Inequality, imperfect competition, and fiscal policy

Balamatsias, Pavlos

24 October 2017

Inequality, imperfect competition and fiscal policy

Pavlos Balamatsias

Abstract

We build an N.K. model with imperfectly competitive goods markets and heterogeneous individuals and examine their impact on fiscal multipliers and on the net increase in output and expenditure caused by fiscal policies, using the balanced budget multiplier. Results show that in highly unequal economies the maximum net increase in output and expenditure comes when governments increase expenditure and tax high-income workers because the adverse effects on the economy are smaller. However, as inequality decreases and enough people belong to the high-income group spending should be funded by taxing low-income people. Finally, inequality also affects the welfare effects of fiscal policies.

(JEL classification codes: D63, E12,E62)

Keywords : Income inequality, Fiscal multiplier, Public Expenditure, Taxation

Pavlos Balamatsias, Greece, pavlosbalamatsias@yahoo.com

1. Introduction

Economic theory has long established that the marginal propensity to consume (MPC) plays an important part in the economic decisions of individuals (Blanchard and Johnson 2012:47). Also recent work by Carroll, Slacalek and Tokuoka (2014) and by Carroll, Slacalek, Tokuoka and White (2016) has confirmed the theoretical assumption that there exists a inverse relationship between income and an individual's MPC with wealthier individuals using a smaller percentage of their income for consumption and vice versa. These works have also shown that there exists considerable variation in the MPC between different income groups in an economy and the reason for this variation is the distribution of income between the different income groups, or in other words income inequality.

An important implication of these findings is that income shocks have a different effect on individuals and that income inequality affects economic policy; however, most economic models do not incorporate income inequality or even the MPC in their analysis. Simple new Keynesian models such as Mankiw (1987), Molana and Moutos (1992) and Torregrosa (1999) and even more complex DSGE models like Bouakez and Rebei (2007), Ercolani (2007) and Forni, Gerali and Pisani (2010) either operate under the assumption of the representative agent or, even if they have heterogeneous agents, do not use the MPC in their analysis. It this gap in the literature we try to cover by building a simple model with income inequality, which results in different MPCs. More specifically we use a simple general equilibrium model of an economy with imperfect competition as in Mankiw (1987), Molana and Moutos (1992); but we expand it by adding heterogeneity, in the form of increased skill endowment, and this heterogeneity along with the different MPCs results in income inequality between individuals. We then examine how income inequality and imperfect competition influence fiscal policy.

Our results indicate that imperfect competition and income inequality have an impact on the size of fiscal multipliers. In the case of government spending, our findings show that the multiplier of government spending is bigger the greater imperfect competition and the more unequal the economy is. In addition, inequality and imperfect competition increase the magnitude of tax multipliers the same way they affect government spending. Consequently when examining the balanced budget multiplier we find that income inequality and imperfect competition also have an effect on the net economic impact of fiscal policy. More specifically, we find that in unequal societies, where the majority of the population has low incomes, increasing government spending and then taxing the minority of high-income workers achieves the maximum net increase in output and expenditure. However, as the percentage of high-income workers increases, fiscal multipliers become smaller and so does the impact of spending and taxation on output and expenditure. Consequently, for sufficient percentages of high-income workers the maximum net increase in output and expenditure comes when the government increases spending and finances it by taxing the minority of low-income workers. Finally, we examine the welfare effects of government policies. The findings show us that government spending financed by taxation can benefit both income groups; or at least benefit the income group that does not pay any taxes while eliminating the welfare losses of the income group that pays taxes, leading to a Pareto improvement. Income inequality plays an important part once again because it positively affects the welfare losses of taxation. These results suggest that fiscal policy which takes into account income inequality between individuals and uses the right mix of spending and taxation can help stabilize the economy and promote growth while minimizing any welfare losses.

The rest of the paper is organized as follows. In section 2, we provide the model of our economy. Section 3 has an analysis of public spending schemes financed by lump-sum, labour and profit taxes respectively. Section 4 analyses the welfare effects of government policies and how income inequality affects them. Section 5 concludes.

2. The economy

The model we will use is based on a simple new Keynesian model of imperfect competition like the ones of Mankiw (1987), and Molana and Moutos (1992). We construct the simplest economic model possible in order to illustrate the main idea we want to present in this paper. Since our main objective is to examine how income inequality affects fiscal policy, we will refrain from using more complex general equilibrium models, which could alter but not invalidate our argument.

2.1 Individuals

We assume that the economy is populated by a continuum of individuals indexed by $\lambda \in (0;1)$. A percentage λ of those individuals belong to Type 1 and have no skill endowment, while the remaining $(1-\lambda)$ percentage are Type 2 individuals, who have high skill endowment due to education or work experience.

The time available to all individuals equals T. This time is divided between working hours, N and leisure, L. However, as we mentioned Type 2 individuals are skilled workers; for this reason their labour productivity is bigger. Therefore the effective labour supply of a Type 2 individual is $(\mathrm{N}+\varepsilon_i)$ where $\varepsilon_i > 0$ shows the increased productivity of a Type 2 worker. The labour supply of a Type 1 individual equals N. Wages are equal to the amount of labour supplied by each individual so Type 1 workers have a wage equal to N and Type 2 workers have a wage equal to $(\mathrm{N}+\varepsilon_i)$.

People choose between two goods, consumption and leisure. As we have seen in Carroll, Slacalek and Tokuoka (2014) and in Carroll, Slacalek, Tokuoka and White (2016) individuals with higher incomes use a smaller percentage of their income for consumption compared to those who have smaller incomes; in other words their MPC is smaller. For this reason, we assume that Type 1 people choose more consumption and less leisure compared to Type 2 individuals.

Each individual maximizes a Cobb-Douglas utility function where he chooses between consumption (C_i) and leisure (L_i) based on the information we analyzed in the previous paragraphs:

$$U_1 = a_1 \log C_1 + (1-a_1)\log L_1, \quad a_1 < 1 \qquad (1)$$

$$U_2 = a_2 \log C_2 + (1 - a_2) \log L_2, \quad a_2 < 1 \qquad (2)$$

Based on our assumptions about the differences between individuals and the aforementioned literature, we assume that $\alpha_1 > \alpha_2$ which shows that Type 1 individuals use a greater percentage of their income for consumption, compared to Type 2 individuals who have bigger incomes but consume a smaller percentage of their income.

Individuals are also the owners of the economy's firms and receive profits Π while they pay all taxes. We first assume that people pay a lump-sum tax, V_i but we will later change that assumption. Each individual's budget constraint is therefore:

$$PCi = (T - L_i) + \Pi - V_i \ ,$$

$$PCi + L_i = T + \Pi - V_i \quad (3)$$

As we mentioned before, α_1 and α_2, denote the share of income which is used for consumption. Using these indexes, we find the consumption function of every type of individual.

$$PC_1 = \alpha_1 (T + \Pi - V_1) \quad (4)$$

$$PC_2 = \alpha_2 [(T + \varepsilon_i) + \Pi - V_2] \quad (5)$$

Equations (4) and (5) are the consumption functions for each one of the two types of people in the economy and α_1, α_2 denote their MPCs. Note that in equation (5) the consumption of Type 2 individuals is higher by ε_i. That is because these individuals can consume more due to their higher skills and higher incomes. However, this effect is mitigated by their lower MPC.

2.2 Firms

We have a number of M firms in the economy, and each firm produces quantity q of a single good using labour as their only input. The demand function for the whole industry equals:

$$Q = \frac{Y}{P} \quad (6)$$

where Q is total output of the industry P the price level and Y is the economy's expenditure.

The cost function of each firm is:

$$TC(q) = F + cq \quad (7)$$

We assume, as in Mankiw(1987) and Molana and Moutos(1992) that firms operate in an environment of imperfect competition and have market power. We calculate market power by using the Lerner Index (Lerner 1934: 157-175)

$$\mu = \frac{P - MC}{P} \quad (8),$$

where μ is the Lerner index, MC the marginal cost and P the price level.

Combining equations (6) and (8) and by differentiating equation (7) we get the following equation describing the demand function of the industry:

$$Q = \frac{(1-\mu)}{c} Y \quad (9)$$

We then calculate total profits for the whole industry which equal revenue minus the costs:

$$\Pi = PQ - MF - cQ \quad (10)$$

Using equation (9) and assuming for simplicity that fixed costs are equal to zero we express profits in terms of expenditure and the profit mark-up that firms have:

$$\Pi = \mu Y \quad (11)$$

Equation (11) shows that profits in the economy depend on expenditure.

2.3 Government

Government raises revenue from taxation in order to produce and provide a single public good to the economy. The level of taxes raised is equal to $V_1 + V_2$ and it is used to buy goods produced by the firms, which are then used as input to produce the public good. This public good can be some form of social service (e.g. education, healthcare) or purely economic in nature (e.g. production of energy, fuel, manufacturing goods and infrastructure by government owned enterprises). The government budget constraint requires that spending equals revenue:

$$V_1 + V_2 = G \quad (12)$$

$$G = f(q) \quad (13)$$

2.4 Total expenditure and output

Total output in the economy is equal to the sum of expenditure of the private sectors i.e. Type 1 and Type 2 individuals and government expenditure:

$$Y = PC_i + G \quad (14)$$

Using equations (4) and (5) and the population percentages to substitute in equation (14) we find:

$$Y = \lambda a_1(T + \Pi - V_1) + (1-\lambda)a_2[(T + \varepsilon_i) + \Pi - V_2] + G \quad (15)$$

Using equation (11) and rearranging terms we find an expression that also makes use of the Lerner index:

$$\begin{aligned} Y = &\frac{\lambda a_1 T}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} + \frac{(1-\lambda)a_2(T+\varepsilon_i)}{1-[\lambda a_i + (1-\lambda)a_2]\mu} - \frac{\lambda a_1 V_1}{1-[\lambda a_i + (1-\lambda)a_2]\mu} \\ &- \frac{(1-\lambda)a_2 V_2}{1-[\lambda a_i + (1-\lambda)a_2]\mu} + \frac{G}{1-[\lambda a_i + (1-\lambda)a_2]\mu} \end{aligned} \quad (16)$$

Equation (16) shows that in our model output is affected by taxation (V_i), government spending (G) and the Lerner index (μ), just like in other New-Keynesian models of imperfect competition. Private consumption also plays a role through the different MPCs (a_i) which are, as we noted before, a result of income differences. However, when we allow for the existence of heterogeneous agents, we see that consumption and in turn output is not affected by the MPC alone, but rather by income inequality, which is the product of income distribution and the MPC ($\lambda\alpha_1$ and $(1-\lambda)\alpha_2$). Different labour supplies, and subsequently different wages (T and $T+\varepsilon_i$), also play an important role since the bigger the difference, the bigger income inequality will be.

3. Fiscal policy using different tax financing sources

In this section, we examine the impact of income inequality and imperfect competition on fiscal policy. Specifically we examine how imperfect competition and income inequality affect the size of fiscal multipliers. In addition, using the balanced budget multiplier seen in Mankiw (1987) we examine the effect of imperfect competition and income inequality on the net increase on output and expenditure, i.e. the net economic effect of fiscal policies. For the time being we ignore any changes these policies can cause in the welfare of any income group and focus only on the effect that government spending and taxation have on output and expenditure. We will deal with this issue in section 4, where we examine the welfare losses that these policies can cause and the possibility of a Pareto improvement.

3.1 Government spending financed by lump-sum taxes

First, consider an increase in government spending, financed by increasing lump-sum taxes:

$$\frac{dY}{dG}=\frac{1}{1-[\lambda a_1+(1-\lambda)a_2]\mu}\geq 1 \quad (17)$$

This result is similar to the government spending multiplier seen in most textbooks. As expected increases in government spending raise expenditure and output in the economy. As we can see the increase in output and expenditure caused by government spending becomes greater the more market power firms have. This happens because increases in government spending help raise profits, which in turn raise expenditure and output in the economy even further in the way the textbook Keynesian public spending multiplier and the multiplier in Mankiw (1987) work. In the limiting case where μ=0 this process ends after the initial increase in government spending and the multiplier is unity. Therefore imperfect competition is crucial in our analysis because as firms' market power increases, $\frac{dY}{dG}$ approaches the standard government spending multiplier of Keynesian models which is greater than unity.

The important finding in this model however is that income inequality positively affects government spending multipliers. Just like in ordinary Keynesian models, the MPC has a positive effect on the size of the multiplier but in the case of heterogeneous agents it is the product of the MPC and the percentages of people belonging to each income group – in other words income inequality – that affect fiscal multipliers. According to equation (17) the bigger income inequality is, the bigger the fiscal multiplier of government spending becomes; this means that increases in government spending lead to a greater rise in output and expenditure the bigger income inequality in an economy is. The rationale behind this result is fairly simple and straightforward: As income inequality increases, the percentage λ of people belonging to the Type 1 category which has lower incomes but a bigger MPC of α_1 increases as well; at the same time the percentage $(1-\lambda)$ of Type 2 people who have higher incomes but a smaller MPC of α_2 decreases with income inequality. As a result the more unequal an economy, the bigger $(\lambda\alpha_1 + (1-\lambda)\alpha_2)$ becomes, which in turn means that the denominator of equation (17) becomes smaller and its overall result bigger.

Therefore, in highly unequal economies where $\lambda\alpha_1 > (1-\lambda)\alpha_2$, the aggregate consumption of Type 1 people is much bigger compared to the consumption of Type 2 people who have the smaller MPC of α_2, because they individually consume much more than Type 2 people do and also because they constitute a much larger segment of the population. Consequently, the aggregate effect in output and expenditure from increased public spending in an unequal economy will be much bigger when compared to a equal economy. This is why in highly unequal economies where the majority of the population belongs to the low-skill, low-income group increases in government spending have a bigger positive effect on output and expenditure.

After increasing government spending, the government chooses which population group to tax in order to have a balanced budget:

$$\frac{dY}{dV_1} = \frac{-\lambda a_1}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \quad (18)$$

$$\frac{dY}{dV_2} = \frac{-(1-\lambda)a_2}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \quad (19)$$

As we can see in equations (18) and (19) the size of the fiscal multiplier of taxes is positively affected by the size of market power, and by income inequality, just like in the case of public spending in equation (17). Just like in the case of government spending, when $\lambda\alpha_1 > (1-\lambda)\alpha_2$ - in other words in a highly unequal economy - aggregate consumption of Type 1 individuals is much bigger compared to the consumption of Type 2 people, because they individually consume much more than Type 2 people do (since $\alpha_1 > \alpha_2$) and also because they constitute a much larger segment of the population. Therefore, the negative effect of a tax increase in output and expenditure is bigger in highly unequal economies.

As the percentage of high-skilled workers in the economy increases, the effects of fiscal policy change. Government spending multipliers become smaller the more equal the economy becomes because $(\lambda\alpha_1 + (1-\lambda)\alpha_2)$ is now smaller since more people now belong to the $(1-\lambda)$ percentage of people who have higher incomes and as result a smaller MPC of α_2; this means that they use less of their extra income for consumption. Moreover, since high-income workers are now a bigger part of the population, the negative effect that taxing these individuals has on the economy becomes bigger. Eventually, for sufficiently high percentages of high-income workers, i.e. when $(1-\lambda)\alpha_2 > \lambda\alpha_1$, taxing the minority of low-income individuals is now the best policy because it has a smaller negative effect in output and expenditure compared to taxing high-income workers.

In order to examine the net economic impact of fiscal policy we use the balanced budget multiplier seen in Mankiw (1987), which gives us the net increase in output and expenditure caused by increased government spending financed by taxes. To use this multiplier we simply subtract equation (18) from equation (17) and equation (19) from equation (17):

$$\frac{dY}{dG_{G=V_1}} = \frac{(1-\lambda\alpha_1)}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu} \geq 1 \quad (20)$$

$$\frac{dY}{dG_{G=V_2}} = \frac{[1-(1-\lambda)\alpha_2]}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu} \geq 1 \quad (21)$$

Equations (20) and (21) show us the net increase in expenditure and output caused by increased government spending when Type 1 or Type 2 people are taxed respectively i.e. the balanced budget multiplier. Comparing equations (20) and (21) helps us find which income group government should tax when government expenditure increases in order to achieve the maximum net increase in output and expenditure. This comparison also reveals the effect of income inequality on the net effects of fiscal policy.

As we can see when comparing the balanced budget multipliers, the crucial term in the analysis is income inequality. In a highly unequal economy, where $(1-\lambda)\alpha_2 < \lambda\alpha_1$, the maximum net increase in expenditure and output comes when the government increases government spending and taxes the minority of high skilled, high-income workers as the adverse effects on expenditure and output will be smaller. The logic behind this idea is one analyzed before: In an economy where the majority of the population belongs to the low-income group taxing these people has a greater adverse effect on the economy due to that group's greater MPC and because they represent such a big part of the population. Therefore, unequal economies should tax high-income individuals because they have smaller MPCs and constitute a smaller part of the population. As the percentage of high-income workers increases and they become the majority, the negative effect of taxing these people increases. Eventually when the number of Type 2 workers becomes big enough that $(1-\lambda)\alpha_2 > \lambda\alpha_1$, the maximum net increase in output and expenditure comes when the government increases government spending and balances the budget by taxing low-skilled, low-income workers as the adverse effects on expenditure and output will be smaller since they now are the minority.

3.2 Government spending financed by labour taxes

We now examine the case where a labour tax is used in order to finance the government budget. To study this case we make a few changes in equations (3), (4), (5) and (12). More specifically, we no longer have a lump-sum tax, but rather a tax on labour income equal to t_{Li}. The new budget constraints for each income group and for the government are the following:

$$PC_1 = \alpha_1((1-t_{L1})T + \Pi) \quad (22)$$

$$PC_2 = \alpha_2[(1-t_{L2})(T+\varepsilon_i) + \Pi\ ] \quad (23)$$

$$T_{(t_{L1})}t_{L1} + (T+\varepsilon_i)_{(t_{L2})}t_{L2} = G \quad (24)$$

Equation (15) which represents the total output function is modified accordingly, when the government uses taxes on labour. Rearranging terms yields an expression similar to (16):

$$Y = \frac{(1-t_{L1})\lambda a_1 T_{(t_{L1})}}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} + \frac{(1-t_{L2})(1-\lambda)a_2(T+\varepsilon_i)_{(t_{L2})}}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} + \frac{G}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \quad (25)$$

Again, we examine the effect of government spending financed by taxing the two different population groups:

$$\frac{dY}{dG} = \frac{1}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \geq 1 \quad (26)$$

$$\frac{dY}{dt_{L1}} = \frac{-\lambda a_1 \mathrm{T}[1+e_{L1}]}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \quad (27)$$

$$\frac{dY}{dt_{L2}} = \frac{-(1-\lambda)a_2(T+\varepsilon_i)[1+e_{L2}]}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \quad (28)$$

Equation (26) is the same as equation (17) so we do not need to analyze this result again. However, looking at equations (27) and (28) we see the major difference between labour taxes and lump-sum taxes. As we can see, the magnitude of the tax multiplier is affected by income inequality and by the firms' market power the same way as before. However, in the case of labour taxation we see that labour supply itself can also affect output and expenditure in two ways as in Harvey and Gayer (2013): The first one is through the decrease in income caused by taxes. When governments tax labour income, then for every hour worked the individual worker receives a lower return on his labour; this results in reduced expenditure and output in the economy. The product of our measure of income inequality and the left hand side term in the parentheses (λa_1T and $(1-\lambda)a_2(T+\varepsilon_i)$ in equations (27) and (28) respectively), captures this effect for each income group.

The second way labour taxes reduce output and expenditure is through the labour – leisure tradeoff. When taxes on labour increase, workers decide to either increase work hours in order to achieve a certain income level (income effect) or to decrease their labour supply and increase their leisure instead (substitution effect). If the second effect is stronger this may reduce their welfare, as well as output and expenditure in the whole of the economy, above and beyond the loss caused by the revenues that the government collects by increasing taxes; in other words labour taxation may create deadweight losses in the economy.

The terms e_{L1} and e_{L2} are the labour elasticities of Type 1 and Type 2 people respectively; when multiplied with income inequality they give us the deadweight loss for each income group. Assuming that e_{L1} and e_{L2} are positive as in Harvey and Gayer (2013) workers reduce their labour supply when labour taxes increase, meaning that the substitution effect dominates, which further reduces output and expenditure in the economy. In the limiting case where e_{L1} and e_{L2} are equal to zero and labour supply is perfectly inelastic the deadweight loss is equal zero as well.

Since high-income workers have a higher labour supply of $(T+\varepsilon_i) > T$ the negative effect that taxing these individuals has on output and expenditure will be bigger, compared to a tax levied on low-income individuals. The size of labour supply elasticity is also important, for example if $e_{L1} < e_{L2}$ in other words if the labour supply of high-income workers is more elastic, taxing these workers causes a bigger reduction of output and expenditure due to bigger deadweight losses. However, the percentage $(1-\lambda)$ of people belonging in the high-income group and their MPC of $\alpha_2 < \alpha_1$ can mitigate the negative effects of taxing high-income workers. Intuitively, even though high-income workers have bigger incomes they individually consume smaller percentages of their income compared to low-income workers; and in economies with high inequality, they constitute a smaller part of the population so their overall consumption will be smaller than that of low-income workers.

In order to find the net increase in output and expenditure we follow the same method used in the case of lump sum taxation:

$$\frac{dY}{dG_{G=t_{L1}}} = \frac{\{1-\lambda a_1 \mathrm{T}[1+e_{L1}]\}}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \geq 1 \quad (29)$$

$$\frac{dY}{dG_{G=t_{L2}}} \frac{\{1-(1-\lambda)a_2(T+\varepsilon_i)[1+e_{L2}]\}}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} \geq 1 \quad (30)$$

The balanced budget multiplier show us that in the case of labour taxes skill endowments and labour supply elasticities also affect the maximum net increase in output and expenditure caused by increased government spending. More specifically, the bigger the endowment differences between individuals are, the bigger the skill gap, wage gap and the adverse effect of taxing high-skilled workers will be. Still, income inequality plays a part in determining the choice of taxation the government should make, but this choice should now take into consideration the differences in labour supply and elasticities, and the associated deadweight losses. In unequal societies where $\lambda\alpha_1 > (1-\lambda)\alpha_2$, the crucial relationship the government examines remains almost the same as it was in lump-sum taxes, namely $\lambda a_1 T[1+e_{L1}] > (1-\lambda)a_2(T+\varepsilon_i)[1+e_{L2}]$. As in lump-sum taxes income inequality affects the maximum net increase in output and expenditure caused by an increase in government spending. Now however, due to skill endowment differences and different elasticities, the negative impact of taxing high-income individuals is bigger even in a highly unequal economy. Consequently it now takes a smaller percentage of people belonging to the high-income group in order for the policy that brings the maximum net increase in output and expenditure, to change (i.e. $\lambda a_1 T[1+e_{L1}] < (1-\lambda)a_2(T+\varepsilon_i)[1+e_{L2}]$); and the bigger the skill endowment ε_i and labour supply elasticity of high-income workers e_{L2} are, the smaller this percentage needs to be.

3.3. Government spending financed by profit taxes

Finally, we examine the case of taxes imposed on firm profits. This tax is a non-neutral profit tax similar to the one in Kreutzer and Lee (1988) and Lee (1998). Therefore, we assume a tax on profits equal to t_{ci} which is similar in its effect to an ad-valorem or a per unit tax. Same as before, we modify equations (3), (4), (5) and (12), and get the budget constraints for each income group and for the government:

$$PC_1 = \alpha_1 (T + (1 - t_{c1})\Pi) \quad (31)$$

$$PC_2 = \alpha_2 [(T + \varepsilon_i) + (1 - t_{c2})\Pi \;] \quad (32)$$

$$\Pi t_{c1} + \Pi t_{c2} = G \quad (33)$$

Using equations (15), (31), (32) and (33) gives us the total output function when profit taxation is used:

$$Y = \frac{\lambda a_1 T}{1 - [\lambda a_1 (1 - t_{C1}) + (1 - \lambda) a_2 (1 - t_{C2})]\mu} + \frac{(1 - \lambda) a_2 (T + \varepsilon_i)}{1 - [\lambda a_1 (1 - t_{C1}) + (1 - \lambda) a_2 (1 - t_{C2})]\mu} + \frac{G}{1 - [\lambda a_1 (1 - t_{C1}) + (1 - \lambda) a_2 (1 - t_{C2})]\mu} \quad (34)$$

Differentiating equation (34) with respect to G, t_{c1} and t_{c2} we find:

$$\frac{dY}{dG} = \frac{1}{1 - [\lambda a_1 (1 - t_{C1}) + (1 - \lambda) a_2 (1 - t_{C2})]\mu} \geq 1 \quad (35)$$

$$\frac{dY}{dt_{c1}} = -\frac{[\lambda \, a_1 \, T \; + (1-\lambda) a_2 (T + \varepsilon_i) + G] \lambda \alpha_1 \mu}{[1 - [\lambda a_1 (1 - t_{C1}) + (1 - \lambda) a_2 (1 - t_{C2})]\mu]^2} \quad (36)$$

$$\frac{dY}{dt_{c2}} = -\frac{[\lambda a_1 T + (1-\lambda) a_2 \; (T + \varepsilon_i) + G](1-\lambda) \alpha_2 \mu}{[1 - [\lambda a_1 (1 - t_{C1}) + (1 - \lambda) a_2 (1 - t_{C2})]\mu]^2} \quad (37)$$

Equation (35) shows that the size of the government spending multiplier is positively affected by imperfect competition and income inequality. However, this time taxation of firm profits also has an effect on the multiplier meaning that the bigger taxes on firm profits are, the smaller the government spending multiplier becomes. The reason this happens is that if taxes are imposed on profits this reduces the incomes individuals receive from the firms they own, which in turn lowers their expenditure. This negative effect reduces the overall expenditure and output in the economy through the channel of the Keynesian multiplier.

Examining equations (36) and (37) we see that income inequality, firms' market power, and profit taxes affect the size of tax multipliers much like the public spending multiplier in equation (35). What is interesting to note, however, is that unlike the two previous cases, now taxes on firms owned by one income group influence public spending and consumption of both income groups. This is seen in equations (36) and (37) where the terms of market power, income inequality and the labour supply enter the numerator of the fractions of taxation of both income groups. The intuition behind this outcome is simple and based on Rosen and Gayer (2013): When the government taxes profits, firms reduce production, the price paid by consumers increases while the price that the firms receive decrease. In addition, because both the price and the quantity produced are now smaller, that means that the profits of the firms taxed have been reduced. Individuals who have seen their profits reduced will buy fewer goods both from their own firms and from the ones owned by other people. Additionally, firms may reduce their workers' wages because of the decrease in profits and production. This eventually leads to a reduction of expenditure and output in the whole of the economy through the channel of the Keynesian multiplier. This result is shown by the product of the terms $[\lambda a_1 T + (1-\lambda)a_2(T+\varepsilon_i)]$ with the term outside the parentheses ($\lambda\alpha_1\mu$ and $(1-\lambda)\alpha_2\mu$ respectively).

When it comes to the reduction of government expenditure, the explanation above can be used. The government uses goods produced by the firms as inputs. Since production of firms has reduced and the prices have increased, production of public goods also decreases.

In order to find the net increase in output and expenditure we follow the same method used in the case of lump sum and labour taxation:

$$\frac{dY}{dG_{G=t_{C1}}} = \frac{1-[\lambda a_1 T + (1-\lambda)a_2(T+\varepsilon_i) + G]\lambda\alpha_1\mu}{[1-[\lambda a_1(1-t_{C1}) + (1-\lambda)a_2(1-t_{C2})]\mu]^2} \geq 1 \quad (38)$$

$$\frac{dY}{dG_{G=t_{C2}}} = \frac{1-[\lambda a_1 T+(1-\lambda)a_2(T+\varepsilon_i)+G](1-\lambda)\alpha_2\mu}{[1-[\lambda a_1(1-t_{C1})+(1-\lambda)a_2(1-t_{C2})]\mu]^2} \geq 1 \quad (39)$$

Equations (38) and (39) show us that the net increase in output and expenditure is affected by the same factors as in the case of labour taxes, namely labour supply and it's elasticity and by income inequality. Imperfect competition also has a negative effect on the size of the net increase of output and expenditure and in the limiting case where μ=0 the increase in taxation does not cause any decrease in output and expenditure.

The size of income inequality, this time alongside the firms' market power, is still important in achieving the maximum net increase in output and expenditure. Looking at an unequal society where $\lambda\alpha_1 > (1-\lambda)\alpha_2$, the crucial relationship the government needs to examine remains similar to the ones in the previous cases: $[\lambda a_1 T + (1-\lambda)a_2(T+\varepsilon_i)+G]\lambda\alpha_1\mu > [\lambda a_1 T + (1-\lambda)a_2(T+\varepsilon_i)+G](1-\lambda)\alpha_2\mu$. This result shows that, just as in the previous cases, in highly unequal societies the maximum net increase in expenditure and output comes when the government increases government spending and balances the budget by taxing the profits of Type 2 workers. This happens because when $\lambda\alpha_1 > (1-\lambda)\alpha_2$ the total consumption of Type 1 individuals is much bigger compared to the consumption of Type 2 people, because they individually consume much more than Type 2 people do and also because they are a much larger part of the population. Eventually when $(1-\lambda)\alpha_2 > \lambda\alpha_1$, the maximum increase in net expenditure and output comes when the government increases government spending and balances the budget by taxing the profits of low-skilled, low-income workers as the adverse effects on expenditure and output will be smaller because they now are the minority.

4. Welfare analysis

The previous section has shown that income inequality plays a role in the increase of output and expenditure in the economy by affecting the size of fiscal multipliers. However, the net economic impact is not the only measure of the effectiveness of economic policy; we also need to see if a government's fiscal policy can actually be Pareto improving for the people living in the economy. For this reason, we will examine the welfare effects that government policies have, using a methodology similar to Adam (2004) in order to measure welfare gains or losses from government policies.

4.1 **Lump sum taxation**

If we want to make a complete evaluation of the welfare effects of government policy, we need to examine both the benefits of increased government spending and the losses of taxation. Government spending is assumed not to affect utility directly; therefore, our analysis is somewhat limited in scope. Utility increases only if the budget constraint of the individual increases. However, since individuals receive all the profits and wages in the economy the change in output and expenditure when government spending increases is sufficient for examining the effect of government spending as in Mankiw (1987). Therefore, we will use the balanced budget multiplier to examine the effect of government spending on utility. In order to calculate the welfare losses caused by taxation we will use a methodology similar to Adam (2004). We first derive the indirect utility functions for Type 1 and Type 2 workers using equations (1) (2) (4) and (5):

$$W_1 = a_1^{a_1}\left(1 - a_1\right)^{(1-a_1)} \frac{\left[T + \Pi - V_1\right]}{P^{a_1}} \quad (40)$$

$$W_2 = a_2^{a_2}\left(1 - a_2\right)^{(1-a_2)} \frac{\left[(T + \varepsilon_i) + \Pi - V_2\right]}{P^{a_2}} \quad (41)$$

Using these results, we calculate the general welfare function following Acemoglu and Robinson (2005)

$$W = \lambda W_1 + (1-\lambda)W_2 \quad (42)$$

We then calculate the loss in welfare (in absolute value) from imposing a lump-sum tax in each income group as:

$$\left|\frac{dW}{dV_1}\right| = \lambda \frac{a_1^{a_1}(1-a_1)^{(1-a_1)}}{P^{a_1}} > 0 \quad (43)$$

$$\left|\frac{dW}{dV_2}\right| = (1-\lambda)\frac{a_2^{a_2}(1-a_2)^{(1-a_2)}}{P^{a_2}} > 0 \quad (44)$$

Equations (43) and (44) give us the welfare losses for an individual belonging to each of the two income groups

What is important for the evaluation of fiscal policy is to see whether government policies can be Pareto improving. Following Adam (2004), we will examine if the expected gains of government policies are bigger than the costs necessary to finance them. To examine that we compare the net economic effect of each spending-taxing plan has, with the welfare loss of each income group. First, we multiply equation (21) with λ and equation (22) $(1-\lambda)$ in order to find the net economic benefits that each income group that pays taxes has, and then we compare the results. The government's policy mix can lead to a Pareto improvement only if the share of the net increase in output and expenditure caused by the increase of spending that each income group receives is bigger than its welfare losses caused by the taxes it pays to finance this increase i.e. :

$$\lambda \frac{(1-\lambda\alpha_1)}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu} - \lambda \frac{a_1^{a_1}(1-a_1)^{(1-a_1)}}{P^{a_1}} \geq 0 \quad (45)$$

$$(1-\lambda)\frac{[1-(1-\lambda)\alpha_2]}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu} - (1-\lambda)\frac{a_2^{a_2}(1-a_2)^{(1-a_2)}}{P^{a_2}} \geq 0 \quad (46)$$

Equation (45) show us if government spending financed by taxing low-income people can be Pareto improving, while equation (46) show us if government spending financed by taxes on high-income people can be Pareto improving. We see that if the left hand side of (45) and (46) is bigger than or equal to zero then fiscal policy can be Pareto improving. The logic behind this result is simple: If the relationships above are true then the net increase of expenditure and output caused by increased government spending increases the welfare of both income groups; or at the very least keeps the welfare of the group that pays taxes steady while benefiting the group that does not pay taxes[1]. However, if the left hand side of (45) and (46) is negative, then although the increased output and expenditure benefits the group that does not pay taxes the welfare losses of the income group that pays taxes are so big that the increase in output and expenditure cannot compensate them.

In both equations, we see that imperfect competition increases welfare. We then examine the effect that our income inequality variable has on welfare by analyzing the effect of its two components. An increase in inequality means an increase in λ. A higher value of λ increases the welfare gains brought about by the net increase in output and expenditure caused by (a balanced budget) increase in government spending; but at the same time it also increases the welfare losses that government policies have on the low-income group's welfare. At the same time, increases in inequality reduce both the welfare gains as well as the welfare losses that the high-income group has due to government policies. Equations (45) and (46) also reveal the effect that the different MPCs have on the welfare losses caused by government policies. The bigger the MPC on the second term of the equation, the bigger welfare losses become. However this effect is somewhat lessened because the MPC is also the exponent of the price level and as the exponent increases the denominator of the fraction increases as well, which in turn means a smaller right hand side in (45) and (46).

4.2 Labour taxation and profit taxation

After examining the case of lump-sum taxes, we examine the cases of labour income and profit taxation using the same method as in section 4.1. Beginning with labour taxes, we use equations (1), (2), (22) and (23) to derive the indirect utility functions of each income group; then we multiply these functions with the percentages of people belonging to each income group and compare them with equation (29) and (30):

[1] Increased government spending benefits both income groups or at least benefits the one that does not pay taxes while the welfare of the other group remains the same because: $\frac{(1-\lambda\alpha_1)}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu} > \lambda\frac{(1-\lambda\alpha_1)}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu}$ and $\frac{[1-(1-\lambda)\alpha_2]}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu} > (1-\lambda)\frac{[1-(1-\lambda)\alpha_2]}{1-(\lambda\alpha_1+(1-\lambda)\alpha_2)\mu}$.

$$W_1 = a_1^{a_1}(1-a_1)^{(1-a_1)} \frac{[(1-t_{L1})T + \Pi]}{P^{a_1}} \quad (47)$$

$$W_2 = a_2^{a_2}(1-a_2)^{(1-a_2)} \frac{[(1-t_{L2})(T+\varepsilon_i) + \Pi]}{P^{a_2}} \quad (48)$$

Just as in the previous section, we calculate the general welfare function. Differentiating with respect to t_{L1} and t_{L2} gives us the change in welfare caused by labour taxes:

$$\left|\frac{dW}{dt_{L1}}\right| = \lambda \frac{a_1^{a_1}(1-a_1)^{(1-a_1)}(1+e_{L1})}{P^{a_1}} > 0 \quad (49)$$

$$\left|\frac{dW}{dt_{L2}}\right| = (1-\lambda) \frac{a_2^{a_2}(1-a_2)^{(1-a_2)}(1+e_{L2})}{P^{a_2}} > 0 \quad (50)$$

After multiplying (29) and (30) with λ and $(1-\lambda)$ respectively, we compare them with equations (49) and (50)

$$\lambda \frac{\{1-\lambda a_1 \mathrm{T}[1+e_{L1}]\}}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} - \lambda \frac{a_1^{a_1}(1-a_1)^{(1-a_1)}(1+e_{L1})}{P^{a_1}} \geq 0 \quad (51)$$

$$(1-\lambda) \frac{\{1-(1-\lambda)a_2(T+\varepsilon_i)[1+e_{L2}]\}}{1-[\lambda a_1 + (1-\lambda)a_2]\mu} - (1-\lambda) \frac{a_2^{a_2}(1-a_2)^{(1-a_2)}(1+e_{L2})}{P^{a_2}} \geq 0 \quad (52)$$

The result is almost identical to the case of lump-sum taxes, the only difference being now that the elasticity of labour supply positively affects the welfare loss that taxation has. The reason this happens is due to the double effect of taxes we analyzed in section 3. When taxes on labour increase workers will find their income has been reduced. The product of the terms outside the parentheses and the first term inside the parentheses on the right hand side of equations (51) and (52) gives the change in welfare due to the reduction of income by taxes. However, as we have seen in the previous section workers might then choose to substitute labour for leisure (substitution effect) which leads them to reduce their labour supply and consequently face even bigger welfare losses. The product of the terms outside the parentheses with the elasticity of labour supply on the right hand side of equations (51) and (52) gives us the effect of the labour-leisure trade-off on welfare.

We then examine the case of profit taxation, by following the same process as the one above. We first use equations (1), (2), (31) and (32) to find the indirect utility functions:

$$W_1 = a_1^{a_1}(1-a_1)^{(1-a_1)}\frac{[T+(1-t_{c1})\Pi]}{P^{a_1}} \quad (53)$$

$$W_2 = a_2^{a_2}(1-a_2)^{(1-a_2)}\frac{[(T+\varepsilon_i)+(1-t_{c2})\Pi]}{P^{a_2}} \quad (54)$$

Differentiating with respect to profit taxes gives us the welfare losses of each income group in the case of profit taxes:

$$\left|\frac{dW}{dt_{c1}}\right| = \lambda\frac{a_1^{a_1}(1-a_1)^{(1-a_1)}(1+e_{c1})}{P^{a_1}} > 0 \quad (55)$$

$$\left|\frac{dW}{dt_{c2}}\right| = (1-\lambda)\frac{a_2^{a_2}(1-a_2)^{(1-a_2)}(1+e_{c2})}{P^{a_2}} > 0 \quad (56)$$

Using the same process as in the previous cases, we have:

$$\lambda\frac{1-[\lambda a_1 T+(1-\lambda)a_2(T+\varepsilon_i)+G]\lambda\alpha_1\mu}{[1-[\lambda a_1(1-t_{C1})+(1-\lambda)a_2(1-t_{C2})]\mu]^2}-\lambda\frac{a_1^{a_1}(1-a_1)^{(1-a_1)}(1+e_{c1})}{P^{a_1}}\geq 0 \quad (57)$$

$$(1-\lambda)\frac{1-[\lambda a_1 T+(1-\lambda)a_2(T+\varepsilon_i)+G](1-\lambda)\alpha_2\mu}{[1-[\lambda a_1(1-t_{C1})+(1-\lambda)a_2(1-t_{C2})]\mu]^2}-(1-\lambda)\frac{a_2^{a_2}(1-a_2)^{(1-a_2)}(1+e_{c2})}{P^{a_2}}\geq 0 \quad (58)$$

The results are identical to (51) and (52) the only difference being that the elasticity of profits now takes the place of elasticity of labour supply. The product of the terms outside the parentheses with the first term inside on the right hand side of equations (57) and (58) show us the direct effect that profit taxes have on the welfare of firm owners by reducing their profits and income. The product of the terms outside the parentheses with the elasticity of profit taxes captures the welfare losses caused by the deadweight losses of profit taxes that we examined section 3.

In the three different cases that we examined we find that income inequality, represented by the MPC and the percentages of people belonging to low-income and high-income groups, has a positive effect on the welfare losses of the income group, which pays the taxes needed to finance government policies. Consequently, income inequality plays an important role in the choices that government should make, regarding its overall fiscal policy. As we have seen in sections 3 and 4 income inequality affects not just the maximum net increase in output and expenditure when public spending increases and is financed by taxation – in other words the net fiscal effect of government policies- but also the welfare effects that these policies can have and whether or not they can be Pareto improving. These results have important policy implications. It shows that government policies, which take into account income inequality in the economy, can not only promote economic growth by increasing the impact of expansionary policy on economic activities, but also improve welfare throughout the economy by using policies resulting in a Pareto improvement for both income groups.

5. Conclusion

The purpose of this paper was to examine the effect of income inequality and imperfect competition on an economy's fiscal policy. For this reason, we used a simple model of general equilibrium with imperfect competition in the goods market and heterogeneous agents with different skill endowments and as a result different wages. Using this model, we explore how the spending and taxing policy is affected. Results indicate that income inequality and firms' market power positively affect the size of fiscal multipliers in an economy meaning that government spending and taxing multipliers in more unequal economies. Additionally using the balanced budget multiplier, we see that income inequality and imperfect competition also affect the net economic effect of government policies. More specifically in more unequal societies, where the majority of the population has low incomes, the maximum net increase in output and expenditure comes when the government increases government spending and then taxes the minority of high-income workers. However, as the percentage of high-income workers increases, fiscal multipliers become smaller and the impact of spending and taxation changes. Consequently, for sufficiently high percentages of high-income workers the maximum net increase in output and expenditure comes when the government increases spending and taxes the minority of low-income workers. Finally, we examine the welfare effects of government policies. Results show us that increased government spending financed by taxation can benefit both income groups; or at least benefit the income group that does not pay any taxes while eliminating the welfare losses of the income group that pays taxes, leading to a Pareto improvement. Income inequality plays an important part once again because it positively affects welfare losses. These results suggest that fiscal policy which takes into account the income inequality between individuals and uses the right mix of spending and taxation can help stabilize the economy and promote growth while minimizing the welfare losses of fiscal policy and lead to Pareto improvements.

The model could be extended in several different directions. One way would be by taking into account the way that public spending can affect individual consumption and welfare. Additionally labour market with imperfect competition between high skilled and low skilled workers might make this analysis more realistic.

References

Acemoglu, D., & Robinson, J. A. (2005). *Economic origins of dictatorship and democracy*. Cambridge University Press.

Adam, A. (2004). Macroeconomic effects of social security privatization in a small unionized economy.

Blanchard, O., & Johnson, D. (2012). Macroeconomics . Millersville University.

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.

Carroll, C. D., Slacalek, J., & Tokuoka, K. (2014). The Distribution of wealth and the MPC: implications of new European data. *The American Economic Review*, *104*(5), 107111.

Carroll, C., Slacalek, J., Tokuoka, K., & White, M. N. (2016). The Distribution of Wealth and the Marginal Propensity to Consume.

Ercolani, V. (2007) The relation between private consumption and government spending: theory and some evidence from a DSGE approach FIRST DRAFT.

Forni, L., Gerali, A., & Pisani, M. (2010). The macroeconomics of fiscal consolidations in euro area countries. *Journal of Economic Dynamics and Control*, *34*(9),1791-1812.

Kreutzer, D., & Lee, D. R. (1988). Tax Evasion and Monopoly Output Decisions: A Reply. *National Tax Journal*, 41, 583.

Lee, K. (1998). Tax evasion, monopoly, and nonneutral profit taxes. *National Tax Journal*, 333-338.

Lerner, A. P. "The Concept of Monopoly and the Measurement of Monopoly Power." *The Review of Economic Studies* 1.3 (1934): 157-175.

Mankiw, N. G. (1987). *Imperfect Competition and the Keynesian Cross* (No. 2386). National Bureau of Economic Research, Inc.

Molana, H., & Moutos, T. (1992). A note on taxation, imperfect competition and the balanced budget multiplier. *Oxford Economic Papers*, *44*(1), 68-74.

Harvey, R., & Gayer, T. (2013). *Public finance*. McGraw-Hill Higher Education.

Torregrosa, R. J. (1999). *Balanced budget multiplier, imperfect competition and indirect taxation*. IVIE, Instituto Valenciano de Investigaciones Económicas.