A DSGE MODEL OF INSIDERS – OUTSIDERS CAPITALISM

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Abstract: In this paper, along the lines of Cole and Ohanian (2004) where insiders are identified as sectors characterized by market failures, we incorporate this insiders–outsiders structure of society in a two sector DSGE model with market and political power interactions in order to characterize the underlying politico-economic equilibrium. This politico-economic equilibrium is summarized by the allocation of resources and the determination of policy variables that an insiders-outsiders society government will choose given the laws of motion of the private sector equilibrium in the economy. The policy variables include the share of uncompetitive industries in the economy. The government's objective function seeks a balance between pursuing the interests of insiders and the interests of the representative household. Both growth and business cycle properties of the politico-economic equilibrium are being studied.

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1. Introduction

The major South European economies (including and especially so, Greece), i.e. the "European Periphery", have suffered over the last four decades from sluggish growth, relative to the OECD average and the "European Core"; and, more recently, the Great Recession was more severe, deeper and considerably longer in Portugal, Spain, Italy and Greece than in Germany, the United States and the OECD average[1]. It is the central thesis of this study that the politico-economic system of these South European countries is an important factor in understanding these disparities. This paper seeks to investigate the extent to which economic and political power interactions in these countries is responsible for these developments.

Different economies respond differently to global shocks in terms of pervasion in economic activity, magnitude, depth, persistence and duration of repercussions.[2] The differences may be quantitative and/or qualitatively and clearly depend on the underlying social, political and economic structure and characteristics of the country. This is also the case when one looks at the repercussions and propagation mechanism of idiosyncratic. i.e., country specific shocks.

It is well documented that most Southern European countries feature not only a relatively large public sector, but also a large part of their GDP is produced by firms that, to various degrees, are controlled by government. Notable examples are power utilities, water and sewage utilities, phone networks, garbage disposal utilities, road networks, road, rail and sea transport companies, airports and seaports, oil refineries, natural gas networks, banks and insurance companies. The industries these firms operate are non-competitive and moreover, they use labour organized in powerful unions. The latter bargain for "high" wages that lead to "high" prices for their services. As these services are important inputs for the rest of the economy, this affects total factor productivity and overall competitiveness. At the same time, the powerful unions and their strategic allies cooperate in the major political parties and government so as maintain and promote their interests. But, this arrangement results in relatively high government spending and financial needs. It is worth noting that such a

[1] The term "Great Recession", refers to the sharp decline in the level of economic activity that occurred in 2008 and 2009 in the USA and spread out to most of the rest of the world, thereafter. For more evidence and information on the dismal macroeconomic performance of Greece the last four decades, and in general the disparities in macroeconomic performance among various OECD countries as well as the striking differences observed between core vis-à-vis periphery European countries in view of the great recession see Christou et al, Kollintzas et al BoG1. and the dismal behaviour of Greece and other Southern European countries in contrast

[2] The very recent economic history provides us with four such major global shocks: The Great Recession that burst out in 2007, the COVID19 Pandemic that burst out in January 2020 as well as the Russian Invasion iin February 2022 and the Gaza conflict in October 2023 whose repercussions are currently unfolding.

strategic interdependence does not happen in Anglo-Saxon countries, because, there, unions and allied business interests have little market power. And, does not happen in the Scandinavian countries or some Central European countries where, although strong, unions and associated business interests work together, thereby taking account of possible negative effects of their decisions on the whole of society.

This analysis relates to the "varieties of capitalism" literature of political science, pioneered by Hall and Soskice (2001). In this literature, it has been suggested that Greece as well as other Southern European countries have their own "variety" of capitalism, where the state plays a major role (see, e.g., Molina and Rhodes (2007). Hence, the insiders-outsiders society idea is based on the institutional complementarity between market organizations, where the wage premium favors individual groups of society ("insiders") and the political system, where these groups control or influence government, for insiders' collective benefit. This interaction has been emphasized on another strand of the political science literature, namely, that on "neo-corporatism" (see e.g. Sargent (1985)).

In a nutshell, the purpose of this paper is to develop the theoretical framework necessary for the construction and estimation of a dynamic stochastic general equilibrium model capable of characterizing the interaction between market and political forces that may play a crucial role for both long run and short run macroeconomic behaviour. The model assigns a key role to the degree government policies cater to the interests of economic agents possessing market power. In so doing, the model is capable of generating quantitative theory predictions in accordance to various combinations of alternative market structure and production technology specifications. In particular, with respect to market power we consider the relative share of the non-competitive industries in the economy and the wage-employment bargaining structure. And, with respect to production technology, we allow for alternative complementarity/substitutability specifications across and within the competitive and noncompetitive sectors.

More specifically, in terms of modelling, building on Kollintzas, et al. (2018, 2021) and along the lines of Cole and Ohanian (2004), we introduce market and political power interactions that resemble the politico-economic structure of South European countries, in a small open economy RBC model. All three models incorporate the insiders-outsiders labor market structure and the concept of an elite government while outsiders form a group of workers that supply labor to a competitive private sector.

In contrasr to Kollintzas et al (2018), where insiders form a group of workers, that enjoy market power in supplying labor to the public sector, we adopt here the framework in

Kollintzas et al (2020) which is built along the lines of Cole and Ohanian (2004) where insiders are identified as sectors characterized by market failures. Therefore, we build a DSGE model where insiders form a group of workers that are organized in labor unions to supply labor to a non-competitive private sector. Insiders influence the policy decisions of government, including those that affect the development and maintenance of public sector infrastructures. This leads to labor misallocation and inefficient fiscal policies that are to the benefit of insiders. Thus, even though expanding public sector output has a positive effect on growth, eventually this is counterbalanced by the labor misallocation and inefficient tax policy outcomes. These frictions affect the economy's shock propagation mechanism in a way that recessions last longer than in the canonical RBC and even leading to a growth reversal phenomenon.

The above models may be applicable to other countries that have a similar politico-economic structure, that is, a politico-economic system characterized by groups of selfish elites that enjoy market power but at the same time cooperate in influencing government in protecting and promoting their collective self-interests.

Within this insiders–outsiders structure of society DSGE model, we characterize the underlying politico-economic equilibrium. This politico-economic equilibrium is summarized by the allocation of resources and the determination of policy variables that an insiders-outsiders society government will choose given the laws of motion of the private sector equilibrium in the economy. The policy variables include the share of uncompetitive industries in the economy.

We follow a Ramsey type optimal policy approach to endogenize government policy, obtaining what we call the politico-economic equilibrium (PE). Then, we study the way this politico – economic equilibrium is affected in the long run by alternative government objectives. We thereby establish a channel where potentially different policy decisions, based on alternative government objectives affect growth and the business cycle.

The private sector equilibrium, given government policy, including the share of insiders' industries in the economy, is characterized by four distortions. The first two consist of an output price markup and a wage premium for insiders over outsiders, in all insiders' industries. These two distortions imply lower output and lower capital and labor inputs than what would have been the case if insiders' industries were competitive. The third distortion relates to the fact that, as different industry outputs are partial complements, the lower output in all insiders' industries lowers the demand for output in all outsiders' industries, lowering aggregate output. The fourth distortion is brought about by the fact that, any strictly positive

share of insiders' industries in the economy results in higher output share of government spending, reflecting the costly adjustment and maintenance of the politico-economic system, further increasing misallocation vis-a-vis a politico-economic system with no insiders. The combination of the above four distortions imply that steady state GDP per head of the model economy will be lower than what would have been the case without the underlying frictions. This is what could serve as an explanation of the relatively poor growth performance of the South European economies.

The government's objective function seeks a balance between pursuing the interests of insiders and the interests of the representative household. The latter, in our homogeneous households set up (i.e., each representative household comprises of both insiders and outsiders), is in line with what Jean Tirole calls government pursuing policies for the "the common good."[3] On the other hand, in line with Daron Acemoglu's notion of "political elites" that influence government decision making, we take the interests of insiders to be represented by the expected value of their income (i.e., labor income and profits in all insiders' industries).[4] Further, combining the aforementioned interests and in line with the political economy tradition of Persson and Tabellini (2002), we define the government's objective to be a weighted average welfare loss function. This is what we call the "Hybrid" government.

We parameterize the model adopting values that are commonly used in the DSGE and RBC literature and at the same time satisfy the restrictions imposed by our theory. We then assess the characteristics of alternative politico-economic equilibria, based on different degrees of insiders' influence in government decisions. To this end, we first focus on the asymptotic steady state of the politico-economic equilibrium (PE) and then compute the impulse response functions (IRFs) of key endogenous variables, in response to temporary shocks in the stochastic exogenous variables of the model related to productivity.

Our model's deep parameters comprise the relative weight associated with the welfare loss of insiders in the government decision making. This weight, denoted by ρ, can serve as a bridge of our theoretical model with the data. That is, different values of ρ are associated with countries with different politico-economic structures. For example, the politico-economic structure of South European countries can be thought of as being characterized by a relatively higher value of ρ compared to the US or the European Core. Hence, we believe that an

[3] See Tirole (2017). Although tempting to associate the interests of outsiders with those of the representative household we refrain in doing so. In our full household insurance set up, household income is the sum of incomes of both its outsiders and insiders members.
[4] See, e.g., Acemoglu (2006, 2009, Ch. 22).

additional contribution of this paper is that this parameter can be estimated in the data and thereby rank countries accordingly. The extent of this influence may explain the different macroeconomic performance observed among countries that, ceteris paribus, enjoy a similar state of development.

The plan of the paper has as follows: In Section 2 we build the model and solve for the private sector equilibrium (PSE), given policy. In Section 3, we define and solve for the politico- economic equilibrium of the Hybrid government, under full commitment. The share of insiders' industries in the economy is now a policy instrument optimally decided by the government. In Section 4 we parameterize the model and investigate the asymptotic steady state and growth implications of the politico-economic equilibrium. Finally, Section 5 offers some concluding remarks.

2. Model

The economy consists of a large number of identical households whose members supply labor and capital services to firms and consume and invest in a final good. This final good that can either be consumed or invested, is produced by means of the services of a number of intermediate goods produced in two sectors: the insiders' sector and the outsiders' sector. Following Cole and Ohanian (2004), we assume that in both insiders' and outsiders' sectors there is continuum of intermediate good products indexed by ς; and that ς takes values in the unit interval. Accordingly, we assume that each intermediate good product is produced in a single industry, so that industries are also indexed by ς. The size of the insiders' sector is denoted by the variable χ_t (and thus $1-\chi_t$ denotes the size of the outsiders' sector. In contrast to Cole and Ohanian (2004) where χ_t (i.e., the relative size of the "cartel" sector in their model) was an exogenously given parameter, in our model the number of insiders' industries χ_t is an endogenous policy instrument decided optimally by the government.[5]

[5] A summary of the model's notation can be found in Section I of the Mathematical Appendix.

2.1. Economic agents and their behaviour

2.1.1. Final good producers

Production in the final good sector takes place in a large number of identical firms. The production technology of the representative firm in this sector is characterized by a CES production function of the form:

$$y_t = A_t\left[\varphi_1\chi_t^{\varphi_2}\left(\mathrm{Y}_t^i\right)^{\phi} + (1-\varphi_1)(1-\chi_t)^{\varphi_2}\left(\mathrm{Y}_t^o\right)^{\phi}\right]^{(1/\phi)}, \quad t \in \mathbb{N}_+ \tag{I.1}$$

where y_t is the output of the representative final good producer in period t; Y_t^i is the composite input of intermediate goods produced in the insiders' sector; Y_t^o is the composite input of intermediate goods produced in the outsiders' sector; A_t is total factor productivity; χ_t is the share of insiders' industries in the economy; and $\frac{1}{1-\phi}$ is the input elasticity of substitution across sectors. $\phi < 0$ ($\phi > 0$) implies that the two inputs used for the production of the final god, namely intermediate goods produced in the insiders' sector and the outsiders' sector, are complements (substitutes); φ_1 and φ_2 are parameters related to the weights of inputs Y_t^i and Y_t^o in the production of the final good.

Composite inputs are defined by the Dixit-Stiglitz aggregator functions:

$$\mathrm{Y}_t^i = \left[\int_0^{\chi_t} y_t^i(\varsigma)^{\theta} d\varsigma\right]^{(1/\theta)}; \theta \in (0,1) \tag{I.2}$$

$$\mathrm{Y}_t^o = \left[\int_{\chi_t}^{1} y_t^o(\varsigma)^{\theta} d\varsigma\right]^{(1/\theta)} \tag{I.3}$$

where $y_t^i(\varsigma)$ denotes input of the intermediate good of the ς industry in the insiders' sector; $y_t^o(\varsigma)$ denotes input of the intermediate good of the ς industry in the outsiders' sector; and $\frac{1}{1-\theta}$ is the aggregation elasticity of substitution across industries in a given sector and is assumed to be the same for both sectors.

The representative final good producer's (real) profits are given by:

$$\pi_t^y = y_t - \int_0^{\chi_t} p_t^i(\varsigma) y_t^i(\varsigma) d\varsigma - \int_{\chi_t}^{1} p_t^o(\varsigma) y_t^o(\varsigma) d\varsigma \tag{I.4}$$

where $p_t^i(\varsigma)$ is the real price of the intermediate good of industry ς in the insiders' sector; $p_t^o(\varsigma)$: real price of the intermediate good of industry ς in the outsiders' sector.

Final good producers behave competitively in all markets. The representative final good producer chooses output and inputs so as to maximize profits, (I.4), subject to the technology constraints (I.1) - (I.3).

The necessary and sufficient conditions for profit maximization are:

$$p_t^i(\varsigma) = \Gamma_t^i y_t^i(\varsigma)^{(\theta-1)} \tag{I.5}$$

$$p_t^o(\varsigma) = \Gamma_t^o y_t^o(\varsigma)^{(\theta-1)} \tag{I.6}$$

where:

$$\Gamma_t^i \equiv \chi_t A_t^{\phi} y_t^{(1-\phi)} Y_t^{i(\phi-\theta)} \tag{I.7}$$

$$\Gamma_t^o \equiv (1-\chi_t) A_t^{\phi} y_t^{(1-\phi)} Y_t^{o(\phi-\theta)} \tag{I.8}$$

2.1.2. Intermediate good producers in the outsiders' sector

Production in any given industry of the outsiders' sector takes place in a large number of identical firms. These firms are producing output using capital and labor services, that they rent from households. The production technology of the representative firm in the $\varsigma \in (\chi_t, 1]$ industry is characterized by a Cobb-Douglas production function of the form:

$$y_t^o(\varsigma) = B_t^o k_t^o(\varsigma)^{\alpha} l_t^o(\varsigma)^{(1-\alpha)} \tag{I.9}$$

where $k_t^o(\varsigma)$ denotes capital input; $l_t^o(\varsigma)$ is labor input; B_t^o is total factor productivity in outsiders' industries; $\alpha \in (0,1)$ is the capital input elasticity.

The (real) profits of the representative firm in the $\varsigma \in (\chi_t, 1]$ industry of the outsiders' sector are given by:

$$\pi_t^o(\varsigma) = p_t^o(\varsigma) y_t^o(\varsigma) - r_t k_t^o(\varsigma) - w_t^o l_t^o(\varsigma) \tag{I.10}$$

where r_t is the real rental cost of capital; w_t^o is the real wage rate of outsiders.

We assume labor augmenting technical progress at a constant growth rate $(1+\eta)$. Thus, output, capital input and the wage rate are expressed in efficient household units and labor input is expressed in household units.

Intermediate good producers in all industries of the outsiders' sector behave competitively in all markets. The representative intermediate good producer in the ς industry of the outsiders' sector chooses output and inputs so as to maximize profits, given by (I.10), subject to the technology constraint (I.9). The necessary and sufficient condition for profit maximization are:

$$r_t = \alpha \frac{p_t^o(\varsigma) y_t^o(\varsigma)}{k_t^o(\varsigma)} \tag{I.11}$$

$$w_t^o = (1-\alpha) \frac{p_t^o(\varsigma) y_t^o(\varsigma)}{l_t^o(\varsigma)} \tag{I.12}$$

Assuming ex post symmetry, it follows that $\left(p_t^o(\varsigma), y_t^0(\varsigma), k_t^o(\varsigma), w_t^o(\varsigma), l_t^o(\varsigma), \pi_t^o(\varsigma)\right)$ is the same for all $\varsigma \in (\chi_t, 1]$. Henceforth, we denote the common value of this vector by $\left(p_t^o, y_t^o, k_t^o, w_t^o, l_t^o, \pi_t^o\right)$. And, clearly, π_t^o=0.

2.1.3 Intermediate good producers in the insiders' sector

We assume the same type of production technology as in the industries of the outsiders' sector. That is:

$$y_t^i(\varsigma) = B_t^i k_t^i(\varsigma)^{\alpha} l_t^i(\varsigma)^{(1-\alpha)} \tag{I.13}$$

where B_t^i is total factor productivity in insiders' industries.

In each industry of the insiders' sector, there is one producer and one labor union. The profits of the $\varsigma \in (0, \chi_t]$ producer in the insiders' sector is given by:

$$\pi_t^i(\varsigma) = p_t^i(\varsigma) y_t^i(\varsigma) - r_t k_t^i(\varsigma) - w_t^i(\varsigma) l_t^i(\varsigma) \tag{I.14}$$

where $w_t^i(\varsigma)$ is the real wage rate in the ς industry of the insiders' sector.

Union preferences are characterized by a utility function of the form:

$$u_t^i(\varsigma) = \left[w_t^i(\varsigma) - w_t^o\right]^{\lambda} \left[l_t^i(\varsigma)\right]^{(1-\lambda)} \tag{I.15}$$

where $\lambda \in (0,1)$ indicates preference intensity of wage premium over union membership / employment.

Behaviour in each industry of the insiders' sector is defined as follows:

Each producer behaves like a monopolist, setting the output price subject to the (inverse) demand function (I.5) and output and inputs are constrained by the production technology (I.13).

Both the producer and the union in each industry of the insiders' sector take as given: the economy and insiders' sector aggregates y_t and Y_t^i, respectively; the real rental cost of capital and the real wage rate in the outsiders' sector, r_t and w_t^o, respectively; and the fraction of insiders' industries in the economy, χ_t .

Further, behavior in any given industry ς of the insiders' sector, is characterized by a two-stage game, whereby:

(i) In the first stage, the producer and the union agree upon a wage–employment Nash bargaining contract:

$$\left(w_t^i(\varsigma)^*, l_t^i(\varsigma)^*\right) = \underbrace{argmax}_{\left(w_t^i(\varsigma), l_t^i(\varsigma)\right)} \left\{\left[u_t^i(\varsigma) - \bar{u}_t^i(\varsigma)\right]^{\mu} \left[\pi_t^i(\varsigma) - \bar{\pi}_t^i(\varsigma)\right]^{1-\mu}\right\} \tag{I.16}$$

where, $\bar{u}_t^i(\varsigma)$ is the union's reservation option; $\bar{\pi}_t^i(\varsigma)$ is the producer's reservation option; and the parameter $\mu \in (0,1)$ denotes the union's relative bargaining power.

(ii) In the second stage, the producer chooses capital input, so as to maximize profits associated with the wage rate and employment determined in the first stage:

$$k_t^i(\varsigma)^* = \underbrace{\arg\max}_{k_t^i(\varsigma)} \left(\Gamma_t^i \left\{ B_t^i k_t^i(\varsigma)^{\alpha} \left[l_t^i(\varsigma)^* \right]^{(1-\alpha)} \right\}^{\theta} - r_t k_t^i(\varsigma) - \left[w_t^i(\varsigma)^* \right] \left[l_t^i(\varsigma)^* \right] \right) \tag{I.17}$$

Finally, we assume that if there is no contract:

(i) union members can work in the industries of the outsiders' sector for w_t^o, so that $\bar{u}_t^i(\varsigma) = 0$

(ii) the producer can operate in the industries of the outsiders' sector, earning π_t^o, so that $\bar{\pi}_t^i(\varsigma) = 0$.

The following proposition characterizes the industry variables in any given industry in the insiders' sector:

Proposition 1: *Provided that the following restriction on the model's parameters holds,*

$$\lambda < \frac{(1-\alpha\theta)}{(1-\alpha\theta)+(1-\theta)} + \frac{(1-a)\theta}{(1-\alpha\theta)+(1-\theta)} \left(\frac{1-\mu}{\mu} \right), \tag{R1}$$

behaviour in any given insiders' industry $\varsigma \in (0, \chi_t]$ *is such that:*

$$r_t(\varsigma) = \alpha\theta \frac{p_t^i(\varsigma) y_t^i(\varsigma)}{k_t^i(\varsigma)} \tag{I.18}$$

$$w_t^i(\varsigma) = (1-\alpha) v \xi \frac{p_t^i(\varsigma) y_t^i(\varsigma)}{l_t^i(\varsigma)} \tag{I.19}$$

$$\frac{w_t^i(\varsigma)}{w_t^o} = v \tag{I.20}$$

$$\pi_t^i(\varsigma) = \kappa p_t^i(\varsigma) y_t^i(\varsigma) \tag{I.21}$$

where:

$$\kappa \equiv 1 - \alpha\theta - (1-\alpha)\nu\xi > 0 \tag{I.22}$$

$$\nu \equiv \frac{1}{1 - \dfrac{(1-\theta)\lambda}{(1-\alpha\theta)(1-\lambda) + (1-\alpha)\theta\left(\dfrac{1-\mu}{\mu}\right)}} > 1 \tag{I.23}$$

$$\xi \equiv \frac{(1-\alpha)\theta + \left\{1 - \alpha\theta - [(1-\alpha\theta) + (1-\theta)]\lambda\right\}\left(\dfrac{\mu}{1-\mu}\right)}{(1-\alpha)\left[1 + (1-\lambda)\left(\dfrac{\mu}{1-\mu}\right)\right]} > 0 \tag{I.24}$$

Proof: *In the Mathematical Appendix, Section II.*

Assuming ex post symmetry, it follows that, $\left(p_t^i(\varsigma), y_t^i(\varsigma), k_t^i(\varsigma), w_t^i(\varsigma), l_t^i(\varsigma), \pi_t^i(\varsigma)\right)$ is the same for all $\varsigma \in (0, \chi_t]$. Henceforth, we denote the common value of this vector by $\left(p_t^i, y_t^i, k_t^i, w_t^i, l_t^i, \pi_t^i\right)$.

Restriction [R1] is a joint restriction on the relative union preferences for the wage premium over union membership, union bargaining power, and production technology. It ensures that the maximand defining the Nash bargaining contract is strictly concave over the interior of the subset of the wage premium – employment space, defined by the union and firm participation constraints.[6] And, its economic implications are that the wage premium, employment, and profits in insiders' industries are strictly positive. Moreover, as (I.23) implies, the wage premium in insiders' industries is larger: the greater the relative bargaining power of the unions, $\left(\dfrac{\mu}{1-\mu}\right)$; and, the stronger the preference intensity of the unions for the wage premium over employment, λ. On the contrary, as (I.22) implies, the revenue share of insiders' industries profits is larger: the smaller the relative bargaining power of the unions, $\left(\dfrac{\mu}{1-\mu}\right)$; and, the weaker the preference intensity of the unions for the wage premium over employment, λ.

[6] When the bargaining power of the union equals that of the firm, the economic meaning of [R1] is equivalent to the well known condition that in the efficient contract: the union indifference curve is tangent to the firm's (inverse) demand for labor. See, e.g., Oswald (1982).

2.1.4. Households

Households' income sources consist of wages and rents from labour and capital services provided to the intermediate goods sectors as well as profits from insiders' industries. They use their income to buy the final good that they turn to consumption and investment. Now, given that behaviour in all insiders' and outsiders' industries is characterized by symmetry, the representative household's flow budget constraint is given by:

$$c_t + (1+\eta)k_{t+1} \leq [1+(1-\tau_t^K)(r_t - \delta)]k_t + (1-\tau_t^L)[\chi_t w_t^i h_t^i + (1-\chi_t)w_t^o h_t^o + \chi_t \pi_t^i] \quad \text{(I.25)}$$

where, c_t denotes (final good) consumption; k_t is capital stock at the beginning of period *t*; $\chi_t h_t^i$ is labor supply to the insiders' sector; $(1-\chi_t)h_t^o$ is labor supply to the outsiders' sector; $\chi_t \pi_t^i$ are dividends from outsiders' industries; τ_t^K is the capital income tax rate; τ_t^L is the labor income tax rate; $\delta \in (0,1)$ is the fixed (geometric) capital depreciation rate.

Again, given that behaviour in all insiders' and outsiders' industries is characterized by symmetry, the time constraint of the representative household is given by:

$$\chi_t h_t^i + (1-\chi_t)h_t^o = h_t \leq 1 \quad \text{(I.26)}$$

where h_t is the fraction of available household time devoted to work; and, consequently, $1-h_t$ is the fraction of available household time devoted to leisure.

Since, given the restriction [R1], $w_t^i > w_t^o$, households prefer to supply labor in the insiders' sector. But, in such a case there would be no outsiders' sector. For that matter, we need to impose a rationing constraint in insiders' industries to the effect that the supply of labor in insiders' industries is restricted to be less than the corresponding demand for labor.[7] That is,

$$h_t^i \leq l_t^i \text{ (given)} \quad \text{(I.27)}$$

Finally, the usual physical constraints apply:

$$c_t, 1-h_t, h_t^i, h_t^o, k_{t+1} \geq 0 \quad \text{(I.28)}$$

Household preferences are characterized by a time separable lifetime expected utility function of the form:

$$U_0^h \equiv E_0 \sum_{t=0}^{\infty} \beta^t u_t^h \quad \text{(I.29)}$$

[7] Since l_t^i is also union membership, (I.27) could be interpreted as a constraint imposed by unions. Alternatively, we could introduce unemployment as in Cole and Ohanian (2004), so that the expected value of the wage rate in the insiders' sector is equal to the wage rate in the outsiders' sector, while $\chi_t(l_t^i - h_t^i)$ represents unemployment.

where:

$$u_t^h = \frac{[c_t^{\vartheta}(1-h_t)^{1-\vartheta}]^{1-\gamma}}{1-\gamma}; \gamma > 0 \qquad \text{(I.30)}$$

and $\beta \in (0,1)$ is the efficient household constant discount factor; $1/\gamma$ is the intertemporal elasticity of substitution; ϑ is the preference intensity for consumption. Note that, since consumption is measured in efficient household units, the discount factor β is given by $\tilde{\beta}(1+\eta)^{\vartheta(1-\gamma)}$, where $\tilde{\beta} \in (0,1)$ is the pure discount factor of the household.

The economic environment is characterized by the exogenous state of the economy, z_t. This is a vector comprising the three total factor productivities (A_t, B_t^i, B_t^o). All economic agents know z_t at the beginning of period *t*. In any given period *t*, government moves first and chooses the government policy variables, based on the information available at the beginning of the period, $z^t = \{z_v\}_{v=0}^t$. That is, $\left(g_t, \tau_t^K, \tau_t^L, \chi_t\right) = \left(g_t(z^t), \tau_t^K(z^t), \tau_t^L(z^t), \chi_t(z^t)\right)$, where g_t is government consumption. Private sector economic agents move second and make their decisions, given $\left(g_t, \tau_t^K, \tau_t^L, \chi_t\right)$, based on z^t. In particular, households choose a contingency plan $\left\{c_t(z^t), h_t(z^t), h_t^i(z^t), h_t^o(z^t), k_{t+1}(z^t)\right\}_{t=0}^{\infty}$. The probability of any particular history of the exogenous state z_t, prob(z_t), is given. $E_t(\bullet)$ stands for the expectations operator, based on z_t, that is, the information available at the beginning of period *t*. As usual in DSGE analysis, prob(z_t) will be specified indirectly, via the laws of motion of the exogenous state, later in Section C.I.

The representative household seeks a contingency plan given government policy $\left\{c_t(z^t), h_t(z^t), h_t^i(z^t), h_t^o(z^t), k_{t+1}(z^t)\right\}_{t=0}^{\infty}$ so as to maximize U_0^h, subject to (I.25)-(I.28) and the initial condition $k_0 \in (0,\infty)$ given.

Then, any solution to the household problem is such that constraints (I.25) - (I.27) are satisfied with equality, the physical constraints (I.28) are satisfied with strict inequality, and together with these constraints and the initial condition, $k_0 \in (0,\infty)$ *given*, the following conditions form a set of necessary and sufficient conditions for a solution to the household's problem:

Intra-temporal condition:

$$\frac{\vartheta(1-\tau_t^L)w_t^o}{c_t} = \frac{1-\vartheta}{1-h_t} \tag{I.31}$$

Euler condition:

$$\frac{u_t}{c_t} = \frac{\beta}{(1+\eta)} E_t \left\{ \frac{u_{t+1}}{c_{t+1}} [1 + (1-\tau_{t+1}^K)(r_{t+1} - \delta)] \right\} \tag{I.32}$$

Transversality condition:

$$\beta^T E_0 \frac{u_T k_{T+1}}{c_T} \to 0 \; as \; T \to \infty \tag{I.33}$$

The necessity of the transversality condition follows from the nature of preferences and the fact that consumption and initial capital stock are strictly positive.

2.1.5. The Government

The government always runs a balanced budget, in the sense that government spending must satisfy the constraint:

$$g_t = \tau_t^K \left(r_t - \delta \right) k_t + \tau_t^L \left[\chi_t w_t^i h_t^i + (1-\chi_t) w_t^o h_t^o + \chi_t \pi_t^i \right] \tag{I.34}$$

Now, government spending is defined by:

$$g_t = \left[\bar{\psi}_t + \hat{\psi}\chi_t + \frac{1}{2}\tilde{\psi}(\chi_{t+1} - \chi_t)^2 \right] y_t; \quad \hat{\psi}, \tilde{\psi} \geq 0; \tag{I.35}$$

where, $\bar{\psi}_t$ is the GDP share of the usual type of government spending (consumption, investment, transfers, etc); and parameters $\hat{\psi}, \tilde{\psi}$ denote the GDP shares of government spending devoted to the maintenance of the existing insiders' sector and the expansion of the insiders' sector, respectively.

That is, in addition to the usual type of government spending represented $\bar{\psi}_t$, this formulation also allows for spending that relates to the existence of insiders. It should be pointed out that there is a number of ways that this assumption can be justified. For example, to the extent that insiders' industries are basic networks, government may directly provide for setting up (represented by the term $\frac{1}{2}\tilde{\psi}(\chi_{t+1} - \chi_t)^2$) and maintain the infrastructure associated with these industries (represented by the term $\hat{\psi}\chi_t$). In that sense, government spending may be thought as incorporating maintenance and adjustment costs in public capital. Alternatively, it may be thought as incorporating the cost of bureaucracy that needs to be put in place to

regulate the "protected" insiders' sector and "promote" competition in the outsiders' sector, also to the benefit of the insiders. [8] Also, the government budget constraint incorporates the assumption that profits are taxed at the same rate as labour income. This assumption is made for simplicity only and it would make no difference for modelling purposes if profits were taxed at the capital income tax rate or at a separate (flat) tax rate.

Hence, $\left(\bar{\psi}_t, \tau_t^k, \tau_t^L, \chi_t\right)$ is the vector of government policy variables. Only three out of the four government policy variables can be chosen independently of each other. We choose the labour tax rate τ_t^L to be determined residually.

2.2. Private Sector Equilibrium (PSE) given policy

2.2.1. Definition:

Given any sequence of the exogenous state $\{z_t\}_{t=0}^{\infty}$ and any sequence of government policy variables $\left\{g_t(z^t), \tau_t^K(z^t), \tau_t^L(z^t), \chi_t(z^t)\right\}_{t=0}^{\infty}$, a private sector equilibrium given policy is a sequence of the form: $\left\{y_t(z^t), y_t^i(z^t), y_t^o(z^t), k_t(z^t), k_t^i(z^t), k_t^o(z^t), l_t^i(z^t), l_t^o(z^t), c_t(z^t), h_t(z^t),\right.$ $\left.h_t^i(z^t), h_t^o(z^t), r_t(z^t), w_t^i(z^t), w_t^o(z^t), \pi_t^i(z^t)\right\}_{t=0}^{\infty}$, such that: (I.1)-(I.3), (I.5)-(I.6), (I.9), (I.11)-(I.13), (I.18)-(I.21), (I.25)-(I.27), (I.31)-(I.33) are satisfied, along with the market clearing conditions:

$$k_t = \chi_t k_t^i + (1-\chi_t)k_t^o \tag{II.1}$$

$$h_t^i = l_t^i \tag{II.2}$$

$$h_t^o = l_t^o \tag{II.3}$$

$$y_t = c_t + [(1+\eta)k_{t+1} - (1-\delta)k_t] + g_t \tag{II.4}$$

Equation (II.1) is the market clearing condition for capital, Equations (II.2) and (II.3) are the market clearing conditions for the insiders' and outsiders' labor markets, respectively. Equation (II.4) is the economy's resource constraint.

2.2.2. Analytic characterization of Private Sector Equilibrium

[8] A similar point is made by Acemoglu (2006), who considers the imposition of distorting taxation to "middle class" producers, by a government controlled by "elite" producers, for "political consolidation" purposes.

Proposition 2*: Given [R1], the private sector equilibrium defined above has the following analytic characterization:*

(a) *Sector Variables: Outputs and inputs in the insiders' and outsiders' industries can be expressed in terms of the exogenous variables,* z_t*, the government policy variable,* χ_t*, and the aggregate state of the private sector,* $\left(k_t, h_t\right)$*, as follows:*

$$\left[\frac{\chi_t k_t^i}{(1-\chi_t)k_t^o}\right] = \theta\Delta_t(\chi_t) \tag{II.5}$$

$$(1-\chi_t)k_t^o = \frac{1}{1+\theta\Delta_t(\chi_t)}k_t \tag{II.6}$$

$$\left[\frac{\chi_t h_t^i}{(1-\chi_t)h_t^o}\right] = \xi\Delta_t(\chi_t) \tag{II.7}$$

$$(1-\chi_t)h_t^o = \frac{1}{1+\xi\Delta_t(\chi_t)}h_t \tag{II.8}$$

$$\left[\frac{\chi_t y_t^i}{(1-\chi_t)y_t^o}\right] = \left[\theta^\alpha \xi^{(1-\alpha)}\left(\frac{B_t^i}{B_t^o}\right)\right]\Delta_t(\chi_t) \tag{II.9}$$

$$(1-\chi_t)y_t^o = B_t^o\left[\frac{1}{1+\theta\Delta_t(\chi_t)}\right]^\alpha\left[\frac{1}{1+\xi\Delta_t(\chi_t)}\right]^{(1-\alpha)}k_t^\alpha h_t^{(1-\alpha)} \tag{II.10}$$

$$\left(\frac{p_t^i}{p_t^o}\right) = \frac{1}{\theta^\alpha \xi^{(1-\alpha)}\left(\frac{B_t^i}{B_t^o}\right)} \tag{II.11}$$

$$\left(\frac{w_t^i}{w_t^o}\right) = \nu = \frac{1}{1-\frac{(1-\theta)\lambda}{(1-\alpha\theta)(1-\lambda)+(1-\alpha)\theta\left(\frac{1-\mu}{\mu}\right)}} \tag{II.12}$$

where:

$$\Delta_t(\chi_t) \equiv \left[\theta^\alpha \xi^{(1-a)}\left(\frac{B_t^i}{B_t^0}\right)\right]^{\phi/(1-\phi)}\left(\frac{\chi_t}{1-\chi_t}\right)^{1+\frac{\phi}{\theta(1-\phi)}} \tag{II.13}$$

(b) *Factor Prices, Profits' Share, and the Aggregate Production Function: Factor prices, insiders' profits, and aggregate output can be expressed in terms of the exogenous variables,* z_t*, the government policy variable,* χ_t *and the aggregate state of the private sector,* $\left(k_t, h_t\right)$*, as follows:*

$$r_t = \alpha \hat{\omega}_t(\chi_t)\frac{y_t}{k_t} \tag{II.14}$$

$$w_t^o = (1-\alpha)\breve{\omega}_t(\chi_t)\frac{y_t}{h_t} \tag{II.15}$$

$$\frac{\chi_t \pi_t^i}{y_t} = \frac{\kappa \Delta_t(\chi_t)}{1+\Delta_t(\chi_t)} \tag{II.16}$$

$$y_t = \bar{\omega}_t(\chi_t) k_t^{\alpha} h_t^{(1-\alpha)} \tag{II.17}$$

where:

$$\hat{\omega}_t(\chi_t) \equiv \frac{1+\theta\Delta_t(\chi_t)}{1+\Delta_t(\chi_t)} \tag{II.18}$$

$$\breve{\omega}_t(\chi_t) \equiv \frac{1+\xi\Delta_t(\chi_t)}{1+\Delta_t(\chi_t)} \tag{II.19}$$

$$\begin{aligned}\bar{\omega}_t(\chi_t) &\equiv A_t\, B_t^o \frac{(1-\chi_t)^{[\theta+(1-\theta)\phi]/\theta\phi}[1+\Delta_t(\chi_t)]^{1/\phi}}{[1+\theta\Delta_t(\chi_t)]^{\alpha}[1+\xi\Delta_t(\chi_t)]^{(1-\alpha)}} \\ &= A_t\, B_t^o \frac{(1-\chi_t)^{[\theta+(1-\theta)\phi]/\theta\phi}[1+\Delta_t(\chi_t)]^{(1-\phi)/\phi}}{\hat{\omega}_t(\chi_t)^{\alpha}\breve{\omega}_t(\chi_t)^{(1-\alpha)}}\end{aligned} \tag{II.20}$$

(c) <u>*Government Spending and the Aggregate State Variables:*</u> *Suppose that, as described in Section 2.1.5, the government always runs a balanced budget, in the sense that government spending must satisfy the constraint (I.34):*

$$g_t = \tau_t^K \left(r_t - \delta\right)k_t + \tau_t^L \left[\chi_t w_t^i h_t^i + (1-\chi_t) w_t^o h_t^o + \chi_t \pi_t^i\right]$$

and that government spending is defined by (I.35):

$$g_t = \left[\bar{\psi}_t + \hat{\psi}\chi_t + \frac{1}{2}\tilde{\psi}(\chi_{t+1} - \chi_t)^2\right] y_t; \quad \hat{\psi}, \tilde{\psi} \geq 0;$$

Then, given z_t *and government policy variables* $\left(\bar{\psi}_t, \tau_t^k, \tau_t^L, \chi_t\right)$*, the laws of motion of the aggregate state of the private sector equilibrium: (i) depend only on the aggregate state of the private sector* $\left(k_t, h_t\right)$*; and (ii) they are characterized, completely, in terms of: the transversality condition (I.33); the initial condition,* $k_0 \in (0,\infty)$ *given; the resource constraint (II.4); and, the following conditions:*

$$\frac{1-\vartheta}{\vartheta}\frac{c_t}{1-h_t} = \breve{\omega}_t(\chi_t)(1-\tau_t^L)(1-\alpha)\frac{y_t}{h_t} \tag{II.21}$$

$$\frac{u_t}{c_t}=\frac{\beta}{(1+\eta)}E_t\left\{\frac{u_{t+1}}{c_{t+1}}\left[1+(1-\tau^K_{t+1})\left[\widehat{\omega}_{t+1}(\chi_{t+1})\alpha\frac{y_{t+1}}{k_{t+1}}-\delta\right]\right]\right\} \tag{II.22}$$

$$\bar{\psi}_t+\hat{\psi}\chi_t+\frac{1}{2}\hat{\psi}(\chi_{t+1}-\chi_t)^2=\tau^K_t\left[\alpha\widehat{\omega}_t(\chi_t)-\delta\left(\frac{k_t}{y_t}\right)\right]+(1-\alpha)\tau^L_t\tilde{\omega}_t(\chi_t) \tag{II.23}$$

where:

$$\tilde{\omega}_t(\chi_t)\equiv\frac{1+o\Delta_t(\chi_t)}{1+\Delta_t(\chi_t)}>1 \tag{II.24}$$

and $o\equiv\dfrac{1-\alpha\theta}{1-\alpha}$

Proof: *In the Mathematical Appendix, Section III.*

Observe that the PSE consists of two block diagonal sets of equations: the first involves aggregate endogenous variables only, while the other involves uniquely sectoral variables. Hence, in a nutshell, the main message from Proposition 2 is that solving for the entire PSE boils down to first solving for the aggregate variables and then solve residually for the sectoral variables.

It is useful to establish certain qualitative properties of the PSE. These properties help us understand the model economy and how this economy compares to DSGE model economies that are not subject to the frictions incorporated herein. These properties become eventually crucial when government policy becomes endogenous, since, as will become clear in the following section, the PSE is a constraint in the Ramsey optimal policy problem.

First, note that the ratio of output in insiders' industries over output in outsiders' industries will depend, in general, on the share of insiders' industries in the economy, χ_t and the ratio of the intermediate goods industry productivities, $\left(\dfrac{B^i_t}{B^0_t}\right)$. Note, however, that (II.9) and (II.13) imply: $\left(\dfrac{y^i_t}{y^o_t}\right)=\left[\theta^\alpha\xi^{(1-a)}\left(\dfrac{B^i_t}{B^0_t}\right)\right]^{1+\frac{\phi}{(1-\phi)}}\left(\dfrac{\chi_t}{1-\chi_t}\right)^{\frac{\phi}{\theta(1-\phi)}}$.

Since, $\left(1+\dfrac{\phi}{1-\phi}\right)>0$, $\theta\in(0,1)$, and, given [R1], $\xi>0$, it follows from the above equation, that, for any given level of χ_t and $\left(\dfrac{B^i_t}{B^0_t}\right)$, the ratio of output in insiders' industries to output in outsiders' industries will be smaller the smaller is ϕ, θ and ξ. With respect to $\phi\in(-\infty,1)$

, this mirrors the monopoly power of producers in the product market in insiders' industries. For, a smaller ϕ implies a lower elasticity of substitution across intermediate good sectors and therefore a less elastic demand facing producers in insiders' industries, allowing for higher mark-ups, higher prices, and lower outputs. With respect to θ, this also mirrors the monopoly power of producers in the product market in insiders' industries. For, a smaller θ implies a lower elasticity of substitution across insiders' industries and therefore a less elastic demand facing the producer in each insiders' industry, allowing for a higher mark-up, higher price, and lower output. With respect to ξ, this reflects the degree by which the firm-union bargaining distortion increases wages and decreaes labor input in insiders' industries, decreasing output in these industries. To see this, observe that the size of ξ crucially depends on the size of λ, i.e. the relative intensity of union preferences for the wage premium over employment, and the relative bargaining power of unions, $\left(\frac{\mu}{1-\mu}\right)$. In particular, it follows from Proposition 1 that ξ decreases with λ and, to the extent that unions care about the wage premium more than they care about employment (i.e., $\lambda > 1/2$), also decreases with $\left(\frac{\mu}{1-\mu}\right)$. Second, it follows from the above equation, that in the case of equal sector shares and equal levels of total factor productivities across intermediate good sector industries (i.e., $\left(\frac{\chi_t}{1-\chi_t}\right) = \left(\frac{B_t^i}{B_t^0}\right) = 1$, output in insiders' industries is less than output in outsiders' industries if and only if $\xi < \theta^{\frac{-\alpha}{1-a}}$. However, $\xi \geq \theta^{\frac{-\alpha}{1-a}} > 1$ does not necessarily violate [R1]. For example, if unions care only about employment (i.e., $\lambda = 0$), $\xi \geq \theta^{\frac{-\alpha}{1-a}}$, for all $\mu > \frac{1}{1+\frac{\alpha(1-\theta)}{(1-\alpha)(\theta^{\frac{-\alpha}{1-a}}-\theta)}}$. Since we are interested in characterizing economies where insiders' industries are producing less output than outsiders' industries, even when technology is the same across industries, due to

the frictions described in the preceding paragraph, we shall impose a sufficient condition for $\xi < \theta^{\frac{-\alpha}{1-a}}$.[9] Namely, $\xi < 1$.[10] Note that $\xi < 1$ if and only if the following condition holds:

$$\lambda > \frac{\alpha}{1+\alpha} - \frac{1-a}{1+\alpha}\left(\frac{1-\mu}{\mu}\right) \qquad \text{[R2]}$$

[R2] imposes a lower bound and [R1] imposes an upper bound on λ, respectively, with both bounds becoming more restricting with μ.

Last but not least, observe that, along the PSE, the exogenous state of the economy affects the aggregate state of the private sector only through the random variables:

$$\tilde{A}_t = \left(A_t B_t^o\right) \qquad \text{(II.26)}$$

$$B_t = \left(\frac{B_t^i}{B_t^o}\right) \qquad \text{(II.27)}$$

$\tilde{A}_t$ can be interpreted as the (static) total factor productivity of the industries in the outsiders' sector when industry inputs are measured in terms of aggregate state variables and B_t can be interpreted as the total factor productivity differential between the insiders' and the outsiders' sectors.

Hence, in order to characterize the stochastic properties of the aggregate state of the economy given policy, it suffices to characterize the stochastic properties of $\tilde{A}_t$ and B_t along with those of three out of the four government policy variables, namely χ_t, $\bar{\psi}_t$ and τ_t^k.

2.3. Understanding the model

In addition to proportional capital and labor income taxes, the model introduced in Sections I and II above, involves three extra frictions: (a) monopolistic producers in insiders' industries, (b) Nash bargaining between the union and the corresponding producer in each one of the insiders' industries, and (c) resources to maintain and adjust the fraction of insiders' industries in the economy. As in Kollintzas, et al BoG1, we label the model where the only

[9] This restriction would not have been an appropriate modelling restriction for countries where unions care more about employment than wage premia, such as in Scandinavian and Central European countries. See Visser (2013), and Kollintzas, et al (2018b).

[10] Also, as shown in the next section, $\xi < 1$ has an additional desirable implication for our purposes.

friction stems from distortionary taxation as the "prototype economy" in juxtaposition to our model characterized by the expanded range of frictions labelled as the "detailed economy" [11].

Understanding the properties of the detailed economy reduces to defining and understanding the "time- varying wedges that distort the equilibrium decisions of agents operating in otherwise competitive markets," as suggested by Chari, Kehoe, McGrattan (2007). Here we have four such wedges, namely, the capital, labor, efficiency and government wedges, which, as shown in Kollintzas, et al (2021), are reflected in the variables $\breve{\omega}_t(\chi_t)$, $\tilde{\omega}_t(\chi_t)$, $\bar{\omega}_t(\chi_t)$ and $g_t(\chi_t)$, respectively. All four variables, defined in equations (II.18)-(II.21) above, are functions of χ_t. The behaviour of the wedges reveal that, given restrictions, the adverse effects implied by the three additional frictions mentioned above increase with the size of the insiders' sector and lead to a significant reduction to steady output per capita relative to an economy where the only friction is distortionary taxation (for details see Kollintzas, et al (2021)).

Crucial for the wedges characteristics and, hence, the extent to which frictions (especially those related to the degree of monopoly power in insiders' industries) propagate in the workings of the economy, are the complementarity-substitutability properties of the inputs in the production technology of the final good sector, i.e. output of the insiders' sector and the output of outsiders' sector (reflected in the value of parameter ϕ), as well as those among the intermediate goods produced by the industries within each sector (reflected in the value of parameter θ).

When parameterizing the model, we shall follow Cole and Ohanian (2004) in considering the empirically relevant case to be the case where the output of the insiders' sector and the output of outsiders' sector in the final good production are not strong complements. We shall refer to the case where $-\frac{\theta}{1-\theta} < \phi < 1$ as a situation where the output of the insiders' sector and the output of outsiders' sector in the final good production are not strong complements. Note that for $0 < \phi < 1$ this implies that the output of the insiders' and outsiders' sectors used as inputs in the production of the final good, are substitutes.

[11]The prototype economy is a two sector model where both sectors are perfectly competitive and the only friction is distortionary taxation. We continue, however, to use the "insiders" – "outsiders" terminology in order to distinguish between these two perfectly competitive sectors of the prototype economy.

3. The politico-economic equilibrium

The stage has been now set to define the Ramsey government problem and the Politico-Economic Equilibrium. That is, a contingency plan for the economy's resource allocation and government policy variables that optimize the government's objective function subject to the private sector equilibrium (PSE) constraints along with the economy's resource constraint and government's budget constraint.

3.1 Constraints faced by Government

From the four policy instruments we shall assume that the capital income tax rate, τ_t^K; and, the GDP share of conventional government spending, $\overline{\psi}_t$, are exogenously determined. Consequently, in any given period *t*, the only endogenous government policy variables are the share of insiders' industries in the economy at the beginning of period *t+1*, χ_{t+1} and the labor income tax rate in period *t*, τ_t^L, which is residually determined for the government budget constraint to be satisfied. Any government (contingency) plan, $\left\{\tau_t^L, \chi_{t+1}\right\}_{t=0}^{\infty}$, must satisfy the private sector equilibrium (PSE).

Recall that any government plan, $\left\{\tau_t^L, \chi_{t+1}\right\}_{t=0}^{\infty}$, that adheres to the PSE equations and the government budget constraint, can be determined once the allocation of aggregate variables $\left\{h_t(z^t), k_{t+1}(z^t), \chi_{t+1}(z^t)\right\}_{t=0}^{\infty}$ has been determined. Therefore, the government is constrained only by the block diagonal set of equations of the PSE involving the aggregate endogenous variables, along with the definitions of wedges, the transversality condition, the initial conditions and the stochastic processes of the exogenous variables. In what follows, we regroup and rewrite these equations that will constrain the government's optimal behaviour, including the sectoral equations for the wages in the two sectors.

Aggregate production function:

$$y_t = \bar{\omega}_t(\chi_t) k_t^{\alpha} h_t^{(1-\alpha)} \tag{III.1}$$

Resource constraint:

$$y_t = c_t + [(1+\eta)k_{t+1} - (1-\delta)k_t] + g_t \tag{III.2}$$

Government budget constraint:

$$g_t \equiv \Delta_t^g(\chi_t, \chi_{t+1}) y_t = \left\{ \tau_t^K \left[\alpha \widehat{\omega}_t(\chi_t) - \delta \left(\frac{k_t}{y_t} \right) \right] + \tau_t^L (1-\alpha) \tilde{\omega}_t(\chi_t) \right\} y_t \tag{III.3}$$

Intra-temporal condition:

$$\frac{1-\vartheta}{\vartheta} \frac{c_t}{1-h_t} = (1-\tau_t^L)(1-\alpha) \breve{\omega}_t(\chi_t) \frac{y_t}{h_t} \tag{III.4}$$

Euler condition for capital:

$$\frac{u_t}{c_t} = \frac{\beta}{(1+\eta)} E_t \left\{ \frac{u_{t+1}}{c_{t+1}} \left[1 + (1-\tau_{t+1}^K)[\widehat{\omega}_{t+1}(\chi_{t+1}) \alpha \frac{y_{t+1}}{k_{t+1}} - \delta] \right] \right\} \tag{III.5}$$

Transversality condition:

$$\beta^T E_0 \frac{u_T k_{T+1}}{c_T} \to 0 \ \ as \ \ T \to \infty \tag{III.6}$$

Initial condition:

$$(k_0, \chi_0) \in (0, \infty) \times (0,1) \ \ given \tag{III.7}$$

Real Rental Cost of Capital:

$$r_t = \alpha \widehat{\omega}_t(\chi_t) \frac{y_t}{k_t} \tag{III.8}$$

Sector wages and wage premium

$$w_t^o = (1-\alpha) \breve{\omega}_t(\chi_t) \frac{y_t}{h_t} \tag{III.9}$$

$$\left(\frac{w_t^i}{w_t^o} \right) = \nu \tag{III.10}$$

Wedges

$$\widehat{\omega}_t(\chi_t) = \frac{1 + \theta \Delta_t(\chi_t)}{1 + \Delta_t(\chi_t)} \tag{III.11}$$

$$\breve{\omega}_t(\chi_t) = \frac{1 + \xi \Delta_t(\chi_t)}{1 + \Delta_t(\chi_t)} \tag{III.12}$$

$$\bar{\omega}_t(\chi_t) = A_t B_t^o \frac{(1-\chi_t)^{\frac{\theta(1-\phi)+\phi}{\theta\phi}} [1 + \Delta_t(\chi_t)]^{\frac{1}{\phi}}}{[1 + \theta \Delta_t(\chi_t)]^{\alpha} [1 + \xi \Delta_t(\chi_t)]^{(1-\alpha)}} \tag{III.13}$$

$$\tilde{\omega}_t(\chi_t) = \frac{1 + o \Delta_t(\chi_t)}{1 + \Delta_t(\chi_t)} \tag{III.14}$$

$$\Delta_t^g(\chi_t,\chi_{t+1}) \equiv \frac{g_t}{y_t} = \bar{\psi}_t + \hat{\psi}\chi_t + \frac{1}{2}\tilde{\psi}(\chi_{t+1}-\chi_t)^2 \tag{III.15}$$

$$\Delta_t(\chi_t) = \left[\theta^{\alpha}\xi^{(1-a)}\left(\frac{B_t^i}{B_t^0}\right)\right]^{\frac{\phi}{1-\phi}}\left(\frac{\chi_t}{1-\chi_t}\right)^{\frac{\theta(1-\phi)+\phi}{\theta(1-\phi)}} \tag{III.16}$$

where, given [R1] and [R2], $\nu>1$, $\xi<1$ and $o>1$.

3.2 The Government Objective

In order to characterize formally the solution to the government's problem, or what we refer to as a politico-economic equilibrium (PE), we need to specify the government's objective function. Naturally, this specification should capture the basic features of the situation we are interested modelling. That is, governments that to some extent are influenced by insiders' interests. We restrict our attention to the case where government seeks a balance between pursuing the interests of insiders and the interests of the representative household. The latter, in our homogeneous households set up, is in line with what Jean Tirole calls policies for the "the common good."[12] Thus, we take the "common good" policies to be those that maximize the expected value of the utility function introduced in Section II:

$$U_0^h = E_0\left\{\sum_{t=0}^{\infty}\beta^t\frac{[c_t^{\vartheta}(1-h_t)^{1-\vartheta}]^{1-\gamma}}{1-\gamma}\right\} \tag{III.17}$$

Further, following Kollintzas et al. (2018a, 2021) we assume that insiders' interests are represented by the expected value of the discounted future stream of their income. That is, labour income and profits in all insiders' industries:

$$U_0^i \equiv E_0\left\{\sum_{t=0}^{\infty}\beta^t\int_0^{\chi_t}\left[w_t^i(\varsigma)l_t^i(\varsigma)+\pi_t^i(\varsigma)\right]d\varsigma\right\} \tag{III.18}$$

At first sight, it would appear that this specification of insiders' interests would entail problems for the analysis, as it involves industry specific variables. However, using the PSE relationships, the discounted future stream of insiders' income can be re-expressed exclusively in terms of the aggregate state variables. Moreover, we show in the appendix that the discounted future stream of insiders' income is strictly increasing in the share of insiders' industries in the economy.

This type of preferences for insiders as a whole, is consistent with the incentive of each group of insiders to cooperate with other groups of insiders in order to influence government

[12] See Tirole (2017).

in maintaining their insider status and promoting their special interests. In particular, insiders as a whole, ceteris paribus, prefer an economy with more insiders. This in turn implies that to the extent government decision making is affected by insiders' preferences this induces the government to choose an economy with a bigger share of insiders' industries. However, it should be pointed out this implies that insiders, by preferring a bigger share of insiders' industries in the economy, are responsible for the creation of a negative externality that, may eventually prove to be detrimental to their own wellbeing, as well. The choice of this kind of preferences captures the essence of the political distortion induced by the very existence of insiders.[13]

Further, we are interested in operationalizing the degree insiders influence governments. In so doing, we follow the political economy literature (see, e.g., Persson and Tabellini (2002, Ch.7)), considering a hybrid government objective function, where, as already mentioned, to some degree government is influenced by representative household preferences and is influenced likewise by insiders' preferences. This will henceforth be labelled as "Hybrid Government".

To avoid scale problems, we follow Kollintzas et al. (2018a) in postulating that government seeks to minimize a loss function comprising the weighted average of the percentage deviations of: (a) the welfare of the representative household under the Hybrid Government from the household welfare that would had been achieved in the long run if government cared only about the representative household (Median Voter Government) and (b) the insiders' welfare under the Hybrid Government from the insiders' welfare that would had been achieved in the long run if government cared only about insiders (Insiders' Government). In this set up the degree of insiders' influence is the weight, denoted by ρ, of the welfare loss of insiders in the government objective function. That is, we consider a government objective function of the form:

$$U_0^{\rho} = \rho\left(\frac{\bar{U}^i - U_0^i}{\bar{U}^i}\right)^2 + (1-\rho)\left(\frac{\bar{U}^h - U_0^h}{\bar{U}^h}\right)^2; \quad \rho \in (0,1) \tag{III.19}$$

[13] Kollintzas and Pechlivanos (2024) study the existence of a coalition of simplified versions of the unions and entrepreneurs in insiders industries of this model. First they study the conditions under which these coalitions are stable. Second, they study the conditions under which stable coalitions are electable, over a regime where there are only outsiders. They find two cases where the latter is true. First, if there is a critical fraction of individuals that perceive that the benefits from being an outsider in a society consisting only of outsiders are lower than the expected benefits of being an insider in the insiders –outsiders regime. Second, if individuals irrationally believe that the probability of being an insider in an insiders - outsiders regime is higher than the corresponding equilibrium probability. The first condition relates to situations where perceptions about a common regime could be manipulated and the second to Pasarelli and Tabellini (2017) individuals, who think that they are better than themselves. In both cases there is a lower bound on the share of insiders' industries in the economy.

where: $\bar{U}^h$ is the maximum value of the household utility function (i.e., the RHS of (III.17)) over all possible steady states of the PSE, given the share of insiders' industries, and for all possible shares of insiders industries (i.e., $\forall \chi \in [0,1]$); $\bar{U}^i$ is the maximum value of the discounted future stream of insiders' income (i.e., the RHS of (III.18)) over all possible steady states of the PSE, given the share of insiders industries, and for all possible shares of insiders industries; and ρ is the degree of insiders' influence in government decision making. On the contrary, $1-\rho$ reflects the degree government decisions are influenced by the "common good."[14]

One of the motivations of this paper was to seek a way to operationalize the "varieties of capitalism" and "neo-corporatism" ideas of the political science literature and in particular the institutional complementarity between the political system and groups in society enjoying market power and the associated influence of the latter groups in government's decision making (see Kollintzas, et al 2018 and the references therein.) Kollintzas et al (2018b) also provide empirical evidence on the existence and repercussions of market and political power interactions. It is exactly the latter that is captured by parameter ρ. Here, this is as an exogenously given deep parameter, in accordance to the political economy literature tradition of aggregating preferences among different groups in society (see, e.g. Persson and Tabellini, 2002). That been said, one of the contributions of this paper is the development of a DSGE model that introduce this additional deep parameter that can be estimated from the data.

Since we allow for the share of insiders industries to take all possible values in the definitions of $\bar{U}^h$ and $\bar{U}^i$, we may think of the steady states of the PSE along with the underlying constant value of the share of insiders , associated with $\bar{U}^h$ and $\bar{U}^i$, as a bliss point for those seeking "common good" policies and insiders' interest, respectively, if they were allowed to choose the structure of the economy, including the extreme case of no insiders

[14] One of the motivations of this paper was to seek a way to operationalize the "varieties of capitalism" and "neo-corporatism" ideas of the political science literature and in particular the institutional complementarity between the political system and groups in society enjoying market power and the associated influence of the latter groups in government's decision making (see Kollintzas, et al 2018 and the references therein.) Kollintzas et al (2018b) also provide empirical evidence on the existence and repercussions of market and political power interactions. The latter is captured by parameter ρ. Here, this is as an exogenously given deep parameter, in accordance to the political economy literature tradition of aggregating preferences among different groups in society (see, e.g. Persson and Tabellini, 2002). That been said, one of the contributions of this paper is the development of a DSGE model where ρ is an additional deep parameter that can be estimated from the data.

(outsiders). Moreover, the expressions $\left(\frac{\bar{U}^h - U_0^h}{\bar{U}^h}\right)^2$ and $\left(\frac{\bar{U}^i - U_0^i}{\bar{U}^i}\right)^2$ reflect the percentage loss of outsiders and insiders, respectively, relative to their bliss point.[15]

3.3 Definition of the Politico-Economic Equilibrium of a Hybrid Government

The politico-economic equilibrium in the case of a Hybrid government (PE) is defined as follows:

Given the vector of stochastic exogenous variables $\{z^t\}_{t=0}^{\infty}$, *a politico-economic equilibrium in the case of a Hybrid Government is a sequence of the form* $\{h_t^*(z^t), k_{t+1}^*(z^t), \chi_{t+1}^*(z^t)\}_{t=0}^{\infty}$, *such that:*

$$\{h_t^*(z^t), k_{t+1}^*(z^t), \chi_{t+1}^*(z^t)\}_{t=0}^{\infty} = \underset{\{h_t(z^t), k_{t+1}(z^t), \chi_{t+1}(z^t)\}_{t=0}^{\infty} \in \Im_0}{\arg\max} U_0^{\rho}$$

$\Im_0$ *is the space of sequences of the form* $\left\{h_t(z^t), k_{t+1}(z^t), \chi_{t+1}(z^t)\right\}_{t=0}^{\infty}$ *such that the constraints 2.1 -2.10 and the initial conditions, are satisfied, along with the definitions of the wedges and the auxiliary variable* $\Delta_t(\chi_t)$, i.e., equations (III.11)-(III.16), *the parameter restrictions [R1], [R2] and,* $\left(h_t(z^t), k_{t+1}(z^t), \chi_{t+1}(z^t)\right) \in (0,1)\times(0,\infty)\times(0,1), \forall t \geq 0.$

The equations that summarize the politico-economic equilibrium are gathered in Section IV of the Mathematical Appendix.

Note that $\chi_{t+1}(z^t) \in (0,1), \forall t \geq 0,$ means that we are only interested in equilibria of a detailed economy with both insiders and outsiders, since the Hybrid Government presupposes the existence of both insiders and outsiders.

To solve for the Politico-economic equilibrium we use the Dynare software. The results are presented in the following section.[16]

Although this paper focuses on theoretical aspects of politico-economic equilibria, we think there are also important implications for applied research via the presence of parameter ρ, i.e, the relative weight associated with the welfare loss of insiders in the government

[15] Kollintzas, et al (2021) show that $\bar{U}^h$ and $\bar{U}^i$ exist, can be attained and are computable.

[16] We also solved the Ramsey optimal policy problem of the Hybrid government following the so-called primal approach of the literature on optimal fiscal policy. In this case, the equations characterizing the PSE can be summarized in the so called implementability constraint. The derivation of this isoperimetric constraint, as well as the First – Order Conditions and the Asymptotic Steady State Equations according to the primal approach solution method are presented in the Mathematical Appendix, Section V. These equations are eventually needed for the estimation of the model implemented in a companion paper.

decision making. This parameter can be retrieved from the data and thus reflect the underlying politico-economic structure of countries.

4. Growth and policy implications of alternative politico-economic equilibria: A numerical analysis

In this section we investigate the long run and growth implications of the politico-economic equilibrium established in the previous section. We are primarily interested in examining the implications of alternative politico-economic equilibria, based on different degrees of insiders' influence in government decisions. That is, we are interested on comparing the various politico-economic equilibria as ρ ranges in the (0,1) interval. It should be emphasized that in so doing we take the existence of insiders as given and what changes is only the degree of their influence in government decision making. We also investigate the sensitivity of the behaviour of our model to alternative values of the parameters related to frictions, namely, ϕ, θ, λ, and μ.

We shall first, focus on the asymptotic steady state of the politico-economic equilibrium (PE) and then compute the impulse response functions (IRFs) of key endogenous variables, in response to temporary shocks in the subset of exogenous variables related to productivity, namely $\Psi = \left\{A, B^i, B^o\right\}$. These tasks necessitate that we assign values to the model's parameters and specify the stochastic laws of motion of the exogenous variables.

4.1. Parameterization

The benchmark parameterization is given in Table 4.1. The parameterization reflects parameter values that are commonly used in the DSGE and RBC literature and at the same time satisfy the restrictions imposed by theory (i.e., Assumptions [R1]-[R5]).[17]

The values of ϕ we use lie between 0 and $-\frac{\theta}{1-\theta}$. As mentioned in the previous section, with values of ϕ in this region, the detailed economy has the desired properties, in the sense that all wedges imply that frictions increase with the share of insiders' industries χ. As already mentioned, we take τ^K along with the GDP-share of the part of government spending that does not relate to the maintenance and adjustment of the insiders-outsiders politico-

[17] The lack of actual data on the share of insiders' industries and the various wedges is an obstacle for a formal calibration of the model.

economic structure, $\bar{\psi}$, to be set exogenously. We set $\bar{\psi}$ equal to the average GDP share of government spending of the US economy. That is, 22.5%. And, we set $\bar{\psi} + \hat{\psi}\chi$ =0.25. This corresponds to the average GDP-share of government spending in the Southern European economies, assuming χ =0.50.

We shall consider three alternative values for the degree of insiders' influence in government decisions ρ, namely [0.25, 0.50, 075].

The laws of motion of the logarithms of the exogenous stochastic variables related to productivity**,** are taken to be AR(1) processes with drift (whose values are defined in Table 4.1), $\ln \Psi_{t+1} = \left(1-\rho^{Z}\right)\ln \bar{\Psi} + \rho^{Z} \ln \Psi_{t} + \varepsilon_{t}^{\Psi}$. In all cases the persistence parameter is set to 0.9 and the variance of the shocks is set to 0.1.

Table 4.1: Benchmark Parameterization

α	capital input elasticity in industry production	0.33	SVL*
$\tilde{\beta}$	constant discount factor of households	0.98	SVL*
$1/\gamma$	household intertemporal elasticity of substitution	0.50	SVL*
δ	capital depreciation rate	0.07	SVL*
η	growth rate of labor of augmenting technology	0.02	SVL*
ϑ	intensity of consumption in household preferences	0.33	SVL*
$\frac{1}{1-\theta}$	aggregation elasticity of substitution across industries in the same sector	2.5 (i.e., $\theta = 0.6$)	SVL* jointly calibrated from equations (I.17) and (I.21) so that given α, θ, λ and μ the wage premium $\nu = \frac{w^i}{w^o}$ equals 1.33
λ	intensity of wage premium in union preferences	0.5	
μ	relative bargaining power of insiders' unions	0.5	
$\frac{1}{1-\phi}$	elasticity of substitution across sectors in final good production function	0.50 (i.e., $\phi = -1$)	CO**
ρ	relative weight associated with the welfare loss of insiders in the government decision making criterion	1/2	
A	Drift of TFP process	1	SVL*
B^i	Drift of B^i process	1	SVL*
B^o	Drift of B^o process	1	SVL*
τ^K	capital income tax rate	0.20	indicative of South European data
$\bar{\psi}$	GDP share of government consumption in the prototype economy	0.225	indicative of US data
$\hat{\psi}$	such that the difference between the GDP share of government consumption in South Europe and the US is $\hat{\psi}\chi$	0.025	calibrated on South European data, such that $\bar{\psi} + \hat{\psi}\chi = 0.25$
$\tilde{\psi}$	GDP share of government spending devoted to the expansion of the insiders' sector	0	

Notes: *SVL: stands for "standard value in the DSGE literature;**CO: stands for values used in Cole and Ohanian (2004).

4.2. Asymptotic Steady State of the politico-economic equilibrium

The comparison among the asymptotic steady states of the politico-economic equilibrium of a Hybrid government, for different degrees of insiders' influence in government, is summarized in Tables 4.2a and 4.2b. To further assess the properties of the steady state, we also conducted a sensitivity analysis of the steady state computations for alternative values of parameters characterizing the structure of the detailed economy (e.g., the elasticity of substitution across sectors in final good production function, ϕ, the elasticity of substitution across industries in the same sector θ, and relative bargaining power of insiders' unions, μ).

The steady state comparisons in Table 4.2.a and 4.2b reveal the extent of the relative importance of the political friction (i.e., the influence of insiders in government).

Table 4.2a. Politico-Economic Equilibrium of Hybrid Government: Steady State Sensitivity with respect to ρ, when $\theta = 0.6$, $\lambda = 0.5$ and $\mu = 0.5$

	$\phi = -1$			$\phi = 0.5 < \theta$			$\phi = 0.7 > \theta$		
ρ	***0.25***	***0.5***	***0.75***	***0.25***	***0.5***	***0.75***	***0.25***	***0.5***	***0.75***
x	0.4988	0.4925	0.4789	0.4122	0.4878	0.6382	0.6014	0.5363	0.3417
y	0.0583	0.0582	0.0580	0.0646	0.0626	0.0574	0.0595	0.0633	0.0776
c / y	0.5833	0.5837	0.5844	0.5630	0.5654	0.5709	0.5624	0.5557	0.5442
k / y	1.9913	1.9892	1.9846	2.2408	2.1934	2.0911	2.1955	2.2877	2.4698
i / y	0.1792	0.1790	0.1786	0.2017	0.1974	0.1882	0.1976	0.2059	0.2223
g / y	0.2384	0.2371	0.2362	0.2353	0.2380	0.2404	0.2403	0.2385	0.2332
h	0.2396	0.2393	0.2389	0.2670	0.2618	0.2505	0.2619	0.2719	0.2917
r	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296
w^i	0.1676	0.1673	0.1665	0.1873	0.1814	0.1656	0.1723	0.1841	0.2271
w^o	0.1257	0.1255	0.1249	0.1405	0.1360	0.1242	0.1292	0.1381	0.1704
$\bar{\omega}$	0.3099	0.3099	0.3097	0.2966	0.2966	0.2928	0.2864	0.2872	0.3060
$\hat{\omega}$	0.7744	0.7736	0.7718	0.8715	0.8530	0.8132	0.8539	0.8897	0.9605
$\breve{\omega}$	0.7744	0.7736	0.7718	0.8715	0.8530	0.8132	0.8539	0.8897	0.9605
$\tilde{\omega}$	1.1128	1.1132	1.1141	1.0643	1.0735	1.0934	1.0731	1.0552	1.0197
u^h	-3.7044	-3.7049	-3.7070	-3.7131	-3.7284	-3.7876	-3.8004	-3.7707	-3.6140
v^i	0.0263	0.0264	0.0265	0.0166	0.0184	0.0214	0.0174	0.0140	0.0061
$loss$	0.7715	0.7890	0.8062	0.7930	0.8251	0.8485	0.8508	0.8588	0.8873

Table 4.2b. Politico-Economic Equilibrium of Hybrid Government: Steady State Sensitivity with respect to ρ, when $\theta = 0.6$, $\lambda = 0.5$ and $\mu = 0.75$

	$\phi = -1$			$\phi = 0.5 < \theta$			$\phi = 0.7 > \theta$		
ρ	***0.25***	***0.5***	***0.75***	ρ	***0.25***	***0.5***	***0.75***	ρ	***0.25***
x	0.4994	0.4940	0.4818	0.4047	0.4689	0.6074	0.6072	0.5539	0.3945
y	0.0583	0.0583	0.0580	0.0647	0.0631	0.0586	0.0591	0.0622	0.0734
c / y	0.5833	0.5836	0.5843	0.5628	0.5648	0.5696	0.5630	0.5574	0.5462
k / y	1.9915	1.9897	1.9856	2.2454	2.2054	2.1133	2.1864	2.2645	2.4326
i / y	0.1792	0.1791	0.1787	0.2021	0.1985	0.1902	0.1968	0.2038	0.2189
g / y	0.2384	0.2367	0.2379	0.2349	0.2361	0.2406	0.2403	0.2395	0.2343
h	0.2396	0.2394	0.2390	0.2675	0.2631	0.2529	0.2609	0.2694	0.2876
r	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296
w^i	0.2011	0.2008	0.2001	0.2254	0.2196	0.2031	0.2056	0.2170	0.2574
w^o	0.1257	0.1255	0.1250	0.1409	0.1372	0.1270	0.1285	0.1356	0.1609
$\bar{\omega}$	0.3099	0.3099	0.3097	0.2966	0.2967	0.2940	0.2864	0.2867	0.2991
$\hat{\omega}$	0.7745	0.7738	0.7722	0.8732	0.8577	0.8219	0.8503	0.8807	0.9461
$\breve{\omega}$	0.7745	0.7738	0.7722	0.8732	0.8577	0.8219	0.8503	0.8807	0.9461
$\tilde{\omega}$	1.1127	1.1131	1.1139	1.0634	1.0712	1.0891	1.0748	1.0597	1.0270
u^h	-3.7043	-3.7048	-3.7064	-3.7121	-3.7237	-3.7721	-3.8023	-3.7802	-3.6636
v^i	0.0263	0.0264	0.0264	0.0164	0.0180	0.0209	0.0177	0.0149	0.0079
$loss$	0.7794	0.8050	0.8303	0.7978	0.8357	0.8671	0.8571	0.8696	0.8963

As long as output from insiders' and outsiders' sectors used as inputs in the production of the final good are complements (i.e. $\phi = -1$), an increase in the influence of insiders in policy decision making (i.e. a rise in ρ), implies a lower optimal value for the size of the insiders' sector, χ, decided by the government. Here, the complementarity effect essentially plays no role, as evidenced from the values of $\bar{\omega}$ that show no variability. This implies that the observed differences in macroeconomic variables are essentially due to the political friction and the subsequent economic frictions that are what we have referred to as the interaction of political and market forces. All macroeconomic variables fall with the exception of the GDP share of consumption fall and welfare losses for outsiders and the economy as a whole increase, while the welfare of insiders imperceptibly increases. Also, with the exception of the efficiency wedge $\bar{\omega}$, which as mentioned above remains practically constant, all other wedges deteriorate.

On the other hand, when output from insiders' and outsiders' sectors are substitutes (i.e., $\phi > 0$) the picture changes and becomes more complicated. In particular, when the substitutability across sectors (as measured by ϕ) is smaller than within each sector (as measured by θ), i.e., $\phi < \theta$, the optimal value for the size of the insiders' sector, χ, increases with the influence of insiders in government decision making. This is accompanied with a fall in output as well as the GDP ratios of investment and capital, wages and hours of work. On the contrary the GDP ratios of consumption and government spending increase. Moreover, here overall production efficiency falls significantly as ρ increases. The pattern of welfare losses remains qualitatively similar but quantitatively bigger relative to the complementarity case.

The aforementioned behaviour, however, is reversed when the substitutability across sectors is bigger than within each sector, i.e., $\phi > \theta$. As ρ increases, the optimal value for the size of the insiders' sector, χ, decided by the government decreases as in the complementarity among sectors case. Now, however, the fact that the output of the two sectors are substitutes, implies that the smaller size of insiders' sector chosen by the government is good for the economy in terms of productivity and output (in contrast to the $\phi = -1$ case where χ also decreases with ρ). The increase, now, in the economy wide welfare losses is due to the welfare deterioration of insiders, while the opposite holds for outsiders.

The above results remain robust to changes in the relative bargaining power of insiders' unions, μ.

Clearly, the complementarity-substitutability issue in the production of the final good is important for the workings of the politico-economic equilibrium. For example, when intermediate good inputs in the production of the final good are complements across sectors, then the frictions associated with non-competitive industries are relatively strong. This is because, the inefficiencies associated with market frictions such as monopolies and firm-union bargaining, that reduce the inputs associated to the noncompetitive industries, also reduce the marginal product of the inputs associated to the competitive industries. In this case, the political friction associated with the size of the insiders sector enhances the negative economic effects mentioned above. In such a case, therefore, a hybrid government may find it difficult to increase the size of the insiders'sector (i.e, not to slaughter the milking cow). On the other hand, when inputs from competitive and non-noncompetitive industries are substitutes, it is less distorting to increase the size of the insiders' sector.

4.3. Impulse response functions

In Figures 4 below, we plot, for the benchmark parameterization described in Table 4.1. and the three alternative values for the elasticity of substitution across sectors in the final good production function, $\varphi = [-1,\ 0.5,\ 0.7]$, the impulse response functions (IRFs) of selected macroeconomic variables, wedges and policy variables to temporary (one period shocks) changes in the exogenous variables related to productivity, $\Psi = \{A, B^i, B^o\}$. Responses for both exogenous and endogenous variables are expressed in percentage deviations from their respective asymptotic steady state.[18]

The response of the aggregate endogenous macroeconomic variables $\{y, k, h, c, i\}$, the policy instrument χ, economy-wide welfare loss, wedges and taxes $\left\{\widehat{\omega}, \breve{\omega}, \bar{\omega}, \tilde{\omega}, \Delta^g \equiv \frac{g}{y}, \tau^l\right\}$ and sectoral welfare and wages $\{u^h, v^i, w^o, w^i\}$ to a negative shock in change in A (an economy-wide TFP shock) are plotted in Figures 4.1.a, 4.1b and 4.1c. These responses are indicative of the well-known response of output, capital, employment, consumption, investment, government spending and real wage rate to a negative productivity shock of a standard canonical RBC model.[19] The negative responses of output, capital, employment, consumption, and investment do not change qualitatively with the sign of φ, but get more pronounced as φ increases, i.e., the outputs of the insiders' and outsiders' sectors become more substitutes. The diversified behaviour when $\varphi > 0$ depending on whether $\varphi < \theta$ or $\varphi > \theta$ are reflected in the response of the wedges

In Figures 4.2a-4.2c and 4.3a-4.3c we report the responses to a positive TFP shock in insiders' industries, B^i, and a positive TFP shock in outsiders' industries, B^o,respectively. , are similar. Both being positive TFP shocks, the results are standard and similar for aggregate variables. As expected, we observe mirror responses in wedges depending on the sector hit by the respective TFP shock.

Again, when it comes to sensitivity of the IRFs with respect to the sign and the value of φ, the responses of a shock in B^i are more pronounced when $\varphi > \theta$. On the other hand, in the case of a shock in B^o, the responses are more pronounced when $\varphi < \theta$.

[18] To further assess the properties of the IRFs, we have also carried out these experiments for different values of the parameters associated with frictions, $\phi, \theta, \lambda, \mu$. The results are qualitatively similar and are available upon request.

[19] See, e.g., Sims (2016).

Figures 4: PE Impulse Response Functions with respect to $\Psi = \{A, B^i, B^o\}$

Figure 4.1a.: IRFs with respect to A – Economy-Wide Variables and χ

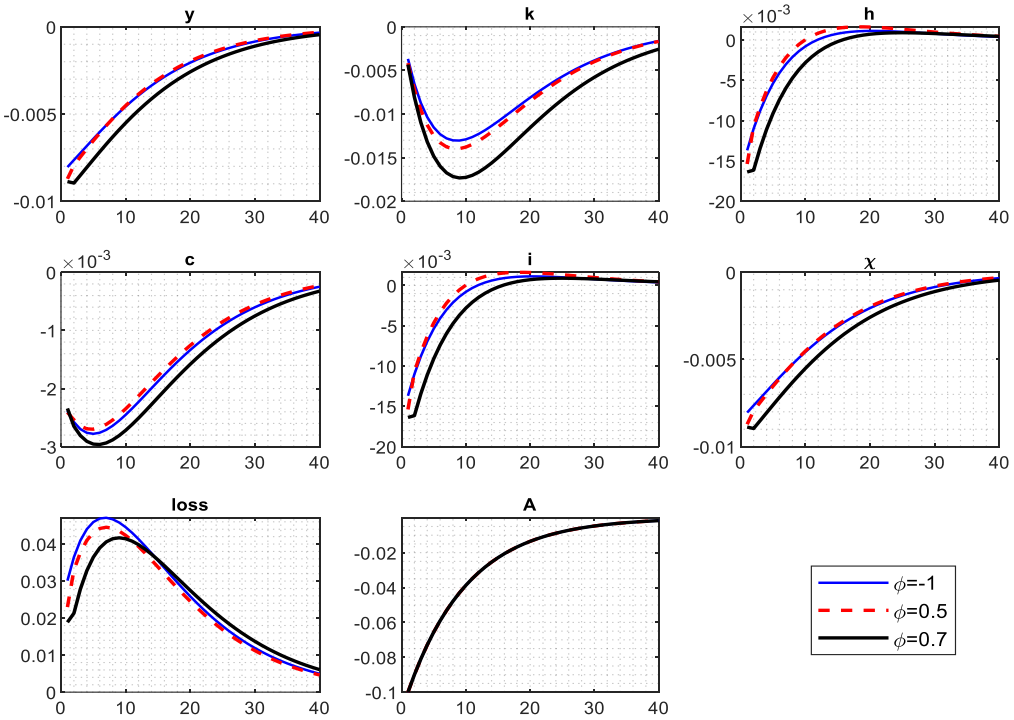


Figure 4.1b.: IRFs with respect to A – Wedges and Taxes

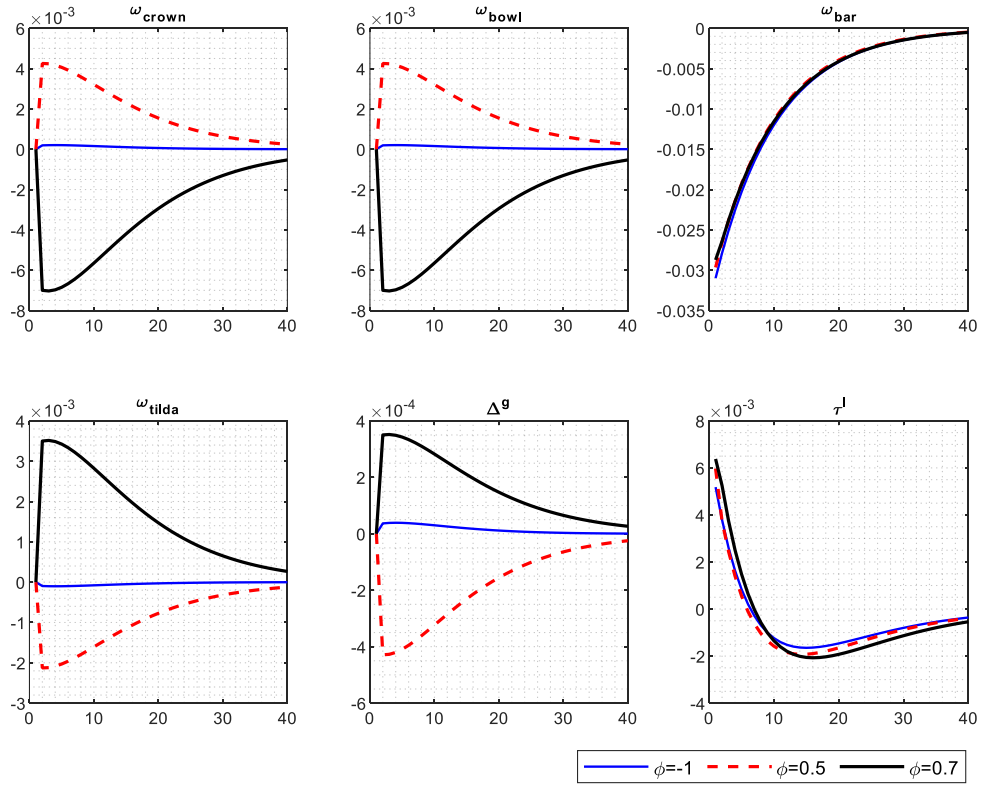


Figure 4.1.c.: IRFs with respect to A – Sectoral Variables

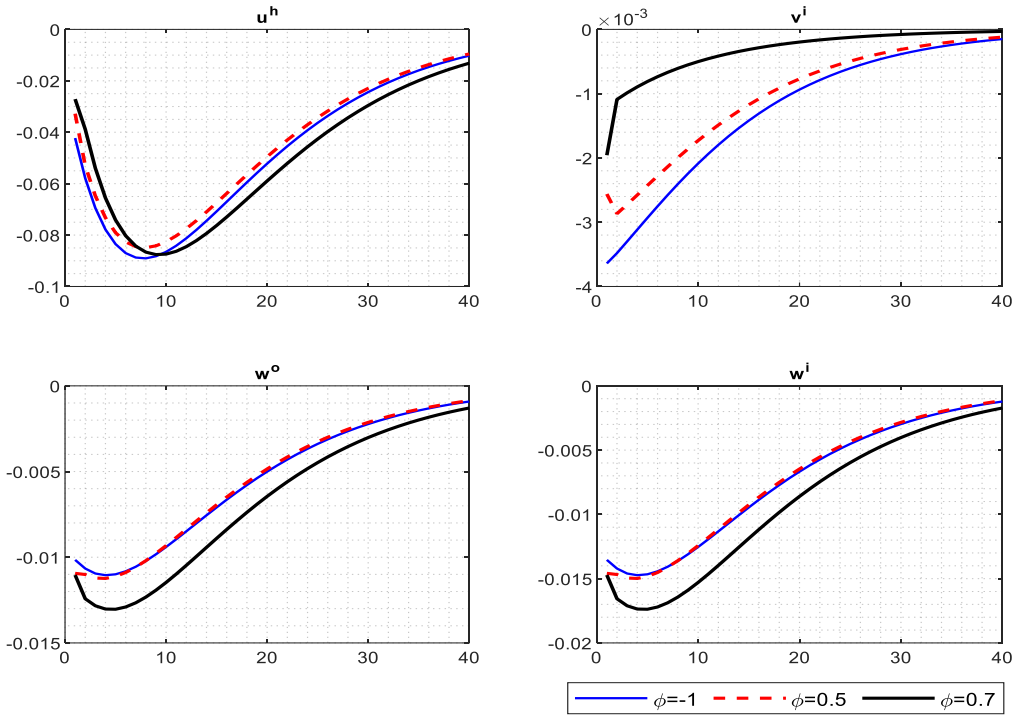


Figure 4.2a.: IRFs with respect to B^i – Economy-Wide Variables and χ

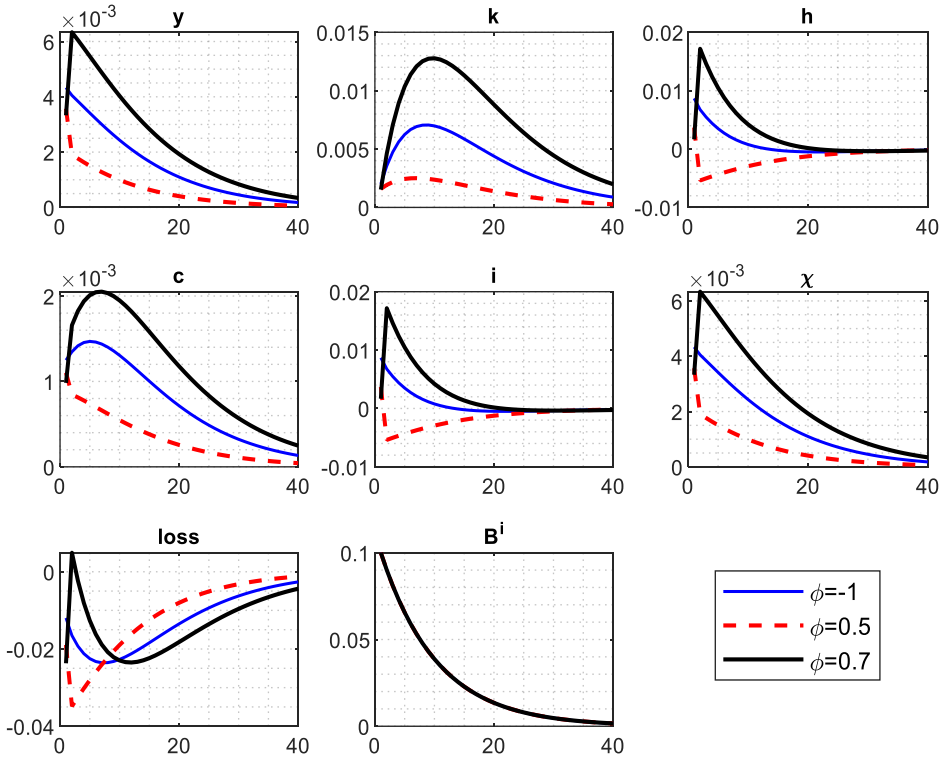


Figure 4.2b.: IRF with respect to B^i – Wedges and Taxes

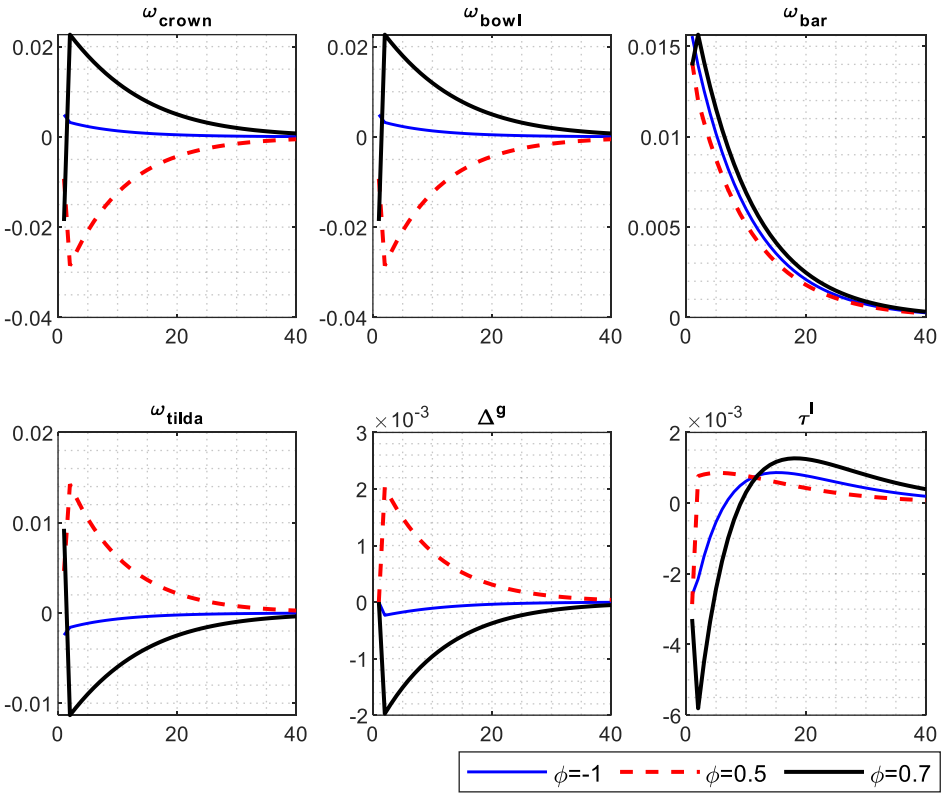


Figure 4.2c.: IRFs with respect to B^i – Sectoral Variables

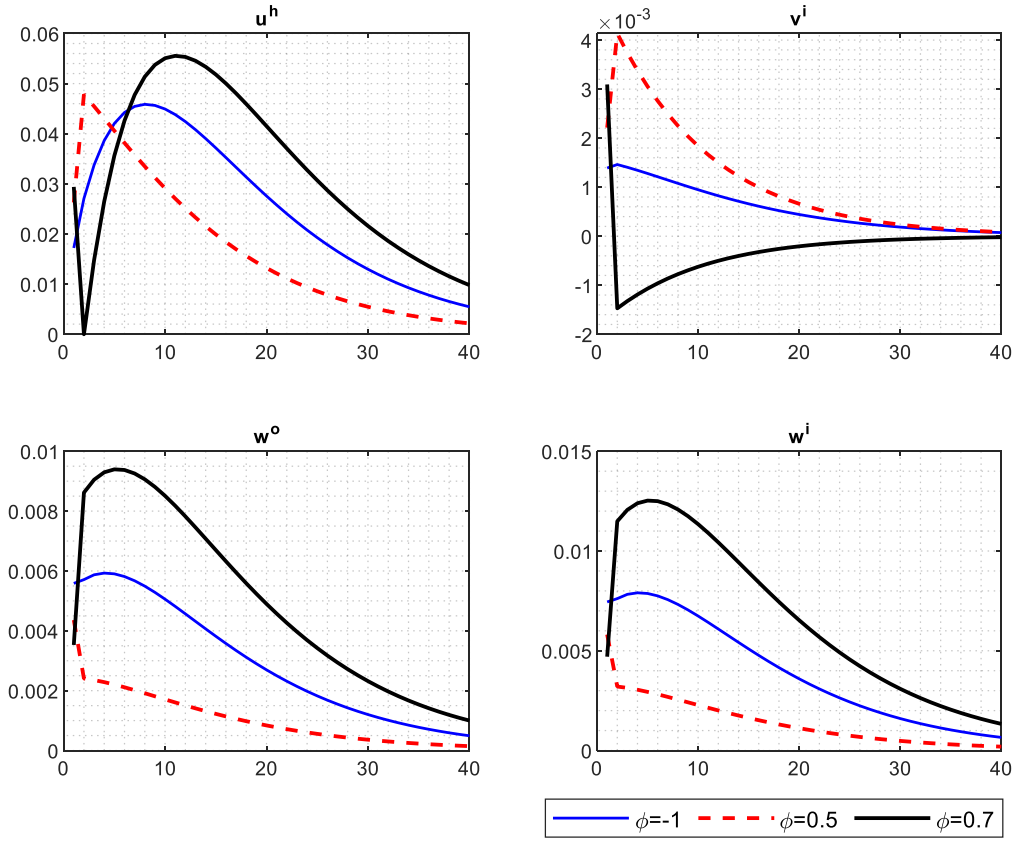


Figure 4.3a: IRFs with respect to B^o – Economy-Wide Variables and χ

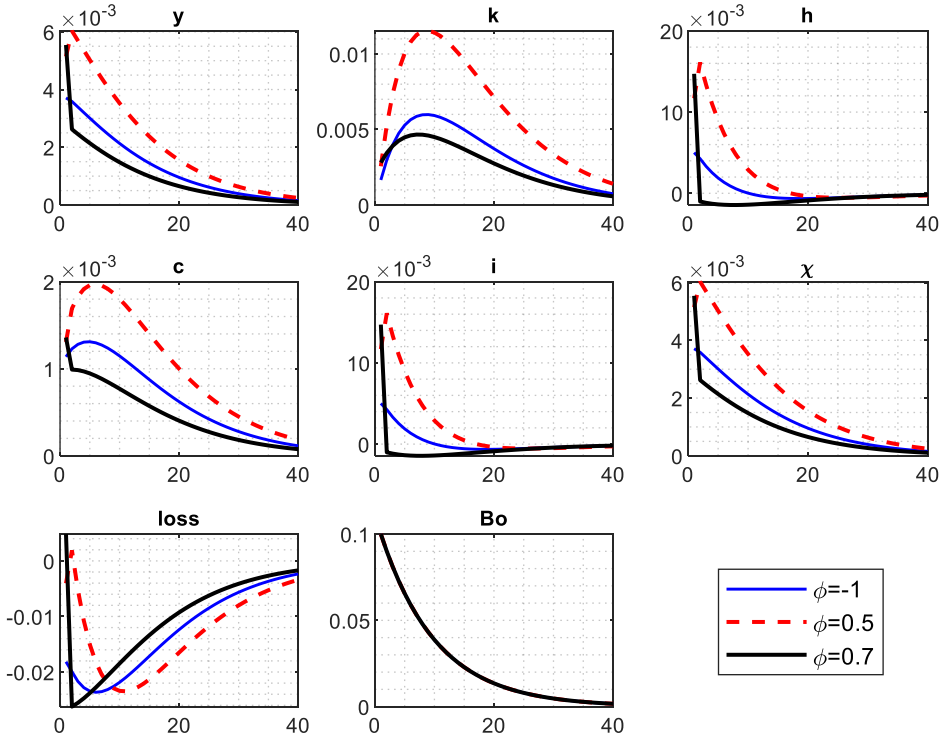


Figure 4.3b: IRF with respect to B^o – Wedges and Taxes

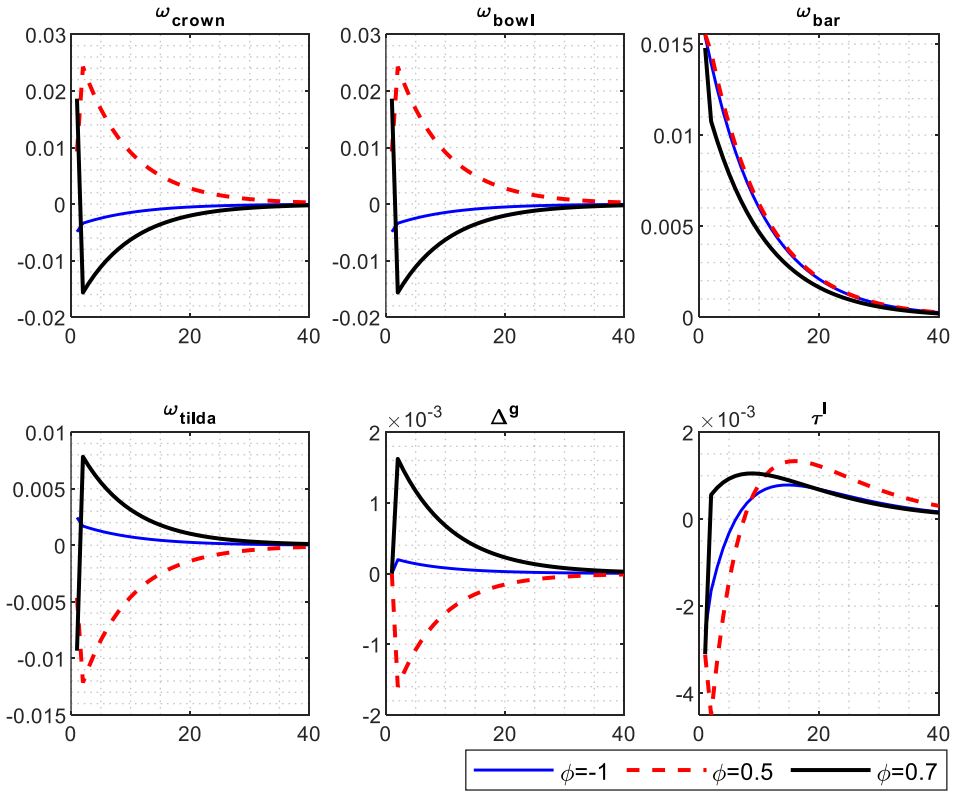
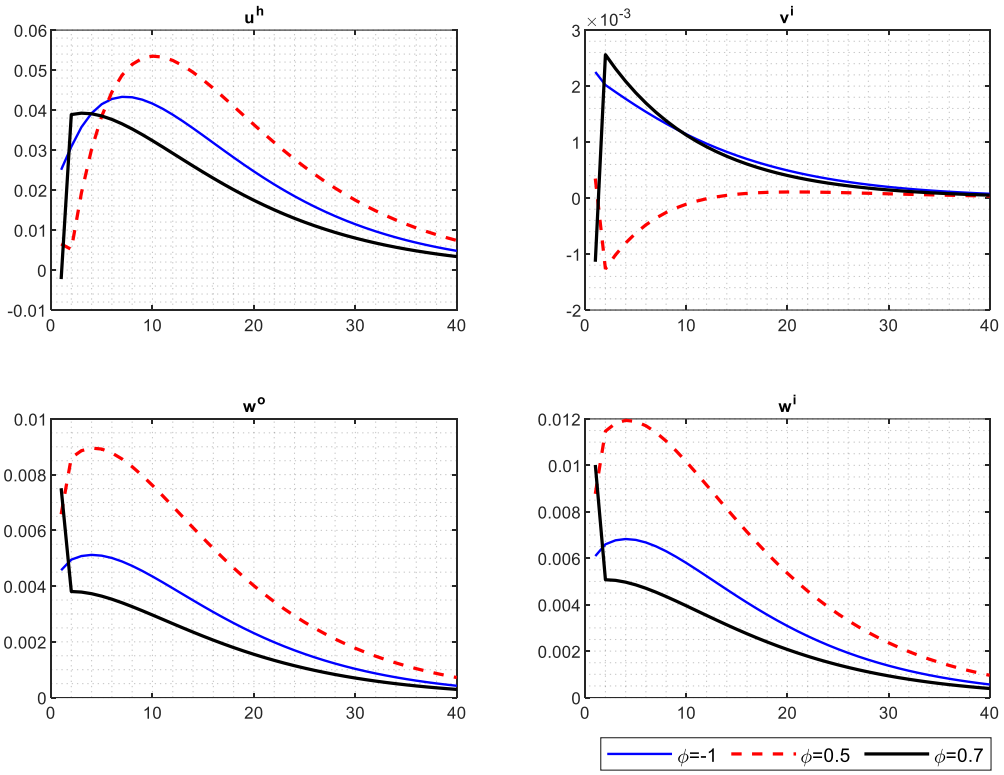


Figure 4.3c: IRFs with respect to B^o – Sectoral Variables



5. Concluding remarks

Simple stylized facts indicate that the economic growth of a group of Southern European countries, over the last fifty years, was relatively slow and that the Great Recession was deeper and lasted longer than in other major economies with similar liberal democracy institutions. We propose that one of the main causes of these disparities is the particular kind of interrelations between market and political power that characterizes the politico-economic system of these countries. Trying to explain how such a politico-economic system may lead to relatively low economic growth and deeper and longer recessions than in other countries, we developed a two sector DSGE model, based on Cole and Ohanian (2004), that incorporates major features of these interrelations. Accordingly, the "insiders'" sector consists of industries with monopolistic producers that bargain over wages and employment with "selfish" labor unions. And, the "outsiders'" sector consists of industries with competitive firms and workers.

Such a framework allows the investigation of optimal policy setting, when, the share of insiders' industries in the economy become a policy instrument decided by a government that is influenced by the coalition of all insiders' unions. That way, a Ramsey government opts for politico-economic equilibria with a nonzero share of insiders' industries in the economy.

We characterized and solved the problem of a government that makes its decisions pursuing a balance between what Jean Tirole calls policies for the "the common good" and the interests of an elite – which we call insiders - that emanates from various market frictions. In so doing we developed a government welfare objective that captures this underlying trade-off and can account for different degrees of the elites' influence in government decision making. Such a welfare objective characterizes what we called the Hybrid government.

We then investigated the growth implications of this politico-economic equilibrium, focusing on steady state comparisons and IRFs of the hybrid government politico-economic equilibrium for different degrees of the insiders' influence in government.

This influence is measured by the weight assigned by the hybrid government to insiders' interests. This is a crucial deep parameter of our model (ρ) that can serve as a bridge of the theoretical model with the data. That is, different values of this weight can be associated with countries with different politico-economic structures. For example, the politico-economic structure of South European countries can be thought of as being characterized by a relatively higher value of ρ compared to the US or the European Core.

Our numerical analysis showed that increasing influence of insiders in government decision making is bad for the economy. This may also serve as an explanation to why the macroeconomic performance of some countries is worse relative to that of others, that, ceteris paribus, enjoy similar state of development.

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