Aligning Public Spending and Taxes in the Moroccan Economy: A Dynamic General Equilibrium Model analysis

El Khalifi, Ahmed and Ouakil, Hicham

Ibn Tofail University

10 July 2024

Aligning Public Spending and Taxes in the Moroccan Economy: A Dynamic General Equilibrium Model analysis*

Ahmed El Khalifi[a], Hicham Ouakil[a]

[a]*Laboratory of Economical Sciences and Public Policies, Faculty of Economics and Management, University of Ibn Tofail, Kénitra, Morocco*

Abstract

We examine the implications of different redistribution policy reforms in Morocco, considering taxation, and based on a dynamic general equilibrium model of three agents: households, firms and Ricardian government. Consequently, a policy that supports public investment guarantees significant social welfare gains, and has a positive multiplier effect on output and tax revenue. However, in the presence of a highly government-dependent population -which behaves like the hand-to-mouth population-, this policy destroys social welfare, through the effect of reducing other expenditure on this population. To counteract this negative impact, authorities can provide additional lump-sum transfers to this population The paper also presents indifference curves (iso-output and iso-income tax), similar to bi-dimensional Laffer curves, associating spending and taxes. A change in any tax could have negative effects on the economy if not combined with a new redistribution of public spending. On the other hand, reducing such a tax followed by a change in spending policy could have positive economic effects (on output, tax revenue and social welfare), and the gains are very high in the case of consumption taxes and employer payroll taxes.

Keywords: Public spending; Ricardian households; Government-dependent households; Taxes; Indifference curves; Welfare cost.

JEL Classification: H21; H32; H42.

*Corresponding author: El Khalifi Ahmed, e-mail: ahmed.elkhalifi@uit.ac.ma.

1. Introduction

Tax policies are extensively discussed in economic literature as instruments to enhance production efficiency and manage public revenue. Developed countries, like those in the OECD, often have near-optimal tax systems, with potential for increased productive efficiency through reductions in taxes on capital income (Trabandt & Uhlig , 2011; Fernández-de-Córdoba & Torres , 2012). Conversely, for developing nations like Morocco, optimal tax systems may involve reducing direct taxes while increasing consumption taxes (**?**Ghiaie et al. , 2019). However, augmenting consumption taxes may negatively impact social welfare, particularly for individuals reliant on public spending for consumption. Alternately, adjusting tax structures by reducing capital taxes and elevating labor income taxes could enhance tax revenue but may dampen economic activity. The role of redistributive policies is crucial in shaping an economy's response to tax policies. The prevalent use of direct taxation in developed countries reflects shifts in spending patterns between investment and consumption over time (Marrero , 2010). Within this framework, there's interest in exploring the potential benefits of policies linking taxation and spending. Zhang et al. (2016) propose an endogenous growth model where government spending on public capital and services, funded through income and consumption taxation, influences firm production functions. They demonstrate that positive growth outcomes can result from allocating consumption tax revenues to public investment expenditure. Moreover, lump-sum transfers (e.g., pensions, family allocations) and public consumption (e.g., education, health spending) are integral components of public expenditure, affecting household income and consumption, and thus should be factored into analyses of optimal tax systems. This paper aims to offer a more nuanced and comprehensive examination of these dynamics.

The primary objective of this paper is to address the following inquiry: How can fiscal policies, taxation and expenditure, be coordinated to maximize production efficiency and enhance societal welfare, all while avoiding the necessity of altering government revenue? To answer this question, we employ a dynamic general equilibrium model that incorporates a government with taxation and redistribution tools. Within this framework, households exhibit Ricardian behavior, optimizing their consumption and leisure levels. Firms operate within a Cobb-Douglas technological paradigm, aiming to maximize profits through the utilization of labor and capital. Government expenditure encompasses consumer goods, public investments, and lump sum transfers. Various forms of taxation are implemented to fund public expenditures, including consumption taxes, income taxes, and consideration of employers' contributions to social security. The interplay between private and public

consumption is governed by a technology characterized by constant elasticity of substitution, reflecting their substitutability. The model's calibration is based on Moroccan economic data covering the period 2010-2020.

The analysis is conducted in two stages. Initially, it outlines the macroeconomic consequences of various redistributive policy reforms, presenting three reform scenarios: adjusting consumption expenditures towards investment or lump-sum transfers, and altering the distribution between lump-sum transfers and public investment. The analysis evaluates the impacts of these scenarios on output, tax revenue, and social welfare. Public investment, recognized in the literature as a tool for stimulating the economy and enhancing social welfare, is highlighted. While reducing consumption expenditure in favor of lump-sum transfers may positively affect output and tax revenue, it could result in welfare losses for households, particularly those reliant on public consumption and transfers in developing countries. The study suggests that increasing public investment may exacerbate economic exclusion and vulnerability among these households. To mitigate negative effects, the Moroccan public authorities could redistribute lump-sum transfers among different populations. In the second part, indifference curves are constructed based on various scenarios and tax levels to illustrate their effects on output and tax revenue. The findings propose strategies to maximize productive efficiency without altering government revenue, such as reducing direct taxation and increasing public investment. Surprisingly, decreasing indirect taxation while boosting investment could yield significant efficiency gains, potentially reducing inequalities and enhancing economic inclusion for vulnerable groups.

The rest of the document is structured as follows. Section 2 presents the economic model. Section 3 describes the data used and the calibration procedure. Section 4 quantifies the distortionary and welfare effects of different redistribution policy reforms. The section 5 considers government-dependent households to reproduce the welfare results of spending reforms. Section 6 characterizes the optimal fiscal policy, linking taxation and redistribution aspects. Finally, section 7 presents some concluding remarks.

2. Model

This paper utilizes a stochastic general equilibrium framework, which involves three key agents: the government, firms, and households. The household, aiming to maximize welfare, allocates its income from labor and capital towards consumption and leisure. Firms aim to maximize profits by utilizing labor and capital as factors of production. The government levies taxes on consumption, wages, capital gains, and profits, with the wage tax split

between employers and employees. Its expenditures encompass consumption, lump-sum transfers, and investments.

The government: Tax revenue, T_t, is collected through consumption tax τ_t^c, labor payroll tax τ_t^l, capital tax τ_t^k, social security tax τ_t^{ss} and profit tax (dividends, Π_t) τ^b. Thus

$$T_t = \tau_t^c C_{P,t} + (\tau_t^l + \tau_t^{ss}) W_t L_t + \tau_t^k (R_t^k - \delta) K_{P,t} + \tau^b \Pi_t \tag{1}$$

where C_t is consumption of goods, W_t is wages, L_t is labor input equal to hours worked, K_t is private capital, with a depreciation rate of δ, and a rental rate of capital, R_t. The government budget is assumed to be balanced, per period, so

$$T_t = G_t \tag{2}$$

where G_t is total government spending. We distinguish three types of government spending: consumption spending (C_g) representing a portion η_1 of government spending, public investment (I_g) with a portion η_2, and lump-sum transfers (Tr_g) with a portion η_3. As a result,

$$C_{g,t} = \eta_1 G_t, \tag{3}$$

$$I_{g,t} = \eta_2 G_t, \tag{4}$$

$$Tr_{g,t} = \eta_3 G_t. \tag{5}$$

The law of motion of stock of public capital is represented by:

$$K_{g,t+1} = (1 - \delta_g) K_{g,t} + I_{g,t} \tag{6}$$

Households: We consider the economy as a unitary set of households. A household $i \in [0, 1]$ seeks to optimize its welfare by choosing the optimal quantities of consumption, investment, and leisure. To this end, a utility function is used, additively separable into consumption (C) and labor (L), represented as follows:

$$\mathrm{u}_t = \frac{C_{i,t}^{1-\rho}}{1-\rho} - \phi \frac{L_{i,t}^{1+\psi}}{1+\psi}, \tag{7}$$

ρ: relative risk aversion parameter. ϕ: willingness to work. ψ: Inverse of the Frisch elasticity of substitution. The effective consumption is a constant elasticity of substitution (CES) function on the private ($C_{i,p,t}$) and publicly provided ($C_{i,g,t}$) goods and services,

$$C_{i,t} = [\gamma C_{i,p,t}^{\sigma} + (1-\gamma) C_{i,g,t}^{\sigma}]^{\frac{1}{\sigma}}, \tag{8}$$

where γ is the CES distribution parameter representing the share of private consumption goods, and σ is a parameter driving the elasticity of substitution between private and publicly provided goods, where the elasticity of substitution is defined as $\upsilon = 1/(1-\sigma)$. The representative household's problem is to maximize the value of her utility given by:

$$Max_{\{C_t,L_t\}_{t=0}^{\infty}} \ \mathcal{U}_t = \sum_{t=0}^{\infty} \beta^t E_t \mathrm{u}_t, \tag{9}$$

where β $(0 < \beta < 1)$ is the discount factor and E_t is the expectation operator, subject to the budget constraint:

$$(1+\tau_t^c)C_{i,p,t} + I_{i,p,t} = (1-\tau_t^{\ell})W_t L_{i,t} + (1-\tau_t^k)R_t K_{i,p,t} + \tau_t^k \delta K_{iP,t} + Tr_{i,g,t} + (1-\tau^b)\Pi_{i,t}, \tag{10}$$

where $I_{iP,t}$ denote private investment, Π the recieved profit and τ^b the profit's tax rate. Capital holdings evolve according to:

$$K_{i,p,t+1} = (1-\delta_k)\, K_{i,p,t} + I_{i,p,t}. \tag{11}$$

From the first order conditions of the household's maximization problem, we derive the following equilibrium conditions:

$$L_{i,t} = \left[\frac{(1-\tau_t^{\ell})W_t}{(1+\tau_t^c)\phi} \gamma C_{i,t}^{1-\rho-\sigma} \ C_{i,p,t}^{\sigma-1} \right]^{1/\psi}, \tag{12}$$

$$\frac{1+\tau^c}{1+\tau^c} \left(\frac{C_{i,t+1}}{C_{i,t}} \right)^{\rho+\sigma-1} \left(\frac{C_{i,p_{t+1}}}{C_{i,p,t}} \right)^{1-\sigma} = \beta \left(1 + \left(1-\tau^k\right) R_{t+1} - \left(1-\tau^k\right) \delta_k \right) \tag{13}$$

The first equation illustrates the optimal labor supply, whereas the second shows the optimal consumption path. Optimal labor supply is distorted by the consumption and labor income taxes, whereas the optimal investment decision in the steady state is only distorted by the capital income tax.

Firms: We assume a competitive market environment. The firm's problem is to find optimal quantities of labor and capital given the technology and the social security tax. The final product, Y_t, depends on labor, private capital, and public capital. The firm rents capital and employs labor from households and maximizes profits, given the wage and the return to capital. The firm use a Cobb-Douglas function as a production technology,

$$Y_t = A_t L_t^{\alpha_1} K_{P,t}^{\alpha_2} K_{G,t}^{\alpha_3} \quad , \qquad \sum_{i=1}^{3} \alpha_i = 1 \tag{14}$$

where α_1, α_2 and α_3 are the elasticity of production with respect to labor, private capital and public capital respectively. A_t is a measure of total factor productivity (TFP). The problem for the firm is to maximize period-by-period profits:

$$\Pi_t = A_t L_t^{\alpha_1} K_{P,t}^{\alpha_2} K_{G,t}^{\alpha_3} - (1+\tau_t^{ss}) W_t L_t - R_t K_{P,t}. \tag{15}$$

From the profit maximization problem we obtain the following two first order conditions:

$$(1+\tau_t^{ss}) W_t = \alpha_1 A_t L_t^{\alpha_1 - 1} K_{P,t}^{\alpha_2} K_{G,t}^{\alpha_3}, \tag{16}$$

$$R_t = \alpha_2 A_t L_t^{\alpha_1} K_{P,t}^{\alpha_2 - 1} K_{G,t}^{\alpha_3}, \tag{17}$$

where the firm's real effective wage cost (including social security contributions) equals the (value of) marginal product of labor.

Competitive equilibrium: Next, we present the feasibility constraint for the economy:

$$Y_t = C_t + I_t + C_{g,t} + I_{g,t}. \tag{18}$$

3. Calibration

The setting of the model is based on four groups of information. Preference parameters (β, ρ, ϕ, ψ, σ), technology parameters (α_1, α_2, α_3, δ_k, δ_g), redistribution parameters (η_1, η_2, η_3, γ) and tax rates (τ^c, τ^ℓ, τ^k, τ^{ss}, τ^π). To represent an annual real interest rate of 3 %, the discount factor is chosen to correspond to around a 0.97 discount factor. Heathcote et al. (2010) set the inverse of the Frisch labor elasticity to 0.72, and the willingness-to-work parameter is calibrated to produce a fraction of hours worked of 0.4, yielding a value of $\phi = 4$. The parameter ρ represents relative risk aversion and varies between 0.5 and 4 (Lambert & Larcker , 1987), and using $\rho = 1$ implies a logarithmic utility function on consumption. It is estimated equal to 2 for OECD countries (Krusell et al. , 1996). Benchimol (2014) set the same value for the euro area. We use a value $\rho = 2$.

Aschauer (1989) and Munnell (1990) estimate values for the public capital share of 0.39 and 0.34, respectively. Cassou & Lansing (1998) considers a range of values between 0.1 and 0.123. However, Aaron (1990) and Tatom (1991) obtain estimates that are statistically weak. A distribution is used in El Khalifi et al. (2022) for a similar production function and for the same country, and is $\alpha_2 = 0.416$ and $\alpha_3 = 0.08$. Accordingly, the technology parameter for the production-labor elasticity is $\alpha_1 = 0.494$. El Khalifi et al. (2022) calculate similar effective tax rates using real data, leading to $\tau^c = 0.22$, $\tau^\ell = 0.14$, $\tau^k = 0.20$, $\tau^{ss} = 0.21$ and $\tau^b = 0.20$.

Total public expenditure is divided into three components: public consumption public investment, and lump-sum transfers. The portion of public investment in total public spending is set at 23%, 58% for final consumption, thus the rest is devoted to lump-sum transfers. The average portion, for the period 2010-2020, of consumption goods between the private and public sectors (γ) is set at 0.752. Total factor productivity (A) at steady state is 1.

The calculation of the substitution elasticity between private and public consumption is the focus of some analyses. Amano & Wirjanto (1997) estimated it to be equal to 0.9 for the United States. More recently, Bouakez & Rebei (2007) estimate a value of 0.33 for the United States. Chiu (2001) estimated a value of 1.2 for Taiwan. Dawood & Francois (2018) estimate the parameter for 24 African countries, including Morocco. They find that the substitution elasticity is less than 1 for 12 countries, with estimated values ranging from 0.26 for Madagascar to 0.92 in Morocco. Indeed, we choose to use $\frac{1}{1-\sigma} = 0.9$. δ_k and δ_g are defined as 7 % and 5 %, respectively. Table 1 summarizes the values of the parameters calibrated in the calculation.

4. Spending Policies Consequences

Government may start to consider distributional policies to achieve economic objectives like stimulating the economy and improving social welfare. The model presented assumes three types of government spending: consumption, investment and lump sum transfers. If the government wishes to increase one type of expenditure, it will have to reduce other expenditures. Indeed, an increase in investment spending, for example, could come at the expense of consumption and/or lump sum transfers. It is assumed that any reform can only affect one pair of government expenditures. Thus, the government can change the allocation of spending either between investment and consumption (scenario 1), between consumption and lump-sum transfers (scenario 2), or between lump-sum transfers and investment (scenario 3). We present how these different possibilities affect the level of output, tax revenue and social welfare. The level of output and tax revenue are strictly increasing on public investment in scenarios 1 and 3, and on lump sum transfers in scenario 2. The results are different for social welfare in scenarios 1 and 2. The distribution between public consumption and lump-sum transfers is optimal, and any change will result in a loss of welfare to households. The welfare gain curve is bell-shaped for reforms related to public consumption and investment, and is positive (and optimal) for consumption portions above 30 % (44 %).

Figure 1 shows the output levels corresponding to the different combinations for each scenario. Output decreases on the public consumption portion (scenarios 1 and 2), and on

Table 1: Calibrated parameters values

Parameter	Description	Value
β	Discount factor	0.975
ρ	Relative risk aversion	2.000
ψ	Inverse of the Frisch elasticity	1/0.72
ϕ	Willigness to work	4.00
τ^{ℓ}	Labor income tax rate	0.140
τ^{k}	Capital income tax rate	0.200
τ^{c}	Consumption tax rate	0.224
τ^{ss}	Employer payroll tax rate	0.207
α_1	Output-Labor Elasticity	0.494
α_2	Output-Private capital Elasticity	0.416
α_3	Output-Public capital Elasticity	0.080
η_1	Public consumption portion	0.580
η_2	lump-sum transfers portion	0.190
η_3	Public investment portion	0.230
γ	Share of private consumption goods	0.752
δ_g	Public capital depreciation rate	0.050
δ_k	Private capital depreciation rate	0.070
$\overline{A}$	Total Factors Productivities	1.000

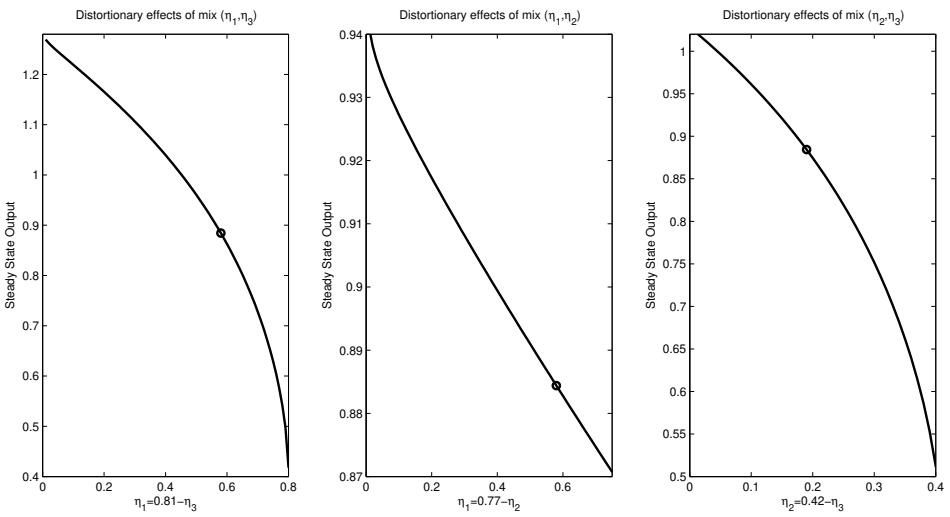


Figure 1: Scenario 1 is the set of possible allocations of expenditures between public consumption and public investment, holding constant the share of lump-sum transfers. Formally, $\eta_1 + \eta_3 = 0.81$. At the origin of the x-axis, $\eta_1 = 0$ and $\eta_3 = 0.81$. For $\eta_1 = 0, 0.01, .., 0.81$, $\eta_3 = 0.81 - \eta_1$, and the figure shows the steady state output level corresponding to each combination. The same exercise was performed for the other two scenarios. Circles: they represent the baseline combination and the corresponding output level.

the lump sum transfer portion (scenario 3). Thus, a reduction in the portion of consumption expenditures directed to public investment and lump-sum transfers has positive effects on output. Increasing the portion of public spending on investment to 26 % (+0.03) leads to an increase in output of 3.4 % in scenario 1, and 3.14 % in scenario 3. Reducing the portion of public consumption to 55 % allows for an output level increased by 0.3 % in the second scenario (3.4 % in the first scenario). The level of output could increase by 14.2% (or 12.7%) if the public investment portion were increased to 37% in scenario 1 (scenario 3). This portion corresponds to the 44 % portion for public consumption, which implies a 10 % higher level of output under scenario 2.

Figure 2 plots the government's revenue over the different scenarios, and is strictly decreasing on public consumption in scenario 1 and 2 and on lump-sum transfers in scenario 3. Indeed, to increase tax revenue through tax expenditures, the government would have to increase the public investment portion at the expense of other expenditures, or reduce the consumption portion in favour of lump sum transfers. Tax revenue could increase by 6.12 % (or 4.17%) with $\eta_3 = 0.30$ and $\eta_1 = 0.51$ ($\eta_2 = 0.12$). If $\eta_1 = 0.51$ is combined with $\eta_2 = 0.26$, tax revenue is expected to increase by 1.90 %. Turning the entire portion of lump-sum transfers into public investment allows tax revenue to rise by 9%. The same additional

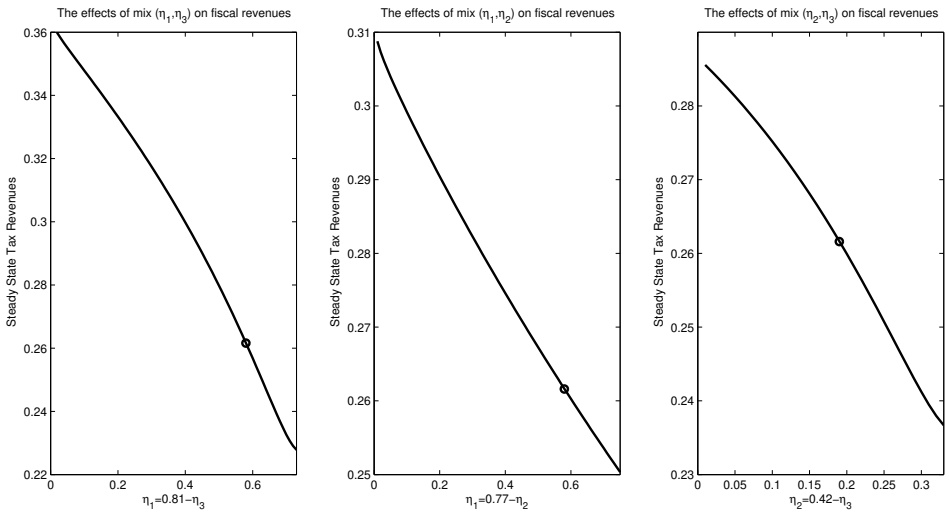


Figure 2: Steady-state fiscal revenues as a function of the public expenditure distribution. The circles represent the baseline combination and the corresponding tax revenues.

investment in scenario 1 implies $\eta_1 = 0.39$ and increases revenue by 11.32 %. A similar portion of public consumption in scenario 2 is combined with $\eta_2 = 0.38$ and corresponds to the increased tax revenue of 5.5%. We see that the gains from reforms that target the rising of public investment at the expense of other expenditures are greater than those targeting lump-sum transfers and public consumption for both tax revenue and output levels.

Figure 3 shows the result in terms of social welfare. The curve is bell-shaped on public consumption in scenario 1 and increasing and concave in scenario 2, while it is decreasing and concave on lump sum transfers in scenario 3. The increase in the portion of public investment at the expense of lump-sum transfers absolutely leads to gains in social welfare, which can reach 4%. The distribution of expenditures between public consumption and lump-sum transfers is optimal, and any redistribution will lead to welfare costs. In scenario 1, whatever the portion η_3 between 0.23 and 0.51, welfare is positive and optimal (2.8%) over $\eta_3 = 0.37$ ($\eta_1 = 0.44$).

The results are not surprising. Public investment is always an important instrument to stimulate the economy. When the investment share of public spending is raised to 0.37 (+0.14), at the expense of consumption spending, households are expected to gain 2.8% of welfare compared to the steady state. These gains can rise to 3.6% if lump sum transfers support the same additional public investment. In fact, additional public spending on public goods such as infrastructure allows firms and households to stimulate themselves, through complementary investments. The new wealth supports household purchasing power, leading

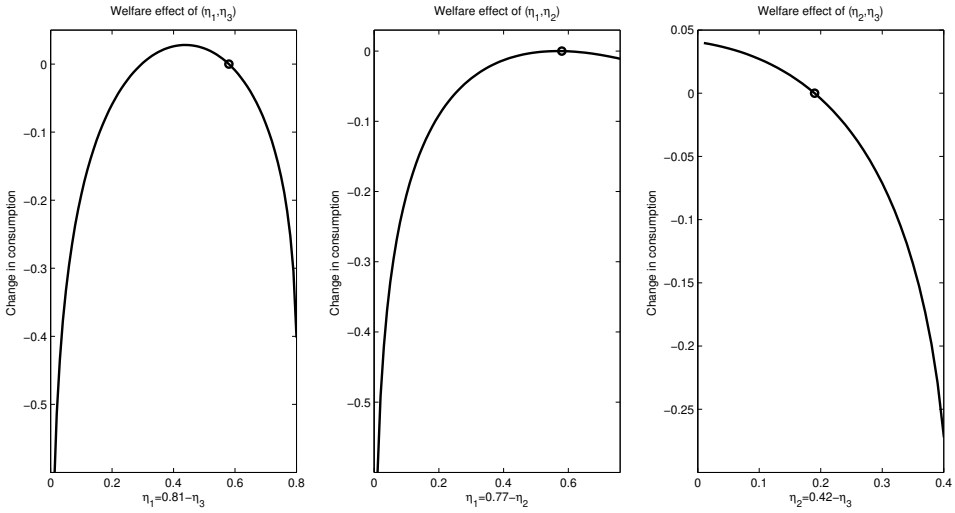


Figure 3: We measure the cost of the redistribution policy in terms of the equivalent change in consumption, i.e. we calculate the%age points by which the consumption of a household living in a steady state would have to increase or decrease if the government changed the expenditure allocation, so that they would be as well off as a household living in a world with no change. We solve the following equation to achieve this, $U((1+\Delta)C, L, \eta_1, \eta_2, \eta_3) = U(C^*, L^*, \eta_1^*, \eta_2^*, \eta_3^*)$, where $\Delta \lesseqgtr 0$ represents the change (positive or negative) in household consumption. This figure shows Δ at steady state for all three scenarios. Circles: represent the baseline combination and the corresponding welfare cost. Here, there is no change and $\Delta = 0$.

to profits for firms, and tax revenue, which offsets the loss of welfare from reduced consumption and transfer spending. In the first case, the gains in output and tax revenues are high. Thus, government priorities can be a tool for choosing between the two strategies. Reducing transfers - such as family allocations and pensions - could lead to more income inequality, while reducing public consumption could create more vulnerability when it affects necessary goods. In contrast, a modest reduction in public consumption of non-necessities, and a reduction in transfers with low externalities such as public grants to wealthy households and/or other countries to encourage public investment, is more important for macroeconomic gains. Public authorities should be prudent when reforming public investment and consumption expenditure. A huge reduction in public consumption to support investment will boost activity and tax revenues, but lead to a loss of welfare for households, and this points to the need for different types of public spending.

5. Government-dependent population

The previous section highlighted the possibility of optimizing the economic situation -output level, tax revenues and social welfare- by modifying redistributive policies. The most interesting case is that of increasing public investment at the expense of other expenditure, which leads to an economic multiplier effect. The specified economy presents a representative household that behaves like a Ricardian agent. However, a large fraction of the population in developing countries have lower incomes and their spending is highly dependent on government spending, lump-sum transfers and government consumption. Thus, the idea of increasing public investment could lead to a welfare loss for this population. The way in which public spending is distributed between different households could have an impact on the macroeconomic effects of public spending reforms.

The aim of this section is to analyze the role of the distribution parameter in the welfare outputs generated by fiscal policy.[1] For the first (and secondary) scenario, we compute for each level of public investment the required distribution of public consumption (the lump sum transfers), which leads individuals to have a zero welfare cost. Figure 5 illustrates the

[1]The household block is modified in this section. The economy consists of a Ricardian population and a government-dependent population. An agent $i \in [\lambda, 1]$ in the Ricardian population has an optimization program similar to the one assumed at the beginning. An agent $j \in [0, \lambda]$ behaves like the "hand to mouth" agents. His consumption, like that of the Ricardian population, depends on government consumption and his income comes from the government, through lump sum transfers. The government has the power to allocate consumption expenditures and lump-sum transfers among the different agents.

results. First, the base combination is at the inflection zone of the indifference curves of the different individuals in the first case. The two curves have two additional points of intersection, i.e. ($\eta_3 = 0.14$; $\pi = 0.46$) and ($\eta_3 = 0.37$; $\pi = 0.54$). These are equivalent combinations to the baseline combination for the welfare of different individuals. An independent increase in public investment at the expense of public consumption leads to welfare costs for the Ricardian population and larger gains for the government-dependent population. If this shift is followed by a change in the distribution of public consumption, the results change and similarly follow the received portion of public consumption. Indeed, individuals become conflicted about any reform that combines investment spending and the distribution of public consumption spending. Any change in the parameter π results in gains for some agents and losses for others. The results are different from those presented in figure 3, where an increase in investment generates welfare gains for the Ricardian population. This is due to the fact that Figure 3 was derived from a model in which transfers and public consumption are completely in the hands of Ricardian households, which is not the case in this section. As a result, the welfare effects of an increase in public investment at the expense of public consumption depend on how public consumption is distributed among individuals, and an increase in public investment could create more economic exclusion if the distribution of consumption expenditures is not adjusted.

Second, the figure illustrates the results for the case of reforms between public investment and lump sum transfers. The welfare isocurve of Ricardian agents takes a convex parabolic shape and that of the government-dependent population is decreasing and concave. With no change in the distribution of lump-sum transfers across households, an increase (or decrease) in investment allows the Ricardian population (the government-dependent population) to realize significant welfare gains. Moreover, the government can achieve welfare gains for different individuals at the same time by pairing an increase in government investment with a more proportional increase in the share of lump sum transfers benefiting the government-dependent population. By allocating all transfers to government-dependent agents, the public authority could increase investment spending to around 33 % of total spending, to improve the welfare of the Ricardian population without affecting other households adversely. This also increases the level of output, leading to additional tax revenue. In the case of a non-existent government-dependent population, any increase in public investment over transfers will have positive effects on the economy (see Figure 3, scenario 3). Without changing the portion of public investment, Figure 5 indicates that both agents can achieve social welfare gains only by reducing the portion of lump-sum transfers from Ricardian agents to those

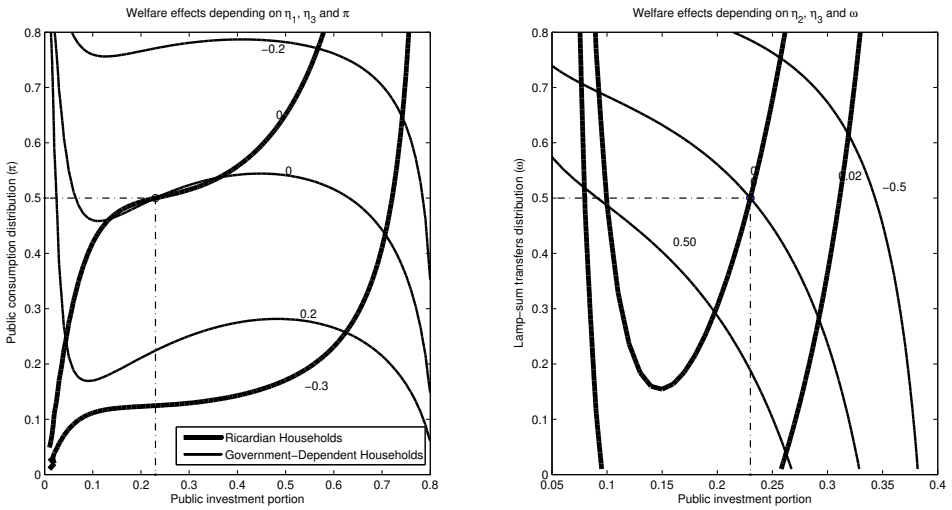


Figure 4: Considering two categories of households: Ricardian households representing about 2/3 of total population. The second household depends on the government, through public expenditure. The parameters π and ω represent respectively the portions of public consumption and lump sum transfers that Ricardian households receive. For the reason of missing information, these parameters are set at 50% in the baseline. Public investment could change in combination with public consumption or lump sum transfers. The left side of the figure (the right side of the figure) shows the indifference curves linking the public investment portion parameter in first (second) case and the public consumption distribution parameter (the lump-sum transfer distribution parameter) for the two household categories. On each isocurve, the implied welfare level is indicated. For the isocurve with 0, the set of combinations have no effect on the welfare of the agents. In the same way, the value 0.2 indicates the increase of the welfare by 20 %. The circles indicate the baseline combinaisons.

who are vulnerable. As a result, the allocation of lump sum transfers plays a key role when supporting public investment expenditures, when a part of the population is dependent on the government.

6. An efficiency bonus: align public spending with taxation

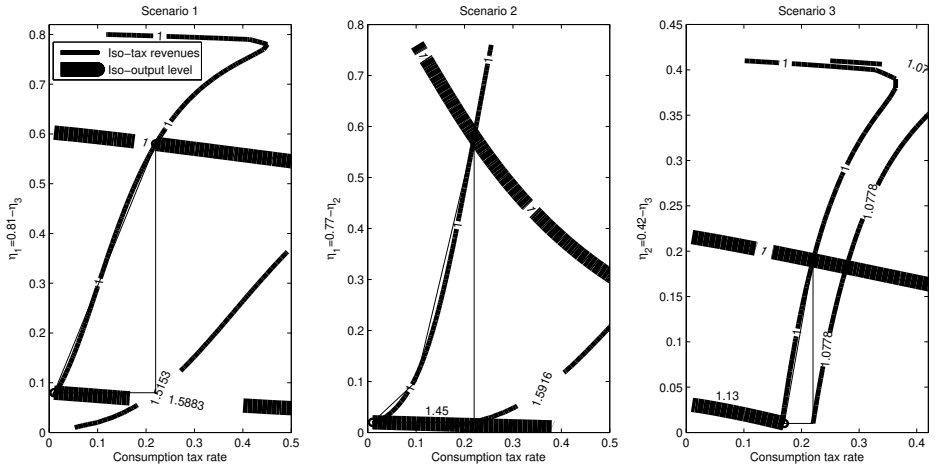
The section 4 presents the set of spending policies that increase tax revenue and output and improve social welfare. The effect of such a strategy on tax revenues explains much of the impact on output and social welfare. The numeric simulation was based on expenditures independently of the tax menu. However, the composition of the tax menu and the way revenues are spent may be more important to the economy than tax revenue and government spending. In other words, given tax revenues, an authority could optimize production (productive efficiency) by matching tax policy with distributional policy. The question we

want to answer is to determine if productive efficiency can be increased in the different scenarios by changing a tax and without influencing government revenues negatively.[2] Then we proceed to examine the answer in terms of social welfare. As a result, the simulations show many strategies that are based on the reduction of a tax rate and the modification of public expenditure redistribution, leading to a significant increase in output level. Surprisingly, the results suggest plans to increase tax revenue also by reducing any tax, including the consumption tax. The reforms defined in the second scenario have no significant impact on household welfare, in contrast to the other scenarios, which show that agents can gain up to more than 4.5% of their consumption.

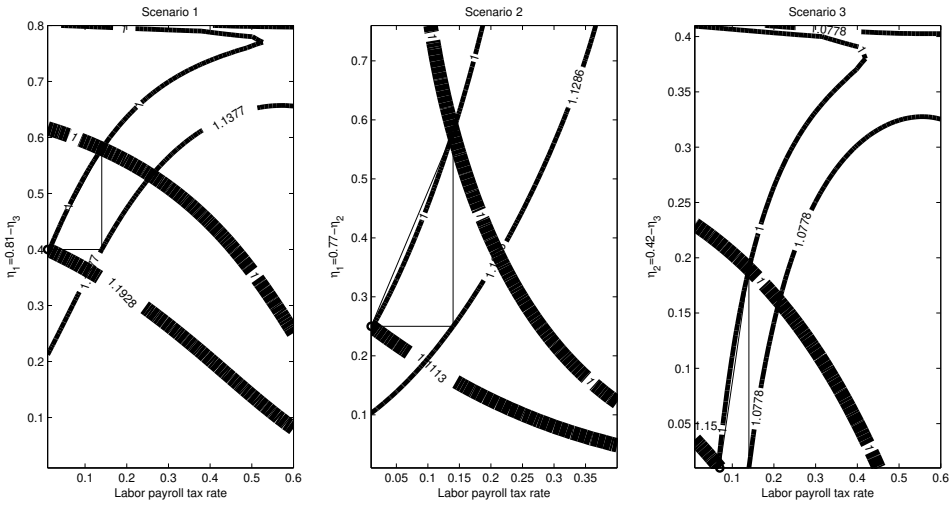
Figure 6 illustrates the results of the simulations, with emphasis on the importance of tax menu composition in the relationship between productive efficiency and redistributive policies. Indeed, the maximum productive efficiency could be achieved by reducing the portion of public consumption in favor of public investment and by cancelling one of the tax rates. The results are similar to scenario 2. The optimum involves a reduced portion of consumption in favor of lump-sum transfers, combined with a zero tax rate. Finally, for scenario 3, the maximum productive efficiency requires a lower tax rate and an increase in the public investment portion at the expense of lump sum transfers. The public consumption portion (or the lump-sum transfer portion) would have to be directed entirely to lump-sum transfers (public investment) if the government chose to cancel the consumption tax (the capital income tax) to maximize productive efficiency. The productive efficiency gains for scenarios 1 and 2 are relative; they are very high on the consumption tax and on the employer contribution rate, and are low on the capital income tax, namely (58 %,27 %,11 %) and (45 %,16.5 %,7.8 %). For scenario 3, the optimal gains appear to be similar on the different taxes, ranging from 13 % to 15 %.

The figure also plots a right triangle for each scenario and tax, and the hypotenuse connects the base combination and the one that maximizes production. The slope of the hypotenuse measures, approximately, the number of%age points by which an expenditure should change when a tax decreases by one point to increase output and keeps public revenue

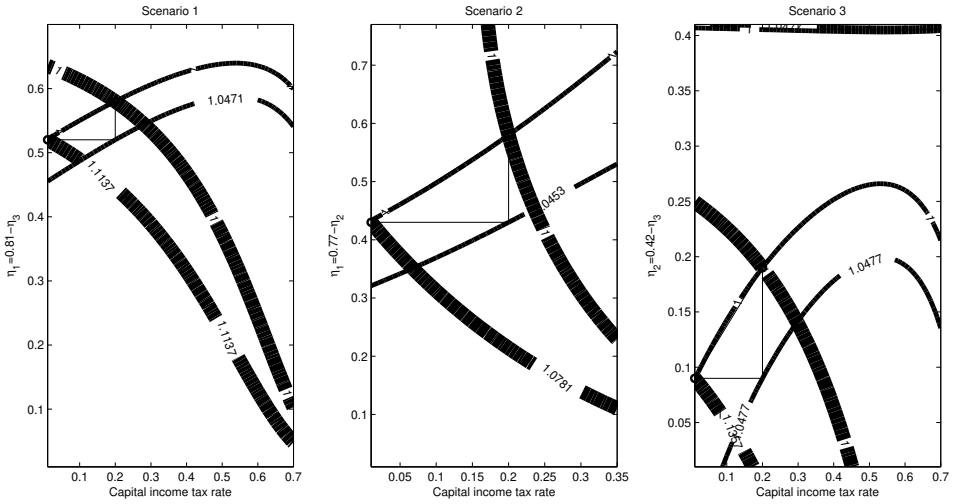
[2]Fernández-de-Córdoba & Torres (2012) studied the implications for output level and tax income considering only the tax menu, and drew bidimensional Laffer curves for OECD countries. Trabandt & Uhlig (2011) performed a similar exercise for EU-14 and US. El Khalifi et al. (2022) plot uni- and bi-dimensional Laffer curves for the case of Morocco. The unidimensional curves show how tax revenue depends on different tax rates. The bi-dimensional curves, in addition, show how to optimize the level of output, given the tax revenue, based on two tax rates. Similarly, this section seeks to present the optimal fiscal policy by constructing bidimensional curves, linking the tax and public spending aspects.


Scenario 1
Scenario 2
Scenario 3
Iso−tax revenues
Iso−output level
Consumption tax rate
Consumption tax rate
Consumption tax rate
1.5153
1.5883
1.5916
1.45
1.0778
1.13

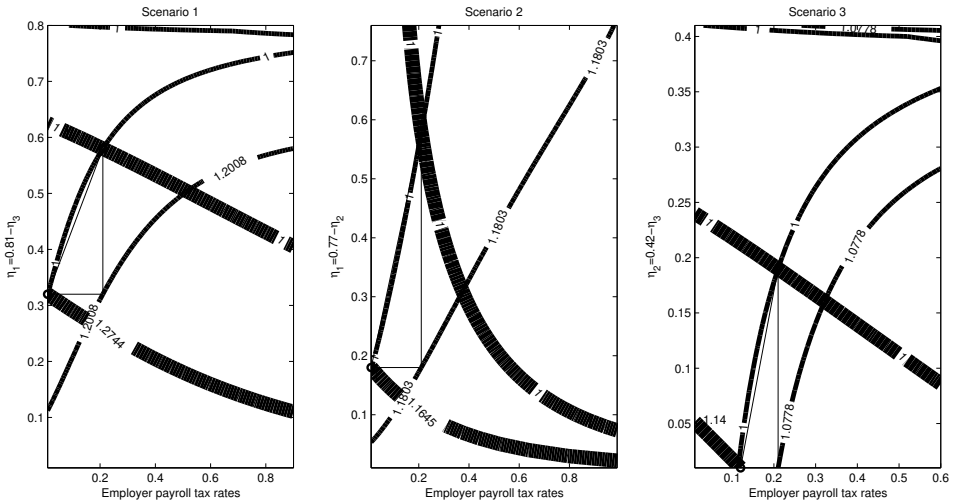
(a)


Scenario 1
Scenario 2
Scenario 3
Labor payroll tax rate
Labor payroll tax rate
Labor payroll tax rate
1.1377
1.1928
1.1286
1.1113
1.0778
1.0778
1.15

(b)



(c)



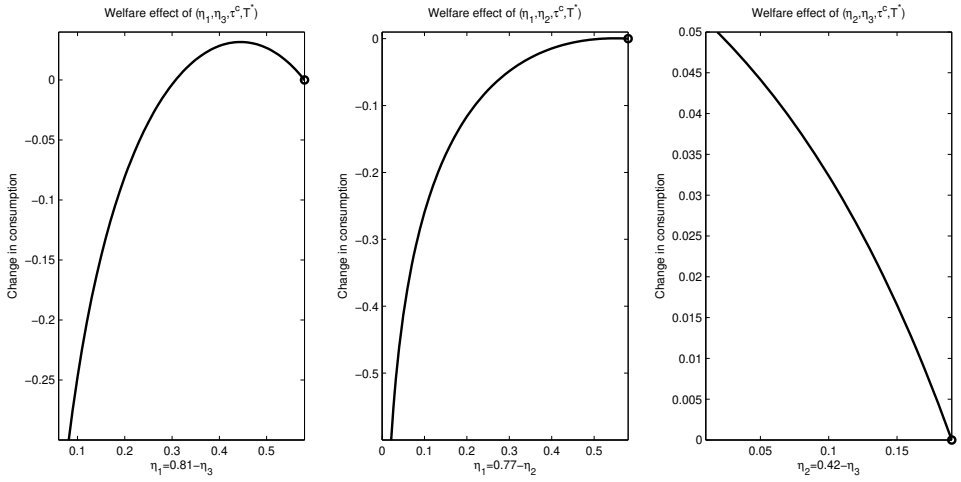
(d)

Figure 5: The figure shows the iso-income tax in yellow and the iso-output in blue for different scenarios and different taxes. Figure 5a (and 5b, 5c, **??**) illustrates those for the consumption tax (the labor tax, the capital tax, and the employer payroll tax). Scenario 1 (figure 5a) presents isocurves based on the combination of η_1 and τ^c, taking into account the restriction $\eta_1 + \eta_3 = 0.81$. The numbers on the curves are the values of tax income and output, expressed as a portion of base values. Thus, the indifference curves with the number "1" correspond to steady state values. Similarly, scenarios 2 and 3 plot the indifference curves combining η_1 and η_2 with τ^c and constrained by $\eta_1 + \eta_2 = 0.77$ and $\eta_2 + \eta_3 = 0.42$, respectively. Circles: the intersection point of the isocurves marked by "1" corresponds to the basic combination (η, τ). The second circle marks the maximum productive efficiency.

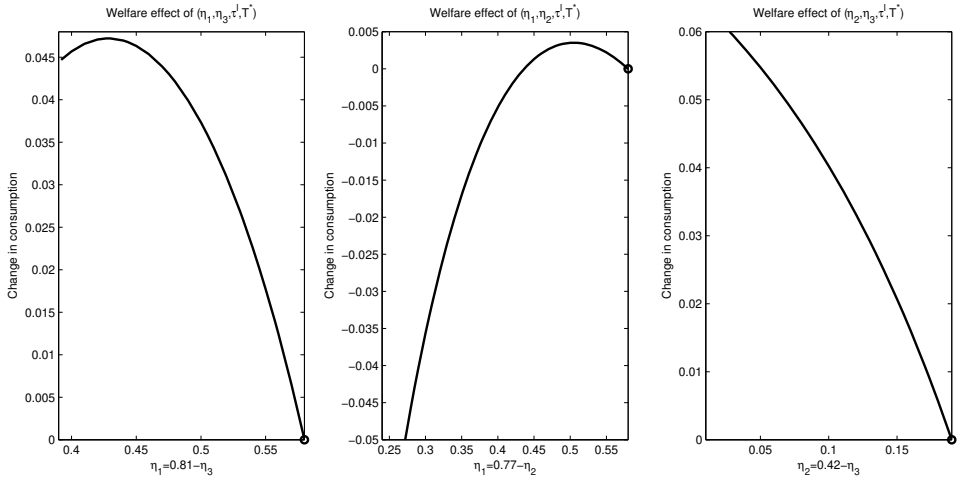
unchanged. It is equal to (2.38, 2.67, 3.6) for scenarios 1 to 3 and for the consumption tax, (1.38, 2.54, 2.57) for the labor income tax, (0.32, 0.79, 0.53) for the capital tax, and (1.3, 2, 2) for the employer social contribution rate. An independent increase (decrease) in the tax rate leads to an increase (decrease) in tax revenue and a decrease (increase) in output level. A modest decrease in a tax rate followed by an increase in public investment - in scenarios 1 and 3 - or an increase in lump-sum transfers - in scenario 2 - more proportional than the slope of the hypotenuse, the level of output and tax revenue are expected to rise at the same time. If it is less proportional, tax revenue is expected to fall. As a result, both tax revenue and output can be boosted by reducing any tax, if redistributive policies are revised. The points on the opposite side of the triangle correspond to spending compositions that increase government revenue and the level of output, without changing taxes. The adjacent presents the combinations allowing a higher tax revenue and production level, by reducing only the tax rates, and taking into account the optimal distribution of spending. The right angle corresponds to the combination that stimulates the economy and maximizes the level of tax revenue, and figure 6 plots the iso-income tax passing through this point in each case. This point is the fiscal optimum - i.e. the combination that allows the maximum tax revenue to be achieved by modifying the distribution of expenditure alone - for scenario 2 on the consumption tax and for scenario 3 on taxes other than the capital tax. The area of the triangle represents the set of combinations that can produce higher levels of both output and tax revenue. The main idea behind this triangle is that it is possible to achieve a higher level of tax revenue and output by reducing tax rates followed by a change in government spending.[3]

Considering the set of combinations -of the hypotenuse- in which the output level is higher than the steady state level, figure 6d presents the results in terms of welfare for different scenarios of fiscal reforms. The different combinations of scenario 1 produce welfare gains of 4.7 % on the labor tax and the employer social contribution rate, and 5% on the capital income tax. For the consumption tax, the gains are positive only on reforms at which the public consumption portion is between 31 % and 58 %, and (the gains) go up to 3.2 %. On the side of redistribution between public consumption and lump-sum transfers, the reforms

[3] The triangles in figure **??** are a series of combinations of fiscal policies (spending policies and tax policies) that have strictly positive effects on tax revenues and output levels. We will therefore use the expression "positive fiscal policies triangle" in the remainder of this paper. A very important feature of this triangle is that new taxes are lower than basic taxes. Similarly, the hypotenuse is indicated as a set of stimulus fiscal policies, because it implies a higher output and tax revenue identical to that of the steady state.



(a)

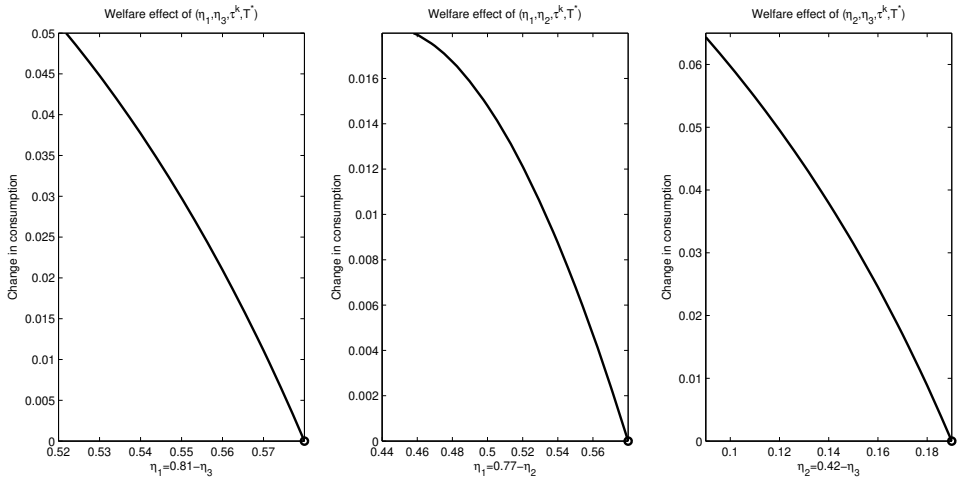


(b)

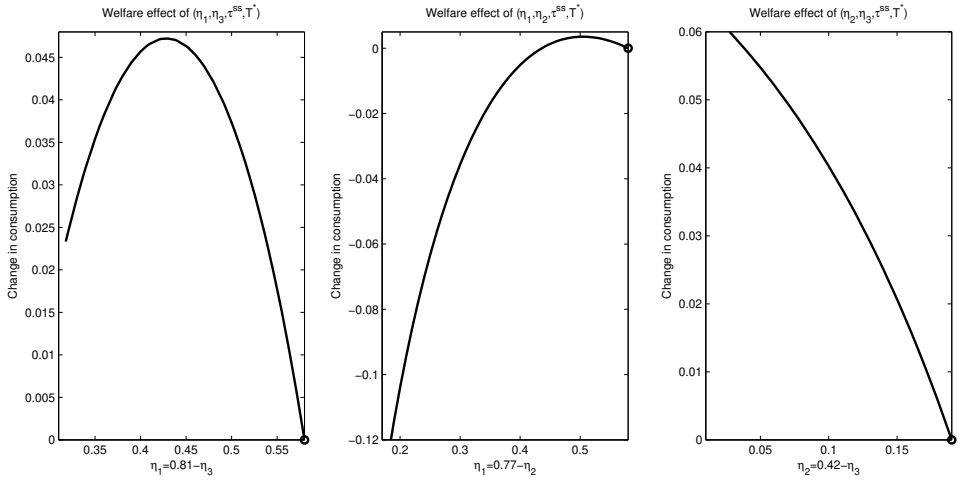
related to the consumption tax allow households to lose welfare. The gains are positive for those related to the capital tax, and can go up to 1.6 %. They are small and insignificant for reforms related to the labor tax and the employer contribution rate, for the portion of public consumption between 44 % and 58 %. Strategies that support public investment over lump-sum transfers have higher positive gains, and can increase to 5 % for consumption taxes and 6 % for other taxes.

7. Conclusion

This study develops a dynamic general equilibrium model incorporating three categories of public expenditure: public consumption, public investment, and lump-sum transfers.



(c)



(d)

Figure 6: This computes the welfare cost over the set of combinations (η, τ) allowing a level of tax revenue identical to that of the steady state (T^*), and an output level higher than that of the steady state. The combinations are selected from the Figure 5 for each scenario and tax. Circles: represent the basic combinations, corresponding to zero welfare costs.

Through the analysis of three reform scenarios, each characterized by different allocations of public spending, we assess their impacts on economic output and tax revenues. Scenario 1 focuses on adjustments to public consumption and lump-sum transfers, while Scenario 2 examines reforms between public consumption and public investment, and Scenario 3 evaluates reforms between public investment and lump-sum transfers. Our findings indicate that augmenting public consumption at the expense of either public investment or lump-sum transfers yields detrimental effects on output and tax revenues. Conversely, elevating lump-sum transfers at the cost of public consumption can potentially enhance household welfare, provided that the proportion of consumption expenditure exceeds 30%. Furthermore, reducing public investment in favor of supporting lump-sum transfers demonstrates positive economic repercussions. However, when a segment of households becomes vulnerable and dependent on the government, supporting public investment can exacerbate economic disparities. Here, the authorities could mitigate inequalities by redistributing lump-sum transfers to help vulnerable households. Additionally, our analysis encompasses reforms that integrate public expenditure adjustments with taxes. The outcomes underscore the potential for achieving comprehensive economic objectives through the reduction of specific taxes combined with an increase in public investment. The gains would be greater if spending reforms were associated with consumption tax and/or employer contribution rates.

References

Aaron, H. J. (1990). Discussion of why is infrastructure important. Is there a shortfall in public capital investment, 51-63.

Amano, R. A., & Wirjanto, T. S. (1997). Intratemporal substitution and government spending. Review of Economics and Statistics, 79(4), 605-609.

Aschauer, D. A. (1989). Is public expenditure productive?. Journal of monetary economics, 23(2), 177-200.

Benchimol, J. (2014). Risk aversion in the Eurozone. Research in Economics, 68(1), 39-56.

Bouakez, H., & Rebei, N. (2007). Why does private consumption rise after a government spending shock?. Canadian Journal of Economics/Revue canadienne d'économique, 40(3), 954-979.

Cassou, S. P., & Lansing, K. J. (1998). Optimal fiscal policy, public capital, and the productivity slowdown. Journal of economic dynamics and control, 22(6), 911-935.

Chiu, R. L. (2001). The intratemporal substitution between government spending and private consumption: Empirical evidence from Taiwan. Asian Economic Journal, 15(3), 313-323.

Dawood, T. C., & Francois, J. N. (2018). Substitution between private and government consumption in African economies. Economic Modelling, 73, 129-139.

El Khalifi, A., Ouakil, H., Torres, J. L. (2024). Efficiency and Welfare Effects of Fiscal Policy in Emerging Economies: The Case of Morocco. International Economic Journal, 38(3), 507–530.

Fernández-de-Córdoba, G., & Torres, J. L. (2012). Fiscal harmonization in the European Union with public inputs. Economic Modelling, 29(5), 2024-2034.

Ghiaie, H., Auclair, G., & Ntsama, J. F. N. N. (2019). Macroeconomic and welfare effects of tax reforms in emerging economies: a case study of Morocco. Journal of Policy Modeling, 41(4), 666-699.

Heathcote, J., Storesletten, K., & Violante, G. L. (2010). The macroeconomic implications of rising wage inequality in the United States. Journal of political economy, 118(4), 681-722.

Krusell, P., Quadrini, V., & Rios-Rull, J. V. (1996). Are consumption taxes really better than income taxes?. Journal of monetary Economics, 37(3), 475-503.

Lambert, R. A., & Larcker, D. F. (1987). An analysis of the use of accounting and market measures of performance in executive compensation contracts. Journal of Accounting research, 85-125.

Marrero, G. A. (2010). Tax-mix, public spending composition and growth. Journal of Economics, 99, 29-51.

Munnell, A. H. (1990). Why has productivity growth declined? Productivity and public investment. New England economic review, (Jan), 3-22.

Tatom, J. A. (1991). Public capital and private sector performance. Review, 73.

Trabandt, M., & Uhlig, H. (2011). The Laffer curve revisited. Journal of Monetary Economics, 58(4), 305-327.

Zhang, L., Ru, Y., & Li, J. (2016). Optimal tax structure and public expenditure composition in a simple model of endogenous growth. Economic Modelling, 59, 352-360.