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Abstract

Standard growth theory is based on atomistic agents with no strategic interactions among them. In contrast, we model growth as resulting from a one-off, strategic game between "workers" and owners of capital ("capitalists") on factor shares, in an otherwise standard "AK" growth model. The resulting distribution of income between factors further determines the marginal revenue product of capital and the rate of growth. We analyse the properties of four equilibria: competitive, Stackelberg equilibrium, a hybrid non-cooperative regime, and cooperative (Nash) solution. We show that our model provides a potentially richer view of the growth process than comparable models, and endogenises a key aspect of the "social contract".

Keywords: Social conflict, factor shares, growth, catching up with the Joneses.

JEL Classification numbers: E11, E22, E25

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1. Introduction

Standard growth theory is based on atomistic agents, exhibiting no strategic interactions. Agents often do have monopolistic power resulting in economic profits, as in models based on technological innovation, but even in this case, (implicitly) their number and size is such that it is still the case that they do not interact in a strategic manner (the paradigm is one of monopolistic power, and not oligopoly). Yet, agents often form powerful associations on the basis of which they make demands in the social and political arenas, be they unions, employers' associations, or even political parties whose nature may be systematically correlated with specific characteristics of the social base.[1] One such characteristic is the "functional" source of agents' incomes, i.e. whether labour or capital income; this is often the basis underlying the formation of the social actors who interact strategically. This strategic interaction, which we term social conflict, is multi-faceted: workers and capitalists, as organised social groups, can capture, or attempt to capture, a larger share of the output either directly (through wage negotiations or price rises given the nominal wages) or indirectly by manipulating the political system to achieve favourable transfers, regulations, and other redistributive policies (see e.g. Benhabib and Rustichini, 1996). Despite this diversity of forms of the social conflict, its core aspect or pursuit is arguably a conflict over factor shares. The allocation of shares is among the key determinants of income distribution; additionally, as the resulting factor shares determine the (marginal revenue) productivity of capital, social conflict also directly impinges on growth. In other words, the functional distribution is the basis for social conflict, which may affect macroeconomic outcomes. As will be detailed below, this perspective has been explored in sociology and politics, particularly in analyses of inflation (Goldthorpe, 1978; Maier, 1978). In economics, however, though some papers have been inspired by similar considerations (Rowthorn, 1977; Benhabib and Rustichini, 1996), the core issues seem not to have been as emphasised as they might have been.

This paper aims to redress this deficit by providing a simple formal model of social conflict and analyse its implications in terms of growth, factor shares and wider income distribution. It does so by modelling social conflict as a bargaining game

[1] E.g., Krugman (2007, Chs. 4 and 6) documents the close links between the Democratic party and trade unions in the US.

between “workers” and owners of capital (“capitalists”). The decision variable in the ensuing bargaining game is labour’s (equivalently: capital’s) share in income, as this seems to be the key aspect of social conflict. We take this class game as played “centrally” either directly between political parties, or between unions (of workers and employers). If the game is between unions, the factor shares follow directly; if between parties, the shares will follow indirectly as a result of policies (determined by the bargain). Apart from determining the distribution of income between workers and capitalists, this game also has a direct implication for the rate of growth. Growth results from the decisions of firms to accumulate that are conditional on the rate of profit the social conflict game allows them to realise.

Our model is a simple endogenous growth one of an AK type, with inelastically supplied labour. Each capitalist or firm optimises intertemporally according to the standard Euler condition; collectively, though, capitalists take this as given and play a game versus workers whereby the factor share is their decision variable. The bargaining game determines the labour share, and the marginal revenue productivity of capital; the growth rate then follows by the Euler equation. Because of its AK structure, the model displays no short-run dynamics, hence only steady state analysis appears. Another noteworthy feature is that workers’ utility depends on their standard of living relative to that of capitalists (the “Joneses effect”). The literature on social comparisons in consumption (“keeping up with the Joneses”) has pointed out the relevance of relative positions in consumption for individual utility (Abel, 1990; Gali, 1994; Hopkins and Kornienko, 2004), and, ultimately, for growth and distribution (Tsoukis, 2007; Tournemaine and Tsoukis, 2008, 2009).

We show that this model delivers a fruitful model for the determination of factor shares, an area of rather sparse attention in the literature. Furthermore, it casts the determination of the growth rate in a different perspective, allowing a richer model than the ones obtained by comparable (AK) models (see below). Here, apart from the marginal product of capital and the rate of time preference, other features such as the political and trade union strength of each class and the intensity of social comparisons (“catching up with the Joneses”) play a role; we show that the latter works in opposite ways than in most other models. Finally, we also show that the model has important implications for other key macroeconomic variables such as inflation and unemployment, that may not be derived from atomistic models of growth and factor shares.

In the present paper, we analyse four types of equilibrium, in terms of factor shares, growth, and wider income distribution. To understand them best, it is worth pointing out that there are close parallels between the equilibrium outcomes studied here and the various models of trade union behaviour (McDonald and Solow, 1981; Oswald, 1986; Manning, 1988; Nickell, 1990). The four types of equilibrium, or arrangement, and their trade-union-behaviour parallels are: A competitive decentralised equilibrium, whereby labour's share is fixed by labour's elasticity in the production function; the parallel here may be the competitive labour market model whereby there is no union. Stackelberg equilibrium, whereby workers unilaterally set labour's share knowing the resulting growth from the capitalists' reaction function (the consumption Euler equation); a regime akin to the "monopoly union" model. A middle-of-the-road arrangement whereby the two parties bargain over the labour share, and then growth follows from the capitalists' reaction function; akin to the "right-to-manage" union model, which may be thought of as a linear combination of the previous two. Finally, cooperation (the Nash solution), whereby the two parties jointly determine both the labour share and growth in an efficient manner; the labour market equivalent here is the "efficient bargain". Because of these parallels, our model draws on some of the basic insights of the literature on union-employer bargaining, which however was mainly conducted in static contexts. In that literature, employment and the real wage were the variables of choice. The formal similarity with these models is brought up by considering that the real wage is closely related to workers' share in output – our variable of choice - and that employment is linked to the marginal product of capital and the growth rate.

As mentioned, there are rather few precedents of the model in the economics literature. Among the papers closest in spirit, Benhabib and Rustichini (1996) model a game between interest groups whereby each group chooses consumption and uses the residual output as investment, which determines growth. Therefore, consumption and growth are negatively related. The level of wealth plays an important role in the outcome as it may affect the temptation to acquire excessive consumption; whether this is the case depends on the structure of preferences and technology. Thus, group conflict and strategic behaviour can potentially lead to slow growth and "poverty traps" at various wealth levels. Tornell and Velasco (1992) build a model of conflict among social groups with "open access" to a common pool of capital, that is, poorly defined property rights (because of corruption, arbitrary taxation, etc). They use this model to explain capital flight from poor countries to rich by a "tragedy of commons" argument, i.e. the suboptimal allocation that results under poor property rights. They show that the introduction of a private second asset, even an inferior one, could ameliorate the situation by putting a floor on the minimum private returns that can be extracted from the common asset, and therefore reducing capital flight and increasing growth. Irmen and Wigger (2002) consider a game between a monopoly union with standard objectives and a firm in an overlapping generations framework. Raising wages above the competitive level because of bargaining may foster economic growth if the workers' marginal propensity to save exceeds the one of capitalists.

There are also affinities between our model and a number of distinct, but related, strands of literature. Models of the functional distribution of income (Alesina and Rodrik, 1994; Bertola, 1993) have pointed out a basic conflict of interest between workers and owners of capital ("capitalists") and analyse its implications for tax policy. The former end up consuming (in the steady state) their entire income, therefore they support redistribution (through taxation, in these models), whereas capitalists consume a fraction of their net worth which depends on growth, therefore they support growth-enhancing policies. Rodrik and van Ypersele (2003) have shown that this basic conflict of interest extends to open-economy issues, which are however outside the scope of this. The importance of the functional distribution is moreover attested by the continuing attention paid to it, evident in, among others, Blanchard (1997) and Garcia-Penalosa and Turnovsky (2005).

The idea of social conflict and in particular its link to macroeconomic outcomes has been explored in politics (e.g. Maier, 1978; Whitehead, 1979) and sociology (e.g. Goldthorpe, 1978, 1984; Hirsch, 1978). The key insight of these approaches is that inflation emerges as a (suboptimal) resolution of social conflict. Our paper links such ideas with the modern theory of growth and distribution. Moreover, the idea of social conflict has also been the focus of some attention in the heterodox economics literature. Rowthorn (1977) links the effectiveness of aggregate demand policies to the economy's profitability in a bargaining game between firms and labour. In particular, aggregate demand management works better (in terms of raising output and not inflation) the closer is the actual profit rate to the firms' target profit rate. In a recent contribution, Tsakalotos (2006) finds evidence consistent with this hypothesis.

This paper takes such insights to their logical conclusion and link them to the conflict between well known, recognised and organised social groups (workers and capitalists), rather than vague "social groups": The core social conflict is about distribution (on which the groups have different preferences), so what we do here is to analyse the implications of the resolution of this conflict for the growth rate and other key macroeconomic variables. Our approach may be seen as combining good elements from mainstream and heterodox approaches. To mainstream economics, we add social context and links to other social disciplines, as inspired by much non-mainstream analysis.[2] To heterodox approaches, we add the rigour and the general equilibrium nature of the mainstream approach. To give an example, the criticism that can be made to Rowthorn's (1977) theory, however interesting, is that the target profit rate is exogenous. In our analysis, instead, there is no exogenous target for the profit rate; firms compare their actual rates to the natural benchmark that would be afforded to them in a competitive situation.

The remainder of the paper is organised as follows. In Section 2, we develop a simple endogenous growth setup. In Section 3, we determine four possible outcomes (competitive case, Stackelberg equilibrium, general non-cooperative regime, cooperation). In Sections 4 and 5, we analyse the implications of the model for inflation and unemployment. We conclude in Section 6. Finally, the implications of this model for income distribution are spelt out in an Appendix in order to avoid clattering the main text.

2. The setup

We postulate an economy in continuous time with (for simplicity) a unit mass of infinitely lived workers and a unit mass of infinitely lived "capitalists". All agents in

[2] This approach is also consistent with our long-running personal research themes (e.g., Tournemaine and Tsoukis, 2008, 2009).

each category are alike. Workers are initially endowed with one unit of labour that they supply inelastically. Capitalists are endowed each with $k_0>0$ units of physical capital. Between them, and in equal shares, they own the unit mass of identical firms in the economy. Because of these conventions, the distinction between firm-specific and aggregate variables is immaterial, so it will not be emphasised (except when accounting for the externality in production below). Output, y_t, can be consumed or saved to give new units of capital. Each firm's technology of production is given by

$$y_t = A(k_t)^{1-\lambda}(l_t B_t)^{\lambda} \quad , \tag{1}$$

where $0<\lambda<1$ is the elasticity of labour in production, so that there are constant returns to the privately-owned factors; $A>0$ is a productivity parameter due to such factors as human capital, skills, or general purpose technology; $l_t \equiv 1$ is labour; k_t is physical capital; and $B_t \equiv \bar{k}_t$ proxies the level of technology by mean (with overbar) capital: endogenous productivity is promoted by a "learning-by-doing" externality (Romer, 1986). Other well known interpretations of this externality are also possible and largely equivalent. For instance, productive public services may be a fraction of aggregate income (as in Barro, 1990) and therefore capital (as in Bertola, 1993). Or, mean capital may serve as a proxy for the ease with which R&D is carried out, and hence for the quality of products (Aghion and Howitt, 1992). Therefore, the resulting "AK" type of technology supports endogenous growth due to some desirable features, namely diminishing returns to private capital, but constant returns to aggregate capital. It is the simplest possible model of endogenous growth, yet rich enough to incorporate the key insight of social conflict.

Firms' profits are output minus the wage bill, which equals workers' consumption (see below). Therefore, if one unit of output saved yields one new unit of physical capital (ignoring depreciation), we have:

$$k_{t+1} - k_t = y_t - c_t^k - c_t^w . \tag{2}$$

where c_t^k and c_t^w denote the levels of consumption of capitalists and workers, respectively. Throughout, the superscripts *w* and *k* are used to distinguish workers' variables and capitalists' ones.

Workers and capitalists differ not only in their capital endowments, but also in their preferences. Formally, the typical worker's period utility function is given by

$$U_t^w = \log\left(c_t^w - \alpha c_t^k\right), \tag{3a}$$

where 0<α<1; the representative capitalist's period utility function is given by

$$U_t^k = \log\left(c_t^k\right). \tag{3b}$$

Accordingly, workers derive utility from social comparisons (or "keeping up with the Joneses") effect as captured by the term αc_t^k, with capitalists' consumption taken as given. That is, from the point of view of the workers, apart from individual consumption, its level also matters relative to that of the capitalists'.[3] As will be seen below, this "Joneses" effect (introduced by α) plays an important role in the solution we get. For simplicity (but plausibly), capitalists are assumed not to engage in such comparisons: they have standard preferences depending only on the flow of consumption. As suggested by Duesenberry (1949) and confirmed empirically by Bowles and Park (2005), social comparisons are mostly made in an upward manner: individuals with a high level of income are likely to affect the consumption decisions of people with a low level of income because the latter are looking to climb up the social status ladder. The reverse, therefore, is less likely to occur. This assumption of asymmetric preferences is plausible if $c_t^k > c_t^w$, which seems to be the empirically relevant case.

A second major difference between capitalists and workers, apart from endowments, is related to forward planning. To derive tractable results, we make a polar distinction.

[3] See Tsoukis (2007) for a review of the various avenues that have been taken up in modelling the "Joneses" effect. For our purposes, the linear specification is the simplest.

Workers consume their entire wage income and therefore do not engage in any forward planning: they are "spenders", in the terminology of Mankiw (2000) and Gali *et al*. (2003).[4] Therefore, at each moment, workers consume their real wages, w_t, which represent a share of aggregate output (income), y_t. Denoting γ_t this share, workers' consumption is given by:

$$c_t^w = w_t = \gamma_t y_t . \tag{4a}$$

The main point here is that the share γ_t is endogenous, determined via bargaining between workers and capitalists (except in perfectly competitive equilibrium, see below).

As is well known, in the kind of AK framework developed here, there is no short-term dynamics. Variables jump instantaneously to their steady states. This is a great simplifying device, as the game between workers and capitalists regarding the choice of γ_t becomes one-off: the decision variable (relative factor share) stays constant at the value decided at the beginning of time, and of the game. Therefore $\gamma_t = \gamma$ for all t.

Capitalists live entirely out of interest income from their capital and do engage in forward planning: they are "savers". They maximise intertemporal utility:

$$\text{Max} \quad W_0^k \equiv \sum_{t=0}^{\infty} (1+\rho)^{-t} U_t^k , \tag{5}$$

where $\rho>0$ is the subjective discount rate, subject to the sequence of resource constraints given by:

$$k_{t+1} - k_t = g_t k_t = y_t - c_t^w - c_t^k \tag{6}$$

Due to symmetry within each class and since labour is normalised to unity, we have the following marginal revenue product of capital (MRPK):

[4] This may be due to credit market imperfections, myopia, or lack of "financial wherewithal" (see

$$\text{MRPK} = (1-\gamma)\text{A}. \qquad (7)$$

Thus, the Euler equation ("Keynes-Ramsey rule of consumption growth") reads:

$$1+\text{g} = \frac{1+(1-\gamma)\text{A}}{1+\rho}, \qquad (8)$$

where g denotes the common growth rate of consumption, capital and output. Log-linearising, we can approximate (8) in the standard way as:

$$g = (1-\gamma)A - \rho. \qquad (8')$$

Dividing (6) through by capital, exploiting symmetry within each class (workers-capitalists) and the production function (1), the Euler equation (8'), and workers' consumption (4a), this yields the capitalists' consumption to be:

$$c_t^k = \rho k_t. \qquad (4b)$$

By the same token, the aggregate resource constraint (2) gives,

$$\text{g} = \text{A} - (\text{c}_\text{t}^\text{k} + \text{c}_\text{t}^\text{w})/\text{k}_\text{t}. \qquad (9)$$

Equation (8) (or equivalently (8')) is the key growth equation in this simple world. As will be seen, it is solved differently according to the arrangements in place: In the competitive case, γ is exogenously fixed (by the competitive labour share, which is equal to the labour elasticity in production, λ, as is standard), and the growth rate and group consumptions follow from (8) and (4a, b). We take the competitive outcome to indicate the (limit of the) process of market liberalisation, be it in goods or labour markets, which typically yields $\gamma=\lambda$. In all other cases, however, the labour share γ is a decision variable, resulting from some form of bargaining between workers and capitalists.

Mankiw, 2000).

The choice of γ and the resulting outcome regarding economic growth is developed in the next Section. Before turning to the full analysis of this issue, a final preliminary step is to go from period utilities to intertemporal ones. Using the same rate of time preference for all classes (as it is standard in this kind of model), indexing on capital at t=0 which is predetermined, normalising it to one (k_0=1), and letting everything grow at rate g thereafter (the perpetual steady state property), we have in generic notation:

$$W_0^w = \sum_{t=1}^{\infty}(1+\rho)^{-t}\left[tg + \log\left(c_0^w - \alpha c_0^k\right)\right] \approx (1+\rho)g/\rho^2 + \log\left[A\gamma - \alpha\rho\right]/\rho \tag{10}$$

Though this is the individual intertemporal utility, there is one amendment needed when we move from the individual to the corporatist (political organisation's or trade union's) objective. The latter aims to increase the labour share from the benchmark λ, hence the corporatist objective can be expressed as:

$$\widetilde{W}_0^w = (1+\rho)g/\rho^2 + \log\left[(\gamma-\lambda)A - \alpha\rho\right]/\rho \tag{11a}$$

On the other hand, the capitalist's intertemporal utility is:

$$W_0^k \approx (1+\rho)g/\rho^2 + \left[\log\rho\right]/\rho \tag{11b}$$

The noteworthy feature here is that this utility function does not depend on the capital's share, as the relevant consumption is a fraction of capital, regardless of the share. Hence, the capitalists' organisation (party or union) takes (11b) as its maximand "as is".

3. Determination of the labour share and growth

In this Section, we elaborate more on the three separate non-atomistic equilibria (that is, in addition to the competitive outcome, in which γ=λ) where workers and capitalists bargain over the value of the labour's share γ, and their parallels in the trade union literature: Stackelberg solution, non-cooperative bargaining and cooperative solution. As it is unclear which one holds in practice and because institutional arrangements may change over time, it seems best to derive results under all of them. Analysis of various alternatives to the competitive outcome is topical because of the ongoing debate on the merits of market liberalisation (which would, in headline terms, bring us away of the social market model to a free market one, or in our terminology, towards the competitive case and away from other alternatives).[5]

The Stackelberg equilibrium involves workers unilaterally choosing their share, subject to the capitalists' reaction (growth). As such, this arrangement corresponds to the "monopoly union" model which maximises the union's welfare subject to the firm's reaction function, the labour demand curve. Labour's share in this regime is generally higher than in the competitive case. This kind of equilibrium has been criticised, naturally, for lack of realism. Its usefulness may be its simplicity, and the fact that the more realistic and general "right-to-manage" model" may be thought of as a hybrid of the Stackelberg and competitive solutions. The "right-to-manage" model lets firms and unions bargain over the wage, again subject to the labour demand curve (Oswald, 1986; Manning, 1988, 1995; Nickell, 1990). In our case, workers and capitalists bargain over the shares, and capitalists set growth. We call such an outcome, the (general) "non-cooperative case". For simplicity, rather than deriving an explicit solution, we let the share be a linear combination of the Stackelberg and competitive shares. As mentioned in the introduction, in real-world situations, such non-cooperative bargaining may be the outcome of distributional conflicts encompassing trade union activity and partisan political power. Finally, we can have more cooperative arrangements like conciliation arrangements with mediating tribunals such as ACAS in the UK, or tri-partite negotiations in the Scandinavian countries (involving firms, unions, and government). Without going into specifics, it may be argued that such arrangements may be modelled via a cooperative solution that involves a joint maximisation of the two parties' utilities over γ (the Nash solution). Non-partisan government policies may also be thought of as acting in a similar vein. This type of solution is akin to the "efficient bargain" of McDonald and Solow (1981); in that analysis, the Nash solution is on the contract curve and is efficient, but may or may not involve an increase in utility for each of the social partners, depending on

[5] The recent financial crisis is widely thought to alter the terms of reference of this debate, but at the

their bargaining powers. The analysis of the outcome of these three types of equilibria is given next.

3.1 Competitive equilibrium

To repeat previous arguments, here we have:

$$\gamma^{comp} = \lambda \tag{12a}$$

Therefore,

$$g^{comp} = A(1-\lambda) - \rho . \tag{12b}$$

3.2 Stackelberg equilibrium

In this case, workers unilaterally maximise over γ, taking into account the capitalists' reaction function, which is the (individually followed) Keynes-Ramsey growth equation (8). Considering the intertemporal utilities for workers (corporatist version 11a), the first-order condition is:

$$\rho \frac{\partial \widetilde{W}_0^w}{\partial \gamma} = \frac{A}{(\gamma - \lambda)A - \alpha\rho} - \frac{(1+\rho)A}{\rho} = 0 .$$

This yields the Stackelberg-equilibrium labour share (superscripted by s):

$$\gamma^S = \lambda + [\rho/(1+\rho) + \alpha\rho]/A . \tag{13a}$$

Introduced into (8'), the Stackelberg share (13a) gives:

$$g^S = A(1-\lambda) - (1+\alpha)\rho - \rho/(1+\rho) \tag{13b}$$

The Stackelberg growth rate depends negatively on the discount rate, but in a stronger manner than in standard models. In addition to the standard effect of the discount rate via capitalists' intertemporal optimisation (the first term, ρ), we also have an effect

time of writing, it is unclear precisely how. Analysis along these lines is beyond the scope of this.

due to workers' impatience arising out of their desire to catch up (second term, $\alpha\rho$) and the effect due to the fact workers are less interested in growth and more single-mindedly concerned about redistribution ($\rho/(1+\rho)$). Thus, the term $(1+\alpha)\rho+\rho/(1+\rho)$ represents a composite rate of discount for the entire society. Additionally, though we do not do so here, our framework allows distinguishing between capitalists' and workers' "primitive" discount rates ($\rho^w \neq \rho^c$). In general, the discount rate increases the labour share as it prompts workers to focus more on redistribution. The level of productivity A plays a somewhat counterintuitive negative role in the labour share; this is because $A=y/k$, so that when A rises, workers become relatively richer for any given share (cf. 4a and 4b), so the bargained share falls. A consideration that we have pushed under the carpet but can easily be incorporated and subsumed under A are possible distributional effects; e.g., if capital and labour and differently distributed among firms, then aggregation of the individual production functions will involve the variance of individual capital or labour (either as an approximation or, under log-normality, exactly). So, such considerations, entirely absent in standard models, will affect factor shares and growth. The higher the "catching up with their betters" or status considerations, α, the higher is the labour share and the lower is the growth rate. It is worthwhile to mention that this result contrasts with the standard literature on status and growth in which a positive relation between the two is generally obtained because of the effect on work effort (see e.g. for instance Corneo and Jeanne, 1997; Pham, 2005; Tournemaine and Tsoukis, 2008). Here instead, labour is fixed. The intuition behind this result is that as the preference for status increases, workers are induced to consume more. As the additional units of consumption given to workers via the higher labour share could have been saved by capitalists, the impact on growth is negative.[6]

3.3 Non-cooperative bargaining

In union bargaining terms, the "monopoly union" model (the Stackelberg-equilibrium equivalent) has no empirical appeal; instead, a more realistic model is the "right-to-manage" one, with unions and firms bargaining over the wage, and firms deciding

[6] In a R&D-based model with endogenous population growth, Tournemaine (2008) shows also that seeking higher social status can have a negative effect on long-run growth. However, the mechanism

employment unilaterally. Motivated by this, we introduce a more general non-cooperative bargaining model. Here, employers and workers bargain over relative shares, and growth follows from the Euler equation (8'). As mentioned, to derive a solution, we consider this case to be a hybrid of the competitive case and the Stackelberg equilibrium, and take the labour share to be a linear combination of the relevant shares. Let us denote by ϕ the bargaining power of workers, due to such factors as political/trade union organisation, but also the generosity of welfare provisions, and cultural and social factors like family networks (which provide insurance against unemployment), and by 1-ϕ the bargaining power of employers; the former prefer the Stackelberg outcome, the latter the competitive outcome. We thus have:

$$\gamma^{\text{non-coop}} = (1-\phi)\lambda + \phi\gamma^{S} = \lambda + \phi[\rho/(1+\rho) + \alpha\rho]/A\,, \qquad (14a)$$

and

$$g^{\text{non-coop}} = (1-\lambda)A - [\phi\rho/(1+\rho) + (1+\alpha\phi)\rho]\,. \qquad (14b)$$

Results are similar to the Stackelberg case with the addition of the relative power of workers (political, union, or other) that increases the share and decreases growth. We can note, however, that the effects of the discount rates and social status on the labour share and growth rate are dampened by the relative bargaining power of workers. Obviously, this comes from the fact that the non-cooperative equilibrium is a hybrid between the two extreme cases: the perfectly competitive equilibrium where workers do not have any bargaining power and the Stackelberg solution where they determine the factor allocation.

3.4 Cooperative solution

To gain tractability, and in view of the log specification of utility, the joint maximisation problem of the two parties' utilities over γ can be written:

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which leads to this outcome differs from the one here: in his framework, this result is due to a trade-off between social aspirations and the choice to bring up children.

$$\text{Max } \phi\widetilde{W}_0^W + (1-\phi)W_0^K .$$

Differentiating with respect to the labour share readily gives

$$\frac{\phi A}{(\gamma-\lambda)A-\alpha\rho} - \frac{(1+\rho)A}{\rho} = 0 .$$

This yields:

$$\gamma^{coop} = \lambda + [\phi\rho/(1+\rho) + \alpha\rho]/A , \tag{15a}$$

and

$$g^{coop} = (1-\lambda)A - [\phi\rho/(1+\rho) + (1+\alpha)\rho] . \tag{15b}$$

Accordingly, the relative bargaining power of workers still dampens the effects of the discount rate, to a lower extent than in the non-cooperative bargaining case; it does not affect the status (or "Joneses") effect. The reason for these results is that the welfare of workers is incorporated into the problem. Thus, the solution is in between the Stackelberg case and the non-cooperative bargaining equilibrium. We turn to a more formal comparison of the regimes next.

The following Proposition summarises and orders the four outcomes:

Proposition 1:

(a) In all equilibria, the labour share increases, and growth decreases, with the rate of time preference, the bargaining and political power of workers, the "catching up with the Joneses" (or status) motivation of workers, and a *decline* in productivity.

(b) The shares arising out of the various equilibria are ordered as follows:

$$\gamma^{comp} < \gamma^{coop} < \gamma^{non-coop} < \gamma^{S} .$$

(c) Correspondingly, the ordering of the growth rates is given by:

$$g^{comp} > g^{coop} > g^{non-coop} > g^{S}.$$

Proof: All clauses readily follow from inspection of (12a,b), (13a,b), (14a,b) and (15a,b). □

It should be remembered that productivity here is broadly defined to include distributional effects not explicitly considered here (see above). These results are interesting for at least two reasons. First, under the (plausible) assumption that $c_t^w < c_t^k$ (i.e. for γ low enough), there is a negative relationship between equality and growth. Formally, more bargaining power to the workers allows them to catch-up with capitalists in terms of consumption level. However, this is at the expense of a lower economic growth rate. Note that, as can be easily shown, the share of output between capitalists and workers is directly related to overall distribution in the obvious way. Second, the results depicted above raise another issue: what is the best equilibrium, or put differently, in which kind of equilibrium is the total welfare of the society (workers and capitalists) higher? This issue is dealt with in the next sub-Section.

3.5 Welfare

To answer this question, we develop the social welfare function, W_0. From equations (10) and (11b), this is given by:

$$W_0 = (1+\rho)g/\rho^2 + \beta\log[A\gamma - \alpha\rho]/\rho + (1-\beta)[\log\rho]/\rho$$

Let β denote the weight given to the welfare of workers in the social utility function, and similarly let 1-β denote the weight given to capitalists, 0<β≤1. Thus, with the size of workers fixed to unity, the size of capitalists is (1-β)/β. Note also that the welfare of workers is the simple one (10, not the objective function in the bargaining game

(11a). Accordingly, total welfare is maximum if the labour share denoted here by γ^* verifies:

$$\gamma^* = \lambda + [\beta\rho/(1+\rho) + \alpha\rho]/A \qquad (16)$$

Society's optimal labour share rises with β, the size of labour relative to the entire society. Intuitively, the "pie" that should be available to workers grows with their number. But the rise is not proportional. The optimal labour share also rises with ρ (the extent of capitalists' income) and α (the willingness of workers to catch up).

Comparison of (16) with (12a), (13a), (14a), and (15a) reveals:

Proposition 2:

(a) The competitive outcome is always suboptimal (too little labour share);

(b) The Stackelberg solution is also suboptimal for the opposite reason – too great a labour share;

(c) To give rise to the socially optimal outcome, non-cooperative bargaining requires a labour bargaining power that is greater than the labour size – essentially because the bargaining does not properly recognise workers' aspirations for catching up -, otherwise the outcome is suboptimal;

(d) Lastly, the cooperative bargain attains maximum when bargaining power equals size, $\phi=\beta$.

Proof: The reasons for these statements are as follows:

(a) $\gamma^* > \gamma^{comp} = \lambda$;

(b) $\gamma^s > \gamma^*$;

(c) This clause follows from $\gamma^{non-coop} - \gamma^* = [(\phi-\beta)\rho/(1+\rho) + (\phi-1)\alpha\rho]/A$, so that $\mathrm{sgn}\{\gamma^{non-coop} - \gamma^*\} = \mathrm{sgn}\{\phi - \beta + (\phi-1)(1+\rho)\}$;

(d) Readily obvious from (15a) and (16). □

These results are interesting if we assume for that the workers' bargaining power reflects their strength in parliament (under proportional representation). Then it becomes obvious that only the cooperative bargain will in general get us to the social optimum.

4. Implications for inflation

We now turn to a different task, namely to illustrate the usefulness of the social conflict approach for wider macroeconomic modelling, not just the issues of distribution and growth. In this Section, we analyse the implications of the model for inflation. Such a line of thinking has been developed in the heterodox (or "Post Keynesian") literature - see the references in the Introduction and Isaac (2009) for a recent exposition. The particular aim of this Section is to show how the social conflict model of this paper can inform more mainstream analyses of inflation. Recent inflation research suggests an inflation specification of the form:[7]

$$\pi_t = \theta_1 \pi_{t-1} + \theta_2 \pi_{t+1} + \psi_0 - \psi_1 u_t + \psi_2 o_t + \psi_3 (\log w_t - \log MPL_t), \tag{17}$$

where θ_1, θ_2, ψ_1, ψ_2, $\psi_3 < 0$ and $0 < \theta_1 + \theta_2 \leq 1$. A number of key parameters play a key role as follows. θ_1 introduces a lagged inflation term necessary for capturing inflation dynamics and persistence, a *sine qua non* term for the empirical performance of this equation; θ_2 introduces the lead that is derived from forward-looking price setting emphasised in the New Keynesian literature. Furthermore, and in obvious notation, ψ_0 introduces structural terms like markups and more generally market structure, ψ_1 introduces unemployment, u_t, ψ_2 the output gap, or excess demand, considerations that are cyclical in nature, o_t, and ψ_3 introduces marginal cost considerations given here by the difference between real wage, w_t, and the marginal product of labour, MPL_t, both in log form. In the steady state, ignoring the cyclical terms and dropping the time index for constant variables, the equation above may be re-written in one of two forms:

$$\pi = [\psi_0 - \psi_1 u + \psi_3 (\log w_t - \log MPL_t)]/(1 - \theta_1 - \theta_2), \tag{18a}$$

[7] Such work is reviewed at length in Kapetanios, Pearlman and Tsoukis (2007) where further references can be found.

if $\theta_1 + \theta_2 < 1$, and

$$\Delta\pi = [\psi_0 - \psi_1 u + \psi_3 (\log w_t - \log MPL_t)]/(\theta_1 - \theta_2), \tag{18b}$$

if $\theta_1 + \theta_2 = 1$. In the former case, the level of inflation is related to unemployment, supply-side considerations like marginal cost and other structural factors. In the latter case, the equation takes the well known accelerationist form whereby marginal cost feeds onto the change in inflation; in this case, it is also assumed that $\theta_1 > \theta_2$, otherwise the equation has the wrong sign. We remain agnostic here as to which of the two hypotheses holds; for evidence the reader may consult Rudder and Whelan (2006). Our point is that the social conflict view of growth and macroeconomic outcomes has implications for either, that we spell out next. In doing so, we keep unemployment, u, exogenously fixed at its long-run structural (or "natural") rate, and we investigate the effects of social conflict on inflation only via the real wage, w_t. In the next sub-Section, we shall see what happens if unemployment is endogenously determined, too.

From the definition of the labour share γ we have:

$$w_t l = \gamma y_t. \tag{19}$$

where w_t is the real wage (in levels) and l is labour allocated to output production, assumed to be of a unit mass above, but not necessarily so here. Furthermore, from the technology of production, we have:

$$MPL_t = \lambda y_t / l. \tag{20}$$

The marginal product of labour is a multiple of the average product of labour. Straightforward substitution yields:

$$w_t = \gamma MPL_t / \lambda. \tag{21}$$

The real wage is a markup over the marginal product of labour, the markup depending on the share of labour (decided through bargaining). Therefore, the inflation equation (18a or b), i.e. in the levels or accelerationist form, feeds off

$$\log w_t - \log MPL_t = \log(\gamma / \lambda) . \qquad (21')$$

Thus, the way social conflict is resolved as analysed in Section 2 affects directly inflation. Accordingly, political and labour market institutions, discount rates and degree of short- or long-termism (by individual classes and on aggregate), social aspirations (the "Joneses" effect), and industry structure like variance of firm size, as well as productivity, marginal cost, and market structure, all potentially affect inflation. In contrast, in the atomistic (monopolistically competitive) model underpinning much mainstream analysis of inflation, we have

$$w_t = (1+\mu) MPL_t , \qquad (22)$$

where $\mu>0$ is the, parametric but exogenous, monopoly power of workers relative to that of firms in the monopolistic labour and product markets; education and skills increase μ and the firm's markup decreases it. (The strict inequality takes into account the skills premia and may be argued to be the plausible case on average.) We can summarise as follows:

Proposition 3:
A range of politico-economic factors that were seen to affect the labour share also enter the determination of inflation.
Proof:
See (18a or b) coupled with (21') and the results of Section 3. □

Thus, our framework yields a much richer model of inflation, in which all the above factors that were seen to affect the labour share also pass on to the real wage as well and in turn, inflation. This is a clear improvement over both mainstream analyses of inflation, with their exclusive focus on dynamics/output gap/markup/marginal cost considerations, and on heterodox analyses like Rowthorn (1977) and the sociological theories mentioned in the introduction, which take on board such considerations but resort to auxiliary assumptions like an exogenous "target" rate of profit.

5. Implications for unemployment

We next turn to the implications for unemployment. In order to do so, we need to relax the assumption of full employment. Instead, we continue to assume an inelastic supply of labour; we do not model an endogenous supply of labour for two reasons: First, to keep things reasonably simple, but also, second, because evidence shows that only about one third of the variations in hours over the business cycle is due to the endogenous variation of hours (the "internal margin") and about two thirds is due to the adjustment along "external margin", i.e. people in and out of employment (King and Rebelo, 1999).[8]

We further need to determine how the labour share $\gamma \equiv w_t l/y_t$ is split between the real wage and employment. (This was implicitly done above by normalising labour to one.)[9] Here, we follow the standard competitive models and assume, as argued above, that the real wage is a multiple of the marginal product of labour, adjusted by the firm's monopoly power μ. Thus, we utilise equations (19), (20) and (22).[10] However, it is easy to check this combination of equations is inconsistent. To resolve this difficulty, we can proceed in two ways, either by assuming that the bargaining power of workers depends on employment, or to dispense with the Cobb-Douglas production function (1) and introduce a CES specification instead. We briefly sketch both alternatives.

The bargaining power of labour may increase with higher employment, for obvious reasons, so that we may write:

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[8] Unemployment and the associated uncertainty make the formal derivation of a consumption of an individual worker problematic. To avoid this difficulty, we assume that there exist large families of individuals. There exists perfect insurance among the individuals of each family, so that there is no individual risk; instead, each member of the family receives $w_t/(1-u)$, the real wage adjusted for unemployment, and provides a unit of labour if employed, or zero labour if unemployed. This analytical device allows the formal derivation of the workers' consumption function (2a).

[9] In Section 4 we used equations (19), (20) and l=1, a combination that produced (21).

[10] This is in a sense the polar assumption from that in Section 4. There, we set employment to unity and let the bargained share affect the wage. Here, we fix the wage and endogenise employment.

$$\phi_t = \phi_0 \phi_1(l_t),$$

where $\phi_1^{'}(\bullet) > 0$, and ϕ_0 may be interpreted as the exogenous bargaining power of labour in the social conflict. Focusing only on the non-cooperative share (14a) for simplicity, we get:

$$\gamma(l) = \lambda + \phi_0 \phi_1(l)[\rho/(1+\rho) + \alpha\rho]/\widetilde{A} = (1+\mu)\lambda . \qquad (14a')$$

The second equality equates the non-cooperative labour share to that derived from the combination of (19), (20) and (22). Employment then is implicitly set by

$$\phi_1(l) = \frac{\lambda\mu\widetilde{A}}{\phi_0[\rho/(1+\rho)+\alpha\rho]}$$

Employment is then seen to decrease with all those factors that increase the Stackelberg share, to decrease with workers' bargaining power (that pushes us towards the Stackelberg case and away from the competitive one), and finally to increase in the skills and education premia relative to the markup rates of firms.

The second possibility mentioned is to introduce an individual CES production function of the form $y_t = \left((1-\lambda)k_t^{(\sigma-1)/\sigma} + \lambda(\bar{k}_t l_t)^{(\sigma-1)/\sigma}\right)^{\sigma/(\sigma-1)}$, with σ the elasticity of substitution between capital and labour, and encompassing the well known special cases: Leontieff, $\sigma \to 0$; and Cobb Douglas, $\sigma=1$ (see e.g. Klump and Preissler, 2004). The reason for using a CES specification is that fairly strong evidence has emerged recently that of an elasticity of substitution significantly lower than unity, with a point estimate of 0.4 preferred by Chirinko, Fazzari and Meyer (2004), with US data, and Barnes, Price and Sebastia-Barriel (2006), with UK data. In this light, we modify the marginal product equation to:

$$MPL_t = \lambda(y_t / l_t)^{1/\sigma} \qquad (20')$$

If so, combination with (19) and (22) yields (taking as empirically relevant the case of σ<1):

$$l_t = y_t\left(\lambda(1+\mu)/\gamma\right)^{\sigma/(1-\sigma)}$$

Accordingly, employment increases with aggregate demand y, the markups or premia enjoyed by labour relative to firms, while it falls with the labour share and all those factors behind it. This prediction is not far off mainstream analyses of employment, but it does widen the field of relevant factors, as it includes political power and a number of sociological considerations like discount rates and impatience, social aspirations and "Joneses" effects, in addition to union organisation and the provisions of the welfare state and industry structure.

6. Conclusions

In this paper, we have present a simple model of a one-off, strategic game between "workers" and owners of capital ("capitalists") on factor shares. We embed this in a very simple "AK" model of growth. We argue that this framework delivers a richer theory of factor shares than available from existing models and yields new insights on the determination of growth as compared to models built on atomistic, non-strategically interacting, agents. Indeed, it introduces a whole host of factors that determine factor shares, in addition to the essentially technical marginal productivity parameter. These factors include the discount rate (degree of forward-lookingness), status and "catching up" motives and technology. In addition, and primarily from our point of view, there is the bargaining power of workers, manifested via a variety of labour market and political institutions (political parties and forms of political organisation, unions and welfare provisions, etc). Correspondingly, these factors affect the growth rate. These are improvements over the standard competitive formulations, as is the very fact that the capital share/profit rate affects growth. The results were stated above in detail, so we refrain from repeating them. Lastly, we show in later Sections that this framework also has important implications for inflation and unemployment.

At this stage, we think that at least two directions for future work are possible. First, it would be interesting to relax the assumption of inelastic labour supply. This may be interesting because it could be informative about key determinants of the reported difference in working hours between the US and Europe (Alesina, Glaeser and Sacerdote, 2005; Pissarides, 2007). Secondly, one could add politics (median voter, etc.) and see which of the four equilibria we analysed could be electorally supported; thus, one might contribute to the positive theory of the "social contract" (Benabou, 2000), i.e. the social and institutional arrangements that underpin and interact with macroeconomic outcomes like income distribution, factor shares, and growth. The social contract is under increasing macroeconomic attention recently, in the broad context of the attempt to endogenise (macroeconomic) "institutions" (as e.g. in Acemoglu, 2006). Our framework has the potential to allow us to contribute towards the endogenous determination of institutions; this is on the agenda for future work.

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