MACROECONOMIC EFFECT OF MINIMUM WAGE INCREASE IN NIGERIA: A DSGE Approach

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ABSTRACT

The minimum wage is an economic policy tool aimed at raising the earnings of low-income households with the ultimate objective of improving the living standard of this group of workers. Nigeria has, over time, enacted four national minimum wage acts. The most recent is the Minimum Wage Repeal and Enactment Act 2019, which has increased the minimum payment to workers from ₦18,000 to ₦30,000; representing an rise of about 66.67 per cent. The implementation of this new bill is expected to have varying macroeconomic effects ranging from wage effects, employment effects, distributional effects, welfare effects and price effects, among others. This study, therefore examined the macroeconomic effects of the four episodes of the minimum wage increase in Nigeria by calibrating and log-linearising a New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model that is extended to include labour heterogeneity. The study found that minimum wage increase does not improve household welfare and living standard, neither does it have any positive growth effect. Furthermore, it strains government finances. The implication of this finding is that minimum wage policy should be complemented with other pro-poor and inclusive development policies in order to improve the quality of life of the poor and vulnerable low-income workers.

JEL classification: **????**

1. Introduction

The minimum wage can be referred to as a legally binding order by the government to employers on the least amount to pay as wages to employees. Since 1981, there have been four changes to the Nigerian minimum wage. The most recent change in the minimum wage came up in early 2019, with the Federal Government of Nigeria approving a 66.67 per cent increase to ₦30,000 from the ₦18,000 minimum wage set in 2011. The National Labour Congress (NLC) has been the major advocate for increase in the minimum wage in Nigeria, citing the need to boost the living standard of the people.

From the literature, existing empirical and theoretical studies present mixed evidence and predictions of the impact of an increase in the minimum wage. Moreover, empirical literature shows that minimum wage has varying macroeconomic effects ranging from wage effects (Wong, 2019); employment effects (Baducco and Janiak, 2018); distributional effects (Neumark, 2006); welfare effects (Gorostiaga and Rubio-Ramirez, 2007); and price effects (Folawewo, 2007) among others. On the one hand, an increase in the minimum wage is expected to enhance the standard of living of the people; also positively affect the productivity of employees, and increase consumption spending and aggregate demand in an economy (Cuong, 2011). On the other hand, evidence subsists that an increase in the minimum wage might not itself deduce any welfare increase to workers, especially when firms attempt to hedge cost by reducing non-cash components (labour employment) or even respond by increasing the price of their goods and services. The aggregate effect of the behaviour of the firms could inadvertently lead to an increase in both unemployment and inflation rate (Antonova, 2018).

Against this background, this study asks the pertinent questions: First, what has been the effect of the previous minimum wage increases on macroeconomic variables such as output, inflation, welfare and wages in Nigeria?; Second, what will be the macroeconomic effect of the proposed ₦30,000 minimum wage? From these questions, the objectives of this study are to:

(1) empirically measure the macroeconomic effect, specifically the wage effects, employment effects, distributional effects, growth effects and welfare effects of the previous minimum wage regimes, and

(2) simulate the effect of the new minimum wage in Nigeria using a dynamic stochastic general equilibrium (DSGE) approach. The DSGE approach is well suited for this study since it provides an appropriate general equilibrium insight on the effect of the minimum wage on the Nigerian economy, which is perceived to be more robust compared to existing partial equilibrium methods (Folawewo, 2007).

The motivation for this study is premised on the recurring debate surrounding the enactment and implementation of minimum wage increase in Nigeria. The debate borders on the policy trade-offs between the benefits accrued to labour interest groups such as the Nigerian Labour Congress and Trade Union Congress, and risen costs due to the minimum wage increase to be borne by reluctant public and private employers. This has, over the years, led to several disruptions in the labour market, and the source of livelihood of many Nigerians, and even affected the level of economic activities due to labour strike actions. This study is therefore relevant given the dynamic labour market in Nigeria, with over 92 per cent of households outside the regulated labour market,[1] and the volatile macroeconomic arrangement. It becomes expedient to assess the resulting macroeconomic outlook following the proposed minimum wage increase. The rest of the paper is structured as follows. Following this introductory section, the stylized facts on minimum wage are presented in section 2. In section 3, a literature review is presented. The dynamic stochastic general equilibrium model and its calibration are specified in section 4. In section 5, the results, that is, the impulse response function, policy experiments and its discussions are presented while the conclusions from the study are made in section 6.

2. Stylised Facts

2.1 The minimum wage trend and inflation dynamics in Nigeria

Three minimum wage changes have been implemented in Nigeria between 1981 and 2018; the fourth, which was announced in 2019, is yet to be implemented by the Federal Government [as at Date?]. The provision of the

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[1] SMEDAN and NBS survey revealed that micro enterprises in Nigeria employed about 57.8 million people in 2012 accounting for 92 per cent of the Nigerian labour force estimated at about 62.6 million people.

National Minimum Wage Act of 1981 obligated employees to pay ₦125 as the lowest amount to employees. In 2000, the Act was amended and the minimum wage was increased to ₦5500, and by 2011, it was adjusted to ₦18,000. These changes indicate that the nominal minimum wage increased by 4300 per cent in 2000, and by 227 per cent in 2011.
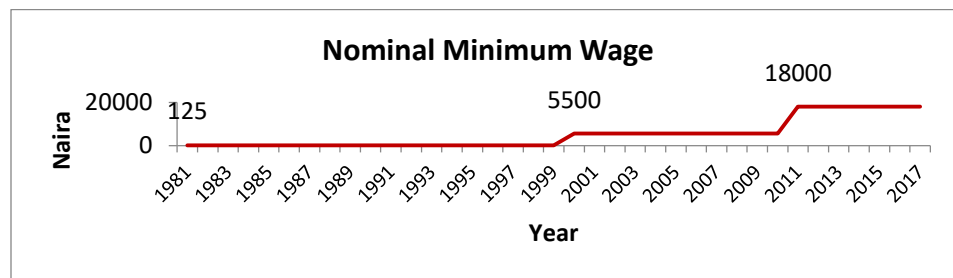

Figure 1. Minimum Wage Trend in Nigeria.
Source: National Minimum Wage Act 1981, 2001 and 2011.

However, while the minimum wage in Nigeria appreciated by 227 per cent from 2011 to 2018, there was a decline in the real minimum wage of Nigerians due to the effect of inflation. Inflation is measured by changes in the consumer price index (CPI) and it is used to determine the average change over time in the prices of goods and services consumed by individuals. Table 1 presents the real minimum wage of Nigerians, adjusted for using 2010 CPI. It shows that year-on-year, there was a decrease in the actual value of the minimum wage earned by the least-paid Nigerian. Although, it also shows that the least paid Nigerian at the minimum wage was better off in 2018 than in 2010 because his real income increased from ₦5,500 in 2010 to ₦6,555.59 in 2018 (19.19% increase).

Table 1. Real Minimum Wage (2010 Base Year) and Inflation in Nigeria

Year	CPI	Nominal Minimum Wage (₦)	Real Minimum Wage (₦' 2010 base year)
2010	100	5,500	5,500.00
2011	110.84	18,000	16,239.62
2012	124.38	18,000	14,471.52
2013	134.92	18,000	13,340.78

2014	145.80	18,000	12,345.43
2015	158.94	18,000	11,325.11
2016	183.85	18,000	9,790.43
2017	214.23	18,000	8,402.10
2018	274.57	18,000	6,555.59

Source: CPI obtained from World Bank; Real minimum wage is based on the researchers' estimates.

However, conducting a 5-year analysis on the real minimum wage earned by the least paid Nigerian (adjusting nominal wage using 2014 CPI), it was observed that an individual being paid a minimum wage of ₦18,000 in 2018, experienced a decline in purchasing power or real income by about 46.90 per cent from 2014 to 2018. The trend analysis on the real minimum wage using 2014 as the base year actually revealed a falling purchasing power year-on-year for the least paid Nigerian from 2015 to 2018 due to increased inflationary pressure on the economy as Nigeria experienced an economic recession in 2016/2017.

Table 2. Real Minimum Wage (2010 Base Year) and Inflation in Nigeria

Year	CPI	Nominal Minimum Wage (₦)	Real Minimum Wage (₦' 2014 base year)
2014	145.80	18,000.00	18,000.00
2015	158.94	18,000.00	16,512.34
2016	183.85	18,000.00	14,274.73
2017	214.23	18,000.00	12,250.51
2018	274.57	18,000.00	9,558.24

Source: Researchers' estimates.

3. Literature Review

The minimum wage has featured prominently among the policy instruments applied to improve the well-being of low-skilled workers, however, policy discussions often raise concerns about its impact on employment, prices, and most especially on non-wage job attributes (Clemens, Kahn and Meer, 2018). Evidence subsists that the minimum wage may not itself deduce [mean?/translate to?] any welfare increase to workers, especially when firms attempt to hedge cost by reducing non-cash components. According to

Mas and Pallais (2017), such non-wage job attributes, **[i.e.?]** 'non-cash component of wages', serve crucial value to workers in the employment arrangement. The study by Clemens et al. (2018) found that a $1 minimum wage increase for those in low-paying occupations was associated with a 4% decline in employer willingness to sponsor a health insurance scheme, making the effect of the minimum wage increase to spill over into the macro-economy.

In the same vein, theoretical strands espouse that minimum wage policy translates moderately to favour higher earners, and reduces low-skilled participation, hence, misaligning the policy advocacy that suggests minimum wage increase as potentially poverty-reducing and welfare enhancing (Stigler, 1946; Mckenzie, 1980; Lee and Saez, 2012). The foregoing theoretical and empirical assertion implies multi-dimensional effects of minimum wage adjustment that transcends a literal income effect. Hence, given the dynamic labour market in Nigeria, with over 56% of households outside the regulated labour market and the volatile macroeconomic arrangement, it becomes expedient to assess the resulting macroeconomic outlook following the proposed minimum wage increase.

Evidence abounds in literature on the macroeconomic effects of raising the minimum wage, especially as it relates to the effect on employment, wage distribution, and output. According to common consensus, which was affirmed by Card and Krueger (1994) and Bauducco and Janiak (2018), employment responds marginally to a moderate rise in the minimum wage, while a very large minimum wage increase leads to negative spillovers on employment. Notably, a minimum wage increase, though, compresses wage distribution but generates more spillovers for higher earners (Neumark and Wascher, 2008**[2002 in ref list])**. A policy experimental test carried out by Bauducco and Janiak (2018) in the US economy showed a decline of 2.8% in employment and an upside of 4% and 1.8% on capital and output following the introduction of a $10 minimum wage. Furthering the policy experiment by introducing a $9 minimum wage left unemployment unchanged but raised capital accumulation. This evidence justifies the earlier assertion by Card and Krueger (1994). In the same spirit, Sauer (2018), using US data, studied the macroeconomic impact of an increase in the statutory minimum wage applying the DSGE model. The study found that an increase in the minimum

wage hampers employment for unskilled workers more, as firms react by adjusting employment contracts resulting in stiffer performance requirements for unskilled workers. The empirical evidence showed that unemployment for the unskilled increased by 3.85%. The firm responded to the wage rise by laying off unskilled workers because unskilled workers became expensive, hence no need for many of them. On the average, total employment declined by 0.21%. Overall, an increase in the minimum wage mainly impacted unskilled households, while skilled households and aggregate variables were minimally influenced.

Strauss, Isaacs and Capaldo (2017) assessed the impact of minimum wage increases on the South African economy. This was achieved by raising the share of income accruable to workers. The study simulated a scenario featuring the implementation of wage compensation such that real wage growth outstriped labour productivity. Given an increase in relative and constant employment, labour's share in national income increases, that is, a higher real wage rebalances national income. The rise in labour's share results in a positive outlook for the South African economy. Also, consumption expenditure rises as national income shifts towards wage earners – who now have a high propensity to consume. On the other hand, the upside in wages results in declining profits accruable to capital and property, and this makes investment share in GDP to fall marginally (though absolute investment rises). The study also found a marginal decline in employment and worsening of the current account. In the same manner, studies conducted by Pauw (2009), Pauw and Leibbrandt (2012), and Development Policy Research Unit (2008, 2016) on the impact of national wage increase on employment, output and poverty concluded that unskilled employment declined with a larger impact in the short run and a marginal fall in general employment level. However, Macleod (2017**[2015 in ref list]**) posed a contrary stand regarding the effect of minimum wage increase on other macroeconomic variables other than employment. He suggested that all economic indicators declined following a wage rise, with real GDP falling by up to 3.7%.

Among notable evidence from Nigeria is the study by Fajana (1983), who found a 0.23% decline in employment as a result of a one per cent increase in the federal minimum wage. Similar evidence was obtained by Okolo and

Attamah (2018). Their study further revealed that rising tax burden, which is likely to follow a minimum wage increase, worsens capital productivity growth and weakens growth potential in the short run. Both studies concluded that a strong negative relationship exists between wage increase and employment in Nigeria. Similar evidence depicting this relationship was also obtained in Nigeria, America and Canada by Douty (1960); Campolieti, Gunderson and Riddel (2006); Brander (2013); and, Siyan, Adegoriola and Adolphus (2016). This strand supports widely acclaimed consensus, however, the literature is still in need of relevant empirics on the impact of minimum wage increase on major macroeconomic variables in Nigeria.

This present re-examination of the impact of the minimum wage on major macroeconomic variables in Nigeria will assess the gap using a macroeconomic model capable of deciphering the impact of several wage scenarios on the aggregate economy. Based on its use of the general equilibrium framework, this study is closely related to Folawewo (2007), who used the computable general equilibrium method. However, this study is different in that it provides the most recent general equilibrium evidence of the impact of minimum wage increases in Nigeria, especially the 2011 and 2019 episodes that Folawewo (2007) did not consider.

4. DSGE Model

The Dynamic Stochastic General Equilibrium (DSGE) model is a useful framework for macroeconomic policy analysis, forecasting and scenario analysis. The DSGE method is premised on New Keynesian theoretical assumptions that are relevant for policy analysis. It is therefore immune to the susceptibility of other estimation techniques to the Lucas critique. The DSGE model, in the spirit of the New Keynesian School of economic thought recognizes the forward looking and optimizing behaviour of economic agents. It deviates from traditional assumptions of frictionless markets, flexible prices and neutrality of money. It also recognizes the existence of real and nominal shocks, non-trivial effect of monetary policy, monopolistic competition and nominal rigidity.

In the case of this paper, the model features four agents that include households, firms, the government sector and monetary authority. The model

assumes that a representative optimizing household seeks to maximize the utility derived from consumption of goods and leisure. There is a representative monopolistic competitive firm that produces goods. The fiscal and monetary authority implements both fiscal and monetary policy. Finally, the model is assumed to be perturbed by technological, monetary, fiscal and minimum wage shocks.

4.1 Household

The household comprises two representative agents: fraction γ, which represents the skilled household that has access to financial assets and can adjust consumption intertemporally, and another fraction $1 - \gamma$, representing the unskilled household that does not have access to financial assets and consumes all of its disposable income.

4.1.1   *The Skilled Household*

The skilled household has attained a high educational level and behaves in the manner of the Ricardian household. The representative household is assumed to choose consumption, and provides skilled labour. The household maximizes its lifetime utility function given as:

$$U(C_t, N_t) = E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{C_{s,t}^{1-\sigma}}{1-\sigma} - \Gamma_t^s \frac{N_{s,t}^{1+\varphi^s}}{1+\varphi^s} \right] \tag{1}$$

where: β and σ represent the discount factor indicative of the choice of the household overtime and the inverse elasticity of substitution for consumption, while Γ_t^s denotes the disutility parameter for offering labour services. Parameter φ^s represents the inverse labour supply elasticity for providing skilled services. The skilled household is also assumed to form habit in its consumption pattern, such that: $C_{s,t} = hC_{s,t-1}$, where h denotes the habit formation parameter.

The budget constraint of the household is defined by the wages received from labour $(W_t^s N_{s,t}^s)$, W_t^{minw} denotes a minimum wage, the returns from capital investment $(r_t^k K_t)$, firm profit (Π_t), transfer payment from the

government (TP_t) and the dividends from government bond (B_t). This is represented as follows:

$$P_t C_t + P_t I_t + E_t(Q_{t,t+1}B_{t+1}) = (1 - \tau_h)(W_t^s N_{s,t}^s) + r_t^k K_t +$$
$$\Pi_t + B_t + TP_t \tag{2}$$

Capital accumulation is assumed to follow the ==law[law?]== of motion process:

$$k_{t+1} = (1 - \delta)k_t + I_t \tag{3}$$

4.1.2   *The Unskilled Household*

The unskilled household is assumed to have a low educational level and behaves like the Non-Ricardian household where all of their income is spent. The representative unskilled household has a similar utility function to the skilled household. However, the difference is that it has no access to financial markets, and it provides unskilled labour. The utility function is given as:

$$U(C_t, N_t) = E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{\bar{C}_{u,t}^{1-\sigma}}{1-\sigma} - \Gamma_t^u \frac{N_{u,t}^{1+\varphi^u}}{1+\varphi^u} \right] \tag{4}$$

And the budget constraint is such that the unskilled individual spends all his income after tax on consumption of goods. This is represented as:

$$P_t C_t = (1 - \tau_h)(W_t^u N_{u,t}^u) \tag{5}$$

4.1.3   *Household Labour Supply Decision*

A proportion of the household (ω) provides skilled labour and the other $(1 - \omega)$ offers unskilled labour to the firms. Therefore, the aggregate labour supply expressed as a Constant Elasticity of Substitution (CES) index is given as:

$$N_t = [\omega^{-\kappa}(N_t^s)^{1+\kappa} + (1 - \omega)^{-\kappa}(N_t^u)^{1+\kappa}]^{\frac{1}{1+\kappa}} \tag{6}$$

4.1.4   *Minimum Wage*

Government dictates the wage that can be given to unskilled labour, such that:

$$W_t^u = W_t^{minw} \tag{7}$$

where: W_t^{minw} denotes a minimum wage.

The choice of the household is to supply more unskilled labour that is demanded at the minimum wage, thereby allowing the firms to dictate how much unskilled labour they require. The real minimum wage process is adapted from Antonova (2018) as:

$$\left(W_t^{minw}\right) - \left(W_{ss}{}^{minw}\right) = \rho_w \left(\left(W_{t-1}^{minw}\right) - \left(W_{ss}{}^{minw}\right)\right) +$$

$$\rho_{\pi w}(\pi_t) - (\pi_{ss}) + \varepsilon_w \tag{8}$$

where: ε_w denotes an exogenous shock assumed to be normally distributed. $\rho_{\pi w}$ is assumed to be less than zero, which allows for an inverse relationship between real wage and inflation. The assumption is based on the assertion that government does not perfectly index the nominal wage to inflation in each period. Consequently, the nominal minimum wage does not reflect living standards in the economy.

4.2 Firms

There is a representative intermediate good producing firm that operates in a monopolistic competitive market, and uses capital and both skilled and unskilled labour as inputs in its production process given as:

$$Y_t = A_t K_t^\alpha (N_t^u)^\gamma (N_t^s)^{1-\alpha-\gamma} \tag{9}$$

where: A_t indicates total factor productivity, N_t^u , N_t^s represents the unskilled labour and skilled labour input while K_t denotes the capital input of the firm.

Equation (9) is log-linearized as:

$$y_t = a_t + \alpha k_t + \gamma(n_t^u) + (1 - \alpha - \gamma)(n_t^s) \tag{10}$$

a_t is assumed to follow an AR(1) process, such that:

$$a_t = \rho_a a_{t-1} + \varepsilon_t^a \tag{11}$$

where: the technological shock to production is represented by ε_t^a.

The aggregate output produced is measured as an index of output represented by:

$$Y_t = \left[\int_0^1 Y_t^{\frac{\varepsilon-1}{\varepsilon}} \, dj \right]^{\frac{\varepsilon}{\varepsilon-1}} \tag{12}$$

The firm's optimization is in two stages: the first stage is minimizing cost given its output level, and the second stage is determining the optimal price for its good. The cost function of the firm is given as:

$$Min \; C_t = \frac{W_t^u N_t^u}{P_t} + \frac{W_t^s N_t^s}{P_t} + \frac{r_t^k K_t}{P_t} \tag{13}$$

The real wages and real rent on capital are denoted by $w_t^u n_t^u$, $w_t^s n_t^s$ and $r_t^k k_t$, respectively. The price setting process of the firm is based on the Calvo (1983) staggered price-setting principle. It is assumed that a fraction $1 - \theta$ of firms can set a new optimal price in each period. The remaining fractions do not change their prices. The representative firm adjusts its price (P_t^*) based on the profit maximization process as shown as:

$$\pi = Max \; E_t \sum_{k=0}^{\infty} \theta^k \; E_t \left[Q_{t,t+k} Y_{t+k} (P_t^* - MC_{t+k}) \right] \tag{14}$$

Subject to the firm's demand function for their goods:

$$Y_{t+k} = \left(\frac{P_t^*}{P_{t+k}} \right)^{-\varepsilon} Y_{t+k} \tag{15}$$

4.3 Monetary authority

We follow the standard practice in the literature by assuming the Central Bank of Nigeria (CBN) adopts an interest rate policy based on the Taylor rule, asserting that central banks adjust the nominal interest rate to respond to deviations in inflation and output from their targets. The Taylor rule function is given as follows:

$$\frac{R_t}{R} = \left[\frac{R_{t-1}}{R} \right]^{\rho_R} \left[\left(\frac{Y_t}{Y} \right)^{\upsilon_Y} \left(\frac{\pi_t}{\pi} \right)^{\upsilon_\pi} \right]^{1-\rho_R} \varepsilon_t^R \tag{16}$$

where: R_t and R_{t-1} represent both the nominal and lagged interest rate, respectively; Y_t, π_t and E_t denote output and inflation rate respectively. ε_t^R indicates innovation to monetary policy.

Log-linearizing equation (16) gives:

$$r_t = \rho_r r_{t-1} + (1 - \rho_r)[\upsilon_y y_t + \upsilon_\pi \pi_t] + \varepsilon_t^r \tag{17}$$

where υ_y and υ_π are the parameters reflecting the responsiveness of CBN to output gap and inflation. The degree of interest rate smoothing is represented by ρ_r.

4.4 Government

The Federal Government of Nigeria is assumed to issue bonds and consume final goods (G_t) through the use of distortionary income taxes. Therefore, budget constraint for the government is defined as:

$$G_t + \frac{B_{t-1}}{P_t} = \tau_t^n (W_t^{minm} N_{u,t}^u + W_t^s N_{s,t}^s) + \frac{B_t}{P_t} \tag{18}$$

where: τ_t^n denotes the labour income tax.

Furthermore, government spending is assumed to adjust to the state of the economy such that:

$$g_t = \rho_g y_t + \varepsilon_t^g \tag{19}$$

4.5 Market clearing conditions

The market clearing condition for the domestic economy requires that aggregate output equals aggregate domestic consumption, investment and government spending such that:

$$Y_t = C_t + I_t + G_t \tag{20}$$

4.6 Aggregation

Total consumption: $c_t = \omega c_{s,t} + (1 - \omega) c_{u,t} \tag{21}$

Total labour supply: $n_t = \omega n_{s,t} + (1 - \omega)n_{u,t}$ (22)

4.7 Parameter calibration

The parameter values used in this study are calibrated based on existing long trend data, values reported in existing studies and the researchers' subjective beliefs as informed by the literature. Structural parameters, such as inverse elasticity of substitution (σ), capital depreciation rate (Δ), habit formation (h), Calvo price setting (θ), are set to be 2.00, 0.025, 0.70 and 0.75 respectively as obtained from Tule, Iklaga and Yusuf (2018) in their study on the Nigerian economy. The inverse elasticity of labour supply (φ) is calibrated as 4.38 based on Çebi (2012). The parameter value of the income tax rate (τ) is fixed at 0.24, reflecting the value of the personal income tax rate as stipulated by the Federal Inland Revenue Service for the period 2011 to 2018. The share of capital in firm's output (α) is fixed at 0.37, according to the mean value of the capital-output ratio series for Nigeria over the annual period 1981-2017. The share of unskilled labour (ω) is calibrated at 0.80 to match the International Labour Organisation (2018)**[Not in ref list]** estimate of the proportion of informal employment to total employment in Nigeria. The share of skilled labour in output (γ) is calculated as (1-parameter value of (ω))*(1- parameter value of (α)) and gives 0.14. The autocorrelation parameter on minimum wage (ρ_w) and the response of inflation to changes in the minimum wage ($\rho_{\pi w}$) are set by regression estimation of equation (8) using annual data from 1981 to 2017. It is fixed at 0.94 and -0.22 respectively. Monetary policy parameters, including the reaction of inflation (v_π) and output (v_y) to deviations in the interest rate, are fixed at 1.5 and 0.5 as obtained from Adegboye (2015). The AR(1) parameter on interest rate (ρ_r) and the response of output to government (ρ_y)is obtained by regression estimates and takes the values of 0.8 and 1.23 respectively. The AR(1) parameter on technology (ρ_A) is derived from Tule, Iklaga and Yusuf (2018) at 0.85. The shock parameters on technology, minimum wage, government spending and interest rate are put at 0.04 to match the model's moment to the moment of actual macroeconomic data series for Nigeria over the annual period 1981 to 2017. The calibrated parameter values are listed in Table 3.

Table 3. Calibrated Values

Symbol	Description	Parameter value
sigma (σ)	Inverse elasticity of substitution	2.00
delta (δ)	Depreciation rate	0.025
phi (φ)	Inverse elasticity of labour supply	4.38
Theta (θ)	Calvo price setting	0.75
(h)	Habit formation	0.70
Tau (τ)	Income tax rate	0.24
Alpha(α)	Share of capital in firm's output	0.37
gama (γ)	Share of skilled labour in output	0.14
Omega (ω)	Share of unskilled labour	0.80
rrho_w(ρ_w)	Autocorrelation parameter on minimum wage	0.94
rrho_πw($\rho_{\pi w}$)	Response of inflation to changes in minimum wage	-0.22
upsilon_π(v_π)	Reaction of inflation to deviations in the interest rate	1.50
upsilon_y(v_y)	Reaction of output to deviations in the interest rate	0.50
rrho_r (ρ_r)	AR(1) parameter on interest rate	0.80
rrho_y (ρ_y)	Response of output to government spending	1.23
rrho_A (ρ_A)	Persistent parameter in Technology	0.85
eps_A	Technology shock	0.1
eps_w	Minimum wage shock	0.1
eps_r	Interest rate shock	0.1
eps_g	Government spending shock	0.1

5. Results: Model Fit and Dynamics

5.1 Model fit

The DSGE model specified in this study was solved by log-linearization that involved a first order approximation of the model's equilibrium conditions as it deviates from the steady state. Table 4 presents the theoretical moments of the DSGE model and the actual moments based on annual time series over the period 1981-2017 for some selected macroeconomic variables. It is necessary for the theoretical moments to closely (although inexactly) match actual moments so that the DSGE model is validated to be a good policy workhorse to replicate the actual economy. The result in table 4 shows that both moments are quite close. The theoretical means are all zeros as expected of a log-linearized model with steady state value of zero. The actual means are seen to be tending towards zero. The second moments are fairly similar.

Table 4. Theoretical versus Actual Moments

Macroeconomic variables	Theoretical Moments		Actual Moments	
	Mean	Standard deviation	Mean	Standard deviation
Output	0.0000	0.19	$6.92*10^{-11}$	0.17
Inflation rate	0.0000	0.43	$-2.97*10^{-9}$	0.62
Interest rate	0.0000	0.65	$5.00*10^{-10}$	0.14
Government spending	0.0000	0.27	$2.52*10^{-9}$	0.41
Total consumption	0.0000	0.07	$-2.52*10^{-10}$	0.21
Total labour	0.0000	0.11	$1.20*10^{-11}$	0.002

Source: Author's computation using Dynare

*The year 1981 is chosen since a minimum wage was first introduced in Nigeria in that year.

*Both moments are obtained by HP-filtering logged variables (lambda value=400 for annual series)

5.2 Model dynamics: Minimum wage shock

From figures 2(a) and (b), a one standard deviation positive shock to minimum wage is seen to increase the wage payments to unskilled workers, which also triggers them to supply more units of labour. In contrast, minimum wage increases do not raise the wages of skilled workers. Rather, the wages of skilled workers fall in response to a surge in the wage floor, yet skilled workers are still willing to supply more labour units. The explanation for the decline in the level of skilled wages in response to a positive shock in minimum wage can be linked to skilled employment. First of all, it is important to note that not every organization is compelled to pay the minimum wage in Nigeria. The national minimum wage act exempts micro and small businesses (organizations with less than 50 employees) from paying the minimum wage; and also organizations engaging employees on a part-time basis. Therefore, a fall in skilled wages could be a result of firms restructuring their employment pattern in favour of contract employment (cheaper skilled labour) in order to manage their labour costs.

Evidence from statistics compiled from the National Bureau of Statistics (NBS) on employment showed that the total number of those on full-time employment dropped from 55.2 million people in 2014Q4 to 51.3 million people in Q32018. On the other hand, part-time employment rose to 18.2 million people from 13.1 million people during the same period. Interestingly, the rise in unskilled wages does not translate to improved welfare as the

consumption of unskilled households falls. This is, however, not surprising because of inflationary pressures. From figure 2(a), it is seen that inflation rose in response to the minimum wage shock. The stylized facts section has been able to show that for a person earning a minimum wage of ₦18000 in 2011, by 2012, the real income of the individual had declined by 20% because of inflationary pressures (table 2). This means that when the inflation rate rises above the increase in the minimum wage, this will lead to a decline in the level of purchasing power.

In the same vein, the consumption of skilled households also fell following the reduction in the income of skilled workers. Aggregate consumption and output invariably trended downwards in response to the positive minimum wage shock This implies that increasing the minimum wage neither serves as a good redistributive policy to improve quality of life for the poor nor does it enhance the growth of the Nigerian economy.
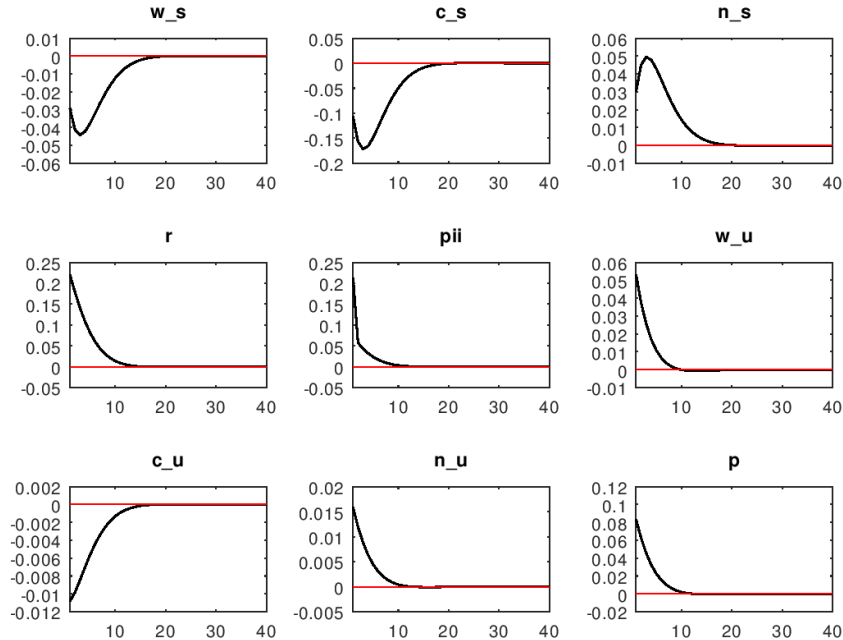

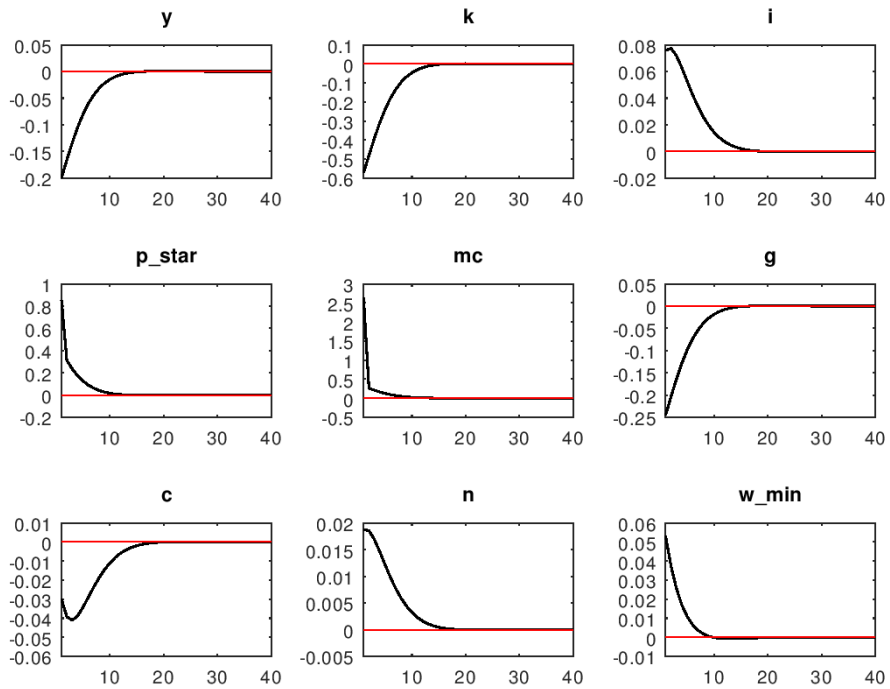**Figure 2(a).** Impulse Response to Minimum Wage Shock.

Figure 2(b). Impulse Response to Minimum Wage Shock.

5.3 Policy experiments

Two types of policy experiments are conducted in this section. The first experiment considers the macroeconomic impact of the magnitude of the four episodes of minimum wage increases while the second considers the shock effect of changes to the minimum wage.

Experiment 1: Magnitude effect of minimum wage increase

The Minimum Wage Act of 1981 stipulated the minimum wage at ₦125. By the year 2000, it was rescaled up to ₦5,500, and in 2011 was further raised to ₦18,000. Presently, a new minimum wage has been ratified at ₦30,000. In this policy experiment, the effect of the different minimum wage values are considered. Each wage value is fed into the model in its natural logarithmic

form. This implies corresponding minimum wage values of 4.83, 8.61, 9.79 and 10.31. Table 5(a) reports the average values of selected macroeconomic variables over the different minimum wage regimes. A key feature is that the average values of these variables have persistently increased in response to successive wage floor regimes. Table 5(b) shows the percentage changes in the mean values relative to the minimum wage introduced in 2019. The result reveals that the impact of the ₦30,000 minimum wage on the Nigerian economy is over 100% greater compared to the impact of the 1981 minimum wage. Furthermore, compared to the economic effect of the wage floor fixed in 2000 and 2011, the 2019 minimum wage will exert only about 19% and 5% better economic outcomes. This implies that the 2019 minimum wage price at ₦30,000, which is over 66.67% higher than the 2011 price of ₦18,000 has only 5% higher benefits on the Nigerian economy relative to the impact of the 2011 minimum wage which can be attributed to the minimum wage not being indexed to inflationary levels in the economy. The difference between the impact of the 2011 and the 2019 minimum wages is quite small stemming from the need to improve the living standards of poor and unskilled Nigerians. This meagre benefit is, moreover, vulnerable to being eroded away in the face of uncertainty and other shocks that have not been accounted for in this study.

Table 5(a). Theoretical Mean at Different Minimum Wage Regimes in Nigeria

Macroeconomic variables	1981 Min_wage = (ln(125))	2000 Min_wage = (ln(5,500))	2011 Min_wage = (ln(18,000))	2019Min_wage = (ln(30,000))
	Mean	Mean	Mean	Mean
Skilled wage	0.9098	1.6218	1.8441	1.9420
Skilled consumption	-6.6048	-11.7738	-13.3874	-14.0985
Skilled labour	2.4998	4.4562	5.0669	5.3360
Inflation rate	-1.3173	-2.3482	-2.6700	-2.8118
Unskilled wage	0.9263	1.6512	1.8775	1.9772
Unskilled consumption	0.4097	0.7303	0.8304	0.8745
Unskilled labour	0.0693	0.1235	0.1405	0.1479
Output	3.4249	6.1053	6.9420	7.3107
Government spending	4.2126	7.5095	8.5387	8.9922
Total consumption	-0.9932	-1.7705	-2.0131	-2.1201

Total labour	0.5554	0.9901	1.1257	1.1855

Source: Author's computation using Dynare

Table 5(b). % Change In Mean Relative to 2019 Minimum Wage

Macroeconomic variables	Min_wage = 4.83 (ln(125))	Min_wage = 8.61 (ln(5,500))	Min_wage = 9.79 (ln(18,000))	Min_wage = 10.31 (ln(30,000))
Skilled wage	113.4535	19.74349	5.308823	100
Skilled consumption	113.4584	19.74469	5.311711	100
Skilled labour	113.4571	19.74328	5.310940	100
unskilled wage	113.4518	19.74278	5.310861	100
unskilled consumption	113.4518	19.74278	5.310861	100
unskilled labour	113.4514	19.74322	5.310253	100
Output	113.4489	19.74531	5.310694	100
Government spending	113.4199	19.75709	5.266904	100
Total consumption	113.4573	19.74350	5.311150	100
Total labour	113.4596	19.74432	5.311113	100

Source: Author's computation using Dynare.

Experiment 2: Shock effect of minimum wage increase

This policy experiment reports the response of Nigeria's macroeconomy to shocks implied by the introduction or change in the minimum wage. The shocks corresponding to the introduction of the Minimum Wage Acts of 1981, 2000, 2011 and 2019 are estimated by regressing the minimum wage on its lagged value and on inflation (as specified in equation 8) using cyclical annual data series from 1980 to 2019. Upon estimation, the residual values for the years 1981, 2000, 2011 and 2019 were computed and used to approximate the size of the various shocks emanating from the introduction or change in the minimum wage since 1981. Table 6 shows that the Nigerian economy was most perturbed by the minimum wage shock of the legislative Act of year 2000. The minimum wage announcement of 2019 is seen to have the least volatile effect on the Nigerian economy. It may be due to the fact that Nigerian households and firms had expected it to be enacted into law in the wake of President Buhari's effort to implement populist policies that would have guaranteed his re-election.

Table 6. Size of Minimum Wage Shock

Year	Shock size
1981	1.22%
2000	2.30%
2011	0.64%
2019	0.13%

Table 7 shows that raising the minimum wage to ₦30,000, that is the 2019 shock, has a negative impact of -0.1 percentage points on skilled wages. This stems from the decision by employers to restructure their employment pattern as previously discussed and supported by data compiled from the NBS. It corroborates with existing theoretical predictions that legislating a wage increase often triggers unemployment as workers are laid off in order for firms to absorb the higher overhead cost (Sabia, 2015). The consumption spending of skilled workers also declines in response to a rise in the minimum wage which could be linked to the view that firms restructure employment in favour of cheaper labour (contract employment), hence causing loss of skilled employment and wages. In contrast, skilled individuals are seen to be willing to supply more labour, thereby creating a situation of excess supply of skilled workers over the demand by employers, which then causes skilled wages to further trend downwards.

Furthermore, inflation rises by 0.8% point in response to an increase in the 2019 minimum wage because prices of goods and services usually trend upwards as the wage floor rises in order for firms to boost their declining profit margin. Wages of low-income workers rise by 0.2% point in response to a positive minimum wage shock but the increased earning fails to translate to a rise in the consumption spending of unskilled households. This indicates that their purchasing power following the minimum wage rise has been eroded by inflation. The aggregate consumption of both skilled and unskilled households dipped, which indicates that the demand for firms' output declines and domestic production stalls. This invariably causes aggregate output to drop by -0.7% point in response to the 2019 minimum wage. From the fiscal

angle, the minimum wage shock impacts negatively on government finance since government is a major employer of labour; the wage rise increases its overhead cost which can pressure government finances. The negative effect of the minimum wage on the Nigerian economy conforms to the result of Siyan, Adegoriola and Adolphus (2016) and Okolo and Attamah (2018).

Table 7. Impulse Response of Macroeconomic Variables to the Different Minimum Wage Shocks (on impact)

Variable	1981 shock	2000 shock	2011 shock	2019 shock
Skilled wage	-0.35	-0.4	-0.25	-0.1
Skilled consumption	-1.25	-1.5	-0.75	-0.4
Skilled labour	0.35	0.5	0.25	0.11
Inflation rate	2.5	3	1.5	0.8
unskilled wage	0.6	0.8	0.4	0.2
unskilled consumption	-0.12	-0.15	-0.08	-0.04
unskilled labour	0.75	0.25	0.125	0.055
Output	-2	-3	-1.5	-0.7
Government spending	-2.5	-3.5	-2	-0.8
Aggregate consumption	-0.35	-0.5	-0.25	-0.11
Total labour	0.2	0.3	0.15	0.07

Source: Author's computation using Dynare.

6. Conclusion

This study examined the macroeconomic effect of the four episodes of minimum wage increase in Nigeria by calibrating a Dynamic Stochastic General Equilibrium model. The DSGE model was initially fitted to the Nigerian economy such that it could replicate the actual macroeconomic statistics of Nigeria. Thereafter, the impulse responses of the economy to an arbitrary minimum wage shock size that fits Nigerian economic features was obtained. The impulse responses graphs showed that the minimum wage shocks impacted negatively on the consumption of both unskilled and skilled households and on aggregate economic output suggesting that the minimum wage policy is not an effective redistributive

or growth-enhancing policy for Nigeria. This negates the result of Folawewo (2007) who found that minimum wage increases affected household income and consumption in a positive manner.

Two policy experiments investigating the magnitude and shock effect of minimum wage increases were conducted. The result of the magnitude experiment revealed that the 2019 minimum wage ~~price~~**[Do we need this word?]** at ₦30,000, which is over 66.67% higher than the 2011 wage price of ₦18,000, has only 5% higher impact on the Nigerian economy relative to the impact of the 2011 minimum wage. This difference is quite small stemming from the need to improve the living standard of poor Nigerians and signals that the ₦30,000 minimum wage price is insufficient. The shock experiment shows that while the Nigerian economy was most perturbed by the minimum wage shock of the legislative Act of year 2000, the minimum wage announcement of 2019 is seen to have the least volatile effect on the Nigerian economy. Furthermore, in line with the model fitted to the Nigerian economy, the 2019 minimum wage shock does not improve household welfare and living standards, neither does it have any positive output effect. Furthermore, it strains government finances.

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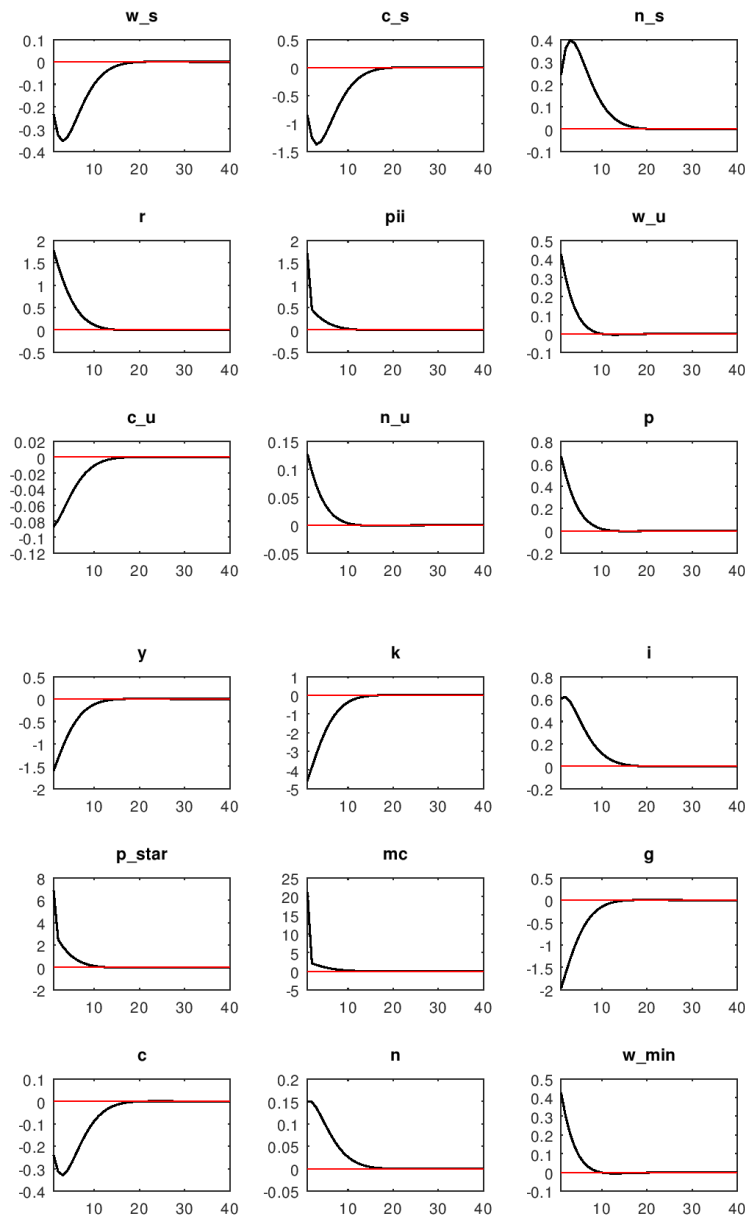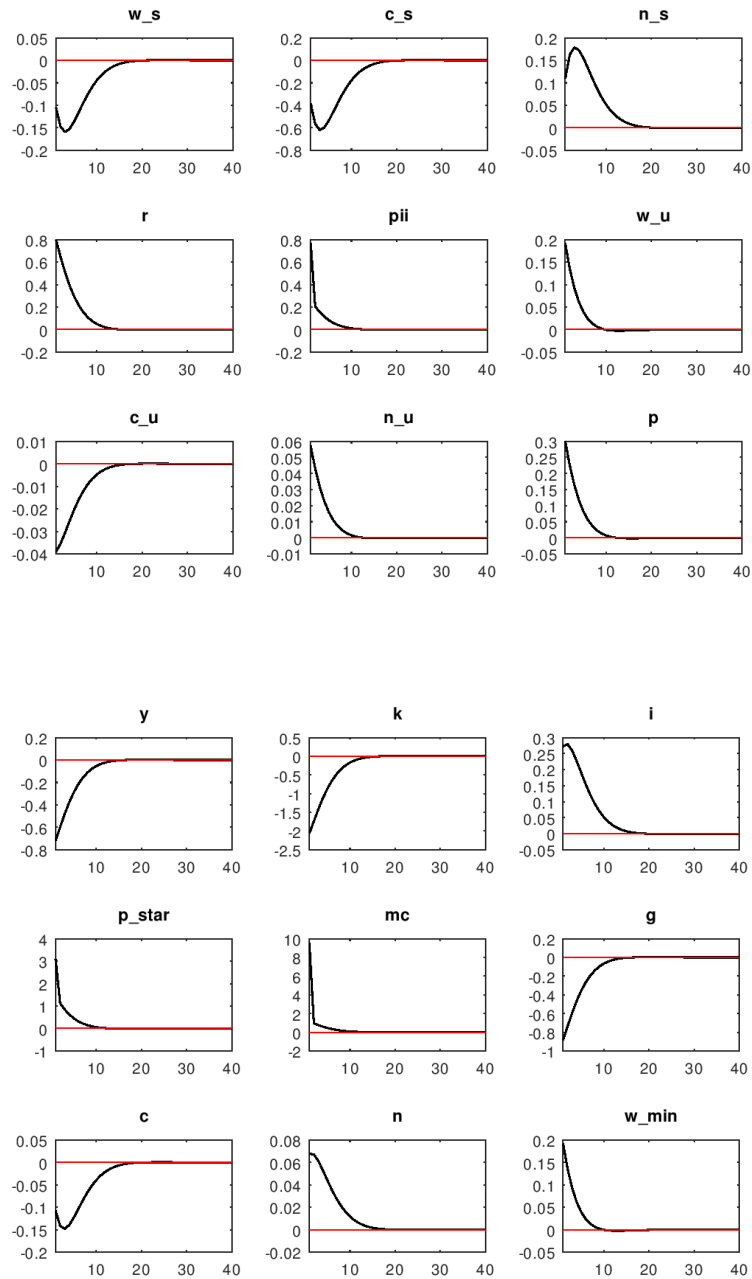
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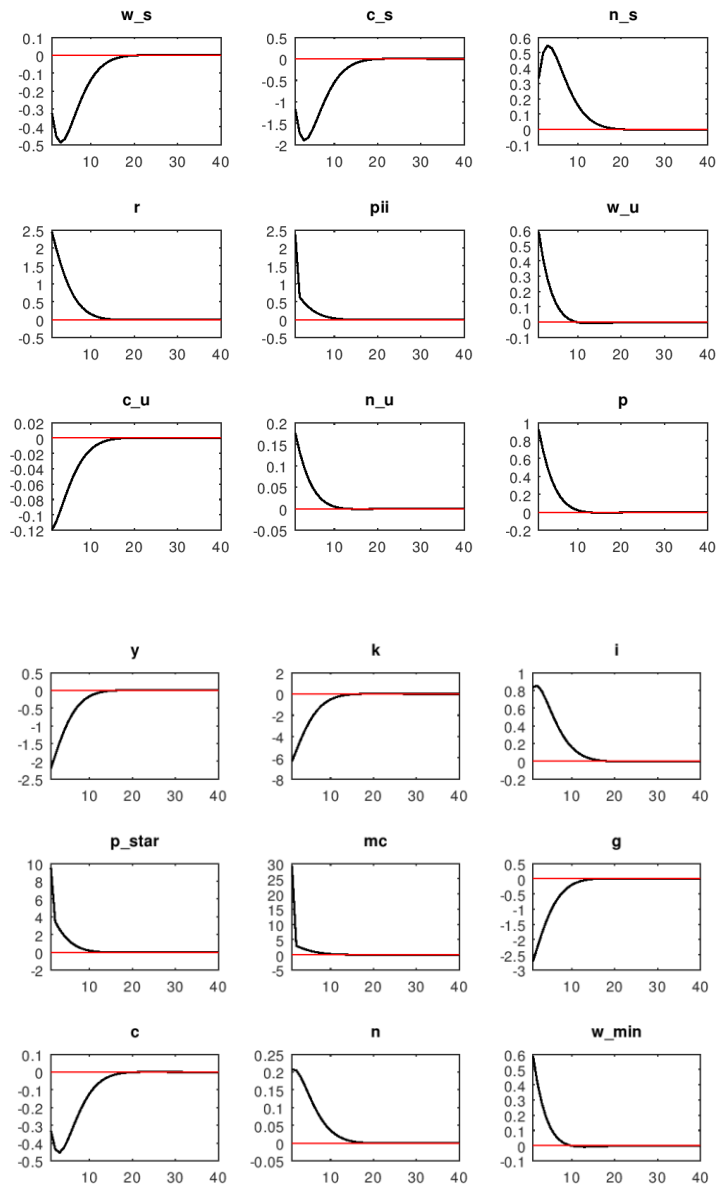
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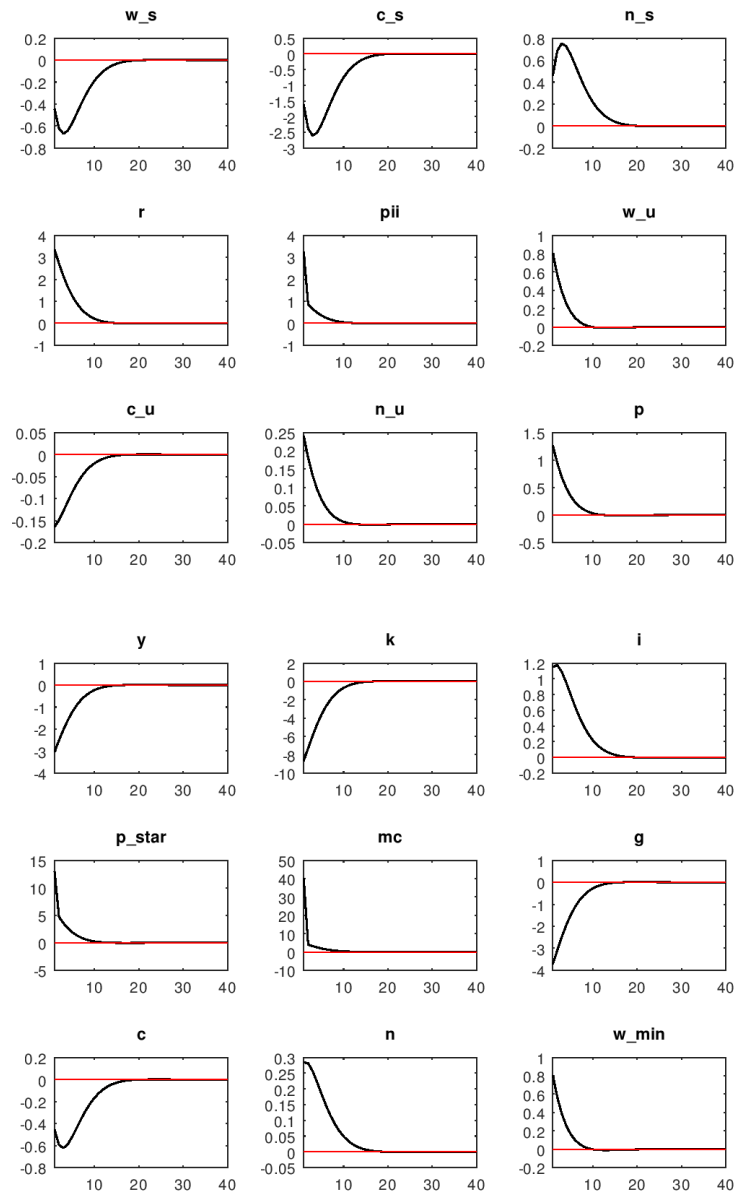
Impulse Response of macroeconomic variables to minimum wage shock in 2000

Impulse Response of macroeconomic variables to minimum wage shocks in 2011

Impulse Response of macroeconomic variables to minimum wage shocks in 2019