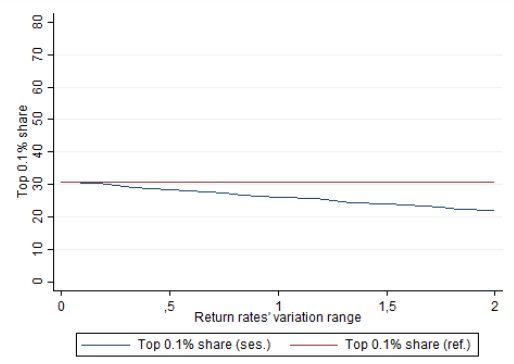

(b) Middle 40% share's 95% confidence interval



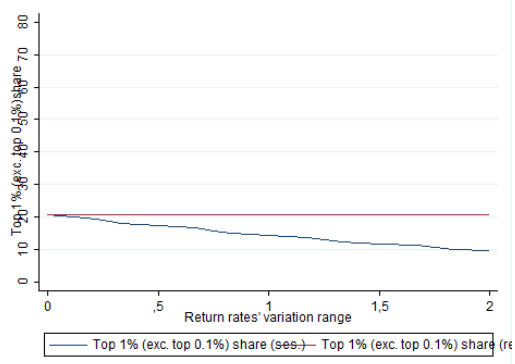

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval



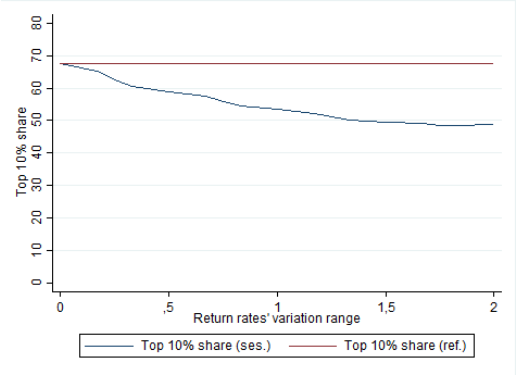

(e) Top 0.1% share's 95% confidence interval



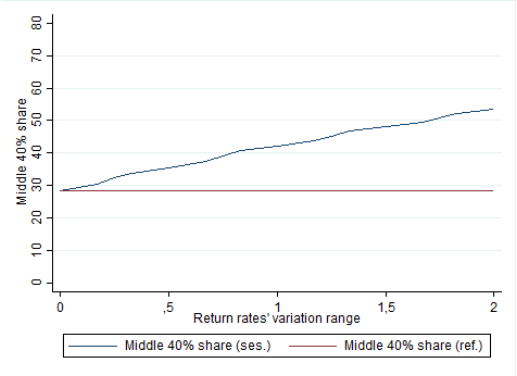

(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Source: Table B.18.
Notes: The x-axis column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are increasing for with capital incomes share, i.e. increasing shares for bottom 50%, middle 40%, top 10% (exc. top 1%) and top 1%. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest groups.

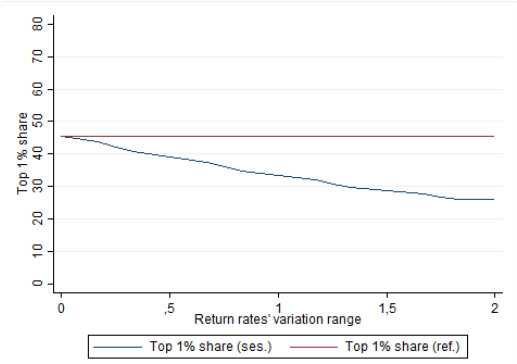
Figure B.3: Wealth correlated returns' sensitivity analysis, 2011.



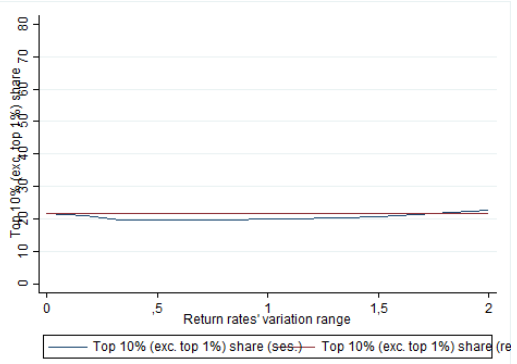

(a) Top 10% share's 95% confidence interval



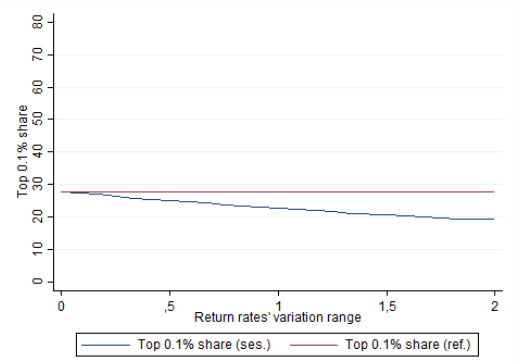

(b) Middle 40% share's 95% confidence interval



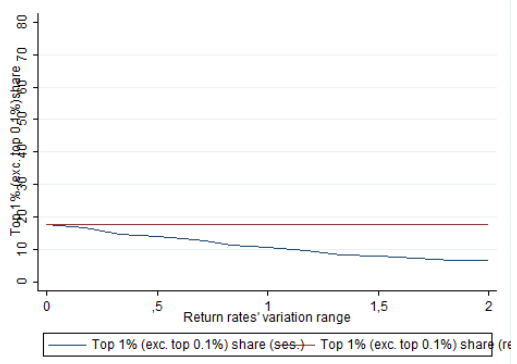

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval




(e) Top 0.1% share's 95% confidence interval

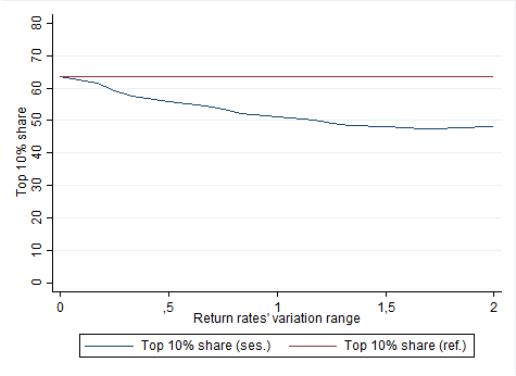



(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

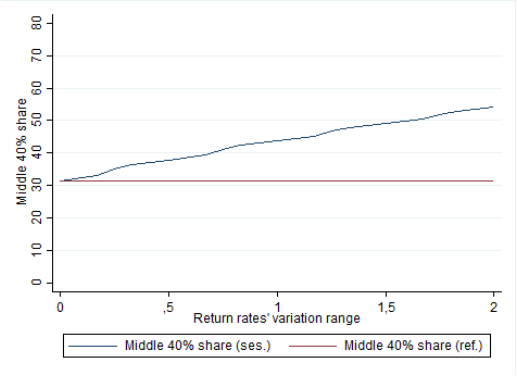
Source: Table B.19.

Notes: The x-axis column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are increasing for with capital incomes share, i.e. increasing shares for bottom 50%, middle 40%, top 10% (exc. top 1%) and top 1%. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest groups.

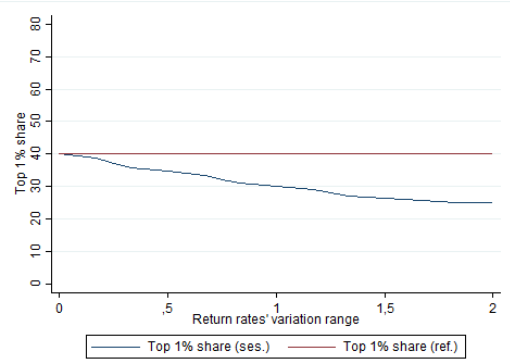
Figure B.4: Wealth correlated returns' sensitivity analysis, 2012.



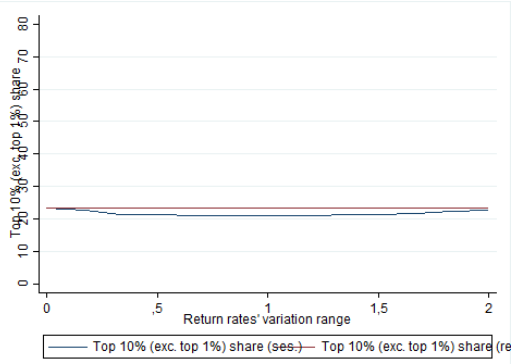

(a) Top 10% share's 95% confidence interval



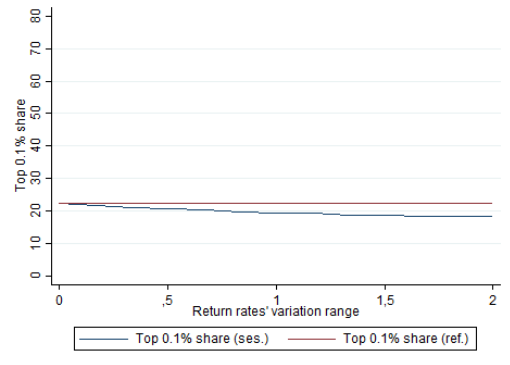

(b) Middle 40% share's 95% confidence interval



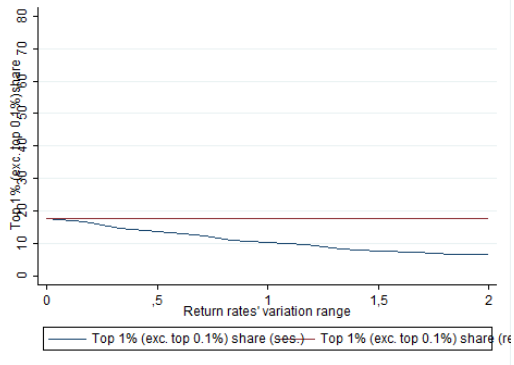

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval




(e) Top 0.1% share's 95% confidence interval

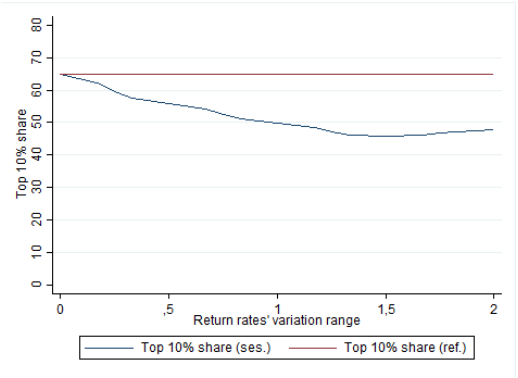



(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

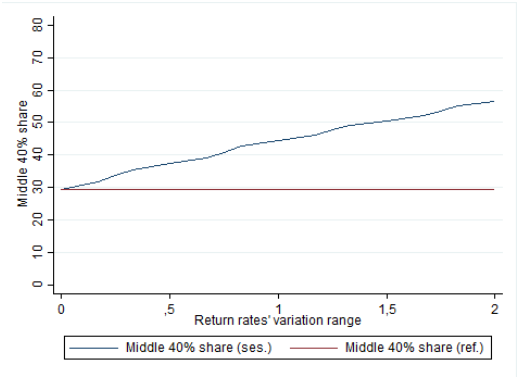
Source: Table B.20.

Notes: The x-axis column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are increasing for with capital incomes share, i.e. increasing shares for bottom 50%, middle 40%, top 10% (exc. top 1%) and top 1%. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest groups.

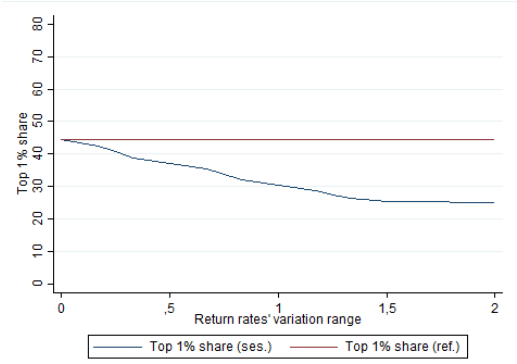
Figure B.5: Wealth correlated returns' sensitivity analysis, 2013.



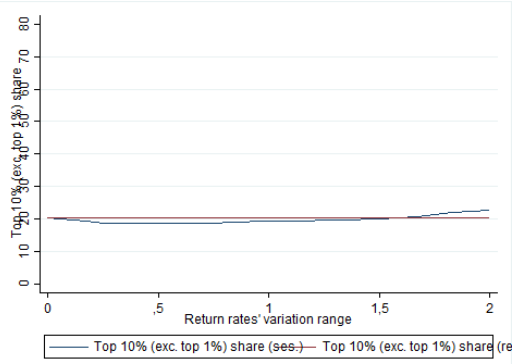

(a) Top 10% share's 95% confidence interval



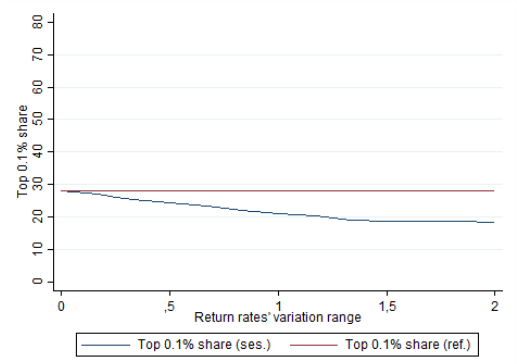

(b) Middle 40% share's 95% confidence interval



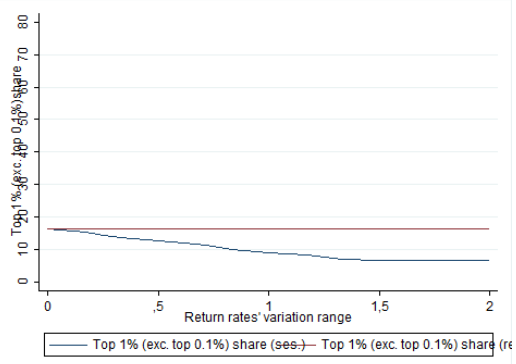

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval




(e) Top 0.1% share's 95% confidence interval

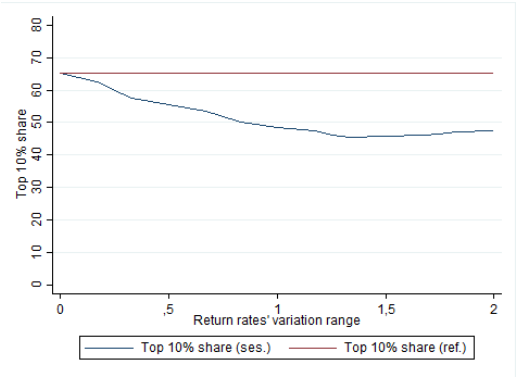



(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

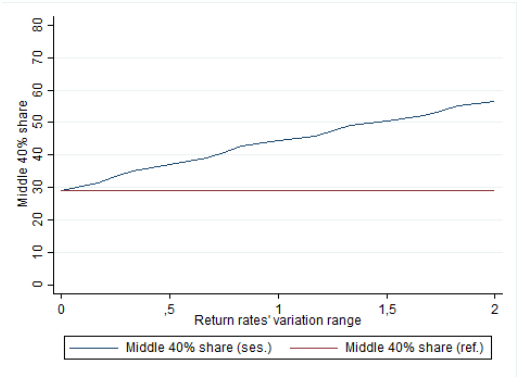
Source: Table B.21.

Notes: The x-axis column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are increasing for with capital incomes share, i.e. increasing shares for bottom 50%, middle 40%, top 10% (exc. top 1%) and top 1%. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest groups.

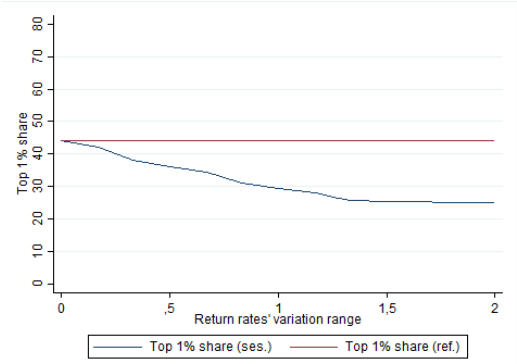
Figure B.6: Wealth correlated returns' sensitivity analysis, 2014.



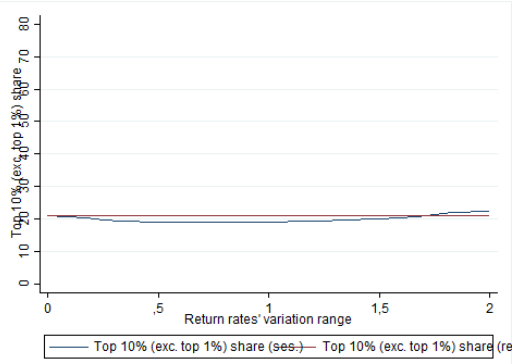

(a) Top 10% share's 95% confidence interval



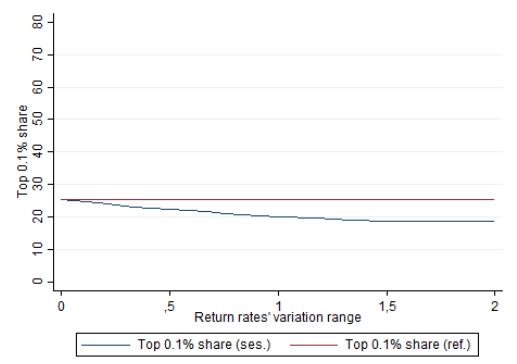

(b) Middle 40% share's 95% confidence interval



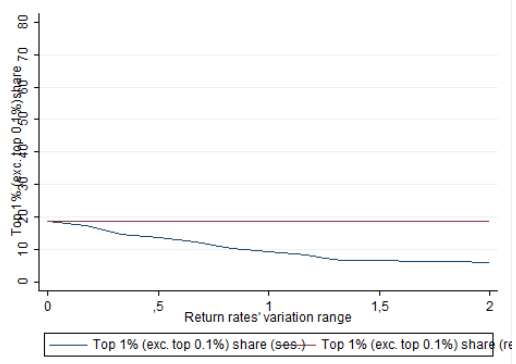

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval




(e) Top 0.1% share's 95% confidence interval




(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Source: Table B.22.

Notes: The x-axis column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are increasing for with capital incomes share, i.e. increasing shares for bottom 50%, middle 40%, top 10% (exc. top 1%) and top 1%. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest groups.

Table B.17: Wealth correlated returns' sensitivity analysis, 2009.

| Rates variation | Top 0.1% | Top 1% (exc. top 0.1%) | Top 1% | Top 10% (exc. top 1%) | Top 10% | Middle 40% | Bottom 50% |
|---|---|---|---|---|---|---|---|
| Ref. estimation | 26.54 | 19.06 | 45.60 | 24.57 | 70.18 | 26.80 | 3.02 |
| ±0.17% | 25.97 | 18.34 | 44.31 | 23.90 | 68.21 | 28.50 | 3.29 |
| ±0.25% | 25.41 | 17.66 | 43.07 | 23.22 | 66.29 | 30.16 | 3.55 |
| ±0.33% | 24.89 | 16.99 | 41.88 | 22.54 | 64.41 | 31.77 | 3.81 |
| ±0.5% | 24.30 | 16.44 | 40.74 | 21.84 | 62.57 | 33.35 | 4.07 |
| ±0.67% | 23.75 | 15.87 | 39.62 | 21.42 | 61.04 | 34.62 | 4.33 |
| ±0.75% | 23.21 | 15.32 | 38.53 | 21.34 | 59.88 | 35.83 | 4.29 |
| ±0.83% | 22.68 | 14.80 | 37.47 | 21.35 | 58.82 | 37.25 | 3.93 |
| ±1% | 22.15 | 14.28 | 36.43 | 21.42 | 57.85 | 38.62 | 3.53 |
| ±1.17% | 21.62 | 13.78 | 35.40 | 21.52 | 56.92 | 39.99 | 3.09 |
| ±1.25% | 21.10 | 13.30 | 34.40 | 21.63 | 56.03 | 41.33 | 2.63 |
| ±1.33% | 20.59 | 12.82 | 33.41 | 21.78 | 55.19 | 42.66 | 2.16 |
| ±1.5% | 20.08 | 12.37 | 32.45 | 21.95 | 54.40 | 43.95 | 1.66 |
| ±1.67% | 19.58 | 11.92 | 31.50 | 22.17 | 53.67 | 45.19 | 1.13 |
| ±1.75% | 19.08 | 11.49 | 30.58 | 22.42 | 52.99 | 46.42 | 0.59 |
| ±1.83% | 18.59 | 11.08 | 29.67 | 22.69 | 52.36 | 47.63 | 0.01 |
| ±2% | 18.10 | 10.68 | 28.78 | 22.98 | 51.76 | 48.82 | -0.59 |

Notes: The first column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are not the same for every individual, but increase linearly. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest individual to the wealthiest. For example, the second row of second column, depicts the top 0.1% share if rates of return were 0.17% lower for the poorest individual and 0.17% higher for the wealthiest, and changing linearly for the individuals in the middle (i.e the only individual with the same rate of return as the reference estimation is the median individual).

Table B.18: Wealth correlated returns' sensitivity analysis, 2010.

| Rates variation | Top 0.1% | Top 1% (exc. top 0.1%) | Top 1% | Top 10% (exc. top 1%) | Top 10% | Middle 40% | Bottom 50% |
|---|---|---|---|---|---|---|---|
| Ref. estimation | 30.95 | 20.78 | 51.73 | 22.13 | 73.87 | 23.25 | 2.89 |
| ±0.17% | 30.34 | 19.87 | 50.21 | 21.22 | 71.43 | 25.33 | 3.23 |
| ±0.25% | 29.73 | 19.01 | 48.74 | 20.34 | 69.08 | 27.34 | 3.58 |
| ±0.33% | 29.13 | 18.20 | 47.32 | 19.56 | 66.88 | 29.19 | 3.92 |
| ±0.5% | 28.53 | 17.41 | 45.95 | 19.35 | 65.29 | 30.68 | 4.03 |
| ±0.67% | 27.94 | 16.66 | 44.60 | 19.29 | 63.88 | 32.45 | 3.67 |
| ±0.75% | 27.36 | 15.92 | 43.28 | 19.30 | 62.58 | 34.16 | 3.26 |
| ±0.83% | 26.78 | 15.20 | 41.99 | 19.36 | 61.35 | 35.84 | 2.81 |
| ±1% | 26.22 | 14.51 | 40.73 | 19.48 | 60.20 | 37.47 | 2.33 |
| ±1.17% | 25.66 | 13.83 | 39.49 | 19.66 | 59.15 | 39.04 | 1.81 |
| ±1.25% | 25.11 | 13.18 | 38.29 | 19.90 | 58.19 | 40.55 | 1.26 |
| ±1.33% | 24.57 | 12.54 | 37.11 | 20.20 | 57.31 | 42.03 | 0.66 |
| ±1.5% | 24.05 | 11.93 | 35.97 | 20.52 | 56.50 | 43.49 | 0.02 |
| ±1.67% | 23.53 | 11.34 | 34.87 | 20.89 | 55.76 | 44.91 | -0.66 |
| ±1.75% | 23.03 | 10.77 | 33.80 | 21.29 | 55.09 | 46.30 | -1.39 |
| ±1.83% | 22.54 | 10.24 | 32.78 | 21.72 | 54.50 | 47.66 | -2.16 |
| ±2% | 22.06 | 9.74 | 31.80 | 22.19 | 53.99 | 48.99 | -2.99 |

Notes: The first column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are not the same for every individual, but increase linearly. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest individual to the wealthiest. For example, the second row of second column, depicts the top 0.1% share if rates of return were 0.17% lower for the poorest individual and 0.17% higher for the wealthiest, and changing linearly for the individuals in the middle (i.e the only individual with the same rate of return as the reference estimation is the median individual).

Table B.19: Wealth correlated returns' sensitivity analysis, 2011.

| Rates variation | Top 0.1% | Top 1% (exc. top 0.1%) | Top 1% | Top 10% (exc. top 1%) | Top 10% | Middle 40% | Bottom 50% |
|---|---|---|---|---|---|---|---|
| Ref. estimation | 27.72 | 17.83 | 45.54 | 21.93 | 67.48 | 28.29 | 4.23 |
| ±0.17% | 27.05 | 16.82 | 43.87 | 21.15 | 65.02 | 30.33 | 4.65 |
| ±0.25% | 26.40 | 15.86 | 42.25 | 20.37 | 62.63 | 32.31 | 5.06 |
| ±0.33% | 25.76 | 14.92 | 40.68 | 19.94 | 60.61 | 33.91 | 5.48 |
| ±0.5% | 25.12 | 14.01 | 39.13 | 19.83 | 58.97 | 35.61 | 5.43 |
| ±0.67% | 24.51 | 13.13 | 37.63 | 19.78 | 57.41 | 37.38 | 5.21 |
| ±0.75% | 23.90 | 12.27 | 36.17 | 19.79 | 55.96 | 39.08 | 4.96 |
| ±0.83% | 23.31 | 11.44 | 34.75 | 19.85 | 54.60 | 40.73 | 4.66 |
| ±1% | 22.74 | 10.65 | 33.39 | 19.96 | 53.36 | 42.31 | 4.33 |
| ±1.17% | 22.19 | 9.90 | 32.09 | 20.13 | 52.22 | 43.83 | 3.95 |
| ±1.25% | 21.66 | 9.21 | 30.88 | 20.33 | 51.20 | 45.31 | 3.49 |
| ±1.33% | 21.16 | 8.58 | 29.74 | 20.58 | 50.32 | 46.74 | 2.94 |
| ±1.5% | 20.69 | 7.99 | 28.68 | 20.92 | 49.60 | 48.14 | 2.26 |
| ±1.67% | 20.27 | 7.46 | 27.72 | 21.31 | 49.04 | 49.51 | 1.46 |
| ±1.75% | 19.88 | 7.01 | 26.90 | 21.72 | 48.62 | 50.86 | 0.52 |
| ±1.83% | 19.55 | 6.71 | 26.27 | 22.18 | 48.44 | 52.13 | -0.57 |
| ±2% | 19.42 | 6.60 | 26.03 | 22.73 | 48.76 | 53.45 | -2.21 |

Notes: The first column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are not the same for every individual, but increase linearly. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest individual to the wealthiest. For example, the second row of second column, depicts the top 0.1% share if rates of return were 0.17% lower for the poorest individual and 0.17% higher for the wealthiest, and changing linearly for the individuals in the middle (i.e the only individual with the same rate of return as the reference estimation is the median individual).

Table B.20: Wealth correlated returns' sensitivity analysis, 2012.

| Rates variation | Top 0.1% | Top 1% (exc. top 0.1%) | Top 1% | Top 10% (exc. top 1%) | Top 10% | Middle 40% | Bottom 50% |
|---|---|---|---|---|---|---|---|
| Ref. estimation | 22.29 | 17.79 | 40.08 | 23.55 | 63.63 | 31.41 | 4.95 |
| ±0.17% | 21.91 | 16.75 | 38.66 | 22.78 | 61.44 | 33.22 | 5.34 |
| ±0.25% | 21.53 | 15.75 | 37.28 | 21.99 | 59.27 | 35.00 | 5.73 |
| ±0.33% | 21.17 | 14.78 | 35.95 | 21.49 | 57.43 | 36.45 | 6.12 |
| ±0.5% | 20.82 | 13.83 | 34.65 | 21.34 | 55.99 | 37.90 | 6.12 |
| ±0.67% | 20.48 | 12.92 | 33.40 | 21.23 | 54.64 | 39.49 | 5.87 |
| ±0.75% | 20.16 | 12.04 | 32.20 | 21.20 | 53.40 | 40.99 | 5.60 |
| ±0.83% | 19.86 | 11.20 | 31.06 | 21.18 | 52.24 | 42.48 | 5.29 |
| ±1% | 19.57 | 10.41 | 29.98 | 21.17 | 51.15 | 43.92 | 4.93 |
| ±1.17% | 19.31 | 9.67 | 28.97 | 21.20 | 50.17 | 45.31 | 4.51 |
| ±1.25% | 19.07 | 8.98 | 28.05 | 21.27 | 49.32 | 46.67 | 4.01 |
| ±1.33% | 18.86 | 8.35 | 27.20 | 21.40 | 48.61 | 47.99 | 3.41 |
| ±1.5% | 18.69 | 7.78 | 26.46 | 21.58 | 48.04 | 49.29 | 2.67 |
| ±1.67% | 18.56 | 7.28 | 25.84 | 21.79 | 47.63 | 50.58 | 1.78 |
| ±1.75% | 18.47 | 6.94 | 25.41 | 22.04 | 47.45 | 51.78 | 0.77 |
| ±1.83% | 18.44 | 6.80 | 25.24 | 22.43 | 47.67 | 52.95 | -0.62 |
| ±2% | 18.42 | 6.74 | 25.16 | 22.87 | 48.04 | 54.21 | -2.25 |

Notes: The first column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are not the same for every individual, but increase linearly. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest individual to the wealthiest. For example, the second row of second column, depicts the top 0.1% share if rates of return were 0.17% lower for the poorest individual and 0.17% higher for the wealthiest, and changing linearly for the individuals in the middle (i.e the only individual with the same rate of return as the reference estimation is the median individual).

Table B.21: Wealth correlated returns' sensitivity analysis, 2013.

| Rates variation | Top 0.1% | Top 1% (exc. top 0.1%) | Top 1% | Top 10% (exc. top 1%) | Top 10% | Middle 40% | Bottom 50% |
|---|---|---|---|---|---|---|---|
| Ref. estimation | 28.10 | 16.41 | 44.51 | 20.44 | 64.96 | 29.50 | 5.54 |
| ±0.17% | 27.17 | 15.45 | 42.62 | 19.59 | 62.21 | 31.69 | 6.10 |
| ±0.25% | 26.25 | 14.51 | 40.77 | 18.83 | 59.59 | 33.75 | 6.65 |
| ±0.33% | 25.35 | 13.61 | 38.96 | 18.67 | 57.63 | 35.39 | 6.97 |
| ±0.5% | 24.47 | 12.71 | 37.18 | 18.67 | 55.86 | 37.32 | 6.82 |
| ±0.67% | 23.61 | 11.82 | 35.44 | 18.74 | 54.18 | 39.19 | 6.63 |
| ±0.75% | 22.78 | 10.95 | 33.73 | 18.88 | 52.60 | 40.97 | 6.42 |
| ±0.83% | 21.97 | 10.08 | 32.05 | 19.06 | 51.11 | 42.70 | 6.18 |
| ±1% | 21.20 | 9.22 | 30.43 | 19.29 | 49.72 | 44.39 | 5.89 |
| ±1.17% | 20.47 | 8.43 | 28.90 | 19.50 | 48.40 | 46.06 | 5.54 |
| ±1.25% | 19.79 | 7.72 | 27.51 | 19.67 | 47.17 | 47.70 | 5.13 |
| ±1.33% | 19.17 | 7.15 | 26.32 | 19.86 | 46.17 | 49.19 | 4.63 |
| ±1.5% | 18.70 | 6.82 | 25.52 | 20.23 | 45.75 | 50.50 | 3.75 |
| ±1.67% | 18.66 | 6.76 | 25.42 | 20.78 | 46.20 | 52.03 | 1.77 |
| ±1.75% | 18.64 | 6.69 | 25.33 | 21.35 | 46.69 | 53.55 | -0.24 |
| ±1.83% | 18.62 | 6.65 | 25.26 | 21.97 | 47.24 | 55.03 | -2.27 |
| ±2% | 18.60 | 6.60 | 25.20 | 22.62 | 47.83 | 56.47 | -4.30 |

Notes: The first column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are not the same for every individual, but increase linearly. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest individual to the wealthiest. For example, the second row of second column, depicts the top 0.1% share if rates of return were 0.17% lower for the poorest individual and 0.17% higher for the wealthiest, and changing linearly for the individuals in the middle (i.e the only individual with the same rate of return as the reference estimation is the median individual).

Table B.22: Wealth correlated returns' sensitivity analysis, 2014.

| Rates variation | Top 0.1% | Top 1% (exc. top 0.1%) | Top 1% | Top 10% (exc. top 1%) | Top 10% | Middle 40% | Bottom 50% |
|---|---|---|---|---|---|---|---|
| Ref. estimation | 25.36 | 18.81 | 44.18 | 21.14 | 65.32 | 29.13 | 5.55 |
| ±0.17% | 24.62 | 17.47 | 42.08 | 20.44 | 62.52 | 31.35 | 6.13 |
| ±0.25% | 23.89 | 16.16 | 40.05 | 19.74 | 59.80 | 33.50 | 6.70 |
| ±0.33% | 23.19 | 14.91 | 38.10 | 19.38 | 57.48 | 35.29 | 7.23 |
| ±0.5% | 22.51 | 13.72 | 36.22 | 19.23 | 55.45 | 37.22 | 7.33 |
| ±0.67% | 21.86 | 12.55 | 34.41 | 19.14 | 53.55 | 39.09 | 7.36 |
| ±0.75% | 21.25 | 11.42 | 32.67 | 19.08 | 51.75 | 40.94 | 7.31 |
| ±0.83% | 20.67 | 10.33 | 31.00 | 19.09 | 50.09 | 42.69 | 7.22 |
| ±1% | 20.15 | 9.30 | 29.45 | 19.17 | 48.61 | 44.36 | 7.03 |
| ±1.17% | 19.69 | 8.34 | 28.03 | 19.32 | 47.35 | 45.96 | 6.69 |
| ±1.25% | 19.31 | 7.48 | 26.79 | 19.52 | 46.31 | 47.54 | 6.15 |
| ±1.33% | 19.01 | 6.83 | 25.84 | 19.77 | 45.62 | 49.02 | 5.36 |
| ±1.5% | 18.90 | 6.59 | 25.49 | 20.24 | 45.73 | 50.50 | 3.77 |
| ±1.67% | 18.87 | 6.49 | 25.35 | 20.79 | 46.15 | 52.06 | 1.80 |
| ±1.75% | 18.83 | 6.40 | 25.23 | 21.37 | 46.61 | 53.59 | -0.19 |
| ±1.83% | 18.80 | 6.31 | 25.12 | 21.98 | 47.09 | 55.10 | -2.19 |
| ±2% | 18.78 | 6.24 | 25.01 | 22.59 | 47.61 | 56.60 | -4.20 |

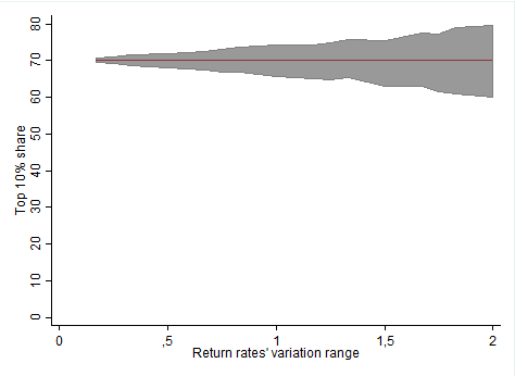
Notes: The first column depicts rates of return' variation ranges in relation to the returned rates used in estimations of Table A.7. In this simulation, rates are not the same for every individual, but increase linearly. In each simulation, rates of return vary from ±0.17% to ±2% intervals from the poorest individual to the wealthiest. For example, the second row of second column, depicts the top 0.1% share if rates of return were 0.17% lower for the poorest individual and 0.17% higher for the wealthiest, and changing linearly for the individuals in the middle (i.e the only individual with the same rate of return as the reference estimation is the median individual).

## B.2 Varying rates of return sensitivity analysis

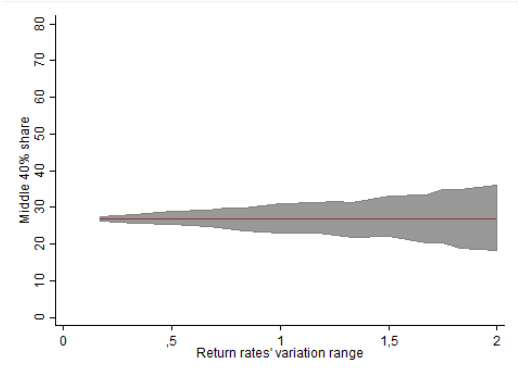
A second sensitivity analysis that may be performed, keeps the rates equal for every individual, but allows them to change altogether. This exercise focuses on assessing the impact of miss-estimation of rates of return rather than the assumption of identical rates across individuals. Results, depicted in Figures B.7 to B.6, show that even if the identical returns rates assumption holds, top share's estimation are very sensitive to the rates of return' used. This is particularly important in this case, since rates of return were calculated without official aggregates to match. Most of the change in estimations when rates are changed is located in the very top of the distribution, so it should be bared in mind that this shares are indeed highly sensitive to the rates of return employed of the estimation of wealth. But what this exercise reveals is that it is of the utmost importance to compare the distributional results estimations with other data

sources and empirical approaches, in order to assess if the estimations are indeed consistent, as done in section 5.

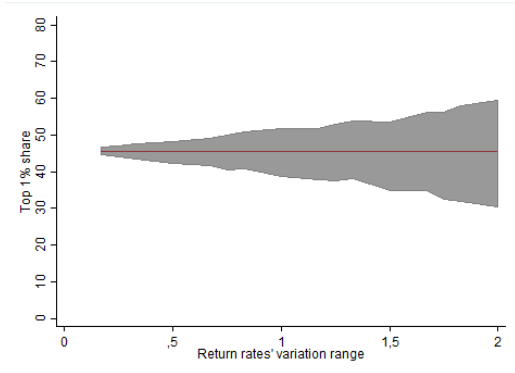
Figure B.7: Varying rates of return sensitivity analysis, 2009.



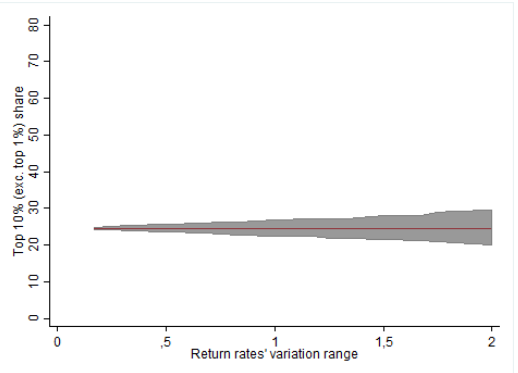

(a) Top 10% share's 95% confidence interval



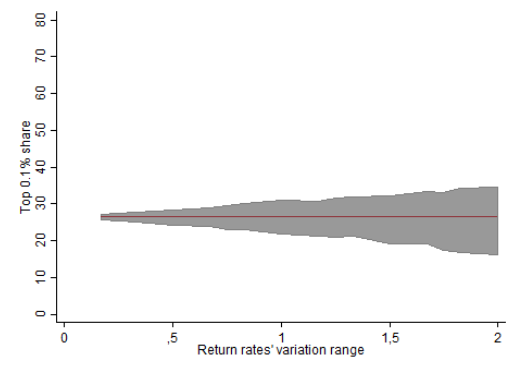

(b) Middle 40% share's 95% confidence interval



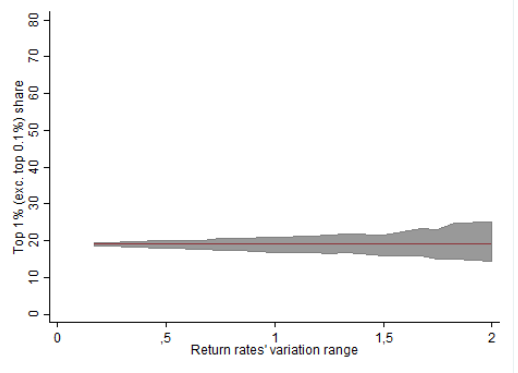

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval



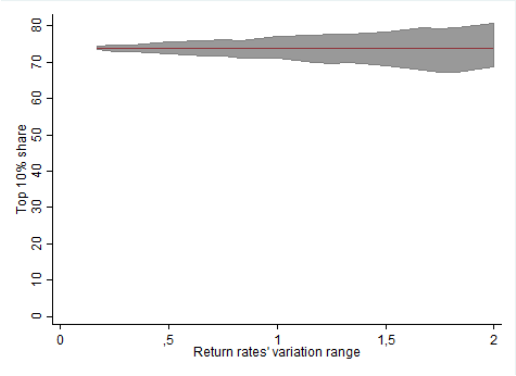

(e) Top 0.1% share's 95% confidence interval



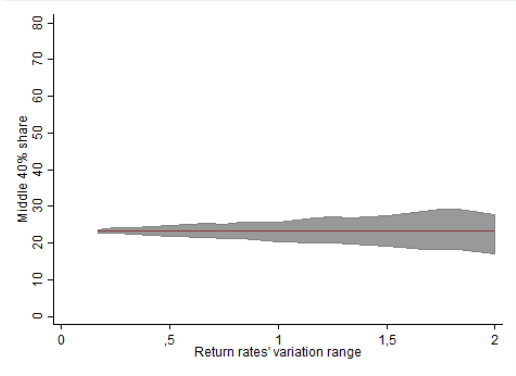

(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Notes: One hundred draws were used for the bootstrapped confidence interval estimation in each variation range. For example, the last confidence interval reflects reflects the wealth shares if rates varied in a range of ±2% with respect to the rates used for the estimations of Table A.7.

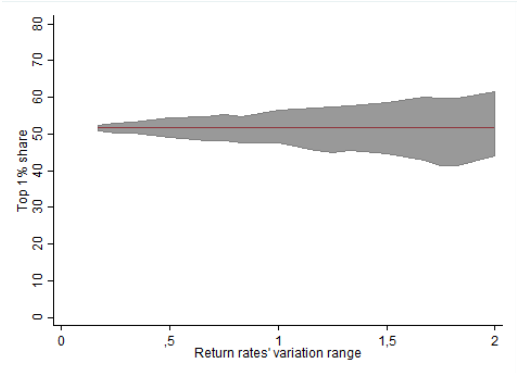
Figure B.8: Varying rates of return sensitivity analysis, 2010.



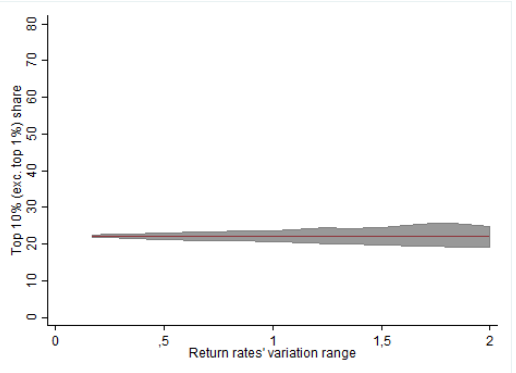

(a) Top 10% share's 95% confidence interval



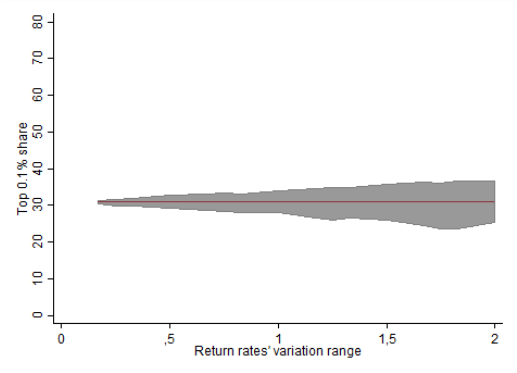

(b) Middle 40% share's 95% confidence interval



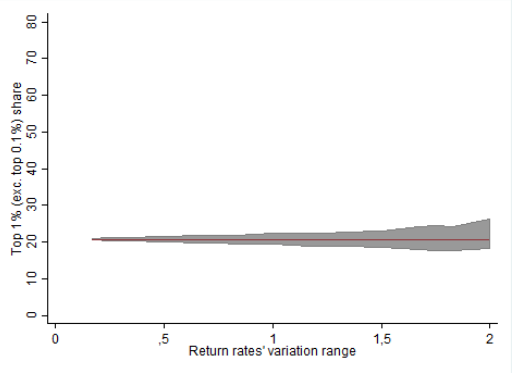

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval



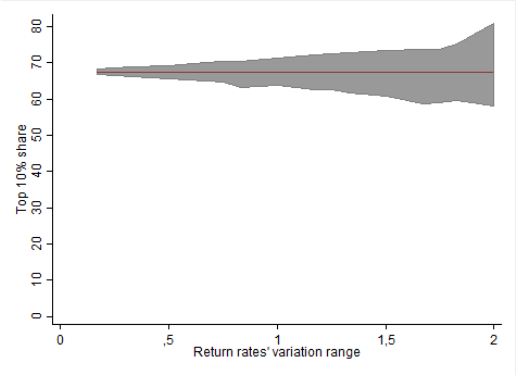

(e) Top 0.1% share's 95% confidence interval



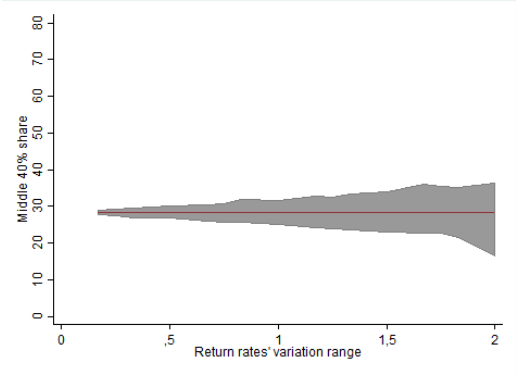

(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Notes: One hundred draws were used for the bootstrapped confidence interval estimation in each variation range. For example, the last confidence interval reflects reflects the wealth shares if rates varied in a range of ±2% with respect to the rates used for the estimations of Table A.7.

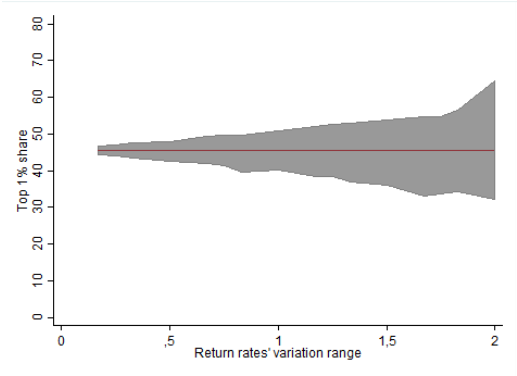
Figure B.9: Varying rates of return sensitivity analysis, 2011.



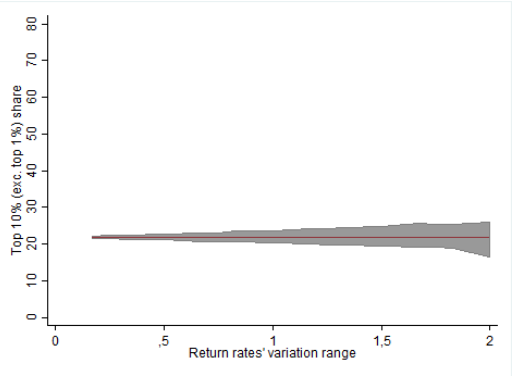

(a) Top 10% share's 95% confidence interval



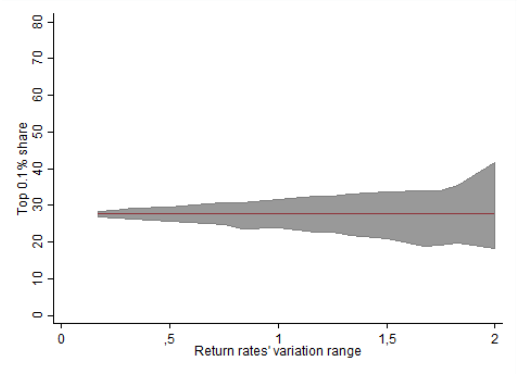

(b) Middle 40% share's 95% confidence interval



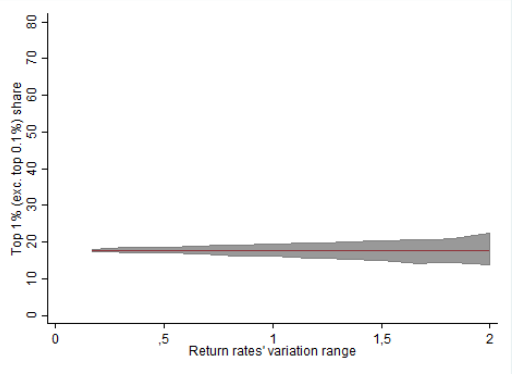

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval



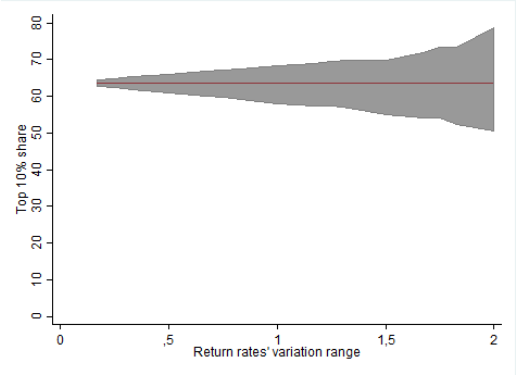

(e) Top 0.1% share's 95% confidence interval



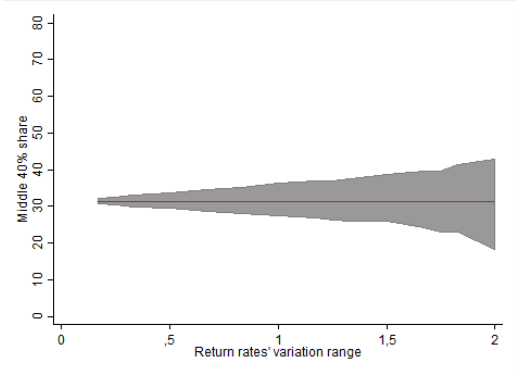

(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Notes: One hundred draws were used for the bootstrapped confidence interval estimation in each variation range. For example, the last confidence interval reflects reflects the wealth shares if rates varied in a range of ±2% with respect to the rates used for the estimations of Table A.7.

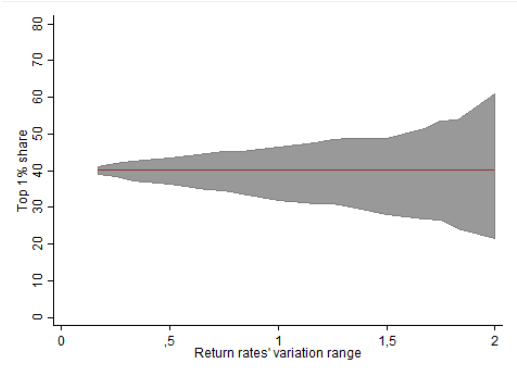
Figure B.10: Varying rates of return sensitivity analysis, 2012.



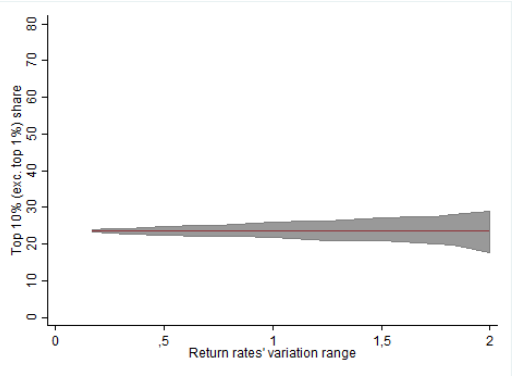

(a) Top 10% share's 95% confidence interval



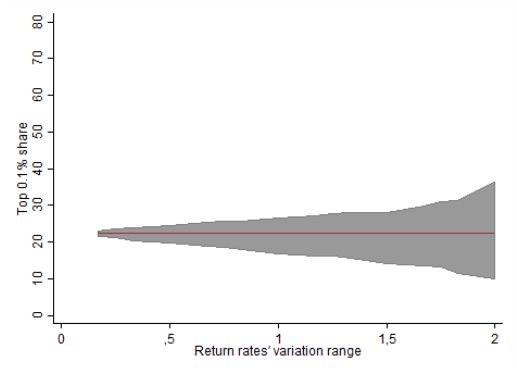

(b) Middle 40% share's 95% confidence interval



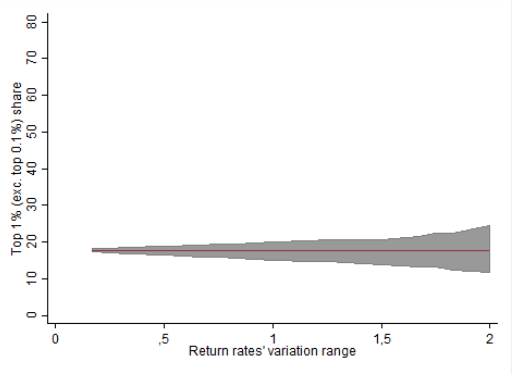

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval



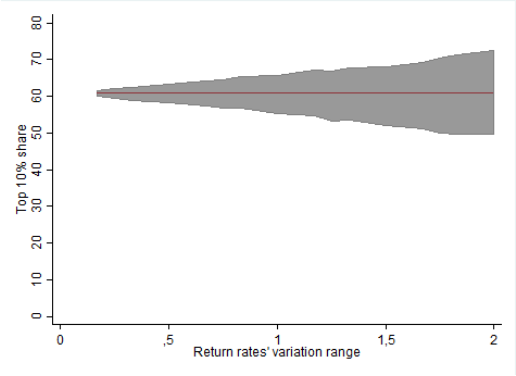

(e) Top 0.1% share's 95% confidence interval



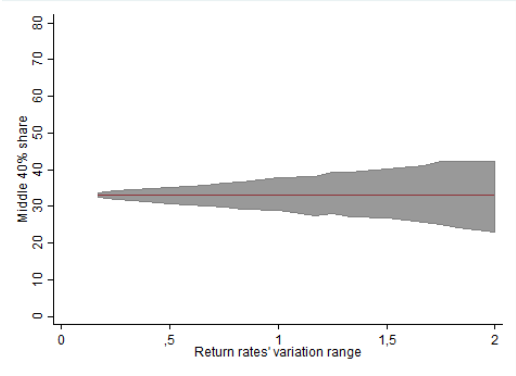

(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Notes: One hundred draws were used for the bootstrapped confidence interval estimation in each variation range. For example, the last confidence interval reflects reflects the wealth shares if rates varied in a range of ±2% with respect to the rates used for the estimations of Table A.7.

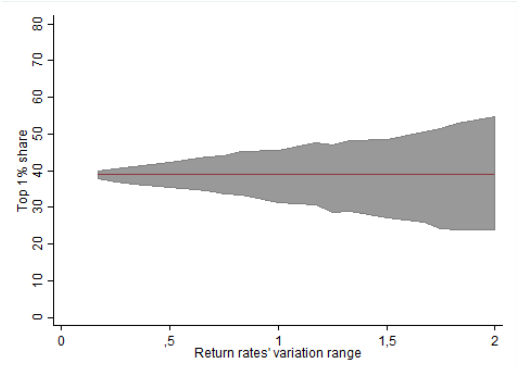
Figure B.11: Varying rates of return sensitivity analysis, 2013.



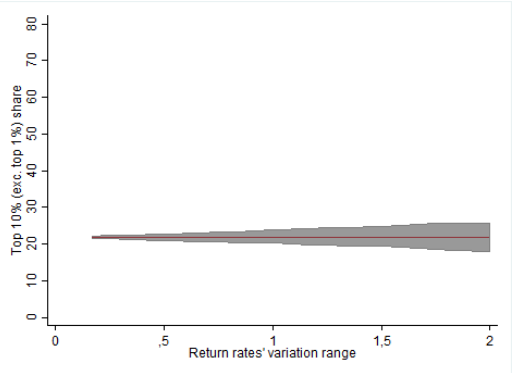

(a) Top 10% share's 95% confidence interval



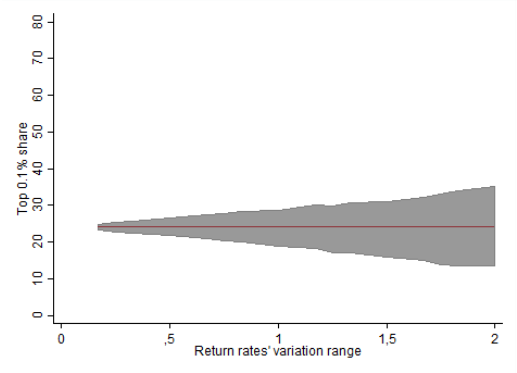

(b) Middle 40% share's 95% confidence interval



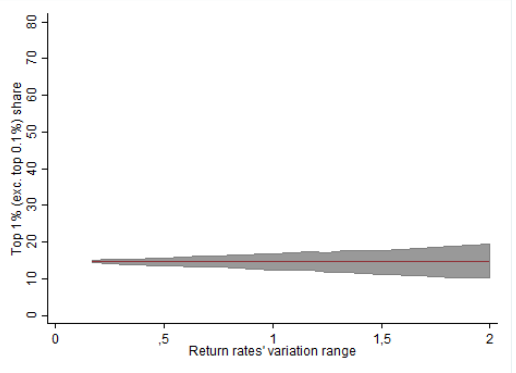

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval



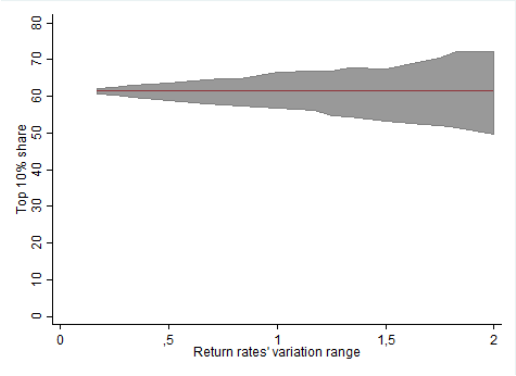

(e) Top 0.1% share's 95% confidence interval



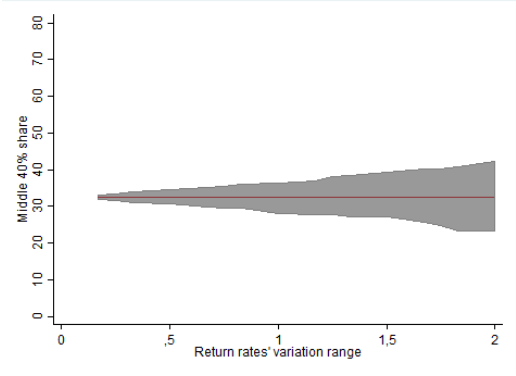

(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Notes: One hundred draws were used for the bootstrapped confidence interval estimation in each variation range. For example, the last confidence interval reflects reflects the wealth shares if rates varied in a range of ±2% with respect to the rates used for the estimations of Table A.7.

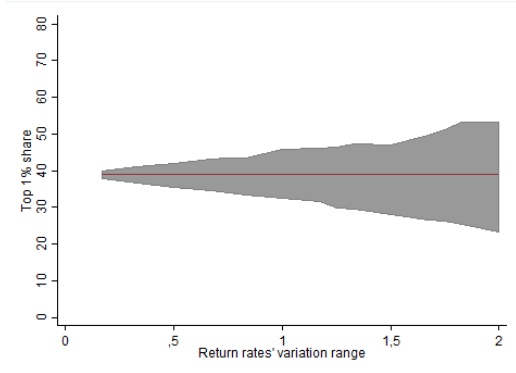
Figure B.12: Varying rates of return sensitivity analysis, 2014.



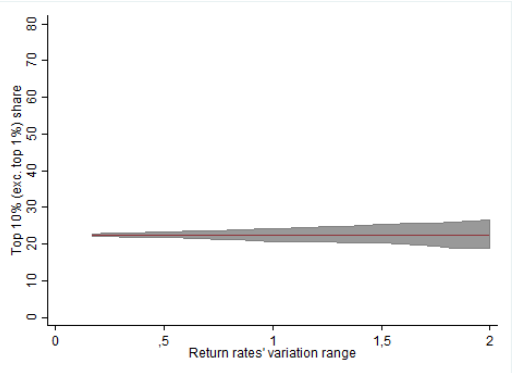

(a) Top 10% share's 95% confidence interval



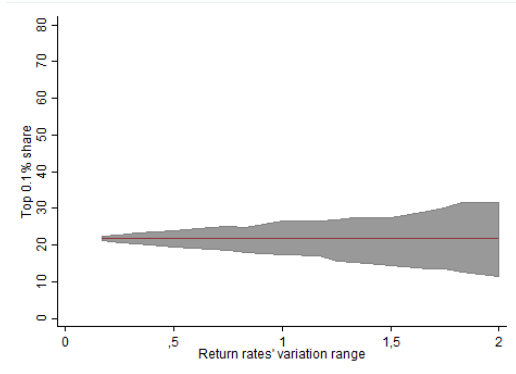

(b) Middle 40% share's 95% confidence interval



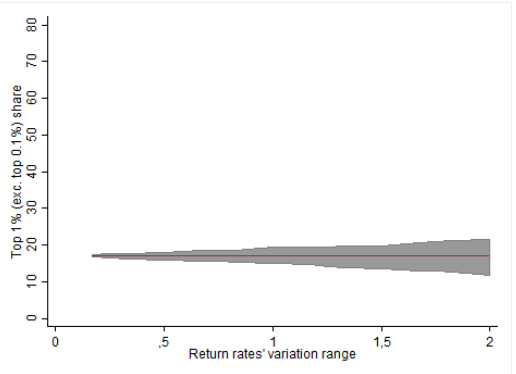

(c) Top 1% share's 95% confidence interval




(d) Top 10% (exc. top 1%) share's 95% confidence interval




(e) Top 0.1% share's 95% confidence interval




(f) Top 1% (exc. top 0.1%) share's 95% confidence interval

Notes: One hundred draws were used for the bootstrapped confidence interval estimation in each variation range. For example, the last confidence interval reflects reflects the wealth shares if rates varied in a range of ±2% with respect to the rates used for the estimations of Table A.7.