Optimal Taxation Policy in the Presence of Comprehensive Reference Externalities.

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Abstract.

We develop a model of optimal taxation in the presence of consumption and labour supply references that extends the model of Ljungqvist and Uhlig (2000). We show that under the assumed 'keeping up with the Joneses'-style peer-group effects in both consumption and labour supply, optimal tax on capital remains negative. However, with respect to the optimal labour tax, the first-best policy requires positive or negative labour income taxation depending on the strength of referencing in consumption relative to the strength of referencing in labour, as well as other parameters of the model. This result extends Guo (2003) conclusions. In terms of fiscal policy prescriptions, we show that the presence of combined referencing effects in consumption and labour supply, as opposed to the referencing in consumption alone, reduces the scope of Keynesian intervention.

Key Words: Reference consumption, Keeping-up with the Joneses, Taxation, Capital Tax, Labour Tax, Consumption, Fiscal Policy, Imperfect Competition, Comprehensive Reference Externality.

JEL Classification: E21, E63, H21.

1. Introduction.

Ljungqvist and Uhlig (LU, 2000) developed analysis of optimal taxation in a model with consumption externality along the lines of the 'keeping up with the Joneses' utility function. LU (2000) shows that in the absence of capital accumulation, positive consumption externality implies that the first best tax policy for labour income taxation is independent of technological shocks and equals to the strength of consumption externality. LU (2000) relies on the assumed perfect competitiveness of the production markets. As the result of this, optimal capital tax is always negative, while the optimal labour tax is always positive.

Guo (2003) extends LU (2000) to include capital and an imperfectly competitive production markets. Guo (2003) models production market by assuming that the firms producing final goods are supplied by the imperfectly competitive intermediaries. The model establishes that the optimal tax policy with respect to labour income remains independent of the productivity shock, as in LU (2000). The optimal capital tax is driven by the monopoly power. As in LU (2000) the capital tax is negative and independent of the consumption externality. In contrast with LU (2000), Guo (2003) finds that the optimal labour tax can be either positive (as in LU, 2000), zero or negative depending on the relative strength of consumption externality as compared to the monopoly power.

Both LU (2000) and Guo (2003), as indeed all of the literature on optimal taxation, consider only models with reference effects in consumption, leaving labour supply decisions to be free of the effects of either past decisions (habits models or 'catching-up with the Joneses' models) or contemporary choices of others ('keeping-up with the Joneses' models). Yet, there is no compelling reason, either mathematical or economic for such assumptions.

Gurdgiev (2004a, 2004b and 2004c) argues that the relevance and empirical applicability of the consumption referencing in the infinite-horizon representative agent models with endogenous labour supply is at the very least matched by the importance of the referencing in labour-leisure decisions of the households. Specifically, Gurdgiev (2004a) develops a model of habits in leisure, while Gurdgiev (2004b) extends this model to consideration of comprehensive habits mechanics that link both labour supply and consumption decisions within a given period to the past decisions of the households over both variables of choice.

Gurdgiev (2004c) develops analysis of the comprehensive external habits model in the context of labour income and consumption taxation. The presence of dual referencing through comprehensive habits implies in Gurdgiev (2005) significant changes in the taxation effects on the model. As shown in Gurdgiev (2004a, 2004b and 2004c), referencing to consumption alone implies labour supply dynamics that cannot be matched by the data. Comprehensive referencing to both consumption and labour/leisure components of the within period utility function alleviates this problem.

In the spirit of Gurdgiev (2004b, 2004c), we extend the LU (2000) and Guo (2003) models to include consideration of the keeping-up-with-the-Joneses mechanism in both consumption and labour supply decisions of the households. In the following we show that inclusion of referencing in labour supply decisions in addition to the more traditional referencing of consumption introduces several important new dimensions to the literature on optimal taxation and fiscal policies. In general, Guo (2003) discusses the role of interactions between the consumption externality and the severity of the market imperfection in the determination of the optimal fiscal policies. The present study conducts a similar exercise by discussing the role of consumption externality interaction with labour effort externality and the effect of labour externality interaction with product markets imperfection.

The paper is organised as follows. Section 2 below develops a model of external referencing in both consumption and labour supply along the lines of the 'keeping-up with the Joneses' mechanics. Section 3 derives optimal taxation policy and discusses the effects of various externalities and product markets imperfection on fiscal policy. Section 4 concludes.

2. Model.

2.1. Firms.

Firms in the economy produce a single unique consumption good, y_t that is produced using a continuum of intermediate inputs, y_{it}, $i \in [0,1]$. Production technology is Dixit-Stiglitz with constant returns to scale:

$$y_t = \left(\int_0^1 y_{it}^{1-\eta} \right)^{\frac{1}{1-\eta}} \tag{1}$$

where $\eta \in [0,1)$ denotes pricing power of the intermediate goods producers and the inverse of the absolute value of the price elasticity of demand for y_{it}. Thus, for $\eta = 0$, the intermediate inputs are perfect substitutes and the intermediate inputs production is perfectly competitive. Condition $\eta = 0$ is equivalent to zero-profit condition in the sector. If $\eta > 0$, producers of intermediate inputs face downward sloping demand curve. In this case, producers of intermediate inputs earn positive profit which is distributed to the households as π_t.

Assuming that final goods sector is perfectly competitive, the first order condition for the firm producing final good is:

$$y_i = y_{it} p_{it}^{1/\eta} \tag{2}$$

Above, p_{it} denotes price of intermediate good relative to the price of final good.

We further assume that all intermediate goods are produced using shared technology that utilises two factors of production (both traded in perfectly competitive markets): capital, k_{it}, labour l_{it} and is subject to the common aggregate technological shocks z_t:

$$y_{it} = z_t k_{it}^{\theta} l_{it}^{1-\theta} \tag{3}$$

for $0 < \theta < 1$ denoting the standard share of specific physical capital in production of intermediate input *i*. Then by (3), factor prices (the rental rate of capital and the wage rate) are given by:

$$r_t = \frac{\theta(1-\eta) p_{it} y_{it}}{k_{it}} \tag{4}$$

$$w_t = \frac{(1-\theta)(1-\eta) p_{it} y_{it}}{l_{it}} \tag{5}$$

In symmetric equilibrium factor price equalisation applies across the intermediate goods sector, so that

$$p_{it} = p_t = 1 \qquad k_{it} = k_t \qquad l_{it} = l_t \tag{6}$$

and the aggregate production function is given by

$$y_t = z_t k_t^{\theta} l_t^{1-\theta} \tag{7}$$

Substituting these conditions into equations (4) and (5) we get:

$$r_t = \frac{\theta(1-\eta) y_t}{k_t} \tag{8}$$

$$w_t = \frac{(1-\theta)(1-\eta)y_t}{l_t} \tag{9}$$

$$\pi_t = \eta y_t \tag{10}$$

Equations (8)-(10) imply that the share of national income arising from profits earned by the intermediate sector is given by the factor determining the monopoly power of firms in the sector, η. If $\eta > 0$, equilibrium factor prices for capital and labour are below their marginal product values. Hence, capital and labour yield rates of return equal to their social value only under the assumption that intermediate sector is perfectly competitive, i.e. $\eta = 0$. The above results reproduce Guo (2003) and set the model for firms' behaviour.

2.2. Households: Motivating Comprehensive Referencing.

Gurdgiev (2004 a, b, c) argue that standard models of consumption referencing, even when extended to include endogenous labour supply, fail to capture the nature of the dynamic behaviour of labour supply / leisure demand.

Behavioural economics provides a general justification for the 'keeping up with the Joneses' effects in consumption. For example, Kadushin (2002) discusses the argument that any effective social network will lead to the motivation of a referencing behaviour in consumption, consistent with the 'keeping up with the Joneses'. In an intuitive justification of the representative agent framework, Kadushkin states that the referencing mechanism applies to the case of keeping up with the Joneses similar to the specific agent. The author states that:

> *'Keeping up with the (equivalent) Joneses' as a consequence of efficacy motives is an attribute of the situations with many structural holes… These motivations are necessary when the costs are high, when the visibility is low, when the discount rate on future returns is high and when one may not be in moral command – in short, in situations in which the modern market is predominant. In such situations, actors attempt at least to keep up with, and at best surpass, others with whom they are structurally similar.* (Kadushkin, 2002, pages 84-84)

Note that nothing in the preceding precludes the extension of the referencing mechanism to labour supply or leisure demand. Indeed, given the evidence on persistency of labour supply and leisure demand, surveyed in Gurdgive (2004a), such an extension appears to be natural.

In terms of specific motivations for the referencing of individual consumption, as in the 'keeping up with the Joneses', Lettau and Uhlig (1995), Ljugnqvist and Uhlig (1996), Mauer and Meir (2003) and Ravina (2004), among many others, provide reviews of the relevant literature. In particular, Mauer and Meir (2003) consider empirical evidence on peer-group and correlated effects in consumption in the standard model of consumption referencing in absence of labour supply decisions. The study finds no evidence of peer-group consumption referencing using PSID data. Thus, overall, there is inconclusive evidence concerning the 'keeping up with the Joneses' effects in consumption. However, this does not warrant a similar conclusion concerning the peer-group referencing with respect to labour supply.

Finally, Lalive (2003) considers peer-group referencing in behaviour of the unemployed agents in the case of Austria. Lalive (2003) presents theoretical and empirical arguments establishing the relevance of the labour supply decision referencing at micro data level.

To summarise, the following findings reinforce our decision to model peer-effects in both consumption and labour supply simultaneously:

- Extensive theoretical literature on referencing in consumption warrants inclusion of this mechanism in our model;
- Presence of interaction effects between consumption and labour supply implies that Gurdgiev (2004 a, c) critique of referencing-in-consumption models holds, so that there is a significant scope for considering consumption-referencing models to be inadequate in their ability to capture labour-supply dynamics;
- There is no theoretical justification for not allowing referencing in labour supply, while there is significant theoretical reasons for doing so, as shown in Gurdgiev (2004c);
- Referencing in labour supply is shown empirically valid in Lalive (2003).

2.3. Household Optimisation.

Assume identical infinitely lived households endowed with one unit of time and maximising the life-time utility over consumption and labour effort given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{\left(c_t - \alpha C_t\right)^{1-\sigma}}{1-\sigma} - A \frac{\left(l_t - \varepsilon L_t\right)^{1+\gamma}}{1+\gamma} \right] \tag{11}$$

where

$0 < \beta < 1; \quad 0 \le \alpha < 1; \quad 0 \le \varepsilon < 1; \quad \sigma > 0, \quad \sigma \neq 1; \quad A > 0; \quad \gamma \ge 0$

In (11), C_t denotes the contemporaneous aggregate consumption in the economy, while L_t refers to the contemporaneous aggregate labour hours supplied. With respect to consumption component, the specification in (11) represents the case of a standard 'Keeping-up with the Joneses' utility function. This is consistent with Ljungqvist and Uhlig (LU, 2000) and Guo (2003), assuming that $\varepsilon = 0$. For $\varepsilon > 0$, specification (11) is consistent with the external referencing mechanism ('keeping-up with the Joneses') applying to both components of the utility function.

Thus, our model represents two departures from LU (2000). First, we assume, as in Guo (2003) that $\gamma \ge 0$, while LU (2000) consider only the case of $\gamma = 0$, i.e. the case of a utility function that is linear in labour effort. Second, in contrast with both LU (2000) and Guo (2003) we assume that $\varepsilon \ge 0$ which implies that households use the aggregate level of labour effort supplied in the economy as a referencing point for their own decisions concerning labour supply / leisure demand.

With respect to the effect of the 'keeping up with the Joneses' mechanism on the consumption component of the utility function, for any level of $0 < \alpha < 1$, the marginal utility of the household with respect to own consumption is increasing in the aggregate consumption. This corresponds to the positive consumption externality, whereby added personal consumption acts to increase the social value of the aggregate consumption as well. In other words, any given household treats the consumption level of other households as a compliment to their own consumption. The same reasoning applies to the case of disutility of hours of labour supplied, so that when $0 < \varepsilon < 1$, any decision by an individual household to supply more hours of work will create a negative externality on other households through an increase in the aggregate hours worked.

As standard we specify the representative household's budget constraint subject to capital and labour income taxes (given by τ_{Kt} and τ_{lt} respectively), and tax revenue transfers T_t as:

$$c_t + k_{t+1} - (1-\delta)k_t = (1-\tau_{lt})w_t l_t + (1-\tau_{Kt})(r_t k_t + \pi_t) + \tau_{Kt}\delta k_t + T_t \qquad (12)$$

where δ is the rate of physical depreciation of capital. Thus term $\tau_{Kt}\delta k_t$ captures standard physical capital depreciation deduction present in the majority of the tax codes.

The government sets both tax rates subject to the balanced budget constraint:

$$T_t = \tau_{lt} w_t l_t + \tau_{Kt}\left(r_t k_t + \pi_t - \delta k_t\right) \tag{13}$$

so that the overall resource constraint for economy is given by

$$c_t + k_{t+1} - (1-\delta)k_t = y_t \tag{14}$$

2.4. Competitive Equilibrium.

Households maximise (11) subject to (12). Denoting by λ_t the shadow value of the budget constraint, the first order conditions for the optimum are:

$$\left(c_t - \alpha C_t\right)^{-\sigma} = \lambda_t \tag{15}$$

$$\frac{A}{\lambda_t}\left(l_t - \varepsilon L_t\right)^{\gamma} = \left(1-\tau_{lt}\right)w_t \tag{16}$$

$$\lambda_t = \beta E_t\left\{\lambda_{t+1}\left(1+\left(1-\tau_{Kt+1}\right)\left(r_{t+1}-\delta\right)\right)\right\} \tag{17}$$

$$\lim_{t\to\infty} E_0\left[\beta^t \lambda_t k_{t+1}\right] = 0 \tag{18}$$

In equilibrium, under the assumption of homogeneous households, $c_t = C_t$ and $l_t = L_t$, so that

$$(1-\alpha)^{-\sigma} c_t^{-\sigma} = \lambda_t \tag{19}$$

and

$$l_t = \frac{\left(1-\tau_{lt}\right)^{1/\gamma}(1-\alpha)^{-\sigma/\gamma} w_t^{1/\gamma}}{A^{1/\gamma}(1-\varepsilon)} c_t^{-\sigma/\gamma} \tag{20}$$

2.5. Pareto Optimum.

To find the Pareto optimal choice of tax policy, set $c_t = C_t$ and $l_t = L_t$ in the utility function (11) and maximise the resulting social planner function subject to the aggregate production function (7) and the aggregate economy wide resource constraint (14). Denoting by μ_t the shadow value of the aggregate resource constraint, the first order conditions for the social planner problem are:

$$(1-\alpha)^{1-\sigma} c_t^{-\sigma} = \mu_t \tag{21}$$

$$\frac{A}{\mu_t}(1-\varepsilon)^{1+\gamma} l_t^{\gamma} = (1-\theta)\frac{y_t}{l_t} \tag{22}$$

$$\mu_t = \beta E_t\left\{\mu_{t+1}\left[1-\delta+\frac{\theta y_{t+1}}{k_{t+1}}\right]\right\} \tag{23}$$

$$\lim_{t\to\infty} E_0\left[\beta^t \mu_t k_{t+1}\right] = 0 \tag{24}$$

Comparing the results of the social planner solution with the competitive equilibrium, by equations (21)-(23) and (15)-(17), we have the following result.

Proposition 1. In the presence of consumption externality, i.e. $\alpha > 0$, equilibrium level of household consumption is above the Pareto optimal level. Also, competitive equilibrium labour supply is below the Pareto optimal level, whenever the intermediate goods sector is monopolistic, i.e. $\eta > 0$. The presence of labour externality ($\varepsilon > 0$) in addition to the consumption externality ($\alpha > 0$), further lowers competitive equilibrium labour supply relative to the Pareto optimum, without further distorting the household's consumption decisions.

Proof: directly from equations (15) and (21) for consumption, and equations (22) and (16) for labour supply.

3. First-Best Fiscal Policy

Proposition 2. The first-best policy implementing Pareto optimal allocation is given by:

$$\tau_{lt}^* = \frac{\alpha - \varepsilon(1-\eta) - \eta}{(1-\eta)(1-\varepsilon)} \tag{25}$$

$$\tau_{Kt}^* = -\frac{\eta r_t}{(1-\eta)(r_t - \delta)} \tag{26}$$

$$T_t^* = y_t\left\{\frac{\alpha - (1-\eta)\varepsilon - \eta}{(1-\varepsilon)}(1-\theta) - \frac{\eta}{r_t - \delta}\left(r_t\frac{\theta(1-\eta)+\eta}{1-\eta} - \delta\theta\right)\right\} \tag{27}$$

Proof: directly from solutions for competitive equilibrium and Pareto optimum.

Equations (25) and (26) provide the source for analysis of the effects of comprehensive referencing on the optimal tax policy.

First, with respect to the results of LU (2000) and Guo (2003), as is clear from equation (25), the optimal labour tax is negative whenever consumption externality is sufficiently strong. If $\alpha > \eta + \varepsilon(1-\eta)$, so that the social effect of personal consumption increase (α) is higher than the combined effect of the negative externality from work effort, adjusted for the tax on monopoly profits ($\varepsilon(1-\eta)$), plus the direct measure of monopoly power in the intermediate goods production (η), then the optimal fiscal policy involves positive taxation of labour. In the case of LU (2000) and Guo (2003) this effect vanishes whenever the intermediate goods markets are perfectly competitive ($\eta = 0$). In our case the effect does not vanish even under the above assumption, since $\tau^{*}_{lt}|_{(\eta=0)} >,< 0$ whenever $\alpha >,< \varepsilon$. This effect is entirely novel to our model.

Second, we can conclude that in our case the first-best tax on labour is always below that of the LU (2000) and Guo (2003).

Third, the optimal tax on capital is always negative and independent of consumption and labour supply externalities, confirming the results of Guo (2003).

Finally, from equation (27) we can conclude that the tax revenue in our case will be higher (lower) than in the case of Guo (2003), whenever consumption externality is stronger (weaker) than labour effort externality.

4. Conclusions.

We extend Guo (2003) model of optimal taxation by considering the effects of consumption and labour supply externalities in the presence of market imperfections. As shown above, the presence of labour supply externality of the 'keeping up with the Joneses' variety implies that (1) First-best tax on labour:

- First-best tax on labour is independent of technology shock (the result consistent with Ljungqvist and Uhlig (2000) and Guo (2003);
- First-best tax on labour is negative whenever consumption externality is weak relative to the joint complimentary effects of market imperfection and of labour supply externality (this represents strengthening of the Guo (2003) result);

- First-best tax on labour is zero, whenever the effect of consumption externality is offset by the complimentary effects of markets imperfection and labour supply externality;
- In the absence of production markets imperfection (as in Ljungqvist and Uhlig (2000)), presence of labour supply externality implies that the optimal tax on wages can be positive or negative (the result that contradicts Guo (2003) and Ljungqvist and Uhlig (2000));
- In all cases, the optimal labour income tax is decreasing in labour supply externality;
- Optimal labour income tax is increasing in the strength of consumption externality at a higher rate in the case of labour externality than in the cases of Guo (2003) and Ljungqvist and Uhlig (2000).

These results have the following policy implications. Guo (2003) suggests that in the presence of consumption externality and market imperfections, negative tax on capital income and positive tax on labour income can be used to simultaneously internalise consumption externality and generate boost in savings and investment in the economy. This result hinges on the assumption that the effect of labour income tax on household behaviour is governed by the two *opposing* forces. According to Guo (2003), setting positive wage tax allows to eliminate consumption externality, while a wage tax subsidy closes the wedge between the marginal product of labour and the wage rate.

In the presence of labour supply externality this clear-cut distinction between the two effects is reduced. In addition to the above effects, positive tax on work effort implies a negative effect on the aggregate hours supplied, exacerbating the effects of labour supply externality. Thus, closing consumption externality via a higher rate of labour income taxation may result in a strengthening of the effects of work effort externality. Thus the effectiveness of positive taxation of work effort is reduced in our model relative to Guo (2003). At the same time, a negative tax (subsidy) to labour implies simultaneous closing of the wage-marginal product gap *and* internalising the labour supply externality. Although this policy achieves simultaneous worsening of consumption externality (preventing the emergence of the negative labour income tax as the unique first-best solution), the result is that in all cases optimal labour taxes are lower in the presence of labour externality than in Guo (2003) or Ljungqvist and Uhlig (2000).

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