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**Abstract**

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Keyword: DINA, inequality, income

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# Improving inequality measurement: A literature review on DINA

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## Abstract

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This article reviews the existing literature on DINA based on the methodology by the World Inequality Lab (WIL). Most works have paid attention to building the series that make up the World Inequality Database, offering a description of the current and historical income distribution at the national level. Using these data, some analysis has also been done on the effectiveness of different redistributive policy measures in reducing observed inequality. However, few studies have developed causal models based on DINA.

The present review allows to highlight that there is a promising space open for research not only in the economic field (by reviewing and updating classic topics such as the causes and effects of income inequality, or its controversial relationship with economic growth), but in other areas of knowledge, such as environmental accounting, sociology or political science.

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# 1. Introduction

Income inequality has traditionally been one of the topics of major interest in the field of economics. The study of this phenomenon requires us to be able to quantify it in order to understand it, and for this we have numerous measures, but whichever one is used, its calculation requires data series that represent the distribution of income as faithfully as possible.

The data sources used in studies on income inequality are mainly three: household surveys, tax records and national accounting. However, the use of one or the other source is not neutral in the results, as a consequence of the methodological differences in their elaboration. An additional problem is the under-representation of high incomes[1], which leads to notable divergences between national accounting figures and the results aggregated from micro sources, which constitutes a serious obstacle in the estimation of causal models aimed at understanding inequality and its influence on different macroeconomic magnitudes such as growth.

Thus, some of the greatest challenges faced by the scientific community working on the field of inequality are to construct some national statistical series that integrate information from different sources, correcting the under-representation of high incomes and making them not only comparable, but also consistent with the figures provided by national accounting. These series are generically known as Distributional National Accounts (DINA). However, under this generic denomination we find several lines of work with different approaches, methods and objectives. Along with independent methodological proposals by different authors, two fundamental lines of work can be distinguished: on the one hand, the work developed by the Expert Group on Disparities in National Accounts (EG-DNA), and, on the other hand, the World Inequality Database (WID.world). The availability of these series not only makes it possible to provide a more accurate description of income distribution, but also a more rigorous evaluation of the effectiveness of redistributive policies. In this sense, there are already some studies evaluating the effectiveness of different economic policy measures (such as monetary and in-kind transfers) or the impact of collective consumption expenditure in reducing observed inequality, by comparing pre- and post-tax income series.

In this paper, a review of the literature on Distributional National Accounts will be carried out, focusing on the most recent contributions to date using the methodology proposed by the World Inequality Lab working group (Alvaredo et al., 2021). Specifically, the review covers 53 studies of a wide geographical spectrum, developed from 2018 to the present. The aim is to provide an updated map of the latest developments in this area, which will be useful for those with an interest in the field of income inequality, either researcher or

[1] The problem of the behaviour of the upper tail of the income distribution and its under-representation is rooted in the first studies of Kuznets (1953), and gained strength in the first decade of this century with the works of Piketty (2003) and Piketty and Sáez (2003), in which they generated series of high-income participation in the income distribution for France and the United States. These early works led to joint efforts which culminated in January 2011 with the World Top Incomes Database (WTID) project, the origin of the current World Inequality Database (WID.world).

non-academic specialists, such as policymakers. So far this is the first attempt to review the literature based on DINA.

The paper is structured as follows: Section 2 will present the main projects that have formulated their own methodology and have generated some, more or less extensive, databases of distributional data. Section 3 will review the papers that have served as a starting point for the WID.world series, from which a general map of global inequality will be provided. Section 4 will deal with research on the effectiveness of public policies, mainly those of a redistributive nature that have been carried out using distributional national accounts. Section 5 explores some other stylized facts regarding inequality, mainly the result of descriptive studies or obtained in the light of the development of the series themselves. Section 6 reviews econometric research on the causes of inequality using the WID.world DINA as a source. In section 7 we point out the new lines of research emanating from the distributional national accounts, aimed at exploring the consequences of inequality. The paper finishes with a section of conclusions.

## 2. Distributional National Accounts: main approaches

Driven by the same need to deepen the knowledge of the aggregate income distribution, and in particular, to correct the underrepresentation of high incomes in household surveys, two parallel projects were launched in 2011 to develop a comprehensive and accessible income database for different countries:

- On the one hand, the OECD, Eurostat and the national statistical institutes of several European Union countries formed the Expert Group on Disparities in National Accounts (EG-DNA), which focused on providing distributional accounts of disposable income by quintiles, limiting its work to the household sector. This work was carried out over three years, and now seems to have been taken over by the Task Force on Household Distributional Accounts (TF HDA) coordinated by Eurostat.
- On the other hand, a group of researchers developed the World Top Incomes Database (WTID), which later became what is now known as WID.world, a database developed and managed by the World Inequality Lab, compiling distributional national accounts (DINA) for a growing number of countries. Its approach focuses on generating a much more detailed national income distribution, offering information at four different levels with considerable granularity, providing 127 generalized percentiles, as opposed to the series of disposable income quintiles of the EG-DNA.

Of these two approaches, the second would be more comprehensive, given that if we aim to understand the causes of inequality and its influence on other magnitudes such as economic growth, technological progress or the effectiveness of economic policies, it is necessary to adopt an holistic approach that encompasses all the income generated and all economic sectors, without restricting oneself to one of them, households -and excluding the rest-, nor limiting the analysis of inequality to an aggregate such as adjusted disposable income. The WID.world approach allows working with four income

concepts, which makes it possible to evaluate inequality before and after taxes, and to study the effectiveness and depth of redistributive policies carried out by different governments[2].

## 3. Distributional National Accounts: the world map of inequality

Since the first works on DINA series for the United States (Piketty et al., 2018) and France (Garbinti et al., 2018; Bozio et al., 2024), several authors have already elaborated and disseminated analogous series for different countries and regions around the world. The series elaborated with the methodology recommended by the World Inequality Lab (Alvaredo et al., 2021) are available and constantly updated at WID.world. Currently, this database includes series covering more or less extensive periods for the complete income distribution in more than 100 countries or regions, including the aforementioned U.S. and France, Europe (Blanchet et al., 2022), China (Piketty et al., 2019), India (Chancel & Piketty, 2019), Russia (Novokmet et al., 2018), Latin America (De Rosa et al., 2020), Middle East (Alvaredo et al., 2019), Africa (Chancel et al., 2023), Australia, Canada and New Zealand (Fisher-Post, 2020), among others.

The main result of these studies is that practically all of them point to an increase in inequality when measured with DINA series with respect to that obtained from official statistics, both when compared with tax records and household surveys. In cases such as in the Middle East, since these are the first measures of inequality provided, there are no previous benchmarks for comparison.

Most of this literature has focused on the descriptive analysis of the trend evolution of income inequality in different countries and economic regions. Other studies have addressed the historical evolution of inequality and its controversial relationship with economic growth, explicitly or implicitly taking Kuznets' hypothesis as a reference. This line of literature includes several recent contributions, as summarized below.

Alvaredo et al. (2018) address the dynamics of global inequality by identifying a growing pattern in the period 1980-2016 in all areas, although with large variations between regions (very marked in Russia, North America, China or India, more moderate in Europe), with the exception of the Middle East, Brazil and sub-Saharan Africa where they observe a relatively stable trend of inequality but extreme levels of inequality. These authors find a strong correlation between the magnitude of the increase in inequality and certain political and institutional changes, such as Reagan's policies in the United States or the transition from communism to capitalism in Russia or China. Authors rule out the possibility that this increase is an inevitable consequence of globalization or technological change. They also analyse the relationship between changes in inequality and growth, studying the distribution of the percentage of growth captured by each income percentile: the richest 1% worldwide appropriates 27% of growth, and the

[2] Some alternative methodologies for developing distributional national accounts can be found in Advani et al. (2023), Ederer et al. (2022) or Ravallion (2022).

percentiles between 20 and 60, which correspond to the large emerging countries such as China and India, capture much higher percentages of growth with respect to both the percentiles below, poor countries, and those immediately above, those being the poor and middle classes of advanced countries, with low growth rates. The representation of these rates is the typical elephant shape described by Lakner and Milanovic (2013).

Similarly, Chancel and Piketty (2021) analyse the behaviour of global inequality for the period 1820-2020 by breaking it down into two main components: inequality "between" and inequality "within" countries. Both the overall magnitude and its components experienced a long period of growth until 1910, but since then, their behaviour differed: although global inequality has stabilised at a very high level up to the present days (the top 10% receives around 50-60% of world income over the period, compared to the bottom 50%, which receives barely 5-10%), its two components exhibit divergent trends: inequality "within" countries declined until 1980 and then resumed its upward trend until the present, while inequality "between" countries showed the opposite trend, rising steadily until 1980 and then beginning a downward phase. Regarding growth, in contrast to the elephant shape observed from 1980 onwards, the Growth Incidence Curve[3] for the entire period is upward: the top 30% have seen their purchasing power grow twice as much as the bottom 50% over the last two centuries.

Regarding specific regions, Piketty et al. (2018) find for the United States in the period 1913-2014 a U-shaped pattern of development for income concentration: it was high before the 1930s, with a strong participation in the average income of the top 10%, decreasing until the 1970s and increasing from the 1980s, with a stagnation of the average income of the bottom 50% and a strong increase of the top 1%, higher than the observed in France, taken as benchmark. Even though the average income per adult in France at the end of the period studied is 35% lower than in the United States, the bottom 50% of the distribution has an average pre-tax income 16% higher in France than in the United States, which shows high levels of inequality for a developed economy such as the United States, both in terms of income distribution before and after taxes. In 2014, the authors indicate that while the bottom 50% of the distribution receives only 12.5% of total pre-tax income, the richest 10% appropriates 47%, with the richest 1% taking as much as 20%. This high inequality is somewhat reduced after taxes, with the share of the bottom 50% increasing to almost 20% of after-tax income, to the detriment mainly of the richest 10%, whose share is reduced to 39.1%.

Moreover, these authors analyse two long periods with significantly differentiated behaviour as regards the distribution of growth: in the period 1946-1980, U.S. income experienced strong growth of about 2% on average, which was distributed almost uniformly throughout the overall distribution, generating an even slightly equalizing effect. In contrast, in the period starting in 1980, growth slowed down to 1.4% per adult and year on average (61% cumulative over the 34-year considered period), and became deeply asymmetric, with the average income of the bottom 50% of the distribution

[3] The Growth Incidence Curve (GIC) shows the annualised growth rate of per capita income for each percentile of the income distribution for a given time period (Ravallion & Chen, 2003).

stagnating before taxes (slightly offset after taxes, with a cumulative growth of 21%) in favour of the upper tail, where the top 10% experienced a 121% cumulative growth (only slightly reduced to 113% after taxes) (Piketty et al., 2018; Saez & Zucman, 2020).

In the same way, Blanchet et al. (2022) report in Europe for the period 1980-2017 a growing inequality, both for the whole area and almost in all of the 26 countries in their study; this rise mainly driven by the "within" rather than the "between" component. There is a more marked increase in inequality in Eastern Europe and in Northern countries, although it is in the North where inequality levels are still lowest. In any case, the study by Blanchet et al. confirms that income inequality in Europe is lower than in the United States, both before and after taxes, in line with the findings of Piketty et al. (2018) comparing the U.S. and France. As for growth, it has been lower on average than in the U.S. (1.1% versus 1.4%), and, though it reproduced the asymmetric pattern to some extent, it has been more evenly distributed: the Growth Incidence Curves of both areas cross at the $67^{th}$ percentile, implying that the average growth of all income groups below that threshold is higher in the European case than in the U.S., and the opposite is true for income groups above this percentile. Positive growth can be observed in Europe for all income groups, unlike in the U.S., where the poorest 30% of the distribution has experienced negative growth. The study by Garbinti et al. (2018) provides a very detailed overview for France over the period 1900-2014, again confirming a U-pattern, although less pronounced than the U.S. The turning point is in 1983, a fact which the authors attribute to mainly institutional causes linked to the decline of unions and collective bargaining, and to the fall in income tax rates. In the preceding period of high growth, the bottom 95% of the distribution saw their income grow above average, contrary to the top 5%, a situation that is reversed from that moment on, with even negative growth rates for the bottom 20%.

Likewise, Chancel et al. (2023), analyse inequality in Africa in the period 1990-2019, finding a very high, almost extreme, level of inequality, being especially high in the South of the continent, where a significant increase was observed throughout the period studied, with respect to other areas, such as North and West Africa where it remained relatively stable and more moderate. In terms of its components, the internal inequality component prevails over the between-country component, although the authors note a growing "between" inequality in the period in contrast to other regions such as Europe or Asia, a disparity that could be due to the poor quality of the data.

Alvaredo et al. (2019) obtain even more extreme results for the period 1990-2016 in the Middle East, with a strong contribution of both inequality "between (especially that between those rich in oil resources and the overpopulated ones) and "within" inequality, being the latter even underestimated due to the lack of access to adequate fiscal data.

Higher levels of inequality are also found in the Canadian case, based on the distributional national accounts. Xuereb et al. (2023) also identify an increasing pattern from 1982 to the mid-2000s, reducing very slightly thereafter and never recovering to the levels of the early 2000s. Growth has been very unevenly distributed, benefiting the upper part of the distribution: throughout the period, the bottom 50% of the distribution

only saw its income grow by 14.3%, compared to 135% for the 99$^{th}$ percentile and 344.02% for the 99.99$^{th}$ percentile.

The same occurs with Australia in the 1991-2018 period, according to Fisher Post et al. (2022), although the pattern of inequality is tendentially increasing, unlike the Canadian case. They perform a comparison exercise with the United States and France, finding an income distribution more similar to the French, albeit with a higher share of the middle 40% to the detriment of the bottom 50% of the distribution, with lower levels of inequality than those found for the United States. The average growth per adult of 1.7% was distributed asymmetrically, with both the bottom 20% of the distribution and the top 5% experiencing above-average growth in their pre-tax income, to the detriment of the middle 75%.

In the Latin American case for the period 2000-2020, De Rosa et al. (2023) question the reliability of the usual conclusions regarding the reduction of inequality in the first half of the 21st century in Latin America, as they are based only on household survey data. By incorporating fiscal information and improving the representativeness of high income brackets they find a huge gap between micro and macro data leading to contradictory results: either the region is more unequal with respect to the official figures, or growth has been lower than that implied by the macroeconomic figures. The adjustments made in the elaboration of the DINA for this region, while confirming a reduction in inequality in the bottom 99% of the distribution, reveal a greater distance with the richest 1% and greater inequality within the top centile, together with a growing contribution of capital income, leading to greater overall inequality that would contradict the official narrative.

Hong et al. (2024) develop DINA series for South Korea for the period 1933-2022 and, although they identify a lower overall inequality than other East Asian countries, motivated by a more equitable distribution of growth in the early 80s of the last century, they observe an upward trend in the last three decades, mainly since the Asian financial crisis. Similarly, Chu et al. (2023) identify for Taiwan a pattern of growth in pre-tax income inequality starting in the mid-1990s, accelerated from 2000 onwards, with levels higher than the values estimated with other sources. In contrast, Khalid and Yang (2021) find that economic growth has been accompanied by a decline in inequality in the Malaysian economy over the period 2002-2014. Additionally, Jenmana (2018) finds for Thailand during the period 2001-2016, a strong growth together with a steady inequality, which the poorest 50% and the richest 1% benefited from to the detriment of the middle classes. The author links these facts to the recent political developments in the country and the rise of anti-democratic narratives. These studies reveal the existence of multiple inequality/growth trends and the impossibility of finding a stable relationship between growth and inequality, as seen above for the U.S. case (Piketty et al., 2018).

To complete this section, a review is made of the evidence in relation to countries that abandoned communist planned economy models. As a common characteristic, a notable increase in income inequality is observed since they began their transition to market economies. The most relevant cases are presented below.

Using DINA, Novokmet et al. (2018) conclude that inequality in the Russian economy has skyrocketed from 1990-1991 after the demise of the Soviet Union, well above the official figures and the levels of other ex-communist countries, such as China and other Eastern European countries. They describe a U-shaped pattern of behaviour in the period 1905-2016, even more pronounced than that observed in other countries such as the United States, France or other ex-communist countries: very high and similar inequality in the tsarist era and in the post-Soviet stage, and on the contrary, very reduced in the Soviet period, as the result (at least to some extent) of the suppression of private property and, consequently, of capital rents and of the compression of wages and labour incomes. In the period 1989-2016 an average growth in mean income close to 1.3% per year is reported, with a very unequal impact across the distribution: the bottom 50% have experienced very little or even negative growth, and the middle 40% positive but very little growth, so it is the top 10% who have enjoyed very high above-average growth rates. This pattern is the opposite of the 1905-1956 period where the bottom 90% of the distribution appropriated the average growth to the detriment of the top 10%. Dorofeev (2021) completes this analysis for the same period using heat maps[4] from the series available in the WID.world making a comparative study with 27 countries and economic regions. He concludes that, though everything seems to indicate that inequality in Russia is higher than the figures of the Federal State Statistics Service (Rosstat), it is not as extreme as usually presented, equating to that of economies such as Brazil, India, Mexico, South Africa and, to a lesser extent, the United States, with a very high concentration of income in the upper part of the distribution.

As for China, Piketty et al. (2019) note in the period 1978-2015, a gradual increase in inequality from levels similar to the Nordic countries in the 1970s, to levels close to, but still below, those observed in the U.S. economy today. The authors show that the trend seems to have stabilized in recent years.

For India Chancel and Piketty (2019) find again in the period 1922-2015 the U-shaped pattern observed in other economies: after the introduction of the income tax in 1922, a period of reduced inequality and moderate growth is observed between 1951 and 1980 during the socialist-style planning phase, in which the bottom 50% of the distribution received 28% of total growth, with their incomes growing above average, while the richest 1% saw their income share decline to below 6%; then, in the period 1980-2015, the trend was reversed with the introduction of deregulatory policies-first by Rajiv Ghandi, later intensified as a result of conditions imposed by the International Monetary Fund (IMF)-, which led, from 2000, to an acceleration of economic growth to an average of 4.7%, but also of inequality, with the poorest 90% growing below the average (especially the bottom 50%) and the richest 10% growing substantially faster than the average.

[4] The author shows several comparative tables reporting for various percentiles their pre-tax income share percentages. Reddish tones are sued for the percentiles with higher income shares and, conversely, blueish tones for those with lower income shares.

These findings are similar for other ex-communist countries: Poland describes a U-shaped behaviour in the period 1892-2015: inequality being very high until World War II and after the return to capitalism, reduced in the communist period (Bukowski et al., 2023; Bukowski & Novokmet, 2021), a pattern analogous to that of the Czech Republic (Novokmet, 2018). The authors consider this evolution an extreme version of the behaviour of inequality in Western European countries and attribute it to institutional and political factors, thus questioning Kuznets' hypothesis, and in line with Piketty's analyses.

## 4. Use of Distributional National Accounts in public policy analysis

The evaluation of the redistributive impact of government policies is clearly facilitated by the very concepts of income used by WID.world since they allow for a comparison of the distribution of pre-tax and post-tax income. Thus, there are several studies that analyse the impact of governments' redistributive policies.

From a global perspective, Fisher-Post and Gethin (2023) conducted a study for 151 countries over the period 1980-2019 observing a generalised increase in income redistribution throughout the period, with the exception of Africa and Eastern Europe, where there was stagnation. They conclude that taxes and transfers effectively reduce inequality, although 90% of the effect is due to the influence of the latter, with only the remaining 10% being the result of taxes. Moreover, tax progressivity is not correlated with per capita income, the latter being connected with the amount of transfers received by the bottom 50% of the distribution. However, they find that the main component explaining variations in post-tax inequality does not come from the direct effect of these policies (redistribution) but from changes in the pre-tax income distribution (predistribution)[5]; nonetheless, countries with more progressive tax and transfer systems show lower levels of pre-tax inequality.

In this sense, it is demystified that the lower inequality in European economies compared to the United States derives from more redistributive tax systems (Blanchet et al., 2022; Bozio et al., 2024): on the contrary, U.S. policies are more redistributive, although not enough to bring inequality down to European levels, which highlights the dominant role of predistribution in explaining the differences observed in comparative analyses. The same is true for the Australian case (Fisher-Post et al., 2022).

[5] The term "predistribution" refers to the distribution of income before state intervention via transfers and taxes, which includes the distribution of market income and the indirect effect that public policies have on it, as a consequence of labour regulations, improvements in qualifications due to a better educational system, etc. An observed decrease in after-tax income inequality can combine two origins: changes derived from variations before taxes and transfers (predistribution) and those derived from redistributive policies by taxes and transfers (redistribution). According to Fisher-Post and Gethin (2023): "About 80% of the changes in after-tax inequality are due to differences in pre-tax inequality (predistribution), while 20% are due to the direct effect of taxes and transfers (redistribution)".

For Africa as a whole, the evidence is very preliminary due to the scarcity of data, but it seems to suggest that taxes and transfers have a minimal impact on the level and evolution of inequality, and that collective spending is insufficient and of low quality (Chancel et al., 2023; Gethin, 2023b). In the particular case of South Africa, this country experiences an extraordinary increase in pre-tax income inequality after the end of apartheid; such an increase is almost entirely offset by redistributive policies in the period 1993-2019 (Chatterjee et al., 2021).

For Latin America, De Rosa et al. (2023) find that the tax system is regressive as a whole, as a consequence of the heavy weight of value added taxes, and this is not compensated by the progressivity of transfers, which results in a regressive or neutral effect, at best. However, their studies once again endorse the effectiveness of in-kind transfers, derived from social spending on education and health, in reducing inequality, except for the case of Mexico.

DINA series have also been used to study the progressivity of tax systems: Guzzardi et al. (2022) examine the Italian case and conclude that, while it is slightly progressive for most of the distribution, it becomes regressive for the top 5%, with a tax rate falling from a maximum of 50% to 35%. Saez and Zucman (2020) reach an analogous conclusion for the U.S. economy, which evolves from a system in 1950 with very slight progressivity for the bottom 99% of income and very marked progressivity for the richest 1%, to a flat model in 2018 that becomes strongly regressive in the upper tail, in line with previous studies (Piketty et al., 2018).

Also in the field of public policy, albeit from another perspective, Balatsky and Ekimova (2021) address the issue of tax progressivity starting from the 2019 DINA, and simulate the effect that the modification of the flat rate by a progressive income tax would have on tax revenue in Russia. They conclude that tax reform in all formulated scenarios would lead to higher tax efficiency of this tax than government estimates.

Gethin (2023b) goes beyond cash transfers and analyses the impact on income distribution of public spending policies for the period 1980-2019 in more than 150 countries. His motivation for this analysis lies in the fact that, although these policies account for less than 10% of world GDP, public investments in education, health, housing, transport infrastructure, social services and other public goods represent about 30% of world GDP, making it essential to estimate the monetary value of public goods received by each income group and, consequently, their effect on income distribution and poverty reduction. The author concludes that in-kind transfers and government expenditures in the form of collective consumption have benefited all income percentiles within the bottom 60% of the distribution, attributing 20% of the decline in global inequality to the effects of public goods provision. Thus, public goods significantly reduce inequality within countries by being distributed more equitably than pre-tax income. That preponderant role of in-kind transfers and collective expenditures over cash transfers in the effectiveness of redistributive policies, especially for the equalization of the bottom 50% of the distribution, had already been pointed out by Piketty et al. (2018) for the U.S. economy.

Apart from these main lines of work, hardly any references explore other lines of research on public policies and inequality within the scope of the DINA. For instance, Ruankham and Sethapramote (2023) study through a VAR model the impact of monetary policies on inequality, for the Thai case over the period 1980-2021. They find that, while in the short run expansionary monetary policies stimulate growth and reduce inequality, their inflationary effect leads to growing inequality in the long run.

Finally, other studies seek to contrast the effect of redistributive policies aimed at reducing inequality on other variables, using causal models. Brzezinski (2022), using a panel of 34 countries in the period 1980-2010, concludes that redistributive policies aimed at reducing inequality do not have a negative impact on innovation.

## 5. Distributional National Accounts: other stylized facts

In a recent study from 2021, Lucas Chancel collected ten stylized facts regarding income and wealth inequality in developed economies. The first of these, the scarcity of data on inequality, speaks of the long road that still lies ahead, which projects such as WID.world are trying to shorten; regarding the others, the distributional national accounts have left evidence on some of them: an U-shaped behaviour over the last century, with an increasing phase at varying speeds starting in the 1980s (Piketty et al., 2018; Chancel & Piketty, 2021) and that was not interrupted by either the 2009 financial crisis nor the COVID-19 pandemic (Jestl & List, 2023); the observed reduction in inequality between countries and the increase in inequalities within countries, (Chancel & Piketty, 2021; Blanchet et al., 2022; Chancel et al., 2023), which, in the author's words, makes inequality more a phenomenon of class tan of nationality; the persistence of gender and racial inequalities, although their reduction over the last century has somewhat cushioned the increase in global inequality at the end of the century (Piketty et al., 2018); the higher inequality linked to lower social mobility; or the importance of public policies in reducing inequality, especially public spending on education or health at the bottom of the distribution (Piketty et al., 2018; Gethin, 2023b), or tax progressivity in relation to high incomes (Fisher-Post & Gethin, 2023)[6].

In any case, there is a notable fragmentation of the analyses that does not allow us to test whether the previously observed stylized facts on income inequality are reinforced or not with the use of DINA series, nor to consistently identify new empirical regularities.

The literature using DINA series to study the behaviour of income inequality in relation to socio-demographic characteristics is scarce and of a very local nature, so it does not allow extrapolating general conclusions that would require broader empirical support. There are barely a few studies that refer to aspects such as ethnicity, gender, educational level, age, origin or place of residence in the framework of broader analyses, such as

[6] Other facts pointed out by Chancel refer to the distribution of wealth: in particular, he notes that, while nations have become richer with the growth of private wealth and the increasing concentration in a few hands, governments have experienced a reduction in public wealth.

Piketty et al. (2018) for U.S., Fisher-Post (2022) for Australia or Khalid & Yang (2021) for Malaysia.

As an illustrative example, several papers address gender differences, based on the comparative analysis of the individualistic series with the "equal-split adults" series[7]. The gradual reduction of the gender gap over the last decades seems to have acted as a restraining factor of the growing inequality in the distribution of national income reported by different studies. This is observed for the United States (Piketty et al., 2018). Additionally, Fisher-Post et al. (2022) make a brief analysis of the evolution of inequality by groups, pointing to a reduction in inequality in the distribution of women incomes lately with respect to the distribution of male income.

As in the case of gender, for the rest of the demographic characteristics, we still find isolated references that do not allow a consistent generalization of conclusions.

## 6. Inequality: analysis of the causes

With regard to the literature focused on the development of econometric models aimed at identifying the factors that influence inequality using DINA series, the previous pattern is repeated: there are very few references and they are very fragmented, although the following are worth mentioning.

Sarkhosh-Sara et al. (2020) build a panel model for 82 countries in the period 2000-2017 and conclude that income inequality would be explained to a greater extent by institutional factors such as economic freedom -through a non-linear pattern- than by the divergent hypothesis (r>g) of Piketty (2013), considering that the effect of the latter is not significant in countries with high levels of inequality.

Likewise, the Kuznets hypothesis is also tested using causality models. Employing cointegration procedures and following an autoregressive distributed lag model (ARDL), Lazar and Litan (2023) find the Kuznetsian pattern in the Romanian development model in the post-communist period 1990-2020: after two decades of growth accompanied by increasing inequality, this seems to be pointing towards the downward branch of the inverted U shape. Additionally, they still identify high levels of inequality resulting from the development differential between urban and rural areas.

For the BRICS in the period 2004-2015, Rani and Kumar (2021), using a panel model, conclude that, while entrepreneurship does not affect income inequality, insofar as it raises the income share of not only the richest 1% but also the poorest 50%, it does have a favourable impact on human development. Accordingly, they encourage policy makers in these countries to create a strong "entrepreneurial ecosystem".

[7] In the "equal-split adults" series, household labour income is split equality between adults in a couple; meanwhile, in the "individualistic" series it is imputed directly to the person who receives it, which allows the evaluation of differentiated behaviour in the distribution of income by individuals' demographic characteristics, e.g., gender or age. On the methodology used in the WID.world, see Alvaredo et al. (2021).

Gethin (2023a) builds a model using the DINA income distribution to evaluate the role of education in economic growth and inequality. Using a sample of more than 150 countries for the period 1980-2019, Gethin concludes that education is responsible for more than 50% of global average per capita income growth and 70% of average per capita income growth in the poorest 20% of countries. Also Gethin (2023b) supports the importance of spending policies on public consumption goods and services in reducing inequality.

## 7. The effects of inequality: new lines of work

As in the previous cases, there are still few studies within the framework of the Distributional National Accounts that develop proposals for causality models analysing the effects of inequality, although it is worth highlighting the new lines of work that are opening up from other disciplines. The following are the main and most recent works in this regard.

Lucas Chancel is incorporating a new dimension to distributional national accounts by linking them to environmental accounting with the aim of developing Distributional Environmental Accounts (Chancel, 2020). He advocates the importance of analysing not only the overall environmental impact but also its distribution in order to increase the effectiveness of policy interventions. Chancel (2022) estimates for the period 1990-2019 at the global level that, 23% of individual greenhouse gas emissions in this period are attributable to the richest 1% of the population, well above the 16% attributable to the poorest 50%. Moreover, this inequality appears to be growing, and this trend is more attributable to inequality "within" countries than "between" them, as is also the case with income inequality.

In the field of environmental economics, Palagi et al. (2022) relate the effects of climate change in terms of precipitation anomalies with greater internal income inequality in countries with a strong dependence on the primary sector. This especially affects the population located in the poorest 50% and, at the same time, increases global inequality, having hardly any effect on more developed economies.

Beyond the economic field, other areas of knowledge are becoming interested in the use of distributional national accounts, such as Sociology or Political Analysis. Thus, Haddon and Wu (2022), based on a panel sample of 27 countries for the years 1992, 1999 and 2009, study the influence of social class on the perception of inequality in relation to the actually existing inequality. They conclude that income inequality at the aggregate level does not have a significant impact on population's perception of inequality, and it is the working class that has a greater perception of inequality, although it is the upper classes that are more sensitive to increases in income inequality.

Likewise, Ivanov (2023) explains the populist vote in Europe as a function of economic insecurity, using a multilevel mixed-effects probit model from a panel of 28 countries for the period 2002-2016. To capture the full effect of economic inequality as an explanatory variable and avoid omitted variable bias, the author combines measures of economic

insecurity with individual perceptions of inequality and with national income polarization, the latter being proxied by data from the distributional national accounts. He concludes that trust in institutions acts as a moderator of the effect of economic insecurity on the vote for populist options, except for the population suffering from greater economic inequality, whose propensity to vote populist is not moderated by greater or lesser institutional trust.

Finally, Blizard (2023) also uses information on income inequality taken from DINA series to incorporate it as a control variable in his model to explain corruption in the United States as a function of economic freedom and level of development.

## 8. Conclusions

In spite of the important number of articles and research in the field of National Distributional Accounts (DINA), we can conclude that the state of development is only incipient: most of the works are focused on the generation of data series and their updating, an essential aspect for the development of further works. Most of the studies aim to provide a description of the level and evolution of inequality and to analyse the impact of government policies on income distribution. Table 1a lists the most relevant global and regional studies and their main results and Table 1b summarizes individual country analyses.

There is an open path of great interest regarding the effectiveness of public policies in redistributive matters, and the analysis of the importance of predistribution on inequality. There is a reasonably large number of descriptive studies in this regard, although it is still insufficient and much remains to be explored, as is the case with the stylized facts linked to the dynamics of income inequality: it is necessary to identify them and verify whether the availability of more detailed and complete information, such as that provided by the DINA, significantly modifies our image of this phenomenon or whether, on the contrary, it confirms our current understanding.

However, few works till now exploit the information provided by the WID in causality models; consequently, future development in the field is wide open, both from (i) the perspective of understanding the determinants of income inequality and its sensitivity to changes in these factors, especially those susceptible to public intervention through different types of economic policies, and from (ii) the perspective of the consequences of greater or lesser income inequality on different variables. In this sense, some new lines research, linked to the environmental problem or to political and social behaviour, are of great interest.

Thus, the use of DINA opens up numerous future lines of research.

A first field of work is to delve into improvements of the methodology itself, such as the study of different hypotheses on the imputation of collective expenses to the different income percentiles that allow us to offer a more faithful image of their impact, or the estimation of the effect of tax evasion to further improve the representativeness of the high-income brackets of the distribution.

*Table 1a: Main references in the study of inequality and the effectiveness of public policies, using DINA. Global and Regional Analyses*

**Global and Regional Analyses**

| Authors | Region of study | Period analysed | Definitions of income | Fingings on Income inequality | Relationship to growth | Findings on the effectiveness of public policies |
|---|---|---|---|---|---|---|
| **(Alvaredo et al., 2018)** | North America, Europe, Russia, India, China, Middle East, Brazil, Sub-Saharan Africa | 1980-2016 | Pretax National Income | • Bottom 50% reflects top 10%.<br>• Growing inequality in all areas, but with large variations, correlated with political and institutional changes.<br>• Exceptions: Middle East, Brazil and sub-Saharan Africa, inequality steady but extreme since 1990. | • The largest percentage of the world's growth is appropriated by p99 and p20/p6<br>• Elephant shape Growth Incidence Curve | |
| **(Alvaredo et al., 2019)** | Middle East (15 countries included) | 1990-2016 | Pretax National Income | • Extreme inequality.<br>• Strong "within" (even probably underestimated) and "between" components. | • National income growth absorbed by population growth. Slight growth. | |
| **(Chancel & Piketty, 2021)** | East Asia, Europe, Latin America, Middle East/North Africa, North America, Oceania, Russia/Central Asia, South and Southeast Asia, Sub-Saharan Africa (incl. 33 countries and subregions) | 1820-2020 | Pretax National Income<br><br>Posttax National Income | • World inequality increasing until 1910 and high and stable until 2020.<br>• Inequality "within" countries, U-shaped, increasing since 1980.<br>• Inequality "between" countries, inverted U-shaped, decreasing since 1980. | • The elephant curve behaviour is observed from 1980 onwards.<br>• Upward Growth Incidence Curve if the whole period is considered: the top 30% have seen their purchasing power grow twice as much as the bottom 50%. | • Very slight redistributive effect of taxes and transfers until 1910 and somewhat greater but very limited after 1910' |
| **(Blanchet et al., 2022),** | Europe (26 countries included) | 1980-2017 | Pretax National Income<br><br>Posttax National Income | • Growing inequality<br>• Predominance of "inside" inequality<br>• Lower than in the U.S. | • Positive growth in all income groups.<br>• Increasing Growth Incidence Curve, but smoother than for the US. | • U.S. system more redistributive than the European system<br>• Greater weight of predistribution in explaining differences in inequality |
| **(Chancel et al., 2023)** | Africa (54 countries included) | 1990-2019 | Pretax National Income<br><br>Post tax National Income | • Extreme inequality.<br>• Significant increase in the South, stable in the North and West.<br>• Inequality "within" prevails over "between", although the latter seems to be growing. | | • Low redistributive impact of taxes and transfers.<br>• Insufficient collective spending and low quality. |
| **(De Rosa et al., 2023)** | Latin America (10 countries included) | 2000-2020 | Pretax National Income | • Contradictory results with respect to official figures. | | • Regressive tax systems<br>• Collective expenditures reduce inequality. |
| **(Fisher-Post & Gethin, 2023)** | 151 countries | 1980-2019 | Pretax National Income<br><br>Posttax National Income | | | • Widespread increase in redistribution, except Africa and Eastern Europe stagnant.<br>• Flat tax systems, with low progressivity<br>• Redistributive effect of transfers.<br>• Greater explanatory power of predistribution of inequality variations.<br>• More progressive tax systems in countries with lower pre-tax inequality. |
| **(Gethin, 2023b)** | Worldwide (all countries) | 1980-2022 | Pretax national income<br><br>Posttax disposable income<br><br>Posttax national income | | | • Increasing redistribution worldwide, mainly through in-kind transfers and collective spending.<br>• Public goods explain 20% of the reduction in global inequality. Effectiveness as much as taxes and transfers combined.<br>• Cash transfers stagnant.<br>• Government redistribution accounts for 30% of global poverty reduction.<br>• Low-income countries spend less, spend more on more regressive services and spend less well. On the contrary, high-income countries. |

Note: Works included in the table have been ordered according to the publication date.

*Table 1b: Main references in the study of inequality and the effectiveness of public policies, using DINA. Individual Country Analyses*

**Individual Country Analyses**

| Authors | Region of study | Period analysed | Definitions of income | Fingings on Income inequality | Relationship to growth | Findings on the effectiveness of public policies |
|---|---|---|---|---|---|---|
| **(Piketty et al., 2018)** | United States | 1913-2014 | Pretax National Income<br><br>Posttax National Income | • High inequality.<br>• U-pattern.<br>• Middle class stagnation, strong increase in top 1%. | • 1946-1980 strong growth spread evenly.<br>• 1980-2014 growth slowed and was appropriated by the top 10%. | |
| **(Garbinti et al., 2018)** | France | 1900-2014 | Pretax National Income | • U pattern: downward from 1968-1983 with wage gains. Ascending since then.<br>• Since then, increase in top 10% and especially top 1% participation. | • Growth experienced is concentrated in the period 1945-1980, average rate 3.7%; 0.9% average thereafter.<br>• Growth above the average for the bottom 95% and below the top 5% before 1983, on the contrary, thereafter.<br>• LP tendency for the bottom 90% to the detriment of the top 10%. | |
| **(Novokmet et al., 2018)** | Russia | 1905-2016 | Pretax National Income | • U-pattern: high inequality in tsarist and post-Soviet times, reduced in the Soviet period.<br>• Sharp increase in inequality since the abandonment of the planned model to the market economy. Above the rest of ex-communist economies and official figures. | • Average growth since 1989 of 1.3% per year, appropriate for the top 10%. bottom 50% zero or negative growth, very moderate in the central section.<br>• In the period 1905-1956 growth appropriate for bottom 90%. | |
| **(Jenmana, 2018)** | Thailand | 2001-2016 | Pretax National Income | • Greater inequality tan reflected in surveys.<br>• Inequality reduction is lower than the official one.<br>• Inequality has stabilized since 2001 | • Decreasing Growth Incidence Curve, except for the top 0.0001% of the distribution.<br>• Bottom 70% of the distribution grows above the average | |
| **(Piketty et al., 2019)** | China | 1978-2015 | Pretax National Income | • Gradual increase in inequality since the abandonment of the planned model towards the market economy. | • Average growth 6.2%. Since 1998, 8.1%. | |
| **(Chancel & Piketty, 2019)** | India | 1922-2015 | Pretax National Income | • U-shaped inequality: decreasing until 1980, increasing thereafter. | • Moderate growth 1951-1980 with decreasing inequality.<br>• Accelerated growth with deregulation since the 1980s, appropriated by the top 10%, and rising inequality. | • The absence of data impedes the evaluation of the distributional impact of economic policies. |
| **(Saez & Zucman, 2020)** | United States | 1978-2018 | Pretax national income<br><br>Posttax disposable income<br><br>Posttax National income | • Rising pre-tax inequality: top 1% almost doubles its income share.<br>• High average income, with bottom 50% receiving an average income in the order of 25%, well below the PPP of countries with lower average incomes such as France. | • If the average growth had been evenly distributed, the bottom 50% would have received 57% more, while the top 1% would have received 36% less (counterfactual analysis). | • Flat tax system, but regressive at the top of the distribution.<br>• Very low average tax rate: 28% vs. 50% in France.<br>• Lower progressivity than official figures.<br>• Redistributive effect of transfers, especially in kind (Medicaid/Medicare) and collective spending. Slightly lower after-tax inequality. |
| **(Khalid & Yang, 2021)** | Malaysia | 1984-2014 | Pretax National Income | • High inequality in the early 2000s with decreasing trend.<br>• 2002-2014: top 1% share decreases from 19% to 15% and bottom 50% share increases from 16% to 19%. | • High average growth: 55% accumulated in the period 2002-2014.<br>• Inclusive poorest 90% grew above average while richest 105 below. Highest growth: bottom 50%. | |
| **(Chatterjee et al., 2021)** | South Africa | 1993-2019 | Factor Income<br><br>Pretax national income<br><br>Posttax disposable income<br><br>Posttax national income | • Extreme leve lof inequality.<br>• Increase in inequality after apartheid. | • Stagnation until 2000, strong and rapid growth until 2011, decline thereafter. Average growth of 13%.<br>• 50% increase in top 1%, loss of 1/3 to bottom 50%. | • Taxes and transfers almost completely correct the increase in inequality.<br>• Regressive taxes, with very high effective rates for the bottom 50% as a result of the large weight of indirect taxes.<br>• Strong redistributive impact of transfers, especially those in kind. |
| **(Guzzardi et al., 2022)** | Italy | 2004-2015 | Factor Income<br><br>Pretax national income<br><br>Posttax disposable income<br><br>Posttax national income | • Greater inequality and higher income concentration at the top of the distribution than previous studies.<br>• Greater inequality for young people, women and inhabitants of the South.<br>• Crisis 2008 increased the share of top 10%, top 1% and richest 0.1%, with an increasing trend. | • Fall in per capita income of 13% on average over the period.<br>• Fall well above the average in the bottom 50%, in the average top 10%, below the middle 40%.<br>• Most affected group, young people in the bottom 50% of the distribution. | • Slightly progressive tax system up to the 95th percentile, regressive in the top 5%, with significant drop in the top 1%.<br>• If the population is ranked according to its net wealth, the tax system is regressive throughout the distribution |
| **(Fisher-Post et al., 2022)** | Australia | 1991-2018 | Pretax National Income | • Increasing inequality Distribution similar to France with higher p50/p90 weight and lower bottom 50%. | • Growth of the bottom 20% and top 5% above average. After taxes, it is the top 5% that is the only group growing above average. | • The inequality of the distribution of after-tax income is lower than that of after-tax disposable income, which in turn is lower than |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Posttax Disposable Income<br><br>Posttax National Income | | | that of pre-tax income over the entire period. |
| **(Chu et al., 2023)** | Taiwan | 1981-2017 | Pretax National Income | • Inequality much higher than official figures, at U.S. level.<br>• High inequality within households.<br>• Low and stable in the 1980s, rising from the mid-1990s, very rapidly since 2000. | • Rapid growth from 1981 to 2001, evenly distributed.<br>• From 2001 to 2017 slowed growth and uneven distribution. | |
| **(Xuereb et al., 2023)** | Canada | 1982-2021 | Pretax National Income<br><br>Posttax National Income | • Increasing until the mid-2000s, slightly decreasing thereafter | • Sharply increasing growth incidence curve. Very low growth in the lower 50% of the distribution, very high in the upper part of the distribution. | |
| **(Hong et al., 2024)** | South Korea | 1933-2022 | Pretax National Income | • Increase in inequality after the 1997 Asian financial crisis.<br>• Lower level of inequality than neighboring countries such as Taiwan or China.<br>• Bottom 50% share decreasing after the financial crisis, and increasing for the top 10%, although the upward trend has slowed down in the last years of the period.<br>• Share of high-income U-pattern: decreasing since 1933 due to political factors, increasing from the 1980s onwards. Current level similar to the 1950s. | • Strong growth since the 1960s, slightly higher before the Asian crisis of 1997 (5.3% annual average) than after (4.6%), evenly distributed in the 1980s. Close to other economies such as Taiwan, but still well below.<br>• Incidence curve fairly flat, with bottom 50% perceiving growth equivalent to p90-p99, somewhat below the central 40%. Top 1% benefits most from strong growth. | |
| **(Bozio et al., 2024)** | France | 1900-2018 | Pretax National Income<br><br>Posttax Disposable Income<br><br>Posttax National Income | | | • Lower inequality after taxes is entirely explained by lower inequality before taxes. |

Note: Works included in the table have been ordered according to the publication date.

A second line of work is to continue developing studies on the redistributive effectiveness of government policies, developing models that allow us to estimate, not from a descriptive but from a causal approach, the marginal contribution of each euro allocated to different expenditure items (monetary or in-kind transfers, collective expenditures...) or of each euro collected through different fiscal channels on inequality of distribution. Likewise, within the analysis of the effectiveness of policies, it would be very interesting to develop models that allow us to estimate their pre-distributive effect, trying to isolate the part of pre-tax income inequality that is a "pure" consequence of the market, from the part derived from public policies that indirectly act to reduce this inequality, which is equivalent to estimating the counterfactual of "what the distribution would be like if there were no state intervention whatsoever". Any step forward in this direction would make it possible to improve public intervention.

A third avenue remains the analysis of the controversial relationship between growth and inequality: understanding the factors behind the Growth Incidence Curve, as well as the influence of inequality on it.

A fourth line of work is to understand inequality that emerges among the different groups of population: differences by sex, educational level, race, ethnicity, etc.

As regards the limitations of the DINA, perhaps one of the main challenges is to integrate the impact of the non-observed economy on income distribution, since two major challenges are to be confronted: on the one hand, national accounting itself quantifies

the weight of this activity in a very deficient way, and on the other, the lack of homogeneous and comparable information to incorporate it.

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