

Kame Babilla, Thierry U.

Article

Tax policy reform and universal basic income effectiveness in a currency union: Implications for long-term growth, inequality, and welfare

Journal of Government and Economics (JGE)

Provided in Cooperation with:

Elsevier

Suggested Citation: Kame Babilla, Thierry U. (2023) : Tax policy reform and universal basic income effectiveness in a currency union: Implications for long-term growth, inequality, and welfare, Journal of Government and Economics (JGE), ISSN 2667-3193, Elsevier, Amsterdam, Vol. 10, pp. 1-15, <https://doi.org/10.1016/j.jge.2023.100075>

This Version is available at:

<https://hdl.handle.net/10419/340713>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by-nc-nd/4.0/>



Tax policy reform and universal basic income effectiveness in a currency union: Implications for long-term growth, inequality, and welfare

Thierry U. KAME BABILLA

University of Yaounde II and Euro Area Business Cycle Network, 35185, Bastos, Yaounde, Cameroon

ARTICLE INFO

JEL Codes:

D63
E12
E62
E63
E64
H21
H25
H53
I38
O47

Keywords:

Tax policy reforms
Universal basic income
Long-term growth
Inequality
Welfare
Currency union
DSGE model

ABSTRACT

This paper aims to assess tax policy reforms that can sustain universal basic income programs and foster long-term growth and welfare in a currency union that faces fiscal rule constraints and inequality. To address this ongoing government and economics' debate, we developed a Dynamic Stochastic General Equilibrium Model of universal basic income enriched with three fiscal policy strategies. Results demonstrate that the effectiveness of universal basic income on long-term growth, inequality, and welfare depends on the type of fiscal policy adopted by government to fund it, notably the trade-off between increasing the tax base or reducing public spending. First, under normal circumstances, universal basic income funded by completely eliminating oil subsidies appears to be the best policy for reducing inequality while increasing growth and welfare. Second, when the currency union faces a crisis, a universal basic income funded by increases in different taxes is more effective in combating stagflation and inequality than a universal basic income funded by total oil subsidy elimination. The welfare analysis confirms that, universal basic income funded by the increase in tax on capital gains and the increase in tax on corporate income is successful in reducing income inequality and consumption inequality and improving households' living standards, its effects lead to higher welfare gains when the economy faces a crisis rather than the economy in normal times.

1. Introduction

Rising inequality in advanced countries and poverty deepening in Africa have raised a huge government and economics' debate around policy incentives to boost development outcomes and welfare. The growing attention is reliant on understanding how to reform tax policy so as to sustain universal basic income programs while attaining redistributive objectives (Mankiw 2000; Mertens and Ravalion 2013; Atkinson 2015; Jones and Klenow 2016; Wagstaff et al. 2016; Gaspar et al. 2017; Banerjee et al. 2019; Magnania and Piccoli 2020; Suzuki 2021; Stiglitz 2021; Phelps 2022; Camacho et al. 2023).

Basically, proponents of a universal basic income program advocate four fundamental development principles. First, they argue that universal basic income will offset the absence of unemployment benefits in developing countries and allow the long-term unemployed to finance their re-skilling and become competitive in the labor market. Second, they emphasize that universal basic income would provide permanent

income to households, particularly female-headed households, allowing them to fund their children's education and expand their health coverage. Investment in health and education will reduce market income inequality, address the persistence of poverty and promote inclusive growth over the medium term. Third, they emphasize that universal basic income will eradicate consumption inequality between low-income households and higher-income households by phasing-out oil subsidy programs. Fourth, they argue that universal basic income will trigger the catch-up of rich countries by poor countries within the currency union by addressing the income decline generated by the commodities price crisis and enhancing domestic demand via the reduction of disposal income inequality (Paine 1797; Friedman 1968; Edge et al. 2007; Rothstein 2010; Atkinson 2015; Hanna and Olken 2018; Holter et al. 2019; Kearney and Mogstad, 2019; Boar and Midrigan 2020; Asta et al. 2021; Anagnostopoulos et al. 2022).

By contrast, opponents of the universal basic income program challenge those four development principles. First, they stress that universal

E-mail address: thierrykamebilla@yahoo.fr.

<https://doi.org/10.1016/j.jge.2023.100075>

Received 25 February 2023; Received in revised form 4 June 2023; Accepted 6 June 2023

Available online 9 June 2023

2667-3193/© 2023 The Author(s). Published by Elsevier B.V. on behalf of The Academic Center for Chinese Economic Practice and Thinking, Tsinghua University and the Society for the Analysis of Government and Economics. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

basic income would act as an instrument to discourage labor force participation by adding more frictions to the labor market. Second, they explained that rich households tend to save their additional revenue, while universal basic income will not be sufficient enough to cover education and health spending for poor households. Third, they point out that, by substituting oil subsidies against universal basic income, the public budget would become unsustainable, and universal basic income would enlarge the infrastructure gap existing in developing countries. Fourth, they underscore that universal basic income could not supplement the revenue gap of poor countries within the currency union, equivalently as it could not supplement the revenue loss of oil-countries due to the collapse of oil prices (Furlanetto, 2011; Dollar et al. 2015; Lopez-Daneri 2016; Lakner and Millanovic 2016; Gaspar et al. 2017; Jones and Marinescu, 2018; Gentilini et al. 2019; Garibaldi et al. 2021; Stark 2021; Kempkes and Stahler 2022).

Specifically, in the Central African Economic and Monetary Community (CEMAC), redistribution and inclusiveness are issues of greater concern since five of the six members countries are oil exporters, while concomitantly all six members are classified as developing countries.¹ Policymakers attempted to overcome this paradox through two policy incentives, such as oil subsidy programs and tax breaks for certain key sectors of the economy. Concerning the first policy incentive, on the one hand, CEMAC uses underpricing and explicit subsidies tools to reduce oil prices for households. On the other hand, member governments within CEMAC make direct transfers to refineries and power companies in order to compensate for underpricing. Nevertheless, this policy incentive didn't yield the expected development outcomes of reducing inequality and enhancing living standards as reported by empirical evidence (Davies and James 2008; Aizer et al. 2016; Krueger et al. 2017; Ravallion, 2018; Ghatak and Maniquet 2019; Guner et al. 2019; Chang et al. 2019; Bordo and Duca 2021; Luduvic, 2019; Karras and Yang 2022). In fact, over the last half century, CEMAC has faced dire development challenges. The deterioration of GDP per capita during those years in CEMAC could sustain this observation. These 50 years can be divided into four sub-periods: (i) From Bretton Woods to the debt crisis in Sub-Saharan Africa (1974–1984). (ii) The debt crisis until the devaluation of the CFA Franc (1985–1994). (iii) The CFA Franc's devaluation until the global financial crisis (1995–2008). (iv) The Great Recession (from 2009 to 2018).

Table 1 compares growth rates of real per capita GDP in different regions, for each of these periods. The top panel of Table 1 shows these statistics for CEMAC. The middle panel of Table 1 shows these statistics for Sub-Saharan Africa. The bottom panel of Table 1 shows these statistics for developing countries.

As reported in Table 1, in average, the growth rate of real GDP per capita in CEMAC is lower than the average of Sub-Saharan African countries and other developing countries.² Specifically, during the Great Recession (2009–2018), CEMAC had the lowest growth rate of real GDP per capita, averaging 0.15 percent, compared to 1.73 percent in Sub-Saharan Africa and 3.39 percent in other developing countries, with annual growth ranging from -2.9 percent to 3.1 percent. The resulting fall in per capita GDP triggers large-scale poverty and disappointing development indicators. Hence, CEMAC was poorer than other developing countries, which performed better in terms of the growth rate of

¹ The Central African Economic and Monetary Community, or CEMAC, is a monetary union of six developing countries such as Cameroon, the Central African Republic, Chad, the Congo Republic, Equatorial Guinea, and Gabon, which share a common currency, the CFA Franc, officially pegged to the euro at a fixed rate of CFAF 655.947 per euro and issued by the Central Bank of the Central African States, or BEAC.

² The group of developing countries in this paper comprises all economies around the world that are not classified as advanced economies or emergent market economies by the International Monetary Fund's World Economic Outlook Classification.

Table 1

Real Per Capita GDP Growth in CEMAC, Sub-Saharan Africa and Developing Countries (percent).

	Mean	Standard deviation	Minimum	Maximum
CEMAC				
1974–1984	0.8	0.84	-0.3	0.9
1985–1994	-0.4	0.2	-1.8	-0.3
1995–2008	1.82	1.12	0.8	3.4
2009–2018	0.15	1.83	-2.9	3.1
Sub-Saharan Africa				
1974–1984	-0.6	1.74	-1.2	3.34
1985–1994	-0.33	1.08	-1.7	1.1
1995–2008	3.3	2.68	0.4	7.4
2009–2018	1.73	1.49	-0.9	4.5
Developing Countries				
1974–1984	1.9	1.007	1.4	4.43
1985–1994	2.71	0.65	1.7	3.5
1995–2008	2.6	1.36	0.8	4.5
2009–2018	3.39	1.01	1.7	5.3

*Source: Author computations from the World Bank Development Indicators and the International Monetary Fund (IMF) World Economic Outlook databases.

real GDP per capita.

Concerning the second policy incentive, tax exemptions remain a great reality within the currency union due to growth challenges. The main implication of a squeezed tax base is the modesty of government revenue. Table 2 displays the basic statistics for government revenue for each of the four periods, in CEMAC, Sub-Saharan Africa, and developing countries. During the great recession period (2009–2018), government revenue in the CEMAC was lower than in other developing countries, averaging 22%. This is compared to 22.36% in other developing countries, with the annual rate ranging from 18.3% to 26.4%. Importantly, government revenue in the CEMAC region was highly volatile, with a standard deviation of 3.34%. By contrast, government revenue was stable in Sub-Saharan African countries and developing countries as a whole, with the standard deviation of government revenue decreasing from 6.93% to 2.41%, and from 2.48% to 1.75%, respectively. This lower government revenue in CEMAC could explain the large infrastructure gap within the zone. Lack of adequate infrastructure and social needs remains a key bottleneck to CEMAC households' living standards. Those economies need to raise both the quality and quantity of public investment to succeed in lowering the infrastructure gap. The good news is that, by pursuing this goal within the zone, various infrastructure programs are undergoing, with a tapping point of 2035, to move as emerging economies. Nonetheless, the goal of closing the infrastructure gap by providing limited government revenue has exposed the currency union to a large fiscal deficit.

Table 2

Government Revenue in CEMAC, Sub-Saharan Africa and Developing Countries (percent of GDP).

	Mean	Standard deviation	Minimum	Maximum
CEMAC				
1974–1984	12.07	2.11	11.5	15.2
1985–1994	14.7	1.47	-12.37	17.4
1995–2008	23.12	1.53	21.5	25.2
2009–2018	22.03	3.34	18.3	26.4
Sub-Saharan Africa				
1974–1984	10	5.87	3	21
1985–1994	13.6	8.2	-13.1	16.4
1995–2008	18.25	6.93	5.9	23.2
2009–2018	19.36	2.41	16.2	23.2
Developing Countries				
1974–1984	10.5	4.55	19.8	21.33
1985–1994	13.8	9.42	-8.2	23.9
1995–2008	14.31	2.48	10.5	16.7
2009–2018	22.36	1.75	17.5	23.4

*Source: Author computations from the World Bank Development Indicators and the International Monetary Fund (IMF) World Economic Outlook databases.

To ensure that national policies are consistent with the smooth functioning of the CEMAC economic and currency union on the one hand, and to prevent the occurrence of excessive deficits, whose financing would be incompatible with the maintenance of an adequate level of international reserves, member states of CEMAC are subject to an explicit balanced budget rule for general government, limiting the fiscal deficit to -1.5% of GDP on the reference fiscal balance.³ Table 3 shows the basic statistics for the overall fiscal balance of each of the four periods, in CEMAC, Sub-Saharan Africa, and developing countries. We observe that, during the great recession period (2009–2018), the fiscal balance in CEMAC was lower than the average of Sub-Saharan African countries and developing countries, at -2.54%, compared to -4.16% and -2.82%. At the same time, fiscal balance exceeded the statutory requirement of the fiscal rule of the CEMAC, with an average of -2.54%, far above the floor of -1.5% for regional convergence within the CEMAC. The results indicate that government revenue has not been sufficient to prevent a sharp deterioration in public accounts over the last decade. This is explained by the fact that most member countries do not always comply with the fiscal rule and violate it most often.

This higher fiscal deficit raises concerns about the affordability of universal basic income programs and the risk of crowding out other high priority government spending necessary for inclusiveness. Therefore, the means by which universal basic income can mitigate redistributive problems so as to boost development outcomes within the CEMAC is relevant. This paper aims to assess whether universal basic income as a policy incentive could be effective in supplementing the social safety net so as to foster economic development and reduce poverty in a currency union where all the member countries are developing countries without compromising the fiscal rule of the currency union.

We develop a small open economy dynamic stochastic general equilibrium model of universal basic income to address this ongoing government and economics' debate. First, our model introduces three strategies for financing the universal basic income program that cover all the citizens of the currency union. The first strategy of the policy incentive is the increase in tax on realised capital gains by economic agents. The second strategy of the policy incentive is the increase of corporate income tax. The third strategy of the policy incentive is the

Table 3
Overall Fiscal Balance in CEMAC, Sub-Saharan Africa and Developing Countries (percent of GDP).

	Mean	Standard deviation	Minimum	Maximum
CEMAC				
1974–1984	1.29	2.6	-0.45	3.2
1985–1994	-1.53	1.88	-3.4	4.6
1995–2008	2.82	3.48	-0.9	7
2009–2018	-2.54	2.57	-5.9	2.2
Sub-Saharan Africa				
1974–1984	-4.5	1.4	-5.93	-1.67
1985–1994	-5.36	1.31	-8	-3.4
1995–2008	-2.63	1.73	-4.3	0.4
2009–2018	-4.16	1.14	-5.5	-2
Developing Countries				
1974–1984	-2.78	1.35	-4.26	-0.8
1985–1994	-4.41	1.50	-6.2	-2.2
1995–2008	-1.11	1.98	-2.7	1.7
2009–2018	-2.82	0.59	-3.9	-1.9

*Source: Author computations from the World Bank Development Indicators and the International Monetary Fund (IMF) World Economic Outlook databases.

³ The reference fiscal balance is defined as the overall fiscal balance minus 20% of oil revenue and 80% of the difference between oil revenue and their average relative to GDP over the previous years. This new criterion became effective with the 2017 budget. It addresses the weaknesses of the former fiscal balance rule adopted in 1996.

elimination of oil subsidies. Second, we model three sectors, and we interpret the first as being the oil producing sector; the second as the domestic tradable goods sector; and the third as the imported tradable goods sector. Third, the model captures the fiscal rules that all members have to comply with for the stability of the currency union.

This research makes contributions to three strands of literature. First, the research would advance the literature regarding the long-term growth effects of fiscal policy efficiency within a currency union. Second, not yet studied, is the fact that tax reform can trigger a universal basic income initiative in less developed countries that face both inequality constraints and fiscal rule constraints. Our research focuses on Africa's currency union as a case study. Third, not yet studied, is the fact that a different type of safety net program than oil subsidies could be used to alleviate inequality while enhancing long-term growth and welfare in an oil-dependent currency union. Our analysis highlights a three-pronged approach to fiscal policy strategies that fund universal basic income as a topical policy in fostering income distribution, long-term growth, and welfare.

The remainder is as follows: The DSGE model is set-up in Section 2. Section 3 examines the calibration procedure. Sections 4–6 present counterfactual analysis. Section 7 performs the welfare analysis of universal basic income. Finally, Section 8 presents the conclusion and recommendations.

2. The DSGE model of universal basic income program and tax policy reform

This section develops a small open economy Dynamic Stochastic General Equilibrium Model to assess tax policy reform and the effectiveness of universal basic income in an African's currency union (Smets and Wouters 2007; Gali et al. 2007; Cogan et al., 2010; Romer and Romer 2010; Coenen et al. 2012; Kaplan, 2012; Christiano et al. 2014; Del Negro et al. 2015; Heathcote et al. 2017; ;Appelbaum, 2021.

The salient features of the model are as follows. First, to feature the policy incentive to reduce inequality, we feature the universal basic income as a cash transfer of an equal amount provided by member governments to all the households within the currency union. Second, to justify the necessity of universal basic income for long term growth and welfare, we introduce three type of strategies to finance universal basic income program. The first strategy of universal basic income is an increase in capital gains tax. The second strategy of universal basic income is an increase in corporate income taxes. The third strategy of universal basic income is the elimination of oil subsidies which was provided by member government to households to lower their oil consumption fees. Third, we model three sectors, and we interpret the first as being oil producing sector, the second as domestic tradable goods sector, and the third as imported tradable goods sector. Oil corporations exploit natural resources endowment using physical capital and labor to produce crude oil. Oil produced within CEMAC is exported abroad and sold domestically. Domestic tradable goods corporations use labor, oil and capital, to produce varieties of export-oriented type tradable goods, who are sold to domestic retailers. The retailers differentiate the domestic tradable goods before exporting part in the foreign market, and retailing the remainder in the domestic market, by taking into account the nominal price rigidity. Subsidiaries of foreign multinational exclusively import from abroad imported tradable goods and sell them to domestic retailers. The retailers repackage the imported manufactured goods, and then retail them in the domestic market by taking in account the nominal price rigidity. Fourth, we feature the presence of nominal wage rigidities in the labor market, that make the substitution of labor from one sector to another imperfect. So, households have the choice to supply labor hours whether to the oil sector or to the non-oil sector. Fifth, we capture the feature that the common central bank should comply to nominal convergence objective. Sixth, we model the statutory fiscal rule that every government member should comply in other to prevent the occurrence of excessive deficits, whose financing would be incompatible

with the maintenance of an adequate level of international reserves for the currency union.

We conducted three scenarios. The first scenario is the first tax strategy universal basic income, which assumes that, government funds universal basic income program by increasing capital gain tax. The second scenario is the second tax strategy universal basic income, which suggests that, government funds universal basic income program by increasing corporate income tax. The last scenario is the third fiscal policy universal basic income program, which indicates that government funds universal basic income program by totally eliminating oil subsidies.⁴

2.1. Households and universal basic income benefits

All the households within the currency union are involved in the universal basic income program, and benefit the same amount of cash transfer funded by three strategies as given:

$$UBI_t = UBI_t^{TK} + UBI_t^{TI} + UBI_t^O, \quad (1)$$

The representative households derive utility from consumption C_t and leisure $1 - N_t$, by maximising an inter-temporal utility function given by:

$$\max_{U_0} E_0 \sum_{t=0}^{\infty} \beta^t u \left(\log(C_t - hC_{t-1}) - \frac{N_t^{1+\eta}}{(1+\eta)} + \frac{UBI_t^{1-\psi}}{1-\psi} \right), \quad (2)$$

Here $0 < \beta < 1$ stands for the subjective discount factor. N_t represents the household's labor effort. E_0 is the conditional expectations operator. hC_{t-1} denotes an external habit which is assumed to be proportional to aggregate past consumption. η is the intertemporal elasticity of labor. ψ is the parameter governing universal basic income. The CEMAC's oil dominance feature affects the household labor effort supply decision. Household has the privilege to supply labor effort either in the non-oil sector or in the oil sector. Total labor effort is thus expressed, by Constant Elasticity of Substitution (CES) aggregator of hours worked in the two sectors as follow:

$$N_t = \left[(1 - \theta_n)^{1/\kappa_n} (N_{g,t})^{\kappa_n - 1/\kappa_n} + \theta_n^{1/\kappa_n} (N_{o,t})^{\kappa_n - 1/\kappa_n} \right]^{\kappa_n / (\kappa_n - 1)}, \quad (3)$$

Here θ stands for the steady-state share of the work done in oil sector, κ_n denotes the elasticity of substitution between the two kind of labor supply, $N_{g,t}$ represents hours worked in the non-oil sector while $N_{o,t}$ is the hours worked in the oil sector.

At times t , households purchase assets denominated in foreign currency B_t^* which pay one unit of foreign currency at the end of period with a foreign gross nominal interest rate R_t^* . Likely, they also purchase at times t government bonds denominated in domestic currency B_t , which pay one unit of domestic currency at the end of period with a domestic nominal gross interest rate R_t .

The representative household is subject to an intertemporal budget constraint:

$$\begin{aligned} P_t C_t + \frac{B_t}{1 + R_t} + \frac{Z_t B_t^*}{(1 + R_t^*) \Psi} + P_t I_{g,t} + P_t I_{o,t} + UBI_t \\ = \left(1 - \tau_g^L \right) W_{g,t} N_{g,t} + \left(1 - \tau_o^L \right) W_{o,t} N_{o,t} + B_{t-1} + Z_t B_{t-1}^* + q_{g,t} K_{g,t} + q_{o,t} K_{o,t} \\ + UBI_t^{TK} + UBI_t^{TI} + UBI_t^O, \end{aligned} \quad (4)$$

Here P_t represents the aggregate price index, $I_{g,t}$ and $I_{o,t}$, are investments in the non-oil sector and in the oil sector respectively. $W_{g,t}$ and $W_{o,t}$ are nominal wage rates in the non-oil sector and in oil sector respectively. τ_g^L and τ_o^L are the tax rates on labor income from both the non-oil sector and oil sector respectively. $q_{g,t}$ and $q_{o,t}$, are the real rental rates of capital in the non-oil sector and in the oil sector respectively. $K_{g,t}$ and $K_{o,t}$ are the accumulated stocks of capital in non-oil sector and in the oil sector respectively. Z_t represents the nominal exchange rate. UBI_t denotes the use by households of cash transfers received under the universal basic income program. UBI_t^{TK} , UBI_t^{TI} and UBI_t^O are respectively universal basic income funded by tax on realized capital gains, universal basic income funded by tax on corporate income, and universal basic income funded by totally phasing-out oil subsidies.

Since CEMAC is linked to international market via foreign assets hold by its citizens, we feature risk premium which is modelled as an increase with the ratio of foreign assets to the value of domestic output (Ambler et al., 2004):

$$\log(\Psi_t) = \kappa \left(\exp \left(\frac{Z_t B_t^*}{Y_t} \right) - 1 \right), \quad (5)$$

2.2. Productive sector and universal basic income strategies

2.2.1. The final goods sector and the tax on realized capital gain

Corporations in the productive sector finance part of universal basic income program in the form of tax rate on realized capital gain τ^G . The law of motion of the stocks of installed capital in the non-oil sector and in the oil sector are respectively expressed as:

$$K_{g,t+1} = K_{g,t} (1 - \delta_g) + I_{g,t} - \left(\frac{\Psi_g}{2} \right) \tau^G \left(\left(\frac{K_{g,t+1}}{K_{g,t}} \right) - 1 \right)^2 \bar{K}_{g,t}, \quad (6)$$

and

$$K_{o,t+1} = K_{o,t} (1 - \delta_o) + I_{o,t} - \left(\frac{\Psi_o}{2} \right) \tau^G \left(\left(\frac{K_{o,t+1}}{K_{o,t}} \right) - 1 \right)^2 \bar{K}_{o,t}, \quad (7)$$

In each of both sectors, $K_{g,t}$ and $K_{o,t}$ stand for the aggregate stock of capital. δ_g and δ_o represent the constant depreciation rates of capital. Ψ_g and Ψ_o are adjustment cost parameters, of non-oil sector and oil sector. τ^G represents tax rate on corporations realized capital gain.

The final good Y_t is the CES aggregation of a basket of domestic intermediate tradable goods and a basket of imported intermediate tradable goods, $Y_{T,t}$, and a basket of intermediate non-tradable goods $Y_{NT,t}^d$, expressed as follow:

$$Y_t = \left[(1 - \theta_y)^{1/\tau_y} (Y_{T,t})^{\tau_y - 1/\tau_y} + \theta_y^{1/\tau_y} (Y_{NT,t}^d)^{\tau_y - 1/\tau_y} \right]^{\tau_y / (\tau_y - 1)}, \quad (8)$$

Here θ_y represents the share in the final good production, of intermediate non-tradable goods, and τ_y is the elasticity of substitution between intermediate non-tradable goods and intermediate tradable goods in the final domestic good.

This final domestic good is used for consumption, C_t , investment in the oil sector $I_{o,t}$, and investment in the non-oil sector, $I_{g,t}$, defined as:

$$Y_t = C_t + I_{g,t} + I_{o,t}, \quad (9)$$

The final domestic good producers evolve in a perfectly competitive environment by maximising their profit as given:

⁴ In fact, consistent with the feature of oil subsidies policy within the BEAC issuing zone, throughout the model oil subsidies policy is reflected by levying lower taxes than requested on households and corporates. The difference between effective tax rates and optimal tax rates represents subsidies in oil prices. The oil subsidy elimination is partial when it concerns the first or second policy. By contrast, total phasing out of oil subsidies concerns the combination of the tax on household income, the tax on corporate income, and the tax on capital gains.

$$\max_{Y_{T,t}, Y_{NT,t}} P_t Y_t - P_{T,t} Y_{T,t} - P_{NT,t} Y_{NT,t}, \quad (10)$$

Subject to the demand of the final goods (9).

The first order conditions of this optimisation problem lead to the two demands for the intermediate tradable goods and the intermediate non-tradable goods:

$$Y_{T,t} = (1 - \theta_y) \left(\frac{P_{T,t}}{P_t} \right)^{-\tau_y} Y_t, \quad (11)$$

$$Y_{NT,t}^d = \theta_y \left(\frac{P_{NT,t}}{P_t} \right)^{-\tau_y} Y_t, \quad (12)$$

Using these two first order conditions and the production function, the no profit condition yields to:

$$P_t = \left[(1 - \theta_y) (P_{T,t})^{1-\tau_y} + \theta_y (P_{NT,t})^{1-\tau_y} \right]^{1/\tau_y}, \quad (13)$$

2.2.2. Domestic tradable goods sector and the tax on capital income

Under monopolistic competition within the currency union, corporations that operate in the sector support universal basic income program via a tax rate on capital income τ^K . Hence a basket of domestic tradable intermediate goods is produced by combining capital, labor and oil inputs and taking in account tax on capital income, as follows:

$$Y_{T,t}^d(i) = A_t A_{T,t} \left[\left(\tau^K K_{g,t}^{1-\frac{1}{\alpha_g}}(i) \right)^{\alpha_g} \left(Y_{o,t}^{\frac{1}{\alpha_g}}(i) \right)^{\alpha_g} \left(\frac{X_1}{X_o} \right)^{\frac{1}{\alpha_g}} \right] N_{g,t}^{1-\alpha_g}(i), \quad (14)$$

Here $Y_{o,t}^{\frac{1}{\alpha_g}}(i)$ is the oil used in the production of domestic tradable intermediate goods by a corporation (i). $(1 - \alpha_g)$ is the share of labor used in production. α_g represents the share of the combined capital and oil inputs. Out of this combined share, $\frac{1}{\alpha_g}$ denotes oil's share and $1 - \frac{1}{\alpha_g}$ stands for the capital share. τ^K represents corporations' tax on capital income. A_t is an aggregate technology shock, which affects the non-oil sector and the oil sector. Finally, $A_{T,t}$ is the non-oil sector technology shock. Each corporation that operate in the non-oil sector minimizes its costs by choosing, labor $N_{g,t}(i)$, capital $K_{g,t}(i)$ and utilized oil $Y_{o,t}(i)$, as given:

$$\min_{N_{g,t}(i), K_{g,t}(i), Y_{o,t}(i)} \left[\frac{(W_{g,t} N_{g,t}(i) + \tau^K q_{g,t} K_{g,t}(i) + P_{o,t} Y_{o,t}(i))}{P_t} \right], \quad (15)$$

Subject to aforementioned varieties of domestic tradable intermediate goods demand (14).

The first order condition of this minimization problem is given by:

$$\frac{W_{g,t}}{P_t} = (1 - \alpha_g) mc_{g,t} \frac{Y_{T,t}(i)}{N_{g,t}(i)}, \quad (16)$$

$$q_{g,t} = \left(1 - \frac{1}{\alpha_g} \right) \alpha_g mc_{g,t} \frac{Y_{T,t}(i)}{K_{g,t}(i)}, \quad (17)$$

$$\frac{P_{T,t}}{P_t} = mc_{g,t} \frac{\alpha_g}{\alpha_g} \frac{Y_{T,t}(i)}{N_{g,t}(i)}, \quad (18)$$

Here $mc_{g,t}$ is the Lagrangian multiplier and can be interpreted as the marginal cost of production, $mc_{g,t} Y_{g,t}(i)$ represents the total costs. Engaged in monopolistic competition, non-oil sector goods varieties producer (i) maximizes profits, Ξ_{t+s} , by choosing the price of variety, $P_{g,t}(i)$, as follow:

$$\max_{P_{T,t}(i)} E_t \left[\sum_{s=0}^{\infty} \beta^s \left(\frac{\lambda_{t+s}}{\lambda_t} \right) \left(\frac{\Xi_{t+s}(i)}{P_{T,t+s}} \right) \right], \quad (19)$$

Following Rotemberg (1982) price setting, the real dividends are given by:

$$\frac{\Xi_{t+s}}{P_t} = \left(P_{T,t+s}(i) \frac{P_{T,t+s}(i)}{P_t} - mc_{g,t} Y_{T,t}(i) - \Omega_{P_{T,t}(i)}(P_{T,t}(i), P_{T,t-1}(i)) \right), \quad (20)$$

Where $\Omega_{P_{T,t}(i)}$ represents a quadratic cost of changing its price, expressed as:⁵

$$\Omega_{P_{T,t}(i)}(P_{T,t}(i), P_{T,t-s}(i)) = \left(\frac{\psi_{P_{T,t}}}{2} \right) \tau^K \left(\left(\frac{P_{T,t}(i)}{P_{T,t-1}(i)} \right) \pi_T \right) - 1 \Big)^2 Y_{T,t}, \quad (21)$$

Here π_t stands for the steady-state inflation in the non-oil sector goods varieties market.

Given the first order condition for the price decision, the demand for non-oil sector goods varieties and the assumption that every producer (i) will decide of the same price $P_{T,t}$, so $P_{T,t}(i) = P_{T,t}$ and we obtain that:

$$P_{T,t} = \frac{P_t}{1 - \omega} E_t \left\{ -\beta \psi_{P_{T,t}} \tau^K \frac{\lambda_{t+1}}{\lambda_t} \left(\frac{\pi_{T,t+1}^2}{\pi_T^2} - \frac{\pi_{T,t+1}}{\pi_T} \right) \frac{Y_{T,t+1}}{Y_{T,t}} + \psi_{P_{T,t}} \frac{\lambda_{t+1}}{\lambda_t} \left(\frac{\pi_{T,t}^2}{\pi_T^2} - \frac{\pi_{T,t}}{\pi_T} \right) - \omega mc_{g,t} \right\}. \quad (22)$$

Retailers aggregate different non-oil sector goods varieties $Y_{T,t}(i)$ produced domestically into wholesale non-oil goods $Y_{T,t}$ and sell them domestically and in the foreign economy. The representative retailer maximizes thus its non-oil goods yields choosing the optimal quantity of each non-oil goods varieties (i) as follow:

$$\max_{Y_{T,t}(i)} P_{T,t} Y_{T,t} - \int_0^1 P_{T,t}(i) Y_{T,t}(i) di, \quad (23)$$

Subject to the demand of wholesale non-oil goods

$$Y_{T,t} = \left(\int_0^1 Y_{T,t}^{\frac{\omega-1}{\omega}}(i) di \right)^{\frac{\omega}{\omega-1}}, \quad (24)$$

Here ω denotes the elasticity of substitution between different varieties of non-oil goods. The first-order conditions of this optimization problem lead to the demand of non-oil goods varieties as follow:

$$Y_{T,t}(i) = \left(\frac{P_{T,t}(i)}{P_{T,t}} \right)^{-\omega} Y_{T,t}, \quad (25)$$

Here $P_{T,t}$ stands for price of the wholesale non-oil goods. $P_{T,t}(i)$ is the price of a non-oil goods variety (i).

Retailers supply part of wholesale non-oil goods in the domestic market and export another part in the foreign market as follow:

$$Y_{T,t} = Y_{T,t}^d + Y_{T,t}^f, \quad (26)$$

Here $Y_{T,t}^d$ stands for domestically sold domestic tradable good. $Y_{T,t}^f$ represents exported domestic tradable goods.

Hence the foreign demand for the BEAC issuing zone wholesale non-oil sector domestic tradable good is given by:

$$Y_{T,t}^f = \alpha_f \left(\frac{P_{T,t}}{Z_t P_t^*} \right)^{-\omega^*} Y_t^*, \quad (27)$$

Here α_f denotes the share of import in the foreign economy. ω^* is the price elasticity for exports of wholesale domestic tradable goods.

The price index of the wholesale domestic tradable goods is defined as:

⁵ Note that the cost of changing price equal zero when retailers decides to change prices at the same rate as average inflation in the sector.

$$P_{T,t} = \left(\int_0^1 P_{T,t}^{1-\omega}(i) di \right)^{\frac{1}{1-\omega}}, \quad (28)$$

2.2.3. Imported tradable goods sector

Manufactured goods are exclusively produced in foreign countries. Subsidiaries of foreign multinational evolve in monopolistic market within the monetary union. They core role is to import manufactured good $Y_{f,t}^*$ at price P_t^* , which is $Z_t P_t^*$ in term of domestic currency, so as to supply differentiated imported tradable goods $Y_{f,t}(j)$ in the domestic economy.

Subsidiaries of foreign multinational minimize their cost of import as follows:

$$\min \left[\frac{(Z_t P_t^* Y_{f,t}^*)}{P_t} \right], \quad (29)$$

subject to the assumption that

$$Y_{T,t}^f = Y_{f,t}^*, \quad (30)$$

The first order condition of this minimization problem gives us:

$$\frac{Z_t P_t^*}{P_t} = mc_{f,t}, \quad (31)$$

Where $mc_{f,t}$ represents the marginal cost of importers.

Subsidiaries of foreign multinational are engaged in commercial activities with retailers and also maximize profits $\Xi_{f,t+s}(j)$ by choosing the price of their variety $P_{f,t}(j)$ as follow:

$$\max_{P_{f,t}(j)} E_t \left[\sum_{s=0}^{\infty} \beta^s \left(\frac{\lambda_{t+s}}{\lambda_t} \right) \left(\frac{\Xi_{f,t+s}(j)}{P_T} \right) \right], \quad (32)$$

The real profit is thus given by:

$$\frac{\Xi_{f,t+s}}{P_t} = \left(P_{f,t+s}(j) \frac{P_{f,t+s}(j)}{P_t} - mc_{f,t} Y_{f,t}(j) - \Omega_{P_{f,t}}(j) (P_{f,t}(j), P_{f,t-1}(j)) \right), \quad (33)$$

Where $\Omega_{P_{f,t}}(j)$ represents a cost of changing its price between periods and is expressed as:

$$\Omega_{P_{f,t}}(i) (P_{f,t}(j), P_{f,t-s}(j)) = \left(\frac{\psi_{P_f}}{2} \right) \tau^{\kappa} \left(\left(\frac{P_{f,t}(j)}{P_{f,t-1}(j)} \right) \pi_f - 1 \right)^2 Y_{f,t}, \quad (34)$$

Here π_f stands for the steady-state inflation in the imported manufactured goods market. Given the first order condition for the price decision, the demand for imported manufactured goods and the assumption that every producer (i) will decide of the same price $P_{f,t}$, so $P_{f,t}(i) = (j)$, and we obtain that:

$$P_{f,t} = \frac{P_t}{1-\mu} E_t \left\{ -\beta \psi_{P_f} \frac{\lambda_{t+1}}{\lambda_t} \left(\frac{\pi_{f,t+1}^2}{\pi_f^2} - \frac{\pi_{f,t+1}}{\pi_f} \right) \frac{Y_{f,t+1}}{Y_{f,t}} + \psi_{P_f} \frac{\lambda_{t+1}}{\lambda_t} \left(\frac{\pi_{f,t}^2}{\pi_f^2} - \frac{\pi_{f,t}}{\pi_f} \right) - \omega mc_{f,t} \right\}. \quad (35)$$

Retailers purchases varieties of manufactured goods $Y_{f,t}(j)$ to subsidiaries of foreign multinational, repackage them, and retail them in the domestic market as final imported tradable goods, $Y_{f,t}$, according to the following production function:

$$Y_{f,t} = \left(\int_0^1 Y_{f,t}^{\frac{\mu-1}{\mu}}(j) dj \right)^{\frac{\mu}{\mu-1}}, \quad (36)$$

Here μ stands for the elasticity of substitution between different

varieties of imported tradable goods.

The representative retailer then maximises its profit by choosing the optimal quantity of each imported manufactured differentiated good (j) as given:

$$\max_{Y_{f,t}(j)} P_{f,t} Y_{f,t} - \int_0^1 P_{f,t}(j) Y_{f,t}(j) dj, \quad (37)$$

Subject to the aforementioned production function (36).

Here $P_{f,t}$ represents the price imported tradable good in the domestic market. $P_{f,t}(j)$ is the price of imported varieties of manufactured goods.

The first order condition of this optimisation problem is given by:

$$Y_{f,t}(j) = \left(\frac{P_{f,t}(j)}{P_{f,t}} \right)^{-\mu} Y_{f,t}, \quad (38)$$

The price index of imported tradable goods in domestic market is thus defined as:

$$P_{f,t} = \left(\int_0^1 P_{f,t}^{1-\mu}(j) dj \right)^{\frac{1}{1-\mu}}, \quad (39)$$

2.2.4. Oil producing sector and the oil strategy of universal basic income

The representative domestic oil producer uses public capital and labor as inputs, according to the following production sector:

$$Y_{o,t} = A_t [A_{o,t} K_{o,t}^{\alpha_o} N_{o,t}^{1-\alpha_o}], \quad (40)$$

Here $Y_{o,t}$ represents the oil produced, α_o denotes the share of capital in the oil production, A_t is the aggregate technology shock affecting both the intermediate manufactured goods sector and the oil sector, and $A_{o,t}$ is a oil sector technology shock.

In the oil production process, the representative oil producer makes decisions about how much labor and capital it may use for oil production to maximize profits, as follow:

$$\max_{N_{o,t}, K_{o,t}} E_t [P_{o,t} Y_{o,t} - W_{o,t} N_{o,t} - q_{o,t} K_{o,t}], \quad (41)$$

Subject to the aforementioned oil production function (40).

The first-order maximization conditions for labor demand and capital provide us, the real wage and the real marginal productivity of capital, in the oil production sector, respectively as follow:

$$\frac{W_{o,t}}{P_{o,t}} = (1 - \alpha_o) \frac{Y_{o,t}}{N_{o,t}}, \quad (42)$$

$$\frac{q_{o,t}}{P_{o,t}} = \alpha_o \left(\frac{Y_{o,t}}{N_{o,t}} \right), \quad (43)$$

Oil produced within CEMAC is exported in the rest of the world $Y_{o,t}^f$ and sold within the economy $Y_{o,t}^d$. Hence total oil produced is basket of domestic oil and exported oil expressed as:

$$Y_{o,t} = Y_{o,t}^d + Y_{o,t}^f, \quad (44)$$

Since CEMAC is a small open economy, domestic oil producers are oil price taker, which is set internationally and defined as:

$$\log P_{o,t}^* = \rho_{P_o} \log P_{o,t-1}^* + \epsilon_{P_o}, \quad (45)$$

Here ρ_{P_o} stands for the autoregressive coefficient and ϵ_{P_o} the oil price shock which is normally distributed with zero mean and standard deviation equals to σ_{P_o} .

Hence the law of one price gap implies that the domestic oil price is defined in term of foreign price as follow:

$$P_{o,t} = Z_t P_{o,t}^*, \quad (46)$$

The profits from the oil sector finances part of the universal basic

income program within the currency union as follows:

$$UBI_t^o = P_{o,t}^* Y_{o,t}, \quad (47)$$

This last relation means the total elimination of oil subsidies, by shifting the oil sector profits to universal basic income program.

2.3. Central bank and nominal stability

The central bank of central African states, the BEAC, main monetary policy objective is to ensure monetary stability. The main monetary policy instrument of the BEAC is the bidding rate for BEAC's tenders or TIAO. The BEAC uses this policy rate within the framework of its monetary programming exercises in order to stabilise inflation around 3 percent. Given this monetary policy framework, we model the conduct of monetary policy in BEAC issuing zone as a monetary policy rule which link the TIAO to its last period value, and deviations from steady-state of inflation and output as follows:

$$\log\left(\frac{R_t}{R}\right) = (1 - \beta_\tau) \left(\beta_\pi \log\left(\frac{\pi_t}{\pi}\right) + \beta_y \log\left(\frac{Y_t}{Y}\right) \right) + \beta_\tau \log\left(\frac{R_{t-1}}{R}\right) + \epsilon_{r,t}, \quad (48)$$

Here $\epsilon_{r,t}$ represents a monetary policy shock, whereas R , π and Y are steady-states values of R_t , π_t and Y_t .

2.4. Government and statutory fiscal rule

Fiscal policy is conducted in CEMAC by national governments which influence the economy by complying to a common fiscal rule. Governments revenues to finance their spending comes from three main sources. Primarily, governments collect taxes (tax on corporation realized capital gain τ_t^G and tax on corporation capital income τ_t^K) from economic agents which are part of their income. Second, the lion share of government' revenues come from the oil sector. Governments in CEMAC own share in the oil exporting corporation. As result, governments earn revenues from exporting crude oil in foreign market, which is given by:

$$P_{Z,t} \psi_o Y_{Z,t}, \quad (49)$$

where ψ_o denotes the government share in total crude oil production. $\psi_o Y_{Z,t}$ represents the crude oil sales from the crude oil corporation. Third, government also collect revenue by issuing bonds B_{t-1} which are purchased by economic agents.

Government revenues are directed toward three different expenditures. Primarily, government conducts operating public investment and infrastructures public investment $I_{g,t}$. Second, government makes payment to economic agents that holds government bonds $\frac{B_t}{1+R_t}$. Finally, we consider in this paper that governments launch the universal basic income program UBI_t .

Consistent to the common fiscal rule of the CEMAC which aims to secure the coherence between national fiscal policies and the common monetary policy, the inter-temporal government budget constraint is defined as follows:

$$P_t I_{g,t} + \frac{B_t}{1+R_t} + UBI_t = P_{Z,t} \psi_o Y_{Z,t} + \tau_t^G K_{g,t} + q_{g,t} \tau_t^K K_{g,t} + B_{t-1} + \epsilon_{r,t}, \quad (50)$$

Here $\epsilon_{r,t}$ represents a fiscal policy shock.

2.5. Rest of the world and international oil prices

We feature the rest of the world based on the exogenous international oil prices. As a small open oil-dependent economy, CEMAC is an oil price taker, which is set internationally and defined as:

$$\log P_{o,t}^* = \rho_{p_o} \log P_{o,t-1}^* + \epsilon_{p_o,t}, \quad (51)$$

Here ρ_{p_o} stands for the autoregressive coefficient and $\epsilon_{p_o,t}$, the oil price

shock which is normally distributed with zero mean and standard deviation equals to σ_{p_o} .

3. Parameters calibration

This section discusses calibration of the structural model parameters. Tables 4-5 present the parameters of the model, which are calibrated to match the salient features of BEAC issuing zone.

The subjective discount factor, β , is set to 0.995 in order to get an annual nominal binding rate for BEAC' tenders of 18% in the steady state. Habit formation, h is calibrated to 0.7, to reflect a large degree of consumption inertia in BEAC issuing zone. This value is in line with the value found by Kano and Nason (2014). The quarterly gross steady-state inflation is calibrated to 3/4, which assumes a trend annual inflation rate of 3%. The gross quarterly real growth rate is set to 1.757 in order to match the average annual per capital real GDP of 2.8%. The inverse of the Frish elasticity of labor supply η is calibrated to 10 so as to capture the characteristic that labour supply is inelastic in BEAC issuing zone. This value is consistent with the value found by Goldberg (2015). The labor mobility between the oil sector and the non-oil sector τ_n is set to 1 to reflects the low level of labor flexibility across both sectors. This value is identical to the value found by Horvath (2000). The steady-state share of work done in the oil sector θ_n is calibrated to be consistent with average ratio of oil used in consumption to aggregate consumption, 0.046. The elasticity of the risk premium with respect to net-foreign asset position κ is calibrated to 0.002, because BEAC issuing zone is more exposed to risk.

To feature the scarcity of physical capital in BEAC issuing zone, the depreciation rate of physical capital in the oil sector δ_o is calibrated to 2.5%. The depreciation rate of physical capital in the non-oil sector δ_g is calibrated to 5 percent. To take in consideration the feature of absorptive capacity constraint in BEAC issuing zone, the physical capital adjustment cost in the oil sector ψ_o is calibrated to 4%. The physical capital adjustment cost in the non-oil sector ψ_g is also calibrated to 25%. The share of physical capital in the oil producing sector α_o is calibrated to 55%, so as to match the 45% of labor share in the oil production process. We calibrate the degree of price rigidity to feature the fact that, prices are more rigid in BEAC issuing zone relatively to developed countries.

The domestic price rigidity ψ_{pg} is calibrated to 0.7, whereas the foreign price rigidity ψ_{pf} is calibrated to 0.6. Consistent with the feature of oil subsidies policy within the BEAC issuing zone, the implicit oil subsidies τ^G is set to 10.7% less than the optimal tax for realized capital gain. In addition, the second implicit oil subsidies parameter τ^K is calibrated to 11.4%, less than the optimal tax rate for corporate income. The third implicit oil subsidies τ^L is calibrated to 10.2%, less than the optimal

Table 4
Calibration of Preference and Oil Sector Parameters.

Parameter	Definition	Value
β	Discount factor	0.995
h	Habit formation	0.8
η	Inverse of the Frish elasticity	10
τ_n	Labor mobility	1
θ_n	Share of labor in oil sector	0.046
κ	Risk premium	0.002
δ_g	Depreciation rate of private capital	0.05
δ_o	Depreciation rate of public capital	0.025
ψ_g	Private capital adjustment cost	0.25
ψ_o	Public capital adjustment cost	0.04
α_o	Share of public capital in oil production	55%
ψ_{pg}	Domestic price rigidity	0.7
ψ_{pf}	Foreign price rigidity	0.6
τ^G	Implicit oil subsidies related to capital gain	10.7
τ^K	Implicit oil subsidies related to corporate income	11.4
τ^L	Implicit oil subsidies related to household income	10.2

Table 5
Calibration of Goods Sectors and Policy Parameters.

Parameter	Definition	Value
ω	Elasticity varieties of domestic non-oil goods	-0.9
ω^*	Elasticity varieties of foreign non-oil goods	0.75
α_g	Share of oil and capital in non-oil sector	30%
x_1	Share of capital in non-oil sector	20%
τ^e	Elasticity of oil and capital	-0.9
μ	Elasticity varieties of imported goods	6
τ^v	Elasticity varieties of non-oil goods	6.54
τ^n	Elasticity of labor varieties input	6.3
α_f	Share of imported tradable goods	0.50
θ_y	Share of non-tradable good	0.25
β_r	Policy inertia parameter	0.95
β_y	Policy response to output growth	0.28
β_π	Policy response to inflation	1.61
ρ_A	Persistence of technology shock	0.95
σ_A	Standard deviation of technology shock	0.47
ρ_o	Persistence of oil price shock	0.92
σ_o	Standard deviation of oil price shock	1.26

tax rate for household income. These implicit oil subsidies parameters are calibrated so as to be below the optimal tax rate, which on average is 15% for low-income countries.

Consequently, under UBI via the first fiscal policy, the elimination of oil subsidies is materialized by an increase of the tax rate on capital gain above the optimal level for low-income countries ($\tau^{G^*} > \tau^G$). Under UBI via the second fiscal policy, the elimination of oil subsidies is materialized by an increase of the tax rate on corporate income above the optimal level for low-income countries ($\tau^{K^*} > \tau^K$). Under UBI via the last fiscal policy, the total elimination of oil subsidies is materialized by an increase of tax rate on households' income, combined with an increase in both corporate income and capital gains tax rates ($\tau^{L^*} > \tau^L$; $\tau^{K^*} > \tau^K$; $\tau^{G^*} > \tau^G$).

We calibrate the elasticity of substitution between different varieties of non-oil goods to capture the feature that BEAC issuing zone is relatively less diversified than developed countries. The elasticity of substitution between different varieties of domestic non-oil goods ω , is set to -0.9 in order to generate a high degree of short-run inelasticity in oil demand. Whereas the elasticity of substitution between different varieties of foreign non-oil goods ω^* , is set to 0.75. The share of combined physical capital and oil in the production of non-oil goods α_g is calibrated to 30% to match the 70% of labor contribution in the production of non-oil goods varieties. The oil share in the production sector x_1 represent 1/3 of the combined input, that is 0.1, while the capital input represents 2/3, that is 0.2. The elasticity of substitution between oil and capital τ^e , is set to -0.9, which is larger in absolute term than the -0.7 used by Kim and Loungani (1992) for the United States. This calibration generates the most price-inelastic short-term factor demand for the model. The negative sign means that oil and capital are complement inputs in the production process.

The elasticity of substitution among differentiated intermediates of non-oil goods τ^v are evaluated by considering the steady-state domestic price mark-up $\frac{\tau^v}{\tau^v-1}$. We calibrate the elasticity at 6.54 to match the steady-state price mark-up $\frac{\tau^v}{\tau^v-1}$ of 1.1, consistent with Chari et al. (2001). The elasticity of substitution among differentiated intermediates of labor input τ^n are related to the steady-state wage mark-up $\frac{\tau^n}{\tau^n-1}$. We set the elasticity at 6.3, to match the steady-state wage mark-up $\frac{\tau^n}{\tau^n-1}$ of 1.15. The elasticity of substitution between different varieties of imported tradable goods μ is calibrated at 6, to match the foreign price mark-up $\frac{\mu}{\mu-1}$ of 1.2, which is the parameter generally used for advanced economies. The share of domestic non-tradable goods θ_y is set at 0.25, to emphasize the oil-dependent currency union feature of BEAC issuing zone. Whereas the share of imported tradable goods in the foreign economy α_f is calibrated at 0.50, to highlight import-dependence in BEAC issuing zone.

We calibrate the parameters of the monetary policy rule, consistent with monetary policy objective of the BEAC. The inertia parameter of the binding rate for BEAC tenders β_r , is calibrated to 0.95 to indicate a significant degree of policy inertia. The parameter that captures the response of the binding rate for BEAC tenders to inflation β_π is calibrated to 1.61, above the standard value of 1.5. While the response of the binding rate for BEAC tenders to output growth β_y is lower than the response to inflation and calibrated to 0.28 below the standard value (0.5). The persistence of the technology shock ρ_A , is assumed to be equal to 0.95, while the standard deviation of the technology shock σ_A is set to 0.47%. The persistence of the oil price shock ρ_o is equal to 0.92. The standard deviation of the shock σ_o is set to 1.26%.

4. Universal basic income and productivity expansion

This section examines the effects of a universal basic income funded by different tax policies on the productivity growth, inequality, and welfare of an African country's currency union. The paper presents three scenarios which are based on enlarging the tax base on the one hand and reducing fiscal spending on the other hand. The first scenario is the universal basic income funded by the first tax policy, which assumes that the government will increase taxes on capital gains. Throughout the analysis, this scenario is materialized within the figures by a solid black line. The second scenario is the universal basic income funded by the second tax policy, which assumes that the government will increase taxes on corporate income. This second scenario is materialized by a star-blue line. The last scenario is the universal basic income funded by the third fiscal policy, which assumes that the government totally phases out oil subsidies. This third scenario is materialized by a dashed cyan line. The benchmark is indicated in the figures by a dot-green line.

Figure 1 displays the impulse responses of key economic variables to the benchmark and the three scenario specifications. The vertical axis of each chart reports the percent deviation from the steady state. The horizontal axis displays the number of quarters, from 0 to 100. Following a one-percentage-point increase in productivity, we observe that tax policy accentuates the expansionary effect of the productivity shock within the currency union through the universal basic income program. Tax policies increase the efficiency of the combined oil and capital inputs and, as a result, accelerate the expansion of total factor productivity. An expansion of total factor productivity raises labor demand and the wage increases, which puts downward pressure on wage inequality and enhances employment, more so for the first fiscal policy than for the second. Hence, universal basic income raises the expansion of the positive productivity shock in the monetary union via the substitution effect.

First, universal basic income funded by an increase in capital gains raises the consumption of non-oil goods, which are mostly demanded by low-income households, and decreases oil consumption, which is primarily demanded by higher-income households. As the share of lower-income households is greater within the monetary union, their consumption demand offsets the consumption demand of higher-income households and leads to an increase in total consumption and a reduction in consumption inequality.

Second, universal basic income funded by an increase in corporate income tax contravenes the operation of less competitive corporations, which enhance the profitability of investment within the union, both in the short and the long term, and hence the total factor productivity growth. As a result, investment opportunity costs fall, and competitive corporations find it optimal to invest more, while less competitive corporations find it optimal to invest less. This substitution effect intensifies the increase in investment and labor demand. Labor demand expansion puts upward pressure on labor income and induces a reduction in income inequality.

More importantly, beyond this substitution effect, universal basic income funded by total phasing-out of oil subsidies additionally

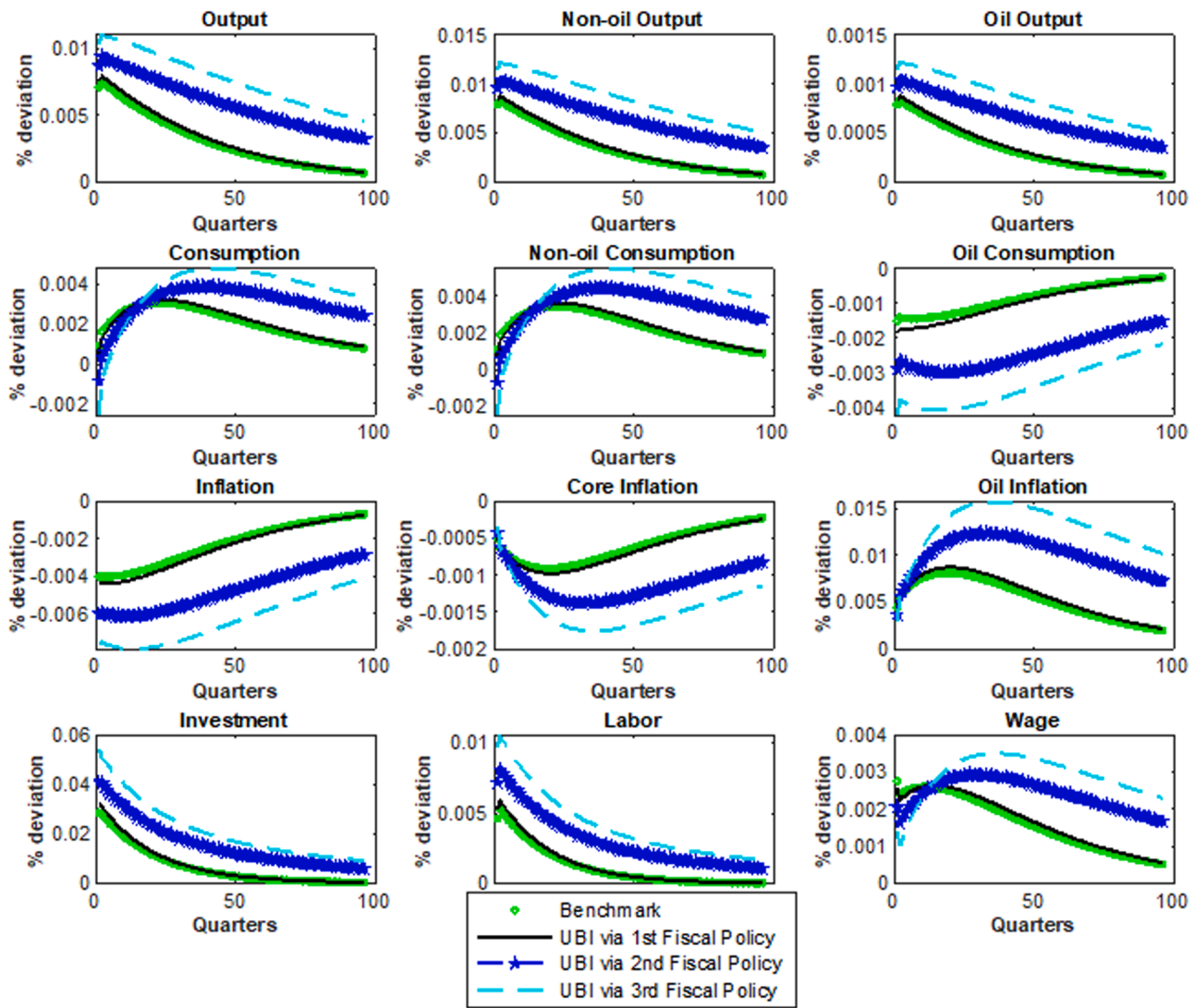


Fig. 1. Tax Policy and UBI under a Positive Technology Shock.

Note: The impulse responses are computed using the designed Dynamic Stochastic General Equilibrium model. All graphs report percentage deviations from steady-state. The green line represents the benchmark of the model with oil subsidies. The dark line is the universal basic income program funded by the first fiscal policy. The blue line is the universal basic income program funded by the second fiscal policy. The cyan line is the universal basic income program funded by the third fiscal policy.

accentuates the expansionary effect of a positive productivity shock via an income effect. Thus, under this third fiscal policy, the effectiveness of universal basic income is optimal and higher than under the two previous first and second fiscal policies. As oil subsidies are eliminated due to the fiscal policy, the income effect supplements the substitution effect, so that oil consumption by lower-income households drastically collapses while their non-oil consumption jumps. The total consumption of the currency union expands more, as does the reduction of consumption inequality. The income effect further accentuates the positive effect of total factor productivity via investment input productivity. The income effect of universal basic income, funded by the phasing-out of oil subsidies, unleashes labor productivity, which consistently rises above the benchmark level and other two fiscal policy levels, on the one hand, long-term growth, on the other, employment. Both the increase in aggregate output and employment further diminish income inequality within the currency union. Headline inflation declines below the benchmark level under the first and second fiscal policies, and persistently under the third fiscal policy, mainly because of the fall of core inflation. The drastic fall in core inflation particularly enhances welfare within the currency union as more and more low-income households are

now consuming more non-oil goods, which are cheaper, rather than oil-dependent goods, which are expensive.

These findings show that the effectiveness of universal basic income on productivity growth, inequality, and welfare is dependent on the type of fiscal policy used to fund it, specifically the trade-off between tax policy and transfer policy. While universal basic income funded by tax policies is effective in reducing inequality and increasing growth and welfare, universal basic income funded by completely eliminating oil subsidies appears to be the best policy in terms of growth, welfare, and inequality reduction.

All in all, to influence long-term productivity growth, welfare, and inequality via universal basic income within the monetary union, the government will face a trade-off between expanding the tax base and reducing public spending.

5. Universal basic income and oil crisis

Figure 2 displays a one percent increase in oil price shock. Higher oil price pushes up production costs, which in turn encourages firms to raise prices. The increase in oil inflation dampens the fall in core inflation and

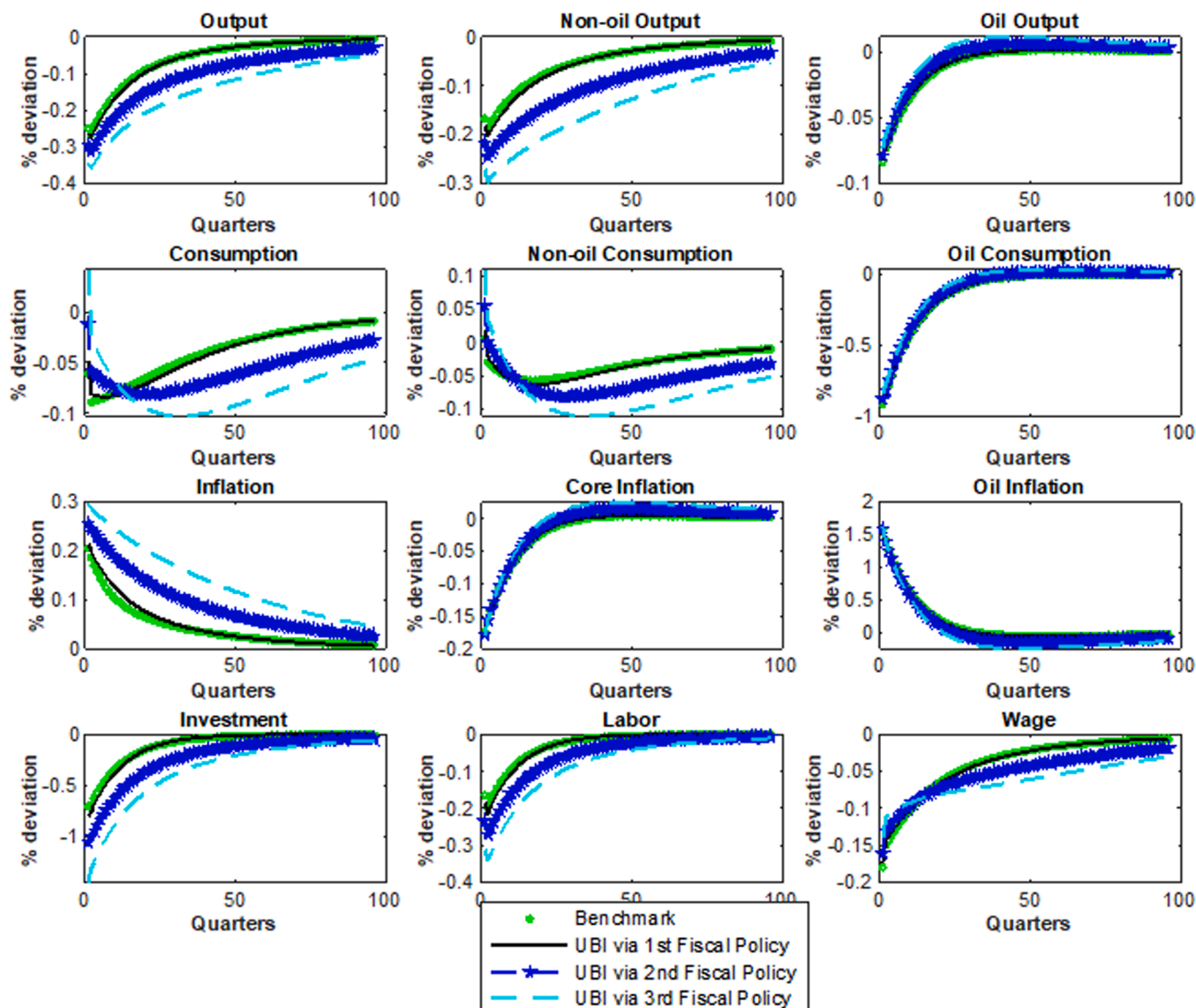


Fig. 2. Tax Policy and UBI under a Negative Oil Price Shock.
 Note: The impulse responses are computed using the designed Dynamic Stochastic General Equilibrium model. All graphs report percentage deviations from steady-state. The green line represents the benchmark of the model with oil subsidies. The dark line is the universal basic income program funded by the first fiscal policy. The blue line is the universal basic income program funded by the second fiscal policy. The cyan line is the universal basic income program funded by the third fiscal policy.

pushes up headline inflation. As a result, headline inflation records the highest level under universal basic income funded by phasing-out oil subsidies than under universal basic income funded by the second and first tax policies. This is explained by the elimination of oil subsidies in the monetary union under the third fiscal policy. In fact, under this fiscal policy, the increases in international oil prices spill over to the entire currency union, undermining households' welfare.

The oil price shock causes an immediate decline in output in the benchmark, which worsens more under the third fiscal policy than under the second and first tax policies. The large jump in inflation expectations in the benchmark raises the expected oil subsidies by state members. The elimination of oil subsidies acts as a negative wealth shock, amplifies the decrease in output after a negative oil price shock, and exposes the currency union to stagflation, with long-term lower growth and higher inflation.

The good news is that stagflation is less severe under universal basic income funded by capital gains increases as well as universal basic income funded by corporate income tax increases. This is explained by the

fact that declining economic growth and zero oil subsidies harm the profitability of firms that rely more on oil inputs in their production processes and lead to a gradual exit from the market of oil-intensive productive firms because, without subsidies, they become less competitive. Fiscal policies crowd-out less competitive corporations from the market and thus enhance the efficiency of the production processes of remaining competitive corporations. These efficiency effects in the production process also explain why the resulting income inequality from the oil crisis is less severe under the tax policy funded universal basic income program than under the public spending funded universal basic income.

Furthermore, the response of consumption to an oil price shock is influenced by households' ability to smooth consumption given oil subsidy elimination. Immediately following a negative oil price shock, households expect the high oil price to persist for a longer period of time because of the absence of oil subsidies. Household incomes start to drop because they pay additional oil prices, which pushes them to drastically cut their oil consumption. The collapse of oil consumption, accentuated

by universal basic income funded by phasing-out oil subsidies, crowds-in the similar decrease in non-oil goods consumption due to complementarity effects. This complementarity results in a drop in both oil and non-oil goods consumption, resulting in a sharp drop in overall consumption within the currency union. The persistent fall of aggregate consumption under universal basic income funded by phasing-out oil subsidies will trigger consumption inequality, which nevertheless remains less severe under the two tax policies that fund universal basic income.

In sum, when the currency union faces an oil crisis, a universal basic income funded by tax policy is more effective in combating stagflation and inequality than a universal basic income funded by oil subsidy elimination. So, oil subsidies appear fundamental in supporting economic activity and welfare when the currency union is in a crisis situation. This is because, by raising taxes on corporates and higher-income households, the government uses those fiscal revenues to fund subsidies and policies that directly target low-income households and reduce inequality between low-income households and high-income households.

6. Universal basic income and inflation crisis

This section examines how universal basic income evolves when the currency union faces the normalization of monetary policy due to the inflation crisis. The central bank aims to curb inflation increases by raising its policy rate. As Fig. 3 denotes, following a 1 percent increase in policy rate the elimination of oil subsidies rather than the increase in taxes on capital gains and corporate income effectively accelerates the central bank's response to inflation. Intuitively, the nominal interest rate has to rise enough to contain rising inflation. This is not the case in the benchmark, where the nominal interest rate responses look similar to those for inflation, reflecting a huge share of oil subsidies in the consumer basket.

As the central bank deepens its monetary policy normalization, monetary policy becomes more aggressive and the nominal interest rate moves more than under the benchmark and the previous scenario relative to inflation, reflecting the elimination of oil subsidies in the consumer basket. In the presence of monetary policy normalization, the nominal interest rate jumps more than inflation and successfully secures

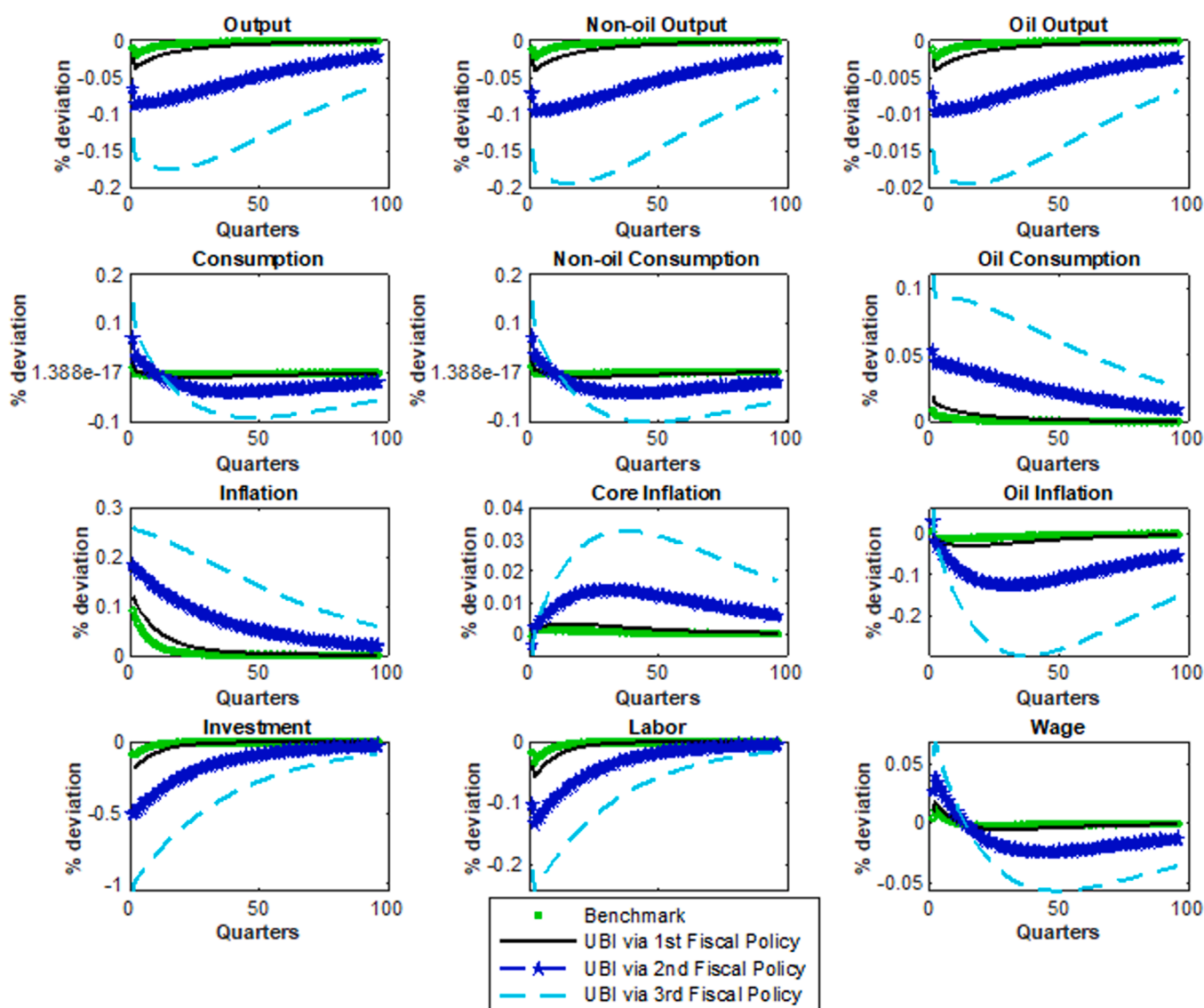


Fig. 3. Tax Policy and UBI under Monetary Policy Normalization.

Note: The impulse responses are computed using the designed Dynamic Stochastic General Equilibrium model. All graphs report percentage deviations from steady-state. The green line represents the benchmark of the model with oil subsidies. The dark line is the universal basic income program funded by the first fiscal policy. The blue line is the universal basic income program funded by the second fiscal policy. The cyan line is the universal basic income program funded by the third fiscal policy.

the purchasing power of lower-income households. Since lower-income people consume more and save less, the normalization will trigger a slight increase in consumption, more so under the third policy than the second and first policy. Because lower-income households represent a large share of the population, an increase in lower income consumption will induce a reduction in inequality within the currency union, more so under universal basic income funded by the third fiscal policy than under UBI funded by the second and first fiscal policies. The important effect of the monetary policy normalization on inflation and consumption comes from the fact that, the universal basic income program is more effective in reducing income inequality, when it is funded by the total phasing-out of oil subsidies, rather than increases in tax on capital gains or tax on corporate income.

By contrast, monetary policy normalization increases investment costs, more so under the first and the second fiscal policies than under the third fiscal policy that funds universal basic income. Under the third scenario, when the central bank normalizes, investment drastically collapses because of the absence of subsidies. This is explained by the fact that the absence of oil subsidies raises the cost of producing goods by corporations, in addition to the increase in funding costs induced by monetary policy normalization.

Intuitively, the nominal interest rate and the elimination of oil subsidies have to rise enough to dampen the variation of inflation. Both effects contradict investments and lead to a drastic fall in employment. As a result, wages and long-term growth collapsed as well. Lower growth and labor income decrease more under universal basic income funded by the third fiscal policy than under universal income funded by the second and first fiscal policies. Hence, the important effect is that monetary policy normalization deepens income inequality due to low growth and lower employment, accentuated by the elimination of oil subsidies in the universal basic income program.

Overall, the normalization of monetary policy following the inflation crisis leads to two opposite effects. On the one hand, universal basic income is more effective in reducing consumption inequality since lower-income households consume more and save less due to monetary policy normalization, more so under the third fiscal policy, rather than the second and first fiscal policies. On the other hand, universal basic income is unable to circumvent income inequality due to lower growth and lower employment induced by the normalization of monetary policy, more so under the third policy rather than the second and first fiscal policies.

7. Welfare analysis: What UBI funding strategy is optimal for households living standard?

This section aims to identify, among the three fiscal policies, the optimal universal basic income funding strategy for the welfare of households within the currency union. Given a parameter calibration, that evaluation is based on the unconditional period losses implied by each measure of universal basic income funding fiscal policy. Three alternative cases and the benchmark are considered, as discussed below. Two different states of the economy are analyzed. The first state is the economy in normal times. The second is the economy under crisis.

Empirically, welfare is measured as the consumption-equivalent (CE) variation associated with each strategy of universal basic income funding fiscal policy. This means that we solve for how much aggregate consumption would need to be decreased in the new steady-state (UBI via first policy, UBI via second fiscal policy, UBI via third fiscal policy) in order for welfare to be the same as in the original steady state (benchmark). The measure of welfare is thus the present discounted value of utility flow:

$$\varpi_t = E_t \left\{ \sum_{j=0}^{\infty} \beta^j U(C_{t+j}, N_{t+j}) \right\}, \tag{52}$$

We assume that Γ_{os} and Γ_{UBI} are respectively the steady state values

of variable Γ in the original steady state (currency union under oil subsidies policy) and the new steady state (currency union under UBI programs). The welfare variation across steady-state according to each state of the currency union (normal or crisis times) is given by:

$$\frac{1}{1-\beta} \left\{ \left[\frac{(C_{UBI})^{1-\sigma}}{1-\sigma} - \frac{(N_{UBI})^{1+\eta}}{1+\eta} \right] - \left[\frac{(C_{os})^{1-\sigma}}{1-\sigma} - \frac{(N_{os})^{1+\eta}}{1+\eta} \right] \right\}, \tag{53}$$

Practically, we solve for how much aggregate consumption in the new steady state would need to be increased or decreased, in percentage points, to make welfare equal across the two steady-states. Mathematically we solve for ξ in the following equation,

$$\left\{ \left[\frac{(\xi C_{UBI})^{1-\sigma}}{1-\sigma} - \frac{(N_{UBI})^{1+\eta}}{1+\eta} \right] - \left[\frac{(C_{os})^{1-\sigma}}{1-\sigma} - \frac{(N_{os})^{1+\eta}}{1+\eta} \right] \right\} = 0, \tag{54}$$

Generally, ξ will be different from zero ($\xi \neq 0$) as welfare will be higher or lower across steady-states. Therefore, the welfare losses are computed as:

$$\varpi_t = 100 * (1 - \xi). \tag{55}$$

Intuitively, ϖ_t will be positive when $\xi < 1$, which happens when welfare is higher in the new steady state.⁶ In that case, the aggregate consumption would need to be lowered by ϖ_t percent to get utility in the new steady state back down its lower level in the original steady state.

Table 6 reports the main findings of that exercise. For each measure of tax policy, the implied standard deviation of key variables is reported, as well as the corresponding average period welfare loss. The top panel reports statistics corresponding to the calibration of the universal basic income funded by an increase in taxes on capital gains. The second panel

Table 6
Welfare Analysis of Tax Policy Reform and Universal Basic Income

	Economy in Normal Times		Economy in Crisis Times	
Universal Basic Income funded by Increased Taxes in Realized Capital Gains				
Investment	0.7574		0.0437	
GDP	0.2670		0.0154	
Employment	0.1261		0.0074	
Welfare Loss	0.2325		0.0133	
Universal Basic Income funded by Expansion of Taxes on Corporate Income				
Investment	0.8165	0.0586		
GDP	0.2940	0.0210		
Employment	0.1330	0.0096		
Welfare Loss	0.2401	0.0168		
Universal Basic Income funded by Totally Phasing-out Oil Subsidies				
Investment	0.9912	0.0872		
GDP	0.3558	0.0310		
Employment	0.1500	0.0132		
Welfare Loss	0.2611	0.0221		
Benchmark Case or Economy without UBI (under Oil Subsidies Policy)				
Investment	0.9978	0.9985		
GDP	0.6327	0.7171		
Employment	0.4758	0.5536		
Welfare Loss	0.4423	0.4696		

Note: Welfare is in consumption-equivalent percentages. Each of the 2 mains columns corresponds to the welfare implications of the universal basic income program, according to each type of fiscal policies within the currency union, in normal times and in times of crisis. Variables are in percent change across steady states. The new steady-states are the ones with UBI funded by the first policy, UBI funded by the second fiscal policy, and UBI funded by the third fiscal policy. The original steady-state represents the benchmark where the currency union is not under a UBI program but rather under an oil subsidies policy.

⁶ Meaning that welfare loss is lower in the new steady-state.

denotes the universal basic income funded by an increase in corporate income taxes. The third panel reports results for the universal basic income funded by a total phasing-out of oil subsidies. The fourth panel reports the benchmark's statistics. Under each state of the currency union, the findings report thus the percentages welfare losses. If these numbers are different, it means that the state of the economy with the lower number experiences a welfare gain relative to the state of the economy with the higher number, which experiences a welfare loss.

In the first case, where the universal basic income is funded by an increase in taxes on capital gains, the standard deviation of investment is lower in the case of an economy in crisis (0.043 percent) than in normal times (0.75 percent). Likewise, this value is lower than the benchmark value of 0.99 percent. Whereas the standard deviation of output is lower than the standard deviation of investment, both for the economy in normal times (0.26 percent) and the economy in crisis (0.01 percent), as well as its benchmark value of 0.63 percent. By contrast, the standard deviation of employment is the smallest among the three variables, both for the economy in normal times (0.12 percent) and the economy in crisis (0.007 percent). Moreover, these values are the lowest relative to the benchmark value of 0.47 percent.

Hence, the implied welfare loss of the currency union in normal times is about 0.23 percent, which is much higher than the implied welfare loss of the currency union under crisis, recorded at 0.013 percent, and represents half of the implied welfare loss of the benchmark case (0.47 percent). This first set of results suggests that, while universal basic income funded by the first tax policy is successful in reducing income inequality and consumption inequality and improving households' living standards, its effects lead to higher welfare gains when the economy faces a crisis than in normal times.

In the second case, where the universal basic income is funded by an increase in corporate income tax, the standard deviation of investment (0.81 percent) is greater than in the first case, where the universal basic income is funded by an increase in taxes on capital gains (0.75 percent), but lower than its benchmark value of 0.99 percent. Whereas the standard deviation of output is lower than the standard deviation of investment, more so in a crisis (0.02 percent) than in a normal time (0.29 percent), but greater than its values under the first fiscal policy (0.01 percent and 0.26 percent respectively). Likewise, while the standard deviation of employment is the smallest among the three variables under this second fiscal policy, more so for the economy under crisis (0.009 percent) than for the economy in normal times (0.13 percent), its values are greater than the values under the first fiscal policy (0.007 percent and 0.12 percent respectively). As a result, the implied welfare loss of the currency union in normal times is about 0.24 percent, which is much higher than the implied welfare loss under crisis (0.016 percent) and also represents half of the benchmark welfare loss (0.44 percent). Similarly, these implied welfare losses are greater than those under the first fiscal policy (0.23 percent and 0.013 percent respectively). This second set of results suggests that, while universal basic income is effective in reducing income inequality and consumption inequality and improving households' living standards, its effects lead to higher welfare gains when it is funded by an increase in tax on capital gains rather than when it is funded by an increase in taxes on corporate income.

In the third case, where the universal basic income is funded by completely eliminating oil subsidies, the standard deviation of investment is the highest among the three fiscal policies, both for the normal times (0.991 percent) and the times of crisis (0.087 percent), but lower than the benchmark values (0.997 percent and 0.998 percent respectively). Likewise, the standard deviation of output, while lower than the standard deviation of investment, records the highest value among the three fiscal policies, both in normal times (0.35 percent) and under crisis (0.03 percent), but remains below its values at the benchmark (0.61 percent and 0.71 percent respectively). Furthermore, while the standard deviation of employment is the smallest among the three variables under the third fiscal policy, it records the highest value among the three fiscal policies, both in normal times (0.15 percent) and under crisis (0.013

percent), but these values are lower than the benchmark values (0.47 percent and 0.55 percent respectively). Consequently, the implied welfare loss of the currency union is the highest among the three fiscal policies, both in normal times (0.26 percent) and under crisis (0.02 percent), even if these welfare losses are lower than the benchmark welfare loss (0.44 percent and 0.46 percent). As a response, the third set of results suggests that universal basic income funded by the total phasing-out of oil subsidies is less effective when the currency union is in crisis, with its effects leading to the highest welfare loss relative to universal basic income funded by the partial removal of oil subsidies.

Overall, this welfare analysis reveals that, when the currency union faces a crisis, universal basic income funded by increases in both taxes on corporate gains and taxes on corporate income appears to be the optimal fiscal strategy rather than universal basic income funded by total oil subsidy elimination. So, a universal basic income funded by enlarging corporate taxes is optimal compared to a universal basic income funded by reducing public spending when the economy is hit by a severe crisis.

8. Conclusion and policy implications

The aim of this paper was to assess tax policy reforms that can sustain universal basic income programs and foster long-term growth and welfare in an African currency union that faces fiscal constraint and inequality. Theoretically, the relationship between tax policy and universal basic income remains unsettled. The proponents of a universal basic income program advocate four fundamental development principles. By contrast, the opponents of the universal basic income program challenge those four development principles. To address this ongoing debate, we developed a Dynamic Stochastic General Equilibrium Model of universal basic income enriched with three fiscal policy strategies. We model the fact that, to alleviate inequality and raise long-term growth and welfare, government members adopt a universal basic income program, which is financed by three fiscal policy strategies. The first fiscal policy strategy is the increase in taxes on realized capital gains. The second is the expansion of corporation income tax. The third is the total phasing-out of the oil subsidy program within the currency union.

The findings show that the effectiveness of universal basic income on productivity growth, inequality, and welfare is dependent on the type of fiscal policy used to fund it, specifically the trade-off between tax policy and transfer policy. While universal basic income funded by tax policies is effective in reducing inequality and increasing growth and welfare, universal basic income funded by completely eliminating oil subsidies appears to be the best policy in terms of growth, welfare, and inequality reduction. Hence, to influence long-term productivity growth, welfare, and inequality via universal basic income within the monetary union, the government will face a trade-off between expanding the tax base and reducing public spending. Second, when the currency union faces an oil crisis, a universal basic income funded by tax policy is more effective in combating stagflation and inequality than a universal basic income funded by oil subsidy elimination. So, oil subsidies appear fundamental in supporting economic activity and welfare when the currency union is in a crisis situation. This is because, by raising taxes on corporates and higher-income households, the government uses those fiscal revenues to fund subsidies and policies that directly target low-income households and reduce inequality between low-income households and high-income households. Third, the normalization of monetary policy following the inflation crisis leads to two opposite effects. On the one hand, universal basic income is more effective in reducing consumption inequality since lower-income households consume more and save less due to monetary policy normalization, more so under the third fiscal policy, rather than the second and first fiscal policies. On the other hand, universal basic income is unable to circumvent income inequality due to lower growth and lower employment induced by the normalization of monetary policy, more so under the third policy rather than the second and first fiscal policies.

The welfare analysis reveals that, when the currency union faces a crisis, universal basic income funded by increases in both taxes on corporate gains and taxes on corporate income appears as the optimal fiscal strategy rather than universal basic income funded by oil subsidy elimination. So, a universal basic income funded by enlarging taxes is optimal compared to a universal basic income funded by reducing public spending when the economy is hit by a severe crisis.

Specifically, the first set of results of this welfare analysis suggests that, while universal basic income funded by the first tax policy is successful in reducing income inequality and consumption inequality and improving households living standard, its effects lead to higher welfare gains when the economy faces crisis rather than the economy in normal time. The second set of results suggests that, while universal basic income is effective in reducing income inequality and consumption inequality and improving households living standard, its effects lead to higher welfare gains when it is funded by an increase in tax on capital gains rather than when it is funded by an increase in taxes on corporates income. The third set of results suggests that, universal basic income funded by the total phasing-out of oil subsidies is less effective when the currency union is under crisis, its effects lead to the highest welfare loss relatively to universal basic income funded by increases in taxes.

Four core policy implications come-out from this analysis:

- First, expanding the tax base is necessary in resource-rich countries for long-term growth and redistribution.
- Second, universal basic income is an effective tool to enhance welfare in Africa and other less developed countries.
- Third, well-targeted government transfers or subsidies are necessary to reduce inequality between lower and higher-income households.
- Finally, fiscal policy can serve as a means to raise welfare and reduce inequality in most countries.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

To the best of our knowledge, there is no conflict of interests or competing interests to disclose, that are directly or indirectly related to this research

Acknowledgments

This research has been accepted for presentation at the 2022 ASMEA Annual Conference, held in Washington, DC, from November 5–7. We acknowledge all the organizers and the scientific committee of the conference for having associated our paper with this prominent discussion.

References

- Aizer, A., Eli, S., Ferrie, J., Lleras-Money, A., 2016. The long-run impact of cash transfers to poor families. *Am. Econ. Rev.* 106 (4), 935–971.
- Ambler, S., Dib, A., Rebei, N., 2004. Optimal Taylor Rules in an Estimated Model of a Small Open Economy. Bank of Canada Working Paper No. 2004-36.
- Anagnostopoulos, A., Orham Erem, A., Carceles-Poveda, E., 2022. Financing corporate tax cuts with shareholder taxes. *Quant. Econ.* 13, 315–354.
- Appelbaum, E., 2021. Improving the efficacy of carbon tax policies. *J. Gov. Econ.* 4, 100027.
- Asta, F., Lela, M., Spruk, R., 2021. Bono malum superate: long-run effects of radical institutional change. *J. Gov. Econ.* 2, 100008.
- Atkinson, A., 2015. *Inequality: What Can Be Done?* Harvard University Press, Cambridge, MA.
- Banerjee, A., Niehaus, P., Suri, T., 2019. Universal basic income in the developing world. *Annu. Rev. Econ.* 11, 959–983.
- Boar, C., Midrigan, V., 2020. Efficient Redistribution. National Bureau of Economic Research. Technical report.
- Bordo, M., Duca, J., 2021. An overview of the Fed's new credit policy tools and their cushioning effect on the COVID-19 recession. *J. Gov. Econ.* 3, 100013.
- Camacho, M., Angela, C., Pena, D., 2023. What drives industrial energy prices? *Econ. Model.* 120, 106158.
- Chang, Y., Sun-Bin, K., Kyooho, K., Richard, R., 2019. Individual and aggregate labor supply in a heterogeneous agent economy with intensive and extensive margins. *Int. Econ. Rev.* 60, 3–24.
- Chari, V.V., Kehoe, P., McGrattan, E., 2001. Sticky Price Models of the Business Cycle: Can the Contract Multiplier Solve the Persistence Problem? *Econometrica* 68, 1151–1179.
- Christiano, L., Motto, R., Rostagno, M., 2014. Risk shocks. *Am. Econ. Rev.* 104 (1), 27–65.
- Coenen, G., Erceg, C., Freedman, C., Furceri, D., Kumhof, M., Lalonde, R., Laxton, D., Linde, J., Mourougane, A., Muir, D., Mursula, S., de Resende, C., Roberts, J., Roeger, W., Snudden, S., Trabandt, M., Veld, J., 2012. Effects of fiscal stimulus in structural models. *Am. Econ. J. Macroecon.* 4 (1), 22–68.
- Cogan, J., Cwik, T., Taylor, J., Wieland, V., 2010. New Keynesian versus old Keynesian government spending multipliers. *J. Econ. Dyn. Control.* 34 (3), 281–295.
- Davies, S., James, D., 2008. A regional multiplier approach to estimating the impact of cash transfer on the markets: the case of cash transfer in rural Malawi. *Dev. Policy Rev.* 26 (1), 91–111.
- Del Negro, M., Giannoni, M., Schorfheide, F., 2015. Inflation in the Great Recession and New Keynesian models. *Am. Econ. J. Macroecon.* 7 (1), 168–196.
- Dollar, D., Kleineberg, T., Kraay, A., 2015. Growth, inequality, and social welfare: cross country evidence. *Econ. Policy* 30 (82), 335–377.
- Edge, R., Laubach, T., Williams, J., 2007. Learning and shifts in long-run productivity growth. *J. Monet. Econ.* 2421–2438.
- Friedman, M., 1968. The case for the negative income tax: a view from the right. In: Bunzel, J.H. (Ed.), *Issues of American Public Policy*. Prentice-Hall, Englewood Cliffs, NJ.
- Furlanetto, F., 2011. Fiscal stimulus and the role of wage rigidity. *J. Econ. Dyn. Control* 35 (4), 512–527.
- Gali, J., Lopez-Salido, D., Valles, J., 2007. Understanding the effects of government spending on consumption. *J. Eur. Econ. Assoc.* 5 (1), 227–270.
- Garibaldi, P., Pedro, G., Sopraseduth, T., 2021. Public employment redux". *J. Gov. Econ.* 1, 100003.
- Gaspar, V., Mauro, P., Poghosyan, T., 2017. *Lessons from the Old Masters on Assessing Equity and Efficiency: A Primer for Fiscal Policymakers*. International Monetary Fund, Washington, D.C. IMF Working Paper.
- Gentilini, U., Grosh, M., Rigolini, J., Yemtsov, R., 2019. *Exploring Universal Basic Income: A Guide to Navigating Concepts, Evidence, and Practices*. The World Bank.
- Ghatak, M., Maniquet, F., 2019. Some theoretical aspects of a universal basic income proposal. *Annu. Rev. Econ.* 11, 895–928.
- Goldberg, J., 2015. *Idiosyncratic Investment Risk and Business Cycles*. Finance and Economics Discussion Series 2014-05. Board of Governors of the Federal Reserve System (U.S.).
- Guner, N., Kaygusuz, R., Ventura, G., 2019. Child-related transfers, household labor supply and welfare. *Rev. Econ. Stud.* 1–51.
- Hanna, R., Olken, B., 2018. Universal basic incomes vs. targeted transfers: anti-poverty programs in developing programs". *J. Econ. Perspect.* 32, 201–226.
- Heathcote, J., Storesletten, K., Violante, G., 2017. Optimal tax progressivity: an analytical framework. *Q. J. Econ.* 132.
- Holter, H., Krueger, D., Stepanchuk, S., 2019. How do tax progressivity and household heterogeneity affect Laffer curves? *Quant. Econ.* 1–49.
- Horvath, M., 2000. Sectoral shocks and aggregate fluctuations. *J. Monet. Econ.* 45 (1), 69–106.
- Jones, C., Klenow, P., 2016. Beyond GDP? welfare across countries and time. *Am. Econ. Rev.* 106 (9), 2426–2457.
- Jones, D., Marinescu, I., 2018. *The Labor Market Impacts of Universal and Permanent Cash Transfers: Evidence From The Alaska Permanent Fund*. NBER Working Paper 24312.
- Kano, T., Nason, J., 2014. Business cycle implications of internal consumption habit for new Keynesian models. *J. Money Credit Bank.* 46 (2–3), 519–544.
- Kaplan, G., 2012. Inequality and the life cycle. *Quant. Econ.* 3 (3), 471–525.
- Karras, G., Yang, M., 2022. Fiscal policy in the 21st century: evidence on automatic stabilizers in the European union". *J. Gov. Econ.* 6, 100038.
- Kearney, M., Mogstad, M., 2019. *Universal Basic Income (UBI) as a Policy Response to Current Challenges*. Report, Aspen Institute, Brookings.
- Kempkes, G., Stahler, N., 2022. Re-allocating taxing rights and minimum tax rates in international profit taxation". *J. Gov. Econ.* 7, 100048.
- Kim, I., Loungani, P., 1992. The role of energy in real business cycle models. *J. Monet. Econ.* 29, 173–189.
- Krueger, D., Mitman, K., Perri, F., 2017. *Macroeconomics and heterogeneity, including inequality*. In: *Handbook of Macroeconomics*, 2B.
- Lakner, C., Millanovic, B., 2016. Global income distribution: from the fall of the Berlin wall to the great recession. *World Bank Econ. Rev.* 30 (2), 203–232.
- Lopez-Daneri, M., 2016. NIT picking: the macroeconomic effects of a negative income tax. *J. Econ. Dyn. Control* 120–139.
- Luduvic, D., 2019. *To Means-Test or Not to Means-Test: Optimality and Life-Cycle Effects of Universal Basic Income Programs*. Working Paper.
- Magnania, R., Piccoli, L., 2020. Universal basic income with flat tax reform in France. *J. Policy Model.* 42 (2), 235–249.
- Mankiw, G., 2000. The savers-spenders theory of fiscal policy. *Am. Econ. Rev.* 90 (2), 120–125.
- Mertens, K., Ravalion, M., 2013. The dynamic effects of personal and corporate income tax changes in the United States. *Am. Econ. Rev.* 103 (4), 1212–1247.

- Paine, T., 1797. *Agrarian Justice*. Devon, UK: Earthsharing Devon, 2017 reprint.
- Phelps, E., 2022. Public Debt: my dissent from "Keynesian" theories. *J. Gov. Econ.* 5, 100029.
- Ravallion, M., 2018. Inequality and globalization: a review essay. *J. Econ. Lit.* 56 (2), 620–642.
- Romer, D., Romer, C., 2010. The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks. *Am. Econ. Rev.* 100 (3), 763–801.
- Rotemberg, J., 1982. Monopolistic price adjustment and aggregate output. *Rev. Econ. Stud.* 49, 517–531.
- Rothstein, J., 2010. Is the EITC equivalent to an NIT? Conditional cash transfer and tax incidence. *Am. Econ. J. Econ. Policy* 2 (1), 177–208.
- Smets, F., Wouters, R., 2007. Shocks and frictions in US business cycles: a Bayesian DSGE approach. *Am. Econ. Rev.* 97 (3), 586–606.
- Stark, O., 2021. Why reducing relative deprivation but not reducing income inequality might bring down COVID-19 infections. *J. Gov. Econ.* 4, 100028.
- Stiglitz, J., 2021. The proper role of government in the market economy: the case of the post-COVID recovery. *J. Gov. Econ.* 1, 100004.
- Suzuki, T., 2021. Basic income, wealth inequality and welfare: a proposed case in New Zealand. *Econ. Anal. Policy* 72, 118–128.
- Wagstaff, A., Cotlear, D., Eozenou, P., Buisman, L., 2016. Measuring progress toward universal health coverage: with application to 24 developing countries. *Oxf. Rev. Econ. Policy* 32 (1), 147–189.