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Monetary policy and wealth inequality in South Africa

Evidence from tax administrative data

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Abstract: This paper examines the relationship between monetary policy and wealth inequality in South Africa. We employed a unique database of tax administrative data which allowed us to account for individual heterogeneity. These tax data span from 2011 to 2017 and include over 3 million individual taxpayers in South Africa after data cleaning. Results based on fixed- and random-effects panel model estimates show that monetary policy generally increases wealth Gini inequality while it decreases the wealth 90–10 percentile differential. Increasing asset prices and gross domestic product per capita generally increases wealth inequality, while inflation reduces wealth inequality. The effect of age on wealth distribution varies depending on whether a fixed- or random-effects panel model is considered. Based on the estimates and observed data, being male tends to increase wealth inequality.

Keywords: monetary policy, wealth inequality, distribution, tax data, heterogeneity

JEL classification: C23, D14, D31, E52

This is an updated version from that published in December 2020, which required a small revision of the dataset reference.

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1 Introduction

Wealth is generally defined as including financial and non-financial assets that provide economic benefits to the owners, over which they can exercise their rights consistent with the United Nations System of National Accounts (European Commission et al. 2009). These include real estate, land, stocks, bonds, pensions, and insurance, among others. Since March 1987, *Forbes* magazine has documented annually the ranking of the net worth (wealth) of the world's wealthiest billionaires, also known as ultra-high net-worth individuals. The total net worth of each person is estimated based on their documented assets less debt. The net worth of the world's billionaires has been increasing over the years—from less than US$1 trillion in 2000 to over US$7 trillion in 2015. By 2018, the figure had increased to US$9.1 trillion relative to US$7.67 trillion in 2017, with an average net worth ofUS$4.1 billion (Dolan and Kroll 2015; Kroll 2017, 2018). This represents an increase of 18.64 per cent within one year. Reports show that 500 of the richest people in the world have become richer by US$1 trillion (Erickson 2017; Metcalf and Witzig 2017) and the top eight billionaires own as much combined wealth as 'the poorest half of the human race' (Mullany 2017; Ratcliff 2017).

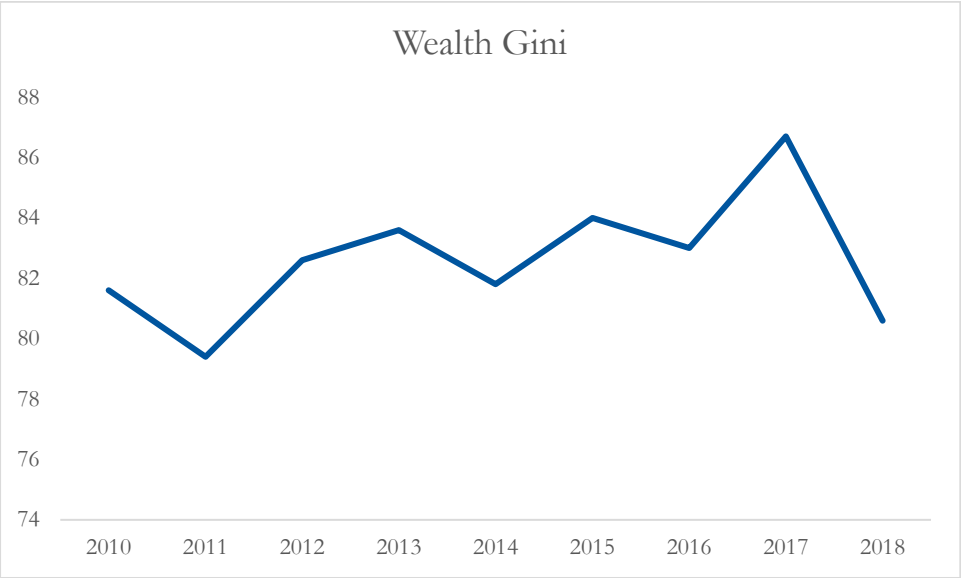
These trends raise concerns about the distribution of wealth and hence wealth inequality. One factor that has arguably contributed to rising wealth inequality in some countries has been the expansionary monetary policy of central banks since 2008. The Federal Reserve's quantitative easing, initiated in 2008, has generated debate over its effects on income and wealth inequality in the USA. A Brookings Institution symposium on the issue opened with the question: 'A widely heard criticism of the Federal Reserve's purchases of trillions of dollars in bonds, or quantitative easing, is that the Fed increased inequality by pushing up prices of stocks, bonds, and other assets already in the hands of the wealthy. Did it?' (Brookings Institution 2015). While quantitative easing is one instrument recently used in major recessions by some central banks, it focuses attention on the possibility that monetary policy more generally might have effects on the distribution of wealth.

Increasing income and wealth inequality has become a trending topic in the policy and research arena. The trend in inequality has been accentuated by the 'Great Recession' (Albert and Gómez-Fernández 2018; OECD 2016; Piketty 2014). South Africa is not an exception. The consumption Gini per capita in South Africa was as high as 0.63 as at 2015, while the wealth Gini, based on aggregate data from household sector balance sheets, was 0.84 and 0.81 in 2015 and 2018, respectively (Shorrocks, et al. 2015, 2018; World Bank 2018). These figures raise concerns, as inequality can impair economic growth (Berg and Ostry 2011; Colciago et al. 2019; Ostry et al. 2014), lead to social discontent, protectionist pressures, political instability (Dabla-Norris et al. 2015), higher household indebtedness, asset bubbles, and financial instability (Coibion et al. 2014; Kirschenmann et al. 2016; Kumhof et al. 2015), and limit opportunities for the poor to invest in education and entrepreneurial activity (Colciago et al. 2019; Jaumotte and Osorio Buitron 2015). While income and wealth inequality are important issues for policy, wealth possesses certain features which lead to it being prioritized over income and consumption. For instance, wealth is distributed less equally than labour income, total money income, or consumption expenditure (Davies and Shorrocks 2000) and tends to be more concentrated at the top (Korhonen 2018). Therefore, the current study focuses on wealth inequality and seeks to examine the impact of monetary policy on wealth inequality using data for South Africa.

By some measures, the trend of wealth inequality in South Africa has mostly been increasing. This is confirmed by the Credit Suisse report covering 2010 to 2018, as depicted in Figure 1. Data from the Credit Suisse report also show that South Africa's top 10 per cent of wealth holders control 68 per cent of the total US$786 billion of wealth, that is, 3.5 million people have US$534.5 billion

of the wealth (BusinessTech 2018; Shorrocks et al. 2018). The *Forbes* list for 2019 provides related information and features five South Africans among the world's list of billionaires, with a total wealth of US$18.7 billion, which represents about 2.4 per cent of the wealth of all 57 million citizens (Forbes 2019). Further, Orthofer (2016) shows that the top 10 per cent of the population own approximately 95 per cent of all wealth, while 80 per cent of the population have no wealth.

Figure 1: Wealth Gini coefficient for South Africa



Source: authors' compilation based on data from Shorrocks et al. (2014, 2015, 2018).

Wealth inequality is driven by several long- and short-term factors, albeit that their relative importance may differ. These factors include economic growth, demographic trends, savings behaviour, inheritance arrangements, general macroeconomic trends (globalization), skill-biased technological change, education, corporate trends in compensation, government or aggregate policies, asset prices, and exchange rate movements (Piketty 2014; Shorrocks et al. 2014). This study focuses on the effects of monetary policy. Although the effects of monetary policy on macroeconomic variables have been widely studied, the literature estimating the distributional impacts of monetary policy is relatively new. Bernanke (2015) argued that the monetary policy authority should not concern itself with distribution issues but should be left to elected officials, through fiscal policy. This implies that the best way that monetary policy can contribute to social welfare is by promoting aggregate economic stability, which is also likely to be beneficial from an inequality perspective (Doladoet al. 2018). Despite this, the relationship between monetary policy and inequality has been recently analysed (Albert and Gómez-Fernández 2018; Amaral 2017; Ampudia et al. 2018; Aye et al. 2019; Bullard 2014; Coibion et al., 2017; Dolado et al. 2018; Gornemann et al. 2016;Saiki and Frost 2014).

Several theoretical channels through which monetary policy may affect inequality in general have been identified, which we discuss in Section 2. According to Coibion et al. (2017), these include the savings redistribution channel, the earnings heterogeneity channel, the income composition channel, the financial segmentation channel, and the portfolio channel. The first two channels predict a reduction in inequality following an expansionary monetary policy shock, while the last three channels predict increasing inequality following an expansionary monetary policy shock. Nakajima (2015) summarized these five channels into two general distributive channels of monetary policy, namely inflation and income channels. The inflation channel contains the financial segmentation channel, the portfolio composition channel, and the savings redistribution channel. The income channel includes the income composition channel and the earnings

heterogeneity channel. Colciago et al. (2019) noted that monetary policy can affect wealth inequality specifically through the savings redistribution, inflation, interest rate exposure, and portfolio composition channels.

While several studies examine the effect of monetary policy on income equality, with few exceptions, studies of the effects on wealth inequality are rare. One reason for this is the absence of extensive sound data on the personal distribution of wealth. As a contribution to closing this gap, we examine the effects of monetary policy on wealth inequality in South Africa using the recently available rich individual panel tax administrative data. We do not know of any previous study that has used tax administrative data to analyse the effects of monetary policy on inequality.

Unlike household survey data, tax data overcomes the under-representation of the top income group, although low deciles are omitted because its coverage is limited to those with incomes above certain filing thresholds. Further, using tax data allows us not only to explore the relationship between monetary policy and wealth inequality but also to account for individual specific characteristics that may impact wealth inequality. In other words, we can capture both macro and micro economic factors that have a potential influence on wealth inequality. Moreover, the use of multiple years of administrative data makes it possible to distinguish the permanently wealthy from those individuals who happen to realize very high, but transitory, incomes and/or wealth in a given year (Bricker et al. 2015). Also, the time series dimension of the data helps to disentangle the effects of monetary policy from the underlying cyclical fluctuations to which monetary policy responds, while the cross-sectional data help to account for individual or household heterogeneity (Ampudia et al. 2018). Although wealth is not liable to taxation in South Africa, taxable investment incomes provide a good proxy for wealth (Atkinson and Harrison 1974; Orthofer 2016) and hence are used in this study. However, it should be noted that only investment income that exceeds the set threshold per tax year is usually included in the South African Revenue Service's (SARS) individual or personal income tax return form.

The rest of the paper is organized as follows. The next section presents the theoretical channels. Section 3 discusses the data. Section 4 presents the empirical model and Section 5 concludes with policy implications.

2 Effects of theoretical channels of monetary policy on inequality

This section discusses in detail the different channels of the transmission of monetary policy to inequality. As highlighted earlier, these channels include the savings redistribution channel, the earnings heterogeneity channel, the income composition channel, the financial segmentation channel, and the portfolio channel (Coibion et al. 2017). Although other studies use terms such as the interest rate exposure channel, inflation channel, macroeconomic activity channel, indebtedness channel, and direct and indirect channels (Amaral 2017; Ampudia et al. 2018; Colciago et al 2019; Dafermos and Papatheodorou 2018), these can still be summarized into the previously listed five channels identified by the first systematic study in this area, i.e. by Coibion et al. (2017).[1] The discussion that follows therefore focuses on the five channels and any other seemingly distinct channel.

Savings redistribution channel: Monetary policy changes in interest rates can have different effects on savers and borrowers across the wealth distribution. If an expansionary monetary policy

[1] The working paper version of this paper dates back to 2012.

leads to rising inflation and lenders have greater net wealth than borrowers, this will benefit the real value of borrowers relative to the real value of savers, as the real value of nominal debts decreases (Doepke and Schneider 2006; Nakajima 2015). In other words, there will be a transfer from lenders to borrowers. This implies that expansionary monetary policy reduces inequality. However, Romer and Romer (1999) showed that, in the long run, low inflation and stable aggregate demand are beneficial to the low-income group. The savings redistribution channel is closely related to the unexpected inflation channel through which the unexpected inflation causes revaluations of nominal balance sheets, with creditors losing and debtors gaining (Colciago et al. 2019).

Earnings heterogeneity channel: Depending on where a household is in the earnings distribution, the impact of monetary policy on its labour earnings may differ, causing a redistributive effect (Heathcote et al. 2010; Huber and Stephens 2014). According to Heathcote et al. (2010), changes in hourly wages affect the top of the earnings distribution, while the unemployment rate and number of hours worked affect the earnings at the bottom. In other words, unemployment rates are considerably higher in lower-income families relative to richer ones. If expansionary monetary policy reduces unemployment more than it increases hourly wages, for instance, income inequality will decrease. This implies that this channel works countercyclically to a monetary policy shock (Mumtaz and Theophilopoulou 2017). However, Inui et al. (2017) showed that under the assumption that high-income households have more capital income and less wage income, this channel may work rather pro-cyclically by widening income inequality, as expansionary monetary policy will lead to increased capital income but wage income may not change due to nominal wage stickiness.

Income composition channel: This also assumes that households are heterogenous and receive income from different sources. Unemployment benefits and food stamps are the main sources of income for households at the low end of the distribution. Households close to the median and at the upper tail of the distribution depend mainly on labour income and business or capital income, respectively (Amaral 2017). If richer or wealthier households have a higher proportion of interest income than poorer ones, an expansionary monetary policy shock which increases asset prices and hence financial incomes more than wages will disproportionately benefit high-income households (Coibion et al. 2017; Galbraith 1998). Moreover, if expansionary monetary policy stimulates economic activity, this could lead to increasing inequality at the lower end of the distribution as a result of rising wages and reduced unemployment, as economic activity does not vary much with transfer income (Amaral 2017).

Financial segmentation channel: This channel is similar to the income composition channel, as it is based on the assumption that richer households tend to be more connected to financial markets. Therefore, monetary policy-induced changes could benefit these more-connected households better than less-connected households (Williamson 2009). In other words, the benefit received by high-income households from increases in asset prices could also occur through the financial segmentation channel.

The portfolio channel: The previously listed channels concern monetary policy's effect on the distribution of income; their relation to wealth distribution is captured only as heterogeneity in investment income changes due to inequality in the initial distribution of wealth. The portfolio channel is the most important potential channel for an expansionary monetary policy to affect wealth distribution (Albert et al. 2019). This becomes apparent when the size and composition of asset portfolios differ across households. A fall in real interest rates increases asset prices, as lower interest rates make it more attractive to buy assets such as stocks, bonds, and housing. Higher equity prices result in capital gains which mainly benefit high-income households, which hold most of the financial assets. An expansionary monetary policy that increases the price of financial assets

would benefit these high-income households more, thus increasing wealth inequality (Coibion et al. 2017; Inui et al. 2017). Further, the value of real estate assets could appreciate due to higher house prices. This could lead to wealth equality if home ownership is largely distributed among the population, or increased wealth inequality if the population at the top of the wealth distribution owns the greater portion of homes (Colciago et al. 2019).

Dafermos and Papatheodorou (2018) explained a slightly different way in which the portfolio composition channel works. According to them, the portfolio reallocation channel implies that the relative rate of return on equities and deposits will change as the base interest rate changes. As firms' interest payments decline due to reduced interest base rates, this increases (reduces) the rate of return on equities (deposit interest rate) and, consequently, distributed profits. Therefore, households tend to invest more in equity. This can lead to rising wealth inequality as equity prices appreciate. However, they noted that the rate of return on equities can be influenced by changes in wages arising, for instance, from increasing macroeconomic activity following a fall in the interest rate. The portfolio reallocation channel can consequently be affected .

Inflation channel: As low-income households hold most of their assets in cash, a low interest rate resulting in high inflation will depreciate the cash because inflation erodes the purchasing power of such households. This will widen the gap between high- and low-income households further. In other words, since low-income households tend to use more cash as a percentage of their total expenditures in conducting their transactions, inflation will act as a regressive consumption tax, increasing income inequality (Amaral 2017; Erosa and Ventura 2002). However, it has been argued that unexpected inflation can cause revaluations of nominal balance sheets such that debtors gain while creditors lose. In other words, inflation causes a redistribution from lenders, who are mostly the wealthy, to savers, thus reducing wealth inequality (Adam and Zhu 2016; Colciago et al. 2019).

Interest rate exposure channel: If the real interest rate falls, this leads to an increase in financial asset prices. However, there is debate about whether this generally favours asset holders. For instance, Auclert (2016) argued that the correct measure of households' balance sheet exposures to real interest rate changes is the unhedged interest rates exposures (UREs).[2] Hence those households who invest their financial wealth mainly in short deposit certificates will have positive UREs, while those with long-term bond investments or adjustable-rate mortgage liabilities will have negative UREs. Therefore, a fall in interest rates will cause a redistribution from the first group to the second.

Ampudia et al. (2018) categorized these channels into direct and indirect channels. The direct channels comprise the savings redistribution channel, the portfolio composition channel, the interest rate exposure channel, and the unexpected inflation channel. According to them, the direct channels of monetary policy can be regarded as the partial equilibrium consequences of changes in interest rates. They are produced by the effect of a change in the policy rate on households' incentives to save and their net financial income while their employment status, prices, and wages are held fixed. The indirect channels include the earnings heterogeneity channel and the income composition channel and are due to the general equilibrium responses of prices and wages, hence of labour income and employment, to a change in monetary policy. Following a change in monetary policy rates, households' expenditure and firms' investments can change, leading to a change in output and an adjustment in employment and wages. Therefore, the indirect effect of

[2] The difference between all maturing assets and liabilities at a point in time.

monetary policy arises from changes in aggregate expenditure caused by variations in employment and wages.

3 Literature review

This section reviews empirical studies that have investigated the relationship between monetary policy and inequality. The section is divided into two: the first section focuses on those studies that consider monetary policy and income/consumption inequality and the second section considers studies on monetary policy and wealth inequality.[3]

3.1 Monetary policy and income inequality

Saiki and Frost (2014) used data from 2008 to 2014 and impulse responses from the vector autoregressive (VAR) model and found a significant positive effect of a contractionary monetary policy shock on Gini income inequality. Specifically, they found that by increasing the monetary base, unconventional monetary policy had widened income inequality in Japan in the short run, as this led to higher asset prices, thus benefiting the rich who usually hold these equities and acquire capital gains.

Using data on top income shares (top 1 per cent, 5 per cent, and 10 per cent), on the share of wage income in gross domestic product (GDP) from the OECD and the Gini coefficient in 32 advanced and emerging countries, and based on impulse responses from the local projection method, Furceri et al. (2018) showed that an expansionary monetary policy shock (that is, a 100 basis point decline in the policy rate) significantly reduced income inequality by 1.25 per cent and 2.25 per cent in the short and medium terms, respectively. Also, countries with a larger share of income and smaller redistribution policies had a larger effect. The effect was found to be asymmetric as the tightening of policy raised inequality more than easing it lowered it and depended on the state of the business cycle.

Inui et al. (2017) analysed the impact of conventional and unconventional monetary policy shocks on income and consumption inequality across Japanese households. They obtained ambiguous results as these differed depending on the span of data, measure of inequality, and whether they included or excluded households whose heads were unemployed. When using 1981Q1 to 1998Q4 data on inequality across households whose heads were employed, their findings showed that expansionary monetary policy shocks significantly increased income inequality. The effect was not significant when the sample was extended up to 2008Q4 or when earnings inequality included households whose heads were not employed. Further, they showed that the effect of monetary policy on income inequality was relatively larger than on consumption inequality.

Coibion et al. (2017) combined quarterly aggregate and household-level data from the US Consumer Expenditure Survey (CEX) in a structural VAR and found that expansionary (contractionary) monetary policy had a significant long-term reducing (increasing) effect on consumption, income, expenditure, and labour earnings inequality in the USA. The analysis was conducted using data from 1980 to 2008. Although they examined all the five channels previously identified, the earnings heterogeneity and income composition channels were especially strong in their results. Following contractionary monetary policy shocks, the earnings for high-income earners rose while the earnings for low-income earners fell, thus providing evidence in support of

[3] A number of studies examined both income and wealth inequality and hence are included in Section 2.

the earnings heterogeneity channel. Also, the income composition channel was confirmed, as the aggregate financial income rose sharply while business income declined after contractionary monetary policy shocks. As the top 1 per cent of the income distribution received a larger share of their income from financial income, whereas the low-income earners mostly received labour income, the resulting disparity between the income of the top and bottom layers of the income distribution led to increasing income inequality. While the effect of contractionary monetary policy tended to be statistically significant, its economic magnitude was moderate, especially during a stable inflation period; after the Volcker disinflation of 1981–82, monetary policy accounted for less than 5 per cent of the total variance of earnings inequality, 10–15 per cent of the variance of income inequality, and around 20 per cent of the variance of consumption inequality. However, Davtyan (2017) found that a contractionary monetary policy shock decreased income Gini inequality by up to 0.4 percentage points based on analysis conducted using US data from 1983 to 2012 and a vector error correction model (VECM).

Mumtaz and Theophilopoulou (2017) examined the effects of monetary policy shocks on earnings, income, and consumption inequality for UK households using micro-level quarterly data from 1969 to 2012. They used two measures of inequality: the Gini coefficient and cross-sectional standard deviation of log levels of disposable income, total consumption, consumption of non-durables, and gross personal wage. The results, based on structural VAR as well as factor augmented vector autoregressive (FAVAR) models, showed that contractionary monetary policy increased the level and volatility of these three measures of inequality. Further, they found that contractionary policy had a greater adverse effect on low-consuming and low-income households relative to households at the top of the distribution.

Sánchez-Fung (2017) examined the impact of monetary policy on income inequality in China based on time series data. The results showed that several monetary indicators and a change in the unemployment rate led to increases in the Gini coefficient. The effect was statistically significant only for unemployment and this was robust to including a fiscal policy proxy alongside inflation in the benchmark equation. Taghizadeh-Hesary et al. (2018) investigated the effect of quantitative easing (QE) and quantitative and qualitative easing (QQE) (through zero interest rate monetary policy and negative interest rate policy) on income inequality in Japan. This was in addition to examining the effect of tax policy on income inequality. Their findings showed that expansionary monetary policy proxied by an increase in monetary stock increased inequality, while tax policy reduced inequality in Japan.

Hafemann et al. (2018) estimated the effects of monetary policy on income inequality in six advanced economies, namely the USA, Canada, South Korea, Czech Republic, Hungary, and Sweden. The results from a VAR framework indicated that expansionary monetary policy shocks led to an increase in income Gini coefficients in all countries, albeit that the response of income inequality was significant only in countries with little redistribution. Analysis of the income composition channel (labour versus capital income) showed that the disproportional surge in capital income was the driving force behind the increase in net income inequality.

3.2 Monetary policy and wealth inequality

Doepke and Schneider (2006) found that an unexpected 10 per cent increase in the price level resulted in substantial redistribution of wealth for US households. Adam and Zhu (2016) showed that, in the euro area, younger, indebted households appeared to benefit from a surprise increase in the inflation rate while older savers seemed to suffer from it. The contrast is the case for surprise deflation. However, with small changes in price levels, the effects are negligible. Bullard (2014) noted that QE in the USA depressed the performance of the safest assets, thus displacing investors to hold assets with higher risk such as stocks—logically resulting in rising stock prices and,

therefore, in an increase in inequality. Similar findings for the USA are reported by Albert and Gómez-Fernández (2018), who used a structural vector autoregressive (SVAR) model to examine US expansionary monetary policy effects on wealth distribution through stock price inflation.

O'Farrell et al. (2016) examined the impact of monetary policy on income and wealth inequality in selected developing countries by focusing on the changes in returns on assets, debt interest payments, and asset prices. The employment and inflation channels were specifically excluded here. Their findings showed that the effect of monetary policy on income and net wealth inequality was small and ambiguous, with house prices reducing net wealth inequality while equity and bond prices increased it. They also found that higher inequality significantly affected the effectiveness of monetary policy.

Using an agent-based, stock-flow consistent model, Dafermos and Papatheodorou (2018) examined the effects of monetary policy on income and wealth inequality. They investigated what they termed the interest income, the indebtedness, the portfolio reallocation, and the macroeconomic activity channels. They found that, in the short run, income inequality rose with expansionary monetary policy due to higher dividends for richer households from reduced interest payments. However, income inequality declined with time as the macroeconomic activity channel became more prominent, resulting in falling unemployment. The portfolio reallocation and the indebtedness channels were the main routes to higher wealth inequality with expansionary monetary policy.

Ampudia et al. (2018) examined the heterogenous distributional effects of monetary policy shocks on euro area households using Household Finance and Consumption Survey data and a simulation approach. Heterogeneity was captured by considering the composition of household income and wealth. While they considered several channels—net interest rate exposure, intertemporal substitution, and indirect income channels—the indirect channel was found to play a more substantial role, especially for households with no or few liquid assets. They assumed a 100 basis points cut in monetary policy interest rates and computed the resulting reaction of house and stock prices after one year based on elasticities taken from the literature. They subsequently applied these changes to the asset portfolios of individual households to compute the impact of monetary policy on Gini wealth inequality by comparing the wealth Gini coefficients before and after the cut in interest rates. Overall, their findings showed that expansionary monetary policy proxied by low short rates benefited most households and did not contribute to an increase in wealth, income, or consumption inequality.

Lenza and Slacalek (2018) analysed the impact of unconventional monetary policy on income and wealth inequality in four large euro area countries—France, Germany, Italy, and Spain—using a large VAR with country-specific variables as well as euro area-wide and US variables. The VAR included house and stock prices, interest rates, and income drivers—unemployment rates and wages, as well as real GDP and GDP deflator. The income composition, portfolio composition, and the earnings heterogeneity channels of transmission were investigated. Overall, the results showed that QE, in the form of an Asset Purchase Program, reduced the unemployment rate, which boosted their mean income and a resultant reduction in the Gini coefficient on gross income from 43.1 to 42.8 per cent after four quarters, thereby providing support for the earnings heterogeneity channel as most low-income households became employed. The effect of monetary policy on wealth inequality was small.

Casiraghi et al. (2018) analysed the distributional impact of unconventional monetary policy using a micro dataset on Italian households' income and wealth, and accounting for all relevant transmission channels. The results, based on a large-scale Italian econometric model, showed that the benefits were larger for households at the bottom of the income distribution due to the

stimulus to economic activity and employment being larger than through financial markets. The net wealth response was U-shaped as less-wealthy households took advantage of their leveraged position, while wealthier households took advantage of their larger share of financial assets. Overall, they found that the effect of non-standard monetary policy on inequality was small and mostly not statistically significant.

Bunn et al. (2018) used a similar approach as in Casiraghi et al. (2018) but took account of the impact of household characteristics such as age. Using panel data from the Office for National Statistics Wealth and Assets Survey on households' characteristics and balance sheet positions from 2008 to 2014, they found that the overall short-run effect of monetary policy on income and wealth inequality in the UK was small. Albert et al. (2019) analysed the distributive effects of unconventional monetary policy (UMP) on household income and wealth in the USA and the eurozone. The results, based on SVAR, suggested that the UMPs applied by the Federal Reserve (FED) in the USA increased wealth and income inequality through the portfolio channel. However, the same results were not observed in the eurozone.

The conclusion from the reviews is that the results are mixed on the impact of monetary policy (conventional and unconventional) on income and wealth inequality. They vary between countries, datasets, methods, and the type of channels investigated. Overall, more country-specific analysis is required. The use of the SARS tax administrative panel datasets in this study sheds more light on the effects of monetary policy on wealth inequality, adding to existing studies that, instead, use mainly household survey data and national balance sheet data.[4]

4 Data

This study uses SARS tax administrative data, specifically, a combination of the individual-level panel dataset and macro-level data (National Treasury and UNU-WIDER 2019). The administrative dataset is an outcome of a joint research project between the South African National Treasury, SARS, and United Nations University World Institute for Development Economic Research (UNU-WIDER). The tax data are extracted from personal income tax return forms and this is anonymized for confidentiality purposes. The data are created from four linked panels: an 'ID panel', containing the original anonymized identification variables for each IRP5 certificate and ITR12 (personal income) return; an 'employment panel', with each row representing a formal period of employment, a lump sum payment, or a payment from a retirement fund; a 'source of income panel', with each row representing the amount of different categories of income including investment income per person per tax year; and an 'income panel', with each row representing the aggregated level of taxable income and tax liability, amongst other types of income, per person per year.[5]

The investment income in the SARS tax dataset is mainly categorized into interest income, rental income, capital gains, royalties, and foreign dividends. Although previous studies compute wealth inequality by capitalizing incomes using average investment returns for each asset class (Saez and

[4] Tables 1 and 2 in Colciago et al. (2019) summarize the empirical studies showing author(s), year of publication, sample period, country or group of countries studied, monetary policy measure used, distributional channel(s) investigated, and impact on income and/or wealth inequality. These are not replicated here as the survey is still very recent.

[5] For more information on the unique dataset, see Pieterse et al. (2018) and Ebrahim and Axelson (2019). In addition, Chatterjee's (2019) scoping paper on wealth inequality in South Africa could provide useful information.

Zucman 2014; Wolff 1987) or related yield multipliers, this study opts for the use of investment income, directly following Orthofer (2016). This avoids the additional sensitivity which would be introduced through such assumptions and, more importantly, given the relatively low granularity of the personal income tax records which amounts to the assumption that all asset classes generate the same average returns. The data are an unbalanced panel with annual data from 2011 to 2018. All individuals with non-zero, non-negative, and non-missing values for wealth are included in the analysis. This leaves us with 3,365,550 usable observations.

The study uses both the three-month Treasury Bill Rate (TBILL) and the Johannesburg Interbank Average Rate (JIBAR) as measures of monetary policy for robustness checks. For wealth inequality, both the Gini and the 90–10 differential are considered. To investigate the different monetary policy channels discussed earlier, the following macro variables are included in the analysis: real housing price, real stock price, real GDP per capita, andc onsumer price index. All macro-level data are sourced from the South African Reserve Bank. Age and gender are included in order to account for individual heterogeneity. The descriptive statistics for the variables used in the analysis are presented in Table 1. All variables except gender are in log form. The majority of the individuals are close to the retirement age of 60, with the average age being 54.5 years in South Africa. About 54.8 per cent of the individuals are males. All variables have positive mean values,with the exception of the wealth Gini inequality coefficient.

Table 1: Summary statistics

Variable	Mean	Std. Dev.
Age	3.9281	4.4333
Gender	0.5479	0.4977
Gini	-0.2737	0.0703
Wealth90_10	7.6043	2.1280
TBILL	1.8064	0.1384
JIBAR	1.8148	0.1291
GDP	10.9335	0.0088
House price	4.4879	0.1234
Stock price	4.9968	0.1511
CPI	4.4873	0.1083

Source: authors' computation.

5 Empirical model

This study uses fixed- and random-effects panel regression models to examine the effect of monetary policy on wealth inequality.[6]

The fixed-effects model is given as:

$$Y_{it} = \beta X_{it} + \phi_1 Z_{it} ..... \phi_k Z_{it} + \alpha_i + u_{it} \quad (1)$$

where:

α_i is the unknown intercept for each individual (that is, fixed effects);

Y_{it} is the dependent variable (wealth Gini or 90–10 percentile wealth differential) for each individual (at time, t);

X_{it} is the main independent variable of interest, monetary policy measured as JIBAR or TBILL;

Z_{it} are the control variables (GDP per capita, stock price, house price, consumer prices, age, and gender);

β and ϕ_1 to ϕ_k are the parameters to be estimated; and.

u_{it} is the stochastic term.

The random-effects model is given as:

$$Y_{it} = \beta X_{it} + \phi_1 Z_{it} ..... \phi_k Z_{it} + \alpha + u_{it} + \varepsilon_{it} \quad (2)$$

where:

u_{it} is the between-entity stochastic term; and

ε_{it} is the within-entity stochastic term.

All the other variables and parameters are as defined earlier.

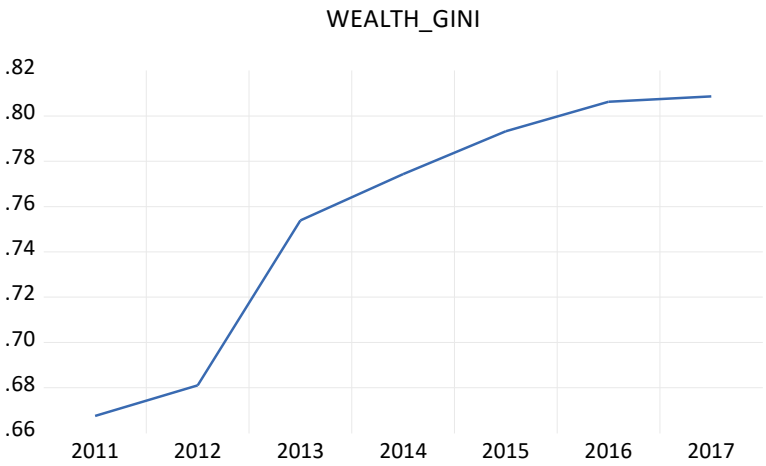
6 Results and discussions

Figure 2 presents the trend of wealth Gini inequality based on the individual tax administrative data over the sample period. It can be clearly observed that wealth inequality followed an increasing

[6] An attempt was made to estimate time fixed-effects panel models. However, the results were not reliable as there was little time variation in the data.

trend from 0.67 in 2011 to 0.81 in 2017. This 2017 value is close to the wealth Gini from Credit Suisse (0.86), which was computed based on national balance sheet data. It should also be noted that it is consistent with the observations in the literature that wealth Gini inequality in South Africa is far above the corresponding income Gini inequality. This demonstrates why research should not be concerned only with income inequality but also with wealth inequality, which is the focus of the current study.

Figure 2: Wealth Gini from individual tax data



Source: authors' computation based on National Treasury and UNU-WIDER (2019).

Table 2 presents the results for the effects of monetary policy on two measures of wealth inequality, namely the wealth Gini and the 90–10 wealth differential when JIBAR is used as a measure of monetary policy. Similar results are presented in Table 3, where the three-month TBILL is used as a measure of monetary policy. The results are obtained from the fixed- and random-effects models. We observe that each individual variable included in the model is statistically significant at 1 per cent. Using either the TBILL or JIBAR as a measure of monetary policy does not make much difference in terms of the signs, but the magnitude of the effects differs. For instance, while the effect of a 1 per cent increase in JIBAR raises the wealth Gini by about 0.02 per cent, the effect of a 1 per cent increase in TBILL raises the wealth Gini by about 0.07 per cent in both the fixed- and random-effects specifications. It is perhaps more interesting to note the different effects of monetary policy on different wealth inequality measures.

It is notable that the effect of monetary policy is positive on the wealth Gini but negative on the wealth 90–10 percentile differential. This may explain why the extant literature reports mixed findings on the effect of monetary policy on inequality as the results are not very robust to different measures of inequality. The results based on the wealth 90–10 differential suggest that expansionary monetary policy increases wealth inequality, while a contractionary monetary policy reduces wealth inequality.

These results are consistent with the portfolio allocation channel, which highlights that a fall in interest rates raises asset prices, as low interest rates make the assets more attractive to buyers. Moreover, rising equity prices as a result of lower interest rates translate to capital gains, which mostly benefit the wealthy, who hold most financial assets. Domanski et al. (2016) also found an increasing effect of expansionary monetary policy on wealth inequality, measured in terms of net wealth quintiles. However, this is in contrast to Ampudia et al. (2018), who found that expansionary monetary policy benefited most euro area households and did not contribute to an increase in wealth, income, or consumption inequality. It also contrasts with Hohberger et al. (2020), who found that expansionary monetary policy reduced wealth inequality, and Dafermos

and Papatheodorou (2018), who found that contractionary monetary policy generally increased wealth inequality although it led to higher equity prices.

Table 2: Estimates of the effect of monetary policy (JIBAR) on wealth inequality

	Gini		Wealth 90–10	
VARIABLES	Fixed effects	Random effects	Fixed effects	Random effects
JIBAR	0.0179***	0.0243***	-8.2639***	-7.9239***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	3.7519***	3.8654***	28.6830***	34.7411***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
House price	0.4317***	0.4280***	19.5618***	19.3657***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Stock price	-0.0260***	-0.0315***	4.9985***	4.7030***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CPI	-0.0355***	-0.0426***	-3.3918***	-3.7742***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age	-0.0233***	0.0001***	-1.2475***	0.0038***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Gender	0.0049***	-0.0000***	0.2629***	-0.0021***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	-42.8906***	-44.1527***	-383.9915***	-451.3420***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
R-squared	0.9639	0.9638	0.8900	0.8898
Individual FE	YES	YES	YES	YES

Note: pval in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Source: authors' estimations based on National Treasury and UNU-WIDER (2019).

Table 3: Estimates of the effect of monetary policy (TBILL) on wealth inequality

	Gini		Wealth 90–10	
VARIABLES	Fixed effects	Random effects	Fixed effects	Random effects
TBILL	0.0740***	0.0788***	-5.2042***	-4.9430***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	4.9152***	4.9893***	79.8246***	83.9120***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
House price	0.4292***	0.4271***	11.9777***	11.8588***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Stock price	-0.0973***	-0.0999***	0.7963***	0.6504***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CPI	-0.0679***	-0.0749***	4.9908***	4.6011***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age	-0.0171***	0.0001***	-0.9494***	0.0060***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Gender	0.0033***	-0.0001***	0.1851***	-0.0029***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	-55.2207***	-56.0478***	-932.3932***	-978.0544***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
R-squared	0.9646	0.9646	0.8840	0.8839
Individual FE	YES	YES	YES	YES

Note: pval in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Source: authors' estimations based on National Treasury and UNU-WIDER (2019).

An increase in house prices consistently increases wealth inequality in our data. The results from previous literature on the effect of house prices are ambiguous. According to Colciago et al. (2019), higher house prices increase the value of real estate assets, but the effect may differ depending on the homeownership structure. It can be equalizing if homeownership is distributed broadly among the population, or it can increase wealth inequality if more people at the top of the wealth distribution own houses. The results here suggest that, in South Africa, home ownership is concentrated at the top of the wealth distribution. The effect of increasing stock prices increases the wealth 90–10 differential and reduces wealth Gini inequality. This seems to follow the behaviour of the monetary policy measures. However, stock price increases are expected to lead to capital gains and if, as assumed, richer households own most of the stocks, stock price increases should increase inequality. As it stands, the response of the wealth 90–10 differential appears to be more consistent with a priori expectations.

In all the models, GDP per capita increases wealth inequality. This suggests that increasing macroeconomic activity may put more wealth into the hands of the already wealthy households, thus increasing inequality. This is the case in South Africa, where production is capital intensive as such rising GDP may be attributed less to the employment of labour. An increase in the price level, with the exception of that relating to the wealth 90–10 differential when TBILL is used, suggests a reducing effect on wealth inequality. These results are consistent with Doepke and Schneider (2006) for the USA and Meh et al. (2010) for Canada, who also found a reducing effect of inflation on wealth inequality. They are also consistent with Adam and Zhu (2016) for most of the euro area, except Austria, Germany, and Malta, where unexpected inflation increased wealth inequality. This reducing effect of inflation may be explained by the fact that inflation redistributes wealth from lenders/savers to borrowers. Since the low-wealth class are often the borrowers, one would expect a reduction in wealth inequality as inflation rises, as this reduces the debt repayments made by this class of individuals. However, this finding is in contrast with studies which find that inflation acts as a regressive consumption tax on poor individuals who have much of their assets in cash and a higher marginal propensity to consume (Amaral 2017; Erosa and Ventura 2002).

The effects of age are mixed, with the results from the fixed-effects models appearing negative, while those from the random-effects models appeared positive. It is expected that inequality should generally increase with age as old age is associated with wealth accumulation. The elderly have been described as net lenders, with large savings and investment primarily in long-term bonds (Doepke and Schneider 2006; Adam and Zhu 2016). With respect to gender, male is the reference category in the estimations. The effects of gender also vary with the model specification, being positive in the fixed-effects model and negative in the random-effects model. Given that, in our sample, the mean wealth (R57388.69) for males is larger than the mean wealth (R36500.95) for females, one may be tempted to stick to the positive gender effect. This is consistent with findings which show that females generally hold less wealth than males (Chang 2010; Di Matteo 2001; Killewald et al. 2017; Yamokoski and Keister 2006), have lower savings (Conley and Ryvicker 2004), and invest in safer lower-yield assets (Chang 2010; Ruel and Hauser 2013). Therefore, the results imply that having more males in the population tends to increase wealth inequality.

7 Conclusion

This study investigated the effects of monetary policy on wealth inequality in South Africa using tax administrative data from 2011 to 2017. These data allowed us to account for individual heterogeneity in the sample. The empirical analysis was conducted using fixed- and random-effects panel models. Our findings show that monetary policy increases wealth Gini inequality and decreases the wealth 90–10 percentile differential. Increasing asset prices (houses and stocks) and

GDP per capita increases wealth inequality, while inflation generally reduces wealth inequality. We show mixed evidence of the effect of age on wealth inequality, while being male tends to increase wealth inequality. These results have important policy implications. The administration of monetary policy should take account of the measure of wealth inequality that is most crucial for the economy. If the focus is on the extent of wealth inequality as measured by the Gini, an expansionary monetary policy in terms of low interest rates could be considered. However, if it is more crucial to handle redistribution of wealth, a contractionary monetary policy in terms of high interest rates should be considered. With regard to the results based on inflation, it is suggested that the monetary policy authority should continue to pursue policies towards achieving price stability in South Africa as this could contribute to improving welfare.

References

Adam, K., and J. Zhu (2016). 'Price-level Changes and the Redistribution of Nominal Wealth Across the Euro Area'. *Journal of European Economic Association*, 14(4): 871–906. https://doi.org/10.1111/jeea.12155

Albert, J.F., and N. Gómez-Fernández (2018). 'Monetary Policy and the Redistribution of Net Worth in the US'. Discussion Paper. London: London School of Economics. Available at: http://eprints.lse.ac.uk/91320/1/Gomez-Fernandez_Monetary-policy.pdf (accessed 10 January 2019).

Albert J-F., N.Gómez-Fernández, and C. Ochando (2019). 'Effects of Unconventional Monetary Policy on Income and Wealth Distribution: Evidence from United States and Eurozone'. *Panoeconomicus*, 66(5): 535–58. https://doi.org/10.2298/PAN161208007M

Amaral, P. (2017). 'Monetary Policy and Inequality'. Federal Reserve Bank of Cleveland Economic Commentary 01. Cleveland, OH: Federal Reserve Bank of Cleveland. https://doi.org/10.26509/frbc-ec-201701

Ampudia, M., D. Georgarakos, J.Slacalek, O.Tristani, P. Vermeulen, G.L. and Violante (2018). 'Monetary Policy and Household Inequality'. European Central Bank Working Paper Series, 2170. Frankfurt am Main: European Central Bank.

Atkinson, A.B., and A.J. Harrison (1974).'Wealth Distribution and Investment Income in Britain'. *Review of Income and Wealth*, 20(2): 125–42. https://doi.org/10.1111/j.1475-4991.1974.tb00914.x

Auclert, A. (2016). 'Monetary Policy and the Redistribution Channel'. Mimeo, Stanford University. Available at: http://web.stanford.edu/~aauclert/mpred_jan16.pdf (accessed 10 January 2019).

Aye, G.C., M.W. Clance, and R. Gupta (2019). 'The Effectiveness of Monetary and Fiscal Policy Shocks on U.S. Inequality: The Role of Uncertainty'. *Quality and Quantity*, 53(1): 283–95. https://doi.org/10.1007/s11135-018-0752-3

Berg, A., and J.D. Ostry (2011). 'Inequality and Unsustainable Growth: Two Sides of the Same Coin?'. IMF Staff Discussion Note 11/08. Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781463926564.006

Bernanke, B S. (2015).'Monetary Policy and Inequality'. Brookings Institution. 1 June. [Online]. Available at: https://www.brookings.edu/blog/ben-bernanke/2015/06/01/monetary-policy-and-inequality/ (accessed 14 January 2019).

Bricker, J., A.M. Henriques, J.A. Krimmel, and J.E. Sabelhaus (2015). 'Measuring Income and Wealth at the Top Using Administrative and Survey Data'. Finance and Economics Discussion Series 2015-030. Washington, DC: Board of Governors of the Federal Reserve System, http://dx.doi.org/10.17016/FEDS.2015.030.

Brookings Institution (2015). 'Did the Fed's Quantitative Easing Make Inequality Worse?'. 1 June. Available at: https://www.brookings.edu/events/did-the-feds-quantitative-easing-make-inequality-worse/ (accessed 20 January 2019)

Bullard, J.B. (2014). 'Income Inequality and Monetary Policy: A Framework with Answers to Three Questions'. Speech 235, Federal Reserve Bank of St. Louis. C. Peter McColough Series on International Economics Council on Foreign Relations. New York, NY. June 26.

Bunn, P., A. Pugh, and C. Yeates. (2018).'The Distributional Impact of Monetary Policy Easing in the UK Between 2008 and 2014'. Staff Working Paper 720. London: Bank of England.

BusinessTech (2018). 'How Much Money You Need to Earn to be in the Top 1 Percent in South Africa'. 21 October. [Online]. Available at : https://businesstech.co.za/news/wealth/278477/this-is-how-much-money-the-top-one-percenter-is-worth-in-south-africa/(accessed 20 January 2019).

Casiraghi, M., E. Gaiotti, L. Rodano, and A. Secchi (2018). 'A "Reverse Robin Hood"? The Distributional Implications of Non-standard Monetary Policy for Italian Households'. *Journal of International Money and Finance*, 85: 215–35. https://doi.org/10.1016/j.jimonfin.2017.11.006

Chang, M.L. (2010). *Shortchanged: Why Women Have Less Wealth and What Can Be Done about It*. New York, NY: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195367690.001.0001

Chatterjee, A. (2019). 'Measuring Wealth Inequality in South Africa: An Agenda'. WIDER Working Paper 2019/45. Helsinki: UNU-WIDER. https://doi.org/10.35188/UNU-WIDER/2019/679-1.

Coibion O., Y. Gorodnichenko, L. Kueng, and J. Silva (2017). 'Innocent Bystanders? Monetary Policy and Inequality'. *Journal of Monetary Economics,* 88: 70–89. https://doi.org/10.1016/j.jmoneco.2017.05.005

Coibion, O., Y. Gorodnichenko, M. Kudlyak, and J. Mondragon (2014). 'Does Greater Inequality Lead to More Household Borrowing? New Evidence from Household Data'. NBER Working Paper 19850. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w19850

Colciago, A., A. Samarinaa, and J. de Haana (2019). 'Central Bank Policies and Income and Wealth Inequality: A Survey'. *Journal of Economic Surveys*. 33(4): 1199–231. https://doi.org/10.1111/joes.12314

Conley D., and M. Ryvicker (2004). 'The Price of Female Headship: Gender, Inheritance and Wealth Accumulation in the United States'. *Journal of Income Distribution*, 13(3–4): 41–56.

Dabla-Norris, E., K. Kochhar, F. Ricka, N. Suphaphiphat, and E. Tsounta (2015). 'Causes and Consequences of Income Inequality: A Global Perspective'. IMF Staff Discussion Note 15/13. Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781513555188.006

Dafermos, Y., and C. Papatheodorou (2018). 'How Does Monetary Policy Affect Income and Wealth Inequality? An Agent-based Stock-flow Consistent Analysis'. Available at: https://www.boeckler.de/pdf/v_2018_10_26_dafermos.pdf (accessed 20 January 2019).

Davies, J., and A. Shorrocks (2000). 'The Distribution of Wealth'. In A.B. Atkinson and F. Bourguignon (eds), *Handbook of Income Distribution*. Amsterdam: North Holland. https://doi.org/10.1016/S1574-0056(00)80014-7

Davtyan, K. (2017). 'The Distributive Effect of Monetary Policy: The Top One Percent Makes the Difference'. *Economic Modelling*, 65: 106–18. https://doi.org/10.1016/j.econmod.2017.05.011

Di Matteo, L. (2001). 'Patterns and Determinants of Wealth Inequality in Late-Nineteenth-Century Ontario: Evidence from Census-Linked Probate Data'. *Social Science History*, 25(3): 347–80. https://doi.org/10.1017/S0145553200012153

Doepke, M., and M. Schneider (2006). 'Inflation and the Redistribution of Nominal Wealth'. *Journal of Political Economy*, 114(6): 1069–97. https://doi.org/10.1086/508379

Dolado, J., G. Motyovszki, and E. Pappa (2018). 'Monetary Policy and Inequality: A New Channel'. *Vox EU CEPR*. 17 May. [Online]. Available at: https://voxeu.org/article/monetary-policy-and-inequality-new-channel (accessed 8 February 2019).

Dolan, K.A., and L. Kroll (2015). 'Inside The 2015 Forbes Billionaires List: Facts and Figures'. *Forbes*. 2 March. [Online]. Available at : https://www.forbes.com/sites/kerryadolan/2015/03/02/inside-the-2015-forbes-billionaires-list-facts-and-figures/#663013c730ca (accessed 12 January 2019).

Domanski, D., M. Scatigna, and A. Zabai (2016). 'Wealth Inequality and Monetary Policy'. *BIS Quarterly Review*, March: 45–64.

Ebrahim, A., and C. Axelson (2019). 'The Creation of an Individual Panel Using Administrative Tax Microdata in South Africa'. WIDER Working Paper 2019/27. Helsinki: UNU-WIDER. https://doi.org/10.35188/UNU-WIDER/2019/661-6

Erickson, A. (2017). 'The World's 500 Wealthiest People Got $1 Trillion Richer in 2017'. *The Washington Post*. 27 December. [Online]. Available at: https://www.washingtonpost.com/gdpr-consent/?next_url=https%3a%2f%2fwww.washingtonpost.com%2fnews%2fworldviews%2fwp%2f2017%2f12%2f27%2fthe-worlds-500-wealthiest-people-got-1-trillion-richer-in-2017%2f (accessed 22 February 2019).

Erosa, A., and G. Ventura (2002). 'On Inflation as a Regressive Consumption Tax'. *Journal of Monetary Economics*, 49(4): 761–95. https://doi.org/10.1016/S0304-3932(02)00115-0

European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (2009). *System of National Accounts 2008*. New York, NY: United Nations.

Forbes (2019). 'Billonnaires: The Richest People in the World'. *Forbes*. 5 March. [Online]. Available at: https://www.forbes.com/billionaires/#166144da251c (accessed 20 January 2019).

Furceri, D., P. Loungani, and A. Zdzienick (2018). 'The Effects of Monetary Policy Shocks on Inequality'. *Journal of International Money and Finance*, 85: 168–86. https://doi.org/10.1016/j.jimonfin.2017.11.004

Galbraith, J.K. (1998). 'With Economic Inequality for All'. *The Nation*, September 7–14.

Gornemann, N., K. Kuester, and M. Nakajima (2016). 'Doves for the Rich, Hawks for the Poor? Distributional Consequences of Monetary Policy'. Board of Governors of the Federal Reserve, System International Finance Discussion Papers 1167. https://doi.org/10.17016/IFDP.2016.1167

Hafemann, L.,P. Rudel, and J. Schmidt (2018).'Moving Closer or Drifting Apart: Distributional Effects of Monetary Policy'. *The Manchester School*, 86(S1): 110–36. https://doi.org/10.1111/manc.12237

Heathcote, J., F. Perri, and G. Violante (2010). 'Unequal We Stand: An Empirical Analysis of Economic Inequality in the United States, 1967–2006'. *Review of Economic Dynamics*, 13(1): 15–51. https://doi.org/10.1016/j.red.2009.10.010

Hohberger, S., R. Priftis, and L. Vogel (2020). 'The Distributional Effects of Conventional Monetary Policy and Quantitative Easing: Evidence from an Estimated DSGE Model'. *Journal of Banking and Finance*, 113. https://doi.org/10.1016/j.jbankfin.2019.01.002.

Huber, E., and J.D. Stephens (2014). 'Income Inequality and Redistribution in Post-industrial Democracies: Demographic, Economic and Political Determinants'. *Socio-Economic Review*, 12(2): 245–67. https://doi.org/10.1093/ser/mwu001

Inui, M., N. Sudo, and T. Yamada (2017). 'Effects of Monetary Policy Shocks on Inequality in Japan'. Bank of Japan Working Paper Series 17-E-3. Tokyo: Bank of Japan.

Jaumotte, F., and C. Osorio Buitron (2015). 'Inequality and Labor Market Institutions'. IMF Staff Discussion Note 15/14. Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781513577258.006

Killewald, A., F.T. Pfeffer, and J.N. Schachner (2017). 'Wealth Inequality and Accumulation'. *Annual Review of Sociology*, 43: 379–404. https://doi.org/10.1146/annurev-soc-060116-053331

Kirschenmann, K., T. Malinen, and H. Nyberg (2016). 'The Risk of Financial Crises: Is There a Role for Income Inequality?'. *Journal of International Money and Finance*, 68(C): 161–80. https://doi.org/10.1016/j.jimonfin.2016.07.010

Korhonen, M. (2018). 'Factsheet: Wealth in South Africa'. Africa Check. 22 March. [Online]. Available at: https://africacheck.org/factsheets/factsheet-wealth-south-africa/ (accessed 10 February 2019).

Kroll, L. (2017).'Forbes 2017 Billionaires List: Meet the Richest People on the Planet'. *Forbes*. 20 March. [Online]. Available at: https://www.forbes.com/sites/kerryadolan/2017/03/20/forbes-2017-billionaires-list-meet-the-richest-people-on-the-planet/?sh=1bb24b662ff0 (accessed 25 January 2019).

Kroll, L. (2018). 'Forbes Billionaires 2018: Meet the Richest People on The Planet'. *Forbes*. 6 March. [Online]. Available at : https://www.forbes.com/sites/denizcam/2018/03/09/indian-jeweler-nirav-modis-fortune-up-in-smoke-amid-bank-fraud-allegations/#74ed766015c4 (accessed 18 February 2019).

Kumhof, M., R. Ranciere, and P. Winant (2015). 'Inequality, Leverage, and Crises'. *American Economic Review*, 105(3): 1217–45. https://doi.org/10.1257/aer.20110683

Lenza, M., and J. Slacalek (2018). 'How Does Monetary Policy Affect Income and Wealth Inequality? Evidence from the Euro Area'. Frankfurt am Main: Mimeo, European Central Bank.

Meh, C., J. Rios-Rull, and Y. Terajima (2010). 'Aggregate and Welfare Effects of Redistribution of Wealth Under Inflation and Price-level Targeting'. *Journal of Monetary Economics*, 57(6): 637–52. https://doi.org/10.1016/j.jmoneco.2010.05.001

Metcalf, T., and J. Witzig (2017). 'World's Wealthiest Became $1 Trillion Richer in 2017'. *Bloomberg News*. 27 December. [Online]. Available at: https://www.bloomberg.com/news/articles/2017-12-27/world-s-wealthiest-gain-1-trillion-in-17-on-market-exuberance (accessed 10 January 2019).

Mullany, G. (2017). 'World's 8 Richest Have as Much Wealth as Bottom Half of Global Population'. *New York Times*. 16 January. [Online]. Available at: https://www.nytimes.com/2017/01/16/world/eight-richest-wealth-oxfam.html (accessed 15 January 2019).

Mumtaz, H., and A. Theophilopoulou (2017). 'The Impact of Monetary Policy on Inequality in the UK. An Empirical Analysis'. *European Economic Review*, 98: 410–23. https://doi.org/10.1016/j.euroecorev.2017.07.008

Nakajima, M. (2015). 'The Redistributive Consequences of Monetary Policy'. Federal Reserve Bank of Philadelphia Research Department, Business Review, Q2, 9-16. Philadelphia, PA: Federal Reserve Bank of Philadelphia.

National Treasury and UNU-WIDER (2019). Individual Panel 2011-2018 [dataset]. Version 2019_1. Pretoria: South African Revenue Service [producer of the original data], 2019. Pretoria: National Treasury and UNU-WIDER [producer and distributor of the harmonized dataset], 2019.

OECD (2016). 'Income Inequality Remains High in the Face of Weak Recovery'. Available at https://www.oecd.org/social/OECD2016-Income-Inequality-Update.pdf (accessed 19 January 2020).

O'Farrell, R., Ł. Rawdanowicz, and K.-I. Inaba (2016). 'Monetary Policy and Inequality'. OECD Economics Department Working Paper 1281. Paris: Organisation for Economic Cooperation and Development.

Orthofer, A. (2016). 'Wealth Inequality in South Africa: Evidence from Survey and Tax Data'. REDI3x3 Working Paper 15. Cape Town: Research Project on Employment, Income Distribution and Inclusive Growth, University of Cape Town.

Ostry, J.D., A. Berg, and C. Tsangarides, C. (2014). 'Redistribution, Inequality, and Growth'. IMF Staff Discussion Note 14/02. Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781484352076.006

Pieterse, D., E. Gavin, and C.F. Kreuser (2018). 'Introduction to the South African Revenue Service and National Treasury Firm-Level Pane'. *South African Journal of Economics*, 86(S1): 6–39. https://doi.org/10.1111/saje.12156

Piketty, T. (2014). *Capital in the Twenty-First Century*. Cambridge, MA: Harvard University Press. https://doi.org/10.4159/9780674369542

Ratcliff, A. (2017). 'Just 8 Men Own Same Wealth As Half the World'. Oxfam. 16 January. [Online]. Available at: https://www.oxfam.org/en/press-releases/just-8-men-own-same-wealth-half-world (accessed 16 February 2019).

Romer, C.D., and D. Romer (1999). 'Monetary Policy and the Well-being of the Poor'. Economic Review, Federal Reserve Bank of Kansas City, Q1: 21–49. Kansas City, MO: Federal Reserve Bank of Kansas City.

Ruel, E., and R.M. Hauser (2013). 'Explaining the Gender Wealth Gap'. *Demography*, 50(4): 1155–76. https://doi.org/10.1007/s13524-012-0182-0

Saez, E., and G. Zucman (2014). 'Wealth Inequality in the United States Since 1913: Evidence from Capitalized Income Tax Data'. NBER Working Paper 20625. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w20625

Saiki, A., and J. Frost (2014). 'Does Unconventional Monetary Policy Affect Inequality? Evidence from Japan'. *Applied Economics*, 46(36): 4445–54. https://doi.org/10.1080/00036846.2014.962229

Sánchez-Fung, J.R. (2017). 'Estimating the Impact of Monetary Policy on Income Inequality in China'. *Journal of Macroeconomics and Finance in Emerging Market Economies*, 10(3): 260–7. https://doi.org/10.1080/17520843.2016.1254665

Shorrocks, A., J. Davies, and R. Lluberas (2014). *Credit Suisse Global Wealth Databook 2014*. Zurich, Switzerland: Credit Suisse Research Institute.

Shorrocks, A., J. Davies, and R. Lluberas (2015). *Credit Suisse Global Wealth Databook 2015*. Zurich, Switzerland: Credit Suisse Research Institute.

Shorrocks, A., J. Davies, and R. Lluberas (2018). *Credit Suisse Global Wealth Databook 2018*. Zurich, Switzerland: Credit Suisse Research Institute.

Taghizadeh-Hesary, F., N. Yoshino, and S. Shimizu (2018). 'The Impact of Monetary and Tax Policy on Income Inequality in Japan'. ADBI Working Paper 837. Tokyo: Asian Development Bank Institute.

Williamson, S.D. (2009.) 'Monetary Policy and Distribution'. *Journal of Monetary Economics*, 55(6): 1038–53. https://doi.org/10.1016/j.jmoneco.2008.07.001

Wolff, E.N. (ed.) (1987). *International Comparisons of the Distribution of Household Wealth*. Oxford: Clarendon Press.

World Bank (2018). *Overcoming Poverty and Inequality in South Africa: An Assessment of Drivers, Constraints and Opportunities*. Washington, DC: The World Bank.

Yamokoski, A., and L.A. Keister (2006).'The Wealth of Single Women: Marital Status and Parenthood in the Asset Accumulation of Young Baby Boomers in the United States'. *Feminist Economics*, 12(1–2): 167–94. https://doi.org/10.1080/13545700500508478