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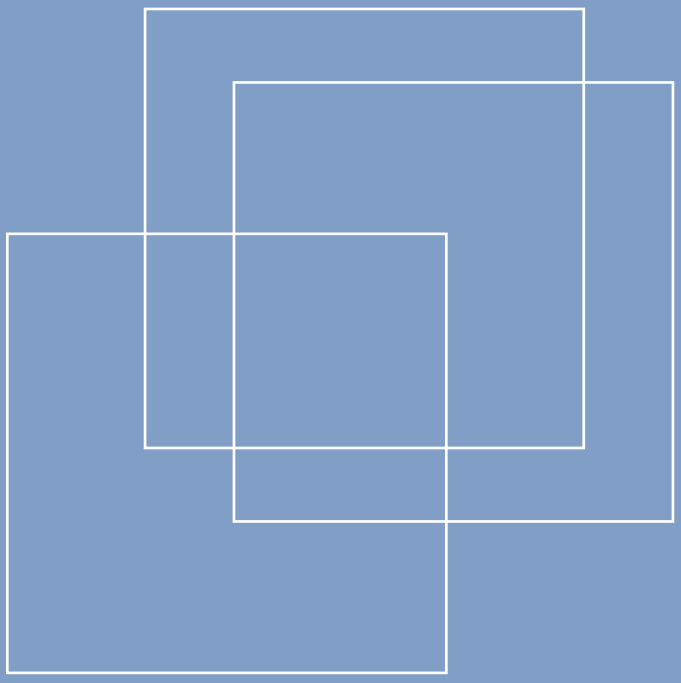

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Table of contents

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Abstract

This paper uses the United Nations Global Policy Model (GPM) to assess how increasing minimum wages might impact the South African economy by increasing the share of income going to workers (the 'labour share') – in contrast to the share that accrues to capital through profits and property income. We simulate the implementation of a national minimum wage through increasing labour compensation in a manner which sees real-wage growth 'catching up' to and then outstripping labour-productivity growth in the period 2015–2025; we refer to this as increasing 'relative' real wages. The results indicate that higher 'relative' real wage growth rebalances national income: the labour share increases since relative wages rise (by definition) and employment is roughly maintained (endogenous response). A rising labour share has in turn a positive effect overall on the South African economy in the model: consumption expenditure rises as national income shifts towards wage earners as a whole, who have a higher propensity to consume than profit earners. However, there are moderate or small negative effects as investment as a share of GDP falls marginally, as the profit rate falls (though the absolute level of investment is higher as GDP rises), employment declines marginally, and there is slight weakening of the current account.

Keywords: labour market, labour share, macroeconomic modelling, minimum wages, South Africa, wage-led growth

JEL classification: C15; C54; C68; D33; E2; E17; J23; J30; O40

1 Introduction

This paper uses the United Nations Global Policy Model (GPM) to assess how increasing minimum wages might impact the South African economy.[1] We focus on the distributional channels through which this impact is felt by increasing labour compensation in a manner that may raise the 'labour share' – the share of national income that accrues to labour through wages in contrast to the share that accrues to capital through profits and property income.[2] We therefore focus on how a shift in this 'functional distribution of income' impacts the South African economy in the GPM. If the model results are favourable, then an increase in minimum wages that increases the labour share positively impacts the South African economy in the GPM.

In the GPM, distributional variables impact the aggregate level of income, employment, output, and prices via the model's demand-driven income and expenditure linkages. By contrast, neoclassical macroeconomic models tend to focus on how wage increases impact the macroeconomy through changes in *relative prices* (rather than through *distributional channels*), with a 'representative' household and firm being the models' micro-founded building blocks. The GPM has a number of other advantages (see Section 3), including incorporating a financial sector, endogenous productivity effects, and a 'globally consistent' open economy (i.e. global trade and investment). The latter is important since it allows for feedback effects from the rest of the world, taking into account how wage levels impact South Africa's competitiveness vis-à-vis the rest of the world.

The approach taken by the GPM, analysing the impact of an increase in the minimum wage on the economy through a change in the income distribution, is an especially appropriate modelling approach in the South African context. The past two decades have witnessed a notable fall in South Africa's labour share and low-wage growth for median and low-wage earners. Concurrently, average wages and wages for higher-wage workers have risen significantly, contributing to growing income inequality (see Finn, 2015). *Income* inequality, measured by the Gini coefficient,[3] was 0.66 in 2012, making it the world's highest (for countries with reliable recent measurements). Income inequality has been driven predominantly by *wage-income* inequality, with wage dispersion accounting for just over 90 per cent of total income inequality in South Africa (Finn, 2015).[4]

Minimum wages have been shown to boost wages (and overall income) at the lower end of the wage distribution and reduce wage and income inequality (see Mudronova, 2016). Such wage growth can positively impact the labour share with some studies directly highlighting a positive relationship between minimum wages and the labour share (EC, 2007; ILO, 2011). In turn, the functional distribution of income, and the factors that impact it (including minimum wages), has been shown to affect spending patterns by consumers, and in turn, investment decisions by firms.

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1 This modelling exercise is undertaken in the context of a debate over whether to institute a national minimum wage in South Africa.

2 See the Appendix for a more detailed technical explanation of the labour share and the GPM.

3 The Gini coefficient is the most common measure of inequality, with 0 representing perfect equality and 1 perfect inequality.

4 Growing wage inequality in South Africa reflects both the increase in the share of households without any wage income (at 28 per cent of all households) and an increase in wage-income inequality among the 72 per cent of households that do receive wage income. In 2008, the presence of households without a wage earner accounted for 38 per cent of wage-income inequality while unequally distributed wage income among households who did receive a wage accounted for 62 per cent (Leibbrandt et al., 2012).

The fact that different income distributions can lead to different aggregate macroeconomic outcomes is now well established within the mainstream of economics (Dabla-Norris et al., 2015). The GPM only partially captures these dynamics, by focusing on how the relative proportion of wages versus profits in the economy impacts consumption, savings, and investment decisions through a number of inter-related mechanisms. Given the relationships outlined above and the trends noted in the South African economy the model offers one useful avenue through which to investigate the possible effect of a national minimum wage in South Africa.[5]

More technically, in this modelling exercise we simulate the implementation of a national minimum wage through increasing labour compensation in a manner which sees real-wage growth 'catching up' to and then outstripping labour-productivity growth in the period 2015–2025; we refer to this as increasing 'relative' real wages. By definition, such relative real-wage growth leads to an increase in the labour share[6] so long as its employment impact is not strongly negative (see Section 4 for further discussion).[7]

The results indicate that: (1) increasing real-wage growth above labour productivity growth does rebalance national income – the labour share increases endogenously as employment hardly declines while relative wages rise; (2) an increasing labour share has overall positive consequences for the South African economy in the model, positively stimulating demand through lower savings rates / higher consumption rates, as incomes shift to those with a higher propensity to consume (wage earners). This leads to a higher GDP growth in the short term and a higher absolute level of real GDP in the medium term. Inflation rates remain subdued given strong productivity increases (due to so-called 'Kaldor-Verdoorn' effects), reductions in firms' mark-ups, sufficient spare capacity, and increases in imports.

These favourable dynamics are accompanied by moderate negative effects: investment as a share of GDP falls as the profit rate falls (though the level of investment is higher as GDP rises), employment declines marginally, and the current account weakens somewhat. Despite this, total aggregate expenditure and income still increase when wage earners receive a larger portion of national income. In the final analysis, the model's results are that a rising labour share raises aggregate domestic demand and economic growth without significant negative effects on the South African economy, though all impacts in the model are fairly small. The findings, therefore, suggests that distributional changes can positively impact economic growth.

The paper proceeds as follows: Section 2 reviews existing studies modelling the impact of minimum wages in South Africa and offers a brief critique of the models used. Section 3 describes the GPM used in this paper; Section 4 outlines the modelling scenarios and presents the findings of the GPM; and Section 5 concludes.

[5] This relies on the assumption that the new national minimum wage would increase labour compensation, this is discussed in Section 4.

[6] Increases to the labour share may result from a number of policy interventions though, including changes in union coverage and labour laws; changing patterns of investment; improvements in educational outcomes; and amendments to South Africa's minimum wage regime.

[7] Productivity growth does not consistently increase above real wage growth in response to increases in output.

2 Existing literature on the impact of minimum wages on the South African economy

Studies analysing how minimum wages impact the macroeconomy generally fall into two categories. The first set comprises econometric studies looking at how minimum wages affect employment in a specific sector or geographical area ex post.[8] The second set of studies are abstract modelling exercises, wherein a mathematical model of the economy is constructed to see how, within this 'model economy', employment and other economy-wide aggregates are affected by minimum wages. The degree of correspondence between the model's assumptions and characteristics and the actual economy in question is vital. Most policy-orientated studies employ a class of mathematical models called 'computable general equilibrium' (CGE) models and impose certain 'neoclassical' behavioural assumptions. There is a notable difference in the findings between ex-post studies, based on data from actual events, and CGE models. Ex-post studies, on aggregate, tend to find a marginal impact on employment in either direction while CGE models predict extremely adverse employment effects – and negative macroeconomic effects if these were to be estimated – by virtue of the stringent theoretical assumptions they employ. This is true of the South African minimum wage literature too.

The modelling exercise undertaken in this paper differs from other studies for at least three reasons. First, we model an increase to South Africa's labour share (via relative real-wage growth). This is one mechanism through which the economy-wide impact of an increase in minimum wages can be assessed: only under extremely large (negative) elasticities will an increase in minimum wages not increase the labour share. This is distinct from modelling a direct increase to the wages of lower-wage workers, as is done in the CGE studies reviewed (see below) and other macro-econometric studies (see Adelzadeh and Alvillar, 2016). Second, due to the modelling approach adopted, this paper reports results for a range of macroeconomic variables. This is in contrast to existing CGE minimum wage modelling exercises which largely focus on the employment effect. Third, our theoretical assumptions are not neoclassical and specifications are estimated from the data.

These distinguishing features mean that a direct comparison between the output presented in this modelling exercise and that found in previous studies is not strictly possible (with the partial exception of MacLeod, 2015). Nevertheless, it is useful to contrast the findings of the UN's GPM with those of CGE models on the narrower question of the impact of a minimum wage on employment. This helps, however imperfectly, to illustrate the implications of the different modelling assumptions and approaches adopted in the competing models. In this section, we review the results of the South African ex-post and CGE studies, followed by a discussion of why CGE models uniformly report large negative consequences.

2.1 Ex-post and CGE studies in South Africa

Bhorat and Mayet (2013)[9] provide an overview of several key South African ex-post econometric studies (see also Dinkelman and Ranchhod, 2010; Garbers, 2015). The studies reviewed find that sectoral minimum wages generally have a positive impact on wages and working conditions with no

[8] For a review of this literature see Isaacs (2016), which summarises the seven recent meta-analyses: Doucouliagos and Stanley (2009), Boockman (2010), Belman and Wolfson (2014), Leonard et al. (2014), Nataraj et al. (2014), Chletsos and Giotis (2015), and Broecke et al. (2015).

[9] Bhorat and Mayet (2013) draws on Basu et al. (2010), Bhorat et al. (2012, 2013, 2014) and Stanwix (2013).

discernible impact on employment, except for the agricultural sector. They highlight countervailing mechanisms used by firms to deal with the increase in wage costs, such as reducing work hours. The studies are, however, only of limited use for addressing the economy-wide question we wish to answer, since a national minimum wage might affect the South African economy *as a whole* very differently to how it affects specific sectors. This is because, while wages are a cost to individual firms, by enabling consumption they are also the major source of income and demand for the economy as a whole. In addition, most ex-post studies assess the impact of minimum wages on the economy over a relatively short time span (see Garbers, 2015, p. 8 for a brief discussion), without much analysis on long-run impacts. For this reason, mathematical models are used to project the possible impact of a national minimum wage.

In South Africa, at least five CGE studies have estimated the macroeconomic impact of a minimum wage.[10] All studies come to very similar conclusions: as wages of low-skilled workers rise, employment declines fairly dramatically (and where modelled, the economy contracts). These results are summarised in Table 1, where epsilon, ε, refers to the assumed employment elasticity.[11]

The CGE models predict substantial job losses even at very low national minimum wage levels. In the South African National Treasury's model (MacLeod, 2015) the lowest national minimum wage modelled at R1,258 entails an average wage increase of only R31 to 16 per cent of the workers in the sample yet results in the loss of 96,000 jobs (about 1 per cent of the employed workforce). In the Development Policy Research Institute's model (DPRU, 2016), a national minimum wage of R1,619 results in up to 451,000 job losses. These modelled wage levels fall well below the lowest 2016 sectoral determinations of R2,231 and R1,994 for domestic workers in areas A and B, respectively.[12] In contrast, the international literature on the impact of minimum wages on employment using mostly ex-post econometric methods tends "overall… [to find that] moderate increases in minimum wages result in little or no decrease in employment" (DPRU 2016, p. 12).[13]

CGE models also predict broad economic deterioration from higher minimum wage. MacLeod (2015) shows that progressively higher national minimum wage levels result in greater negative economic effects. In the 'short-run' a national minimum wage of R4,303 results in serious economic contraction with real GDP, household consumption, gross fixed capital investment, government investment, imports, and exports all declining by between 3 and 4 per cent, and in the 'long run' these indicators decline between 11 and 15 per cent.

[10] DPRU (2008, 2016) and Pauw and Leibbrandt (2012) are published studies. Pauw (2009) is a PhD thesis. MacLeod (2015) is a presentation from National Treasury on their CGE modelling, the full details of which they have declined to make public.

[11] The near-identical nature of the results found in the CGE studies makes sense given that they all use variants of two very similar CGE models (the STAGE and SAGE models).

[12] The same CGE models predict substantial employment gains from lowering the effective cost of labour through a youth wage subsidy/employment tax incentive (ETI) (see Pauw and Edwards, 2006; Pauw, 2009). However, current evidence indicates no statistically significant employment gains occurred from the ETI (Ranchhod and Finn, 2014, 2015).

[13] Recent meta-analyses confirm the minimal employment impact of minimum wages, including in emerging markets. See Doucouliagos and Stanley (2009), Boockmann's (2010), Leonard et al. (2014), Cheletsos and Giotis (2015), Nataraj et al. (2014), Broecke et al. (2015) and Isaacs (2016) for a review.

Table 1: Summary of results from South African neoclassical CGE models

	Aim	Short-run employment impact	Long-run employment impact	CGE Model type
DPRU (2008)	Estimate impact of a National Minimum Wage (NMW) (increase in real wages) on employment and output.	Unskilled employment declines by 455,915. A 4.8 per cent decline in low-skilled (and total) employment. (ε = - 0.7)	Unskilled employment declines by 514,923. A 5.4 per cent decline in low-skilled (and total) employment. (ε = - 0.7)	Standard General Equilibrium (STAGE) model (McDonald, 2007).
Pauw (2009)	Estimate impact of a NMW (increase in real wages) on poverty and employment.	Low-skilled employ-ment declines by 488,991 where ε = - 0.7 (and for higher and lower amounts when the elasticity is higher or lower)	Low-skilled employ-ment declines by 502,130 where ε = - 0.7 (and for higher and lower amounts when the elasticity is higher or lower)	Standard General Equilibrium (STAGE) model (McDonald, 2007).
Pauw and Leibbrandt (2012)	Estimate impact of a NMW (increase in real wages) on poverty and employment.	5.2 per cent of low-skilled workers lose their jobs or 448,991 workers. (ε = - 0.7)	Results are assumed to be short-run but this is not specified in the paper.	Standard General Equilibrium (STAGE) model (McDonald, 2007).
MacLeod (2015)	Estimate impact of a NMW (increase in real wages) on employment and other macro-economic indicators.	Job losses range from 0.8 per cent to 10.1 per cent (96,000 to 1,168,000 workers). All economic indicators slide, with real GDP falling by up to 3.7 per cent. (ε = - 0.5)	Employment impact not given. All economic indicators slide, with real GDP falling by up to 13 per cent. (ε = - 0.5)	South Africa General Equilibrium (SAGE) model.
DPRU (2016)	Estimate impact of a NMW (increase in real wages) on employment and welfare.	Job losses range from 0.8 per cent to 6.8 per cent (100,446 to 997,068) depending on level and elasticity. (ε = -0.1, -0.3, -0.5)	Presumed short-run only.	South Africa General Equilibrium (SAGE) model.

Source: Authors based on cited studies.

These results stand in sharp contrast to the output from the GPM, given in Section 4, in which increases to the labour share have positive, or very moderately negative, effects on these variables. The GPM findings are supported by the findings in Adelzadeh and Allvivar (2016), who use a macroeconometric model combined with a micro-simulation module (DIMMSIM). The model economy in DIMMSIM is more complex than in the CGE models and is disaggregated by sector without relying on representative households or firms. It makes use of demand- and supply-side relationship and estimates the coefficients (on a sectoral basis) econometrically. The output indicates that a national minimum wage results in rising real wages, which lifts household income and expenditure, boosting output and growth. As in the GPM productivity rises and inflation falls with investment as a share of GDP declining somewhat. In line with the local and international ex-post evidence employment falls marginally by up to -0.3 per cent but households, and the economy, are left better off and poverty and inequality decline.

2.2 Why CGE models predict employment losses

The results from the CGE modelling exercises reflect the strong neoclassical assumptions and casual relations employed (see Taylor and von Arnim, 2007; Taylor, 2011; Storm and Isaacs, 2016 for a critique of the South African models discussed here). Within these models higher wages result in employment losses and lower aggregate demand almost irrespective of the calibrated price, wage, and substitution elasticities. This predisposition towards deflationary outcomes means that as aggregate demand declines, output and employment invariably fall. The key assumptions within the neoclassical CGE models include:

- As the price of labour rises employers are only able to respond by raising output prices or shedding workers, or, more likely, some combination of the two (Pauw, 2009, pp. 141–142). These two responses to rising minimum wages have been shown to occur only very moderately (for evidence on employment, see Broecke et al., 2015; Low Pay Commission, 2015; on prices, see Lemos, 2008). Real-world adjustment mechanisms employed by firms to accommodate rising wage costs are poorly captured or entirely neglected. These include: productivity increases where production techniques are altered to raise productivity levels;[14] so-called efficiency wage effects through which higher wages improve worker performance and reduce job turnover; a contraction of wages for high earners within firms; changes to the number of hours worked or non-wage benefits; and increases in output in response to higher domestic demand (see Broecke et al., 2015; Low Pay Commission, 2015)

- Job losses arise from two interrelated processes: firms employ relatively more machines and less workers (a 'substitution effect'); and price rises erode real incomes and reduce (local and international) demand (a 'scale effect'). Such job losses reduce incomes and hence spending and demand in the economy. The negative impact on demand outweighs positive effects that may have occurred due to increased incomes from higher wages, with any other outcome precluded. Such a fall in aggregate demand depresses output and growth, lowers firm profits and increases unemployment.

- Investment declines as firms have less savings available to finance investment due to profits falling. This is based on the neoclassical assumption that savings equal investment.[15] This assumption is expressed in the neoclassical CGE models by either allowing investment to fluctuate in tandem with savings, or by holding investment as a percentage of domestic demand fixed and equal to savings. In the latter case consumption demand declines as household savings must rise to compensate for a fall in firm savings (Leibbrandt et al., 2012, p. 774) and investment falls so as to keep investment as a percentage of domestic demand constant. The economy contracts and employment falls further (see Storm and Isaacs, 2016 for further detail).

[14] DPRU (2008) and Pauw (2009) do model productivity increases but are only able to do so by exogenously imposing them.

[15] The absence of a detailed financial sector precludes firms borrowing to maintain investment levels.

3 The Global Policy Model

An alternative theoretical approach is provided by the United Nations Global Policy Model (GPM) (see, for example, UNCTAD, 2014). The GPM is a demand-driven, global econometric model that draws on an UN-compiled dataset of consistent macroeconomic data for every major economy or economic bloc. It is used by the G20 and the UN as a medium-term forecasting and modelling tool on a range of issues including trade policy, shifts in the sources of energy generation, and demographic change. The GPM has several useful features that are detailed in the next subsection.

The model is estimated using annual data – a panel structure with fixed effects (T=43; N=190) – from 1970 to 2013 for South Africa and all other major countries and blocs (with 2014 being a forecast in this version of the model). The data for South Africa includes Swaziland, which is unfortunate but of negligible influence. The data comes from national accounts submitted to the United Nations. Employment data is from the International Labour Organization (via Statistics South Africa household survey data, the OHS/LFS/QLFS). Data is in US$ PPP unless stated otherwise.[16] As the GPM contains dozens of equations, we do not get into the details here and we provide a brief overview of the modelling approach and key relevant features in the Appendix (see Cripps and Izurieta, 2014 for more details).

3.1 Basic tenets of the Global Policy Model

The model has a number of unique features that make it well suited to assess the complex macroeconomic effects of a policy change in a country such as South Africa. The GPM has certain strengths that are important to note.

First, in the GPM the estimation of the behavioural relationships and parameters are informed by the data in fairly open specifications and estimated econometrically, rather than imposed exogenously using rigid assumptions (as in CGE models). In addition, the equations of each economy are adapted to the specificities of that economy through the inclusion of additional ‘state’ variables.

Second, aggregate demand has a far greater effect on the level of economic activity than in CGE models. This is because full capacity is not assumed in the GPM, in contrast to an economy operating in a general equilibrium. As a result an increase in demand can lead to increased consumption, increased investment, or both, depending on where the demand is coming from and the estimated coefficients. Greater demand can also increase productivity growth (through Kaldor-Verdoon’s law) and employment growth (through Okun’s law). However, demand effects in the GPM are also subject to supply-side constraints through endogenously determined labour productivity growth and inflation. This means that any stimulus to aggregate demand will affect productivity, jobs, wages, and prices and, through these, have an impact on exports, imports, consumption, and investment.

[16] GDP is measured at base-year dollar prices divided by a different base-year purchasing power parity adjustment for each country. Real incomes and expenditures in each country are measured by dividing current dollar values by the domestic expenditure deflator for the country, to convert the figures to base-year values, and further dividing by the base-year purchasing power adjustment to make them more comparable across countries.

Allowing aggregate demand to play a significant role in the level of economic activity is particularly relevant in the South African context where resources remain idle. As Kantor (2012) notes:

> "…sometimes the economic problem becomes one of too little spending rather than of dismal constraints on spending. Too little demand is now the major problem in many of the developed economies and also for us in SA. Given the current availability of labour, plant and equipment in the US, Europe and SA, more goods and services would be produced and more income would be earned in the process of expanded production, if only economic agents would spend more. More spending is thus possible without the usual trade-offs and choices having to be made between one kind of spending or another. There is no opportunity cost to employing more resources when they are standing idle."

Third, the distribution of income matters: the level of economic activity varies in the GPM depending on the functional distribution of income and related constraints. The savings function, determined by nine variables including the distribution of income, becomes especially important, as a shift in income away from labour generally sees the overall savings rate increase and in turn the consumption rate fall. This is consistent with the notion that upper deciles have a greater propensity to save (see, for example, Dynan et al., 2004; OECD, 2012) and is particularly relevant for the present context in South Africa and globally.

Fourth, investment is modelled in a fairly realistic manner. Investment is neither fixed as a share of GDP nor limited by available savings, as in typical neoclassical CGE models. Instead, it exhibits an 'accelerator' response to growth in GDP with some additional influence from growth in profits. In addition, the presence of a detailed financial sector – absent from most CGE models – allows bank lending to play an important role in determining the level of investment. Financial conditions, the real bond rate, changes in external flows, and changes in lending from the domestic financial sector are all included in the investment function, creating a more realistic and economically integrated investment specification.

Fifth, employment and the unemployment rate are impacted by several factors, though ultimately driven by changes in economic activity (demand). This relationship, known as Okun's law, is estimated from the historical country-level data. Using ILO data, the GPM estimates how, for a given change in GDP growth, the employment rate responds, and vice versa. Employment is differentiated by age and gender, after taking into account the labour force participation rate, which is determined by urbanization, GDP per capita, demographics, and child dependency ratios. This Keynesian approach is in contrast to the neoclassical CGE models, in which employment levels are driven by relative prices, and in particular the wage rate, the wage-employment elasticity (or capital-labour elasticity of substitution), and price levels.

Sixth, changes in productivity are endogenous to the model and respond to changes in output. Kaldor-Verdoorn effects estimate how changes in output affect changes in labour productivity,[17] and they play an important role in the model. The relationship is estimated from the historical country-level data. This relationship means that the aggregate impact of changes in the labour share on output can become amplified in the GPM as more output leads to more productivity, up to a point. This approach differs

[17] A number of studies try to estimate this relationship. See, for example, Storm and Naastepad (2007), Pianta and Crespi (2008), Millemaci and Ofria (2014), and Magacho (2016).

from the hypothesis that productivity growth is due to progress in science and technology, human capital, or exogenous shocks.

Seventh, the GPM is globally consistent, so that the benefits (or costs) of a policy to a single country can take into account their impact on other countries and the resulting feedback effects. As a result the GPM allows us to assess whether a given policy strategy is globally sustainable. For example, the GPM shows that, when sought by every country, a strategy of export-driven growth through holding down real labour compensation may lead to adverse effects at the aggregate level, making such a strategy unsustainable (UNCTAD, 2014). Similarly, the model indicates that any policy to increase the labour share in South Africa is far more effective when other countries implement similar policies.

3.2 The functional distribution of income in the GPM

It is now widely recognised that issues of growth and distribution (inequality) cannot be separated when understanding and modelling the macroeconomy (see Mian and Sufi, 2014; for heterogeneous agent models see Krusell and Smith, 2006; and for an overview of a range of neoclassical models see Bertola et al., 2014). Recent research led by the IMF (Dabla-Norris et al., 2015) finds a strong link between growth and distribution, drawing on a growing body of evidence on why inequality might be harmful for an economy (Aghion et al., 1999; Galor and Moav, 2004; Bourguignon and Dessus, 2009; Acemoglu, 2011; Ostry and Berg, 2011; Ostry et al., 2014).

The 'functional distribution of income' in the GPM divides the economy into workers who earn wages, and the owners of capital who earn profits.[18] More precisely, in the GPM labour income includes the national accounting categories 'compensation of employees' and 'mixed income', while profits are represented by the 'operating surplus'.[19] Employment includes employees, self-employed, and unpaid family workers. This differs from the 'personal distribution of income', which addresses the division of personal income between individuals or households.

Expanding on the third point in the previous subsection, the functional distribution of income in the GPM impacts domestic consumption (savings) and investment, which in turn (indirectly) impacts the level of income, employment, output, and inflation. The functional distribution also directly impacts the latter four variables. Through these direct and indirect linkages the functional distribution of income shapes the balance of payments, bank lending, and government policy. These relationships make it possible to model domestic inflation explicitly as an interaction between growth of earnings, aggregate productivity and profit mark-ups and to trace the impact of changes in the share of profits on savings, portfolio and real expenditure. Employment levels, as well as changes in the distribution between profits and labour income, may have significant impact on patterns of household consumption and investment spending, depending on the estimated coefficients.

Higher profit mark-ups tend to have a positive, albeit moderate and short-term impact on investment. However, such increases in profit mark-ups also reduce labour income, generally having a negative

[18] In practice not all types of income can easily be ascribed to either capital or labour. Aggregate income data are generally given as wages, benefits, proprietors' income, net interest, rents, and corporate profits. There is, therefore, no straightforward counterpart to the wages/profits/rents division used in economic theory (see Giovannoni, 2014).

[19] This means that the labour share is calculated in the GPM as the sum of 'compensation of employees' and 'mixed income' as a percentage of GDP. Value added is measured at market prices as data on taxes are more difficult to come by globally.

impact on consumer spending. The net impacts of increases in the profit mark-up on growth in final demand and GDP tend to be negative, although not always so (see next sub-section). Finally, the aggregation of these influences in a global model reveals large cross-border spill-overs in demand and business confidence, which makes the call for global coordination of demand management particularly relevant.

More specifically, consumption is determined by the savings function (Equation 1). As the functional distribution of income shifts away from labour, the aggregate saving rate increases and thus consumption falls. There are also weak tendencies for savings to rise with inflation, *pi*, and with per capita income of the country relative to the world average, *YR*. α_b and ε_b denote country-specific fixed terms and stochastic errors. The rate of private savings, *Sp*, follows a schedule that is moderately path-dependent, responding to the current growth of private income and in the longer term to the rate of growth of wealth, *Wp*. Short- and long-term dynamics of the saving rate are influenced by changes in income distribution, which are expressed as the share of labour income, *VVem*, in private income, *Yp*. This will impact GDP and profits, which in turn impacts private investment.

Equation 1: Savings function

$$\Delta\frac{Sp}{Yp_{-1}} = \Phi\left[\frac{Sp_{-1}}{Yp_{-2}}, \frac{\Delta Yp}{Yp_{-1}}, \frac{\Delta Wp_{-1}}{Wp_{-2}}, \frac{VVem_{-1}}{Yp_{-1}}, \Delta\left(\frac{VVem}{Yp}\right), \log\left(1+pi/100\right), \log YR_{-1}, \alpha_{b,}\varepsilon_b\right]$$

Source: Cripps and Izurieta (2014)

The distribution of GDP between labour income, *VVem*, and profits, *VVpr*, is largely determined by the profit mark-up (Equation 2). The profit mark-up on average unit labour cost, *mu*, is strongly path dependent and in the short run responds to the interaction between forces driving wage costs, *ei*, on the one hand, and productivity growth on the other, $\frac{V}{NE}$. The mark-up is also affected by credit conditions, $\frac{LN}{VV}$, government policies including social protection and government employment, $\frac{G}{VV}$, movements of the terms of trade, *tt*, and energy exports, *XE$*.

Equation 2: Profit mark-up

$$\Delta\log\left(1+mu\right) = \Phi\left[\log\left(1+mu_{-1}\right), \log\left(1+ei\right), \Delta\log\frac{V}{NE}, \Delta\log\frac{LN}{VV_{-1}}, \Delta\frac{G}{VV_{-1}}, \Delta\log tt, \Delta\frac{XE\$}{rxVV}, \alpha_b, \varepsilon_b\right]$$

Source: Cripps and Izurieta (2014)

Unit labour costs are in turn determined by changes in average money earnings, and output per person employed, with a variable profit mark-up and a further mark-up for indirect taxes less subsidies. Domestic inflation is in turn modelled as the outcome of increases in unit labour costs. Wage costs, or average money earnings per person employed, in turn respond to increases in output per person employed and, with some lag, to price inflation, with negative pressure exerted by a higher real exchange rate, influenced by the relative income per capita. Wages are not determined by marginal revenue products, as in a neoclassical model.

These are some of the key relationships that regulate the interaction between the functional distribution of income and consumption, investment, and economic activity. Note that the model does not assume, *a priori*, that an increase in the labour share necessarily leads to an economic expansion in South Africa or elsewhere.[20] In fact, the data for particular countries may suggest that a *reduction* in labour compensation generates a large and positive response in private investment. In some countries, an increase in the profit mark-up (and hence property share) leads to an increase in GDP growth, according to the GPM in South Africa this is not the case (see full GPM description in Cripps and Izurieta, 2014; for further discussion of this theoretical approach see Bhaduri and Marglin, 1990).

3.3 Evidence supporting the modelling approach taken in the GPM

The functional distribution of income may seem like an odd concept given that there is no neat alignment between belonging to a certain class of economic agent (workers vs. capitalists) and receiving a particular source of income (wages vs. property income including profits). Sources of income have become increasingly heterogeneous for both workers and high-income earners: the boom in CEO wage income and the ownership of capital assets by workers through pension funds are two examples of this. Nonetheless, there are several good reasons to study the functional distribution of income (see Atkinson, 2009; Glyn, 2011), including understanding the drivers of accumulation and inequality in an economy.[21]

At the macroeconomic level, the distribution of factor income (wages and profits) is found to be a central determinant of the level of demand in an economy, and in turn its level of output. Evidence indicates that the global contraction in labour shares appears to have harmed global aggregate demand (see ILO, 2013, 2014). Underlying the 2007/8 financial crisis and subsequent weak recovery has been an insufficiency in consumer demand, reflected in a long-term decline in the labour share (Dullien et al., 2010; OECD, 2012) – even as CEO pay has risen.[22] This is consistent with the evidence that upper deciles have a greater propensity to save (see, for example, Dynan et al., 2004; OECD, 2012). This in turn has seen investment levels – which usually follows consumer and government spending – stagnate, including in South Africa (Kantor, 2016).

At the microeconomic level, the personal distribution of income is impacted by the functional distribution of income: international evidence indicates that a higher labour share reduces overall income inequality (Checchi and García-Peñalosa, 2005; Daudey and García-Peñalosa, 2007, cited in Glyn, 2011; Schlenker and Schmid 2013). A recent joint ILO and OECD (2015) report for G20 countries (including South Africa) confirms a strong relationship between eroding labour shares and rising inequality. Furthermore, property income tends to be even more unequally distributed than wage income, as is the case in South Africa too (see Daniels and Augustine, 2016; Orthofer, 2016), as well as the negative consequences that falling demand may have on wages and employment. Inequality in

[20] The GPM allows us to interrogate in a more considered manner whether a particular economy can be said to be 'wage-led' or 'profit-led'.

[21] This approach stands in contrast to much of neoclassical theory which, under certain assumptions, sees equilibrium outcomes as being invariant to the distribution of endowments. Furthermore, within a perfectly competitive neoclassical framework, the return to each 'factor of production' corresponds to its marginal (revenue) product rather than the outcome of a bargaining process based on power, an erroneous proposition (Samuelson, 1957, p. 894).

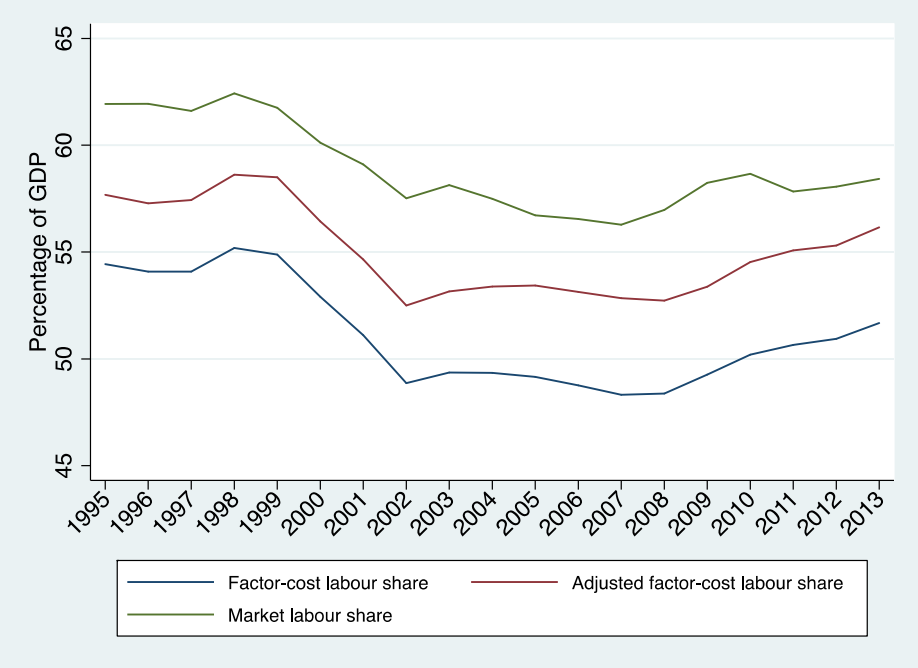
[22] The fall in the labour share in most OECD countries took place together with the share of wage compensation going to the top 1 per cent of income earners increasing substantially in nearly all countries for which data are available (Atkinson et al., 2011). This implies that the decline in the labour share for the other 99 per cent is more substantial than the figures would indicate (for example OECD, 2012, p. 115).

South Africa has tended to be almost exclusively analysed with respect of the personal distribution of income and so explicit attention to the functional distribution of income adds to our understanding of macroeconomic relationships within the economy and the consequences of growing inequality.

4 Simulation strategy and results

Using the GPM, we assess the impact of a national minimum wage on the South African economy through an increasing labour share resulting from rising relative labour compensation. This approach makes two assumptions: first, that a national minimum wage would cover a meaningful segment of the workforce and that it would be enforced;[23] and second, that rising minimum wages do in fact increase overall labour compensation. The first assumption is expected to hold on the basis of a descriptive statistics analysis of the labour market (see Finn, 2015), and the second assumption on the basis of the ex-post minimum wage studies already cited.

Figure 1: South Africa's labour share, various estimates (1995–2013)



Notes: Factor-cost labour share = gross compensation of employees / GVA at factor cost; Adjusted factor-cost labour share = Factor-cost labour share adjusted to include mixed income; and Market labour share = mixed income + gross compensation of employees / GDP at (current) market prices.
Source: Author's computations based on SARB (2015).

In the modelling exercise undertaken here, an adjustment path is set for the economy whereby a particular increase in the labour share is targeted. As already noted, this is achieved through real-wage growth outstripping labour-productivity growth – a 'catch-up' between real wages and labour

[23] This relies on the assumption that the new national minimum wage would represent an increase over existing sectoral minimum wages and/or entail greater compliance (as the literature indicates, see Rani et al., 2013), thereby raising wages at the bottom of the wage distribution. This assumption was made subsequent to the original drafting of this paper, when the proposed national minimum wage was to be set at R20 (approximately $1.50) per hour (in May 2018), thereby covering approximately a third of the formal sector workforce.

productivity. By definition if labour's relative remuneration is growing quicker than its contribution to output, then its share in national income will increase (relative to profits and other property income). Such a 'catch-up' would reverse the decline seen in the post-apartheid labour share shown in Figure 1, as labour-productivity growth outstripped real-wage growth.

However, it is possible that the economy within the model may respond to higher relative real wages by employment growth declining sufficiently to outweigh any growth in real wages, therefore leading any attempt to increase the labour share as being self-defeating. The model, therefore, does not assume, *a priori*, that higher (relative) real wages automatically increase the labour share. Instead, an iterative process occurs whereby labour compensation is endogenously increased in a manner that raises relative real wages by an amount sufficient to reach the desired increase to the labour share (with on-going feedback effects between the variables within the economy); if the desired change to the labour share cannot be reached the model becomes unstable.[24] In addition, the GPM is programmed so that a larger share of the adjustments occurs in the initial years; this is done to avoid another adaptation occurring when the policy stops. This means that in the scenarios modelled the impact of the policy simulation tapers off. The effects of the policy simulation also subside due to Kaldor-Verdoorn effects diminishing.

4.1 Possible scenarios

We model three different scenarios and compare them with a baseline 'business-as-usual' scenario based on the economy's current trajectory. South Africa's baseline trajectory is made consistent with the global baseline projections and can be found in UNCTAD (2014). In all three scenarios, beginning in 2015, we set an adjustment path for the economy that aims to increase the labour share of national income by a prescribed percentage above the baseline by 2025.

In scenario 1, we implement 'catch-up' only in South Africa. The labour share is targeted to reach a level 2 percentage points higher than the baseline scenario by 2025 (therefore reaching 44 per cent of GDP). In scenario 2, we target a labour share 4 percentage points above the baseline (so that it reaches 46 per cent of GDP by 2025) and also strongly expand public expenditure on fixed capital in South Africa. This is done through increasing expenditure on fixed government investment by an extra 5 per cent of GDP, sustained for seven years. This is used as a heuristic to indicate the implementation of an NDP-style infrastructure expansion plan. This investigates whether complementary policies can accentuate the gains from an adjusted wage structure. In scenario 3, we target a labour share 5 percentage points above the baseline in South Africa (so that it reaches 47 per cent of GDP by 2025), and also raise the labour share for all countries who experienced a fall in the labour share since 2002. We set individual paths so that each country's labour share returns to its 2002 level by 2025. This investigates whether such policies are globally sustainable, as well as the sensitivity of the South African economy to the global environment.[25]

[24] The scenario may not be able to be completed if the model dynamics become unstable – for example if consumption-led growth encourages a debt-led financial bubble – or if variables are constantly being pushed outside of the permissible bounds of their probability distribution. In addition, the targeted adjustment to the labour share must be achieved without producing significant economic imbalances, such as excessive inflation or credit extensions that 'crash' the economic model.

[25] The implementation of 'catch-up' internationally is not without a basis in reality. There are large ongoing increases in federal minimum wages in the United States; Germany just established a national minimum wage; the UK raised its national minimum wage again with advisory inputs given via the Low Wage Commission; and the minimum wage was increased strongly in Israel, India, Malaysia, and again in China's latest (12th) Five

4.2 Empirical results

In all three scenarios modelled the basic sequence of events is similar while magnitudes differ. For all variables the change is least pronounced for scenario 1 and most pronounced for scenario 3. This is not surprising given the nature of the scenarios described above. The results are presented in Table 2 and 3 and are shown in Figure 2 through 11.

The most immediate effect of a rising labour share in the GPM is a strong, positive, consumption effect as income flows to those who have a lower propensity to save and in turn a higher propensity to consume (Figure 2). The increase in the labour share is not due to increases in the employment rate, instead real labour compensation rises at a faster rate than productivity growth. Private consumption increases in all scenarios (Figure 3). In scenario 1 it rises by 2 per cent and as a share of GDP is 0.5 percentage points higher by 2025. Relative to the baseline projection, consumption grows by 4 per cent in scenario 2 and is 1 percentage point higher as a share of GDP by 2025. In scenario 3 the respective increases are 5 per cent and 1.2 percentage points. This consumption growth leads to an increase in domestic demand as it relies on the falling savings rate.[26]

Higher demand expands domestic output and in turn raises growth. As such, in all three scenarios the GDP growth rate increases: by around 0.5 percentage points at its peak in scenario 1 (from 2.5 per cent in the baseline to 3 per cent in scenario 1) and by almost 1 percentage point at its peak in scenario 3 (thereby reaching 3.4 per cent) (Figure 4), and scenario 2 lies in between this range. In scenario 1 GDP is 1.1 per cent larger in 2025 than in the baseline scenario. By 2025, in scenario 2 South Africa's GDP is 2.3 per cent larger than in the baseline scenario. In scenario 3 GDP is 2.9 per cent larger in 2025 than in the baseline scenario – the largest increase out of all the scenarios. The growth rate of nominal unit labour costs falls initially and becomes negative in the scenarios, before increasing sharply and then it declines steadily towards the baseline (Figure 5). This is because the positive (i.e. cost reducing) productivity and output affects nominal unit labour costs, and outweighs the negative effects of a falling rate of inflation and modest employment growth.

Endogenous changes in monetary policy act as a positive reinforcing mechanism to economic adjustment as the financial sector adjusts. Changes in the policy rate follow a Taylor rule determined by capacity utilisation and domestic inflation. Capacity utilisation increases as the labour share increases, while the real price of capital (an endogenous variable in the model) responds to changes in capacity utilisation. The covered position of lending from banks to the private sector expands as income grows, with loans and deposits rising together.

Year Plan – where it was stipulated that average annual increases in minimum wages be 13 per cent (the same as in the previous Five Year Plan).

[26] In the model, savings increase with inflation. However, because inflation is contained this does not play a strong role.

Figure 2: Labour share as percentage of GDP in baseline and three scenarios (2014–2025)

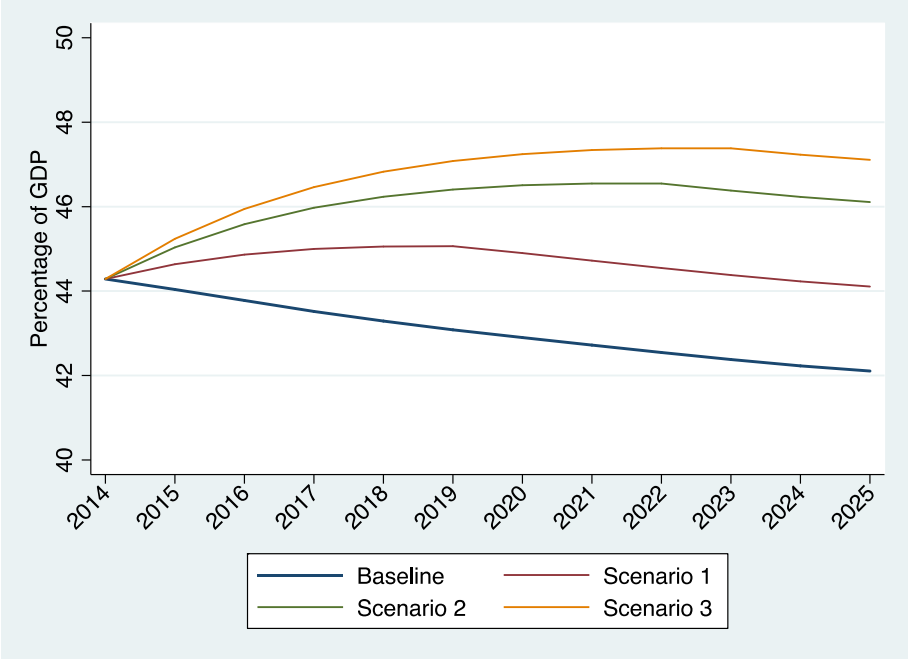


Figure 3: Private consumption as a percentage of GDP in baseline and three scenarios (2014–2025)

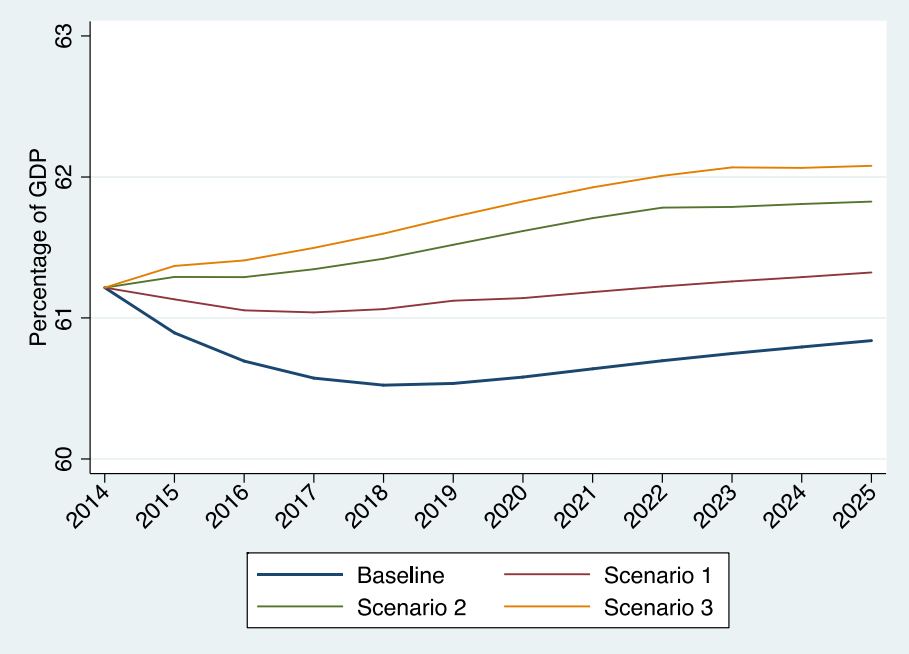


Figure 4: GDP growth rate in baseline vs. three scenarios (2014–2025)

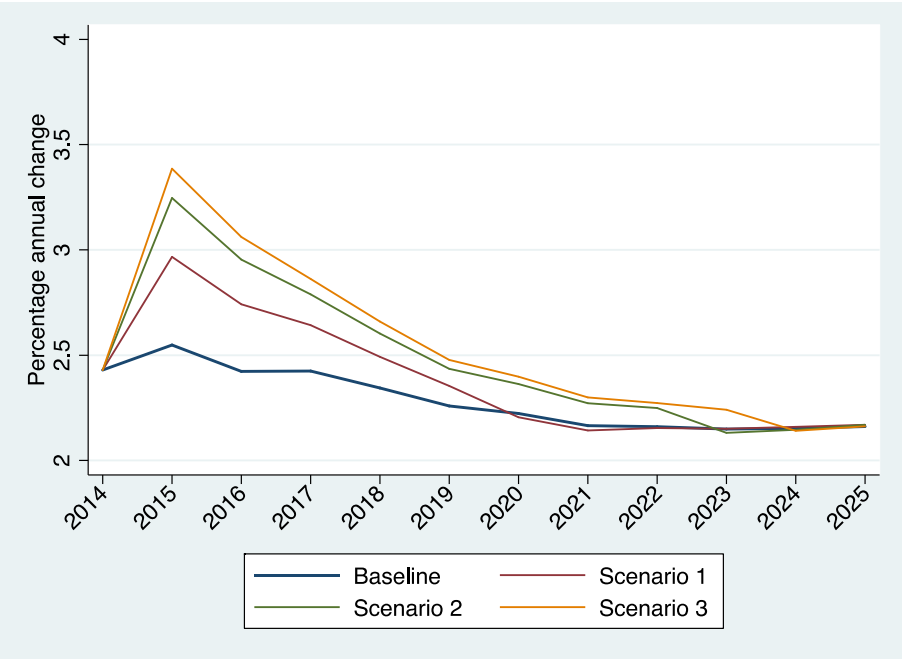
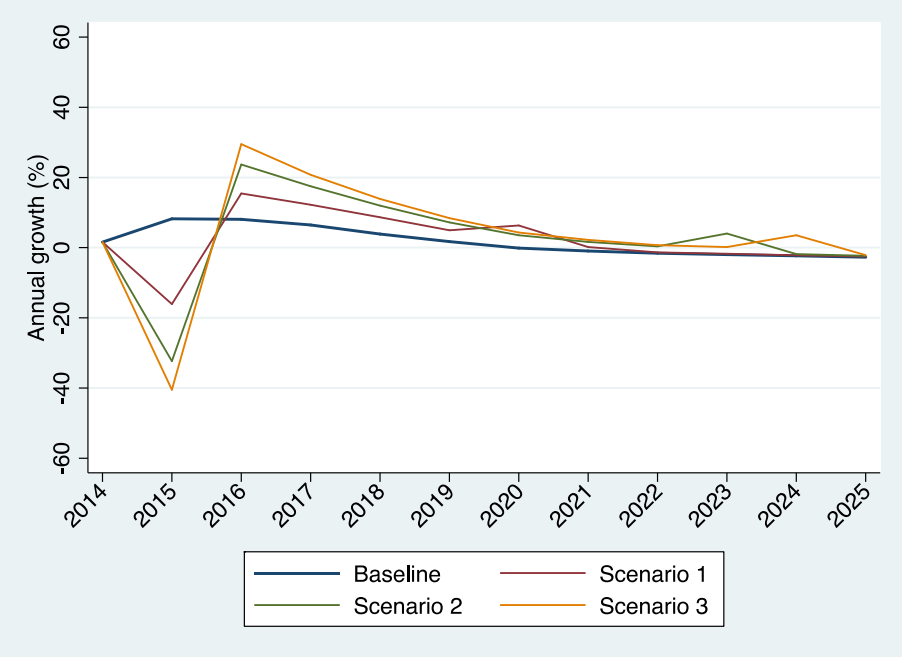
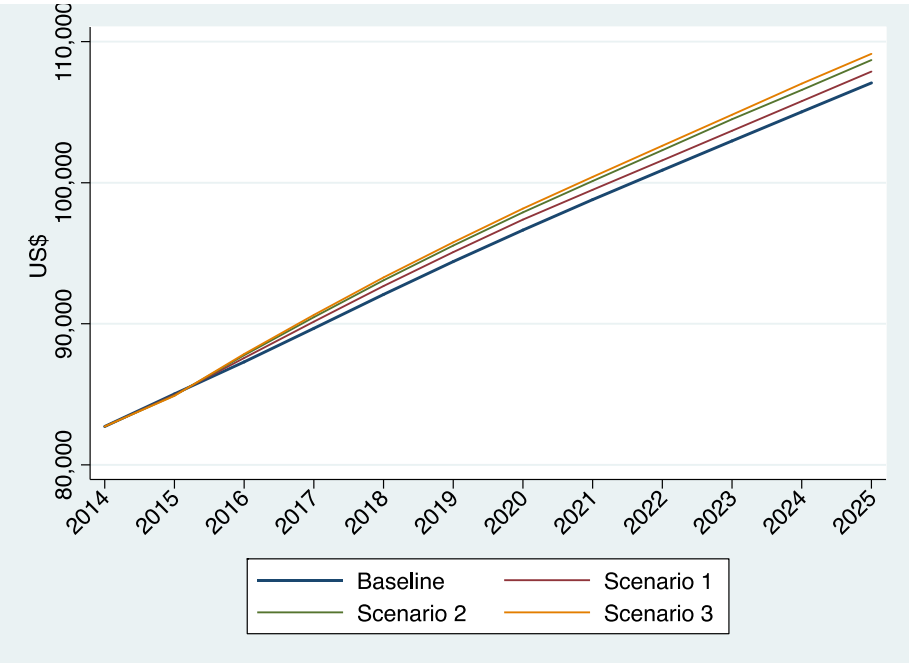


Figure 5: Growth rate of nominal unit labour costs (ULC) in baseline and three scenarios (2014–2025)



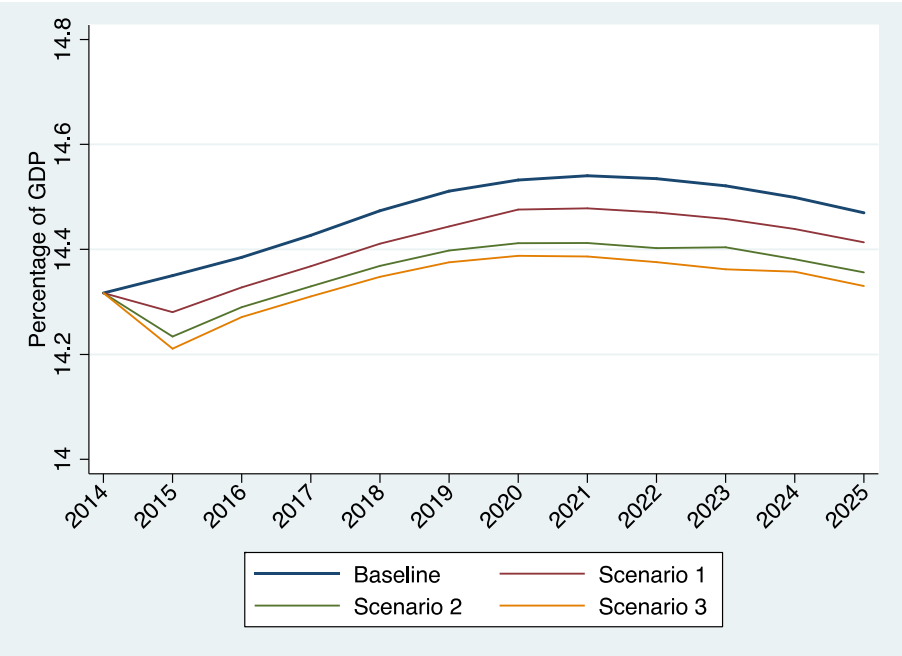
Investment expenditure increases in all scenarios, although it falls as a percentage of GDP. The fall in the rate of investment as profit growth declines is partly mitigated by the investment 'accelerator', such that investment expands as GDP growth accelerates. In neoclassical closures the decline in firms' savings rate would lead to a decrease in investment or a fall in consumption demand, both resulting in lower aggregate demand (as discussed in Section 2). In contrast, in this model investment is not passively determined by savings. Rather, it increases in absolute terms above the baseline projection owing to stronger GDP growth (Figure 6), itself arising from a fall in the savings rate as the functional distribution of income rebalances. Investment as a share of GDP still declines (relative to the base scenario) as firms' mark-ups and the profit rate decline, thereby reducing the incentive to invest (Figure 7).[27] Scenario 1 has a more benign impact on the share of private investment in GDP, as it decreases by less than in the other scenarios. While the effects differ by scenario the relative declines are all marginal. This indicates that in the case of South Africa investment responds strongly enough to expansions in output and that rising input costs does not unduly dampen investment.

Figure 6: Gross private investment (US$ millions) in baseline and three scenarios (2014–2025)



[27] This will help dampen the deterioration in the current account given that investment, by requiring capital goods, is found to be more import-intensive in the model. For more on the profit mark-up, see the Appendix.

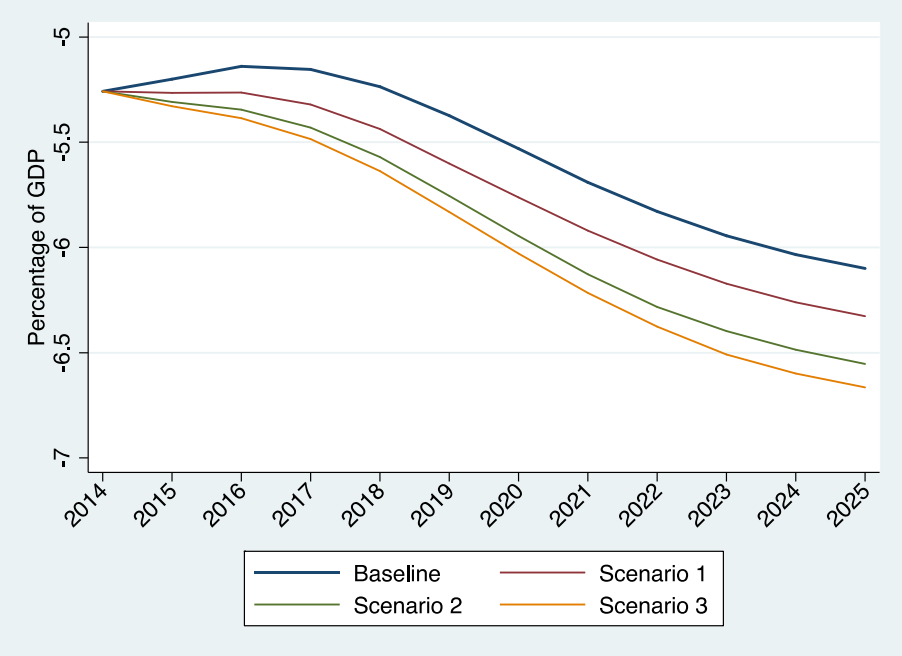
Figure 7: Private investment as a percentage of GDP in baseline and three scenarios (2014–2025)



A worsening current account balance, due to a loss in international price competitiveness due to higher wages, could offset domestic economic gains in output. South Africa's current account balance suffers in all three scenarios as imports increase relative to exports (Figure 8). This happens as the overall distribution of income shifts toward wages and consumption spending increases. Developing economies are more prone to weakening current account balances when domestic spending suddenly increases. In scenario 1 the current account deteriorates relative to GDP by 0.23 per cent; while in scenario 2 it is 0.45 per cent of GDP lower than in the baseline. The current account deteriorates most significantly in scenario 3 (0.57 per cent of GDP). The deterioration in the current account highlights the importance of complementary industrial development and trade-facilitation policies to boost domestic supply capacity and its flexibility.

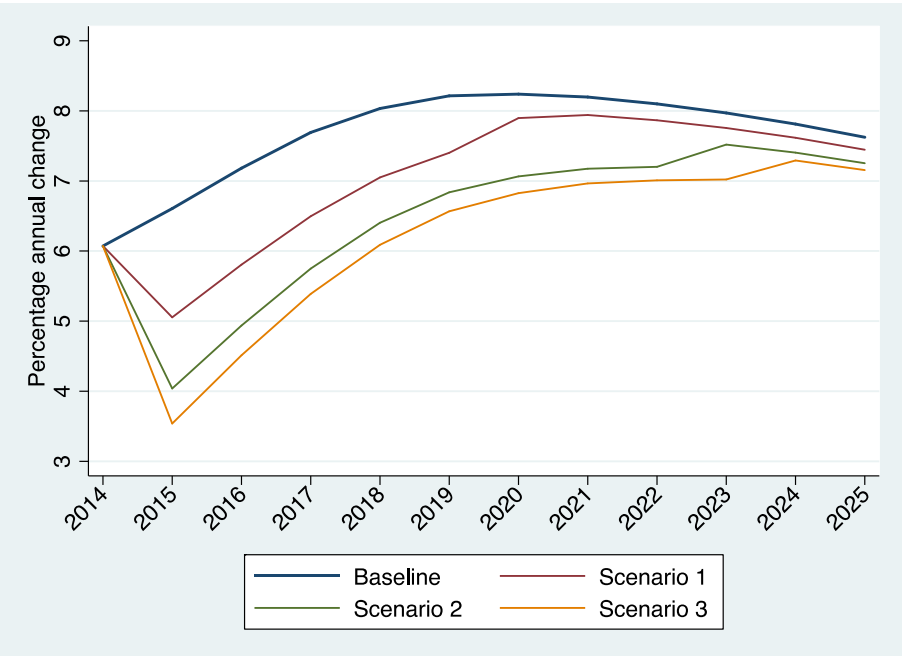
Deterioration in the current account is somewhat contained because price competitiveness is maintained through strong productivity increases. An increase in output and GDP growth raises productivity through the so-called 'Kaldor-Verdoorn' effects estimated for South Africa. Such productivity growth helps to contain the unit labour costs (ULC) facing firms as well as maintain external competitiveness by alleviating pressure on the exchange rate. Slight declines in investment as a share of GDP will also dampen the deterioration in the current account given that investment, by requiring capital goods, is generally more import-intensive in the model.

Figure 8: Current account deficit in baseline and three scenarios as a percentage of GDP (2014–2025)



Inflation falls in the model due to strong productivity increases, reductions in the profit mark-up, sufficient spare capacity, and increases in imports (Figure 9). This finding is important since inflation is one possible outcome of rising wages if firms pass on labour costs to consumers and productivity growth is mild. Productivity increases occur through the Kaldor-Verdoorn effects, already discussed. Reductions in profit mark-ups are a well-established response to rising costs and hence incorporated into the model's specifications.

Figure 9: Price inflation in baseline and three scenarios (2014–2025)



Potential job losses risk reducing spending and consumption, but this does not occur; the employment rate (employment/population) remains fairly constant across all three scenarios (Figure 10). The estimated 'Okun's Law' means that as GDP grows so does employment, even though the relationship is very weak for South Africa. This provides a positive feedback effect between growth and employment.

Figure 10: Employment rate in baseline and three scenarios (2014–2025)

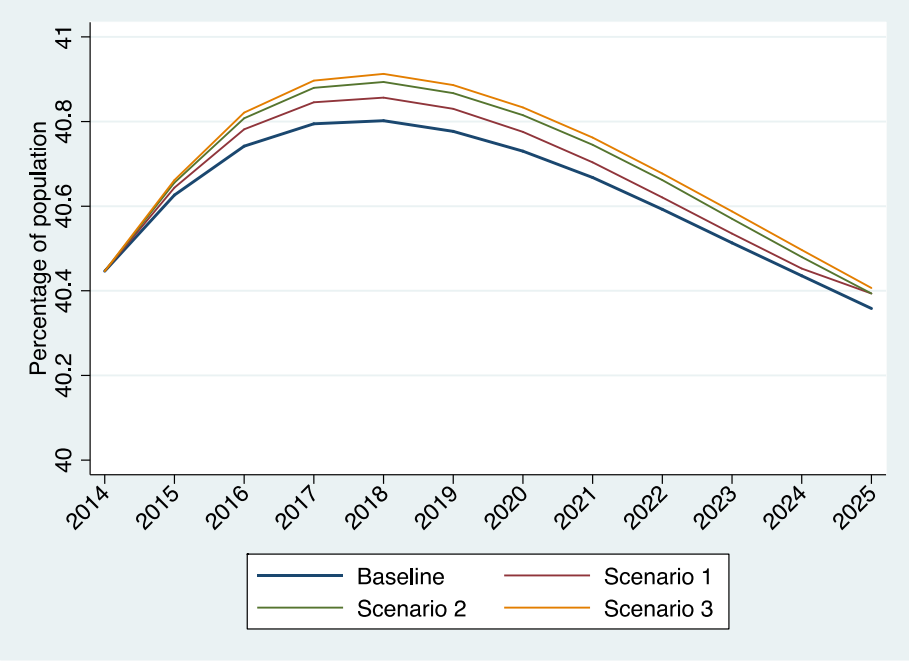
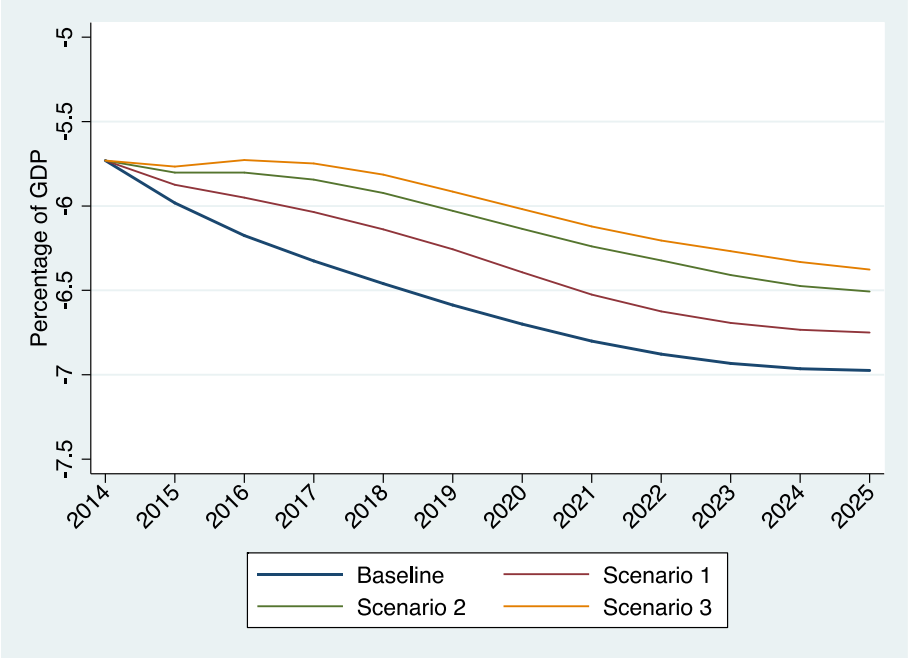


Figure 11: Government net lending as a percentage of GDP in baseline and three scenarios (2014–2025)



The aggregate effect on government net lending (as a percentage of GDP) is positive in all scenarios as it declines (though in absolute terms net lending increases as GDP increases). It improves (i.e. declines) the most in scenario 3, by approximately 0.6 per cent of GDP by 2025, while in scenario 1 it improves by around 0.2 per cent (Figure 11). The government net balance improves as direct revenue net of transfers and interest payments rises with increases in gross national income (with a lag). Moderate reductions in the unemployment rate give rise to moderate savings on transfers.

The adjustments witnessed in the model are generally in line with the observed adjustments to increased minimum wages (even though such a policy change is not directly implemented): productivity increases,[28] minimal negative effects on employment, limited price rises, modest reductions in firm profit mark-ups, and increases in demand and output. On aggregate, the policy of 'catch-up' has a positive effect on South Africa's economy.

The relatively small effects in scenario 1 indicates the limitations of influencing a small-open economy through modestly adjusting a single domestic policy variable. The somewhat larger effects in scenario 2 highlights that a domestic policy of 'catch-up' can be amplified by supporting policies, in this instance large public expenditure on fixed capital. A higher labour share also helps improve multipliers in the economy so that such expenditure has more beneficial knock-on effects. Scenario 3 has the greatest effect on the South African economy highlighting how the path-dependent nature of smaller open economies makes it difficult for a single domestic intervention to improve economic indicators when implemented in isolation from other countries' policies. The new global policy environment in scenario 3, whereby the labour share is increased in various other countries, has significant spill-over benefits for South Africa.

These results are summarised in Table 2 and 3. Table 2 shows percentage point change in key variables in 2025 compared to the baseline scenario (except for real GDP which shows a percentage rise). For instance, the labour share in 2025 for the baseline is 42.1 per cent of GDP, while in scenario 3 the labour share is 47.1 per cent of GDP, 5 percentage points above the baseline. Table 3 shows the actual levels reached by the key indicators by 2025 and in both '≈' indicates little effective change.

Table 2. Percentage point change in key variables in 2025 relative to baseline

	Labour share	GDP	Private Consumption to GDP	Government net lending to GDP	Employ-ment rate	Private investment to GDP	Current account deficit to GDP
Scenario 1	2.0	1.1	0.5	0.3	≈	-0.1	-0.2
Scenario 2	4.0	2.3	1.0	0.5	≈	-0.1	-0.5
Scenario 3	5.0	2.9	1.3	0.6	≈	-0.2	-0.6

Note: GDP is a percentage change relative to baseline and not percentage point.

[28] Labour productivity increases over the long-term are in almost all instances synonymous with, and caused by, a growing relative use of machinery in production.

Table 3: Key variables by 2025 for baseline and all three scenarios

	Labour share (per cent)	**GDP** (USD PPP, millions)	**Private Consumption to GDP** (per cent)	**Government net lending to GDP** (per cent)	**Employment rate** (per cent)	**Private investment to GDP** (per cent)	**Current account deficit to GDP** (per cent)	**Price inflation** (per cent)
Baseline	42.1	739 956	60.8	-7.0	40.4	14.5	-6.1	7.6
Scenario 1	44.1	748 431	61.3	-6.7	≈	14.4	-6.3	7.4
Scenario 2	46.1	757 078	61.8	-6.5	≈	14.4	-6.6	7.3
Scenario 3	47.1	761 522	62.1	-6.4	≈	14.3	-6.7	7.2

5 Discussion and conclusion

In this paper, we simulated a rise in real remuneration so that the rate of real-wage growth outstrips labour-productivity growth, thereby rebalancing national income away from property income and towards the labour share. The analysis is undertaken on the presumption that wages at the lower end of the distribution would rise in response to the implementation of a national minimum wages in South Africa and that this would stimulate such a reallocation of national income; country-level and international research on minimum wages and the labour share tend to support such a proposition. However, other policy interventions are also likely to result in the reallocation of national income and so the results have implications beyond the institution of a national minimum wage and highlight the positive potential of other programmes with a similar redistributive effect.

The overall impact on the South African economy of higher minimum wages, simulated in the above manner, is positive. The labour share increases can be sustained over some time (although we do not explore if the increase will be sustained beyond the ten-year forecast period). A rising labour share results in positive macroeconomic shifts, including higher GDP growth, without meaningful negative economic effects. On this basis, the South African economy can be said to be modestly 'wage-led' during this time period under examination.

The above modelling exercise has limitations when trying to infer the impact of the specific intervention of higher minimum wages on the economy; We do not estimate the direct relationship between a given minimum wage level, and changes in aggregate economy wide wage levels, and so we cannot make any prescription as to the level at which minimum wages should be set. Econometric estimations of this relationship would be helpful in future research. Similarly, we cannot assess the impact of the above scenarios on the personal distribution of income (this is assessed in Adelzadeh and Alvillar, 2016). However, a specific focus on the distribution of national income contributes to the South African literature on inequality which has tended to focus almost exclusively on the distribution of personal income, and more recently on wealth.

The results reveal the importance of explicitly modelling the relationship between growth and distribution for the South African economy: changes in the functional distribution of income towards labour have very real, mostly positive, effects on the workings of South Africa's macro economy, according to the estimated econometric specifications. As such, the results caution against using policy models that largely treat issues of growth as separate from issues of distribution.

The paper also illustrates the benefits of using the GPM over CGE models for the specific question at hand. Unlike in CGE models, where the consequences of increased real wages is driven purely by changes in relative prices, the distribution of income is central to the GPM and drives the macroeconomic changes resulting from higher minimum wages. This is an important alternative depiction of economic reality and arguably more appropriate in describing actual macroeconomic relationships in the South African context.

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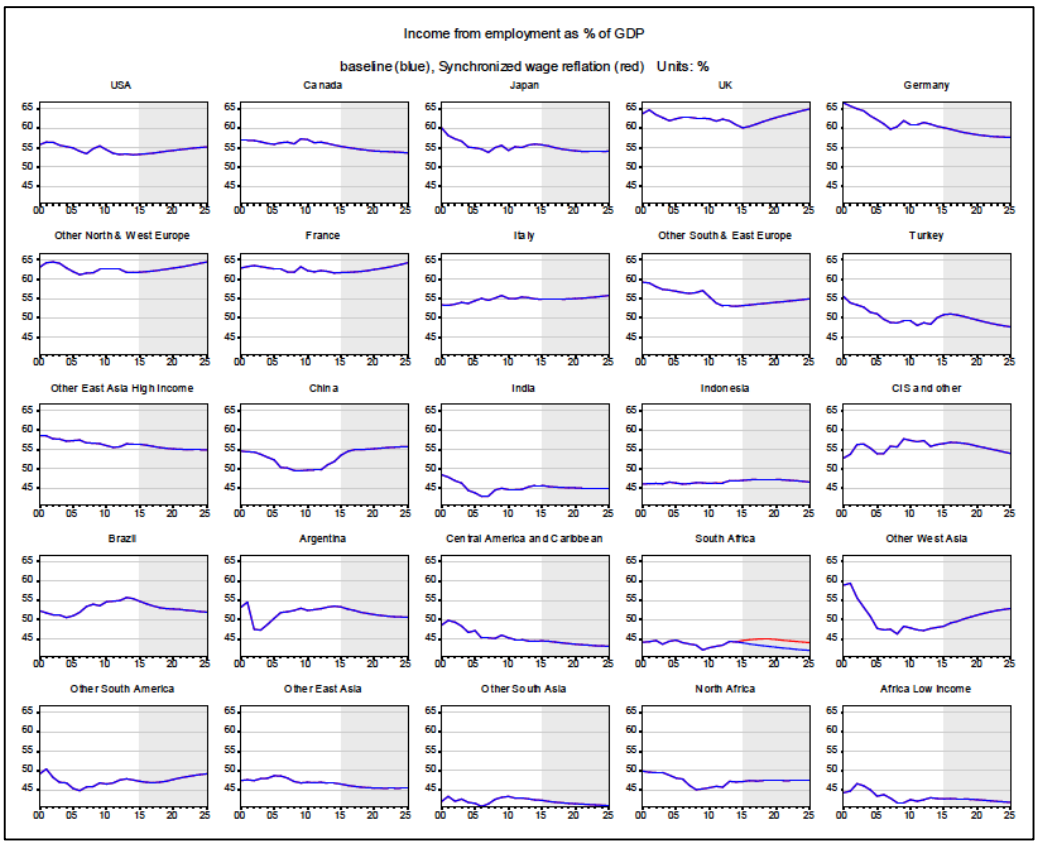
Appendix: United Nations Global Policy Model

Defining the Labour Share

The labour share (also called the 'wage share') is defined as the share of value added paid to workers in an economy. The labour share is defined as: $S_L = \frac{WL}{PY}$, where W is total labour income, Y is value added or output, L is the labour input (usually measured in man-hours) and P is the overall price level. The labour share is therefore the nominal wage bill over nominal output or nominal GDP. This fraction is also known as *real* unit labour costs, since *nominal* unit labour costs are (nominal) wage costs over real output (instead of nominal output as in the above): $ULC = \frac{WL}{Y}$. The property share (also called the 'profit share') is the remaining value added. In the GPM the impact of changes in the labour share are felt throughout the model due to the role of the functional distribution of income in determining the composition and level of economic activity.

Figure A1: South Africa's labour share relative to other economies in GPM (2000–2025)



History of the GPM

The first version of the GPM was created by the Department of Economic and Social Affairs of the United Nations in 2007. It drew heavily from the experience of more than 30 years of global modelling undertaken by the Department of Applied Economics (DAE) at the University of Cambridge, UK. One of the primary architects of DAE's global modelling work, Francis Cripps, has been the principal

investigator behind all versions of the UN GPM, including this one (version 5.c). Francis Cripps was joined by Alex Izurieta while at the University of Cambridge and later by Rob Vos, then Director of the Department of Policy Analysis of UNDESA, with whom earlier versions of the GPM were co-authored. Apart from UNDESA, other partners have collaborated in the development of the model, most notably UNDP's International Policy Centre (IPC), Cambridge Endowment for Research on Finance (CERF, University of Cambridge), UNCTAD, the ILO, and the Global Development and Environment Institute (GDAE) of Tufts University (MA, US). From December 2013 onwards, the responsibility for the maintenance and revisions of the model resides with UNCTAD, who is responsible to make the databank and model programmes available to a wider audience.

Additional model information

In addition to the facets of the UN Global Policy Model that have been discussed in the paper, there are other facets that we would like to point out. Domestic cost inflation is modelled as the outcome of increases in unit labour costs, determined by changes in average money earnings and output per person employed, along with a variable profit mark-up and a further mark-up for indirect taxes less subsidies. Put simply, the price level responds to changes in wages, productivity, and the mark-up of firms. The annual change in the domestic expenditure deflator is mainly a function of cost inflation and changes in the terms of trade (to the extent that import prices fall relative to exports and domestic prices).

The real exchange rate represents the combined effect of changes in domestic and external price levels and changes in nominal exchange rates. The real exchange rate rises in the long run with GDP growth and increases in relative per capita income terms. In the short run it fluctuates in response to nominal exchange rate changes and changes in global inflation.

The ability of the model to estimate the impact of a policy change on financial variables is fairly sophisticated and far more so than in most general equilibrium models. Finance and financial flows are modelled explicitly, and dynamically integrated into the model to ensure that changes in income, government expenditure, and investment by the private sector fully translate into changes in net lending or borrowing positions of sectors. Such flow 'closures' may directly influence economic activity; as flows accumulate on balance sheets these feed back into the adjustment behaviour of the real economy. Both a short-term 'policy' rate and a long-term bond interest rate, as well as changes in external flows, are included in the model and these form part of the investment function. Given the impact of the financial crisis, omitting the financial sector from a macroeconomic model (as in CGE models) is a pivotal shortcoming, especially given the role of credit expansion found in previous studies on the impact of minimum wages.[29]

Financial balances affect net government lending in the GPM, which represents the difference between net revenue (taxes less subsidies, transfers and debt interest) and spending on goods and services, as well as additional terms which represent autonomous policy divergences and shocks.

Based on the data for South Africa the general behaviour of the model to a 'shock' is shown in Table A1. This indicates how a country's GDP, consumption, fixed private investment, government

[29] As Aaronson et al. (2012, p.2) note: "First, a $1 minimum wage hike increases household income by roughly $250 and spending by approximately $700 per quarter in the year following a minimum wage hike. These findings are corroborated by independent data showing that debt rises substantially after a minimum wage increase."

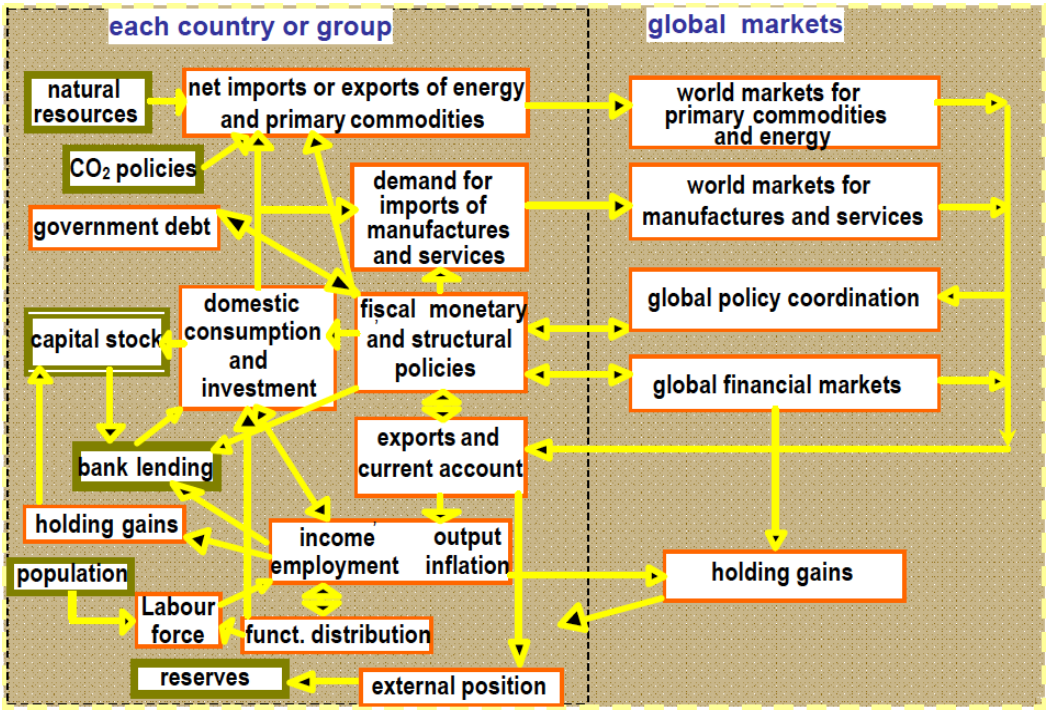
expenditure and net lending, and the current account (the rows in the table) respond to one of the following: an increase (or decrease) in government expenditure (by $1bn); an increase in net direct taxes (by $1bn); an increase in the rate of indirect taxation (by 1 per cent), or an increase in the profit mark-up (by 1 per cent) (the columns in Table A1). Figure A2 graphically depicts the main modules and linkages with the GPM.

Table A1. South Africa's multiplier analysis using GPM

Impact of the shock on: $bn if shock in $bn; and % change if shock in %	**Resulting from:**			
	Government expenditure ($1bn shock)	**Net direct taxes** ($1bn shock)	**Rate of indirect taxation** (1% change)	**Profit markup** (1% change)
GDP	1.60	– 0.11	– 0.35	– 0.16
Consumption	0.41	– 0.19	– 0.69	– 0.28
Fixed private investment	0.14	– 0.01	– 0.03	0.02
Govt exp. on goods & services	1.00	0.08	0.22	– 0.01
Government net lending	– 0.64	0.90	0.73	– 0.03
Current account	– 0.14	0.03	0.07	0.02

Note: For net lending and current account, % change is measured as % of GDP.
Source: Cripps and Izurieta (2014).

Figure A2: Main modules and linkages in GPM



Source: Cripps and Izurieta (2014).