MODELING MARKET AND POLITICAL POWER INTERACTIONS: A DSGE MODEL OF INSIDERS – OUTSIDERS CAPITALISM

Vassiliki Dimakopoulou, Tryphon Kollintzas, Alekos Papadopoulos and Vanghelis Vassilatos

IOS ΕΛΙΔΕΚ Conference

July 5-6, 2024

H.F.R.I.
Hellenic Foundation for Research & Innovation

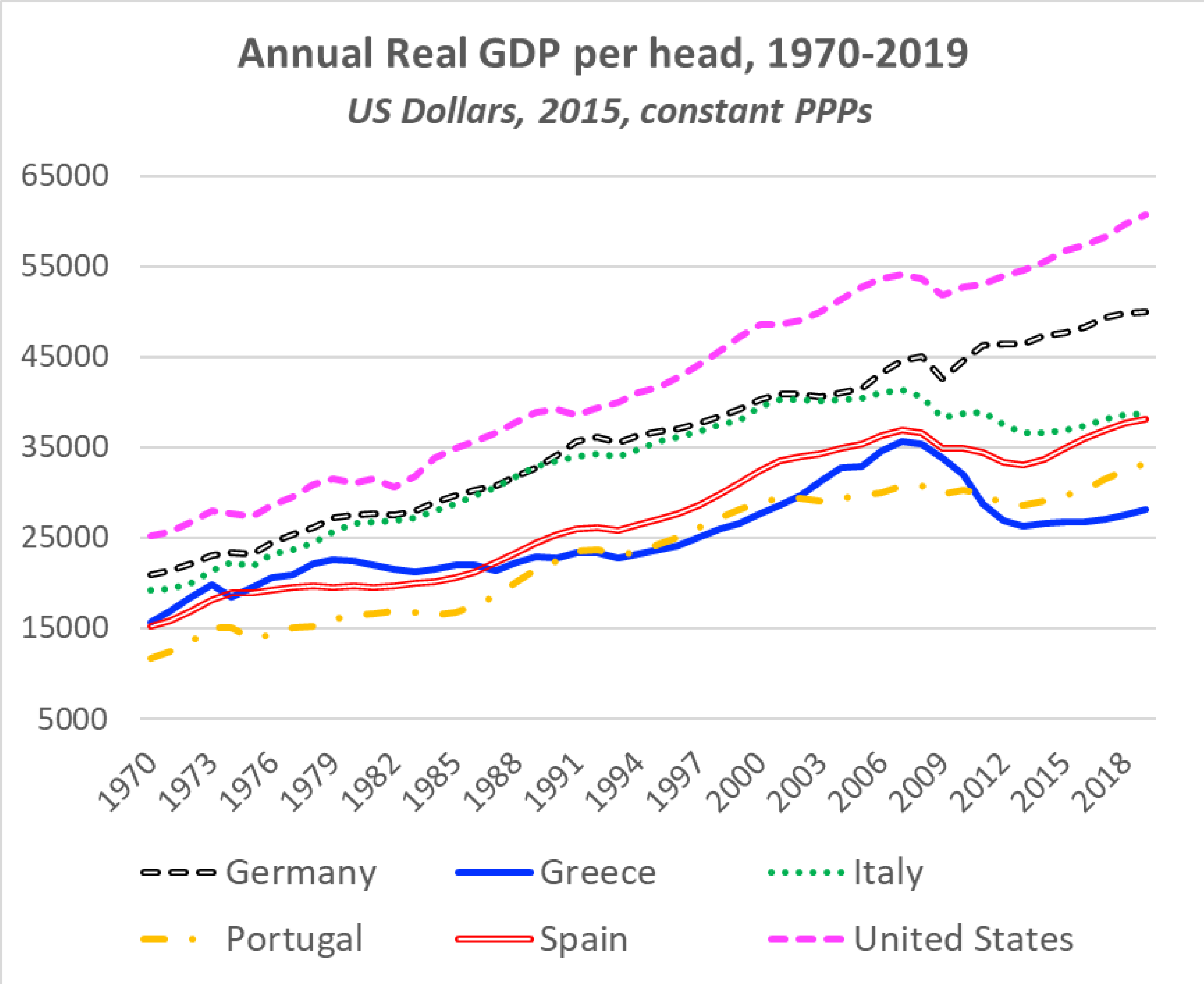
The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the “2nd Call for H.F.R.I. Research Projects to support Faculty Members & Researchers” (Project Number: 4566)

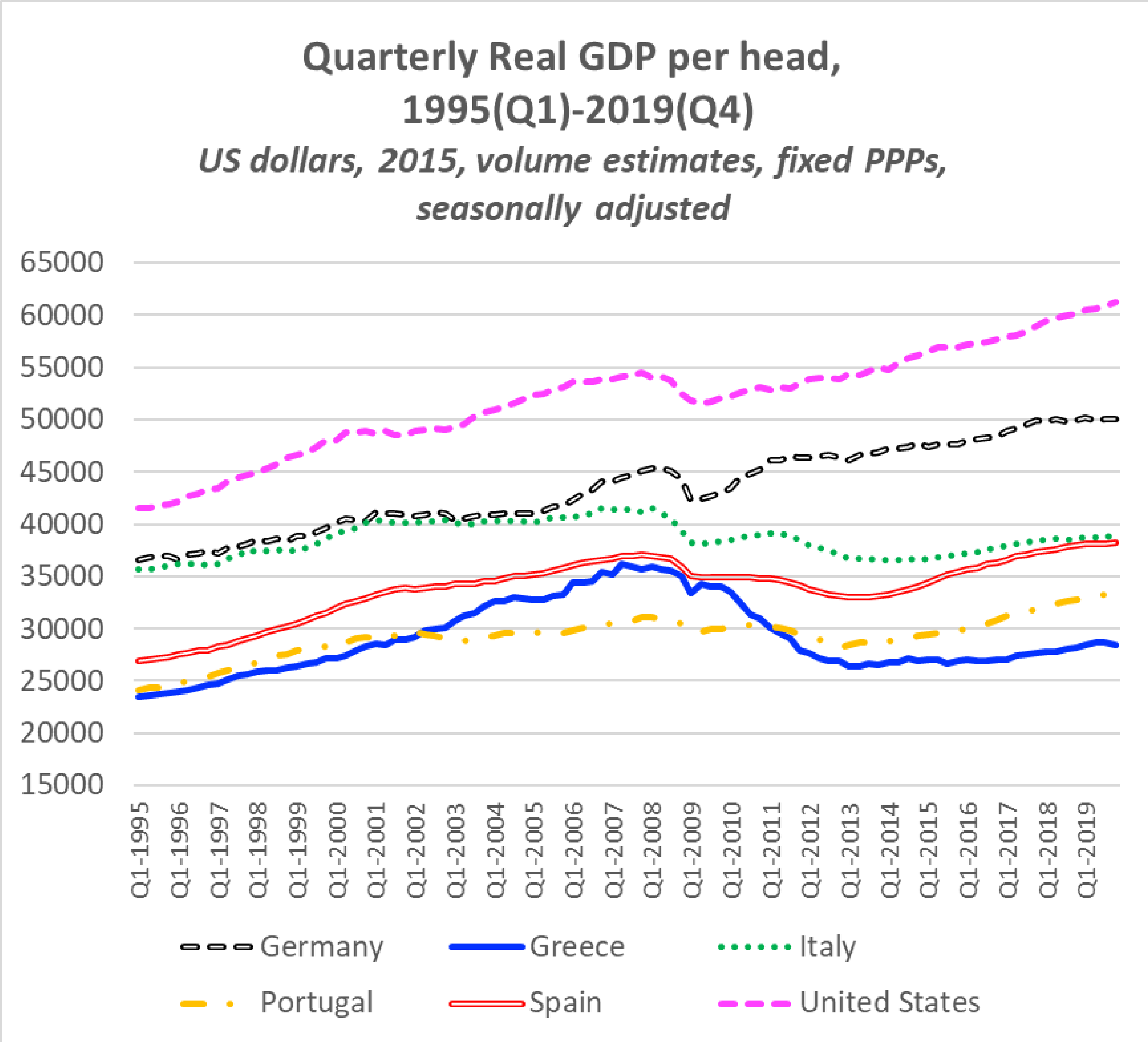
In recent years the growth pattern of Greece as well as most Southern European countries has been disturbed, as those countries are suffering from economic crises that go beyond the usual business cycle.

As is evident to the naked eye, the real per capita GDP paths of the United States and Germany on the one hand and that of the Southern European countries on the other hand do not seem to converge. This characteristic is surprising on at least two counts.

First, as these are countries with similar institutions and, on a per capita basis, similar resources, standard growth theory would have predicted that, over this half a century long period, the real per capita GDP of the Southern European countries would have converged to a large extent to those of the United States and Germany

Second, the apparent non convergence to Germany is even more problematic, as the European Investment and Structural Fund programs transferred relatively large amounts of financial capital from the richer European countries, such as Germany, to the poorer Southern European countries. And, economic policy consensus behind the design of these European Investment and Structural Fund programs, was that they would help the convergence with the richer European countries, such as Germany.


Annual Real GDP per head, 1970-2019
US Dollars, 2015, constant PPPs
65000
55000
45000
35000
25000
15000
5000
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
Germany
Greece
Italy
Portugal
Spain
United States


Quarterly Real GDP per head,
1995(Q1)-2019(Q4)
US dollars, 2015, volume estimates, fixed PPPs,
seasonally adjusted
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
Q1-1995
Q1-1996
Q1-1997
Q1-1998
Q1-1999
Q1-2000
Q1-2001
Q1-2002
Q1-2003
Q1-2004
Q1-2005
Q1-2006
Q1-2007
Q1-2008
Q1-2009
Q1-2010
Q1-2011
Q1-2012
Q1-2013
Q1-2014
Q1-2015
Q1-2016
Q1-2017
Q1-2018
Q1-2019
Germany
Greece
Italy
Portugal
Spain
United States

Moreover, it is evident that the Great Recession lasted considerably more and was deeper in Portugal, Spain, Italy and Greece, than in Germany and the United States

TABLE A.1: BUSINESS CYCLE FACTS OF THE GREAT RECESSION:
Quarterly Real GDP per head: 2007(IV) -2019(IV)

	Germany	**Greece**	**Italy**	**Portugal**	**Spain**	**USA**
peak quarter	2008(I)	2008(I)	2008(I)	2007(IV)	2007(IV)	2007(IV)
back to previous peak quarter	2011(I)	x*	x*	2017(I)	2017(III)	2013(III)
quarters from peak to peak	12	> 49**	> 49**	37	39	23
trough quarter	2009(I)	2013(I)	2014(IV)	2012(IV)	2013(I)	2009(II)
change from peak to trough	-7%	-27%	-12%	-9%	-11%	-5%

Notes: * Real GDP per head did not return to its previous peak quarter level, before the end of 2019; ** More than 49 quarters

There are many contributors to these dismal economic growth and business cycle facts; especially, if we examine independently any particular Southern European country.

And, there is also no doubt that these facts have grave implications for society and European cohesion. For, they make clear that countries with different politico-economic structure have different propagation mechanisms such that shocks, brought about by common monetary and or fiscal policies, will not, in general, have the same effects across the Euro area countries.

Here we focus on a potential contributor – the market and political power interactions that characterize the politico-economic system of Southern European countries.

Based on Kollintzas et al. (2018a), we introduce market and political power interactions, that resemble the politico-economic structure of these South European countries, in a dynamic stochastic general equilibrium model (DSGE), to investigate the effects of these interactions on economic growth and the business cycle.

Our motivation to construct such a model in order to characterize the growth and business cycle behavior of the South European economies, is based on several facts as well as the political science literature.

First, it is well documented that Southern European countries feature not only a relatively large public sector, but also a large part of their GDP is produced by firms that are allowed to possess considerable market power.

Notable examples are energy 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.

Second, the industries these firms operate are not only non-competitive in their output market, but they are also non-competitive in their labor market, where employees are organized in powerful labor unions.

The latter, typically, bargain directly or indirectly with the firms in the corresponding industry for wages, employment, and an assortment of benefits for their members, including job protection. What is important here is that these bargaining agreements are made independently of each other and for that matter do not internalize the profound adverse effects for the economy as a whole.

For example, relatively high wages in the energy sector tend to increase costs for the competitive as well as the uncompetitive industries, affecting total factor productivity and overall competitiveness.

It is worth noting that such a strategic interdependence does not happen in Anglo-Saxon countries, because, there, unions have little market power.

And, does not happen in the Scandinavian countries and Germany, where, although strong, unions and associated business interests work together, thereby taking account of possible negative effects of their decisions on the rest of society.

This inefficient type of capitalism survives for it is in a symbiotic relation with the political system:

In South Europe, the powerful unions and their strategic business allies cooperate in the major political parties and government so as maintain and promote this arrangement.

This can also explain the relatively high levels of government spending and financial needs, observed in these countries.

This kind of interaction between market and political powers has been emphasized in the political science literature:

Schmitter (1977), Sargent (1985), Cawson (1986), Molina and Rhodes (2007))

This kind of interaction between market and political powers has been emphasized in the political science literature. Schmitter (1977), Sargent (1985), and Cawson (1986) introduced the concept of a "neo-corporatist" state, whereby there is an institutional complementarity between market organizations, where wage premia favour individual groups of society and the political system, where these groups influence government, for their collective benefit. And, more important for our purposes, is the realization, also in the political science literature, that in South Europe, this complementarity is related to the protected greater public sector (e.g., Molina and Rhodes (2007))

Thus motivated, we construct a model that synthesises the insiders-outsiders labor market of Lindbeck and Snower (2001) and the political economy concept of a hybrid government (Person and Tabellini (2002)), that to a varying degree is influenced by the labor market insiders. The underlying model we use to carry out this synthesis, is similar to Cole and Ohanian (2004)

Their model is a two sector DSGE model – a cartel sector and a competitive sector coupled with a non-competitive and a competitive labor market, respectively. In their seminal paper, they showed that the New Deal policies, put in place as a response to the Great Depression in the United States, that allowed for workers to bargain for higher wages and non-competitive firms to have higher markups, deepened and prolonged the Great Recession in the United States, considerably.

PUNCHLINE

Purpose: **Explain Growth and Shock Propagation Mechanism Disparities among different groups of countries (e.g. South Europe, Latin America, and so on)**

***Medium*:** **A DSGE model capable of generating quantitative theory predictions in accordance to the data**

- **This is a theory paper**

There are two sub-classes of models:

a) Output of Insiders' and Outsiders' Sectors are Complements (as in Cole & Ohanian)

b) Output of Insiders' and Outsiders' Sectors are Substitutes

This has two important implications:

a) Different Narratives

b) Different underlying frictions and implications for Growth and Business Cycles

MODEL FEATURES

a non-competitive sector coupled with a non-competitive labor market

and

a competitive sector coupled with a competitive labor market.

Outsiders form a group of workers that supply labor to the industries of a competitive sector.

Insiders are workers organized in independent unions that supply labor to a number of monopolistic industries that constitute the insiders' sector.

Prices, output and capital in insiders' industries is determined by a Nash bargaining contract.

In Cole and Ohanian (2004), the share of non-competitive industries in the economy is fixed

In our model, eventually, the fraction of insiders' industries is decided by a government, given the behaviour of all agents in the economy:
That is, the share of insiders' industries in the economy will be part of a "Ramsey"-type allocation, dictated by the government objective function

This particular function - **hybrid** government objective function - reflects median voter preferences, as well as the preferences of all insiders' unions.

Our conjecture is that the solution to the problem of the "Ramsey planner", called **politico-economic equilibrium**, will be characterized by a greater share of insiders' industries compared to the politico-economic equilibrium corresponding to the standard median voter case.

We take the view that Southern European economies operate in such a politico-economic equilibrium.

We shall compare the performance of the following alternative cases

1) **Prototype economy**: An economy without distinction between insiders and outsiders, where the only friction is distortionary factor income taxes;

2) **Detailed economy**: An economy where in addition to distortionary taxation there are market power frictions, namely one competitive final good sector (outsiders) and one non-competitive final good sector (insiders)

We shall first focus on the **Private Sector Equilibrium** given policy.

Then we shall proceed to the **Politico-Economic Equilibrim** whith optimal policy

The private sector equilibrium, given government policy, including the share of insiders' industries in the economy, is characterized by an output price markup and a wage premium for insiders over outsiders, in all insiders' industries. This implies lower output and lower capital and labor inputs than what would have been the case if insiders' industries were competitive. As different industry outputs are partial complements, the lower output in all insiders' industries lowers the demand for the output of all outsiders' industries, lowering aggregate output. Furthermore, any strictly positive share of insiders' industries in the economy results in a 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 combined political, misallocation, and fiscal distortion effects imply that steady state GDP per head of the model economy will be lower than what would had been the case without the underlying frictions. This is what explains the relatively low growth rate of the South European economies.

The relatively low per capita GDP along the steady states implied by the private sector equilibrium (PSE), given policy, along with the fact that the larger the three effects mentioned above the lower the steady state per capita GDP, can also explain the deeper and longer recessions associated with a greater share of insiders' industries, along the lines suggested by Cole and Ohanian (2004). In addition, the frictions associated with market and political power interactions should affect the economy's shock propagation mechanism. Finally, the shock propagation mechanism of the politico-economic equilibrium, where the share of insiders' industries is endogenous will be most likely different than the private sector equilibrium given policy, as insiders try to avoid painful adjustments.

The main quantitative theory results can be summarized as follows:

(i) The steady state output per capita of the detailed economy is lower compared to that of the prototype economy.

(ii) The consumption share of GDP is similar in the detailed and the prototype economies, while comparing the remaining great ratios (capital–output ratio, employment, investment share of GDP) between the detailed and the prototype economies, these are close but always smaller in the detailed economy, with employment characterized by the sharpest difference.

(iii) The government spending share of GDP and the labor income tax rate are higher than the corresponding figures of the prototype economy.

(iv) Differences (i)-(iii) mirror corresponding differences in the capital, labor, efficiency and government wedges.

(v) Differences (i)-(iii) are sharper the larger is the share of insiders' industries.

(vi) Differences (i)-(iii) are sensitive to the degree of monopoly power in insiders' industries (i.e., how close substitutes are the products of different insiders' industries and how close substitutes are the aggregate products of the insiders' and outsiders' sectors) and the combination of union relative bargaining power and the degree of union preferences for the wage premium over union employment.

(vii) The impulse response functions of the endogenous variables to temporary changes in the exogenous variables in the prototype and detailed economies are qualitatively similar.

(viii) The graphs of the IRFs of output, consumption, investment and employment with respect to an exogenous negative productivity shock lie lower than the corresponding graphs of the prototype economy, but the underlying quantitative differences are small.

(ix) The IRFs of output, consumption, investment and employment with respect to an (exogenous) temporary increase in the share of insiders' industries are negative and quantitatively significant. (x) To a great extent the properties of the IRFs described in (vii) – (ix) emanate from properties of the IRFs of the four wedges. (xi) In addition to (viii), there is a second amplification effect, since distortionary taxation has a stronger effect on the detailed rather than the prototype economy.

The model in detail - Economic agents and their behavior

Final good producers

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

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

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

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

Intermediate good producers in the outsiders' sector

$$y_t^o(\varsigma) = B_t^o k_t^o(\varsigma)^{\alpha} l_t^o(\varsigma)^{(1-\alpha)}; \alpha \in (0,1)$$

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 subject to the technology constraint

Intermediate good producers in the insiders' sector

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

In each industry of the insiders' sector, there is one producer and one labor union.

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

$$u_t^i(\varsigma) = \left[w_t^i(\varsigma) - w_t^o \right]^{\lambda} \left[l_t^i(\varsigma) \right]^{(1-\lambda)} ; \lambda \in (0,1)$$

The producer behaves like a monopolist, setting the output price subject to demand function. Output and inputs are constrained by the production technology.

Both the producer and the union in each industry of the insiders' sector take as given:

the economy and insiders' sector aggregates

the real rental cost of capital and the real wage rate in the outsiders'

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:

$$\left(w_t^i(\varsigma)^*, l_t^i(\varsigma)^*\right) = \underbrace{argmax}_{\left(w_t^i(\varsigma), l_t^i(\varsigma)\right)} \left\{\left[u_t^i(\varsigma) - \bar{u}_t^i(\varsigma)\right]^{\mu}\left[\pi_t^i(\varsigma) - \bar{\pi}_t^i(\varsigma)\right]^{1-\mu}\right\}; \mu \in (0,1)$$

$\bar{u}_t^i(\varsigma)$: union's reservation option

$\bar{\pi}_t^i(\varsigma)$: producer's reservation option

μ : 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:

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

Households

Households' income sources consist of wages and rents from labor and capital services provided to the intermediate goods sectors and profits from insiders' industries. They use their income to buy the final good that they turn to consumption and investment.

The representative household's flow budget constraint and time constraints are given by:

$$c_t + (1+\eta)k_{t+1} \leq [1+(1-\tau_t^K)(r_t \ -\delta)]k_t + (1-\tau_t^L)[\chi_t w_t^i h_t^i + (1-\chi_t)w_t^o h_t^o + \chi_t \pi_t^i]; \ \delta \in (0,1)$$

$$\chi_t h_t^i + (1-\chi_t)h_t^o = h_t \leq 1$$

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

$$U_0^h \equiv E_0 \sum_{t=0}^{\infty} \beta^t u_t^h$$

where:

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

The representative household seeks a contingency plan $\left\{c_t(z^t), h_t\ (z^t), h_t^i(z^t), h_t^o(z^t), k_{t+1}(z^t)\right\}_{t=0}^{\infty}$ so as to maximize lifetime utility , subject to it's constraints

Government

Government spending is defined by:

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

To the extent that insiders' industries are basic networks, government may directly provide for setting up and maintain the infrastructure associated with these industries. 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

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

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

Understanding the model

Detailed versus prototype economy

In order to understand the model, we follow the methodology of Chari, Kehoe, Mc Grattan (2007) and we compare it to its no-frictions counterpart, focusing on the implied wedges.

We shall refer to our model with frictions as the "**detailed**" economy.

We shall refer to the no-frictions version of our model as the "**prototype**" economy.

In addition to proportional capital and labor income taxes, the "detailed" economy involves three more 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.

Although a misnomer, it might be helpful to also think of the prototype economy as a detailed economy with an insiders' and an outsiders' sector. The outsiders' sector of the prototype economy is exactly the same with the outsiders' sector of the detailed economy. The insiders' sector of the prototype economy is not however the same with the insiders' sector of the detailed economy, since it is now characterized by the following three assumptions: (i) producers in insiders' industries behave perfectly competitive in all markets; (ii) workers supplying labor in insiders' industries behave perfectly competitive; and (iii) there are no resources to maintain and adjust the fraction of insiders' industries in the economy. In other words, under these assumptions the prototype economy is a two-sector neoclassical growth model (or a two sector RBC model, in the business cycle literature) with proportional capital and labor taxes and government spending. Also note that, if we make in the case of the prototype economy the additional assumption that there is only one sector in the economy (i.e, $\chi_t = 0$, for all *t*), the prototype economy becomes a one sector neoclassical growth model or a Canonical RBC model, with proportional capital and labor taxes and government spending. To avoid confusion, we shall refer to the two sector prototype economy as the prototype economy and we shall refer to the one sector prototype economy as the Canonical RBC economy. In what follows we shall focus on the comparison between the detailed economy and the prototype economy. This is because we are mainly interested in comparing the two economies exclusively with respect to the three additional frictions mentioned above, over and above the distortionary traxation friction shared by both the detailed and prototype economies. On the other hand, comparisons of the detailed economy to the Canonical RBC economy are also tainted with the difference in the production technology.

Understanding the properties of the detailed economy reduces to defining and understanding the "time- varying wedges in the prototype economy 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.

Hence, understanding the differences between the prototype and detailed economies is equivalent to understanding the properties of these four wedges.

Strictly speaking, the way we define the capital, labor and efficiency wedges in this paper, these are actually inverse wedges in the terminology of Chari, Kehoe and McGrattan. In other words, in our case, the greater the corresponding distortion of the detailed vis-a-vis the prototype economy, the smaller the value of the respective wedge. The opposite holds for the government wedge

Capital Wedge:

The capital wedge, $\dfrac{\widehat{\omega}(\chi)}{\widehat{\omega}^*(\chi)}$, is less than one, in general, and decreasing (increasing) with χ, if insiders' and outsiders' sector inputs in final good production are not (are) strong complements.

The reason this is happening is that the demand for capital is lower in the detailed economy than in the prototype economy for two reasons:

(i) the monopolistic producer restricts output needing less from both inputs, and

(ii) the firm-union bargaining results in a higher wage rate and further reduces labor input in such a way that the output effect dominates the substitution effect. The main implication of this distortion is to lower the marginal product of capital in the economy.

This has a static and a dynamic effect. The static effect is immediate from the steady state equations of the economy and implies a lower steady state capital-output ratio for the economy.

The dynamic consequence follows from the Euler condition for capital.

That is, in the detailed economy investment, in any given period t, must equate the marginal value of sacrificing current consumption to a lower discounted expected marginal value of next period consumption due to the after tax gross return of this investment.

Because of the capital wedge, the latter is lower in the detailed economy than in the prototype economy.

Labor Wedge:

Qualitatively, the labor wedge, $\frac{\breve{\omega}(\chi)}{\breve{\omega}^*(\chi)}$, behaves much the same and for similar reasons like the capital wedge.

The main implication of the labor wedge is the distortion of the equality of the marginal rate of substitution (MRS) between consumption and leisure and the corresponding marginal rate of transformation (MRT) in the economy. This is manifested in the intratemporal condition (II.23).

Specifically, because of the labor wedge, the detailed economy has a lower MRT than the prototype economy.

This again has a static and a dynamic consequence.

The static consequence is immediate from the steady state version of (II.23) (i.e., (II.33)) and implies lower employment in the steady state of the detailed economy than in the prototype economy. And, again, in view of (II.23), the dynamic consequences are apparent from (II.24).

***Efficiency Wedge*:**

The capital wedge results in less capital both in the long run and in any given period.

Likewise, the labor wedge results in less employment both in the long run and in any given period.

The efficiency wedge, $\dfrac{\bar{\omega}_t(\chi_t)}{\bar{\omega}_t^*(\chi_t)}$, characterizes the static total factor productivity (TFP) for any input levels and, again, is defined as the ratio of TFP in the detailed over the prototype economy.

Due to all frictions in the economy, output will be lower in the detailed economy over that of the prototype economy.

There are three sources of these frictions:

(i) the way capital and labor are combined in insiders' industries,

(ii) the way capital and labor are combined in outsiders' industries, and

(iii) the way output from insiders' and outsiders' industries are combined in the production of the final good. The first two effects are incorporated in the term $\frac{1+\Delta_t^*(\chi_t)}{[1+\theta\Delta_t(\chi_t)]^{\alpha}[1+\xi\Delta_t(\chi_t)]^{1-\alpha}}$, in the denominator of the efficiency wedge. The third effect is incorporated directly in the term $\left[\frac{1+\Delta_t(\chi_t)}{1+\Delta_t^*(\chi_t)}\right]^{1/\phi}$, in the numerator of the efficiency wedge. (See (A.20) in the Mathematical Appendix.)

Further, Proposition 3 implies that the efficiency wedge falls continuously and then rises continuously with the share of insiders' industries for all ϕ that satisfy condition **[R3].**

In particular, the graph of the efficiency wedge with respect to the share of insiders' industries in the economy is "U" shaped, as the efficiency wedge is equal to one in the two cases where there is only one sector in the economy (i.e., $\chi = 0$ and $\chi = 1$).

Thus, there is no efficiency loss due to the frictions mentioned above when there is only one sector producing intermediate goods, while the efficiency loss is maximized in an intermediate value for the share of sectors producing intermediate goods in the economy near 1/2.

The key to understand this somewhat counterintuitive result - in the sense that it might had been expected that the efficiency wedge monotonically declines with χ throughout $\chi \in (0,1)$ - is the combination of two effects:

(i) input complementarity in the final good sector ("complementarity effect"), and

(ii) a kind of multiplicity in what concerns the adverse effect (i.e., output reduction) when the insiders' sector of the detailed economy is characterized by either a few but "strong" monopolistic industries, i.e., χ close to zero, or many but "weak" monopolistic industries, i.e., χ close to one ("multiplicity effect".)

The multiplicity effect is brought about by the fact that the output of the insiders' sector in the detailed economy is less than the output of the insiders' sector in the prototype economy due to the monopolistic product markets, the wage-employment bargaining arrangements, and the extra fiscal policy distortions.[1] But, any given reduction in the output of the insiders' sector in the detailed economy can be achieved in two different ways. One way is with a relatively small share of insiders' industries in the economy, whereby there are relatively few non-competitive industries (but due to the structure of the model) resulting in big output reductions. And the second way is with a relatively large share of insiders' industries in the economy, whereby there are relatively many non-competitive industries resulting in big output reductions. Accordingly, in the extreme cases $\chi = 0$ and $\chi = 1$ this output reduction in the insiders' sector of the detailed economy is non-existent while, on the other hand is maximized for some intermediate value of χ near 1/2. The case $\chi = 1$ is exactly the same as the case where $\chi = 0$, as the product demand in each industry in the economy is perfectly elastic and the same is true for the industry demand for both factors of production. Turning now to the complementarity effect, to the degree that intermediate good inputs are complements in the production of the final good, balanced input combinations produce more output than one-sided input combinations. Note, however, that this effect relates to the quantities of the inputs from the two intermediate good sectors and not the shares of these sectors in the economy. Combining, now the two effects, it is straightforward that efficiency losses between the two economies are non-existent in the extreme cases when $\chi = 0$ and $\chi = 1$ and are maximized for some intermediate value of χ. Around this point, TFP both in the prototype and the detailed economy is the highest, due to the complementarity effect, but so is their difference due to the output loss of the insiders' sector, described by the multiplicity effect. Loosely speaking, the maximum efficiency loss occurs when the lower output of the insiders' sector in the detailed economy hinders the complementarity effect when the latter is strongest. That is, in a balanced input combination of the insiders' and outsiders' sectors in the production of the final good.

[1]Remember that the prototype economy is a two sector model where both sectors are perfectly competitive. We continue, however, to use the "insiders" – "outsiders" terminology in order to distinguish between these two perfectly competitive sectors of the prototype economy.

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	10 (i.e., $\theta=0.9$) or 20 ($\theta=0.8$)	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 1.25 (for $\theta=0.9$) or 1.75 (for $\theta=0.8$)
λ	intensity of wage premium in union preferences	0.75	
μ	relative bargaining power of insiders' unions	0.75	
τ^K	capital income tax rate	0.20	indicative of South European data
$\frac{1}{1-\phi}$	elasticity of substitution across sectors in final good production function	0.50 (i.e., $\phi=-1$)	CO**
χ	share of insiders' industries	0.25, 0.35, 0.5, 0.65, 0.75	
$\bar{\psi}$	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	

The laws of motion of the logarithms of the exogenous stochastic variables $Z = \left\{A, B^i, B^o, x/(1-x), \tau^K, \bar{\psi}\right\}$, are taken to be AR(1) processes with drift (whose values are defined in Table C.1.):

$$Z_{t+1} = \left(1-\rho^Z\right)\bar{Z} + \rho^Z Z_t + \varepsilon_t^Z .$$

Private Sector Equilibrium: Steady State Sensitivity with respect to χ.
Part A: Great Ratios

	χ = 0.25	χ = 0.35	χ= 0.50	χ = 0.65	χ= 0.75
y	0.1121	0.1020	0.0951	0.0948	0.0985
y^*	0.1461	0.1368	0.1324	0.1368	0.1461
y / y^*	0.7671	0.7456	0.7184	0.6925	0.6738
k / y	2.3361	2.3130	2.2833	2.2545	2.2331
k^* / y^*	2.5713	2.5713	2.5713	2.5713	2.5713
$(k / y) / (k^* / y^*)$	0.9085	0.8996	0.8880	0.8768	0.8685
h	0.2503	0.2447	0.2374	0.2303	0.2250
h^*	0.3029	0.3029	0.3029	0.3029	0.3029
h / h^*	0.8264	0.8080	0.7839	0.7603	0.7428
c / y	0.5523	0.5493	0.5445	0.5396	0.5365
c^* / y^*	0.5436	0.5436	0.5436	0.5436	0.5436
$(c / y) / (c^* / y^*)$	1.0159	1.0106	1.0017	0.9927	0.9870
i / y	0.2102	0.2082	0.2055	0.2029	0.2010
i^* / y^*	0.2314	0.2314	0.2314	0.2314	0.2314
$(i / y) / (i^* / y^*)$	0.9085	0.8996	0.8880	0.8768	0.8685
g / y	0.2375	0.2425	0.2500	0.2575	0.2625
g^* / y^*	0.2250	0.2250	0.2250	0.2250	0.2250
$(g / y) / (g^* / y^*)$	1.0556	1.0778	1.1111	1.1444	1.1667

Confirming the theoretical results, the capital, labor, and efficiency wedges are all less than one.

Moreover, the capital and labor wedges are decreasing (implying that the respective frictions increase) with the share of insiders' industries, while the efficiency wedge remains roughly constant.[2]

The fact that the capital and labor wedges decline with χ, reflect the greater frictions in input and output markets.

Note also that, clearly, from the three wedges the labour wedge is the most distortive.

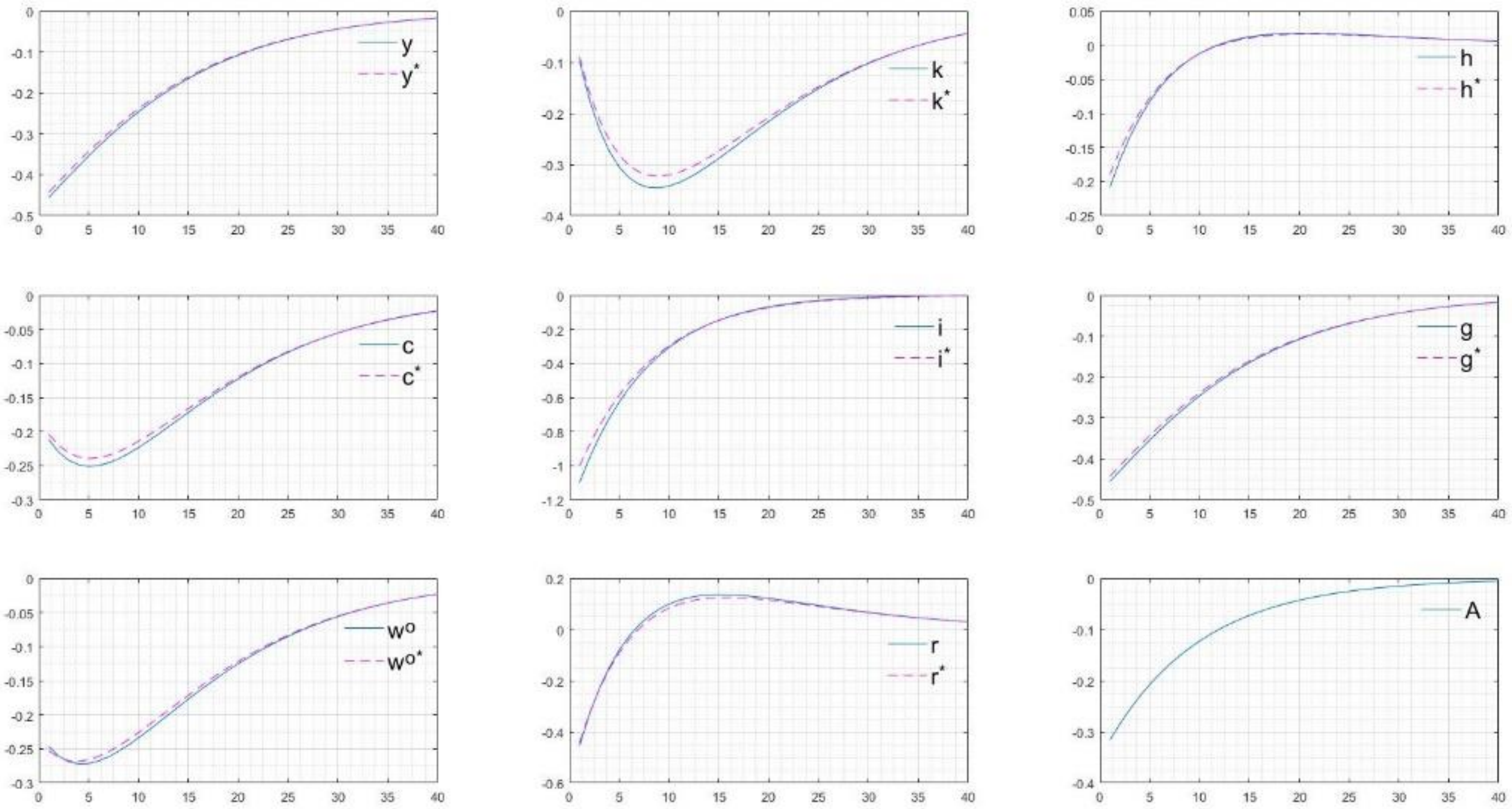
These wedges, along with the government spending wedge $(g/y)/(g^*/y^*)$ and the consequent labour tax distortion, justify the observed differences in output between the detailed and the prototype economies.

Private Sector Equilibrium: Steady State Sensitivity with respect to χ. - Part B: Wedges

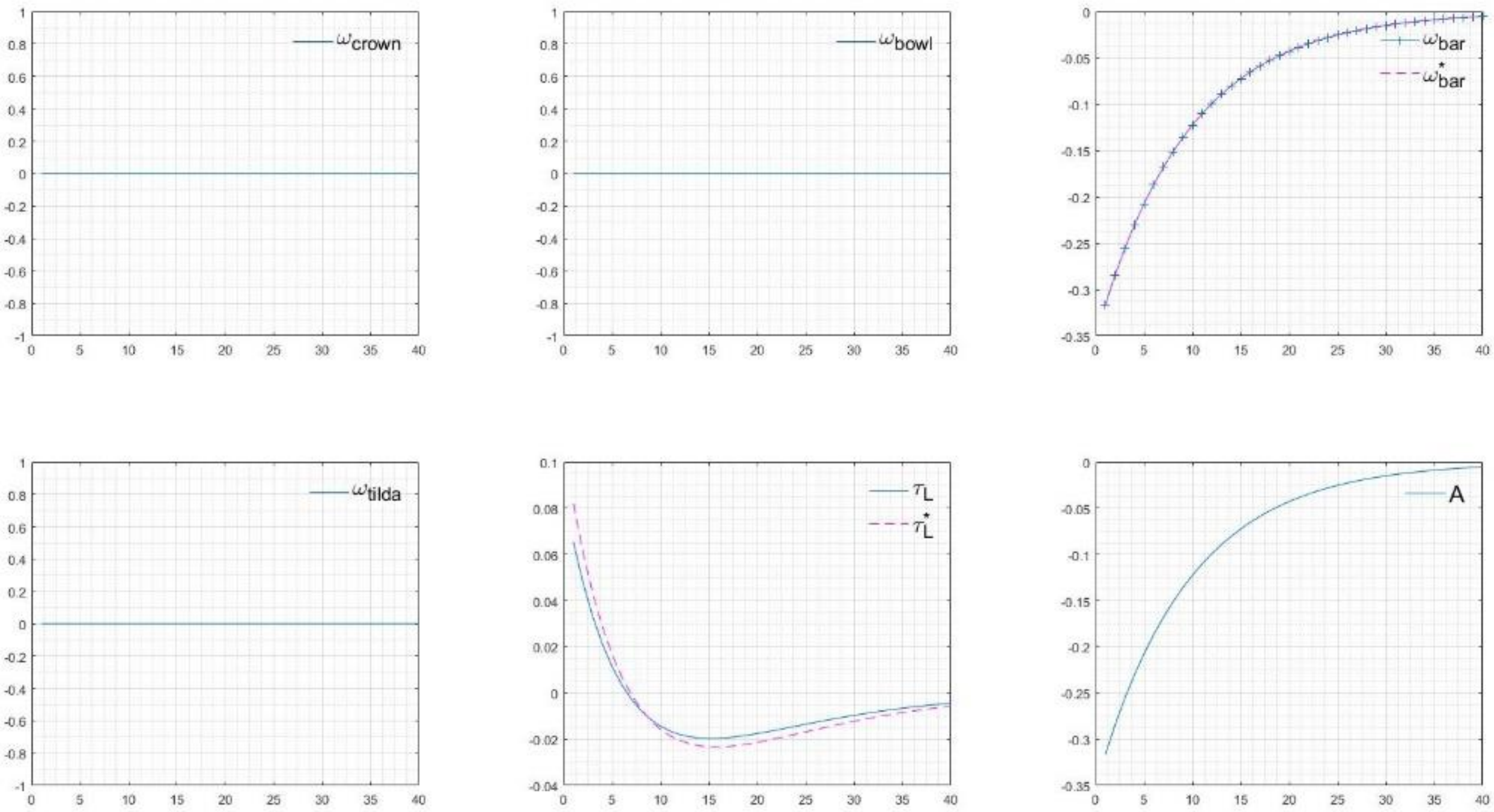
	χ = 0.25	χ = 0.35	χ= 0.50	χ = 0.65	χ = 0.75
$\widehat{\omega}$	0.9085	0.8996	0.8880	0.8768	0.8685
$\widehat{\omega}^*$	1.0000	1.0000	1.0000	1.0000	1.0000
$\widehat{\omega}/\widehat{\omega}^*$	0.9085	0.8996	0.8880	0.8768	0.8685
$\breve{\omega}$	0.7909	0.7704	0.7440	0.7184	0.6994
$\breve{\omega}^*$	1.0000	1.0000	1.0000	1.0000	1.0000
$\breve{\omega}/\breve{\omega}^*$	0.7909	0.7704	0.7440	0.7184	0.6994
$\bar{\omega}$	0.4412	0.4220	0.4127	0.4219	0.4410
$\bar{\omega}^*$	0.4490	0.4298	0.4204	0.4298	0.4490
$\bar{\omega}/\bar{\omega}^*$	0.9825	0.9819	0.9816	0.9817	0.9822
g/y	0.2375	0.2425	0.2500	0.2575	0.2625
g^*/y^*	0.2250	0.2250	0.2250	0.2250	0.2250
$(g/y)/(g^*/y^*)$	1.0556	1.0778	1.1111	1.1444	1.1667

[2] Recall that, as mentioned in footnote 15, unlike the government wedge, the way the capital, labor, and efficiency wedges are defined here, the greater the corresponding distortion of the detailed vis-a-vis the prototype economy, the smaller the value of the respective wedge.

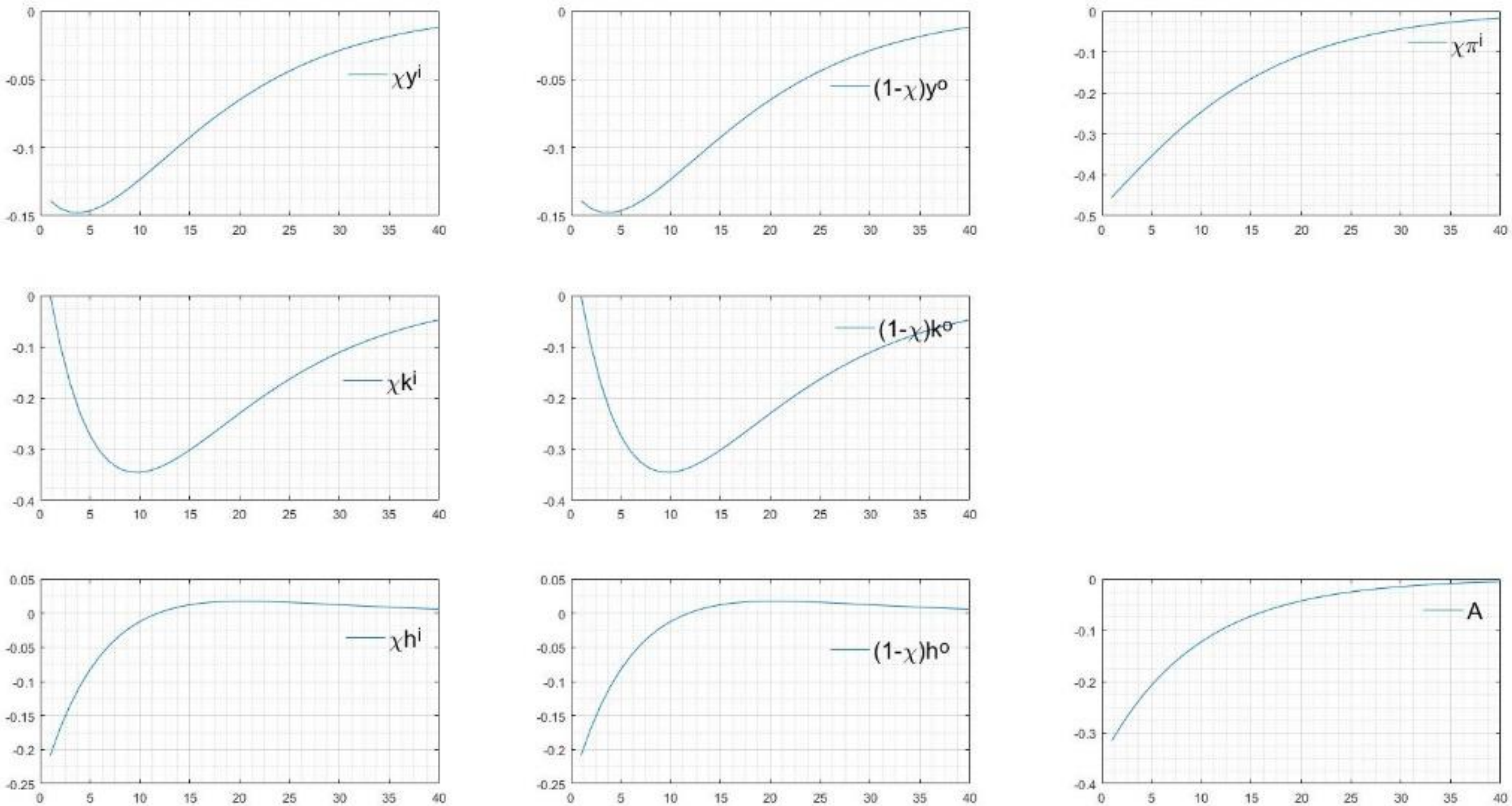
IRFs with respect to A – Aggregate State Variables



IRFs with respect to *A* – Wedges and Taxes



IRFs with respect to *A* – Industry Variables



Summarizing the results so far (given policy)

The Private Sector Equilibrium can be expressed only in terms of aggregate variables like a typical macro model.

This equilibrium (the equilibrium of the “detailed” economy) can be represented as the equilibrium of a fully competitive economy or an economy without insiders’ industries (the equilibrium of the “prototype” economy) that is being distorted by four wedges.

These wedges summarize all the frictions of the detailed economy

Given restrictions, the behaviour of the wedges reveal that frictions increase with the size of the insiders’ sector and that the steady state of the detailed economy, because of these wedges, is consistent with output per capita that is significantly less than the output per capita of the steady state of the prototype economy.

This alone can explain the dismal growth performance of South European economies

The IRF analysis, from a model calibrated on pertinent stylized facts (i.e., price mark ups, wage premia, factor taxes, output share of government spending), reveals two shock amplification results:

First, in the detailed economy the effects of negative TFP and positive tax shocks are moderately amplified, compared to the corresponding shocks in the prototype economy.

Second, the effects of positive shocks on the share of insiders’ industries has significant negative and prolonged effects on the economy.

The stage is now set to define the Ramsey government problem and the Poilitico-Economic Equilibrium

The Government Objective

The 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."

We take the "common good" policies to be those that maximize the expected value of the utility function introduced in Section II:

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

Insiders' interests are represented by the expected value of the discounted future stream of their income. That is, labor income and profits in all insiders' industries.:

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

“Hybrid Government”

A government, which, is to some degree is influenced by representative household preferences and likewise influenced by insiders’ preferences

Such a government seeks to minimize a 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).

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

where:

$\bar{U}^h$ is the maximum value of the household utility function ($\forall \chi \in [0,1]$, given). $\bar{U}^h$ is attained by the steady state of the PSE in the Canonical RBC specification.

$\bar{U}^i$ is the maximum value of the discounted future stream of insiders' income. $\bar{U}^i$ is attained by the steady state of the PSE in an all insiders economy

ρ is the degree of insiders' influence in government decision making.

$1-\rho$ reflects the degree government decisions are influenced by the "common good." think of $\bar{U}^h$ 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

$\frac{\bar{U}^h - U_0^h}{\bar{U}^h} \left(\frac{\bar{U}^i - U_0^i}{\bar{U}^i} \right)$ reflects the percentage loss of outsiders (insiders) from their respective bliss point.

Table 2.2: Functions of the Share of Insiders Industries in the Economy, χ, in the Steady State of the PSE for Alternative Economy Specifications

	Prototype Economy		***Detailed Economy***	
	Canonical RBC	***Two Sector RBC***	***Insiders-Outsiders***	***All Insiders***
	$\chi = 0$	$\chi \in (0,1)$	$\chi \in (0,1)$	$\chi = 1$
$\widehat{\omega}(\chi)$	1	1	$\dfrac{1+\theta\Delta(\chi)}{1+\Delta(\chi)}$	θ
$\breve{\omega}(\chi)$	1	1	$\dfrac{1+\xi\Delta(\chi)}{1+\Delta(\chi)}$	ξ
$\bar{\omega}(\chi)$	AB^o	$AB^o(1-\chi)^{\frac{\theta(1-\phi)+\phi}{\theta\phi}}[1+\Delta(\chi)]^{\frac{1-\phi}{\phi}}$	$AB^o \dfrac{(1-\chi)^{\frac{\theta(1-\phi)+\phi}{\theta\phi}}[1+\Delta(\chi)]^{\frac{1}{\phi}}}{[1+\theta\Delta(\chi)]^{\alpha}[1+\xi\Delta(\chi)]^{(1-\alpha)}}$	AB^o
$\tilde{\omega}(\chi)$	*1*	*1*	$\dfrac{1+o\Delta(\chi)}{1+\Delta(\chi)}$	o
$\Delta(\chi)$	-	$\left(\dfrac{B^i}{B^0}\right)^{\frac{\phi}{1-\phi}}\left(\dfrac{\chi}{1-\chi}\right)^{\frac{\theta(1-\phi)+\phi}{\theta(1-\phi)}}$	$\left[\theta^{\alpha}\xi^{(1-a)}\left(\dfrac{B^i}{B^0}\right)\right]^{\frac{\phi}{1-\phi}}\left(\dfrac{\chi}{1-\chi}\right)^{\frac{\theta(1-\phi)+\phi}{\theta(1-\phi)}}$	-
$\Delta^g(\chi,\chi)$	$\bar{\psi}$	$\bar{\psi}$	$\bar{\psi}+\hat{\psi}\chi$	$\bar{\psi}+\hat{\psi}$

2.3 The Politico-economic Equilibrium

Definition: *Given* $\{z^t\}_{t=0}^{\infty}$, *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:*

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

where $\Im_0$ *is the space of sequences of the form* $\{h_t(z^t), k_{t+1}(z^t), \chi_{t+1}(z^t)\}_{t=0}^{\infty}$ *such that:*

The IC (2.10), the GSPARC (2.15), and the initial condition (2.7) are satisfied; and, (b) $\left(h_t(z^t), k_{t+1}(z^t), \chi_{t+1}(z^t)\right) \in (0,1)\times(0,\infty)\times(0,1), \forall t \geq 0.$

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.

Benchmark Parameterization

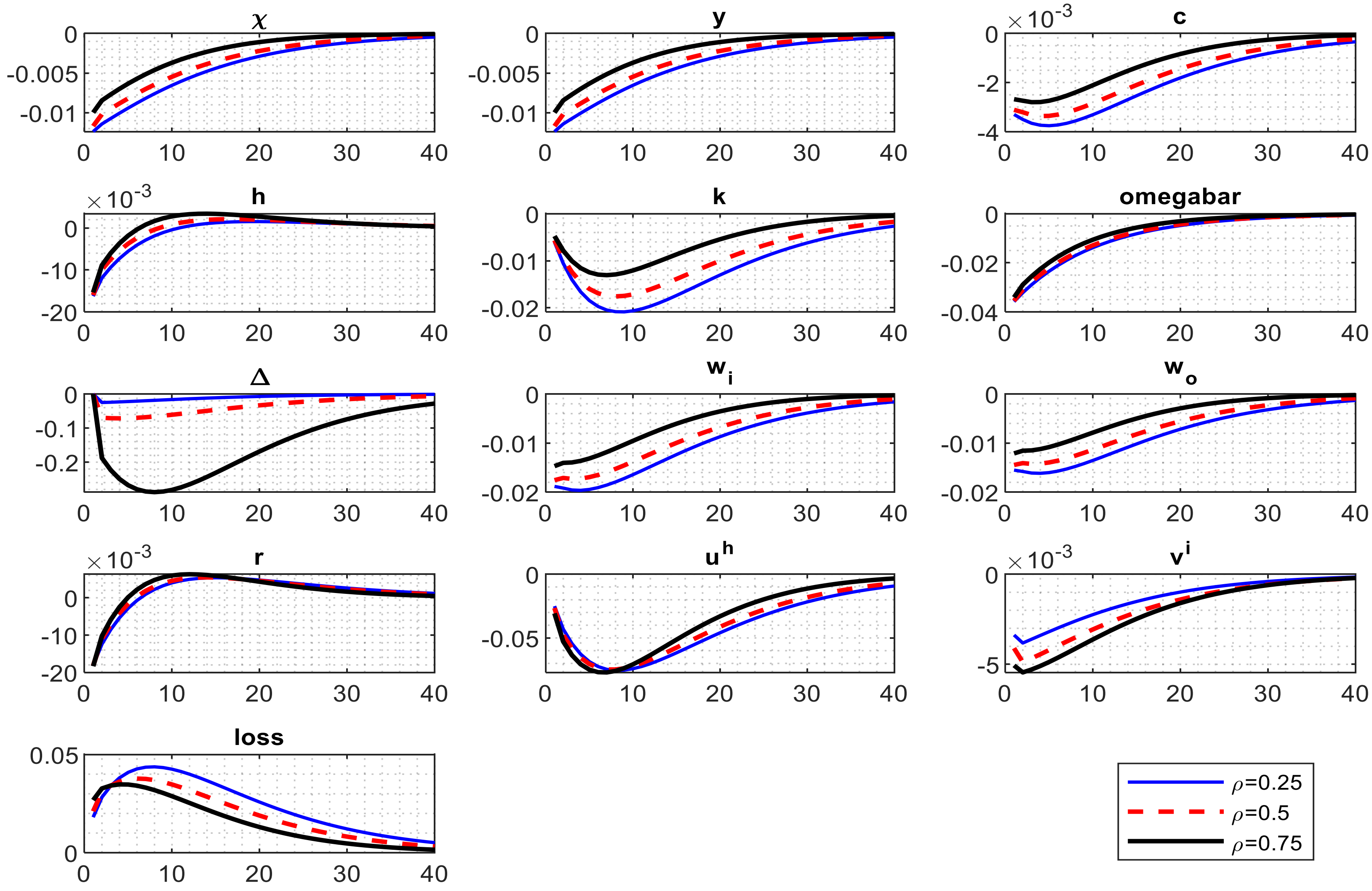
α	capital input elasticity in industry production	0.33
$\tilde{\beta}$	constant discount factor of households	0.98
$1/\gamma$	household intertemporal elasticity of substitution	0.50
δ	capital depreciation rate	0.07
η	growth rate of labor of augmenting technology	0.02
ϑ	intensity of consumption in household preferences	0.33
$\frac{1}{1-\theta}$	aggregation elasticity of substitution across industries in the same sector	10 ($\theta = 0.9$)
λ	intensity of wage premium in union preferences	0.5
μ	relative bargaining power of insiders' unions	0.5
τ^K	capital income tax rate	0.20
$\frac{1}{1-\phi}$	elasticity of substitution across sectors in final good production function	0.50 ($\phi = -1$) (-1, 0.6, 0.7)
$\bar{\psi}$	GDP share of government consumption in the prototype economy	0.225
$\hat{\psi}$	such that the difference between the GDP share of government consumption in South Europe and the US is $\hat{\psi}\chi$	0.025
$\tilde{\psi}$	GDP share of government spending devoted to the expansion of the insiders' sector	0
ρ	relative weight associated with the welfare loss of insiders in the government decision making criterion	1/4, 1/2, 3/4

Politico-Economic Equilibrium of Hybrid Government: Steady State Sensitivity with respect to ρ

	$\phi = -1, \theta = 0.9$			$\phi = 0.6, \theta = 0.7$			$\phi = 0.7, \theta = 0.6$		
ρ	**0.25**	**0.5**	**0.75**	**0.25**	**0.5**	**0.75**	**0.25**	**0.5**	**0.75**
$loss$	0.3677	0.4980	0.6284	0.5829	0.6735	0.7467	0.8508	0.8588	0.8873
χ	0.4174	0.4036	0.3823	0.4761	0.6388	0.8666	0.6014	0.5363	0.3417
y	0.1413	0.1411	0.1409	0.0887	0.0833	0.0706	0.0595	0.0633	0.0776
c	0.0770	0.0770	0.0769	0.0493	0.0466	0.0401	0.0334	0.0352	0.0422
h	0.2882	0.2882	0.2882	0.2730	0.2643	0.2470	0.2619	0.2719	0.2917
k	0.3444	0.3440	0.3434	0.2037	0.1847	0.1455	0.1306	0.1449	0.1916
i	0.0310	0.0310	0.0309	0.0183	0.0166	0.0131	0.0117	0.0130	0.0172
g	0.0333	0.0332	0.0330	0.0210	0.0201	0.0174	0.0143	0.0151	0.0181
w_i	0.3270	0.3267	0.3261	0.2348	0.2200	0.1854	0.1723	0.1841	0.2271
w_o	0.3098	0.3095	0.3089	0.1934	0.1812	0.1527	0.1292	0.1381	0.1704
r	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296
u^h	-2.9485	-2.9487	-2.9495	-3.3727	-3.4104	-3.5307	-3.8004	-3.7707	-3.6140
v^i	0.0512	0.0512	0.0513	0.0241	0.0292	0.0358	0.0174	0.0140	0.0061
k/y	2.4382	2.4380	2.4376	2.2973	2.2180	2.0614	2.1955	2.2877	2.4698
c/y	0.5451	0.5455	0.5461	0.5563	0.5594	0.5678	0.5624	0.5557	0.5442
i/y	0.2194	0.2194	0.2194	0.2068	0.1996	0.1855	0.1976	0.2059	0.2223
$\bar{\omega}$	0.4619	0.4616	0.4611	0.3580	0.3550	0.3409	0.2864	0.2872	0.3060
$\widehat{\omega}$	0.9482	0.9481	0.9480	0.8935	0.8626	0.8017	0.8539	0.8897	0.9605
$\hat{\omega}$	0.9482	0.9481	0.9480	0.8935	0.8626	0.8017	0.8539	0.8897	0.9605
$\widetilde{\omega}$	1.0259	1.0259	1.0260	1.0533	1.0687	1.0992	1.0731	1.0552	1.0197

Politico-Economic Equilibrium of Hybrid Government: IRFs with respect to *A* – Negative Shock

$\phi = 0.6, \theta = 0.7$



<u>Unifying Representation of Private Sector Equilibrium):</u>

Aggregate state variables:

Aggregate production function:

$$y_t = \bar{\omega}_t(\chi_t) k_t^{\alpha} h_t^{(1-\alpha)} \tag{2.1}$$

Resource constraint:

$$y_t = c_t + [(1+\eta)k_{t+1} - (1-\delta)k_t] + g_t \tag{2.2}$$

Government budget constraint:

$$g_t = \left\{ \tau_t^K \left[\alpha \widehat{\omega}_t(\chi_t) - \delta \left(\frac{k_t}{y_t} \right) \right] + \tau_t^L (1-\alpha) \tilde{\omega}_t(\chi_t) \right\} y_t \tag{2.3}$$

Intratemporal condition:

$$\frac{1-\vartheta}{\vartheta} \frac{c_t}{1-h_t} = (1-\tau_t^L)(1-\alpha) \breve{\omega}_t(\chi_t) \frac{y_t}{h_t} \tag{2.4}$$

Euler condition for capital:

$$\frac{u_t}{c_t} = \frac{\beta}{(1+\eta)} E_t \left\{ \frac{u_{t+1}}{c_{t+1}} \left[1 + (1-\tau_{t+1}^K)[\widehat{\omega}_{t+1}(\chi_{t+1}) \alpha \frac{y_{t+1}}{k_{t+1}} - \delta] \right] \right\} \tag{2.5}$$

Transversality condition and Initial condition:

$$\beta^T E_0 \frac{u_T k_{T+1}}{c_T} \to 0 \;\; as \;\; T \to \infty \tag{2.6}$$

$$\left(k_0, \chi_0\right) \in \left(0, \infty\right) \times \left(0, 1\right) \;\; given \tag{2.7}$$

Prices and Dividends:

Real Rental Cost of Capital:

$$r_t = \alpha \widehat{\omega}_t(\chi_t)\frac{y_t}{k_t} \tag{2.8}$$

Dividends:

$$\chi_t w_t^i h_t^i + (1-\chi_t) w_t^o h_t^o + \chi_t \pi_t^i = (1-\alpha)\tilde{\omega}_t(\chi_t) y_t \tag{2.9}$$

where the sector wages and all functions of the share of insiders' industries in the economy, χ, characterising the *aggregate state of the PSE (i.e., Equations (2.1) – (2.7)), are given in Table 2.1, for each alternative economy specification.*

Table 2.1: Functions of the Share of Insiders Industries in the Economy, χ, in the PSE Representation for Alternative Economy Specifications

	Prototype Economy		*Detailed Economy*	
	$\chi_t = 0\ ,\forall t \in \mathbb{N}_+$	$\chi_t \in (0,1)\ ,\forall t \in \mathbb{N}_+$	$\chi_t \in (0,1)\ ,\forall t \in \mathbb{N}_+$	$\chi_t = 1\ ,\forall t \in \mathbb{N}_+$
	Canonical RBC	*Two Sector RBC*	*Insiders – Outsiders*	*All Insiders*
w_t^o	$(1-\alpha)\frac{y_t}{h_t}$	$(1-\alpha)\frac{y_t}{h_t}$	$(1-\alpha)\breve{\omega}_t(\chi_t)\frac{y_t}{h_t}$	-
w_t^i	-	$(1-\alpha)\frac{y_t}{h_t}$	$(1-\alpha)\nu\breve{\omega}_t(\chi_t)\frac{y_t}{h_t}$	$(1-\alpha)\nu\xi\frac{y_t}{h_t}$
$\widehat{\omega}_t(\chi_t)$	*1*	*1*	$\frac{1+\theta\Delta_t(\chi_t)}{1+\Delta_t(\chi_t)}$	θ
$\breve{\omega}_t(\chi_t)$	*1*	*1*	$\frac{1+\xi\Delta_t(\chi_t)}{1+\Delta_t(\chi_t)}$	ξ
$\bar{\omega}_t(\chi_t)$	$A_t B_t^o$	$A_t B_t^o (1-\chi_t)^{\frac{\theta(1-\phi)+\phi}{\theta\phi}} [1+\Delta_t(\chi_t)]^{\frac{1-\phi}{\phi}}$	$A_t B_t^o \frac{(1-\chi_t)^{\frac{\theta(1-\phi)+\phi}{\theta\phi}} [1+\Delta_t(\chi_t)]^{\frac{1}{\phi}}}{[1+\theta\Delta_t(\chi_t)]^{\alpha}[1+\xi\Delta_t(\chi_t)]^{(1-\alpha)}}$	$A_t B_t^o$ *(*)*
$\tilde{\omega}_t(\chi_t)$	*1*	*1*	$\frac{1+o\Delta_t(\chi_t)}{1+\Delta_t(\chi_t)}$	o
$\Delta_t(\chi_t)$	-	$\left(\frac{B_t^i}{B_t^0}\right)^{\frac{\phi}{1-\phi}} \left(\frac{\chi_t}{1-\chi_t}\right)^{\frac{\theta(1-\phi)+\phi}{\theta(1-\phi)}}$	$\left[\theta^{\alpha}\xi^{(1-a)}\left(\frac{B_t^i}{B_t^0}\right)\right]^{\frac{\phi}{1-\phi}} \left(\frac{\chi_t}{1-\chi_t}\right)^{\frac{\theta(1-\phi)+\phi}{\theta(1-\phi)}}$	-
$\Delta_t^g(\chi_t,\chi_{t+1})$	$\bar{\psi}_t$	$\bar{\psi}_t$	$\bar{\psi}_t + \hat{\psi}\chi_t + \frac{1}{2}\tilde{\psi}(\chi_{t+1}-\chi_t)^2$	$\bar{\psi}_t + \hat{\psi}$

where, given ***[R1]*** *and* ***[R2]*** *(**)****:***

$$\nu = \frac{1}{1-\dfrac{(1-\theta)\lambda}{(1-\alpha\theta)(1-\lambda)+(1-\alpha)\theta\left(\dfrac{1-\mu}{\mu}\right)}} > 1 \quad \xi = \frac{(1-\alpha)\theta+\left\{1-\alpha\theta-[(1-\alpha\theta)+(1-\theta)]\lambda\right\}\left(\dfrac{\mu}{1-\mu}\right)}{(1-\alpha)\left[1+(1-\lambda)\left(\dfrac{\mu}{1-\mu}\right)\right]} < 1 \quad o = \frac{1-\alpha\theta}{1-\alpha} > 1$$

(*) Since in this case there are no insiders' industries, we adopt the convention: $B_t^0 = B_t^i$

(**) Assumptions [R1], [R2] were introduced and discussed in the companion paper (Kollintzas, et al., 2021) and are also quoted in Appendix I.

Note: *1) Prototype economy: An economy without distinction between insiders and outsiders, where the only friction is distortionary factor income taxes;1a) Canonical RBC economy: A prototype economy with one competitive final good sector; 1b) Two sector RBC economy: A prototype economy with two competitive final good sectors; 2) Detailed economy: An economy where in addition to distortionary taxation there are market power frictions; 2a) Insiders-Outsiders: A detailed economy with one competitive final good sector (outsiders) and one non-competitive final good sector (insiders); 2b) All Insiders: A detailed economy with one non-competitive final good sector.*

Proposition II-1: ***(a)*** *The equations characterizing the aggregate state of the PSE, (2.1) -(2.7), are equivalent to the following three conditions:*

(i) ***The "Implementability Constraint"*** *(IC):*

$$E_0 \sum_{t=0}^{\infty} \beta^t \tilde{\varsigma}\,(h_t, \chi_t; z_t) u^h(c_t, h_t) = \hat{\varsigma}(c_0, h_0, k_0, \chi_0; z_0) u^h(c_o, h_0) \tag{2.10}$$

where:

$$\hat{\varsigma}(c_0, h_0, k_0, \chi_0; z_0) \equiv \frac{\alpha(1-\tau_0^K)\hat{\omega}_0(\chi_0)\bar{\omega}_0(\chi_0) k_0^{\alpha} h_0^{1-\alpha} + \left[1-(1-\tau_0^K)\delta\right] k_0}{c_0} \tag{2.11}$$

$$\tilde{\varsigma}\,(h_t, \chi_t; z_t) \equiv 1 - \varpi_t(\chi_t) \frac{(1-\vartheta) h_t}{\vartheta(1-h_t)} \tag{2.12}$$

and, given restrictions ***[R1] - [R2]****:*

$$\varpi_t(\chi_t) \equiv \frac{\tilde{\omega}_t(\chi_t)}{\breve{\omega}_t(\chi_t)} = \begin{cases} 1, & \text{in the prototype economy with } \chi_t = 0, \forall t \in \mathbb{N}_+ \\ 1, & \text{in the prototype economy with } \chi_t \in (0,1), \forall t \in \mathbb{N}_+ \\ \dfrac{1+o\Delta_t(\chi_t)}{1+\xi\Delta_t(\chi_t)} > 1, & \text{in the detailed economy with } \chi_t \in (0,1), \forall t \in \mathbb{N}_+ \\ o > 1, & \text{in the detailed economy with } \chi_t = 1, \forall t \in \mathbb{N}_+ \end{cases} \tag{2.13}$$

(ii) The "government spending policy augmented resource constraint" (GSPARC):

H.F.R.I. Hellenic Foundation for Research & Innovation

The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the "2nd Call for H.F.R.I. Research Projects to support Faculty Members & Researchers" (Project Number: 4566)

$$c_t = \left[1 - \Delta_t^g(\chi_t, \chi_{t+1})\right]\overline{\omega}_t(\chi_t) k_t^{\alpha} h_t^{(1-\alpha)} - \left[(1+\eta)k_{t+1} - (1-\delta)k_t\right] \tag{2.14}$$

where, *the government spending policy function* $\Delta_t^g(\chi_t, \chi_{t+1})$ *is given in Table 2.1 for all specifications of the economy.*

(iii) *The initial condition,* (2.7).

(b) *Along any PSE, the labor tax rate is set according to the "government spending policy augmented government budget constraint" (GSPAGBC):*

$$\tau_t^L = \frac{\Delta_t^g(\chi_t, \chi_{t+1}) - \tau_t^K \left[\alpha\widehat{\omega}_t(\chi_t) - \dfrac{\delta}{\overline{\omega}_t(\chi_t)}\left(\dfrac{k_t}{h_t}\right)^{(1-\alpha)}\right]}{(1-\alpha)\tilde{\omega}_t(\chi_t)} \tag{2.15}$$

Any government plan, $\{\tau_t^L, \chi_{t+1}\}_{t=0}^{\infty}$, that adheres to the PSE equations and the government budget constraint, can be determined once the allocation $\{h_t(z^t), k_{t+1}(z^t), \chi_{t+1}(z^t)\}_{t=0}^{\infty}$ has been determined

***Remark II-2*: (a)** *Given the PSE representation in Remark II-1, it follows that:*

$$U_0^i = E_0 \sum_{t=0}^{\infty} \beta^t v^i \left[h_t(z^t), k_t\,(z^{t-1}), \chi_t\,(z^{t-1}); z_t \right] \qquad (2.18)$$

where:

$$\mathrm{v}^i \left[h_t(z^t), k_t\,(z^{t-1}), \chi_t\,(z^{t-1}); z_t \right] \equiv \mathrm{v}_t^i(h_t\,, k_t\,, \chi_t\,) \equiv \hat{\omega}_t(\chi_t) k_t^{\alpha} h_t^{1-\alpha} \qquad (2.19)$$

$$\hat{\omega}_t(\chi_t\,) \equiv \ddot{\omega}_t(\chi_t)\overline{\omega}_t(\chi_t) \qquad (2.20)$$

$$\ddot{\omega}_t(\chi_t) \equiv (1-\alpha\theta)\frac{\Delta_t(\chi_t)}{1+\Delta_t(\chi_t)} \qquad (2.21)$$

(b) If $\phi \in \left(-\frac{\theta}{1-\theta}, 0\right)$ *and **[R3]*** hold, then: $\hat{\omega}(\bullet):(0,1)\to(0,1)$; $\lim_{\chi\to 0} \hat{\omega}(\chi)=0$, $\lim_{\chi\to 1} \hat{\omega}(\chi)=1$; *and* $\hat{\omega}'(\chi)>0, \forall\chi\in(0,1)$.

2.2.2. Analytic characterization of Private Sector Equilibrium

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

(a) <u>Sector Variables</u>*: 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,* (k_t, h_t)*, as follows:*

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

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

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

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

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

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

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

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

where:

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

(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,* (k_t, h_t)*, 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:

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

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

$$\bar{\omega}_t(\chi_t) \equiv A_t B_t^o \frac{(1-\chi_t)^{[\theta+(1-\theta)\phi]/\theta\phi}[1+\Delta_t(\chi_t)]^{1/\phi}}{[1+\theta\Delta_t(\chi_t)]^{\alpha}[1+\xi\Delta_t(\chi_t)]^{(1-\alpha)}}$$
$$= A_t B_t^o \frac{(1-\chi_t)^{[\theta+(1-\theta)\phi]/\theta\phi}[1+\Delta_t(\chi_t)]^{(1-\phi)/\phi}}{\widehat{\omega}_t(\chi_t)^{\alpha}\,\breve{\omega}_t(\chi_t)^{(1-\alpha)}} \qquad \text{(II.20)}$$

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

$$g_t = \tau_t^K\left(r_t - \delta\right)k_t + \tau_t^L\left[\chi_t w_t^i h_t^i + (1-\chi_t)w_t^o h_t^o + \chi_t \pi_t^i\right] \qquad \text{(II.21)}$$

and that government spending is defined by:

$$g_t = \left[\bar{\psi}_t + \hat{\psi}\chi_t + \frac{1}{2}\tilde{\psi}(\chi_{t+1} - \chi_t)^2\right]y_t; \quad \hat{\psi},\tilde{\psi} \geq 0; \qquad \text{(II.22)}$$

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:*

$$\frac{1-\vartheta}{\vartheta}\frac{c_t}{1-h_t} = \breve{\omega}_t(\chi_t)(1-\tau_t^L)(1-\alpha)\frac{y_t}{h_t} \qquad \text{(II.23)}$$

$$\frac{u_t}{c_t} = \frac{\beta}{(1+\eta)}E_t\left\{\frac{u_{t+1}}{c_{t+1}}\left[1+(1-\tau_{t+1}^K)\left[\widehat{\omega}_{t+1}(\chi_{t+1})\alpha\frac{y_{t+1}}{k_{t+1}} - \delta\right]\right]\right\} \qquad \text{(II.24)}$$

$$\bar{\psi}_t + \hat{\psi}\chi_t + \frac{1}{2}\hat{\psi}(\chi_{t+1} - \chi_t)^2 = \tau_t^K\left[\alpha\widehat{\omega}_t(\chi_t) - \delta\left(\frac{k_t}{y_t}\right)\right] + (1-\alpha)\tau_t^L\tilde{\omega}_t(\chi_t) \qquad \text{(II.25)}$$

where:

$$\tilde{\omega}_t(\chi_t) \equiv \frac{1 + \frac{1-\alpha\theta}{1-\alpha}\Delta_t(\chi_t)}{1 + \Delta_t(\chi_t)} > 1$$

That’s it

Thank you all!!!