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Wage inequality under inflation-targeting in South Africa

Serena Merrino*

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Abstract

This paper provides new evidence of the effect of conventional monetary policy shocks on wage inequality through the earnings heterogeneity channel under the inflation-targeting regime that has been in place in South Africa since 2000. The empirical contribution follows previous studies by implementing a multivariate time-series analysis and identifying the structural shocks, as in Romer and Romer (2004). Impulse response functions, estimated from linear and non-linear local projections, show that the overall wage distribution temporarily worsens in response to unanticipated monetary contractions because of a widening gap between the two most extreme deciles. Wages in the top half of the wage distribution are less responsive to contractionary shocks, remaining protected by skill-biased technology and strong labour unions. The effect on inequality is temporary, however, declining after one year. Policy effects are also asymmetric, with very small reactions to accommodative shocks. Over the longer term and during expansionary phases of the business cycle, monetary tightening significantly and persistently *reduces* all metrics of inequality. This suggests that countercyclical use of monetary policy effectively contributes to lower wage inequality.

JEL classification: C32, D13, D31, E52

Keywords: Monetary policy, inequality, earnings heterogeneity, time series, South Africa

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1.   Introduction[1]

In modern economic theory, labour income is thought of as a function of a worker's capability (Mincer 1958). If access to schooling, health care and other determinants of labour productivity is unequally distributed among workers, then this will also be reflected in the distribution of earnings. High and rising income gaps in both advanced and emerging economies suggest that there are additional mechanisms determining the distribution of income. The literature identifies various causes, including weak unions (Machin 1997), skill-biased technological progress (Hassler, Rodriguez Mora and Zeira 2007), greater return on capital (Piketty 2013) and globalisation (Jaumotte, Lall and Papageorgiou 2013).

Usually, distributive issues do not warrant the attention of monetary authorities, whose mandate is normally concerned with aggregates. With a few exceptions, such as the United States Federal Reserve and the Bank of Israel that follow a dual mandate, price stability, which is intended to maintain inflation around a low target level or target range, is the primary objective of modern central banks around the world. While countercyclical monetary policy may be an effective output stabilisation tool, containing inflation is crucial to financial stability, sustainable debt servicing and thus long-run growth.[2]

Nonetheless, the established monetary policy frameworks of central banks were modified in response to challenges brought about by the 2007–08 global financial crisis. Not only has inequality become recognised as a factor contributing to financial instability and asset market inflation (Debelle 2004; Skott 2013), but experimental policies like quantitative easing are now cited for making inequality worse (Mumtaz and Theophilopoulou 2017; Saiki and Frost 2014). Most recently, the significant role of central banks in how countries have responded to the COVID-19 pandemic raises additional issues about connections with both inequality and fiscal financing. Thus,

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[2]   This central banking dogma results from the classical assumption that money is neutral in the long run and that markets are complete with agents fully insured against shocks. Consistent with these principles, the workhorse model in monetary policy analysis summarises the demand-side of the economy by means of a representative agent, whose welfare is the normative criterion of optimal resource allocation.

there is an inescapable need in academic and policy circles to discuss the interaction between monetary policy and inequality. South Africa's high degree of inequality, which has worsened since the achievement of a democratic government in 1994 and coexists with well-defined central banking practices, makes this study of the relationship between monetary policy and inequality particularly timely.

The response of the South African Reserve Bank (SARB) to the 2007–08 global financial crisis was similar to those of other central banks. While it has been following a flexible 3–6% inflation-targeting rule since February 2000, the SARB implemented accommodative actions in the face of both the global recession in 2008 and the pandemic-induced recession in 2020–21. During 2020, the monetary policy rate – the repo rate that stood at 6.25% in February 2020 – was reduced by 300 basis points. Debates about South Africa's interest rate policy under inflation-targeting include reference to its distributional effects: while the International Monetary Fund (IMF) has suggested moving from an inflation target range to a point target, citing benefits for poorer households (International Monetary Fund 2018: 35), significant public pressure exists to loosen monetary policy to fight unemployment.

Although several dimensions of agent heterogeneity characterise emerging markets, the policy importance for South Africa of assessing connections between monetary policy and distribution dynamics has not been matched by research into the subject. Aye and Harris (2019), for instance, investigate how exchange rate volatility affects the functional distribution of income. Aye, Harris and Chiweza (2020) report mixed findings by showing that tightening monetary policy increases wealth inequality measured by the Gini index but reduces the gap between the 90th and the 10th percentile of wealth distribution. Miyajima (2021) shows that the SARB Monetary Policy Committee's commitment to maintaining low and stable inflation affects the allocation of real consumption positively, given that those on the lower end of the consumption distribution benefit more from low inflation and are 'less negatively affected by lower labour income, weaker asset price performance and higher debt service cost' (Miyajima 2021:16). A few other works focus on the impact of inflation on the poor (Kahn 1984; Oosthuizen 2007).

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Additional evidence has to be collected before robust stylised facts can be produced. This paper contributes to the debate, on the premise that a better understanding of how monetary policy affects South Africa's economic inequality is essential for developing innovative and sustainable economic policy in the country.

This paper reports new evidence of the consequences for wage inequality of conventional monetary policy shocks in South Africa. It focuses on the earnings heterogeneity channel to explore the indirect effects that unexpected changes in the policy rate have on the distribution of wages among employees through their differential impact on economic activity and therefore on employment opportunities for various sub-groups of the population (Auclert 2019). A relevant analysis in this field should answer the following questions:

1. Has the SARB's monetary policy had any significant reallocative effect on the wage distribution? If so, are these effects long term or transitory? And how do the responses of economic activity, unemployment, and the labour share of income relate to dynamics in the wage distribution?

2. Are effects asymmetric such that contractionary shocks affect wage inequality more or less than accommodative monetary policy shocks? Do these heterogeneous effects depend on the state of the economy?

The paper is organised as follows: Section 2 reviews how monetary policy actions can redistribute wealth and income, including labour income; Section 3 describes the data cleaning process that was crucial to develop time-consistent inequality measures and the method followed to identify the monetary policy shocks; Section 4 presents the core model, extensions and results of the impact of monetary policy shocks on wage inequality in South Africa since the start of the inflation-targeting regime in 2000; and Section 5 presents my conclusions.

2.   Redistributive channels of monetary policy

When the SARB varies the repo rate at which commercial banks fund their reserve requirements, the decision has a direct effect on the prime rate at which banks lend to firms and households, and an indirect impact on employment and output due to the general equilibrium echo of prices and wages (Ampudia et al. 2018). However, empirical evidence suggests that, assuming market participants have different

endowments and preferences, individual responses to interest rate variations will differ.[3] As a result, the actions of central banks may have some redistributive effect across households depending on the size and the composition of their income or wealth. On the other hand, if markets are incomplete and risk is not fully insurable, agent heterogeneity can affect the overall transmission of monetary policy, because policy actions in certain key markets (labour, goods, asset markets) impact some groups more than others.[4] Even under the assumption that the effects of monetary policy on real variables cancel out over the course of the business cycle, redistributive effects can be persistent if agents' responses to contractionary and expansionary monetary policy shocks are not perfectly symmetric.

The next section outlines the channels through which monetary policy shocks can alter resource allocation across heterogeneous agents and produce inequality in income or wealth. Given the scope of the empirical model in Section 4, special attention is given to those channels of transmission that are particularly relevant to the labour market and wage inequality: the income composition and earnings heterogeneity channels, described in Sections 2.5 and 2.6 respectively. The theoretical argument is illustrated in terms of an expansionary policy shock, a surprise reduction in the repo rate that initially raises the inflation rate. In contrast to the SARB being averse to inflation, politicians and other commentators have often advocated accommodative monetary policy as a quick fix for South Africa's most fundamental issues of economic growth, job creation and economic inequality. In the following section, the transmission instrument of expansionary monetary policy shocks as well as the dimension of household heterogeneity associated with each channel are stressed.

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[3]   Income sources include labour income (wages and salaries), capital or financial income, business income (from proprietorships) and transfer income (such as unemployment benefits). Household net wealth results from subtracting households' liabilities (mortgages, car loans, credit card debt, etc.) from assets (not only financial assets, but also business assets and, crucially, housing).

[4]   For instance, a growing body of theoretical works explores how balance sheet differences across households determine their marginal propensity to consume out of temporary income shocks, and so may amplify the transmission of monetary policy (e.g. Iacoviello 2005; Krueger, Mitman and Perri 2016; Bilbiie and Ragot 2017).

2.1   Savings redistribution channel

As the real value of assets and liabilities decreases, surprise inflation redistributes wealth from creditors to debtors, thereby lowering inequality if the poor have a relatively higher balance sheet exposure. Laidler and Parkin (1975: 789) find evidence 'overwhelmingly based on United States data' that loose monetary policy reduces the indebtedness of middle-class households that tend to own relatively more debt than upper-income households. Voinea and Cojocaru (2018) achieved a similar result in post-crisis Romania and stressed how poor households with limited access to financial markets did not respond to policy changes. For the euro area, Adam and Zhu (2016) conclude that younger households are generally indebted and tend to benefit from an unexpected hike in the inflation rate. However, these effects are quantitatively very small for single-digit hikes in the inflation rate, and differ across countries. The distributional effects of surprise inflation not only depend on the size but also on the maturity structure of households' nominal position (Auclert 2019). Doepke and Schneider (2006) map households in the United States into age and wealth categories, and find that unexpected inflation hurts rich households the most, as they tend to hold long-term assets like bonds and short-term debt, whereas low-income and middle-income population groups exhibit the opposite tendency because of the weight of long-term fixed-rate debt, such as mortgages, on their balance sheets. Furthermore, households with little or negative net wealth tend to adjust to interest rate changes significantly more than the wealthy (Cloyne et al. 2020).

In South Africa, although no study has yet assessed the distributional effects of this channel, there is evidence of balance sheet heterogeneities across the income ladder. According to Ardington et al. (2004), the most indebted South African households belong to either the lowest decile or the highest deciles of the income distribution, although they vary in the debt instrument and source of financing. The former usually incurs short-term debt held by retail stores and family members, whereas debt at the top end of the distribution comes in the form of mortgages or vehicle loans. Therefore, in South Africa, the interest rate channel is likely to redistribute wealth in a way that favours the rich indebted class more than the poorest.

2.2 Interest rate exposure channel

A fall in real interest rates also redistributes financial income between creditors and debtors. It decreases creditors' returns on interest-paying loan assets and lowers the real value of debtors' servicing costs. O'Farrell, Rawdanowicz and Inaba (2016) analyse this interaction in selected Organisation for Economic Co-operation and Development (OECD) economies and find that lower returns on net wealth had a positive impact on income redistribution in Canada, the Netherlands and the United States only, but had a negative impact elsewhere. The effect is always found to be small, indicating that direct interest payments account for a tiny portion of household income. Bunn, Pugh and Yeates (2018) also conclude that loose monetary policy narrows the income gap between age groups in the United Kingdom, where young households tend to have outstanding debts. In the best-case scenario, if highly indebted households adjust their consumption to changes in disposable income while expenditure choices of the top percentile do not depend on credit conditions, expansionary policy would reduce the consumption gap. Floden et al. (2016) observed Swedish households that had loans with adjustable rates and found this group to be very responsive to interest rate changes. In particular, monetary policy will affect consumption if households do not vary the level of indebtedness in response to rate variations. Otherwise, if the household is forward-looking and has good access to financial markets, such variations in cash flows will not necessarily result in consumption changes.

In South Africa, data reveal the large differences in access to formal financial services across income categories (Ardington et al. 2004). In particular, higher income households usually procure their debt from banks in order to accumulate assets (such as housing and vehicles) and so benefit from interest rate cuts, whereas poorer households that incur debt from family and retail stores are vulnerable to high and much less responsive interest rates, and have limited access to financial markets. Expansionary monetary policy is thus likely to increase inequality through this channel.

2.3 Portfolio allocation channel

Low interest rates increase the appeal of financial assets with higher expected returns and, consequently, raise the price of those assets. This will, in principle, redistribute

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wealth and capital income from households whose net asset values increase slowly, if ever, such as cash- and bond-holders, to those with faster asset price inflation, such as equity investors. In the context of a new Keynesian dynamic stochastic general equilibrium (DSGE) model with heterogeneous agents and search and matching frictions in the labour market, Gornemann, Kuester and Nakajima (2016) find that by reducing labour income risk and precautionary savings, accommodative monetary shocks adversely affect the price of shares at the expense of the wealthy. The unintended distributive consequences of monetary policy actions on asset prices have also been examined in the context of recent unconventional large-scale asset purchases by central banks. The estimated impact of quantitative easing on wealth inequality through the portfolio allocation channel is trivial (Montecino and Epstein 2015; Bivens 2015; Adam and Tzamourani 2016; O'Farrell, Rawdanowicz and Inaba 2016; Bunn, Pugh and Yeates 2018) or the impact is cancelled out through the savings redistribution channel of the monetary shock (Casiraghi et al. 2018; Inui, Sudo and Yamada 2017). However, the rising value of real estate could reduce wealth inequality if homeowners represented a large proportion of the population (Adam and Tzamourani 2016; Domanski, Scatigna and Zabai 2016; O'Farrell, Rawdanowicz and Inaba 2016).

In South Africa, Orthofer (2016) estimates that 10% of the population possesses approximately 95% of national wealth, while 80% of the population has no wealth at all. Consistent with the portfolio allocation channel, Aye, Harris and Chiweza (2020) find that in South Africa, contractionary monetary policy decreases the wealth gap between the richest and the poorest 10% of the population, while higher stock and house prices lead to higher wealth differentials.

2.4   Inflation tax channel

Using time-series evidence for the United States, Romer and Romer (1999) find that expansionary monetary policy decreases inequality in the short run through the channels mentioned thus far. However, they also notice monetary policy has a differential impact across economic agents in the long run too, through the new equilibrium rate of inflation. In fact, they show that in the long run, low inflation and stable aggregate demand growth are associated with the enhanced well-being of the poor. Persistently high inflation discourages investment and consumption, and

therefore job creation and long-run growth too. Also, inflationary pressures disproportionately erode the purchasing power of low-income households that tend to use relatively more cash and rely on state-determined income that is not fully indexed (Easterly and Fischer 2001). Furthermore, individuals at the low end of the distribution usually spend a higher proportion of their income and have less choice over consumption baskets that consist of a few basic items, such as staple food and housing. Inflation, therefore, encourages precautionary savings (Erosa and Ventura 2002). Assuming that the shopping time is a mirror image of the inflation tax, and so that poor households spend more time shopping and searching for better deals to protect from higher inflation costs, productivity can also drop (Cysne, Maldonado and Monteiro 2005). Albanesi (2007) models a bargaining game in which richer households hold greater power in the political process, such that the government finds incentives to finance public spending through seigniorage rather than taxation. This leads to inflation and income inequality. Finn, Leibbrandt and Oosthuizen (2014) adjusted income by the inflation rate experienced by the poor in South Africa and found that the poverty rate soared by 4.5 percentage points over the period 2005–10. Based on a panel of 15 OECD countries, Galli and Von der Hoeven (2001) find a U-shaped relationship between inflation and inequality: income inequality declines as inflation rises from low to moderate rates, but inequality increases when inflation is above 12%. De Mendonca and Esteves (2018) observe that, in developing countries, enhancing the transparency of central bank operations can significantly decrease the adverse effect of inflation on the poor. Miyajima (2020) explores the distributional consequences of monetary policy on consumption levels in South Africa and concludes that individuals with lower consumption levels, who tend to rely less on labour income, appear to benefit mainly from lower inflation, while individuals with higher consumption levels are more likely to be negatively affected by monetary contractions through lower labour income, weaker asset price performance and higher debt service cost.

2.5   Income composition channel

In general, different segments of the income distribution depend on distinct sources of income. Finn (2015), who elaborates on 2012 survey data to represent the composition of household income by income decile in South Africa, shows that government transfers and remittances are a fundamental source of income for poor households and they become less important in upper deciles of the distribution: in 2012,

government grants represented about 80% of income in the lowest decile (Finn 2015). Wage income is a relatively small part of poor household income, accounting for about 20% at the bottom. Wages overtake government grants as the largest contributor to income after the fourth decile and their importance increases as we move towards middle- and top-income households, which depend mostly on labour earnings. Finally, households at the top of the distribution can also rely on capital income, which in 2012 made up 10% of total income of the highest decile (Finn 2015). If, given government transfers, monetary policy actions boost one type of income disproportionately, then they may have redistributive consequences depending on the composition or source of income by decile. Yet any effect on wages is likely to have a relatively small impact on the overall allocation of income, given the limited contribution of wages to the living standards of poor households in South Africa.

Based on an analysis of past recessions in the United States, Heathcote, Perri and Violante (2010) proposed that the global financial crisis would mitigate rising pre-tax income inequality by causing larger declines in income from business activities and dividends than from wages and rising transfers. They also concluded that taxes and social transfers improved income inequality at the bottom of the distribution, with only tiny effects on the whole distribution. Coibion et al. (2017) report that a contractionary shock leads to a significantly negative response of total incomes in the 10th percentile, especially at longer horizons, whereas incomes of those at the 90th percentile rise persistently relative to the median household. The DSGE model by Gornemann, Kuester and Nakajima (2016) provides results similar to, but less persistent than, that of Coibion et al. (2017): in their exercise, the income of high-wealth households rises due to a spike in dividends, whereas the income of lower-wealth households declines on the back of lower earnings. Using data on the wage share and income distribution in 32 advanced and emerging countries, Furceri, Loungani and Zdzienicka (2018) show that a positive monetary policy shock significantly increases income inequality by 1.25% and 2.25% in the short and medium term respectively. The effect is found to be asymmetric as policy tightening raises inequality more than easing lowers it. By contrast, investigating monetary policy in the United States from 1983 to 2012, Davtyan (2017) finds that a surprise increase in the interest rate reduces income inequality up to 0.4 percentage points in the Gini index. In contrast to the effects of conventional monetary policy easing, quantitative easing supposedly worsens income inequality by

raising realised returns on various financial assets, concentrated in the hands of rich households (Mumtaz and Theophilopoulou 2017; Montecino and Epstein 2015; Bunn, Pugh and Yeates 2018). Saiki and Frost (2014) estimate these effects based on Japanese household survey data and find that the Bank of Japan's Abenomics programme significantly widened income inequality. Feldkircher and Kakamu (2018) find an opposite result for Japan, but their measure of unconventional monetary policy is the shadow interest rate, which is likely to understate the portfolio rebalancing effect of central banks' asset purchases.

2.6   Earnings heterogeneity channel

The earnings heterogeneity channel tries to capture how changes in policy impact on labour earnings and through to income inequality. Empirical evidence is ambiguous. Coibion et al. (2017) show that contractionary shocks significantly increase inequality in the United States, and that the effects on wage income are larger than for total income. By contrast, under the inflation-targeting regime in Mexico, Villarreal (2014) finds that unanticipated monetary tightening reduces labour income inequality over a two-year horizon. The study also notes that this result may be explained by the presence of stronger financial frictions in Mexico (such as financial access) that flattens the Phillips curve and increase the output cost of inflation stabilisation, 'such that inflation stabilisation is welfare enhancing, whereas the opposite occurs in the United States' (Villarreal 2014: 14).

Another stream of literature explores how countercyclical monetary policy actions affect the job creation process across different income decile groups. For example, Gregg and Machin (2012) and Bivens (2015) estimate decile-specific hourly Phillips wage regressions in the United Kingdom and United States respectively. Both studies find a negative relationship between wage growth and unemployment across all deciles: the lower down the income distribution, the more vulnerable an individual is to unemployment. Bivens (2015: 30) observes that 'the most important distributional effect of expansionary monetary policy is by far the impact that lower unemployment rates have on wages at the bottom and middle of the wage distribution. (…) If, for example, the Fed should move monetary policy in a contractionary direction before the economy was stabilised at full employment, this would disproportionately harm the wages of low- and moderate-wage workers'.

Reallocative effects may arise through the earnings heterogeneity channel for different reasons. For example, when labour markets are segmented and mobility across firms is limited, or when unionisation is stronger in services than in manufacturing, the heterogeneous impact of monetary policy on firms and sectors easily translates into large distributional effects across workers. Galbraith and Hale (2014) find that between-sector gaps drive wage inequality in the United States. Bivens (2015) points out the heterogeneity of sectors and particularly how interest-sensitive industries – such as construction, durable goods manufacturing and tradable goods – could benefit relatively more from lower interest rates. These sectors also tend to pay higher wages than other economic sectors. Using a two-sector dynamic general equilibrium model, Inui, Sudo and Yamada (2017) explore these dynamics in Japan in the period before 2008 and demonstrate that labour market flexibility (rather than financial heterogeneity) is the crucial structural feature that prevents monetary policy shocks from having large distributional effects. However, the authors also note that by weakening the profile of workers at the bottom of the income distribution, sustained flexibility in the labour market can become a source of structural inequality in the long run. Looking at asymmetric elasticities across the skill distribution, Carpenter and Rodgers (2004) find that the US Federal Reserve's monetary tightening increases unemployment rates of low-skilled workers and racial minorities, particularly teenagers, due to their higher substitutability. Dolado, Motyovszki and Pappa (2018) develop a new Keynesian model with capital-skill complementarity in the production function and asymmetric search-and-matching frictions in the labour market. They find that expansionary monetary policy shocks increase earnings inequality by raising the wage premium and employment opportunities for high-skilled workers, and therefore they favour a stricter inflation-targeting regime. They also note that their model is not consistent to conclude that, by opposite reasoning, contractionary shocks reduce income inequality, given that high-skilled workers would have the opportunity to search for low-skill jobs. Using a similar framework, Gornemann, Kuester and Nakajima (2016) show that a less conservative monetary policy rule that provides partial insurance against unemployment risk is relatively more beneficial for poorer households.

When considering the transmission of monetary policy through the earnings heterogeneity channel in South Africa, it is particularly important to take into account the structure of the country's labour market. Due to high reservation wages and strong

bargaining institutions, wages are generally not very responsive to labour market conditions and so the sacrifice ratio is large, requiring large changes in aggregate demand to stabilise inflation (Dadam and Viegi 2015). In general, the South African literature indicates that the Phillips curve trade-off between inflation and unemployment has reduced substantially or even disappeared (Vermeleun 2017; Fedderke and Liu 2018; Kabundi, Schaling and Some 2019). Nevertheless, due to a serious shortage of skilled workers and consequent labour market segmentation, a monetary policy shock is likely to affect labour earnings differently across the income distribution. For instance, Essama-Nssah et al. (2007) study the distributional effects of a large oil price shock in South Africa and find that it negatively affects wages and employment for the poorer, low-skilled segment of the formal labour market, whereas the earnings of high-skilled households rise. Similarly, Heathcote et al. (2010) show that in the United States, while top earnings are mainly affected by changes in hourly wages, earnings in the bottom deciles are directly related to the number of working hours and the unemployment rate, that is, with business cycle fluctuations.

The South African labour market is thus characterised by a series of rigidities that are not uniformly distributed across workers. One of those rigidities is the difference between the unionised and non-unionised labour market, that implies the existence of higher and more sticky non-clearing wages in the unionised sector, and which accounts for a quarter of formal jobs (Fedderke 2012). In light of these features, this paper will now empirically analyse the effects of monetary policy on wage inequality and the earnings heterogeneity channel of monetary policy transmission in South Africa.

3   Data

3.1   Wage inequality[5]

Despite there being a rich body of literature examining cross-sectional inequality in South Africa, no consensus has been reached on the quality of long-run time series that measure the distribution of income in the post-apartheid period. In effect, multiple generations of household surveys have been produced since 1994 by local statistical

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[5]   This section relies heavily on my previous work (Merrino 2020).

and research agencies, providing nationally representative micro-level information on the labour market.[6] Although these resources constitute today an abundant pool of information, they were not originally designed for dynamic analysis and, indeed, do not allow for straightforward comparability and immediate use in longitudinal studies. In other words, the nature of the data collected differs more or less substantially in each survey wave because of, for example, differences in the sample design instrument and definitions.

As a response to rising concerns over the validity of using distributional data to undertake time-comparative exercises, the University of Cape Town's research data service DataFirst initiated a study of 58 successive labour market cross-sections and integrated them into a single stacked dataset: the so-called Post-Apartheid Labour Market Series (PALMS) (Kerr, Lam and Wittenberg 2019). The main advantage of the latest release, PALMS v3.3, is that it exhibits a labour income variable at individual level that is consistent over the entire period, from 1993 to 2017.[7] Although PALMS yields significant improvements in the treatment of labour data in South Africa, it preserves a number of incongruities inherited from primary sources. To date, the South African literature that assesses the sensitivity of distributional trends to economic policy shocks is almost non-existent precisely because dynamic analyses would suffer from the presence of methodological shortcomings: spurious shifts among repeated cross-sections are inevitably related to real changes in the variables of interest. For the purpose of this paper, it is therefore necessary to derive unbiased estimates and accurate standard errors of inequality coefficients that can be better compared over time. While it is not feasible to fully address all problems pertaining to primary data collection, corrections implemented on PALMS v3.3 deal with outliers and implausible data records, missing observations at random, bracket responses and sample weights, breaks in the series (or missing observations not at random), under-reporting of high incomes, and extrapolation of quarterly frequency observations. My previous work (see Merrino 2020) provides a more detailed discussion of the corrections applied to PALMS v3.3 and the derivation of the Gini index and other measures of inequality (i.e.

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[6] According to Devereux (1983), until the 1980s, government censuses ignored the personal incomes of black people that had to be calculated as a residual of national accounts. For this and other reasons, the present paper refers only to the post-apartheid period.

[7] This is labelled '*realearnings*' and it reports monthly earnings *per capita* before taxes and at constant prices as for December 2015.

percentile dispersion ratios and the labour share of income) used in Section 4 of this paper. Ultimately, inequality is measured on pre-tax wage income at constant prices and individual level, for employees of working age, collected between the first quarter of 2000 and the second quarter of 2019.

Figure 1: Evolution of the Gini index and the labour share of income (2000 Q1–2019 Q2)
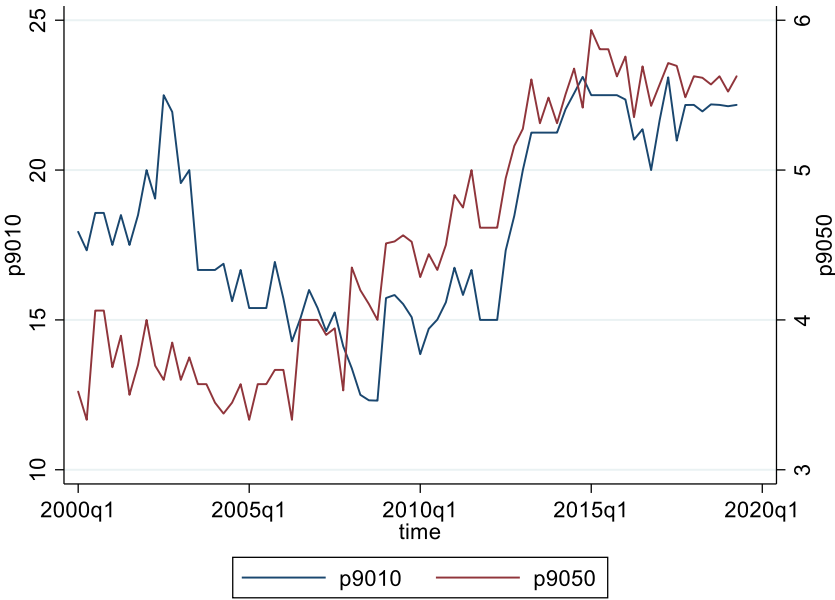

Source: Author's calculation based on PALMS v3.3 after adjustment

Figure 1 plots the Gini index estimate series (blue line) and the labour share of national income (red line) that is the part of national income allocated to workers in the form of monetary compensations as opposed to the part of value added going to the capital input. This plot reveals the presence of a positive trend in wage inequality as measured by the Gini index, confirmed by existing literature that makes use of alternative South African survey data. As noted in Merrino (2020), the labour share moves together with inequality as if increasing wages and employment opportunities affected higher incomes relatively more. This figure also displays a 10% rise in the Gini index over the course of one year, from 2012 Q1 to 2013 Q1. This sudden change may be mostly due to methodological issues, given that 'in 2012 South African officials changed the way they collected data on earnings' (Leibbrandt, Ranchhood and Green 2018: 10), and partly to the decline in real gross domestic product (GDP) growth that corresponds to this period, although this is just speculation that cannot be tested here. As evident by the evolution of the 90th-10th percentile dispersion ratio in Figure 2, the explosion in

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the Gini index is driven by the widening gap between wages at the bottom and at the top of the distribution.

Figure 2: Evolution of the P90/P10 and the P90/P50 dispersion ratio (2000 Q1–2019 Q2)

Source: Author's calculation based on PALMS v3.3 after adjustment

Figure 2 shows the evolution of the P90/P10 and the P90/P50 dispersion ratios. These two measures represent, respectively, the gap between the average wage of the richest decile and the median earner (red line), and the gap between the average wage of the richest and the poorest decile of the distribution (blue line). Both widened until 2013–14, but while the P90/P50 dispersion ratio follows a positive trend, the evolution of the P90/P10 ratio resembles the Gini index in Figure 1, with an alarming peak in 2012 Q2 that could have resulted from the aforementioned methodological changes. This measure of wage inequality does not account for unemployed and self-employed individuals, meaning the actual figure may be an underestimate.

3.2   Monetary policy shocks

To date, the most common approach used in the South African literature to identify conventional monetary policy innovations relies on contemporaneous restrictions and a Cholesky decomposition of the variance-covariance matrix of the residuals from a vector autoregressive (VAR) model in which the policy rate is ordered last, or on long-run restrictions in the tradition of Blanchard and Quah (1989). One issue that is not

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addressed by these methods is to distinguish between the stochastic component of the monetary policy measure and its systematic response to economic conditions. This is particularly problematic in times when the central bank targets inflation and interest rates move endogenously with economic activity. In light of these concerns, in order to identify the unexpected component of the US Federal Reserve funds rate, Romer and Romer (2004) regressed the change in the target interest rate announced by the Federal Open Market Committee meetings on a proxy for the information set available to the policymaker just prior to that decision. This information set includes a range of real-time indicators and forecasts to reflect the forward-looking nature of monetary policy. A simplified version of the Romer and Romer (2004) shock series is used here to identify monetary policy innovations purged of anticipatory effects between the third quarter of 2000, corresponding to when the inflation-targeting regime began, and the second quarter of 2019.

$$\Delta i_t = \propto + \tilde{\iota}_t + \sum_{t=0}^{t+2} \beta_t \Delta \tilde{y}_t + \sum_{t=0}^{t+2} \gamma_t \tilde{\pi}_t + \varepsilon_t \quad (1)$$

In Equation (1), Δi_t indicates the change in the prime rate at which commercial banks lend to their customers over each quarter. On the right side of the equation, $\tilde{\iota}$, $\Delta \tilde{y}_t$ and $\tilde{\pi}_t$ represent forecasts of the prime rate,[8] the annualised real output growth and consumer price index inflation rate, respectively, as sourced from the Reuters Econometer (2000–19).[9] Time horizons, indicated by *t*, account for the present quarter and the two quarters ahead. Finally, ε_t is the residual that represents the monetary policy innovation in quarter *t*.

The unexpected change in the rate derived from Equation (1) is plotted in Figure 3: it seems that stronger and more restrictive shocks occurred up to the global financial crisis while, since 2010, as inflation became more stable, and after 2017 central bank communication was better targeted towards the midpoint of the inflation target range.

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[8]   The Reuters Econometer provides forecasts of the prime rate until 2008 and of the repo rate thereafter. Since variations in the prime rate reflect changes in the repo rate, especially since 2009, missing prime rate forecasts are derived by applying the repo rate forecast's growth rate to the prime rate's forecast in the last quarter available (2008 Q4).

[9]   The Reuters Econometer (2000–19) data are supplied by the SARB and have been used in this study with permission from the SARB Research Department.

Figure 3: Evolution of the monetary policy shock (2000 Q4–2019 Q2)
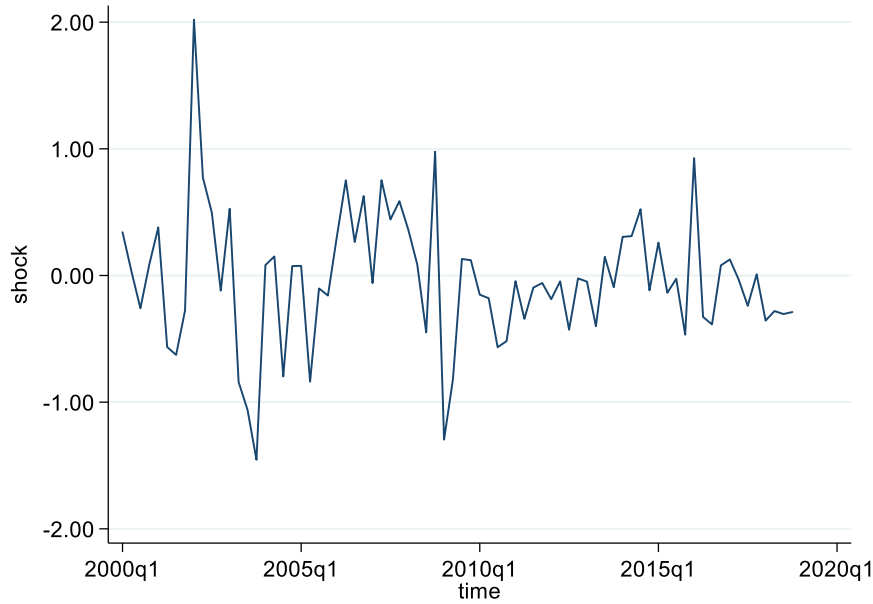
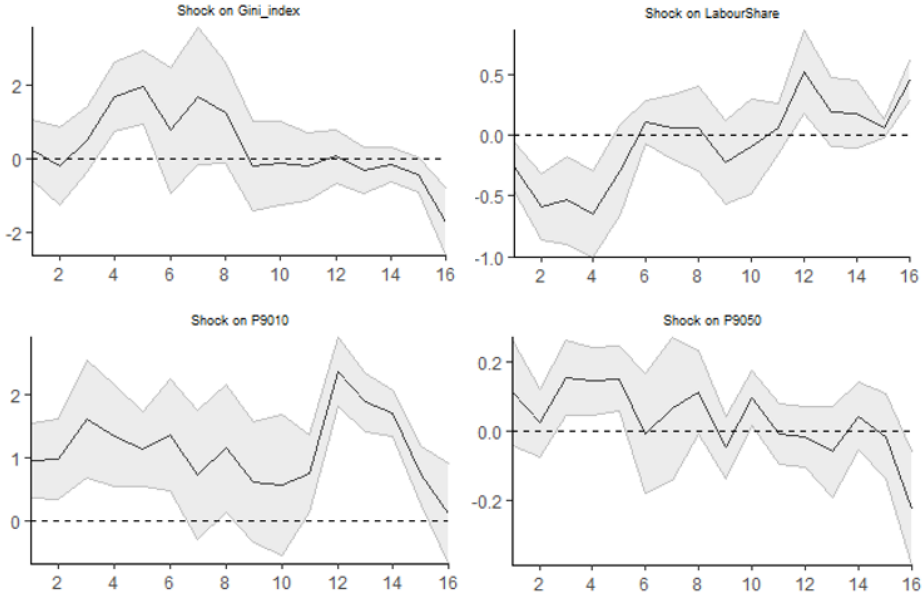Source: Author's calculation based on SARB (2019)

4. Local projections method and impulse response functions

Once wage inequality and monetary policy shocks have been quantified, it is possible to empirically investigate the distributional effect of monetary policy on the wage income of South African households through a multivariate time-series and impulse response functions (IRFs) analysis. To do so in the presence of multiple continuous variables that are potentially mutually dependent, the natural solution is to estimate a VAR model – that is, a system of dynamic linear equations where each variable is regressed on p lagged values of its own as well as of the other variables. In a VAR model, identification of unobserved economic shocks is performed through imposing a number of restrictions, based on theoretical assumptions, to the structural matrices of the reduced-form VAR. However, Jordá (2005) presents a valid alternative that estimates IRFs from local linear projections. The model, described by Equation (2), requires ordinary least squares (OLS) estimation of a series of regressions for each horizon (h) and each variable. With respect to VARs, the main advantages of employing the local projections method are that estimation of IRFs does not require identifying restrictions and it is based on a single equation, as in (2), that refers to the variable of interest:

$$y_{t+h} = \alpha_h + \Pi_h(L)x_{t-1} + \beta_h shock_t + u_{t+h} \qquad h = 0, 1, \dots, H-1 \qquad (2)$$

18

In Equation (2), *y* is the dependent variable, represented by a measure of individual real wage inequality (i.e. the Gini index, the P90/10 dispersion ratio, the P90/50 dispersion ratio or the labour share of income); α_h is the constant; x_{t-1} denotes the vector of lagged control variables that include the log of real GDP, the log of private investment, the log of real wage, the unemployment rate and the inflation rate;[10] and $shock_t$ represents the exogenous monetary policy shock identified in Section 3.2. The slope β_h reflects the response of variable *y* at *h* horizon to the $shock_t$'s variable impulse happening at time (*t*). The impulse responses relative to *y* are then constructed from all estimated β_h. As in Jordá (2005), the Newey-West correction is employed to predict robust standard errors that account for the serial correlation in u_{t+h}. Also, IRFs have been rescaled to show an unexpected increase of the repurchase rate by 100 base points. The vertical axis indicates percentage points

Figure 4: IRFs of wage inequality to contractionary monetary policy shocks

Source: Author's calculation using SARB data and PALMS v3.3 after adjustment

Figure 4 shows the response over 16 quarters of different measures of inequality. Each quadrant is the result of the model presented in Equation (2), with the dependent variable measured by the Gini index, the labour share of national income, the 90th/10th or the 90th/50th percentile dispersion ratios. The IRFs' plots demonstrate that

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[10]   All control variables are sourced from SARB (2019). The inflation rate is calculated from the GDP price deflator.

monetary tightening significantly increases inequality in the allocation of labour income across South African wage-paid workers. In particular, plots of IRFs suggest that the Gini index significantly increases after two quarters from the contractionary shock. Its response reaches two percentage points after five quarters and then vanishes after two years from the shock. The 90th/10th percentile dispersion ratio, which indicates the wage gap between the highest and lowest deciles of the distribution, increases by one percentage at impact and remains persistently higher. Lastly, the bottom-right quadrant shows a tiny positive response of the 90th/50th percentile dispersion ratio, as if inequality in the top half of the distribution is not significantly affected by the surprise increase in the repo rate.

A possible explanation for this puzzle of figures, which takes into account the various moments of the distribution through different metrics, is that the contractionary shock causes a relatively greater deterioration in the bottom half of the wage distribution than in the top half. If the loss of employment depicted in Figure 5 allegedly prevails among low-paid workers (below the median wage earner), then the average wage earned by the 10th percentile decreases. At the same time, given the segmented structure of the South African labour market, monetary policy remains ineffective in curbing wage growth at the top deciles, where unionisation and skill constraints cause large wage rigidities.

Contrary to percentile ratios that compare two points in the wage distribution, the Gini index uses information from the entire distribution dataset. The IRFs in Figure 4 therefore suggest that, while the gap between the poorest and the richest decile increases persistently, wage inequality measured by the Gini index is possibly alleviated in the medium term due to improved dynamics in the middle of the wage distribution.

In addition, the top-right quadrant of Figure 4 shows that the labour share of income decreases by 0.5 percentage points in the first four quarters before returning to zero in the fifth quarter. The labour share, measured by total employee compensation as a share of national income, is often considered an alternative measure of income inequality. As the labour share increases in relation to the capital share, the higher income is channelled to the bottom deciles of the distribution, assuming that they rely

on employment as the main source of earnings. According to this measure, a higher labour share of income is thus associated with lower labour income inequality. In Figure 4, the responses of the Gini index and the labour share are indeed opposite, such that a contractionary monetary policy shock temporarily raises inequality while lowering the labour share. These findings indicate that higher unemployment (Figure 5) and a lower labour share of income particularly affect low wage-paid individuals, thus worsening South Africa's overall wage inequality.

Figure 5: IRFs of control variables to contractionary monetary policy shocks
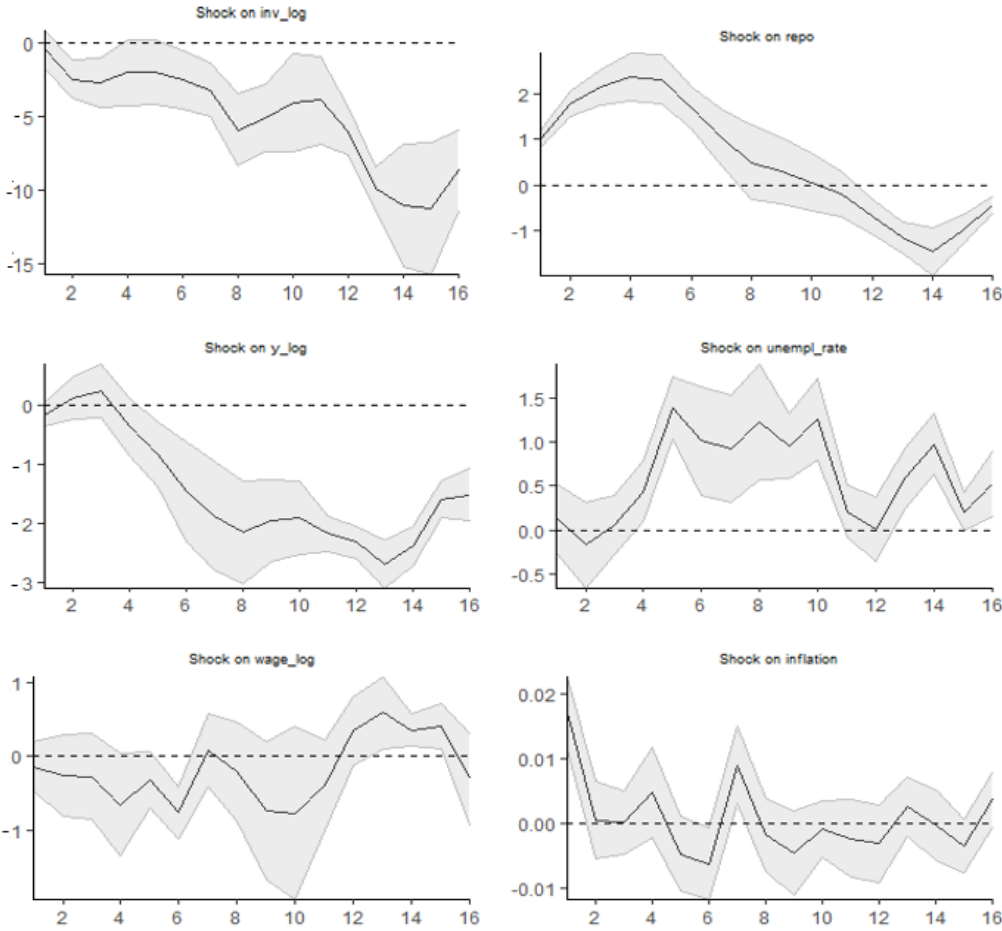
Source: Author's calculation using SARB data and PALMS v3.3 after adjustment

Figure 5 shows the response of control variables to the contractionary shock to the repo rate, which hits 100 base points at impact and persists for two years. Private investment and real GDP decline permanently, while the unemployment rate becomes positive after two quarters from the shock and persists for over two years. In contrast to other studies that make use of structural VAR techniques (Gumata, Kabundi and Ndou 2013; Kabundi and Rapapali 2019), effects on the repo rate, investment and GDP are longer lasting. Unsurprisingly, the reaction of average wage and inflation are

less significant (Dadam and Viegi 2015). In line with Kabundi, Schaling and Some (2019), these weak responses can be attributed to an improvement in monetary policy credibility, which is reflected by the anchoring of inflation expectations and the flattening of the Phillips curve since the mid-2000s.

4.1 Non-linearities in the response of wage inequality to monetary shocks

The impact of unexpected monetary contractions or expansions on inequality can be asymmetric. Furceri, Loungani and Zdzienicka (2018) find that the tightening of policy raises inequality more than easing lowers it. In such a case, the multiplication of shocks can cause persistent effects. To distinguish between negative and positive shocks, IRFs are estimated from non-linear local projections where the system of endogenous variables of Equation (2) can now switch across two regimes, A and B, as in Equation (4), according to a logistic probability function $F(z_t)$, described below:

$$F(z_t) = \frac{e^{(-\gamma z_t)}}{1+e^{(-\gamma z_t)}} \qquad \text{and } \gamma > 0 \tag{3}$$

$$y_{t+h} = F(z_{t-1})[\alpha_{A,h} + \Pi_{A,h}(L)x_{t-1} + \beta_{A,h}shock_t] + F(z_{t-1}))[\alpha_{B,h} + \Pi_{B,h}(L)x_{t-1} + \beta_{B,h}shock_t] + u_{t+h} \tag{4}$$

In Equation (3), z_t is a standardised variable that determines the two regimes. In this case, the switching variable defines the transition between regimes of monetary tightening and monetary loosening, and so it is the repo rate.[11]

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[11]   The parameter γ in Equation (3) that defines the smoothness of the regime transition is set as 5.
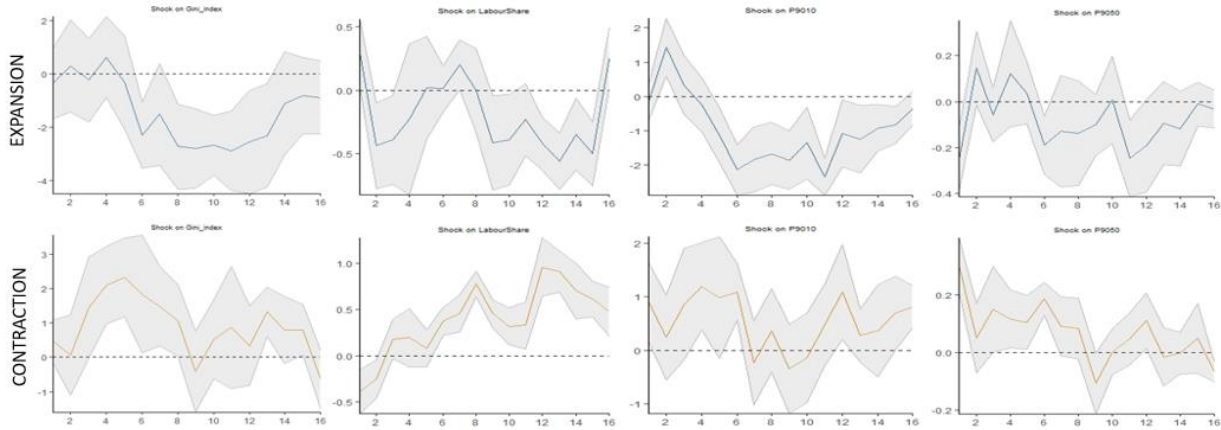
Figure 6: IRFs of wage inequality to contractionary and expansionary monetary policy shocks
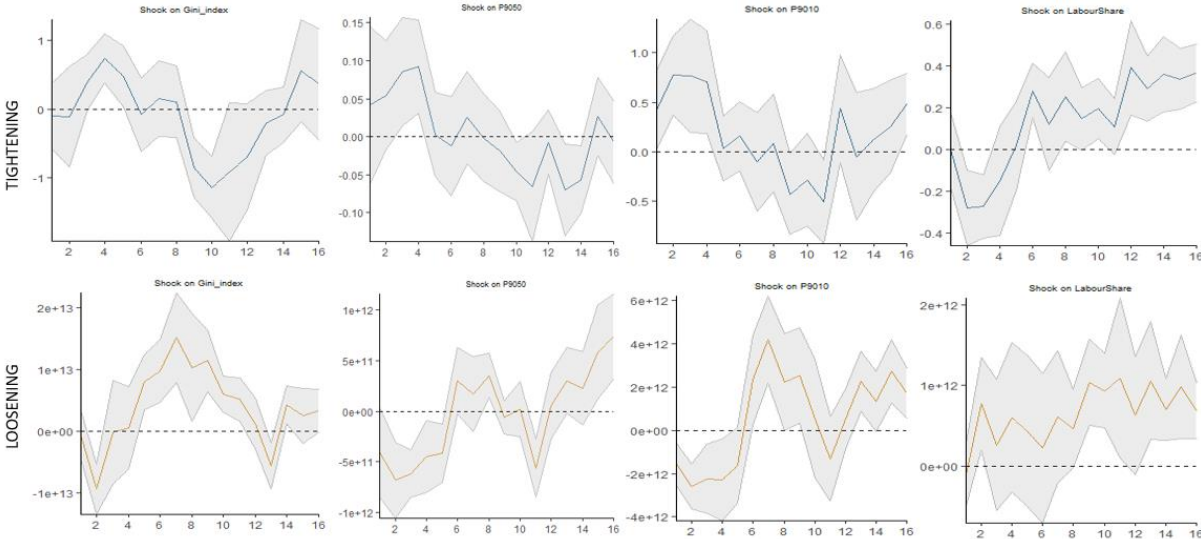
Source: Author's calculation using SARB data and PALMS v3.3 after adjustment

In Figure 6, the effect of unanticipated monetary policy shocks on inequality appears to be asymmetric, depending on whether the shock is tightening or loosening. Asymmetry is particularly evident in terms of the extent of the response. Therefore, while a tightening of monetary policy has a sizable, albeit short-lived, effect on all measures of wage inequality due to disproportionate deterioration of wages at the bottom of the distribution compared to the top (as established in the previous section), a loosening of monetary policy has an effect that is close to zero. This is likely to be the consequence of the structural segmentation of the South African labour market, where lower-paid jobs suffer from a surprise hike but do not benefit from a surprise cut in rates, or at least benefit relatively less than higher-paid jobs. Non-linear IRFs also show that monetary contractions raise all three measures of inequality only temporarily and that, after four or six quarters from the shock, their response turns down.

Figure 7: IRFs of wage inequality to contractionary monetary policy shocks under different economic regimes

Source: Author's calculation using SARB data and PALMS v3.3 after adjustment

Instead, the most notable result from the non-linear models is the response of wage inequality across different phases of the business cycle. Figure 7 reveals that during expansionary periods, a contractionary shock to the repo rate fails to increase inequality. Instead, the Gini index and the 90th/10th percentile dispersion ratio seem to decrease after a year from the shock, while the response of the top half of the wage distribution is again insignificant. In contrast to Figure 4, the responses of Gini inequality in both regimes are sustained over the years, such that a contractionary monetary policy shock persistently reduces the coefficient in expansions and increases it in recessions.

Interestingly, in Figure 7, the labour share of income is found to respond positively to a tightening monetary policy shock during downturns. This potentially counterintuitive dynamic can be explained by the fact that during recessions capital gains are being lost disproportionally and are much more sensitive to interest rate changes, such that the labour share of income respectively increases. An alternative explanation is that if unions do not internalise external conditions and keep demanding higher wages, adjustment will be driven by lower dividends. In effect, by looking at Figure 1, it emerges that the labour share started to increase when the growth rate of the South African economy began to decline around 2011.

5   Conclusions

This paper contributes to the fledgling literature on the effects of monetary policy on South African wealth and income distribution by exploring the earnings heterogeneity channel of monetary policy transmission. The empirical analysis made use of forecasted and observed data of macroeconomic time series to identify monetary policy shocks that are orthogonal to the business cycle, and of disaggregated data on labour to quantify the evolution of wage inequality in South Africa since 2000. The econometric model investigated the impact of shocks on real economic activity, and thus on the allocation of wage income across workers. In fact, results must be interpreted in light of the measure of inequality considered, which is based on full-time, wage-paid workers only, including employed individuals who earn zero monetary compensation but overlooking self-employed and unemployed individuals.

If wages are particularly important as a source of income for higher-income sub-groups of the South African population (Finn, 2015). then we have good reason to think that dynamics of wage inequality mostly affect the richest deciles of the income distribution. This implies monetary policy shocks have less impact on overall inequality than was depicted in this paper. As an example, the IMF study by Miyajima (2020) on the unintended effects of monetary policy on consumption inequality in South Africa is based on a form of inequality that derives from all types of income (i.e. financial, labour, government grants and remittances), rather than wage income exclusively, and presents a very different picture.

In this paper, IRFs are estimated from both linear and non-linear local projections and show that unexpected monetary policy contractions have negative and significant, but only temporary, effects on wage inequality in South Africa. Adopting different metrics of inequality allows us to explore the effect of monetary surprises on the various moments of the wage distribution. For example, an unanticipated monetary contraction that causes a deterioration in wage inequality measured by the Gini index widens the gap between the top and bottom deciles but has almost no effect on the top half of the distribution. Furthermore, the model reveals that accommodative shocks have a negligible effect in scaling down inequality, such that low wages that are more responsive to contractions do not significantly benefit from monetary stimuli.

Overall, the redistributive effects of monetary policy in South Africa are transmitted through the earnings heterogeneity channel due to the peculiar structure of the country's economy and, particularly, its deeply segmented labour market, characterised by a shortage of skilled jobs and strong unions that sustain high wage growth in such sectors. As a result of segmentation and unionisation, monetary policy is ineffective in lessening skilled-job wage inflation and a surprise contraction disproportionally hurts the low end of the wage distribution. Intuitively, the short-term negative distributional effects of monetary policy could disappear were these market rigidities relaxed (such as creating low and middle-skilled jobs and aligning the skills of workers to the market demand).

More interestingly, monetary tightening reduces wage inequality during expansionary phases of the business cycle, such that the redistributive effect of monetary policy is likely to cancel out over the course of the business cycle. Therefore, it can be said that improving the SARB's ability to limit the need for contractionary policy actions during times of slack, while maintaining a countercyclical stance, will help support a fairer distribution of wages in the South African economy.

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