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The effect of income distribution and fiscal policy on growth, investment, and budget balance: the case of Europe

Thomas Obst, Özlem Onaran, Maria Nikolaidi

Abstract

This paper develops a multi-country Post-Kaleckian model augmented by a government sector with public spending and taxes on consumption, labour and capital and estimates it for the EU15 countries. We estimate country specific equations to find the effect of income distribution, public spending and taxes on growth, on each component of private aggregate demand (i.e., consumption, investment, and net exports) and on budget balance for the EU15 countries. Next, we calculate a Europe-wide multiplier based on the responses of each country to changes not only in domestic income distribution, taxation and government expenditure but also to changes in the other European countries' wage share, taxes and public spending. One novelty of this paper is that it goes beyond an isolated country-by-country analysis and integrates cross-country effects of a simultaneous change in the wage share on demand in Europe in a government augmented Post-Kaleckian model. Extending the model by taxes on labour and capital increases the likelihood of a wage-led economic regime. The fiscal multiplier effects are much stronger when policies are implemented simultaneously, and wage, tax and public spending policies are integrated into the policy mix. The impact of egalitarian wage policies are positive but small; the overall stimulus becomes much stronger when mixed with fiscal expansion. Expansionary fiscal policy is sustainable when wage, public spending and progressive tax policies are combined. The analysis of the paper can guide the development of a fiscal and wage policy mix conducive to equitable development.

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1. Introduction

The outbreak of the Great Recession and sluggish growth in the aftermath in most European countries has rekindled interest in the effect of fiscal policy on growth, as evidenced in the vast literature on fiscal multiplier effects (Blanchard and Leigh, 2013; Gechert, 2015). Although it has been shown that austerity policies have negative effects on growth and private investment, contributing to the prolonged stagnation in Europe (Cozzi et al., 2016), fiscal contraction continues to be the dominant European strategy in the post-crisis era.

At the same time inequality has increased significantly since 1980s in all the major developed and developing countries with a simultaneous fall in the share of labour income in national income and a rise in top income shares (Stockhammer, 2015). The negative impact of inequality on growth has been well evidenced in empirical research based on both supply-side growth models (Barro, 2000; Daudey and Garcia-Penalosa, 2007; Berg et al. 2012) and post-Keynesian demand-led growth models (Naastepad and Storm, 2006; Hein and Vogel, 2008; Stockhammer et al, 2009; Onaran and Galanis, 2014; Onaran and Obst, 2016).

However, the combined effects of fiscal policy and income distribution on economic growth and fiscal performance have not yet been empirically investigated in the context of demand-led growth models. Theoretically, this issue has been explored in various Kaleckian models. Blecker (2002) and Palley (2014) have analysed how different tax rates on labour and capital income affect whether the demand and growth regime of an economy is wage-led or profit-led. Mott and Slattery (1994), Commendatore et al. (2011), Seguino (2012), Dutt (2013), Palley (2013), Hein (2016), amongst others, have studied the effects of functional income distribution and government expenditures on various macroeconomic variables, such as capital accumulation, labour productivity, inflation and public debt. Blecker (1999) has examined open economy issues within a Kaleckian model with government expenditures and taxes. However, in the Kaleckian literature there is still a lack of a detailed empirical analysis of the joint effects of income distribution and fiscal policy.

The novelty of this paper is twofold. First, we develop a Post-Kaleckian theoretical model that incorporates a government sector within an open economy context. The model moves beyond the above-mentioned Kaleckian models because (i) it is a multi-country model that allows the analysis of the interactions between countries and (ii) incorporates an explicit distinction between different types of government expenditures, permitting a careful analysis of the different growth effects of each expenditure category. Second, we use this model in order to estimate econometrically the effects of income distribution and fiscal policy on the components of aggregate demand (consumption, investment and net exports) for each of the

EU15[1] countries. We calculate a Europe-wide multiplier based on the responses of each country to changes in not only domestic but also other European countries' income distribution, taxation and government spending. Hence, we move beyond Onaran and Galanis (2014) and Onaran and Obst (2016) who presented the impact of simultaneous changes in income distribution in the G20 and EU15 but did not incorporate the impact of public spending and taxes. From a policy perspective, the analysis of the paper can guide the development of a fiscal and wage policy mix conducive to equitable development.

The rest of the paper is organised as follows. Section 2 presents the data sources. Section 3 outlines the theoretical model. Section 4 describes the estimation methodology. Section 5 presents and discusses the estimation results. Section 6 discusses a wage and fiscal policy mix and its implications for growth, private investment, trade balance, and budget balance. Finally, section 7 concludes.

2. Data

The data used in the econometric estimation comes from the annual macro-economic database of the European Commission (AMECO) and the OECD national accounts, in most cases for the period between 1960 and 2013. Our model includes various variables about the macro economy, the distribution of income, the government sector and the open economy. The definition of the variables and the details of the data sources are reported in Appendix A.

We use implicit tax rates (ITR) on capital (t_r), labour (t_w), and consumption (t_c). The tax rates are based on the dataset provided by Onaran et al. (2012) which itself draws on the data reported by the European Commission (2000) as well as Eurostat online database with data ranging between 1970 and 2007. We extend this dataset to 2012 using the growth rate of the data provided by Eurostat (2015).

In our econometric estimations we focus attention only on these components of government expenditures that are part of GDP. These are the gross capital formation (I_g), individual consumption expenditure (G_i) and the collective consumption expenditure (G_C) of the general government. On average, G_i, G_C and I_g constitute roughly 50 per cent of total government expenditures in our sample. An important part of the rest government expenditures is the social benefits in kind and other current transfers. These expenditures are

[1] EU15 refers to the 15 West European old member states of the EU, which includes the UK. Despite the Brexit decision we keep the UK as part of our analysis for Europe, as policy coordination issues we discuss in the paper can be implemented even when countries are not part of a political union, although we recognise the importance of political union to facilitate such policy coordination.

included in our theoretical model but are not part of our empirical estimations due to limited data availability (e.g. social benefits in cash start only in 1995 for most EU15 countries).

3. A post-Keynesian/post-Kaleckian macro model with government

In this section we present our multi-country demand-led growth model for the EU15 countries. The model is based on a Post-Kaleckian framework[2]; however, the behavioural functions also encompass standard Keynesian models (e.g. Blanchard, 2006). We integrate fiscal policy (tax rates, government expenditures, public debt) into the private sector open economy model presented in Onaran and Obst (2016).

We model the effects of a change in the profit share and fiscal policy by means of analysing the country level effects on private aggregated demand: consumption, investment, exports and imports. We then estimate European interactions through integrating the effects of a change in the profit share as well as fiscal policy of other EU15 countries.

Consumption (C) is given by:

$$log\ C = c_0 + c_r\ log((1-t_r)R) + c_w(log((1-t_w)W) + log(B) + log(OCT)) \quad (1)$$

where $R' = (1-t_r)R$ denotes after-tax adjusted profits, $W' = (1-t_w)W$ denotes after-tax adjusted wages, t_r denotes ITR on capital income, t_w denotes ITR on labour income, B denotes social benefits in cash and OCT denotes other current transfers. Compared to Onaran and Obst (2016), consumption function (1) has two new features: first, it includes ITR on capital income and ITR on labour income; second, it incorporates the social benefits in cash and other current transfers, which augment the disposable income of households. We hypothesise that a more progressive tax system (taxes on capital increasing while those on labour decreasing) supports a wage-led economic regime, whereas a more regressive tax system would help growth in a profit-led regime.

Private investment (I) is modelled based on two alternative specifications. Our first specification is the following:

$$logI = i_a + i_y log\ (Y_P) + i_\pi log\ ((1-t_r)\pi) + i_g\ log(\mathrm{G}) + i_d log\ (\tfrac{D}{Y}) \quad (2)$$

where $\mathrm{i_a}$ is autonomous investment and captures the effects of 'animal spirits', Y_p is private output[3], $\pi' = (1-t_r)\pi$ denotes after-tax adjusted profit share, G denotes government expenditures and D/Y is the ratio of domestic government debt to GDP. Profit share is an

[2] Our model is a version of the Bhaduri and Marglin (1990). Theoretically, aggregate demand can be either wage-led or profit-led depending on how the effects on C, I, and NX add up.

[3] Private output is calculated as total GDP (Y) minus total government expenditure ($G = I_g + G_c + G_i$).

indicator for expected profitability as well as the availability of internal finance. Private GDP is a proxy for capacity utilisation with positive accelerator effects on private investment. Compared to Onaran and Obst (2016), we have made three extensions: first, we assume that firms consider after-tax profits in making investment decisions as widely assumed in the literature (see e.g. Rowthorn, 1981; Blecker, 2002; Seguino, 2012); second, we include public debt as a ratio to GDP, which allows us to take into account possible financial crowding out effects which (see Dutt, 2013); third, we introduce total government expenditures in order to examine potential crowding-in effects that might stem from the fact that government expenditures can improve business environment and increase future output.

Our second alternative specification for investment is the following:

$$logI = i_a + i_y log\ (Y_P) + i_\pi log\ ((1 - t_r)\pi)$$
$$+ i_i\ log(I_g) + i_{gc}\ log(G_c) + i_{gi} log\ (G_i) + i_d\ log\left(\frac{D}{Y}\right) \qquad (2')$$

where G_i is individual consumption expenditure, G_c is collective consumption expenditure and I_g is gross capital formation expenditure. The difference between equation (2) and equation (2') is that the latter includes a disaggregation of government expenditures into different categories drawing broadly on Seguino (2012) who clusters government expenditures into investment in physical and social infrastructure in order to capture their different crowding-in effects. In equation (2') individual consumption comprises the social transfers in kind that are provided to individual households. Collective consumption refers to collective goods and services that are provided by the government to all members of the society. Both collective and individual consumption include expenditures related to health, education and culture. Public investment includes, amongst others, investment in transportation, construction and other physical capital.

We expect that each of these types of expenditures has a different impact on private investment. However, due to severe data limitations with rather short time series and multicollinearity issues, this detailed specification is unlikely to capture potentially significant effects of different types of public spending; therefore we present the empirical results of this specification only as a robustness check and interpret them as indicative results[4].

[4] This also implies that for the multiplier estimations we only consider equation (2) that integrates government expenditures (G).

In order to integrate the effects of expansionary fiscal policy on growth in the EU14 we define an exogenous increase in government expenditures as a fraction of national income (GDP)[5]:

$$G = \kappa_g Y \tag{3}$$

In disaggregated form this exogenous increase is equal to:

$$I_g = \kappa_{ig} Y \tag{3'}$$

$$G_c = \kappa_{gc} Y \tag{3''}$$

$$G_i = \kappa_{gi} Y \tag{3'''}$$

In our model the total primary government expenditures (G_{tot}) are equal to:

$$G_{tot} = G + B + OCT \tag{4}$$

Taxes[6] (T) can be expressed as:

$$T = t_w W + t_r R + t_c C \tag{5}$$

where $t_c C$ is taxes on private consumption and t_c is VAT on domestic prices.

The interest rate on government debt (r) is:

$$r = f\left(\frac{D}{Y_{-1}}\right) \tag{6}$$

The national income identity (Y) is given by:

$$Y = C + I + I_g + G_c + G_i + X - M \tag{7}$$

The total wage bill (W) is given by:

$$W = W_p + W_g \tag{8}$$

where W_P wage is bill in the private sector and W_g denotes total wage bill in the government sector.

Private sector's operating surplus (R) is identical to:

$$R = C + I + I_g + G_c + G_i + X - M - W \tag{9}$$

where X are exports and M are imports. The debt of the government sector is:

$$D = D_{-1} + G_{tot} + rD_{-1} - T \tag{10}$$

where D_{-1} denotes debt of the previous period and rD_{-1} is the interest payments on government debt of the previous period. For simplicity, we assume away the asset side of the balance of the government.

Domestic prices (P) and export prices (P_x) are determined as follows:

[5] We assume that the government decides on expansionary fiscal policy targets taking into account the share of (G) in national income (GDP) rather than the absolute value.

[6] However, the tax intake only represents a (crucial) part of government revenues leaving aside other revenue streams such as property income or national insurance payments.

$$logP = p_0 + p_{ulc}\, log(ulc) + p_{tc} log(1 + t_c) + p_m log(P_m) \quad (11)$$

$$log\ P_x = px_0 + p_{xulc} log(ulc) + p_{cf} log(1 + t_{cfi}) + p_{xm} log\ (P_m) \quad (12)$$

where ulc are nominal unit labour costs, P_m are import prices, t_c is VAT at home and t_{cfi} is VAT abroad. We model the effects of distribution on net exports using a stepwise approach that follows Stockhammer et al. (2009), Onaran et al. (2011) and Onaran and Galanis (2014). First, domestic prices and export prices are a behavioural function of nominal unit labour costs and import prices (as a proxy for non-labour input costs), based on a mark-up pricing model in an imperfectly competitive economy. We extend the specification of domestic and export prices by including VAT at home and abroad.

Exports are given by equation (13):

$$log\ X = x_0 + x_{pxm}\ log\ (\tfrac{P}{P_m}) + x_{Yrw} log(Y_{rw}) + x_e log\ (E) \quad (13)$$

where Y_{rw} is the GDP of the rest of the world and E is the exchange rate. Exports are a behavioural function of relative prices of exports to imports and the GDP of the rest of the world.

Imports (M) are a function of domestic prices relative to import prices (P/P_m), private GDP, government expenditures and exchange rate:

$$logM = m_0 + m_{ppm} log\ (\tfrac{P}{P_m}) + m_y log\ (Y_p) + m_g log\ (G) + m_e log\ (E) \quad (14)$$

We include government expenditures to account for the import content in government spending as suggested by Palley (2009).

In parallel to the alternative investment specification, we also estimate an alternative specification where we disaggregate government expenditure into the three different types in the import function:

$$log\ M = m_0 + m_{ppm} log\ (\frac{P}{P_m}) + m_y\, log\big(Y_p\big) + m_i\, log\big(I_g\big)$$
$$+ m_{gc}\, log(G_c) + m_{gi}\, log(G_i) + m_e log\ (E) \quad (14')$$

The sum of partial effects of a change in π on consumption, investment, and net exports ($NX = X - M$) is the effect on private excess demand. This, in turn, will further affect consumption, investment, and imports through the multiplier mechanism[7].

[7] See Appendix B for the derivation of the national multiplier integrating fiscal policy.

3.1. Effects of a simultaneous change in the profit share and fiscal policy

Until now, we have ignored the effects following a simultaneous change in distribution in Europe; however, this overestimates the positive effects of a fall in the wage share on net exports. European economies are integrated and, as recommended by the EC, all countries are trying to compete on the basis of wage costs. Therefore, while higher openness of an economy increases the relevance of the positive effects of a fall in the wage share, the simultaneous implementation of the same wage moderation strategy in a variety of European countries diminishes the positive effects on net exports. Given the high economic integration of the European economy[8], a full understanding of the simultaneous fall in the wage share requires an integrated Europe-wide analysis. Following the modelling strategy in Onaran and Obst (2016) we simulate the effects of a simultaneous decline in the wage share on growth in Europe. Hence, the European multiplier mechanism incorporates the effects of a change in the profit share on AD of each economy through the changes in import prices and the GDP of trade partners. For the case of 15 countries, the percentage change in GDP of each country is given by:

$$\begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} = E_{15x15} \begin{bmatrix} \Delta\pi_1 \\ \vdots \\ \Delta\pi_{15} \end{bmatrix} + H'_{15x15} \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} + P_{15x15} \begin{bmatrix} \Delta\pi_1 \\ \vdots \\ \Delta\pi_{n15} \end{bmatrix} + W_{15x15} \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} \quad (15)$$

The matrices E and H' represent the effects of a change in each country's own profit share on demand in that particular country. E is a matrix, whose diagonal elements are the effect of a change in profit share in country j on private excess demand $((C + I + G + NX)/Y)$ in country j. Matrix H' reflects the national multiplier effects and hence shows the effect of an autonomous change in private excess demand on AD. Matrix *P* illustrates the effect of a change in trade partners' profit share on import prices and hence on net exports in each country. Finally, matrix W shows effects of a change in trade partners' GPD on exports of each country. The details are in Appendix B.

Solving equation (15) for $\left[\frac{\Delta Y}{Y}\right]$ gives us the equivalent of a European multiplier effect:

$$\begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} = (I_{15x15} - H'_{15x15} - W_{15x15})^{-1}(E_{15x15} + P_{15x15}) \begin{bmatrix} \Delta\pi_1 \\ \vdots \\ \Delta\pi_{15} \end{bmatrix} \quad (16)$$

[8] In 2013, the greater proportion of EU countries total trade in goods was with partners within the EU-28 with an average of 62% of total exports (Eurostat, 2015).

Moreover, in order to take into account the simultaneous change in public spending we model the impact of a 1% point increase in government expenditure (G) as a ratio to GDP on the percentage change in GDP of each country is given by:

$$\begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} = Eg_{15x15} \begin{bmatrix} \Delta\kappa_{g_1} \\ \vdots \\ \Delta\kappa_{g_{15}} \end{bmatrix} + Hg_{15x15} \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} + W_{15x15} \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} \quad (17)$$

The matrices Eg and Hg represent the effects of a change in each country's own public spending on demand in that particular country. Eg is a matrix, whose diagonal elements are the effect of a change in κ_g in country j on excess demand ($C + I + NX + G$) in country j[9]. Matrix Hg reflects the national multiplier effects and hence shows the effect of an autonomous change in excess demand ($C + I + NX + G$) on AD via national multiplier effects. The details are in Appendix B.

Solving equation (17) for $\left[\frac{\Delta Y}{Y}\right]$ gives us the equivalent of a European multiplier effect of public spending[10]:

$$\begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} = (I_{15x15} - Hg_{15x15} - W_{15x15})^{-1}(Eg_{15x15}) \begin{bmatrix} \Delta\kappa_{g_1} \\ \vdots \\ \Delta\kappa_{g_{15}} \end{bmatrix} \quad (18)$$

Finally, we consider a change in tax policy and hence model the impact of a 1% point increase change in the ITR on capital income:

$$\left[\frac{\Delta Y}{Y}\right]_{15x1} = \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} = Etr_{15x15} \begin{bmatrix} \Delta t_{r1} \\ . \\ \Delta t_{r15} \end{bmatrix} + Ht_{15x15} \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} + W_{15x15} \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} \quad (19)$$

The matrices Etr and Ht represent the effects of a change in each country's own taxation on demand in that particular country. Etr is a matrix, whose diagonal elements are the effect of a change in t_r in country j on excess demand ($C + I + NX + G$) in country j. Matrix Ht reflects the national multiplier effects and hence shows the effect of an autonomous change in excess demand ($C + I + NX + G$) on AD. The details are given in Appendix B.

[9] An increase in public spending produces an increase in the wages of the public sector employees, affecting the wage share. For simplicity, we assume away this effect. If this effect was taken into account, an increase in public spending would provide a further boost to economic activity. We account for an effect on private investment (I) twice since there is a direct positive effect of an increase in public spending on private investment (crowding in) as well as a direct negative effect of an increase in public debt on private investment (crowding out).

[10] We do the same method for disaggregated government expenditure (I_g, G_i, G_c) and estimate a European multiplier effect. The details are given in Appendix B.

Solving equation (19) for $\left[\frac{\Delta Y}{Y}\right]$ gives us the equivalent of a European multiplier effect of a change in ITR on capital income[11]:

$$\left[\frac{\Delta Y}{Y}\right]_{15x1} = \begin{bmatrix} \frac{\Delta Y_1}{Y_1} \\ \vdots \\ \frac{\Delta Y_{15}}{Y_{15}} \end{bmatrix} = (I_{15x15} - Ht_{15x15} - W_{15x15})^{-1}(Etr_{15x15}) \begin{bmatrix} \Delta t_{r1} \\ \vdots \\ \Delta t_{r15} \end{bmatrix} \quad (20)$$

3.2 Policy mix and total effects on budget balance, investment, net exports and inflation

Next, we model the effects of a policy mix (cpm) that combines (a) a change in income distribution and government expenditure; (b) a change in ITR on capital income and ITR on labour income; (c) a combined change in income distribution, government expenditure, and ITR on capital and labour income in all countries integrating both national and cross-country multiplier effects, which is a novelty of this paper.

For policy mix (a) we model a 1% fall in the profit share and 1% increase in public spending. The total European multiplier effect on equilibrium AD of each country is given by:

$$\left[\frac{\Delta Y}{Y}\right]_{15x1} = (I_{15x15} - Hg_{15x15} - W_{15x15})^{-1}((E_{15x15} + P_{15x15}) \begin{bmatrix} \Delta\pi_1 \\ \vdots \\ \Delta\pi_{15} \end{bmatrix} + Eg_{15x15} \begin{bmatrix} \Delta k_{g1} \\ \vdots \\ \Delta k_{g15} \end{bmatrix}) \quad (21)$$

For policy mix (b) we model a progressive tax policy based on a 1% increase in the ITR on capital income and a 1% fall in the ITR on labour income. The total European multiplier effect on equilibrium AD of each country is given by:

$$\left[\frac{\Delta Y}{Y}\right]_{15x1} = (I_{15x15} - Ht_{15x15} - W_{15x15})^{-1}(Etr_{15x15} \begin{bmatrix} \Delta tr_1 \\ \vdots \\ \Delta tr_{15} \end{bmatrix} + Etw_{15x15} \begin{bmatrix} \Delta tw_1 \\ \vdots \\ \Delta tw_{15} \end{bmatrix}) \quad (22)$$

For policy mix (c) we model the joined effect of all 4 policy changes. The total European multiplier effect on AD of each country is:

$$\left[\frac{\Delta Y}{Y}\right]_{15x1} =$$

$$(I_{15x15} - Ht_{15x15} - W_{15x15})^{-1}((E_{15x15} + P_{15x15}) \begin{bmatrix} \Delta\pi_1 \\ \vdots \\ \Delta\pi_{15} \end{bmatrix} +$$

$$Eg_{15x15} \begin{bmatrix} \Delta k_{g1} \\ \vdots \\ \Delta k_{g15} \end{bmatrix} + Etr_{15x15} \begin{bmatrix} \Delta tr_1 \\ \vdots \\ \Delta tr_{15} \end{bmatrix} + Etw_{15x15} \begin{bmatrix} \Delta tw_1 \\ \vdots \\ \Delta tw_{15} \end{bmatrix}) \quad (23)$$

Next, we calculate effects of the policy mix on investment and the budget balance integrating both national and cross-country multiplier effects. The total effect on investment ultimately depends on the character of the accumulation regimes (Onaran and Obst, 2016).

[11] We follow the same approach for a change in ITR on labour income, which is outlined in Appendix B.

The total effect of a change in income distribution, government expenditure, and ITRs on capital and labour income on investment is as follows:

$$\frac{\Delta I/Y}{\Delta \pi}+\frac{\Delta I/Y}{\Delta \kappa_g}+\frac{\Delta I/Y}{\Delta dt_r}+\frac{\Delta I/Y}{\Delta dt_w}=\frac{\partial I/Y}{\partial \pi}+\frac{\partial I/Y}{\partial \kappa_g}+\frac{\partial I/Y}{\partial t_r}+\frac{\partial I/Y}{\partial D/Y}\left(\frac{\partial D/Y}{\partial \kappa_g}+\frac{\partial D/Y}{\partial t_r}+\frac{\partial D/Y}{\partial t_w}\right)+$$
$$\frac{\partial I}{\partial Y}\left(\frac{\partial Y^*/Y}{\partial \pi}+\frac{\partial Y^*/Y}{\partial \kappa_g}+\frac{\partial Y^*/Y}{\partial t_r}+\frac{\partial Y^*/Y}{\partial t_w}\right) \quad (24)$$

We estimate the total effects of a simultaneous change in income distribution, government expenditures, and ITRs on capital and labour income on the budget balance as follows:

$$\frac{\Delta BAL/Y}{\Delta \pi}+\frac{\Delta BAL/Y}{\Delta \kappa_g}+\frac{\Delta BAL/Y}{\Delta dt_r}+\frac{\Delta BAL/Y}{\Delta dt_w}=\left(\frac{\partial T}{\partial Y}-\frac{\partial G}{\partial Y}\right)\left(\frac{\partial Y^*/Y}{\partial \pi}+\frac{\partial Y^*/Y}{\partial \kappa_g}+\frac{\partial Y^*/Y}{\partial t_r}+\frac{\partial Y^*/Y}{\partial t_w}\right)$$
$$+\frac{\partial T/Y}{\partial t_r}+\frac{\partial T/Y}{\partial t_w}-\frac{\partial G/Y}{\partial \kappa_g} \quad (25)$$

4. Estimation methodology

We analyse the effects of a change in income distribution and public investment on economic growth by means of estimating separate single equations for consumption, investment, exports, imports, and domestic prices and export prices.

The caveats and qualifications concerning the single equation approach (SEA) have been discussed in Onaran and Obst (2016). We chose the SEA approach over systems estimations such as vector autoregressive models (VAR). The applied estimation approach has the convenience of having a clearer interpretation of the results but might introduce some bias resulting from endogeneity issues and single-equation-based estimations. The main alternative of using a VAR model, however, comes with its own issues.

Unit root tests suggest that most of our variables are integrated of order one[12]. The profit share is stationary in Denmark, Greece, Spain, Sweden and the UK. Hence we use this variable in its level in these countries. ECM is applied wherever statistically significant.

In the short-run specifications we start with general specification with both contemporaneous values as well as first lags of the variables and include lagged dependent variables. We only keep those variables, which are statistically significant. In order to test for autocorrelation we use the Breusch-Godfrey test due to severe limitations in the Durbin Watson test statistic. In case of autocorrelation, either we keep the lagged dependent variable or add an AR(1) term. As outlined in Onaran and Obst (2016), we derive the long-term

[12] Results are available upon request.

coefficients (elasticities) using two different methods depending on whether there is a short-run (differenced form) or long-run relationship (ECM) among the variables.

5. Estimation results

The estimation results for consumption are given in table 1. After-tax wages and after-tax profits[13] show significant expected effects in all EU14 countries, except in Spain (negative effect of profit income on consumption) and Sweden (positive but insignificant effects of profit income on consumption). However, estimating a reduced sample size between 1960 and 2007 without the crisis years shows that the perverse effects in Spain are driven by the significant policy changes in capital tax[14] after the outbreak of the Great Recession in 2007[15]. The hypothesis that the MPC out of profit income is larger than out of wage income is confirmed in all countries.

Table 1

Table 2

Table 3

Table 4

Table 5

Table 6

Table 2 presents the effects on private investment based on equation (2)[16] including total government expenditure (G). In order to take into account the lag structure of the effect we have run investment specification with (G) in contemporaneous and lagged form[17]. There are positive significant effects of G in 9 EU countries: Austria, Finland, Greece, Germany, Ireland, Netherlands, Portugal, Spain, and Sweden. This presents the vast majority of our sample and hence indicates the importance of a public investment stimulus. Only in France, the effects of total government expenditure on private investment are negative[18]. We find

[13] After-tax profits are calculated by multiplying profit income with $(1 - t_r)$. We extended data for Greece and Portugal from 1980 back to 1970 assuming a constant tax ratio and for Spain and Sweden back to 1960. We did the same for after-tax wage income assuming a constant tax ratio on labour (t_w) for the same set of countries. After-tax wages are calculated by multiplying the wage bill with $(1 - t_w)$.

[14] The ITR on capital was significantly reduced from 42% to 26% in that short time period.

[15] We have run a robustness check for all EU14 countries estimating the reduced sample size 1970-2007. However, our results hold robust for all countries. Hence, we only take the reduced sample size for Spain.

[16] We present further robustness checks of our results regarding private investment in Appendix E and discuss the results in section 6.3 below.

[17] Moreover, in order to avoid issues with only a few degrees of freedom we estimated G in moving sum of 3 and 5 years. However, our results are robust.

[18] We also found negative significant effects for the UK in the full sample 1960-2012. However, when running a robustness check with a reduced sample size (1960-2007) the significant negative effects in UK do not hold true. Hence, we dropped (G) here. For France, the negative effects of (G) hold true also in the reduced sample, hence we keep the original estimation. The results are presented in Appendix E table E4.

strong and significant accelerator effects of private GDP on private investment in all countries. Regarding the after-tax profit share[19] the effects are more varied. It has no statistically significant effect in 9 countries: Austria, Denmark, Finland, Germany, Greece, Ireland, Portugal, Spain and the UK[20]. In these cases, the effects are treated as zero when we calculate the total effects on private excess demand. We find significant negative effects of an increase in public debt on private investment, which represents evidence of crowding out effects in 8 countries: Belgium, Finland, France, Ireland, Portugal, Spain, Sweden and the UK.

The estimation results for domestic prices, export prices, exports, and imports are given in tables 3 to 6[21]. We include VAT into domestic and export prices[22] as well as total government expenditure in the import function. The results are in line with our expectations; however, there are no significant effects of export prices relative to import prices on exports in Belgium, Ireland, Luxembourg, the Netherlands and Portugal. We also find no statistically significant effects of domestic prices relative to import prices in Denmark, Finland, Germany, Greece, Luxembourg, and the UK. Appendix D summarises the effects of a change in profit share on X/Y and M/Y.

The total effect does not only depend on the elasticity of exports and imports on relative prices and the pass-through from labour costs on prices but also on the relative size of each component in GDP. Therefore, in small open economies the effects are likely to be much larger compared to large relatively closed economies. Regarding VAT we find statistically significant effects on domestic prices in 7 countries: Finland, Ireland, Italy, Portugal, Spain, Sweden, and the UK. In regards to export prices we find statistically significant effects in only 3 countries: Denmark, Germany and Italy. An increase in government expenditure leads to an increase in imports in 6 countries: Belgium, Germany, Ireland, Portugal, Sweden and the UK.

5.1. National effects

Table 7 summarises the effects of a 1% increase in the profit share on components of private AD: consumption, investment, exports and imports. The first column reports the

[19] We have calculated after-tax profit share by multiplying profit share with $1 - t_r$. We have extended data back to 1960 for all countries assuming a constant tax ratio on capital.

[20] When we compare our results to previous findings in the empirical literature (Onaran and Obst, 2016) we find a general breakdown of the profit-investment nexus since the start of the Great Recession in 2007. Taking after-tax profits this issue becomes even more apparent. Only 5 EU countries have a statistically significant profitability effect.

[21] Our export equation has not been modified; hence the results are identical to Table 5 in Onaran and Obst (2016).

[22] In the export price function $1 + t_{cf}$ is a weighted average calculated by multiplying t_c in country j multiplied with the share of exports (in total exports) of country i that are exported to country j.

partial effects on consumption. In comparison to our estimates for the EU15 countries presented in Onaran and Obst (2016), which do not take the role of taxes into account, the difference in MPC is significantly larger in the majority of countries with differences ranging from -0.34 (Ireland) to -0.86 (Spain). Only for Belgium and Italy we find surprisingly low (but significant) differences in MPC of -0.17 and -0.21 respectively. On average, our mean differential is 0.44[23].

Table 7

The second column gives the partial effects on private investment. A 1% point increase in π in the EU14 countries leads to a partial positive effect on private investment with the effect ranging between 0.09%-points (Italy) and 0.34%-points (Belgium) as a ratio to GDP. The marginal effects of public spending are positive in the majority of countries and range between 0.32%-points (Germany) and 0.63%-points (Sweden). France is the only country with a negative effect of -0.36%-points. Public debt has a significant negative effect in 8 countries with effects ranging between -0.05%-points (Spain) and -0.28%-points (Finland). In comparison, the negative crowding out effects are thus much lower than the positive effects of public spending.

If we sum up the effects of an increase in π on domestic private demand, the negative effect on consumption is substantially larger than the positive effect on investment in absolute values in 14 out of 15 countries[24]. Thus, domestic demand in the EU15 is clearly wage-led.

The integration of the foreign sector has a crucial role to play in determining whether an economy is wage-led or profit-led. The effects of an increase in π on net exports range between 0.06%-points in Belgium and 0.4%-points in Austria, as a ratio to GDP. Column F sums up the partial effects on private excess demand when the π increases in each country in isolation. Strikingly, the integration of the foreign sector does not lead to a change of the demand regime. Belgium already had profit-led domestic demand due to low differences in MPC and high investment effects.

Column G reports the multiplier, which was calculated using the elasticities of C, I, M and G with respect to Y (see Appendix B)[25]. As expected, the multipliers are above one and range

[23] Marglin and Bhaduri (1992) find a mean differential of 0.37 for a sample of 16 OECD countries. For Luxembourg the MPC is based on pre-tax wages and pre-tax profits.
[24] Belgium is the exception in our sample. This finding is in alignment with our estimations in Onaran and Obst (2016). However, domestic demand in Denmark is now wage-led.
[25] The results illustrate short run multiplier effects.

between 1.04 in Belgium and 5.05 in Greece[26]. In comparison to the multipliers estimated in Onaran and Obst (2016) when integrating fiscal policy[27] the multiplier becomes significantly larger. For countries with multipliers larger than one the effect of a change in distribution on demand becomes amplified. Column H reports the per cent change in equilibrium demand after the multiplier mechanism.

Table 8 presents 3 fiscal policy changes including (1) an increase in public spending by 1% point of GDP; (2) a 1% point increase in ITR on capital income, (3) a 1% point decrease in ITR on labour income, first in each country in isolation and then in all countries simultaneously. For the details on the calculations see Appendix B.

Table 8

As a response to increasing public spending in each country in isolation, $excess\ demand\ /\ Y$ (Column A) is increasing in all countries with effects ranging between 0.52% (Belgium) and 1.51% (Austria). Column B shows the multipliers that take into account positive accelerator effects of output as well as negative crowding out effects of an increase in public debt. As expected, multipliers following a change in public spending are larger on average compared to multipliers following a change in income distribution (Table 7 Column G). The total effects on AD are significantly positive for all countries as can be seen in column C. Following an isolated 1% points increase in G/Y equilibrium AD increases by roughly 3% in Austria or 7% in Greece.

As a result of a rise in taxes on capital in each country in isolation, $excess\ demand\ /\ Y$ (Column E) declines in all countries with effects ranging between -0.07% (Finland) and -0.17% (Belgium). An increase in taxation on profits will have negative effects on consumption as well as investment (through reducing profitability). The multipliers take into account the direct effect of a change in ITR on capital income on tax revenues as well as the indirect accelerator effects of output on government expenditure and possible negative public debt effects on private investment (see Appendix B for details). When the multiplier mechanism is taken into account these effects become amplified leading to a significant decline of equilibrium AD in all counties (Column G). For instance, equilibrium AD decreases by 0.50% in the Netherlands and by 0.66 in Greece.

[26] The results for Luxembourg (0.560) do not include government sector in the calculation but are based on the estimations in Onaran and Obst (2016). Stockhammer et al. (2009) find multipliers ranging between 1.4 and 2.7 for the Euro area (hypothetical aggregate of EU12 countries).

[27] We augment the multiplier by taking into account the effects of public spending and public debt on private investment as well as the effects of (*G*) on imports. Moreover, we account for the effect of output on government expenditure.

In response to a 1%-point decline in taxes on labour in each country in isolation, $excess\ demand\ /\ Y$ (Column I) increases in all countries with effect ranging between 0.26% (Belgium) and 0.64% (Spain). The decrease in ITR on labour income will induce consumption and hence increase demand in the economy. When the multiplier mechanism is taken into account the effects become amplified with effects ranging between 0.30 (Belgium) and 2.86 (Spain).

Appendix F table F1 shows the effects of a 1% fall in the profit share, a 1%-point increase in G/Y and tr as well as 1% decrease in tw on investment. The investment regime is wage-led, e.g. the effect of a fall in π on I/Y is positive in Austria, Denmark, Finland, Germany, Greece, Ireland, Portugal, Spain and the UK. The effects are ranging from strong positive effects in wage-led countries such as Spain (0.62%-points) to moderate negative effects in profit-led countries such as Belgium (-0.38%-points).

The effect of a 1% fall in π on the trade balance is negative with effects ranging between 0.08%-points in Italy and 0.44%-points in |Austria. Belgium is an exception due to low positive net export effects via the price channel and a strong fall in imports following the fall in AD as a profit led country.

As expected, the effects of a 1% increase in G on investment are positive and range between 0.27%-points in France[28] and 2.0%-points in Finland capturing positive crowding in and demand effects as well as negative debt effects on private investment. The effects on the trade balance are negative in all countries due to increased demand for imports.

The effects of an increase in ITR on capital income on private investment are negative in all countries with the effects ranging between 0.03%-points (Austria) and 0.13%-points (Greece). On the contrary, a fall in ITR on labour income would lead to positive effects on private investment. The effects are strong in countries with high differences in MPC such as in Portugal (0.84%-points).

Table F3 in Appendix F shows the effects on budget balance if the policies are implemented in isolation. A 1% fall in the profit share leads to an improvement in the budget balance in all countries except in Belgium. Since 14 EU countries are wage-led an increase in the wage share has positive effects on GDP growth. An increase in public spending, however, leads to a deterioration of the budget balance with effects ranging from -0.49%-points (Austria) to -0.98%-points (Greece). A 1% increase in taxation on capital income as well as a 1% fall in taxation on wages both lead to an improvement in the budget balance with the latter

[28] France had a negative partial effect of government expenditure and also a significant negative effect of public debt effect on *I*.

having significantly larger positive effects. Overall, a combined change in the 4 policies leads to in improvement in the majority of the countries except in Belgium, Greece and Ireland.

5.2. Europe-wide effects

Next we analyse the effects of a simultaneous 1% point increase in the profit share in all EU15 countries. Column I in Table 7 presents the results. Most strikingly, all countries start to contract after the incorporation of further effects on their net exports. Comparing columns H and I, wage-led economies experience even stronger negative effects on demand. Demand decreases by between 0.39% (Italy) and 3.80% (Spain). Belgium, the only profit-led country, also starts contracting (0.39%) after a race to the bottom in the wage share in Europe. Overall, a simultaneous decline in the wage share in all countries leads to a decline in EU15 GDP by 1.45%[29].

Furthermore, we analyse the effects of a simultaneous 1% point increase in public spending in all EU15 countries. Column D in table 8 presents the results. Indeed, all countries would experience significant positive effects on equilibrium AD with values ranging between 2.09% (UK) and 10.04% (Finland). Overall, EU15 GDP increases by 3.82% indicating the significant positive effects of an increase in public spending on output through the multiplier mechanism. The effects of fiscal expansion are now stronger compared to fiscal expansion in one country in isolation due to high cross-country spillovers[30].

Taking into account taxation policies we analyse the effects of a simultaneous 1% point increase in the ITR on capital income as well as a simultaneous 1% point decrease in the ITR on labour income. The former leads to negative effects in all countries ranging with values ranging between 0.18% (Ireland) and 0.80% (Netherlands). Overall, EU 15 GDP would decrease by 0.36%. However, the positive effects on demand following a simultaneous decrease in ITR on wages are significantly larger in comparison. AD increases by 0.93% in Italy or 3.66% in Spain. EU15 GDP increases by 1.79%. We will contrast these effects directly with each other in section 7.

[29] Onaran and Obst (2016) found a decline in EU15 GDP by 0.30% following a 1%-point fall in the wage share in Europe.

[30] The empirical significance of spillover effects as well as the importance of coordination of fiscal policies is also confirmed in for instance Auerbach and Gorodnichenko (2013).

Next, we report the effects on investment and net exports following a simultaneous change in income distribution, government expenditure, and implicit tax rates on capital and labour income[31].

Table G2 shows that effects of a simultaneous 1% point fall in the profit share on investment are positive in 13 countries (now also including France, Netherlands and Sweden). Only Belgium and Italy have a profit-led investment regime in this case. On average, private investment increases by 0.20%-points, as a ratio to GDP. This is a striking finding, indicating that the accumulation regime is wage-led in the vast majority of the EU15 countries when we take simultaneous policy changes into account.

Regarding net exports, in all countries, the total effects of a simultaneous fall in profit share is lower compared to an isolated change of the profit share. A fall in the profit share by 1% point leads to an improvement of the trade balance in Belgium, Denmark, Finland, France, Italy, Luxembourg, Netherlands, and Sweden.

Regarding the effect of a rise in public spending table G2 shows that the effects on private investment are strongly positive in all countries with values ranging between 0.429%-points (UK) and 2.97-points (Finland). Overall, a 1% point increase in public spending leads to an increase in private investment of 0.92%-points. Again the effect is stronger when fiscal policy is implemented in coordination as opposed to in isolation. The effects on the trade balance are still negative in Germany, Ireland, Netherlands, Portugal, Sweden, Spain, and the UK; however the negative effect on trade balance is now smaller in absolute value because of the cross border spill over effects of higher demand on exports.

Finally, we analyse the effects of a simultaneous change in implicit tax rates on capital and labour income on investment. As expected, a simultaneous 1% point increase in ITR on capital leads to slightly stronger negative effect on private investment in all countries with values ranging between 0.03%-points (UK) and 0.18%-points (NL), compared to a change in isolation. On average, private investment declines by 0.08% points. In contrast, a simultaneous 1% point fall in ITR on labour income leads to stronger positive effects on private investment due to increased consumption and hence investment demand. The values range between 0.17%-points (Italy) and 0.96%-points (Finland) and are larger compared to an isolated change in ITR on labour income.

[31] We do not model the impact of a change in ITR on capital and labour income on net exports. Also, for modelling the impact of *G* on *NX* we only use the *M* and *W* matrices as there are only income effects following an increase in public spending.

5.3. Robustness checks

We have run a series of robustness checks for our consumption and investment function. For our consumption function[32] we have checked the robustness of our results using different sample sizes (1960-2007; 1980-2007; 1980-2012). Our results are robust for the EU14 countries, except for Spain. Here, we did either find insignificant or perverse effects of net profit income on consumption for the full sample, which is at odds with our previous estimations and the empirical literature presented in Onaran and Obst (2016). Hence, we have kept the full sample size for all EU14 countries, but reduced it to the pre-crisis period for Spain.

Appendix E illustrates the tables for different investment functions we have estimated to test the robustness of our results. Table E1 presents the results for the private investment specification, which includes after-tax profit share $(1 - t_r)\pi$, total GDP (Y) and the real long-term interest rate (r). In comparison to our estimations of the investment function in Onaran and Obst (2016) (from now on called 'benchmark specification') the results are robust. We have a statistically significant profit marginal in half of the EU14 countries: Austria, Belgium, France, Italy, Ireland, Netherlands, and Sweden. In all countries, private GDP has strong and significant accelerator effects. The profitability effect is significantly larger in the Netherlands with 0.26%-points (0.08%-points in benchmark specification) as well as in Belgium with 0.55%-points (0.21%-points in benchmark specification) and France with 0.25%-points (0.10%-points). However, we find no statistically significant effects in Denmark (0.17%-points in benchmark specification).

Table E2 presents the effects on private investment when G is integrated in the specification as moving sum of 3 years. As can be seen, total government expenditure is significant in 6 countries: Belgium, Finland, France, Netherlands, Sweden and the United Kingdom. We find positive effects in Finland, Netherlands, and Sweden. We find negative effects on private investment in Belgium, France and the UK. However, when we estimated a reduced sample size (1960-2007) only the positive government expenditure effects in Finland, Netherlands and Sweden remain. In Belgium, France and UK the effects become statistically insignificant and are hence not robust.

Table E3 shows the results for private investment based on equation (2') where I is a function of public investment (I_g), government spending in social infrastructure (G_i) and other

[32] Since our tax data for ITR on capital and labour income) comes from different data sources we have also checked correlations between before tax and after tax profit share and wage share as well as before tax and after tax adjusted profits and wages to check for the validity of our calculated after-tax wage and profit bill as well as after-tax profit share.

government spending (G_c), after-tax profit share ($(1-t_r)\pi$), private GDP (Y_p) and public debt as a ratio to GDP (D/Y).[33]

The results mostly confirm our theoretical expectations for different types of government expenditure. In alignment with the expected positive demand and additional crowding in effects of public investment, I_g shows indeed positive effects in the short run as well as in the long run in 8 countries. However, we also find significant negative effects in three countries (Belgium, France and Spain). Regarding our variables G_i and G_c our theoretical assumptions are also visible in the data. We find positive effects in 5 countries for both government spending categories. On average, investment in social infrastructure shows larger effects compared to other government spending where the positive effects (elasticities) are smaller. This result seems plausible since we expect that other government spending primarily increases output through multiplier effects, but does not lead to additional crowding in effects enhancing private investment such as investment in social infrastructure does.

However, other government spending also shows large effects in the Netherlands. In the UK other government spending has a negative impact. In Greece investment in social infrastructure has a negative impact[34].

There is a group of countries that have strong and significant positive effects of different types of government expenditure on private investment including Austria, Finland, Greece, Netherlands, and Sweden. For instance in Austria both I_g and G_i have positive effects on private investment. In Greece, both I_g and G_c have positive effects but G_i has a negative effect.

There is another group of countries with mixed effects of government expenditure: Belgium, France, Spain and the UK. In Belgium, surprisingly, I_g has a negative effect in the long as well as in the short run. However, G_i has a strong and significant positive effect in the long run. In the UK, I_g has the expected positive and significant effects, however, G_c has a negative effect on private investment. In an alternative long-run specification for the UK, I_g and G_c are insignificant but G_i has a strong positive and significant effect. However, the effect of G_i is not robust across specifications.

[33] Theoretically this specification is closest to our preferred investment specification outlined in section 3. However, due to the short sample size and multicollinearity issues we report it as a robustness check only. Nevertheless, the results for different government expenditure categories confirm and further explain our estimated effects of total G on private investment (table 2 in section 4).

[34] We have run a robustness check with reduced sample size (1960-2007) and the results are overall robust. Only in Denmark G_c has become insignificant and in Greece I_g has become insignificant.

Moreover, we estimated the effects of each variable (I_g, G_i, G_c) on *excess demand*/Y, the multiplier effects and how equilibrium AD changes following a 1% point increase in isolation as well as following a simultaneous change. The results are presented in table F5 in Appendix F. In the first scenario, all countries increase public investment by 1% point. The total effects on AD are significantly positive for all countries. Following an isolated 1% point increase in I_g equilibrium AD increases by 1% in Belgium or 5.10% in Greece, as a ratio to GDP (Column C). Similarly, in the second scenario, where all countries increase government spending in social infrastructure (Column G), the effects are strongly positive on equilibrium AD ranging between 1.07% (Ireland) and 3.41% (Finland). Moreover, in the third scenario, where all countries increase other government spending the multiplier effects are large leading to an increase in equilibrium AD (Column K) with values ranging between 1.08% (Belgium) and 6.25% (France).

Following a simultaneous rise in I_g by 1%-point as a ratio to GDP, EU15 GDP would increase by 3.71%; following a simultaneous change in G_i it increases by 3.80% and following a simultaneous rise in G_c it increases by 5.15%.

6. Policy mix scenarios for egalitarian growth and sustainable fiscal policies

In this section, we set out an alternative scenario of a policy mix that includes 4 policies implemented simultaneously in each country: (a) a pro-labour wages policy and expansionary fiscal policy based on 1%-point increase in the pre-tax wage share and a 1%-point increase in public spending; (b) a progressive tax policy based on a 1%-point fall in the tax rate on wages; and a 1%-point increase in the tax rate on profits, and (c) a policy mix that combines the effects of all 4 policies, i.e. pro-labour pre-distribution and redistribution and fiscal expansion. See Appendix F for details.

Table 9 (Column A) shows that a combined increase in the wage share and government expenditure has large positive effects on equilibrium AD of each national economy with values ranging between 2.29% (Ireland) and 13.67% (Finland). Overall, EU15 GDP would increase by 5.56%.

Column B presents the effects of a more progressive tax policy on equilibrium AD in each national economy. The positive effects of a fall in ITR on labour income on consumption outweigh the negative effects of a rise in ITR on capital income on private investment as well

as consumption. All countries experience positive effects with values ranging between 0.52% in Ireland and 3.22% in Spain[35]. Overall, EU15 GDP increases by 1.43%.

Finally, we combine the 4 policy changes in income distribution, public spending, and taxation. The effects of this policy mix are strongest in Finland (11.71%), Greece (14.47%) and Spain (15.49%). These countries had high differences in MPC, no significant effect of profit share but significant government expenditure effects on private investment. Overall, EU15 GDP increases by 6.63% illustrating the importance of a more comprehensive policy mix of wage, taxation and investment policies.

Moreover, we estimate the total effect of a combined policy mix on investment. (Column D in table 9). Following a simultaneous and combined change in wage and fiscal policies private investment increases in all countries. Hence, despite negative effects coming from an increase in ITR on capital the strong the positive effects coming from a fall in ITR on wages, as well as a fall in the profit share and an increase in public spending lead to an average increase in private investment by 1.46%-points, as a ratio to GDP. The effects are strongest in countries with significant effect of G on I; for instance (I/Y) increases by 2.06%-points in Austria or 4.19%-points in Finland. The effects are weaker in countries without significant effect of G on I but with significant negative effect of public debt such as in Belgium (0.82%-points) or in the UK (0.85%-points).

Table 9

Next, we estimate the impact of each fiscal policy change on the budget balance $(T - G)$ as a ratio to GDP. Table 10 outlines the results when there is a simultaneous change in fiscal policy in all countries. A 1% point simultaneous fall in the profit share leads to an improvement in the budget balance due to the fact that 14 EU countries are wage-led and hence an increase in the wage share has positive effects on GDP growth. The effects range from 0.007%-points (Greece) to 0.62%-points (Spain). An increase in public spending by 1% point, however, leads to a deterioration of the budget balance with effects ranging from -0.02%-points (Finland) and -0.98% points (Greece). Surprisingly, expansionary fiscal policy in Spain is self-sustaining indicated by a positive effect in Spain (0.36%-points) due to strong multiplier effects.

A 1% point simultaneous increase in taxation on capital income has positive effect on the budget balance. The improvement ranges between 0.18%-points in the Netherlands and 0.36%-points in Greece. However, the effects of a 1% point fall in the implicit tax rate on

[35] Spain has the largest MPC of -0.858 and hence experiences a significant increase in consumption when taxation on wages is reduced.

wages leads to an even larger improvement in the budget balance with effects ranging between 0.55%-points in Greece and 1.21%-points in Spain. Overall, when we combine the 4 policies there is an improvement in the budget balance in all countries except in Greece and Ireland. Here, the budget balance deteriorates slightly by -0.06%-points and -0.05%-points respectively. On average, however, the budget balance in the EU15 countries improves by 0.84% points.

Table 10

Finally, we analyse to what extent a wage stimulus in the EU15 countries would exert inflationary pressures. Table F4 in Appendix F shows the effects for an isolated as well as simultaneous 1% increase in the wage share on inflation in the EU15 countries. Annual inflation increases by roughly 1.3% following an isolated increase and by 1.5% following a simultaneous 1% point increase in the wage share. As a result, the majority of the countries would experience inflation rates well below the ECB target inflation rate (2%).

7. Conclusion

This paper developed a multi-country Post-Kaleckian model augmented by a government sector. We introduced public spending and taxes on consumption, labour and capital in a demand-led growth model and estimated it for the EU15 countries.

The empirical analysis in this paper has shown that a simultaneous decline in the wage share in a highly integrated European economy leads to a decline in growth. There is room to stimulate demand in an economic climate of sluggish growth: a 1% simultaneous increase in the wage share at the European model could lead to a 1.45% increase in EU15 GDP.

The negative effects of a fall in the wage share on consumption overpower the positive effects on investment in 14 European countries. When considering after-tax income, the difference in MPC is significantly larger in the majority of the EU15 countries, compared to the previous empirical literature. Moreover, when firms consider after-tax profits, the general breakdown of the profit-investment nexus becomes even more apparent. Hence, domestic demand is clearly wage-led in the EU15. Interestingly, integrating the foreign sector does not lead to a regime shift in the EU15 since domestic demand is strongly wage-led. Therefore, in isolation, we find 14 countries to be wage led and 1 country to be profit-led.

We find evidence for both crowding in and (financial) crowding out effects of fiscal variables on private investment. On the one hand, government expenditure enhances private investment in 9 EU countries, which presents the majority of our sample. On the other hand, public debt has a negative effect on private investment in 8 countries. However, the negative

effects of public debt are small compared to the positive effects of public spending, indicating that private investment is overall positively affected by fiscal expansion.

When we disaggregate public spending into three parts the empirical results confirm our theoretical expectations for different types of government expenditure. Public investment has significant positive effects on private investment in the majority of the EU15 countries. Moreover, both public spending in social infrastructure and other government spending have significant positive effects in 5 countries each. These results are very important from an economic policy making perspective. However, due to data limitations and econometric issues (e.g. multicollinearity) these results are at best only indicative and require further research in the future.

Integrating public spending and public debt into the model increases the multiplier (on average) compared to the multipliers estimated in the private sector open economy model in the previous empirical literature. Moreover, the multipliers related to an increase in public spending are larger on average than multipliers related to a change in income distribution since they integrate impacts of public debt and taxation as well.

As expected, all multiplier effects are much stronger when policies are implemented simultaneously. A combined and simultaneous change of a 1% increase in the pre-tax wage share and 1% increase in public spending leads to a significant increase of 5.56% in the EU15 GDP and hence indicates the importance of a comprehensive policy mix that combines wage-led and public investment policies in Europe, The impact of egalitarian wage policies are positive but small; however when mixed with the much stronger impact of fiscal expansion, the overall stimulus is much more effective in achieving both targets of income equality and strong job creation,

The hypothesis that a more progressive tax system potentially stimulates demand (e.g. through national multiplier effects) is confirmed in our empirical estimations. A redistributive policy of a 1% point fall in ITR on labour income and a simultaneous 1% point increase in ITR on capital income leads to an increase in EU15 GDP of 1.43%, as a ratio to GDP. The positive effects of a reduction of the tax rate on wages significantly induce consumption and thus outweigh the negative effects on investment spending (and consumption demand) due to an increase of taxation on profit income.

Finally we estimated the impact of a combined policy mix that includes pre-distribution, redistribution and public spending based on a 1% point increase in the wage share, a 1% point increase in public spending, a 1% increase in ITR on capital income, and a 1% fall in ITR on labour income in all countries. As expected, a combined policy mix that takes into account

wage policy, public spending, and progressive taxation leads to much stronger growth effects and increases EU15 GDP by 6.63%, as a ratio to GDP.

This paper also analysed the impact of expansionary fiscal policy on budget balance. A targeted public spending policy, together with a more progressive tax policy and a pro-labour wage policy, leads to an improvement in the budget balance in the majority of the EU15 countries. In these countries the positive accelerator and multiplier effects on demand and growth lead to a rise in taxes that outweighs the adverse effects of higher government spending on the budget balance. Following a simultaneous change in income and fiscal policy only Greece and Ireland experience a negligible deterioration of the budget balance. On average, the budget balance improves by 0.84% points in the EU15 countries. Hence, expansionary fiscal policy is sustainable when wage and public spending policies are combined with progressive tax policy; the impact is stronger when these policies are implemented in a coordinated fashion across Europe due to strong positive spill over effects on demand.

As an outcome of a wage-led recovery scenario (e.g. wage share increasing by 1% point), the majority of the countries would experience increasing inflation rates but well below the ECB target inflation rate of 2%. In fact, the results indicate that a wage stimulus in the EU15 would help to keep the European economy away from deflation.

Extending the post-Kaleckian private sector open economy model by taxes on capital and labour has shown to increase the likelihood of a wage-led economic regime. Integrating public spending increases the multiplier effects and amplifies the wage-led outcome. Hence, the analysis of this paper highlights the importance to link fiscal policy with policies targeting a more equal income distribution.

Combining egalitarian labour market and tax policies with public spending policies are important not only for achieving higher growth, investment and sustainable debt levels but also for other important social targets, such as lowering carbon emissions via green investments or improving gender equality via public spending in social infrastructure. Similarly, public investment policies are key to achieving structural change, higher productivity in tradable sectors and keeping trade balance under control while still managing an egalitarian economic model.

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Table 1. *Consumption: dependent variable* $d\ log\ (C)$

	c	$dlog(1-t_r)R$	$dlog(1-t_w)W$	$dlog(C-1)$	$(AR1)$	DW	R^2	Sample
A	0.010	0.113	0.588			2.073	0.544	1971-2012
	(3.760) ***	(3.792) ***	(5.950) ***					
B	0.015	0.094	0.289			1.638	0.339	1971-2012
	(5.795) ***	(2.152) **	(4.071) ***					
DK	0.007	0.087	0.519			1.668	0.211	1971-2011
	(1.434)	(1.987) **	(3.089) ***					
FIN	0.017	0.106	0.439			1.814	0.553	1966-2012
	(5.386) ***	(4.455) ***	(6.445) ***					
F	0.014	0.086	0.515			1.608	0.535	1971-2012
	(6.307) ***	(3.100) ***	(5.802) ***					
D	0.005	0.067	0.381	0.419		1.810	0.634	1966-2012
	(1.576)	(1.731) *	(3.711) .***	(3.726) ***				
GR	0.018	0.190	0.399		0.375	1.957	0.735	1972-2013
	(3.396) ***	(3.902) ***	(5.619) ***		2.102 **			
IRL	0.011	0.129	0.457			1.989	0.472	1971-2012
	(2.036) **	(3.110) ***	(5.058) ***					
I	0.014	0.112	0.311		0.568	1.890	0.657	1972-2012
	(2.867) **	(4.810) ***	(3.596) ***		3.855 ***			
L	0.016	0.103	0.350			1.741	0.350	1961-2013
	(4.087) ***	(3.451) ***	(4.920) ***					
NL	0.000	0.095	0.338	0.519		1.921	0.668	1971-2012
	-(0.040)	(3.340) ***	(3.673) ***	(4.878) ***				
P	0.018	0.089	0.574			1.821	0.591	1971-2012
	(4.495) ***	(5.287) ***	(6.867) ***					
E	0.009	0.072	0.753			2.449	0.847	1961-2007
	(3.510) ***	(2.136) **	(15.132) ***					
S	0.010	0.019	0.236	0.258		1.865	0.282	1962-2012
	(2.640) **	(0.666)	(2.701) ***	1.924 *				
UK	0.011	0.072	0.626		0.310	2.038	0.682	1967-2012
	(3.268) ***	(4.288) ***	(6.761) ***		(2.051) **			

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table 2. *Private investment: dependent variable $d\,log(I)$ with government expenditures (G)*

	c	$dlog((1-tr)\pi_{-1})$	$dlog((1-t_r)\pi)$	$log((1-t_r)\pi_{-1})$	$dlog(Y_p)$	$dlog(Y_{p-1})$	$dlog(I_{-1})$	$dlog(G)$	$dlog(G_{-1})$	$dlog(DY)$	$dlog(DY_{-1})$	$log(I_{-1})$	$log(Y_{p-1})$	$log(G_{-1})$	$log(DY_{-1})$	$(AR1)$	DW	R^2	Sample
A	-0.017	0.138			1.285			0.630		-0.168							1.935	0.570	1971-2013
	-(1.415)	(1.433)			(4.131) ***			1.724 *		-1.612									
B	-0.004	0.397			1.429					-0.393							1.607	0.640	1970-2012
	-(0.402)	2.667 ***			(5.137) ***					-2.766 ***									
DK	0.075			0.064	2.342												2.245	0.754	1961-2012
	(0.855)			1.142	(10.928) ***														
FIN	-0.510		-0.027		1.344					-0.140	-0.231	-0.483	0.265	0.336	-0.105		1.884	0.915	1972-2012
	-(3.811) ***		-0.394		(6.958) ***					-2.436 **	-4.213 ***	-5.203 ***	3.081 ***	3.925 ***	-4.063 ***				
F	0.017	0.177			1.390				-0.528	-0.335							1.975	0.912	1978-2013
	(2.638) ***	(3.002) ***			(9.538) ***				-(3.076) ***	-5.365 ***									
D	-0.364	0.0002			1.642		0.187		0.327			-0.217	0.217				2.001	0.792	1962-2012
	-(3.457) ***	(0.002)			(10.578) ***		2.228 **		1.808 *			-2.974 *	3.397 ***						
GR	0.033			0.084	1.696			0.498								-0.259	2.090	0.615	1961-2013
	(0.585)			(1.613)	(7.160) ***			1.829 *								-(1.648) *			
IRL	0.184	0.171				0.575				-0.440		-0.445	0.161	0.280	-0.124		1.721	0.629	1971-2012
	(1.038)	(0.970)				1.339				-4.148 ***		-3.262 *	1.958 *	1.915 *	-3.007 ***				
I	-0.018	0.129			1.374											0.333	1.924	0.640	1962-2012
	-(2.251) **	(1.722) *			(8.303) ***											(2.413) **			
L	-0.029	0.160			1.728												2.410	0.273	1963-2013
	-(1.420)	(0.675)			(4.172) ***														
NL	-0.033	0.254			1.549			0.538									1.802	0.578	1962-2013
	-(2.979) ***	2.644 ***			(7.732) ***			1.864 *											
P	-1.979	-0.069			2.424	0.717		0.588				-0.622	0.993		-0.179		2.074	0.728	1974-2012
	-(3.969) ***	-(1.398)			(6.286) ***	1.838 *		1.965 **				-3.732 **	3.684 ***		-2.510 **				
E	-1.301			0.094	2.565				0.408		-0.231	-0.359	0.500			0.398	1.770	0.939	1972-2013
	-(2.528) **			(1.171)	(13.832) ***				2.518 **		-3.408 ***	-3.792 **	3.540 ***			(2.291) **			
S	0.164			0.152	1.617			1.235		-0.206							1.629	0.772	1971-2013
	(1.869) *			(2.206) **	(7.229) ***			2.465 **		-2.593 ***									
UK	-0.659			0.053	1.697						-0.203	-0.388	0.403				2.173	0.785	1972-2012
	-(2.377) **			(1.321)	(9.743) ***						-2.392 **	-(3.680) **	(3.542) ***						

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table 3. *Price deflator: dependent variable* $dlog(P)$

	c	$dlog(P_m)$	$dlog(P_{m-1})$	$dlog(P_{-1})$	$dlog(ulc)$	$dlog(ulc_{-1})$	$dlog(1+t_c)$	$(AR1)$	DW	R^2	Sample
A	0.005	0.146		0.453	0.286				1.920	0.851	1962-2013
	(2.433) **	(3.715) ***		(5.320) ***	(4.952) ***						
B	0.019	0.158	0.129			0.214		0.573	2.139	0.813	1962-2013
	(3.985) ***	(6.721) ***	(4.197) ***			(2.456) ***		(3.662) ***			
DK	0.008	0.183		0.465		0.249			2.029	0.865	1962-2013
	(2.423) **	(5.266) ***		(4.037) ***		(2.698) ***					
FIN	0.009	0.236		0.198	0.416		0.742		1.966	0.860	1966-2012
	(2.299) **	(5.712) ***		(2.128) **	(5.399) ***		(2.336) **				
F	0.004	0.094		0.633		0.194			1.795	0.907	1962-2013
	(1.718) *	(3.580) ***		(4.635) ***		(1.624) *					
D	0.017		0.032		0.366			0.697	2.105	0.841	1962-2013
	(4.498) ***		(1.635) *		(7.781) ***			(8.452) ***			
GR	0.019	0.462			0.423 0.000				1.758	0.810	1962-2013
	(2.870) ***	(6.435) ***			(5.932) ***						
IRL	0.030		0.235			0.334	1.003	0.404	2.120	0.753	1971-2012
	(2.418) **		(2.872) ***			(2.512) **	(2.309) **	(2.727) ***			
I	0.028	0.084			0.445		0.909	0.902	2.404	0.958	1971-2012
	(1.333)	(4.292) ***			8.934 ***		(3.251) ***	(11.479) ***			
L	0.024	0.523		-0.482	0.345				1.651	0.479	1962-2013
	(4.180) ***	(5.076) ***		-(3.605) ***	(3.284) ***						
NL	0.007	0.152		0.448		0.255			1.997	0.801	1962-2013
	(2.492) **	(4.599) ***		(3.656) ***		(2.687) ***					
P	0.005	0.206	0.199			0.668	0.768		1.645	0.921	1981-2012
	(0.982)	(3.418) ***	(3.584) ***			(9.214) ***	(1.870) *				
E	0.025		0.078		0.430		0.640	0.857	2.257	0.944	1981-2012
	(1.971) **		(2.700) ***		(5.281) ***		(2.335) **	(7.580) ***			
S	0.011	0.156	0.225			0.407	0.628		1.590	0.846	1971-2012
	(3.032) ***	(3.915) ***	(5.372) ***			(6.697) ***	(2.553) **				
UK	0.002	0.036		0.380	0.558		0.565		2.136	0.945	1966-2012
	(0.769)	(1.206)		(7.491) ***	(12.119) ***		(1.708) *				

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table 4. *Export price deflator: dependent variable* $dlog(P_x)$

	c	$dlog(P_m)$	$dlog(P_{m\_1})$	$dlog(P_{x-1})$	$dlog(ulc)$	$dlog(ulc_{-1})$	$dlog(1+t_c)$	$log(P_{x-1})$	$log(P_{m-1})$	$log(ulc_{-1})$	$log(t_{c-1})$	$(AR1)$	DW	R^2	*Sample*
A	0.002	0.616			0.152								2.339	0.867	1961-2013
	(1.060)	(15.385) ***			(3.490) ***										
B	0.001	0.789			0.096								2.037	0.949	1961-2013
	(0.674)	(26.133) ***			(1.920) *										
DK	1.250	0.728					0.445	-0.630	0.384	0.213			1.989	0.922	1966-2012
	(3.965) ***	(18.834) ***					(1.661) *	-(4.344) ***	(4.262) ***	(3.904) ***					
FIN	-0.003	0.776			0.185								1.569	0.879	1961-2013
	-(0.811)	(15.279) ***			(2.612) ***										
F	-0.002	0.528		0.142		0.248							1.875	0.956	1962-2013
	-(1.025)	(21.465) ***		(3.074) ***		(4.124) ***									
D	0.636	0.378			0.193		0.407	-0.267	0.133	0.089	0.325		1.778	0.926	1966-2012
	(2.543) ***	(13.884) ***			(3.118) ***		(3.013) ***	-(3.281) *	(3.683) ***	(2.157) **	(3.207) ***				
GR	1.115	0.828			0.154			-0.511	0.297	0.192			1.880	0.914	1961-2013
	(3.237) ***	(12.355) ***			(1.631) *			-(4.341) ***	(3.536) ***	(3.250) ***					
IRL		0.708			0.171								2.004	0.810	1961-2013
	(0.009)	(10.398) ***			(1.946) *										
I	-0.001	0.530		0.213		0.202	0.705					-0.470	2.028	0.962	1966-2012
	-(0.240)	(33.334) ***		(3.370) ***		(2.886) ***	(1.757) *					-(3.515) ***			
L	0.024		-0.001		0.322								1.800	0.076	1962-2013
	(2.389) **		-(0.006)		(1.704) *										
NL	0.002		0.229			0.370							2.008	0.171	1962-2013
	(0.251)		(1.877) *			(1.823) *									
P	0.211	0.666	-0.247	0.151		-0.235		-0.486	0.427	0.044			2.192	0.956	1966-2013
	(1.617)	(15.640) ***	-(2.640) ***	(1.296)		-(3.867) ***		-(6.498) ***	(7.425) ***	(1.937) *					
E	0.011	0.407		0.130		0.320						0.482	1.593	0.881	1962-2013
	(1.071)	(9.092) ***		(1.329)		(3.712) ***						(3.905) ***			
S	-0.002	0.716			0.172								1.928	0.877	1961-2013
	-(0.616)	(16.126) ***			(2.509) ***										
UK	0.558	0.577			0.136			-0.486	0.377	0.101			1.667	0.928	1966-2012
	(3.051) ***	(13.998) ***			(2.084) **			-(4.725) ***	(4.975) ***	(3.172) ***					

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table 5. *Exports: dependent variable* $dlog(X)$

	c	$dlog((P_x/P_m)_{-1})$	$dlog(P_x/P_m)$	$dlog(Y_{rw})$	$dlog(E)$	$(AR1)$	DW	R^2	Sample
A	-0.028		-1.728	2.314			1.778	0.676	1961-2013
	-(2.813) ***		-(5.717) ***	(9.008) ***					
B	-0.029		-0.185	2.315			1.876	0.669	1961-2013
	-(3.264) ***		-(0.728)	(10.045) ***					
DK	-0.004		-0.627	1.540			1.718	0.472	1961-2013
	-(0.483)		-(3.581) ***	(6.445) ***					
FIN	-0.068		-0.576	3.428		0.430	2.121	0.486	1962-2013
	-(3.074) ***		-(2.003) **	(6.415) ***		(3.077) ***			
F	-0.020		-0.439	2.155	0.158	0.371	2.194	0.725	1962-2013
	-(1.718) *		-(3.075) ***	(7.689) ***	(1.665) *	(2.684) ***			
D	-0.017	-0.379		2.136			2.022	0.372	1962-2013
	-(1.145)	-(1.876) *		(5.376) ***					
GR	-0.037	-0.729		2.917			1.664	0.305	1962-2013
	-(1.342)	-(1.805) *		(3.968) ***					
IRL	0.043		-0.178	1.041		0.351	1.896	0.189	1962-2013
	(2.223) **		-(0.903)	(2.155) **		(2.608) ***			
I	-0.053	-0.307		3.006			1.966	0.586	1962-2013
	-(3.811) ***	-(1.994) **		(8.285) ***					
L	-0.033	0.187		2.688		0.317	2.102	0.388	1963-2013
	-(1.621)	(0.789)		(4.893) ***		(2.064) **			
NL	-0.027		-0.290	2.445		0.559	2.194	0.725	1962-2013
	-(2.681) ***		-(1.318)	(10.955) ***		(4.761) ***			
P	-0.017	0.316		2.409		0.330	1.816	0.420	1963-2013
	-(0.799)	(1.354)		(4.401) ***		(2.383) **			
E	-0.012		-0.277	2.448			1.664	0.426	1961-2013
	-(0.815)		-(2.214) **	(6.029) ***					
S	-0.045		-0.508	2.715		0.497	2.037	0.575	1962-2013
	-(3.009) ***		-(2.915) ***	(7.877) ***		(3.832) ***			
UK	0.001		-0.518	1.174			1.562	0.453	1961-2013
	(0.152)		-(3.708) ***	(4.696) ***					

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table 6. *Imports: dependent variable* $dlog(M)$

	c	$dlog(P/P_m)$	$dlog(P\_1/P_{m-1})$	$dlog(M_{-1})$	$dlog(Y_p)$	$dlog(Y_{p\_1})$	$dlog(G)$	$dlog(G_{-1})$	$dlog(E)$	$log(M\_1)$	$log(P\_1/P_{m-1})$	$log(Y_{p-1})$	$log(G_{-1})$	$(AR1)$	DW	R^2	Sample
A	-0.001		0.341		1.702										2.256	0.688	1962-2013
	-0.091		1.985 **		8.983 ***												
B	0.003		0.371	-0.291	1.293	0.584		0.299							2.111	0.740	1962-2013
	0.436		3.794 ***	-2.355 **	7.379 ***	2.373 **		1.757 *									
DK	0.014		0.060		1.510										2.050	0.637	1961-2013
	2.319 **		0.498		8.823 ***												
FIN	0.003		0.135		1.496										2.342	0.760	1962-2013
	0.474		1.273		12.448 ***												
F	0.014		0.169	-0.241	2.013										1.831	0.823	1962-2013
	2.486 **		2.388 **	-3.460 ***	11.838 ***												
D	0.012		0.072		1.504		0.284								1.548	0.661	1962-2013
	1.699 *		0.763		9.087 ***		1.657 *										
GR	0.001	0.103			1.038	0.442									1.752	0.572	1962-2013
	0.067	0.553			5.743 ***	2.497 **											
IRL	-0.493		0.401		0.632	0.479	0.270		0.320	-0.206		0.307			1.859	0.678	1962-2013
	-3.176 ***		3.925 ***		3.503 ***	2.248 **	1.835 *		2.570 **	-3.265 *		3.246 ***					
I	-0.006	0.210			1.983										2.182	0.689	1961-2013
	-0.710	2.329 **			10.521 ***												
L	0.010	-0.025			1.230										2.146	0.490	1961-2013
	1.107	-0.168			6.925 ***												
NL	-0.155	0.018	0.139		1.187										2.036	0.720	1962-2013
	-1.064	3.951 ***	1.821 *		9.365 ***												
P	-4.574				1.221	1.816	0.726		-0.314	-1.051	0.597	1.816		0.896	1.828	0.716	1961-2013
	-4.817 ***				3.683 ***	6.464 ***	2.986 ***		-2.598 ***	-7.969 ***	3.583 ***	6.464 ***		6.409 ***			
E	0.001		0.244		2.220										1.602	0.652	1962-2013
	0.096		2.271 **		8.222 ***												
S	-2.760				1.449		0.526			-0.481	0.223	0.621	0.202		1.971	0.763	1961-2013
	-5.148 ***				11.206 ***		1.690 *			-5.104 ***	4.262 ***	4.521 ***	3.951 ***				
UK	-3.542		0.051		1.263		0.788			-0.541		0.787	0.220		2.119	0.782	1962-2013
	-4.484 ***		0.826		10.153 ***		4.517 ***			-4.633 ***		4.720 ***	2.806				

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table 7. *The effects of a 1%-point increase in the profit share*

	The effect of a 1%-point increase in the profit share in only one country on:								
	C/Y	I/Y	X/Y	M/Y	NX/Y	Private excess demand / Y	Multiplier	% Change in aggregate demand (F*G)	The effect of a simultanous 1%-point increase in the profit share on % change in aggregate demand
	A	*B*	*C*	*D*	*E(C-D)*	*F(A+B+E)*	*G*	*H*	*I*
A	-0.534	0.000	0.234	-0.168	0.402	-0.132	2.048	-0.271	-1.547
B	-0.165	0.335	0.000	-0.057	0.057	0.226	1.044	0.236	-0.392
DK	-0.424	0.000	0.180	0.000	0.180	-0.243	2.191	-0.533	-1.199
FIN	-0.369	0.000	0.074	0.000	0.074	-0.295	2.471	-0.729	-1.749
F	-0.463	0.160	0.062	-0.036	0.098	-0.205	2.383	-0.489	-0.926
D	-0.689	0.000	0.063	0.000	0.063	-0.626	2.256	-1.413	-1.810
GR	-0.572	0.000	0.099	0.000	0.099	-0.473	5.055	-2.391	-3.410
IRL	-0.335	0.000	0.000	-0.140	0.140	-0.195	1.062	-0.207	-0.697
I	-0.207	0.086	0.037	-0.043	0.080	-0.042	1.718	-0.071	-0.395
L	-0.153	0.000	0.000	0.000	0.000	-0.153	0.560	-0.086	-0.919
NL	-0.367	0.170	0.000	-0.066	0.066	-0.131	2.760	-0.361	-1.683
P	-0.443	0.000	0.000	-0.317	0.317	-0.126	2.520	-0.318	-0.917
E	-0.858	0.000	0.034	-0.039	0.074	-0.784	3.990	-3.128	-3.800
S	-0.535	0.120	0.063	-0.137	0.200	-0.215	2.582	-0.554	-1.749
UK	-0.547	0.000	0.070	0.000	0.070	-0.477	2.065	-0.984	-1.253
EU15 GDP *									-1.446

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

* Change in each country is multiplied by its share in EU15 GDP.

Table 8. *Effects of changes in public spending, taxes on capital and labour on demand*

	Policy 1				Policy 2				Policy 3			
	Increase in public spending by 1% point				Increase in ITR on capital income by 1% point				Decrease in ITR on labour income by 1% point			
	Excess Demand / Y	Multiplier	% change in aggregate demand (A*B)	The effects of a simultaneous 1%-point increase in public spending on % change in aggregate demand	Excess Demand / Y	Multiplier	% change in aggregate demand (E*F)	The effects of a simultaneous 1%-point increase in tr on % change in aggregate demand	Excess Demand / Y	Multiplier	% change in aggregate demand (I*J)	The effects of a simultaneous 1%-point increase in tw on % change in aggregate demand
	A	B	C	D	E	F	G	H	I	J	K	L
A	1,508	2,048	3,087	4,734	-0,087	2,048	-0,177	-0,335	0,512	2,048	1,049	1,825
B	0,517	1,185	0,612	2,238	-0,173	1,153	-0,199	-0,348	0,257	1,153	0,296	1,038
DK	1,000	2,191	2,191	3,431	-0,065	2,191	-0,142	-0,261	0,407	2,191	0,892	1,475
FIN	1,211	4,682	5,669	10,038	-0,071	3,357	-0,239	-0,543	0,362	3,357	1,215	2,708
F	0,497	3,395	1,689	2,951	-0,120	2,988	-0,359	-0,455	0,450	2,988	1,343	1,839
D	1,068	2,256	2,409	3,382	-0,090	2,256	-0,202	-0,297	0,581	2,256	1,311	1,754
GR	1,396	5,055	7,059	9,230	-0,131	5,055	-0,662	-0,868	0,337	5,055	1,703	2,737
IRL	0,826	1,176	0,971	1,652	-0,105	1,140	-0,120	-0,183	0,347	1,140	0,395	0,705
I	1,000	1,718	1,718	2,659	-0,126	1,718	-0,216	-0,303	0,279	1,718	0,479	0,932
L	1,000	0,560	0,560	2,758	-0,042	0,560	-0,023	-0,233	0,206	0,560	0,115	1,146
NL	1,340	2,760	3,699	6,936	-0,180	2,760	-0,498	-0,800	0,521	2,760	1,439	2,969
P	0,900	3,460	3,113	4,731	-0,072	3,187	-0,228	-0,371	0,460	3,187	1,465	2,164
E	1,413	4,680	6,615	8,367	-0,058	4,490	-0,259	-0,434	0,636	4,490	2,857	3,655
S	1,208	3,239	3,912	6,704	-0,054	2,938	-0,158	-0,404	0,280	2,938	0,822	2,033
UK	0,637	2,330	1,485	2,089	-0,075	2,238	-0,168	-0,223	0,491	2,238	1,099	1,360
*EU15 GDP**				*3,82*				*-0,36*				*1,79*

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L=Luxemburg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

* Change in each country is multiplied by its share in EU15 GDP. See Appendix B for details.

Table 9. *The effects of a simultaneous change of the policy mix in all countries*

	The effect of a simultaneous 1% point fall in profit share and a 1% increase in public spending on equilibrium aggregate demand of each national economy ΔY/Y	The effect of a simulteaneous 1% point fall in ITR on labour income and a 1% point increase in ITR on capital income on equilibrium aggregate demand of each national economy ΔY/Y	Total European multiplier effect of a simultaneous combined change in income distribution, government expenditures and taxation on capital and labour income on equilibrium demand of each national economy ΔY/Y	Total European multiplier effect of a simulteanous combined change in income distribution, government expenditures and implicit tax rate on capital and labour income on private investment of each national economy ΔI/Y
	A	*B*	*C***	*D***
A	6.41	1.49	7.75	2.06
B	2.81	0.69	3.28	0.82
DK	4.73	1.21	5.83	0.85
FIN	13.68	2.17	11.72	4.19
F	4.35	1.38	5.13	1.01
D	5.28	1.46	6.63	1.47
GR	12.82	1.87	14.48	3.34
IRL	2.29	0.52	2.68	1.61
I	3.25	0.63	3.78	0.57
L	3.85	0.91	4.56	0.69
NL	8.89	2.17	10.74	2.02
P	6.12	1.79	7.29	2.92
E	12.96	3.22	15.49	3.84
S	9.12	1.63	9.67	2.54
UK	3.55	1.14	4.49	0.85
EU15 GDP*	**5.57**	**1.43**	**6.64**	**1.46**

Note: Regressions for Luxembourg are based on estimation in Onaran and Obst (2016). A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom.

* Change in each country is multiplied by its share in EU15 GDP.

** Combines both policy mixes of column A and column B - A 1% point fall in profit share; a 1% point increase in public spending; a 1% point fall in ITR on labour income; and a 1% increase in ITR on capital income (see Appendix C for details).

Table 10. *Total effects of a policy mix on budget balance following a simultaneous change in all countries*

	1%-point fall in profit share	*1%-point increase in public spending*	*1%-point increase in taxation on capital income*	*1%-point fall in taxation on wage income*	*Combined effect on budget balance*
	A	***B***	***C***	***D***	***E***
A	0.254	-0.222	0.219	0.900	1.150
B	0.046	-0.735	0.253	0.725	0.290
DK	0.192	-0.450	0.243	0.818	0.803
FIN	0.171	-0.017	0.228	0.874	1.257
F	0.154	-0.510	0.190	0.908	0.742
D	0.342	-0.362	0.257	0.932	1.168
GR	0.007	-0.981	0.358	0.554	-0.062
IRL	0.012	-0.972	0.303	0.602	-0.055
I	0.049	-0.673	0.290	0.702	0.367
L	0.050	-0.851	0.397	0.582	0.178
NL	0.208	-0.142	0.183	1.002	1.250
P	0.115	-0.406	0.227	0.911	0.847
E	0.617	0.359	0.227	1.209	2.412
S	0.114	-0.561	0.272	0.650	0.475
UK	0.119	-0.801	0.256	0.742	0.317
** Change in each country is multiplied by its share in EU15 GDP*					*0.839*

Appendix

Appendix A. *Data sources and definitions*

Symbol	Variable name	Definition	Source/variable construction	Time period
C	Private consumption (real)	Private final consumption expenditure at constant prices	AMECO (2016)	1960-2013
D	General government consolidated gross debt	Total gross debt at nominal value outstanding at the end of the year of the sector of general government	AMECO (2016)	1960-2013
DY	General government debt-to-GDP	Ratio of gross debt at nominal value to nominal GDP	$DY=D$ /nominal Y	1960-2013
E	Exchange rate	Average of local currency per dollar, euro, and yen	World Bank World Development	1960-2013
G	General government expenditures		$G=G_i+G_c+I_g$	1970-2013
G_c	Collective consumption expenditure of general government	Expenditures for collective consumption (defence, justice, etc.) which benefit society as a whole, or large parts of society, and are often known as public goods and services	OECD, National Accounts (2016)	1970-2013
G_{ce}	General government consumption expenditure	General government consumption expenditure, consists of expenditure incurred by government in its production of non-market final goods and services (except gross fixed capital formation) and market goods and services provided as social transfers in kind.	OECD, National Accounts (2016)	1970-2013
G_i	Individual consumption expenditure of general government	Expenditures for individual consumption (health care, housing, education, etc.), reflect expenditures incurred by government on behalf of an individual household. This category of expenditure is equal to social transfers in kind from government to households and so includes expenditure by government on market goods and services provided to households	OECD, National Accounts (2016)	1970-2013
G_{tc}	Total final consumption expenditure of general government	Final consumption expenditure of general government = individual consumption of general government + collective consumption of general government	AMECO (2016)	1960-2013
I	Private investment (real)		$I=I_t I_{ps}$	1960-2013
I_g	Gross capital formation expenditure of general government	Gross fixed capital formation consists of resident producers' acquisitions, less disposals, of fixed assets during a given period plus certain additions to the value of non-pro-duced assets realised by the productive activity of producer or institutional units. Fixed assets are produced assets used in production for more than one year.	$I_g = I_t(1-I_{ps})$	1960-2013
I_t	Total investment (real)	Gross fixed capital formation at constant prices, total economy	AMECO (2016)	1960-2013
I_{pr}	Private investment (current prices)	Gross fixed capital formation at current prices, private sector	AMECO (2016)	1960-2013
I_{ps}	Ratio of private to total investment		$I_{ps}=I_{pr}/I_{tcurr}$	1960-2013
I_{tcurr}	Total investment (current prices)	Gross fixed capital formation at current prices, total economy	AMECO (2016)	1960-2013
M	Imports (real)	Imports of goods and services at constant prices	AMECO (2016)	1960-2013
M_{ji}	Imports from country j to country i	For each reporting country or group, all the trading partners are listed	IMF, Direction of Trade Statistics	1980-2012
P	GDP deflator	Price deflator gross domestic product at market prices	AMECO (2016)	1960-2013
P_m	Import price deflator	Price deflator imports of goods and services	AMECO (2016)	1960-2013
P_x	Export price deflator	Price deflator exports of goods and services	AMECO (2016)	1960-2013

(continued from the previous page)

Symbol	Variable name	Definition	Source/variable construction	Time period
R	Adjusted gross operating surplus (real)		$R=\pi Y_f$	1960-2013
$rulc$	Real unit labour costs		$rulc=w_s Y_f/Y$	1960-2013
t_c	Implicit tax rate on consumption (ITRC)	All consumption taxes divided by the final consumption expenditure of private households on the economic territory	European Commission, Eurostat	1965-2012
t_r	Implicit tax rate on capital (ITRK)	Revenue from all capital taxes divided by all potentially taxable business and capital income in the economy	European Commission, Eurostat	1965-2012
t_w	Implicit tax rate on labour (ITRL)	Sum of all direct and indirect taxes and employees and employers social contributions levied on employed labour income divided by the total compensation of employees working in the economic territory	European Commission, Eurostat	1965-2012
ulc	Unit labour costs		$ulc=rulcP$	1960-2013
W	Adjusted compensation of employees (real)		$W=w_s Y_f$	1960-2013
w_s	Adjusted wage share	Compensation per employee as percentage of GDP at factor cost per person employed	AMECO (2016)	1960-2013
X	Exports (real)	Exports of goods and services at constant prices	AMECO (2016)	1960-2013
X_{ji}	Exports from country *i* to country *j*	For each reporting country or group, all the trading partners are listed	IMF, Direction of Trade Statistics	1980-2012
Y	GDP in market prices (real)	Gross domestic product at 2010 market prices	AMECO (2016)	1960-2013
Y_f	GDP at factor costs (real)	Gross domestic product at market prices minus taxes on production and imports, plus subsidies	AMECO (2016)	1960-2013
Y_{rw}	Foreign GDP (real)	GDP of the rest of the world. Calculated from World GDP (in constant 2005 US$) - own GDP (in constant 2005 US$)	World Bank World Development	1960-2013
π	Adjusted profit share		$\pi=1-w_s$	1960-2013

Notes:

***Government individual and collective consumption expenditure, real**: OECD data is linked with AMECO online data on General Government Final Consumption Expenditure. We take the ratio of (G_i/GCE) and (G_c/GCE) respectively, and multiply with (G_{tc}).*

***ITR on consumption**: For Germany and the UK we have calculated data from 1970 back to 1965 using growth rates based on consumption tax rates provided in the study by Mendoza et al. (1997). For Sweden from 1980 to 1970. For Austria and Finland from 1980 back to 1965. Data starts only in 1980 in Greece, Portugal and Spain.*

***ITR on labour**: For Germany and the UK we have calculated data back from 1970 to 1965, for Austria and Finland from 1980 to 1970 and 1965 respectively, and for Sweden from 1980 to 1970 using growth rates based on labour tax rates provided by Mendoza et al. (1997). Data starts only in 1980 in Greece, Portugal, and Spain.*

***ITR on capital**: For Luxembourg there is no data on ITR on capital. For Greece, data is not available after 2007 and for Denmark 2012 is unavailable. For Austria and Sweden we have calculated data back from 1980 to 1970, for Germany and the UK from 1970 to 1965, and for Finland from 1979 to 1965 using growth rates based on capital tax rates provided in the study by Mendoza et al. (1997). Data starts only in 1980 in Greece, Portugal, and Spain.*

***Real gross capital formation of the general government, as a ratio to real GDP**: Data for Austria starts in 1995 and for Luxembourg in 1990. For Belgium, Denmark, Italy, Ireland, Netherlands, Spain and Sweden it starts in 1970. We have extended the data back to 1960 in these countries assuming the ratio of general government gross capital formation to total investment stayed constant.*

Appendix B. *National and European Multiplier Effects*

Any change in private demand in country *i* will lead to a multiplier mechanism in that country, that is, it will affect consumption, investment, and imports. The total effect of a change in income distribution on equilibrium demand is given by:

$$\frac{dY}{d\pi} = \frac{dC}{d\pi} + \frac{dI}{d\pi} + \frac{dNX}{d\pi} + \frac{dG}{d\pi} \quad \text{(B1)}$$

where:

$$\frac{dC}{d\pi} = \frac{\partial C}{\partial \pi} + \frac{\partial C}{\partial Y}\frac{\partial Y}{\partial \pi}$$
$$\frac{dI}{d\pi} = \frac{\partial I}{\partial \pi} + \frac{\partial I}{\partial Y}\frac{\partial Y}{\partial \pi}$$
$$\frac{dNX}{d\pi} = \frac{\partial NX}{\partial \pi} + \frac{\partial NX}{\partial Y}\frac{\partial Y}{\partial \pi}$$
$$\frac{dG}{d\pi} = \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial \pi}$$

Equation (B1) becomes:

$$\frac{dY^*/Y}{d\pi} = \frac{\frac{\partial C/Y}{\partial \pi} + \frac{\partial I/Y}{\partial \pi} + \frac{\partial NX/Y}{\partial \pi}}{1 - \partial C/\partial Y - \partial I/\partial Y - \partial NX/\partial Y - \partial G/\partial Y} \quad \text{(B2)}$$

The marginal effects are given by:

$$\frac{\partial C}{\partial R} = \frac{\partial C/Y}{\partial \pi} = c_r \frac{C}{R} - c_w \frac{C}{W} \quad \text{(B3)}$$
$$\frac{\partial I}{\partial R} = \frac{\partial I/Y}{\partial \pi} = i_\pi \frac{I}{R} \quad \text{(B4)}$$
$$\frac{\partial X}{\partial R} = \frac{\partial X/Y}{\partial \pi} = \left(-e_{XPx} e_{Pxulc} \frac{1}{1 - e_{Pulc}} \frac{Y_f}{Y}\right) \frac{X/Y}{rulc} \quad \text{(B5)}$$
$$\frac{\partial M}{\partial R} = \frac{\partial M/Y}{\partial \pi} = \left(-e_{MP} e_{Pulc} \frac{1}{1 - e_{Pulc}} \frac{Y_f}{Y}\right) \frac{M/Y}{rulc} \quad \text{(B6)}$$
$$\frac{\partial I}{\partial G} = \frac{\partial I/Y}{\partial \kappa_g} = i_g \frac{I}{G} \quad \text{(B7)}$$
$$\frac{\partial G}{\partial G} = \frac{\partial G/Y}{\partial \kappa_g} = 1 \quad \text{(B8)}$$
$$\frac{\partial NX}{\partial G} = \frac{\partial NX/Y}{\partial \kappa_g} = -\frac{\partial M}{\partial G} = -m_g \frac{M}{G} \quad \text{(B9)}$$
$$\frac{\partial I}{\partial Y_p} = i_y \frac{I}{Y_p} \quad \text{(B10)}$$
$$\frac{\partial I/Y}{\partial D/Y} = i_d \frac{I/Y}{D/Y} = i_d \frac{I}{D} \quad \text{(B11)}$$
$$\frac{\partial M}{\partial Y_p} = m_y \frac{M}{Y_p} \quad \text{(B12)}$$

$$\frac{\partial D/Y}{\partial Y} = \frac{\frac{\partial D}{\partial Y}Y + \frac{\partial Y}{\partial Y}D}{Y^2} = \frac{\partial D}{\partial Y}\frac{1}{Y} - \frac{D}{Y^2} = \left(\frac{\partial D}{\partial Y} - \frac{D}{Y}\right)\frac{1}{Y} = \left(\frac{\partial G}{\partial Y} - \frac{\partial T}{\partial Y} - \frac{D}{Y}\right)\frac{1}{Y} \quad \text{(B13)}$$
$$\frac{\partial D}{\partial Y} = \frac{\partial (D_{-1} + G - T + rD_{-1})}{\partial Y} = \frac{\partial G}{\partial Y} - \frac{\partial T}{\partial Y} \quad \text{(B14)}$$
$$\frac{\partial T}{\partial Y} = \frac{\partial (t_w W + t_r R + t_c C)}{\partial Y} = t_w \frac{\partial W}{\partial Y} + t_r \frac{\partial R}{\partial Y} + t_c \frac{\partial C}{\partial Y} \quad \text{(B15)}$$
$$\frac{\partial R}{\partial Y} = \frac{\partial \pi Y}{\partial Y} = \pi \quad \text{(B16)}$$
$$\frac{\partial W}{\partial Y} = \frac{\partial (1-\pi)Y}{\partial Y} = 1 - \pi \quad \text{(B17)}$$
$$\frac{\partial Y_p}{\partial Y} = \frac{\partial (Y - G)}{\partial Y} = \frac{\partial (Y - \kappa_g Y)}{\partial Y} = 1 - \kappa_g \quad \text{(B18)}$$
$$\frac{\partial R/Y}{\partial Y} = \frac{\partial \pi}{\partial Y} = 0 \quad \text{(B19)}$$

$$\frac{\partial C}{\partial Y}=\frac{\partial C}{\partial R}\frac{\partial R}{\partial Y}+\frac{\partial C}{\partial W}\frac{\partial W}{\partial Y}=c_r\frac{C}{R}\pi+c_w\frac{C}{W}(1-\pi)=(c_r+c_w)\frac{C}{Y} \tag{B20}$$

$$\frac{\partial NX}{\partial Y}=-\frac{\partial M}{\partial Y}=-\left(\frac{\partial M}{\partial Y_p}\frac{\partial Y_p}{\partial Y}+\frac{\partial M}{\partial G}\frac{\partial G}{\partial Y}\right)=-\left(m_y\frac{M}{Y_p}(1-\kappa_g)+m_g\frac{M}{G}\kappa_g\right)=-(m_y+m_g)\frac{M}{Y} \tag{B21}$$

$$\frac{\partial G}{\partial Y}=\frac{\partial \kappa_g Y}{\partial Y}=\kappa_g \tag{B22}$$

$$\frac{\partial I}{\partial Y}=i_y\frac{I}{Y_p}(1-\kappa_g)+i_g\frac{I}{G}\kappa_g+i_d\frac{I}{D/Y}\frac{\partial D/Y}{\partial Y}=(i_y+i_g)\frac{I}{Y}+i_d\frac{I/Y}{D/Y}\left(\frac{\partial G}{\partial Y}-\frac{\partial T}{\partial Y}-\frac{D}{Y}\right) \tag{B23}$$

The term $1-\partial C/\partial Y-\partial I/\partial Y-\partial NX/\partial Y-\partial G/\partial Y$ has to be positive for stability.

Total European multiplier effects of a change in the income distribution in all countries on equilibrium aggregate demand of each national country are estimated in equation (16).The details of each matrix are given by:

$$E_{15\times15}=\begin{bmatrix}\frac{\partial C_1/Y_1}{\partial \pi_1}+\frac{\partial I_1/Y_1}{\partial \pi_1}+\frac{\partial NX_1/Y_1}{\partial \pi_1} & 0 & . & 0\\ 0 & . & . & .\\ . & . & . & .\\ 0 & 0 & . & \frac{\partial C_{15}/Y_1}{\partial \pi_{15}}+\frac{\partial I_{15}/Y_{15}}{\partial \pi_{15}}+\frac{\partial NX_{15}/Y_{15}}{\partial \pi_{15}}\end{bmatrix}$$

$$H'_{15\times15}=\begin{bmatrix}\frac{\partial C_1}{\partial Y_1}+\frac{\partial I_1}{\partial Y_1}+\frac{\partial NX_1}{\partial Y_1}+\frac{\partial G_1}{\partial Y_1} & 0 & . & 0\\ 0 & . & . & .\\ . & . & . & .\\ 0 & 0 & . & \frac{\partial C_{15}}{\partial Y_{15}}+\frac{\partial I_{15}}{\partial Y_{15}}+\frac{\partial NX_{15}}{\partial Y_{15}}+\frac{\partial G_{15}}{\partial Y_{15}}\end{bmatrix}$$

$$W_{15\times15}=\begin{bmatrix}0 & e_{XYrw,1}\frac{X_1}{Y_1}\frac{Y_2}{Y_w} & . & e_{XYrw,1}\frac{X_1}{Y_1}\frac{Y_{15}}{Y_w}\\ e_{XYrw,2}\frac{X_2}{Y_2}\frac{Y_1}{Y_w} & . & . & e_{XYrw,2}\frac{X_2}{Y_2}\frac{Y_{15}}{Y_w}\\ . & . & . & .\\ e_{XYrw,15}\frac{X_{15}}{Y_{15}}\frac{Y_1}{Y_w} & e_{XYrw,15}\frac{X_{15}}{Y_{15}}\frac{Y_2}{Y_w} & . & 0\end{bmatrix}$$

$$P_{15\times15}=\begin{bmatrix}0 & \frac{\partial\left(\frac{NX}{Y}\right)_1}{\partial \pi_2}\frac{M_{21}}{M_1} & . & \frac{\partial\left(\frac{NX}{Y}\right)_1}{\partial \pi_{15}}\frac{M_{151}}{M_1}\\ \frac{\partial\left(\frac{NX}{Y}\right)_2}{\partial \pi_1}\frac{M_{12}}{M_2} & . & . & ..\\ . & . & . & .\\ \frac{\partial\left(\frac{NX}{Y}\right)_{15}}{\partial \pi_1}\frac{M_{115}}{M_{15}} & \frac{\partial\left(\frac{NX}{Y}\right)_{15}}{\partial \pi_2}\frac{M_{215}}{M_{15}} & . & 0\end{bmatrix}$$

where

$$P_{ij} = \frac{\partial\left(\frac{NX}{Y}\right)_i}{\partial \pi_j}\frac{M_{ji}}{M_i} = \left(e_{Pxj}\,\frac{1}{1-e_{Pj}}\,\frac{Y_{fj}}{Y_j}\,\frac{1}{rulc_j}\right)\frac{M_{ji}}{M_i}\left(e_{XPi}\,\frac{X_i}{Y_i} - e_{MPi}\,\frac{M_i}{Y_i}\right)$$

Total effects of a change in government expenditures on equilibrium aggregate demand:

$$\frac{dY^*}{dG} = \frac{dC}{dG} + \frac{dNX}{dG} + \frac{dG}{dG} + \frac{dI}{dG} \tag{B24}$$

where:

$$\frac{dC}{dG} = \frac{\partial C}{\partial Y}\frac{\partial Y}{\partial G}$$

$$\frac{dNX}{dG} = \frac{\partial NX}{\partial G} + \frac{\partial NX}{\partial Y}\frac{\partial Y}{\partial G}$$

$$\frac{dG}{dG} = \frac{\partial G}{\partial G} + \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial G}$$

$$\frac{dI}{dG} = \frac{\partial I}{\partial G} + \frac{\partial I}{\partial Y}\frac{\partial Y}{\partial G} + \frac{\partial I}{\partial D/Y}\frac{\partial D/Y}{\partial G}$$

$$\frac{\partial D/Y}{\partial G} = \frac{\frac{\partial D}{\partial G}Y - \frac{\partial Y}{\partial G}D}{Y^2} = \frac{\partial D}{\partial G}\frac{1}{Y} - \frac{\partial Y}{\partial G}\frac{D}{Y^2} = \left(\frac{\partial D}{\partial G} - \frac{\partial Y}{\partial G}\frac{D}{Y}\right)\frac{1}{Y}$$

$$\frac{\partial D}{\partial G} = \frac{\partial\left(D_{-1} + G - T + rD_{-1}\right)}{\partial G} = \frac{\partial G}{\partial G} - \frac{\partial T}{\partial Y}\frac{\partial Y}{\partial G}$$

Therefore (B24) becomes:

$$\frac{dY^*}{dG} = \frac{\frac{\partial I}{\partial G} + \frac{\partial NX}{\partial G} + \frac{\partial G}{\partial G} + \frac{\partial I/Y}{\partial D/Y}\frac{\partial G}{\partial G}}{1 - \frac{\partial C}{\partial Y} - \frac{\partial I}{\partial Y} - \frac{\partial NX}{\partial Y} - \frac{\partial G}{\partial Y} + \frac{\partial I/Y}{\partial D/Y}\left(\frac{\partial T}{\partial Y} + \frac{D}{Y}\right)} \tag{B25}$$

Dividing (B25) by Y we get:

$$\frac{dY^*/Y}{d\kappa_g} = \frac{\frac{\partial I/Y}{\partial \kappa_g} + \frac{\partial NX/Y}{\partial \kappa_g} + \frac{\partial G/Y}{\partial \kappa_g} + \frac{\partial I/Y}{\partial D/Y}\frac{\partial G}{\partial G}}{1 - \frac{\partial C}{\partial Y} - \frac{\partial I}{\partial Y} - \frac{\partial NX}{\partial Y} - \frac{\partial G}{\partial Y} + \frac{\partial I/Y}{\partial D/Y}\left(\frac{\partial T}{\partial Y} + \frac{D}{Y}\right)} \tag{B26}$$

Total European multiplier effects of a change in government expenditures in all countries on equilibrium aggregate demand of each national country are estimated in equations (17) and (18). The details of each matrix are given by:

$$Eg_{15\times 15} = \begin{bmatrix} \frac{\partial I_1/Y_1}{\partial \kappa_{g1}} + \frac{\partial NX_1/Y_1}{\partial \kappa_{g1}} + \frac{\partial G_1/Y_1}{\partial \kappa_{g1}} + \frac{\partial I_1/Y_1}{\partial D_1/Y_1}\frac{\partial G_1}{\partial G_1} & 0 & . & 0 \\ 0 & . & . & . \\ . & . & . & . \\ 0 & 0 & . & \frac{\partial I_{15}/Y_{15}}{\partial \kappa_{g15}} + \frac{\partial NX_{15}/Y_{15}}{\partial \kappa_{g15}} + \frac{\partial G_{15}/Y_{15}}{\partial \kappa_{g15}} + \frac{\partial I_{15}/Y_{15}}{\partial D_{15}/Y_{15}}\frac{\partial G_{15}}{\partial G_{15}} \end{bmatrix}$$

$$Hg_{15\times15}=\begin{bmatrix} \frac{\partial C_1}{\partial Y_1}+\frac{\partial I_1}{\partial Y_1}+\frac{\partial NX_1}{\partial Y_1}+\frac{\partial G_1}{\partial Y_1}-\frac{\partial I_1/Y_1}{\partial D_1/Y_1}\left(\frac{\partial T_1}{\partial Y_1}+\frac{D_1}{Y_1}\right) & 0 & . & 0 \\ 0 & . & . & . \\ . & . & . & . \\ 0 & 0 & . & \frac{\partial C_{15}}{\partial Y_{15}}+\frac{\partial I_{15}}{\partial Y_{15}}+\frac{\partial NX_{15}}{\partial Y_{15}}+\frac{\partial G_{15}}{\partial Y_{15}}-\frac{\partial I_{15}/Y_{15}}{\partial D_{15}/Y_{15}}\left(\frac{\partial T_{15}}{\partial Y_{15}}+\frac{D_{15}}{Y_{15}}\right) \end{bmatrix}$$

Total effects of a change in gross fixed capital formation of general government[36] on equilibrium aggregate demand:

$$\frac{dY^*}{dI_g}=\frac{dC}{dI_g}+\frac{dNX}{dI_g}+\frac{dG}{dI_g}+\frac{dI}{dI_g} \tag{B27}$$

where:

$$\frac{dC}{dI_g}=\frac{\partial C}{\partial Y}\frac{\partial Y}{\partial I_g}$$

$$\frac{dNX}{dI_g}=\frac{\partial NX}{\partial I_g}+\frac{\partial NX}{\partial Y}\frac{\partial Y}{\partial I_g}$$

$$\frac{dG}{dI_g}=\frac{\partial G}{\partial I_g}+\frac{\partial G}{\partial Y}\frac{\partial Y}{\partial I_g}$$

$$\frac{dI}{dI_g}=\frac{\partial I}{\partial I_g}+\frac{\partial I}{\partial Y}\frac{\partial Y}{\partial I_g}+\frac{\partial I}{\partial D/Y}\frac{\partial D/Y}{\partial I_g}$$

$$\frac{\partial D/Y}{\partial I_g}=\frac{\frac{\partial D}{\partial I_g}Y-\frac{\partial Y}{\partial I_g}D}{Y^2}=\left(\frac{\partial D}{\partial I_g}-\frac{\partial Y}{\partial I_g}\frac{D}{Y}\right)\frac{1}{Y}$$

$$\frac{\partial D}{\partial I_g}=\frac{\partial\left(D_{-1}+G-T+rD_{-1}\right)}{\partial I_g}=\frac{\partial G}{\partial I_g}-\frac{\partial T}{\partial Y}\frac{\partial Y}{\partial I_g}$$

Therefore (B27) becomes:

$$\frac{dY^*}{dI_g}=\frac{\frac{\partial I}{\partial I_g}+\frac{\partial NX}{\partial I_g}+\frac{\partial G}{\partial I_g}+\frac{\partial I/Y}{\partial D/Y}\frac{\partial G}{\partial I_g}}{1-\frac{\partial C}{\partial Y}-\frac{\partial I}{\partial Y}-\frac{\partial NX}{\partial Y}-\frac{\partial G}{\partial Y}+\frac{\partial I/Y}{\partial D/Y}\left(\frac{\partial T}{\partial Y}+\frac{D}{Y}\right)} \tag{B28}$$

where:

$$\frac{\partial I}{\partial I_g}=\frac{\partial I/Y}{\partial I_g/Y}=i_i\frac{I}{I_g}$$

$$\frac{\partial NX}{\partial I_g}=\frac{\partial NX/Y}{\partial I_g/Y}=-m_i\frac{M}{I_g}$$

$$\frac{\partial G}{\partial I_g}=\frac{\partial G/Y}{\partial I_g/Y}=\frac{\partial\left(I_g+G_{gc}+G_{gi}\right)}{\partial I_g}=1$$

Dividing (B28) by Y we get:

[36] The same method is followed when estimating an exogenous increase in G_c and G_i.

$$\frac{dY^*/Y}{d\kappa_{ig}} = \frac{\frac{\partial I/Y}{\partial \kappa_{ig}} + \frac{\partial NX/Y}{\partial \kappa_{ig}} + \frac{\partial G/Y}{\partial \kappa_{ig}} + \frac{\partial I/Y}{\partial D/Y}\frac{\partial G/Y}{\partial \kappa_{ig}}}{1 - \frac{\partial C}{\partial Y} - \frac{\partial I}{\partial Y} - \frac{\partial NX}{\partial Y} - \frac{\partial G}{\partial Y} + \frac{\partial I/Y}{\partial D/Y}\left(\frac{\partial T}{\partial Y} + \frac{D}{Y}\right)} \tag{B29}$$

Total European multiplier effects of a change in gross fixed capital formation of general government expenditures in all countries on equilibrium aggregate demand of each national economy:

$$\left[\frac{dY}{Y}\right]_{15\times 1} = \begin{bmatrix} \frac{dY_1}{Y_1} \\ \cdot \\ \cdot \\ \frac{dY_{15}}{Y_{15}} \end{bmatrix} = Eig_{15\times 15}\begin{bmatrix} d\kappa_{ig1} \\ \cdot \\ \cdot \\ d\kappa_{ig15} \end{bmatrix} + Hg_{15\times 15}\begin{bmatrix} \frac{dY_1}{Y_1} \\ \cdot \\ \cdot \\ \frac{dY_{15}}{Y_{15}} \end{bmatrix} + W_{15\times 15}\begin{bmatrix} \frac{dY_1}{Y_1} \\ \cdot \\ \cdot \\ \frac{dY_{15}}{Y_{15}} \end{bmatrix} \tag{B30}$$

$$\left[\frac{dY}{Y}\right]_{15\times 1} = \left(I_{15\times 15} - Hg_{15\times 15} - W_{15\times 15}\right)^{-1} Eig_{15\times 15}\begin{bmatrix} d\kappa_{ig1} \\ \cdot \\ \cdot \\ d\kappa_{ig15} \end{bmatrix} \tag{B31}$$

where

$$Eig_{15\times 15} = \begin{bmatrix} \frac{\partial I_1/Y_1}{\partial \kappa_{ig1}} + \frac{\partial NX_1/Y_1}{\partial \kappa_{ig1}} + \frac{\partial G_1/Y_1}{\partial \kappa_{ig1}} + \frac{\partial I_1/Y_1}{\partial D_1/Y_1}\frac{\partial G_1/Y_1}{\partial \kappa_{ig1}} & 0 & . & 0 \\ 0 & . & . & . \\ . & . & . & . \\ 0 & 0 & . & \frac{\partial I_{15}/Y_{15}}{\partial \kappa_{ig15}} + \frac{\partial NX_{15}/Y_{15}}{\partial \kappa_{ig15}} + \frac{\partial G_{15}/Y_{15}}{\partial \kappa_{ig15}} + \frac{\partial I_{15}/Y_{15}}{\partial D_{15}/Y_{15}}\frac{\partial G_{15}/Y_{15}}{\partial \kappa_{ig15}} \end{bmatrix}$$

Total effects of a change in implicit tax rate on capital income on equilibrium aggregate demand:

$$\frac{dY^*}{dt_r} = \frac{dC}{dt_r} + \frac{dNX}{dt_r} + \frac{dG}{dt_r} + \frac{dI}{dt_r} \tag{B32}$$

where:

$$\frac{dC}{dt_r} = \frac{\partial C}{\partial t_r} + \frac{\partial C}{\partial Y}\frac{\partial Y}{\partial t_r}$$

$$\frac{dNX}{dt_r} = \frac{\partial NX}{\partial Y}\frac{\partial Y}{\partial t_r}$$

$$\frac{dG}{dt_r} = \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial t_r}$$

$$\frac{dI}{dt_r} = \frac{\partial I}{\partial t_r} + \frac{\partial I}{\partial Y}\frac{\partial Y}{\partial t_r} + \frac{\partial I}{\partial D/Y}\frac{\partial D/Y}{\partial t_r}$$

$$\frac{\partial D/Y}{\partial t_r} = \frac{\frac{\partial D}{\partial t_r}Y - \frac{\partial Y}{\partial t_r}D}{Y^2} = \left(\frac{\partial D}{\partial t_r} - \frac{\partial Y}{\partial t_r}\frac{D}{Y}\right)\frac{1}{Y}$$

$$\frac{\partial D}{\partial t_r} = \frac{\partial\left(D_{-1} + G - T + rD_{-1}\right)}{\partial t_r} = \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial t_r} - \frac{\partial T}{\partial t_r} - \frac{\partial T}{\partial Y}\frac{\partial Y}{\partial t_r}$$

Therefore (B32) becomes:

$$\frac{dY^*}{dt_r} = \frac{\frac{\partial C}{\partial t_r} + \frac{\partial I}{\partial t_r} - \frac{\partial I/Y}{\partial D/Y}\frac{\partial T}{\partial t_r}}{1 - \frac{\partial C}{\partial Y} - \frac{\partial I}{\partial Y} - \frac{\partial NX}{\partial Y} - \frac{\partial G}{\partial Y} - \frac{\partial I/Y}{\partial D/Y}\left(\frac{\partial G}{\partial Y} - \frac{\partial T}{\partial Y} - \frac{D}{Y}\right)} \tag{B33}$$

where:

$$\frac{\partial C}{\partial t_r} = \frac{\partial C}{\partial R'}\frac{\partial R'}{\partial t_r} = c_r \frac{C}{(1-t_r)R}(-R) = -c_r \frac{C}{(1-t_r)}$$

$$\frac{\partial I}{\partial t_r} = \frac{\partial I}{\partial \pi'}\frac{\partial \pi'}{\partial t_r} = i_\pi \frac{I}{(1-t_r)\pi}(-\pi) = -i_\pi \frac{I}{(1-t_r)}$$

$$\frac{\partial C}{\partial R'} = \frac{\partial C}{\partial (1-t_r)R} = c_r \frac{C}{(1-t_r)R}$$

$$\frac{\partial R'}{\partial t_r} = \frac{\partial (1-t_r)R}{\partial t_r} = -R$$

$$\frac{\partial I}{\partial \pi'} = \frac{\partial I}{\partial (1-t_r)\pi} = i_\pi \frac{I}{(1-t_r)\pi}$$

$$\frac{\partial \pi'}{\partial t_r} = \frac{\partial (1-t_r)\pi}{\partial t_r} = -\pi$$

Dividing (B33) by Y we get:

$$\frac{dY^*/Y}{dt_r} = \frac{\frac{\partial C/Y}{\partial t_r} + \frac{\partial I/Y}{\partial t_r} - \frac{\partial I/Y}{\partial D/Y}\frac{\partial T/Y}{\partial t_r}}{1 - \frac{\partial C}{\partial Y} - \frac{\partial I}{\partial Y} - \frac{\partial NX}{\partial Y} - \frac{\partial G}{\partial Y} - \frac{\partial I/Y}{\partial D/Y}\left(\frac{\partial G}{\partial Y} - \frac{\partial T}{\partial Y} - \frac{D}{Y}\right)} \tag{B34}$$

where:

$$\frac{\partial C/Y}{\partial t_r} = -c_r \frac{C/Y}{(1-t_r)}$$

$$\frac{\partial I/Y}{\partial t_r} = -i_\pi \frac{I/Y}{(1-t_r)}$$

$$\frac{\partial T}{\partial t_r} = \frac{\partial (t_w W + t_r R + t_c C)}{\partial t_r} = R \text{ or } \frac{\partial T/Y}{\partial t_r} = \frac{R}{Y}$$

Total European multiplier effects of a change in implicit tax rate on capital income in all countries on equilibrium aggregate demand of each national economy are estimated in equation (19) and (20). The details of each matrix are given by:

$$Etr_{15\times 15} = \begin{bmatrix} \frac{\partial C_1/Y_1}{\partial t_{r1}} + \frac{\partial I_1/Y_1}{\partial t_{r1}} - \frac{\partial I_1/Y_1}{\partial D_1/Y_1}\frac{\partial T_1/Y_1}{\partial t_{r1}} & 0 & . & 0 \\ 0 & . & . & . \\ . & . & . & . \\ 0 & 0 & . & \frac{\partial C_{15}/Y_{15}}{\partial t_{r15}} + \frac{\partial I_{15}/Y_{15}}{\partial t_{r15}} - \frac{\partial I_{15}/Y_{15}}{\partial D_{15}/Y_{15}}\frac{\partial T_{15}/Y_{15}}{\partial t_{r15}} \end{bmatrix}$$

$$Ht_{15\times 15}=\begin{bmatrix} \frac{\partial C_1}{\partial Y_1}+\frac{\partial I_1}{\partial Y_1}+\frac{\partial NX_1}{\partial Y_1}+\frac{\partial G_1}{\partial Y_1}+\frac{\partial\, I_1/Y_1}{\partial\, D_1/Y_1}\left(\frac{\partial G_1}{\partial Y_1}-\frac{\partial T_1}{\partial Y_1}-\frac{D_1}{Y_1}\right) & 0 & . & 0 \\ 0 & . & . & . \\ . & . & . & . \\ 0 & 0 & . & \frac{\partial C_{15}}{\partial Y_{15}}+\frac{\partial I_{15}}{\partial Y_{15}}+\frac{\partial NX_{15}}{\partial Y_{15}}+\frac{\partial G_{15}}{\partial Y_{15}}+\frac{\partial\, I_{15}/Y_{15}}{\partial\, D_{15}/Y_{15}}\left(\frac{\partial G_{15}}{\partial Y_{15}}-\frac{\partial T_{15}}{\partial Y_{15}}-\frac{D_{15}}{Y_{15}}\right) \end{bmatrix}$$

Total effects of a change in implicit tax rate on labour income on equilibrium aggregate demand:

$$\frac{dY^*}{dt_w}=\frac{dC}{dt_w}+\frac{dNX}{dt_w}+\frac{dG}{dt_w}+\frac{dI}{dt_w} \tag{B35}$$

where:

$$\frac{dC}{dt_w}=\frac{\partial C}{\partial t_w}+\frac{\partial C}{\partial Y}\frac{\partial Y}{\partial t_w}$$

$$\frac{dNX}{dt_w}=\frac{\partial NX}{\partial Y}\frac{\partial Y}{\partial t_w}$$

$$\frac{dG}{dt_w}=\frac{\partial G}{\partial Y}\frac{\partial Y}{\partial t_w}$$

$$\frac{dI}{dt_w}=\frac{\partial I}{\partial Y}\frac{\partial Y}{\partial t_w}+\frac{\partial I}{\partial\, D/Y}\frac{\partial\, D/Y}{\partial t_w}$$

$$\frac{\partial D/Y}{\partial t_w}=\frac{\frac{\partial D}{\partial t_w}Y-\frac{\partial Y}{\partial t_w}D}{Y^2}=\left(\frac{\partial D}{\partial t_w}-\frac{\partial Y}{\partial t_w}\frac{D}{Y}\right)\frac{1}{Y}$$

$$\frac{\partial D}{\partial t_w}=\frac{\partial\left(D_{-1}+G-T+rD_{-1}\right)}{\partial t_w}=\frac{\partial G}{\partial Y}\frac{\partial Y}{\partial t_w}-\frac{\partial T}{\partial t_w}-\frac{\partial T}{\partial Y}\frac{\partial Y}{\partial t_w}$$

Therefore (B35) becomes:

$$\frac{dY^*}{dt_w}=\frac{\frac{\partial C}{\partial t_w}-\frac{\partial\, I/Y}{\partial\, D/Y}\frac{\partial T}{\partial t_w}}{1-\frac{\partial C}{\partial Y}-\frac{\partial I}{\partial Y}-\frac{\partial NX}{\partial Y}-\frac{\partial G}{\partial Y}-\frac{\partial\, I/Y}{\partial\, D/Y}\left(\frac{\partial G}{\partial Y}-\frac{\partial T}{\partial Y}-\frac{D}{Y}\right)} \tag{B36}$$

where:

$$\frac{\partial C}{\partial t_w}=\frac{\partial C}{\partial W'}\frac{\partial W'}{\partial t_w}=c_w\frac{C}{(1-t_w)W}\left(-W\right)=-c_w\frac{C}{(1-t_w)}$$

$$\frac{\partial C}{\partial W'}=\frac{\partial C}{\partial(1-t_w)W}=c_w\frac{C}{(1-t_w)W}$$

$$\frac{\partial W'}{\partial t_w}=\frac{\partial(1-t_w)W}{\partial t_w}=-W$$

Dividing (B36) by Y we get:

$$\frac{dY^*/Y}{dt_w}=\frac{\frac{\partial\, C/Y}{\partial t_w}-\frac{\partial\, I/Y}{\partial\, D/Y}\frac{\partial\, T/Y}{\partial t_w}}{1-\frac{\partial C}{\partial Y}-\frac{\partial I}{\partial Y}-\frac{\partial NX}{\partial Y}-\frac{\partial G}{\partial Y}-\frac{\partial\, I/Y}{\partial\, D/Y}\left(\frac{\partial G}{\partial Y}-\frac{\partial T}{\partial Y}-\frac{D}{Y}\right)} \tag{B37}$$

where:

$$\frac{\partial C/Y}{\partial t_w} = -c_w \frac{C/Y}{(1-t_w)}$$

$$\frac{\partial T/Y}{\partial t_w} = \frac{W}{Y}$$

Total European multiplier effects of a change in implicit tax rate on labour income in all countries on equilibrium aggregate demand of each national economy:

$$\left[\frac{dY}{Y}\right]_{15\times 1} = \begin{bmatrix} \frac{dY_1}{Y_1} \\ . \\ . \\ \frac{dY_{15}}{Y_{15}} \end{bmatrix} = Etw_{15\times 15} \begin{bmatrix} dt_{w1} \\ . \\ . \\ dt_{w15} \end{bmatrix} + Ht_{15\times 15} \begin{bmatrix} \frac{dY_1}{Y_1} \\ . \\ . \\ \frac{dY_{15}}{Y_{15}} \end{bmatrix} + W_{15\times 15} \begin{bmatrix} \frac{dY_1}{Y_1} \\ . \\ . \\ \frac{dY_{15}}{Y_{15}} \end{bmatrix} \tag{B38}$$

$$\left[\frac{dY}{Y}\right]_{15\times 1} = \left(I_{15\times 15} - Ht_{15\times 15} - W_{15\times 15}\right)^{-1} Etw_{15\times 15} \begin{bmatrix} dt_{w1} \\ . \\ . \\ dt_{w15} \end{bmatrix} \tag{B39}$$

where

$$Etw_{15\times 15} = \begin{bmatrix} \frac{\partial C_1/Y_1}{\partial t_{w1}} - \frac{\partial I_1/Y_1}{\partial D_1/Y_1}\frac{\partial T_1/Y_1}{\partial t_{w1}} & 0 & . & 0 \\ 0 & . & . & . \\ . & . & . & . \\ 0 & 0 & . & \frac{\partial C_{15}/Y_{15}}{\partial t_{w15}} - \frac{\partial I_{15}/Y_{15}}{\partial D_{15}/Y_{15}}\frac{\partial T_{15}/Y_{15}}{\partial t_{w15}} \end{bmatrix}$$

Appendix C. *Policy mix and further effects*

Total European multiplier effects of a change in income distributions and government expenditures in all countries on equilibrium aggregate demand of each national economy:

$$\left[\frac{dY}{Y}\right]_{15\times1} = E_{15\times15}[d\pi]_{15\times1} + P_{15\times15}[d\pi]_{15\times1} + Eg_{15\times15}[d\kappa_g]_{15\times1} + Hg_{15\times15}\left[\frac{dY}{Y}\right]_{15\times1} + W_{15\times15}\left[\frac{dY}{Y}\right]_{15\times1} \quad \text{(C1)}$$

Total European multiplier effects of a change in implicit tax rate on capital income and implicit tax rate on labour income in all countries on equilibrium aggregate demand of each national economy:

$$\left[\frac{dY}{Y}\right]_{15\times1} = Etr_{15\times15}[dt_w]_{15\times1} + Etw_{15\times15}[dt_w]_{15\times1} + Ht_{15\times15}\left[\frac{dY}{Y}\right]_{15\times1} + W_{15\times15}\left[\frac{dY}{Y}\right]_{15\times1} \quad \text{(C2)}$$

Total European multiplier effects of a change in income distributions, government expenditures, implicit tax rate on capital income and implicit tax rate on labour income in all countries on equilibrium aggregate demand of each national economy:

$$\left[\frac{dY}{Y}\right]_{15\times1} = E_{15\times15}[d\pi]_{15\times1} + P_{15\times15}[d\pi]_{15\times1} + Eg_{15\times15}[d\kappa_g]_{15\times1} + Etr_{15\times15}[dt_r]_{15\times1} + Etw_{15\times15}[dt_w]_{15\times1}$$

$$+ Ht_{15\times15}\left[\frac{dY}{Y}\right]_{15\times1} + W_{15\times15}\left[\frac{dY}{Y}\right]_{15\times1} \quad \text{(C3)}$$

We calculate the total effects of a change in the income distribution on investment as follows:

$$\frac{dI}{d\pi} = \frac{\partial I}{\partial \pi} + \frac{\partial I}{\partial Y}\frac{\partial Y}{\partial \pi}$$

$$\frac{dI/Y}{d\pi} = \frac{\partial I/Y}{\partial \pi} + \frac{\partial I}{\partial Y}\frac{\partial Y^*/Y}{\partial \pi} \quad \text{(C4)}$$

We calculate the total effects of a change in government expenditures on investment as follows:

$$\frac{dI}{d\kappa_g} = \frac{\partial I}{\partial \kappa_g} + \frac{\partial I}{\partial Y}\frac{\partial Y}{\partial \kappa_g} + \frac{\partial I}{\partial D/Y}\frac{\partial D/Y}{\partial \kappa_g}$$

$$\frac{d\,I/Y}{d\kappa_g} = \frac{\partial\, I/Y}{\partial \kappa_g} + \frac{\partial I}{\partial Y}\frac{\partial Y^*/Y}{\partial \kappa_g} + \frac{\partial\, I/Y}{\partial\, D/Y}\frac{\partial D/Y}{\partial \kappa_g} \quad \text{(C5)}$$

where:

$$\frac{\partial D/Y}{\partial \kappa_g} = \frac{\partial D}{\partial G} - \frac{\partial Y}{\partial G}\frac{D}{Y}$$

We calculate the total effects of a change in implicit tax rate on capital income on investment as follows:

$$\frac{dI}{dt_r} = \frac{\partial I}{\partial t_r} + \frac{\partial I}{\partial Y}\frac{\partial Y}{\partial t_r} + \frac{\partial I}{\partial D/Y}\frac{\partial D/Y}{\partial t_r}$$

$$\frac{d\,I/Y}{dt_r} = \frac{\partial\, I/Y}{\partial t_r} + \frac{\partial I}{\partial Y}\frac{\partial Y^*/Y}{\partial t_r} + \frac{\partial\, I/Y}{\partial\, D/Y}\frac{\partial D/Y}{\partial t_r} \quad \text{(C6)}$$

We calculate the total effects of a change in implicit tax rate on labour income on investment as follows:

$$\frac{dI}{dt_w} = \frac{\partial I}{\partial Y}\frac{\partial Y}{\partial t_w} + \frac{\partial I}{\partial D/Y}\frac{\partial D/Y}{\partial t_w}$$
$$\frac{d\,I/Y}{dt_w} = \frac{\partial I}{\partial Y}\frac{\partial Y^*/Y}{\partial t_w} + \frac{\partial I/Y}{\partial D/Y}\frac{\partial D/Y}{\partial t_w} \quad \text{(C7)}$$

We calculate the total effects of a change in income distributions, government expenditures, implicit tax rate on capital income and implicit tax rate on labour income on investment as in equation (24) in the main text.

We calculate the total effects of a change in the income distribution on net exports as follows:

$$\frac{dNX}{d\pi} = \frac{\partial NX}{\partial \pi} + \frac{\partial NX}{\partial Y}\frac{\partial Y}{\partial \pi}$$
$$\frac{dNX/Y}{d\pi} = \frac{\partial NX/Y}{\partial \pi} + \frac{\partial NX}{\partial Y}\frac{\partial Y^*/Y}{\partial \pi} \quad \text{(C8)}$$

We calculate the total effects of a change in government expenditures on net exports as follows:

$$\frac{dNX}{d\kappa_g} = \frac{\partial NX}{\partial \kappa_g} + \frac{\partial NX}{\partial Y}\frac{\partial Y}{\partial \kappa_g}$$
$$\frac{d\,NX/Y}{d\kappa_g} = \frac{\partial\, NX/Y}{\partial \kappa_g} + \frac{\partial NX}{\partial Y}\frac{\partial Y^*/Y}{\partial \kappa_g} \quad \text{(C9)}$$

Following Onaran and Obst (2016) we calculate the post-multiplier net export effects as

$$\begin{bmatrix} \frac{\Delta NX/Y_1}{\Delta \pi_1} \\ \vdots \\ \frac{\Delta NX/Y_n}{\Delta \pi_n} \end{bmatrix} = (NX_{nxn} + P_{nxn}) \begin{bmatrix} \Delta\pi_1 \\ \vdots \\ \Delta\pi_n \end{bmatrix} + (W_{nxn} - M_{nxn}) \begin{bmatrix} \frac{\Delta Y/Y_1}{\Delta \pi_1} \\ \vdots \\ \frac{\Delta Y/Y_n}{\Delta \pi_n} \end{bmatrix} \quad \text{(C10)}$$

where

$$NX_{nxn} = \begin{bmatrix} \frac{\frac{\Delta NX}{Y_1}}{\Delta \pi_1} & 0 & \cdots & 0 \\ 0 & \ddots & \vdots & \vdots \\ \vdots & \ddots & \ddots & \vdots \\ 0 & \cdots & \cdots & \frac{\frac{\Delta NX}{Y_n}}{\Delta \pi_n} \end{bmatrix}$$

$$M_{nxn} = \begin{bmatrix} \frac{\Delta M_1}{\Delta Y_1} & 0 & \cdots & 0 \\ 0 & \ddots & \cdots & \vdots \\ \vdots & \cdots & \ddots & \vdots \\ 0 & \cdots & \cdots & \frac{\Delta M_n}{\Delta Y_n} \end{bmatrix}$$

where NX_{ii} is $\frac{\frac{\Delta X}{Y_1}}{\Delta \pi_1} - \frac{\frac{\Delta M}{Y_1}}{\Delta \pi_1}$ calculated as in equations (13) and (14) and M_{ii} is calculated as $e_{MYi}\frac{M_i}{Y_i}$.

We calculate the total effects of a change in the income distribution on primary budget balance as follows:

$$\frac{dBAL}{d\pi} = \frac{dT}{d\pi} - \frac{dG}{d\pi} = \frac{\partial T}{\partial Y}\frac{\partial Y}{\partial \pi} - \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial \pi}$$
$$\frac{d\ BAL/Y}{d\pi} = \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial \pi} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial \pi} \quad \text{(C11)}$$

We calculate the total effects of a change in government expenditures on budget balance as follows:

$$\frac{dBAL}{d\kappa_g} = \frac{dT}{d\kappa_g} - \frac{dG}{d\kappa_g} = \frac{\partial T}{\partial Y}\frac{\partial Y}{\partial \kappa_g} - \frac{\partial G}{\partial \kappa_g} - \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial \kappa_g}$$
$$\frac{d\ BAL/Y}{d\kappa_g} = \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial \kappa_g} - \frac{\partial G/Y}{\partial \kappa_g} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial \kappa_g} \quad \text{(C12)}$$

We calculate the total effects of a change in ITR on capital income on budget balance as follows:

$$\frac{dBAL}{dt_r} = \frac{dT}{dt_r} - \frac{dG}{dt_r} = \frac{\partial T}{\partial t_r} + \frac{\partial T}{\partial Y}\frac{\partial Y}{\partial t_r} - \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial t_r}$$
$$\frac{d\ BAL/Y}{dt_r} = \frac{\partial T/Y}{\partial t_r} + \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial t_r} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial t_r} \quad \text{(C13)}$$

We calculate the total effects of a change in ITR on labour income on budget balance as follows:

$$\frac{dBAL}{dt_w} = \frac{dT}{dt_w} - \frac{dG}{dt_w} = \frac{\partial T}{\partial t_w} + \frac{\partial T}{\partial Y}\frac{\partial Y}{\partial t_w} - \frac{\partial G}{\partial Y}\frac{\partial Y}{\partial t_w}$$
$$\frac{d\ BAL/Y}{dt_w} = \frac{\partial T/Y}{\partial t_w} + \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial t_w} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial t_w} \quad \text{(C14)}$$

We calculate the total effects of a change in income distributions, government expenditures, ITR on capital income and ITR on labour income on budget balance as in equation (25) or as follows:

$$\frac{d\ BAL/Y}{d\pi} + \frac{d\ BAL/Y}{d\kappa_g} + \frac{d\ BAL/Y}{dt_r} + \frac{d\ BAL/Y}{dt_w} = \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial \pi} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial \pi} + \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial \kappa_g} - \frac{\partial G/Y}{\partial \kappa_g} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial \kappa_g}$$
$$+ \frac{\partial T/Y}{\partial t_r} + \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial t_r} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial t_r} + \frac{\partial T/Y}{\partial t_w} + \frac{\partial T}{\partial Y}\frac{\partial Y^*/Y}{\partial t_w} - \frac{\partial G}{\partial Y}\frac{\partial Y^*/Y}{\partial t_w} \quad \text{(C15)}$$

We calculate the total effects of a change in the income distribution on the percentage change in the domestic price level as follows:

$$\frac{dP}{dws} = \frac{\partial \log P}{\partial \log ws}\frac{P}{ws} = \frac{\partial \log P}{\partial \log ulc}\frac{\partial \log ulc}{\partial \log rulc}\frac{\partial \log rulc}{\partial \log ws}\frac{P}{ws}$$
$$\frac{dP}{dws} = e_{Pulc}\frac{1}{1-e_{Pulc}}\frac{Y_f}{Y}\frac{ws}{rulc}\frac{P}{ws} = e_{Pulc}\frac{1}{1-e_{Pulc}}\frac{Y_f}{Y}\frac{P}{rulc}$$
$$\frac{dP}{d\pi} = -e_{Pulc}\frac{1}{1-e_{Pulc}}\frac{Y_f}{Y}\frac{P}{rulc}$$
$$\frac{dP/P}{d\pi} = -e_{Pulc}\frac{1}{1-e_{Pulc}}\frac{Y_f}{Y}\frac{1}{rulc}$$

$$\frac{d\ log\ P}{d\pi} = -e_{Pulc}\frac{1}{1-e_{Pulc}}\frac{Y_f}{Y}\frac{1}{rulc} \tag{C16}$$

where:

$$e_{Pulc} = \frac{\partial\ log\ P}{\partial\ log\ ulc} = \frac{\partial log(ulc/rulc)}{\partial\ log\ ulc} = \frac{\partial\ log\ ulc}{\partial\ log\ ulc} - \frac{\partial\ log\ rulc}{\partial\ log\ ulc} = 1 - \frac{\partial\ log\ rulc}{\partial\ log\ ulc}$$

$$\frac{\partial\ log\ rulc}{\partial\ log\ ulc} = 1 - e_{Pulc}$$

$$\frac{\partial\ log\ ulc}{\partial\ log\ rulc} = \frac{1}{1-e_{Pulc}}$$

$$\frac{\partial\ log\ rulc}{\partial\ log\ ws} = \frac{\partial rulc}{\partial ws}\frac{ws}{rulc} = \frac{\partial\left(\frac{ws\times Y_f}{Y}\right)}{\partial ws}\frac{ws}{rulc} = \frac{Y_f}{Y}\frac{ws}{rulc}$$

$$ws = \frac{rulc\times Y}{Y_f} \rightarrow rulc = \frac{ws\times Y_f}{Y}$$

$$rulc = \frac{ulc}{P}$$

Following Onaran and Obst (2016) we calculate the price effects of a simultaneous change in each country as:

$$\begin{bmatrix}\frac{\Delta logP}{\Delta\pi_1}\\ \vdots \\ \frac{\Delta logP}{\Delta\pi_n}\end{bmatrix} = \left(DP_{nxn}\begin{bmatrix}\Delta\pi_1\\ \vdots \\ \Delta\pi_n\end{bmatrix} + PM_{nxn}\begin{bmatrix}0 & \Delta\pi_2 & \cdots & \Delta\pi_n\\ \Delta\pi_1 & \ddots & \cdots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ \Delta\pi_1 & \Delta\pi_2 & \cdots & 0\end{bmatrix}\begin{bmatrix}p_{m1}\\ \vdots \\ p_{mn}\end{bmatrix}\right) \tag{C17}$$

where

$$DP_{nxn} = \begin{bmatrix}\frac{\Delta logP}{\Delta\pi_1} & 0 & \cdots & 0\\ 0 & \ddots & \cdots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ 0 & \cdots & \cdots & \frac{\Delta logP}{\Delta\pi_n}\end{bmatrix}$$

$$PM_{nxn} = \begin{bmatrix}0 & \frac{\Delta log(P_x)_2}{\Delta\pi_2}\frac{M_{21}}{M_1} & \cdots & \frac{\Delta log(P_x)_n}{\Delta\pi_n}\frac{M_{n1}}{M_1}\\ \frac{\Delta log(P_x)_1}{\Delta\pi_1}\frac{M_{12}}{M_2} & 0 & \cdots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ \frac{\Delta log(P_x)_1}{\Delta\pi_1}\frac{M_{1n}}{M_n} & \frac{\Delta log(P_x)_2}{\Delta\pi_2}\frac{M_{2n}}{M_n} & \cdots & 0\end{bmatrix}$$

where DP_{ii} is $\frac{logP}{\Delta\pi}$ as calculated in equation (17) and $PM_{ij}$is calculated as:

$$PM_{ij} = \frac{\Delta log(P_x)_j}{\Delta\pi_j}\frac{M_{ji}}{M_i} = -(e_{Pxj}\frac{1}{1-e_{pj}}\frac{Yf_j}{Y_j}\frac{1}{rulc_j})\frac{M_{ji}}{M_i} \tag{C18}$$

Appendix D.

Table D1. *The marginal effect of a 1%-point increase in the profit share on net exports*

Exports									Imports					Sum
$e(P)$	$\frac{1}{1-e(P)}$	$e(PX)$	$e(XP)$	$eX.rulc$	$rulc$	Y_f/Y	X/Y	$\frac{\partial X/Y}{\partial \pi}$	$e(M,P)$	$e(M,rulc)$	(M/Y)	$\frac{\partial M/Y}{\partial \pi}$	$\frac{\partial NX/Y}{\partial \pi}$	
	A	B	C	D	E (B*C*D)	F	G	H	I(-E*G*H/F)	J	K(A*B*J)	L	M(-K*G*L/F)	I-M
A	0.524	2.099	0.152	-1.728	-0.551	0.599	0.874	0.291	0.234	0.341	0.375	0.306	-0.168	0.402
B	0.214	1.272	0.096	0.000	0.000	0.603	0.897	0.491	0.000	0.287	0.078	0.487	-0.057	0.057
DK	0.465	1.870	0.338	-0.627	-0.397	0.582	0.866	0.305	0.180	0.000	0.000	0.261	0.000	0.180
FIN	0.518	2.076	0.185	-0.576	-0.221	0.608	0.890	0.230	0.074	0.000	0.000	0.244	0.000	0.074
F	0.529	2.121	0.289	-0.439	-0.269	0.602	0.869	0.161	0.062	0.136	0.153	0.163	-0.036	0.098
D	0.366	1.577	0.333	-0.379	-0.199	0.600	0.913	0.207	0.063	0.000	0.000	0.195	0.000	0.063
GR	0.423	1.734	0.377	-0.729	-0.476	0.547	0.908	0.125	0.099	0.000	0.000	0.179	0.000	0.099
IRL	0.334	1.501	0.171	0.000	0.000	0.588	0.896	0.455	0.000	0.401	0.201	0.456	-0.140	0.140
I	0.445	1.802	0.257	-0.307	-0.142	0.586	0.913	0.165	0.037	0.210	0.169	0.165	-0.043	0.080
L	0.232	1.303	0.322	0.000	0.000	0.521	0.930	1.190	0.000	0.000	0.000	0.999	0.000	0.000
NL	0.461	1.855	0.370	0.000	0.000	0.634	0.916	0.428	0.000	0.139	0.119	0.385	-0.066	0.066
P	0.668	3.011	0.090	0.000	0.000	0.638	0.913	0.161	0.000	0.568	1.143	0.194	-0.317	0.317
E	0.430	1.754	0.320	-0.277	-0.155	0.614	0.913	0.149	0.034	0.244	0.184	0.144	-0.039	0.074
S	0.407	1.687	0.172	-0.508	-0.147	0.517	0.815	0.273	0.063	0.464	0.319	0.273	-0.137	0.200
UK	0.558	2.264	0.207	-0.518	-0.243	0.612	0.890	0.199	0.070	0.000	0.000	0.198	0.000	0.070

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, L = Luxembourg, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Appendix E. *Robustness checks for investment*

Table E1. *Private investment: dependent variable* $dlog$ *with total GDP, after-tax profit share and interest rate*

	c	$dlog(\pi_{-1})$	$dlog(\pi)$	$log(\pi)$	$log(\pi_{-1})$	$dlog(Y)$	$dlog(Y_{-1})$	$dlog(I_{-1})$	$dlog(r_{-1})$	$dlog(r)$	$log(I_{-1})$	$log(Y_{-1})$	$log(r_{-1})$	$(AR1)$	DW	R^2	Sample
A	-0.025	0.155				1.873									1.944	0.547	1962-2013
	-2.908 ***	1.750 *				7.516 ***											
B	-0.025		0.431			2.059			-0.007					0.340	2.038	0.557	1963-2013
	-1.260		1.897 *			4.419 ***			-1.747 *					1.804 *			
DK	0.066				0.068	2.895			-0.008						1.827	0.742	1963-2012
	0.695				1.120	10.013 ***			-2.137 **								
FIN	-0.045	-0.078				2.143		0.227	-0.004						1.855	0.802	1963-2012
	-5.689 ***	-1.098				10.163 ***		2.743 ***	-1.863 *								
F	-0.010	0.171				2.066	-1.062	0.387							1.733	0.791	1962-2013
	-1.716 *	2.541 **				10.926 ***	-3.456 ***	3.181 ***									
D	-0.449		0.033			2.050		0.151			-0.203	0.210			1.711	0.780	1962-2012
	-4.709 ***		0.319			10.422 ***		1.802 *			-3.196 *	3.875 ***					
GR	0.033			0.034		1.948	-0.840	0.338							1.904	0.724	1962-2012
	0.699			0.969		10.312 ***	-2.533 **	2.455 **									
IRL	-0.046	0.363				1.770			-0.009	-0.008					1.993	0.593	1973-2013
	-2.551 ***	2.321 **				5.248 ***			-2.851 ***	-2.488 **							
I	-0.012	0.195				1.824	-0.831	0.341							2.082	0.649	1962-2013
	-1.549	1.974 **				8.111 ***	-2.346 **	2.509 **									
L	-0.029					1.728									2.410	0.273	1963-2013
	-1.420	0.160				4.172 ***											
NL	-0.316	0.109				2.671					-0.266	0.257	0.101		2.173	0.725	1962-2013
	-1.969 **	1.288				9.362 ***					-4.561 ***	4.350 ***	2.647 ***				
P	-0.041	0.025				2.116									2.025	0.485	1962-2013
	-2.819 ***	0.460				6.640 ***											
E	0.222				0.194	2.342								0.336	1.865	0.763	1961-2013
	1.237				1.438	14.625 ***								2.269 **			
S	0.098				0.105	2.281		0.274	-0.006						1.777	0.737	1963-2013
	1.149				1.621 *	9.214 ***		3.490 ***	-1.961 *								
UK	-0.470				0.057	2.262					-0.207	0.227			1.930	0.676	1961-2013
	-1.776 *				1.509	8.635 ***					-3.205 *	2.845 ***					

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table E2. *Private investment: dependent variable $d\log(I)$ with G in moving sum 3 years*

	c	$dlog(\pi_t - 1)$	$dlog(\pi_t)$	$log(\pi_t)$	$log(\pi_t - 1)$	$dlog(Yp_t)$	$dlog(Yp_{t-1}$	$dlog(I_{t-1})$	$dlog(Gsum_t)$	$dlog(DY_t)$	$dlog(DY_{t-1})$	$log(I_{t-1})$	$log(Y_{t-1})$	$log(G_{t-1}))$	$log(\pi_{t-1}))$	$log(DY_{t-1}))$	$(AR1)$	DW	$R2$	Sample
A	-0.019	0.128				1.532			0.051									2.035	0.531	1963-2012
	-1.577	1.361				6.619 ***			0.114											
B	0.008	0.166				1.818			-1.130		-0.451							1.564	0.707	1971-2012
	0.713	1.070				7.645 ***			-2.552 **		-3.809 ***									
DK	-0.017			0.007		2.463			0.019									2.284	0.744	1963-2011
	-0.157			0.100		10.170 ***			0.055											
FIN	-0.510		-0.027			1.344				-0.140	-0.231	-0.483	0.265	0.336		-0.105		1.884	0.839	1972-2012
	-3.811 ***		-0.394			6.958 ***				-2.436 ***	-4.213 ***	-5.203 ***	3.081 ***	3.925 ***		-4.063 ***				
F	0.016	0.187				1.378			-0.512	-0.316								2.038	0.898	1978-2012
	2.078 **	2.871 ***				8.782 ***			-1.993 **	-4.698 ***										
D	-0.021		-0.043			1.565			0.112								0.313	1.968	0.739	1964-2012
	-2.130 **		-0.402			10.351 ***			0.374								2.155 **			
GR	0.114				0.181	1.906	0.789	-0.271	0.128									1.862	0.631	1963-2012
	1.130				1.825 *	5.932 ***	2.127 **	-2.021 **	0.274											
IRL	0.004	0.346				0.616			0.105	-0.331								2.002	0.530	1971-2012
	0.139	2.252 **				1.398			0.347	-2.752 ***										
I	-0.015	0.135				1.397			-0.222								0.324	1.765	0.634	1964-2012
	-1.423	1.749 *				7.925 ***			-0.590								2.245 **			
NL	-0.139	0.051				1.857			1.242			-0.348	0.316		0.169			2.184	0.711	1963-2012
	-0.871	0.553				8.565 ***			2.602 ***			-4.601 ***	4.307 ***		3.696 ***					
P	-1.765					2.709			0.437			-0.636	1.049		0.067	-0.259		2.055	0.704	1974-2012
	-3.090 ***					6.354 ***			0.761			-3.521 *	3.573 ***		2.015 **	-3.090 ***				
E	0.303				0.252	2.475			0.115								0.287	1.887	0.829	1964-2012
	2.411 **				2.705 ***	11.725 ***			0.466								2.093 **			
S	0.141				0.145	1.911		0.208	1.364		-0.153							2.076	0.813	1972-2012
	1.578				2.066 **	10.163 ***		2.025 **	1.732 *		-1.797 *									
UK	-0.439				-0.002	1.407				-0.211		-0.513	1.407	-0.239				2.094	0.817	1971-2012
	-1.850 *				-0.053	8.202 ***				-2.970 ***		-3.918 **	8.202 ***	-1.808 *						

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table E3. *Private investment: dependent variable $d\log(I)$ and three separate government spending variables ($G_c; G_i; I_g$)*

	c	$dlog(\pi_t - 1)$	$dlog(\pi_t)$	$log(\pi_t)$	$log(\pi_t - 1)$	$dlog(Yp_t)$	$dlog(Yp_t - 1)$	$dlog(I_{t-1})$	$dlog(Igc_t)$	$dlogIgc_{t-1}$	$dlog(Gc_t)$	$dlog(Gc_{t-1})$	$dlog(Gi_t)$	$dlog(Gi_{t-1})$	$dlog(DY_t)$	$dlog(DY_{t-1})$	$log(I_{t-1})$	$log(Yp_{t-1})$	$log(\pi_{t-1}))$	$log(Igc_{t-1}))$	$log(Gc_{t-1}))$	$log(Gi_{t-1}))$	$log(DY_{t-1}))$	*DW*	*R2*	Sample
A	-0.030	0.245				1.367			0.166				0.649											1.880	0.619	1971-2012
	-3.273 ***	2.451 **				5.382 ***			2.187 **				2.348 **													
B	0.735					1.528			-0.178							-0.610	-0.315		0.181	-0.189		0.529		1.983	0.866	1971-2012
	3.329 ***					8.176 ***			-2.634 ***							-4.562 ***	-6.328 ***		2.706 ***	-3.076 ***		6.565 ***				
DK	0.041				0.042	2.303	0.503			0.168	0.482			-0.761										1.955	0.828	1972-2012
	0.409				0.670	10.203 ***	2.024 **			1.840 *	1.992 **			-2.315 **												
FIN	-0.231		0.008			1.370				0.170					-0.122	-0.256	-0.473	0.265				0.287	-0.094	2.033	0.927	1972-2012
	-2.182 **		0.123			7.548 ***				2.642 ***					-2.269 **	-4.842 ***	-5.587 ***	3.247 ***				4.262 ***	-4.235 ***			
F	-1.233	0.103				1.421	0.389						1.128		-0.384		-0.207			-0.229		0.720	-0.150	2.120	0.941	1979-2012
	-3.777 ***	1.689 *				8.281 ***	2.848 ***						3.375 ***		-5.091 ***		-3.393 *			-3.649 ***		3.986 ***	-3.134 ***			
D	-0.017	0.017				1.651						-0.351												1.518	0.658	1972-2007
	-2.414 **	0.141				7.343 ***						-2.114														
GR	-1.519			0.030		1.648	1.142				0.338						-0.841	1.156		0.176		-0.290	-0.188	1.881	0.862	1971-2012
	-2.411 **			0.204		5.463 ***	3.879 ***				2.066 **						-5.532 ***	3.829 ***		2.439 **		-2.327 **	-3.677 ***			
IRL	-0.015	0.420				0.681							0.550		-0.296									1.893	0.570	1971-2012
	-0.564	2.789 ***				1.660 *							1.929 *		-2.671 ***											
I	-0.011	0.043				1.590					-0.535		0.443			-0.222								1.891	0.747	1971-2012
	-2.017 **	0.572				9.131 ***					-1.944 *		1.846 *			-1.810 *										
NL	-0.226	0.009				1.716	1.036		0.276		0.735						-0.412			0.197	0.373			2.146	0.794	1971-2012
	-2.633 ***	0.092				8.466 ***	3.181 ***		2.374 **		2.970 ***						-4.681 ***			3.232 ***	5.427 ***					
P	-0.022	0.018				1.790		-0.286						0.677	-0.229	-0.264								2.038	0.697	1975-2012
	-1.203	0.383				3.882 ***		-2.130 **						2.500 **	-1.678 *	-2.282 **										
E	0.694				0.104	1.934	-0.594			0.114					-0.250	-0.382	-0.253			-0.087	0.298		-0.039	1.654	0.964	1972-2012
	6.293 ***				1.766 *	7.822 ***	-2.311 **			4.120 ***					-3.642 ***	-5.190 ***	-6.005 ***			-4.503 ***	6.064 ***		-2.012 **			
S	0.093				0.103	1.761		0.414	0.458			0.451												2.056	0.861	1972-2012
	1.299				1.882 *	12.270 ***		6.018 ***	3.978 ***			2.725 ***														
UK	-0.238				-0.017	1.287		0.168		0.062					-0.314		-0.728	0.800			-0.256		-0.066	2.142	0.860	1971-2012
	-0.875				-0.408	7.891 ***		1.635 *		2.026 **					-4.384 ***		-5.192 ***	5.131 ***			-2.900 ***		-2.505 ***			

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table E4. *Private investment: dependent variable $d\log(I)$ with G in contemporaneous and lagged form, Reduced Sample 1960-2007*

	c	$dlog(\pi_{-1})$	$dlog(\pi)$	$log(\pi_{-1})$	$dlog(Y_p)$	$dlog(Yp_{-1})$	$dlog(I_{-1})$	$dlog(G)$	$dlog(G_{-1})$	$dlog(DY)$	$dlog(DY_{-1})$	$dlog(I_{-1})$	$log(Y_{p-1}))$	$log(G_{-1}))$	$log(DY_{-1}))$	$(AR1)$	DW	R^2	Sample
A	-0.021	0.141			1.279			0.793		-0.172							1.953	0.476	1971-2007
	-1.365	1.329			2.864 ***			1.733 *		-1.482									
B	-0.007	0.364			1.931			-0.418			-0.491						1.532	0.725	1972-2007
	-0.541	1.533			7.141 ***			-0.753			-3.811 ***								
DK	-0.026			0.016	3.270			0.492			-0.088					-0.383	1.809	0.807	1973-2007
	-0.330			0.326	13.105 ***			1.263			-2.459 **					-1.818 *			
FIN	-0.429		-0.011		1.555					-0.123	-0.270	-0.444	0.162	0.402	-0.103		2.098	0.920	1972-2007
	-2.978 ***		-0.150		6.563 ***					-2.118 **	-4.640 ***	-4.716 ***	1.624 *	4.498 ***	-3.994 ***				
F	0.017	0.222			1.319				-0.532	-0.327							1.776	0.894	1978-2007
	2.246 **	3.421 ***			7.330 ***				-2.983 ***	-5.335 ***									
D	-0.020		-0.052		1.536			0.037								0.297	1.938	0.668	1961-2007
	-1.646 *		-0.482		7.760			0.208								1.941 *			
GR	0.020			0.067	1.387			0.770									2.110	0.461	1961-2007
	0.261			0.876	4.452			2.098 **											
IRL	0.327	0.182				0.412				-0.698		-0.401	0.076	0.313	-0.130		1.892	0.526	1971-2007
	1.511	0.931				0.738				-3.344 ***		-2.753	0.777 *	1.966 *	-2.754 ***				
I	-0.016	0.109			1.242		0.238	-0.141									1.611	0.520	1962-2007
	-1.683 *	1.116			5.937 ***		2.043 **	-0.510											
NL	-0.036	0.231			1.550			0.617									1.716	0.483	1962-2007
	-2.445 **	2.222 **			6.114 ***			1.797 *											
P	-2.176	-0.030			2.218			0.758				-0.667	1.046		-0.148		2.146	0.720	1974-2007
	-4.056 ***	-0.672			4.612 ***			1.847 *				-3.723 **	3.686 ***		-2.002 **				
E	-1.476			0.077	1.765				0.460	-0.186	-0.254	-0.426	0.580			0.489	1.720	0.917	1973-2007
	-2.019 **			0.534	3.098 ***				2.316 **	-1.320	-3.169 ***	-3.257 *	3.116 ***			1.784 *			
S	0.154			0.152	1.821			1.461		-0.179							1.625	0.759	1971-2007
	1.626 *			2.053 **	6.015 ***			2.758 ***		-2.061 **									
UK	-0.668			0.008	1.200					-0.180		-0.531	0.650				1.929	0.746	1971-2007
	-1.775 *			0.194	6.352 ***					-2.236 **		-3.582 **	3.185 ***						

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Appendix F. *Policy mix and further effects*

Table F1. *The total effect of an isolated 1% point fall in profit share, a 1% point increase in government expenditure, a 1% point increase in capital taxation or a 1% point fall in labour taxation on investment and net exports*

	Total effect of π on I / Y	*Total effect of π on NX / Y*	*Total effect of G on I/Y*	*Total effect of G on NX /Y*	*Total effect of t_r on I/Y*	*Total effect of t_w on I /Y*
A	0.054	-0.444	1.125	-0.482	-0.036	0.210
B	-0.380	0.035	0.437	-0.639	-0.121	0.347
DK	0.078	-0.233	0.319	-0.218	-0.021	0.130
FIN	0.154	-0.138	2.045	-0.494	-0.043	0.645
F	-0.071	-0.119	0.265	-0.071	-0.106	0.545
D	0.243	-0.155	0.740	-0.414	-0.035	0.226
GR	0.485	-0.210	1.828	-0.327	-0.134	0.345
IRL	0.036	-0.213	0.810	-0.824	-0.012	0.526
I	-0.073	-0.084	0.315	-0.091	-0.062	0.088
L	0.013	-0.104	0.084	-0.680	-0.004	0.017
NL	-0.107	-0.128	0.987	-0.631	-0.125	0.252
P	0.057	-0.345	1.563	-0.809	-0.035	0.835
E	0.622	-0.214	1.940	-0.297	-0.050	0.725
S	-0.022	-0.270	1.461	-0.822	-0.054	0.282
UK	0.138	-0.140	0.345	-0.406	-0.022	0.241

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table F2. *The total effect of a simultaneous 1% point fall in profit share, a 1% point increase in government expenditure, a 1% point increase in capital taxation or a 1% point fall in labour taxation on investment and net exports*

	Total effect of π on I / Y	*Total effect of π on NX / Y*	*Total effect of G on I/Y*	*Total effect of G on NX /Y*	*Total effect of t_r on I/Y*	*Total effect of t_w on I /Y*
A	0.310	-0.020	1.455	0.065	-0.067	0.365
B	-0.261	0.393	0.746	0.099	-0.150	0.488
DK	0.175	0.005	0.500	0.225	-0.038	0.215
FIN	0.369	0.186	2.967	0.058	-0.107	0.960
F	0.009	0.046	0.495	0.248	-0.124	0.635
D	0.312	-0.005	0.907	-0.047	-0.051	0.302
GR	0.692	-0.055	2.268	0.002	-0.176	0.555
IRL	0.122	-0.084	0.929	-0.488	-0.023	0.580
I	-0.013	0.156	0.487	0.406	-0.078	0.171
L	0.138	0.372	0.416	0.577	-0.035	0.173
NL	0.124	0.126	1.553	-0.010	-0.178	0.519
P	0.164	-0.161	1.852	-0.485	-0.060	0.960
E	0.755	-0.076	2.288	-0.001	-0.084	0.884
S	0.190	0.044	1.956	-0.308	-0.098	0.496
UK	0.175	-0.029	0.429	-0.190	-0.030	0.277
Average*	**0.20**	**0.036**	**0.92**	**0.045**	**-0.08**	**0.42**

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

* Change in each country is multiplier by its share in EU15 GDP

Table F3. *Total effects of a policy mix on budget balance following an isolated change in each country*

	1%-point fall in profit share	*1%-point increase in public spending*	*1%-point increase in taxation on capital income*	*1%-point fall in taxation on wage income*	*Combined effect on budget balance*
	A	***B***	***C***	***D***	***E***
A	0.044	-0.493	0.245	0.772	0.569
B	-0.028	-0.927	0.271	0.637	-0.047
DK	0.085	-0.649	0.262	0.725	0.423
FIN	0.071	-0.445	0.258	0.728	0.613
F	0.081	-0.719	0.206	0.826	0.394
D	0.267	-0.545	0.275	0.848	0.844
GR	0.005	-0.986	0.359	0.552	-0.070
IRL	0.004	-0.984	0.304	0.597	-0.079
I	0.009	-0.789	0.300	0.646	0.166
L	0.005	-0.970	0.409	0.527	-0.030
NL	0.045	-0.543	0.220	0.812	0.535
P	0.040	-0.610	0.245	0.824	0.499
E	0.508	0.074	0.255	1.080	1.917
S	0.036	-0.744	0.288	0.571	0.151
UK	0.094	-0.858	0.261	0.717	0.214

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table F4. *The effect of a 1% point increase in the wage share on annual inflation and nominal unit labour costs*

	1% point increase in the wage share in isolation		1% point simultaneous increase in the wage share
	ULC $\Delta log ulc/\Delta w_s$	*Annual inflation* $\Delta log P/\Delta w_s$	*Annual inflation* $\Delta log P/\Delta w_s$
A	3.062	1.603	1.777
B	1.893	0.405	0.700
DK	2.785	1.296	1.603
FIN	3.037	1.574	1.845
F	3.059	1.617	1.833
D	2.399	0.878	1.166
GR	2.877	1.217	1.452
IRL	2.288	0.764	0.875
I	2.807	1.249	1.442
L	2.325	0.541	0.773
NL	2.680	1.235	1.386
P	4.307	2.877	3.102
E	2.605	1.120	1.362
S	2.661	1.083	1.335
UK	3.289	1.836	2.066
Average	*2.805*	*1.286*	*1.515*

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

Table F5. *Three policy scenarios with disaggregated government expenditures*

	Scenario 1				Scenario 2				Scenario 3			
	Increase in public investment (I_g) by 1% point				Increase in government spending in social infrastructure (G_i) by 1% point				Increase in other government spending (G_c) by 1% point			
	Excess Demand / Y	Multiplier	% change in aggregate demand (A*B)	The effects of a simultaneous 1%-point increase in Ig on % change in aggregate demand	Excess Demand / Y	Multiplier	% change in aggregate demand (E*F)	The effects of a simultaneous 1%-point increase in Gi on % change in aggregate demand	Excess Demand / Y	Multiplier	% change in aggregate demand (I*J)	The effects of a simultaneous 1%-point increase in Gc on % change in aggregate demand
	A	B	C	D	E	F	G	H	I	J	K	L
A	1.010	2.048	2.067	3.679	1.011	2.048	2.070	3.718	1.000	2.048	2.048	4.294
B	0.844	1.185	1.000	2.576	0.923	1.185	1.094	2.704	0.918	1.185	1.088	3.279
DK	0.997	2.191	2.185	3.391	0.994	2.191	2.177	3.410	1.008	2.191	2.209	3.890
FIN	0.729	4.682	3.412	7.698	0.729	4.682	3.412	7.794	0.720	4.682	3.372	9.344
F	0.796	3.395	2.703	3.868	0.885	3.395	3.005	4.182	1.841	3.395	6.249	7.721
D	1.000	2.256	2.256	3.208	1.000	2.256	2.256	3.233	0.993	2.256	2.241	3.625
GR	1.009	5.055	5.103	7.233	0.993	5.055	5.020	7.200	1.005	5.055	5.083	8.061
IRL	0.875	1.176	1.029	1.691	0.912	1.176	1.072	1.749	1.222	1.176	1.437	2.356
I	1.000	1.718	1.718	2.632	0.993	1.718	1.705	2.641	2.583	1.718	4.437	5.627
L	1.000	0.560	0.560	2.698	1.000	0.560	0.560	2.746	1.000	0.560	0.560	3.529
NL	1.020	2.760	2.816	5.999	1.001	2.760	2.763	6.022	1.017	2.760	2.806	7.273
P	0.875	3.460	3.026	4.601	0.876	3.460	3.032	4.643	0.875	3.460	3.026	5.219
E	0.923	4.680	4.321	6.109	0.950	4.680	4.446	6.272	0.988	4.680	4.624	7.161
S	0.936	3.239	3.033	5.767	0.916	3.239	2.966	5.764	0.562	3.239	1.820	5.669
UK	0.937	2.330	2.182	2.748	0.938	2.330	2.186	2.765	0.933	2.330	2.174	2.985
*EU15 GDP**				*3.71*				*3.80*				*5.15*

Note: A = Austria, B = Belgium, DK = Denmark, FIN = Finland, F = France, D = Germany, GR = Greece, IRL = Ireland, I = Italy, NL = Netherlands, P = Portugal, E = Spain, S = Sweden, UK = United Kingdom

* Change in each country is multiplied by its share in EU15 GDP. See Appendix B for details.