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Fundamental accrued capital gains and the measurement of top incomes: an application to Chile

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Abstract Most previous studies of income inequality have either ignored capital gains or have used taxable realized capital gains to estimate top incomes. Neither of these approaches is fully satisfactory. We apply for the first time a new methodology that allows us to account for *fundamental accrued* capital gains as part of the top incomes in a theoretically consistent manner. We estimate the shares of the super-rich in Chile showing that accrued capital gains have a large impact on these estimates. Also, the top income shares estimated using fundamental capital gains appear to exhibit a more stable and presumably more plausible time profile than estimates based on capital gains derived from asset market variations.

Keywords Inequality · Fundamental accrued capital gains · Top incomes

1 Introduction

Recent literature has pointed to the need of obtaining a picture of the distribution of income as complete and reliable as possible emphasizing the measurement of the top incomes

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(Alvaredo et al. 2013; Atkinson et al. 2011). This has required the use of tax data as it has been demonstrated that the household survey data are often insufficient to capture the income of the very rich whose income is highly affected by capital incomes (Atkinson et al. 2011; Burkhauser et al. 2012). Studies using tax declaration data have estimated the share accruing to the top income groups (the richest 1%, 0.1% and 0.01% of the population) for about 30 countries, most of them from the OECD (Atkinson and Piketty 2007, 2010; Atkinston et al. 2011). A finding of these studies is that considering top incomes significantly improves the accuracy of the picture of the income distribution.

A significant number of these studies has for various reasons either failed to include capital gains altogether (e.g., Dell 2005; Burdín et al. 2014) or have only used *taxable realized* capital gains (e.g., Piketty and Saez 2003; Roine and Waldenström 2012; Chu et al. 2015). The latter studies have shown the crucial importance of considering capital gains when analyzing the levels and trends of the income shares of the top 1%.

However, the use of realized taxable capital gains as opposed to *accrued* capital gains has been criticized on several grounds. In fact, using realized capital gains as part of the income of individuals in a particular period is generally wrong because they often reflect capital appreciations that have taken place over many years before the period in which the incomes are actually being measured (Armour et al. 2013; Smeeding and Thompson 2011). Conversely, parts of the capital gains obtained by individual investors in a particular period may not be realized in the same year and, therefore, are omitted when the conventional approach of accounting for only realized capital gains is used. In addition, as Burkhauser et al. (2014) argue, taxable realized capital gains are a poor proxy for the theoretically more appropriate yearly accrued capital gains because changes in the tax legislation within countries may affect the definition of taxable capital gains over time. These drawbacks have prompted researchers to start measuring accrued capital gains rather than taxable realized gains as part of the income of the top fractals (Armour et al. 2013; Burkhauser et al. 2014).

A distinctive feature of the present study is that we apply for the first time a new methodology that allows us to account for *fundamental business-accrued* capital gains as part of the top incomes in a theoretically consistent manner. Unlike the few studies that have recently used accrued capital gains, we focus exclusively on fundamental accrued capital gains; that is, on capital gains that arise from fundamental conditions given by the enterprises‘ profitability which in turn become capitalized in the value of the firm. This approach has the advantage of, on the one hand capturing capital gains at the time that they are actually generated (as opposed to realized capital gains which may consider gains generated in earlier periods) and, at the same time adding only accrued income generated from retained profits during the period considered (as opposed to values based on speculation).[1] In addition, the use of accrued capital gains may allow us to relate changes in inequality to other fundamental variables in the economy (e.g., economic growth) without contaminating such relationship with changes caused by legal modifications in taxation and others that often affect the measurement of realized capital gains.

The fact that we only consider retained profits as a source of accrued capital gains not considering gains arising from real estate transactions and other transactions is a limitation of this study. This could be a problem in analyzing income distribution to the extent that the

[1] Our approach is thus consistent with the idea of “accounting conservatism” which emphasizes the inadequacy of having to pay taxes on just accrued (unrealized) gains that may be originated in merely speculative and likely ephemeral gains, which could be reverted before the gain is realized. . However, from the point of view of “accounting conservatism” considering all realized capital gains as a tax base has some merit. (We are grateful to an anonymous reviewer for raising these points with us.).

excluded capital gains may not be distributed equally across individuals. However, in Chile as in most developing countries there is scant data on transactions of assets other than firm stocks and thus there is little option but to ignore them.

Other studies have used asset appreciations as measured by the fluctuations of the stock and/or real estate markets (Armour et al. 2013; Burkhauser et al. 2014). These measures include the effects of both fundamental capital gains as well as capital appreciations generated by market speculation, which often cause temporary asset market bubbles or collapses. While this approach allows for a more comprehensive measure of capital gains than ours, it may encompass ephemeral gains arising for example in part from asset market speculation.

An issue is whether or not the unrealized ephemeral component of capital gains should be considered part of income. While there may be some merit in considering unrealized ephemeral gains, in most cases there are no reliable data on this type of gains unless they are realized and reported to the tax office. However, as we argued earlier, using realized as opposed to accrued capital gains causes significant problems for the time attribution of such gains which means that using them might not be advisable.

The present study is one of the few studies of income distribution based on tax data in Latin America. Other recent studies using tax data for Latin American countries include Alvaredo (2011) for Argentina, Alvaredo and Londoño (2013) for Colombia, and Burdín et al. (2014) for Uruguay.[2] We measure the participation of the super-rich in Chile's national income using annual tax data for the period 2004–2013 explicitly accounting for accrued fundamental capital gains. Preliminary estimates show that capital gains constitute a massive part of the income of the rich as many of the largest corporations have very few controller shareholders. In Chile, capital gains are mostly not taxed as corporations that are regularly traded in the stock markets (which comprise more than 90% of the total sales of goods and services in the economy) are legally exempted from such taxes.[3]

Recent analyses have merely added undistributed profits to the other income sources, an approach which we show is adequate only under very special conditions. For example, Wolfson et al. (2016) uses this approach for Canada, Atkinson (2005) looks at the impact of distributing retained earnings in the U.K, and the National Income and Product Accounts in the United States include undistributed profits as part of the national income. Also, this same approach has been used in two recent studies applied to Chile Fairfield and Jorratt De Luis (2016), López et al. (2013). A commendable feature of the Fairfield and Jorratt De Luis (2016) study is that it is one of the few that uses actual measures of income as reported to the tax office even for the very top segments of the income distribution, instead of relying on interpolations as most studies of the super-rich have done (Piketty and Saez 2003; Atkinson 2007).[4]

We demonstrate that this procedure is generally incorrect in a context where many different taxes are in place. We thus propose a theoretically consistent way of using undistributed

[2] Several studies for Chile have used household survey data (Sanhueza and Mayer 2011; Solimano and Torche 2008; Friedman and Hofman 2013; Contreras et al. 2001). However, as it is well recognized household data are not generally adequate to estimate top incomes. While Burkhauser et al. (2012) have shown that household data and tax data can in principle be made consistent by defining income appropriately, the fact that all the studies using household survey data for Chile have excluded capital income prevents such consistency.

[3] Also, closely held firms are allowed to deduct their retained profits from their capital gains for tax purposes. This effectively means that their fundamental capital gains are tax exempted as well.

[4] However, Fairfield and Jorratt De Luis use disaggregated data only for two years (2005 and 2009) while for other years they also rely on Pareto interpolations.

profits to transform them into accrued capital gains. A dollar that remains undistributed inside the firm has a different effective value than when it has been already distributed. As a result, the procedure of just directly adding the firms' undistributed profits to the shareholders' other sources of income generally overestimates their true income associated with retained profits. We show here that, for the case of Chile, this methodological innovation makes a large impact on the estimates of the share of the top incomes in national income. We show below that our results not only differ quite substantially from those obtained by studies that directly add undistributed profits to the other income sources but, more importantly, they appear to be more stable and consistent.

2 Non-distributed corporate profits and accrued capital gains

While data from tax declarations are generally more reliable than data from surveys because tax declarations are made under legal warning, tax data is not exempt from biases. Biases from fraudulent tax declarations exist in all countries and are difficult to correct and estimating income due to capital gains is particularly challenging (Atkinson et al. 2011). In Chile, there are some peculiarities in the tax legislation that make the significance of retained profits and business-accrued capital gains as part of the total income of the super-rich even greater than in most other countries.

In particular, in Chile the owners of corporate shares have incentives to retain profits within their firms because in this way they avoid paying the personal income taxes for distributed profits which are much higher than the taxes on retained profits. These incentives to tax elusion are quite significant because the tax rate for capital gains is zero for corporate shares. Moreover, the Chilean tax system is integrated; which means that the so called 'first category tax' to corporate profits is an automatic tax credit for the personal income tax that the owners of the firms must pay.[5] In most OECD countries the tax system is either not integrated or only partially integrated and business capital gains are taxed; therefore, while most countries do have tax incentives to retain profits these are not as great as in Chile.

3 Methodology

3.1 From undistributed profits to fundamental business-accrued capital gains

Haig (1921) and Simons (1938) defined personal income of individual i at time t as equal to her/his consumption plus the net change in wealth at time t. One may alternatively define total personal income, $I(t)$ as the sum of labor income, distributed dividends and other personal income, $y(t)$ plus business-accrued capital gains, $G(t)$, and other capital gains, $OG(t)$ (such as real estate capital gains and others) at time t

$$I(t) = y(t) + G(t) + OG(t). \tag{1}$$

Define the opportunity cost of a retained dollar in terms of foregone dividend as,

$$\theta \equiv \frac{(1 - \tau + \varphi\tau)\,[1 - m(y(t))]}{(1 - \tau)\,(1 - z)}. \tag{2}$$

[5] The direct tax rate on accrued corporate profits is 20%, while the marginal income tax rate to taxpayers with highest income is twice as high, which implies a powerful incentive to postpone indefinitely the distribution of corporate profits (or to distribute only the minimum required by law).

In Eq. (2), τ is the tax rate on firms' profit; $m(y(t))$ (a non-decreasing function of y(t)) is the personal tax rate on dividends; z is the tax rate on capital gains, and $0 \leq \varphi \leq 1$ is the fraction of the tax paid by the firm that is allowed as a tax credit to the stockholder. As shown by Gutiérrez et al. (2015), this formula is a slight generalization of the well-known formula developed by King (1974).

The following proposition shows the relationship between retained or undistributed profits (π_r) and business-accrued capital gains *(G(t))*,

Proposition 1 *In equilibrium, business-accrued capital gains are related to retained profits as follows*

$$G(t) = \theta\left(\tau, m\left(y\right), z; \varphi\right)\pi_r(t)\,. \tag{3}$$

Proof Equilibrium in the capital market implies (King 1974):

$$(1-m)\,rV(t) = d(t) + (1-z)\left(V\left(t+1\right) - V(t)\right) \tag{4}$$

where, $V(t)$ is the value of the firm in time t and $d(t)$ is the net after tax dividend paid by the firm.

We generalize (4) to allow for different degrees of tax integration (φ),

$$\frac{1-\tau+\varphi\tau}{1-\tau}\,(1-m)\,rV(t) = d(t) + (V(t+1) - V(t))\,(1-z). \tag{5}$$

Using the definition of θ in Eq. (2), (5) can be written as:

$$\theta rV(\tau) = \frac{d(t)}{1-z} + \left(V(t+1) - V(t)\right). \tag{6}$$

Because $\frac{d(t)}{1-z} = \theta\left((1-\tau)\,\pi - \pi_r\right)$ and noting that in equilibrium $rV\left(\tau\right) = (1-\tau)\pi$, we have,

$$G \equiv V(t+1) - V(t). \tag{7}$$

Then, we obtain that:

$$G\left(t\right) = \theta\pi_r. \tag{8}$$

□

Thus, using Eqs. (1) and (8), we obtain that total income is,

$$I(t) = y(t) + \theta(\tau, m\left(y\left(t\right)\right), z; \varphi)\,\pi_r(t) + OG\left(t\right). \tag{9}$$

Therefore only in the special case where $\theta = 1$ it is legitimate to simply add retained profits to the other incomes of shareholders to estimate their true total income. This implies that directly adding retained profits to other income sources to estimate incomes of shareholders would be theoretically correct only if the non-corporate tax system is neutral and if there is no tax integration (e.g., if $\phi = 0$ and $m = z$). Otherwise, this procedure biases the effect of retained profits in total income.

However, under most tax regime $\theta \neq 1$. The case where $\theta < 1$ is the most interesting one because it applies to most countries. This is in fact the case of Chile where, using the prevailing (marginal) tax rates relevant to the top income earners, the estimated value of θ fluctuates between 0.72 and 0.75 throughout the period 2004–2013. The opportunity cost of one dollar of foregone dividend is therefore in the case of Chile about 72 to 75 cents.

It is important to indicate that the valuation of retained profits represented by Eq. (3) in Proposition 1 should be interpreted as pertaining to the financial market which transforms retained profits into capital gains and hence increased share values. The market discounts the retained profits by the tax costs involved in transforming captive profits inside the firm into money outside it. This implies that the market price of a share of a firm that retains one dollar per share does not increase by one dollar as the financial market in the case of Chile would value that dollar at only 72 or 75 cents.[6] Thus, if we ignore this market discount factor caused by the fact that the dollar remains captive inside the firm and simply add this dollar to the rest of the shareholder' incomes will result in an overestimation of their true capital gain income.[7]

Importantly, individuals in the top fractals are in most cases subjected to the maximum marginal personal income tax rate, m. This implies that for these individuals m is fixed and independent of their income as long as it is above the threshold that triggers the maximum tax rate. Thus, if financial market participants are mostly in the top tax bracket (which includes individuals that are below the top 1%) the tax rate used by the market to value the shares are fixed and determined by such tax rates. The value of θ only depends on tax parameters that are identical for financial market participants. This greatly facilitates the empirical application of this methodology to estimate capital gains for the richest individuals, which is the focus of this paper.

3.2 Fundamental accrued capital gains before taxes

The use of Eq. (3) to estimate fundamental business-accrued capital gains raises the question of whether or not this specification may effectively provide an after-tax estimate rather than pretax. We argue that despite the fact that this formula does consider taxes in estimating the correction factor θ, the estimated measure of fundamental capital gains that it provides is effectively before taxes. The reason is that, as discussed earlier in the interpretation of Proposition 1, the factor θ which discounts the value of retained profits to transform them into capital gains simply reflects the valuation that the financial market makes of the retained profits, not the taxes that the shareholder actually pays. For the financial market one dollar of retained profits inside the firm does not perfectly substitute with liquid money outside it, because retained profits entail tax liabilities associated to future dividends or capital gains. This reduced liquidity is punished by the financial market when it values retained profits. Potential buyers of the company's shares will consider that withdrawing such retained profits will generate tax liabilities and the consequent arbitrage in the financial market implies that these taxes will be reflected in the equilibrium market price of the asset. This is what generally causes a negative premium on retained profits.

To see that for the shareholder the accrued capital gain estimated using Eq. (3) corresponds to before tax income rather than after tax income, note that if he/she decides to realize such capital gain by selling shares he/she will have to pay the corresponding taxes. That is, once profits are retained the stockholder obtains a capital gain that is valued by the market considering all potential tax liabilities of withdrawing such retained profits but this

[6] This issue is related to the debate about how one should view demands on government transfers that do affect private savings but which cannot be treated the same as individual income since the individual does not have full discretion over the use of the money.

[7] However, in countries where $\theta > 1$ simply adding retained profits underestimates the total personal income.

does not mean that the capital gain thus valued by the market is after tax. That is, for the stockholder the capital gain thus estimated is in fact pretax.[8]

3.3 Income interpolation

To accurately determine the participation of the top incomes of the income distribution, researchers generally face the common problem that the income of the various fractals above the 99% is often not directly measured. This informational limitation is usually overcome by using a Pareto interpolation, which allows estimating the income share of higher fractals using the known information on the income share of a lower contiguous fractal. Feenberg and Poterba (1993) have shown that this interpolation provides good empirical estimates of the incomes of the top fractals. Subsequent studies of income distribution at the top have in fact confirmed the reliability of Pareto interpolations, including among others Piketty and Saez (2003), Atkinson (2007), Atkinson et al. (2011) and Armour et al. (2014).

3.4 Gini coefficient interpolation

Atkinson (2007) has shown that data for the income shares of the top fractals of the distribution can be used to correct the estimates of the Gini coefficient obtained using household survey data that often ignore the income of the top fractals. The formula for the correction is:

$$G = (1 - \sigma)\,\hat{G} + \sigma \tag{10}$$

where, G is the true Gini coefficient, σ is the share of a very small group in total income which accounts for a large portion of the total income, and $\hat{G}$ is the Gini coefficient estimated without considering this small group.[9]

4 Empirical analysis

4.1 Control income and capital gains

Given that the accrued fundamental capital gains estimated using Eq. (3) are indeed pretax we can add them to the other pretax income sources. We first define control income excluding capital gains, which includes wage income, pensions, interests, distributed profits and other incomes reported to the tax office that are not due to either sales of shares or constitute undistributed profits. Next we add to these income sources fundamental capital gains from the firm' sector.

However, it is not straightforward how to consider the value of retained profits as a source of capital gains. An individual shareholder may not be able to demand a payment in the

[8] To illustrate, consider a minority shareholder in a corporation that decides to retain profits. If the shareholder wants to withdraw the money he/she cannot demand his/her share of the retained profit. The shareholder's only option is to sell his/her shares at a price discounted by the market by factor θ. Once implementing this operation the shareholder will be liable to pay taxes for the capital gain thus obtained, which means that , the capital gain thus estimated is in fact a pretax income for the shareholder.

[9] This formula is convenient because it does not depend on the number of the people that are generally excluded from household surveys.

form of dividend or otherwise of his/her share of retained profit; this is so especially in large corporations. This may imply that the correcting factor θ should in addition include non-tax costs associated with the captive or retained profits which the financial market would consider in valuing the firm's share. However, considering the practical problem of simply not having enough data about the non-tax costs of withdrawing retained profits we have to rely on the approximation provided by Eq. (3).[10]

To allocate the fundamental capital gains arising from retained profits we used Eq. (3). We separated the retained profits belonging to the richest 1% from those belonging to the rest of the distribution. Clearly the correcting factor θ depends on the tax brackets relevant to the financial market participants that value or capitalize the retained profits. We assume that the financial market participants are in the top marginal income tax bracket (the top marginal tax bracket rate is reached at lower incomes than the minimum income of the top 1%) and therefore evaluate θ using the tax rates corresponding to the top tax bracket.[11] To allocate these capital gains to the top 1% we use existing estimates indicating that the retained profits belonging to the richest 1% are about 70% of all retained profits.[12]

4.2 Empirical implementation and data

Annual data on corporate profits reported to the tax office for the years 2004–2010 is available from Jorratt (2012). For the remaining three years (2011–2013) we use actual profit data reported by firms provided by Thomson One Banker data base[13] linking it with the data from the previous seven years in a consistent manner.

To impute retained profits to the richest 1% of the population we need first to estimate the proportion of profits accruing to individuals in this group. Using empirical estimates by Cea et al. (2009) and Solimano and Pollack (2006) as well as data from the Santiago Stock Exchange we obtained an estimate of the corporate profits owned by the richest 1% of the population at about 70% of the total corporate profits on average for the period of analysis. With this information, we use Pareto interpolation to adjust total incomes of the richest fractals (above 1%) by business-accrued capital gains. We also correct these incomes for tax evasion using data provided by Jorratt (2012).[14]

[10] For closely held firms, particularly in the case of Chile which has great incentives to retain profits, this problem may not be as serious as in the corporate sector because the often small number of firm owners may have greater discretion to retain or withdraw profits than many minority shareholders in publicly-held corporations.

[11] Retained earnings in a firm are not related in an obvious way to individual income, and, in particular, the relationship may differ across firms. In a closely held firm, with only one shareholder, keeping money in the firm or distributing it as dividends is obviously close to an individual choice (and is typically much influenced by tax legislation). However, micro and small firms in Chile represent only 11% of the total value added of the economy (Ministerio de Economía 2014). Hence, our assumption that all accrued capital gains are subject to the maximum marginal tax rate may induce only a relatively small error in the estimation of the factor θ.

[12] Fairfield and Jorratt De Luis (2016) estimates that the participation of the top 1% in total undistributed profits is between 63.4% and 92.2%. We use other somehow more conservative estimates provided by Solimano and Pollack (2006), and assume that 70% of all retained profits belong to the top 1%.

[13] Available at http://banker.thomsonone.com.

[14] See Online Supplementary Material for more information on the data used to correct for tax evasion.

We use official data from the Chilean Internal Revenue Service (SII, for its Spanish name) on annual personal incomes declared by individuals for the decade of 2004–2013. These incomes include labor incomes, pensions, interests plus distributed corporate profits and others. This information does not consider either undeclared incomes associated with tax evasion or fundamental capital gains.

Capital gains of large corporations are simply not declared to the tax office and therefore are not included in the incomes provided by the tax office. Also, the income information from the tax office does not include fundamental capital gains from closely held companies (which in principle should declare capital gains) because these companies are allowed to deduct all their retained profits from their capital gains (Engel and Galetovic 2000). Therefore the income directly estimated from tax declarations excludes any type of fundamental business-accrued capital gains. This is why we need to add to the reported income to the tax office the fundamental accrued capital gains estimated from the data on retained profits using Eq. (3) and calculated according to the approach presented in Section 3.3.

Table 1 shows data for the year 2013 on declared personal income by individuals within the 8 income tax brackets established by law. Similar data are available for each year for the ten-year period of analysis. The data in Table 1 constitute the starting point of the estimation of the non-capital gains component of the incomes of the top income brackets.

The other basic data source concerns estimates of the fundamental business-accrued capital gains. Table 2 shows these data including estimated annual corporate profits pertaining to the top 1%, dividends, retained profits and accrued-capital gains for the period 2004-2013.

4.3 Estimating the shares of the richest fractals

This section presents the results of applying the methodologies explained in Section 3 aimed at correcting the reported incomes to SII to account for accrued corporate capital gains and tax evasion. This is done by using the basic tax data shown in Tables 1 and 2 for each year in the period 2004–2013. These data are used to implement the Pareto interpolation to obtain the income of the richest fractals. These data are corrected first by tax evasion and then by adding business-accrued capital gains corresponding to the top fractals.

Table 1 Chile: Participation by income brackets in total declared income by individuals to the Tax National Service (SII); 2013

Income bracket	Income Bracket's Limits		Monthly Income	Marginal Income Tax Rate	Number of Taxpayers	Proportion of Total Taxpayers	Bracket's Total Income	Proportion of total declared income
	Lower	Higher						
	(USD 2013)		(USD 2013)	(%)	(individuals)	(%)	(mill USD 2013)	(%)
1	_	1,119	473	_	7,005,895	76.9	33,122	31.0
2	1,119	2,488	1,924	4	1,364,161	15.0	26.,247	24.6
3	2,488	4,147	3,764	8	381,237	4.2	14,350	13.4
4	4,147	5,807	5,818	14	154,325	1.7	8,979	8.4
5	5,807	7,466	7,802	23	81,264	0.9	6,340	5.9
6	7,466	9,954	10,176	30	60,219	0.7	6,128	5.7
7	9,954	12,442	13,129	36	25,407	0.3	3,336	3.1
8	12,442	_	25,164	40	32,571	0.4	8,196	7.7

Source: Authors' estimates using data from Chile's Tax National Service (SII)

Table 2 Chile: Corporate profits and business-accrued capital gains; 2004–2013

Year	Corporate profits	Dividends	Retained profits	θ	Business Accrued Capital Gains	Business Accrued Capital Gains Imputed to Richest 1%
	(million USD 2013)			(value)	(million USD 2013)	
2004	20,469	7,001	13,468	0.72	9,697	6,788
2005	27,399	7,453	19,947	0.72	14,362	10,053
2006	31,696	9,445	22,251	0.72	16,020	11,214
2007	40,455	13,795	26,660	0.72	19,195	13,436
2008	52,548	16,605	35,943	0.72	25,879	18,115
2009	51,310	15,701	35,609	0.72	25,639	17,947
2010	41,835	12,927	28,908	0.75	21,681	15,177
2011	33,646	10,498	23,148	0.75	17,361	12,153
2012	34,895	10,887	24,008	0.75	18,006	12,604
2013	38,127	11,896	26,231	0.75	19,673	13,771

Source: Authors' estimates using data from Jorratt (2012) and Thomson One Banker

4.3.1 Estimating the top incomes excluding business-accrued capital gains

Table 3 shows the participation in the country's total income of the richest fractals of the population excluding fundamental accrued capital gains. The figures in this table have been calculated using the so-called Control for Total Income (CTI), an approximation for the households' gross total income as described in Section 4.1 (explained in more detail in the Online Supplementary Material). The procedure to correct for tax evasion is based on data from Jorratt (2012) and is also explained in the Online Supplementary Material.

As can be seen in Table 3, just correcting for tax evasion makes a significant difference on the share of the top echelons of the income distribution. For example, the average participation of the top 1% over the period increases from 20.2% to 22.7%. This is so despite the fact that we assume that the rate of tax evasion is equal for all income groups liable to pay income tax. The main reason for the increased participation of the top incomes in national income is that in Chile only the richest 15% of the population is liable to pay any income tax; therefore, it is in this group where all tax evasion is concentrated.

Our estimates for the evasion-corrected shares of the top 1% in the years 2005 and 2009 were 23.6% and 22.4%s, respectively. These estimates fall well within the interval estimated by Fairfield and Jorratt De Luis (2016) for those years when they exclude capital gains, which was from 15.6% to 25.9%, depending on the income definitions used.

4.3.2 Participation of the richest fractals including business-accrued capital gains and corrected for tax evasion

Table 4 shows the evolution of the income shares of the super-rich over the period 2004–2013 once correction for tax evasion has been implemented and fundamental

Table 3 Chile: Income shares (%) of the richest 1%, 0.1%, 0.01% and 0.001% of individuals and Gini coefficients for incomes uncorrected and corrected by tax evasion and excluding fundamental business-accrued capital gains; 2004–2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
Share of the richest 1%											
Uncorrected for tax evasion	20.9	20.7	20.5	20.1	22.0	19.9	19.6	19.4	19.3	19.2	20.2
Corrected for tax evasion[a]	23.9	23.6	23.3	22.7	24.9	22.4	21.9	21.7	21.5	21.2	22.7
Share of the richest 0.1%											
Uncorrected for tax evasion[a]	6.3	6.3	6.1	6.1	7.9	6.0	5.9	6.0	6.2	6.3	6.3
Corrected for tax evasion[a]	7.2	7.2	6.9	6.9	8.9	6.7	6.7	6.7	7.0	7.0	7.1
Share of the richest 0.01%											
Uncorrected for tax evasion	1.9	1.9	1.8	1.8	2.8	1.8	1.8	1.8	2.0	2.1	2.0
Corrected for tax evasion[a]	2.1	2.2	2.1	2.1	3.2	2.0	2.0	2.1	2.2	2.3	2.2
Share of the richest 0.001%											
Uncorrected for tax evasion	0.6	0.6	0.5	0.6	1.0	0.5	0.5	0.6	0.7	0.7	0.6
Corrected for tax evasion[a]	0.6	0.7	0.6	0.6	1.1	0.6	0.6	0.6	0.7	0.8	0.7
Gini coefficient[b]	0.58	0.58	0.5	0.5	0.56	0.56	0.56	0.54	0.54	0.54	0.56

a The procedure used to correct for tax evasion is explained in the Online Supplementary Material.
b Calculated using income corrected for tax evasion and Atkinson's (2007) correction for incomes obtained from survey data
Source: Authors' estimates using data from SII, CASEN, Jorratt (2012); Cea et al. (2009) and Solimano and Pollack (2006)

business-accrued capital gains have been included. As can be seen the rate of income concentration in the top fractals is extremely high. The top 1% concentrates on average for the period 29.8% of the total national income while the richest 0.1% obtained 14.8% and the richest 0.01% obtained 7.4% of the total income.

The great relevance of business-accrued capital gains in measuring income inequality in Chile is illustrated by comparing the figures in the upper panels of Tables 3 and 4. In fact, the average share of the top 1% increases from 22.7% to 29.8%. This difference is

Table 4 Chile: Income shares (%) of the richest 1%, 0.1%, 0.01% and 0.001% of individuals and Gini coefficients for incomes corrected by tax evasion and including fundamental business-accrued capital gains; 2004–2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
Share of the richest 1%[a]	28.4	30.5	30.6	30.6	33.5	32.1	30.0	27.9	27.6	27.4	29.8
Share of the richest 0.1%[a]	12.4	14.8	14.8	14.8	18.9	17.3	15.2	13.1	13.1	13.4	14.8
Share of the richest 0.01%[a]	5.5	7.2	7.2	7.2	10.7	9.3	7.7	6.1	6.3	6.5	7.4
Share of the richest 0.001%[a]	2.4	3.5	3.5	3.9	6.0	5.0	3.9	2.9	3.0	3.2	3.7
Gini coefficient[b]	0.62	0.63	0.62	0.62	0.64	0.63	0.62	0.59	0.59	0.59	0.61

a Corrected for tax evasion; correction procedure is explained in the Online Supplementary Material.
b Calculated using income corrected for tax evasion and Atkinson's (2007) correction for incomes obtained from survey data
Source: Authors' estimates using data from SII, CASEN, Jorratt (2012); Cea et al. (2009) and Solimano and Pollack (2006)

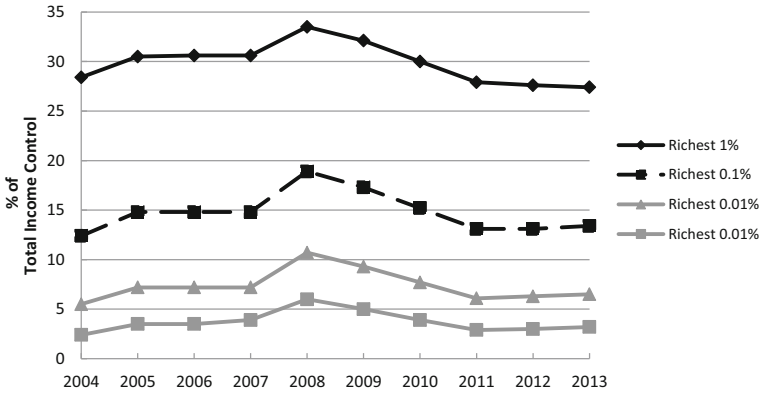

Fig. 1 Chile: Total income shares of the top 1%, 0.1%, 0.01% and 0.001% of individuals; 2004–2013 (Incomes corrected for tax evasion and including fundamental business-accrued capital gains)

proportionally even larger when we consider richer fractals. For example, the share of the top 0. 1% more than doubles when we include capital gains going from 7.1% to 14.8%. Also, the average Gini coefficient for the period was 0.61 when we include capital gains, much higher than 0.56 obtained without capital gains. This is also much higher than the consensus estimates obtained from household data which is about 0.53 for the period considered here (MDS 2013; Solimano and Torche 2008).

4.4 Evolution of the top income shares over the decade

Using the estimates in Table 4, Fig. 1 shows the evolution of the shares of the top income groups in total income over the decade after correcting for tax evasion and including fundamental business-accrued capital gains. The share of the top 1% falls at a rate of 1.2% per year. All other richer fractals considered here do not show a significant trend. However, if we exclude capital gains the share of the top 1% declines at a faster rate, 1.4% per annum.

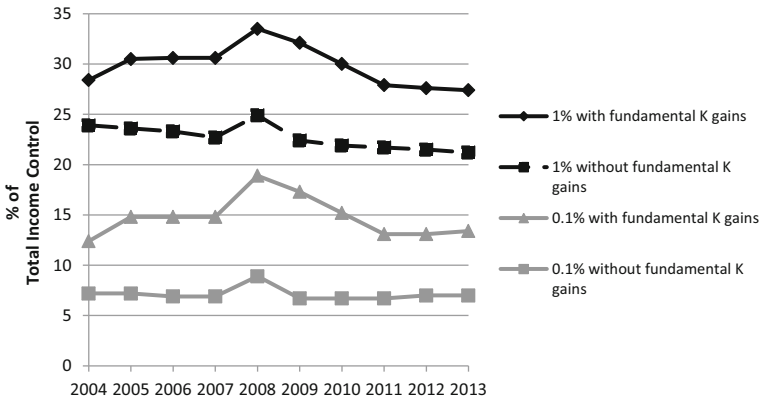

Fig. 2 Chile: Total income shares of the top 1% and 0.1% of individuals for incomes corrected by tax evasion and with and without business-accrued capital gains

Table 5 Chile: Income shares (%) of the richest 1%, 0.1%, 0.01% and 0.001% of individuals and Gini coefficients for incomes corrected by tax evasion and including fundamental business-accrued capital gains based on capital market appreciation; 2004–2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
Share of the richest 1%[a]	30.7	29.2	32.0	23.2	24.9	33.2	31.0	21.7	25.5	21.2	27.3
Share of the richest 0.1%[a]	16.0	14.2	18.2	7.3	8.9	20.6	17.8	6.7	11.3	7.0	12.8
Share of the richest 0.01%[a]	8.3	6.9	10.4	2.3	3.2	12.8	10.2	2.1	5.1	2.3	6.3
Share of the richest 0.001%[a]	4.3	3.3	5.9	0.7	1.1	7.9	5.9	0.6	2.2	0.8	3.3
Gini coefficient[b]	0.63	0.62	0.63	0.59	0.59	0.63	0.62	0.56	0.58	0.56	0.60

a Corrected for tax evasion; correction procedure is explained in the Online Supplementary Material.
b Calculated from the estimates for income corrected for tax evasion using correction from Atkinson's 2007.
Source: Authors' estimates using data from SII, CASEN, Jorratt (2012); Cea et al. (2009) and Solimano and Pollack (2006)

As in the previous case, the richest 0.1% and 0.01% of individuals do not exhibit any significant change over the period. The apparent fall in the participation of the top 1% in national income occurs in the period after the 2008–2009 international crisis. It appears that this is due to the fact that capital gain incomes never fully recover after the crisis.

Figure 2 shows the evolution of the shares of the top 1% and 0.1% over the period with and without accrued capital gains. As can be seen, there is a turning point in 2009 possibly as a consequence of the world recession after which the shares appear to start declining. This decline is stronger when capital gains are included than when they are not. This is consistent with the idea that the greatest relative impact of the crisis was on the capital incomes, which affected the richest segments of society proportionally more intensely.

5 Shares of top incomes using asset market valuation as a proxy for business-accrued capital gains

Here we show the estimates of the top income shares using a different methodology to estimate business-accrued capital gains. Instead of fundamental capital gains as estimated

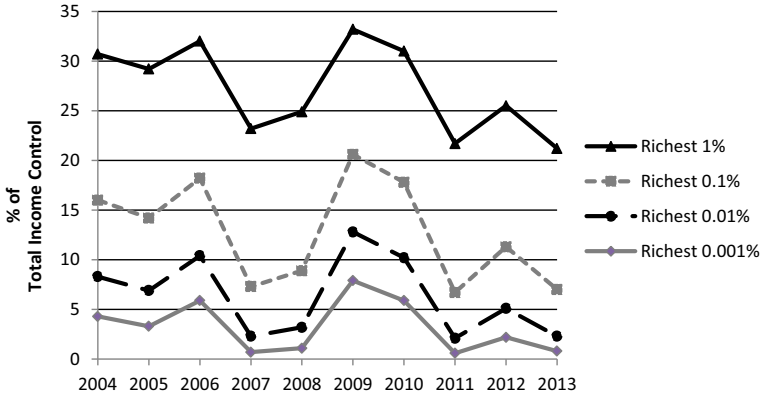

Fig. 3 Chile: Total income shares of the top 1%, 0.1%, 0.01% and 0.001% of individuals for incomes corrected by tax evasion and with business-accrued capital gains calculated from asset valuation

from retained profits we present here measures based on capital gains obtained using data regarding appreciation of the asset market.[15] Table 5 reports these estimates for the period of analysis. Also, Fig. 3 graphically illustrates the evolution of the estimated top shares over time. The average estimates for the period using this approach as reported in Table 5 are similar, albeit slightly lower than those obtained using fundamental capital gains reported in Table 4.

However, the patterns of evolution over time are quite different. In fact, comparing Figs. 1 and 3 it is apparent that the shares estimated using stock market valuations tend to be much more unstable than those shares estimated using fundamental capital gains. This is due to the fact that the estimates based on the stock market valuation incorporate an ephemeral component which is caused by bubbles and collapses of the stock market prices. By contrast, fundamental capital gains tend to be less affected by temporary fluctuations on the asset markets.

Comparing our quantitative estimates to those obtained by Fairfield and Jorratt De Luis (2016), it is clear that our approach of using fundamental capital gains instead of merely adding all retained profits to the income makes a large difference. Adding fundamental capital gains to the other incomes increases the participation of the top 1% by 26.3% on average over the 10 year period. Using the Fairfield and Jorratt De Luis method raises the share of the top 1% by much more, almost 50%; also, the income variance of the retained profit component estimated by these authors is practically zero while the variance in our estimate of fundamental capital gains is larger reflecting the significant tax changes introduced in the year 2010.

On the other hand, it appears that the trends of total accrued capital gains and fundamental capital gains over the decade also differ specially in the case of the richest 0.1%. In fact, the income share of the top 0.1% considering all accrued capital gains fell about 9% whereas when only fundamental capital gains are used it rose by 0.15%. This may be due to the fact that the period of analysis is not long enough to erase the ephemeral component of the accrued capital gains. It appears that the ephemeral component was very high in the earlier part of the period while much less in the last three or four years. The relatively short period after the financial crisis considered here may explain this difference in trends. Presumably using a longer time series would gradually erase most of these trend differentials between fundamental and total accrued capital gains as the very high ephemeral capital gains in the earlier part of the period would gradually reduce their weight in the overall trend.

6 Conclusion

The most important contribution of this study is the use for the first time of a methodology that allows us to estimate fundamental accrued capital gains (as opposed to merely realized taxable capital gains or to non-fundamental accrued capital gains) in a theoretically consistent manner. Also, we demonstrate that directly adding undistributed profits to the shareholders' other income is generally wrong.

Our results confirm previous suspicions that the real problem of the distribution of income in Chile is due to the large concentration of incomes in the very top of the distri-

[15] In the Online Supplementary Material we show the annual change in market value of the index of stock market valuation used here.

bution. These results are greatly reinforced by the inclusion of fundamental accrued capital gains. It is really the richest 1%, and especially the richest 0.1% and 0.01% of the population which have the 'lion's share' of the country's income.

Our estimates provide evidence on two additional facts regarding the distribution of income in Chile. First, comparing our estimates with the existing measures based on household surveys the inequality of the distribution as measured by the Gini coefficient increases significantly, from 0.53 to 0.62. Second, we show that the estimated shares of the top incomes obtained using fundamental accrued capital gains tend to be much more stable than when we instead estimate accrued capital gains relying on asset market appreciation data.

Our approach is complementary to other approaches used in the literature to capture capital incomes. Subsequent studies may benefit by using the new methodology proposed here to shed light on the real importance of fundamental accrued capital gains in determining the shares of the top incomes in other countries. Unfortunately, there are no data in Chile for the values of assets other than the corporate sector, especially for real estate values and for a longer period of time. This prevented us to obtain a more comprehensive measurement of accrued capital gains and throughout a longer period of time. It would be worthwhile studying whether the key qualitative results for Chile are valid in other contexts where more comprehensive data are available.

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References

Alvaredo, F.: The rich in Argentina over the twentieth century. In: Atkinson, A., Piketty, T. (eds.) Top Incomes over the Twentieth Century; Vol. II: A Global Perspective, pp. 253-298, pp. 1932-2004. Oxford University Press, Oxford (2011)

Alvaredo, F., Atkinson, A.B., Piketty, T., Saez, E.: The top 1 percent in international and historical perspective. J. Econ. Perspect. **27**(3), 3–20 (2013)

Alvaredo, F., Londoño, J.: High incomes and personal taxation in a developing economy: Colombia 1993–2010. Center for the Inter-American Policy Research (CIPR), Tulane University Commitment to Equity Working Paper No. 12 (2013)

Armour, P., Burkhauser, R.V., Larrimore, J.: Deconstructing income and income inequality measures: A crosswalk from market income to comprehensive income. Am Econ Rev **103**(3), 173–177 (2013)

Armour, P., Burkhauser, R.V., Larrimore, J.: Using the Pareto distribution to improve estimates of topcoded earnings. NBER Working Paper Number 19846 (2014)

Atkinson, A.B.: Top Incomes in the UK over the 20th Century. J Royal Stat Soc Series A **168**(2), 325–343 (2005)

Atkinson, A.B.: Measuring top incomes: Methodological issues. In: Atkinson, A.B., Piketty, T. (eds.) Top Incomes over the Twentieth Century, A Contrast between Continental European and English-Speaking Countries. Oxford University Press, Oxford (2007)

Atkinson, A.B., Piketty, T.: Top Incomes over the Twentieth Century: A Global Perspective, vol. 2. Oxford University Press, Oxford (2010)

Atkinson, A.B., Piketty, T., Saez, E.: Top Incomes in the long run of history. J. Econ. Lit. **49**(1), 3–71 (2011)

Burkhauser, R.V., Feng, S., Jenkins, S.P., Larrimore, J.: Recent trends in top income shares in the United States: reconciling estimates from March CPS and IRS tax return data. Rev Econ Stat **94**(2), 371–388 (2012)

Burkhauser, R.V., Hahn, M.H., Wilkins, R.: Measuring top incomes using tax record data: A cautionary tale from Australia. J Econ Inequal **13**(2), 181–205 (2014)

Burdín, G., Esponda, F., Vigorito, A.: Inequality and top incomes in Uruguay: A comparison between household surveys and income tax micro-data. Instituto de Economía, Universidad de la República, CEQ Working Paper No. 21; Montevideo, Uruguay (2014)

Chu, C., Chow, T., Hu, S.: Top income shares in Taiwan 1977-2013 WTID Working Paper 2015/2 (2015)
Cea, S., Contreras, D., Martínez, C., Puentes, E.: Trabajadores por Cuenta Propia: ¿Quiénes Son? ¿De dónde vienen? ¿Para dónde van? Serie Documentos de Trabajo No.308. Departamento de Economía, Universidad de Chile (2009)
Contreras, D., Larrañana, O., Litchfield, J., Valdes, A.: Poverty and income distribution in Chile 1987–1998: New evidence. Cuad. Econ. **38**(114), 191–208 (2001)
Dell, F.: Top incomes in Germany and Switzerland over the twentieth century. J. Europ. Econ. Assoc. **3**(23), 412–421 (2005)
Engel, E., Galetovic, A.: ¿Qué hacer con los impuestos a las ganancias de capital? Estudios Públicos **79**, 199–236 (2000)
Fairfield, T., Jorratt De Luis, M.: Top income shares, business profits, and effective tax rates in contemporary Chile. Rev. Income Wealth **62**(S1), 120–144 (2016)
Feenberg, D., Poterba, J.: Income inequality and the incomes of the very high income taxpayers: Evidence from tax returns, NBER Working Paper No. 4229 (1993)
Friedman, J.R., Hofman, A.: Inequality and the top of the income distribution in Chile 1990-2012: Questioning the Consensus. Mimeo University of Santiago (2013)
Gutiérrez, P., López, R.E., Figueroa, E.: Top income measurement and undistributed profits. Econ. Lett. **134**, 138–140 (2015)
Haig, R.M.: The concept of income: economic and legal aspects. In: Haig, R. (ed.) The Federal Income Tax, pp. 1–28. Columbia University Press, New York (1921)
Jorratt, M.: Gastos tributarios y evasión tributaria en Chile: Evaluación y propuestas. In: Arellano, J.P., Corbo, V. (eds.) Tributación para el Desarrollo: Estudios para la Reforma del Sistema Chileno, pp. 39–142. CEP-Cieplan Santiago, Chile (2012)
King, M.A.: Taxation and the cost of capital. Rev. Econ. Stud. **41**(1), 21–35 (1974)
López, R., Figueroa, E., Gutiérrez, P.: La 'parte del león': Nuevas estimaciones de la participación de los súper ricos en el ingreso de Chile Serie de Documentos de Trabajo, vol. 379. Departamento de Economía, Universidad de Chile (2013)
Ministerio de Economía: Boletín Empresas en Chile por Tamaño y Sector 2005–2012. http://www.economia.gob.cl/wpcontent/uploads/2014/06/Bolet%C3%ADn-Empresas-en-Chile-por-Tama%C3%B1o-y-Sector-2005-2012.pdf (2014)
MDS: Indicadores de Distribución del Ingreso en la Región Metropolitana de Santiago: comparación encuesta Casen y encuesta de ocupación y desocupación Universidad de Chile. Ministerio del Desarrollo Social-Chile http://www.ministeriodesarrollosocial.gob.cl/pdf/upload/DOCUMENTOCOMPARACIONDISTYCASENUDECHILE.pdf (2013)
Piketty, T.: Income inequality in France, 1901–1998. J. Polit. Econ. **111**(5), 1004–1042 (2003)
Piketty, T., Saez, E.: Income inequality In the United States, 1913–1998. Q. J. Econ. **118**(1), 1–39 (2003)
Roine, J., Waldenström, D.: On the role of capital gains in Swedish income inequality. Rev. Income Wealth **58**(3), 569–587 (2012)
Sanhueza, C., Mayer, R.: Top incomes in Chile using 50 years of household surveys. Estud. Econ. **38**(1), 169–193 (2011)
Simons, H.C.: Personal Income Taxation: The Definition of Income as a Problem of Fiscal Policy. University of Chicago Press, Chicago (1938)
Smeeding, T.M., Thompson, J.P.: Recent trends in income inequality: labor, wealth and more complete measures of income. Res. Labor Econ. **32**, 1–50 (2011)
Solimano, A., Pollack, M.: La Mesa Coja. Prosperidad y Desigualdad en el Chile Democrático. Colección CIGLOB, Santiago (2006)
Solimano, A., Torche, A.: La distribución del ingreso en Chile: la experiencia del último cuarto de siglo. Santiago de Chile, Revista del Banco Central de Chile, 31 de julio de 2008 http://www.andressolimano.com/publicaciones/distribucion.pdf (2008)
Wolfson, M., Veall, M., Brooks, N., Murphy, B.: Piercing the veil: Private corporations and the income of the affluent. Canadian Tax J. **64**(1), 1–30 (2016)