Taxation and Globalization

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Abstract

The decline of capital taxation is associated with efficiency gains. We show that, when agents are heterogeneous, equity concerns can change the policy recommendation driven by efficiency. Given the empirical evidence on the roots of heterogeneity inside each country, either in developing or developed economies, the elimination of capital taxation would lead always to a decline in inequality and to an increase of welfare of the poorest, in a small open economy acting unilaterally. On the contrary for a group of open economies following the same policy, the opposite occurs: with the elimination of capital taxation inequality worsens and it hurts the poorest of each country. Therefore globalization can be important to support a positive tax on capital.

Keywords: Capital taxation; Incidence; Globalization of capital markets; Policy coordination;

JEL: D63; E62; F42;

1   Introduction

That a decline of the tax rate on capital income in the steady state has a positive effect in the efficiency of the economy is a well known result since the work of Chamley (1986) and Judd (1985). However that second best solution of not taxing capital has not been taken seriously by policy makers. One reason invoked, among others, is the regressive characteristic of the elimination of the tax on capital income, when accompanied by the increase of the tax rate on labor income, if the same pattern of government expenditures

has to be financed. In short, either from a positive point of view, or from a normative without additional redistribution instruments, transforms the robust policy recommendation of eliminating the tax on capital into a weak on, if that change of policy is accompanied by a decline of the welfare of the poorest households in the economy. This assertion on the decrease of equity is usually based on a partial equilibrium reasoning: the reduction of the tax on capital and the increase of the tax on labor income increases the return on capital and declines the return on labor and therefore benefits the upper income agents and worsens-off the situation of the lower income agents.

This article shows, using a general equilibrium framework, that the effect on equity caused by the elimination of the tax on capital depends mainly on the joint distribution of characteristics that determine the society' heterogeneity and on the degree of effective international mobility of capital, for the economy under study. In the case of a small open economy, with perfect capital mobility, that decides unilaterally to change policy, the positive effect on efficiency of the elimination of the tax on capital income is maximized and it is shown that the effect on equity is always positive for the existing empirical evidence on heterogeneity. However in an economy where the elimination of capital taxation leads to a transitional period, either because the economy is closed to capital movements, or because the change in policy has a small effect on capital inflows, it is no longer in general guaranteed that the elimination of the capital taxation is equity improving. On the contrary we show that here, for the empirical relevant heterogeneity, the decline in equity given the policy change is the rule. Besides, as claimed in Chari, Christiano and Kehoe (1994) in this case the increase in efficiency of applying the second best solution of capital taxation is mainly driven from the high tax rates in the initial periods. This implies that, the simple elimination of capital taxation has a smaller effect on efficiency, and can even being negative for special parametrization. Both the low effect on efficiency and the negative effect on equity lead in this case to a loss to the poorest of the economy.

Therefore, if some equity concerns or political economy ingredients are included in the analysis, the desirability to decline or even to eliminate capital taxation depends crucially on the effective mobility of capital, given the change of policy.

We consider an economy with infinitely lived households[1]. The house-

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[1]Since accounting for the distribution of wealth is fundamental to assessing the con-

holds in our model economy differ in initial wealth and in labor efficiency. Since we assume those distributions to be exogenous, we can replicate exactly the particular moments of the wealth- and earnings-distributions that are crucial to assessing the effects of the tax reform.[2]

The exogenous distributions of initial wealth and labor efficiency, as well as the conditions for Gorman aggregation, i.e. that there is a representative agent, considerably simplify the computation of the aggregate general equilibrium effects. These assumptions allow us to perform the exercise without a full characterization of the joint distribution of wealth and earnings. The exercise can be developed using only a subset of the moments of those distributions. To measure the effects of the reform, we compare welfare distributions before and after the reform. The method used is the one developed in Correia (1999) to analyze distributional effects on models with heterogeneous households, and applied in Correia (2010) to study the effect on equity of the introduction of consumption taxation.

Our exercise is quite different from the one developed in Judd (1985). That work assumes the existence of idiosyncratic taxes. On the contrary in the present work we want exactly to analyze a world where the government does not have enough information to use those household specific taxes. We do not determine the optimal plan but we limit our analysis to the effect on equity of a policy measure that is efficient. There are two articles in the literature near ours. One is the well known result of Harberger (1995), where it is shown that wages decline due to an increase of the tax of capital in a general equilibrium model of a small open economy. This is a different exercise from ours since it assumes that the change in tax revenue distributed lump sum, and the tax on labor is maintained. The second article is the one by Garcia-Milá, Marcet and Ventura (2010). There a closed economy model of heterogeneous agents is developed, with preferences such that there is no representative agent. They find that the poor agents are worse off after the

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sequences of this tax reform, typical overlapping-generation models cannot replicate our results. For an explanation see, e.g., Ana Castañeda, Javier Diaz-Giménez, and Jose-Vitor Rios-Rull, (2003).

[2]In the model, households belong to the same group if they share the same earnings/wealth ratio, and are thus affected in a similar way by the tax reform. Other studies, such as Per Krusell and Jose-Vitor Rios-Rull (1996), use similar partitions of the population. Taxes are used to finance transfers, but transfers are endogenous, and part of a political equilibrium.

elimination of the tax on capital income, when total tax revenues are made constant by the increase the tax on labor income. The results in our paper clarify the apparent contradiction existent on the results of these two works.

The paper proceeds as follows: In section 2 the model of the small open economy is presented. In section 3 the exercise is described and the results are derived for that economy. Section 4 extends the model to a closed economy and discusses the importance for the results of having a real interest rate endogenous to the change of policy. Section 5 contains the conclusions.

2 The model

The model represents a small open economy with perfect capital mobility. The technology is characterized by a neoclassical production function using as inputs capital, K, and labor measured in units of efficiency, EN, where N represents hours of work and E is an index of labor efficiency. The government spends a constant flow of per capita expenditures, G, and taxes labor and capital income, at the origin, at the tax rates τ_n and τ_k, respectively. The assumption that the system of taxing capital income is the territorial system implies that the income of external assets held by domestic households, B^*, is not subject to taxation. The real net return of these assets is the net international real interest rate, r^*. This constant rate is the one that characterizes the steady state of the rest of the world, which we assume to have fundamentals identical to the small economy. These assumptions imply that, with no costs of adjustment of capital, the economy will converge immediately to the new steady state, following the change of policy.

Agents are heterogeneous in labor efficiency and in non-human wealth. Each household i has a labor efficiency level measured by E_i and holds wealth in physical capital, K_i, domestic bonds, B_i and external assets B_i^*. Agents are identical in every other characteristic. To apply the method described in Correia (1999) we assume that preferences are such that Gorman aggregation is possible. Moreover, given cross section empirical evidence, we propose the type of preferences used in Greenwood, Hercowitz and Huffman (1988) (GHH), which are characterized by a zero wealth effect on labor decisions. This characteristic implies that rich households do not work less than poor households, when having the same labor efficiency.

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Then preferences of household i can be represented by[3]

$$U_i = \sum_{t=0}^{\infty} \beta^t \frac{(C_{it} - \chi N_{it}^{\varphi})^{1-\sigma}}{1 - \sigma}, \quad \chi > 0, \varphi > 1 \qquad (1)$$

where C_{it} and N_{it} represent the consumption and hours of work of agent i in period t.

The intertemporal budget constraint of this household can be written as:

$$\sum_{t=0}^{\infty} \frac{C_{it}}{(1 + r_o)(1 + r^*)^t} = \sum_{t=0}^{\infty} \frac{w_t E_i N_{it}}{(1 + r_o)(1 + r^*)^t} + A_{i0} \qquad (2)$$

where r_0 is the net rate of return in period zero, w_t is the net wage rate at period t and A_{i0}, the initial wealth, is defined as $K_{i0} + B_{i0} + B_{i0}^*$. It is straightforward to verify that the optimal choice of hours is given by:

$$N_{it} = \left(\frac{E_i w_t}{\chi \varphi}\right)^{\frac{1}{\varphi - 1}} \qquad (3)$$

So it is clear that hours of work do not differ across agents when these have the same level of efficiency. When richer agents have a higher level of labor efficiency, they will work more than poor agents. Substituting this expression in the utility function (1) and in equation (2) allows to redefine the optimal choice of consumption as:

$$MAX \; U_i = \sum_{t=0}^{\infty} \beta^t \frac{\left(C_{it} - \overline{C_{it}}\right)^{1-\sigma}}{1 - \sigma} \qquad (4)$$

subject to:

$$\sum_{t=0}^{\infty} \frac{C_{it} - \overline{C_{it}}}{(1 + r_0)(1 + r^*)^t} = \sum_{t=0}^{\infty} \frac{(E_i w_t)^{\frac{\varphi}{\varphi - 1}}}{(1 + r_0)(1 + r^*)^t} \frac{(1 - \frac{1}{\varphi})}{(\chi \varphi)^{\frac{1}{\varphi - 1}}} + A_{i0} \qquad (5)$$

where

$$\overline{C_{it}} = \chi \left[\frac{E_i w_t}{\chi \varphi}\right]^{\frac{\varphi}{\varphi - 1}} \qquad (6)$$

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[3]The qualitative result on equity is maintained with different preference representations.

Note that preferences are homogeneous in $\widehat{C}_{it} \equiv C_{it} - \overline{C}_{it}$. Given the isoelastic preferences described in (4) and since the international real interest rate is at the steady state level, $r^* = \frac{1}{\beta} - 1$, then $\widehat{C}_{it} = \widehat{C}_i$, i.e., the transformed consumption is constant over time. The intertemporal budget constraint, given by equation (5), allows for the determination of the optimal level of this variable for every household i as a function of the net wages path, the international real interest rate, the interest rate at time zero and its level of labor efficiency and of initial wealth.

We can write

$$\widehat{C}_i = \frac{r^*}{1+r*} \left[\sum_{t=0}^{\infty} \frac{(E_i w_t)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t} \frac{\left(1 - \frac{1}{\varphi}\right)}{(\chi\varphi)^{\frac{1}{\varphi-1}}} + (1+r_0)A_{i0} \right] \qquad (7)$$

The general equilibrium of this economy is characterized by equations (3) and (7) for the representative agent, $i = r$, non-Ponzi game conditions for the external debt, and the following equations:[4],[5]

$$Y_t = F(K_t, E_r N_{rt}) = C_{rt} + G + K_{rt+1} - (1-\delta)K_{rt} + B^*_{rt+1} - (1+r^*)B^*_{rt}$$

$$A_{r0} = K_{r0} + B^*_{r0} \equiv \frac{1}{M} \sum_{i=0}^{M} K_{i0} + \frac{1}{M} \sum_{i=0}^{M} B^*_{i0}$$

$$E_r \equiv 1$$

$$\frac{1+r^*}{r^*}G = \tau_n \sum_{t=0}^{\infty} \frac{F_{2t} N_{rt}}{(1+r^*)^t} + \sum_{t=0}^{\infty} \frac{\tau_{kt}(F_{1t}-\delta)K_{rt}}{(1+r^*)^t}$$

$$r_0 = (1-\tau_{k0})(F_{10}-\delta)$$

$$r^* = (1-\tau_{kt})(F_{1t}-\delta), \ t \geq 1$$

$$w_t = (1-\tau_n)F_{2t}$$

The representative agent is the household with the weighted average labor efficiency level of the economy[6] and with the average stock of initial

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[4]For simplicity we impose that the initial government debt is zero.

[5]We will represent the parcial derivative of function $F(.)$ in order to the ith argument as F_i.

[6]We choose units such that this average efficiency level is one.

non-human wealth. Given preferences and technology, as well as the initial average stock of physical capital and of external assets, and given policy instruments $(G, \tau_n$ and $\tau_{kt})$ the general equilibrium of this small open economy can be computed. The efficiency of the economy is measured by the utility of the representative agent given equilibrium prices. The linear homogeneous utility of every agent can be easily computed substituting the equilibrium price vector and the idiosyncratic labor efficiency and initial wealth in (7).

3 Elimination of the capital income tax

The objective of this article is to compare the welfare distribution of agents in case 1, where the economy is characterized by a constant positive tax rate on capital, with the alternative situation, case 2, where the economy is characterized by that same tax in period zero but with a zero tax rate on capital afterwards. In Correia (1996) we prove that case 1 is the second best solution. Then, case 2 is always more efficient than case 1, i.e. the utility of the representative agent is higher in 2 than in 1

To avoid problems of cardinality when comparing utility across experiences and across agents we use the compensation consumption criteria, i.e. the percentage change in transformed consumption, $\widehat{C}$, that each agent should experience to be as well off in both situations. This is equivalent to choose as utility indicator the defined variable $\widehat{C}_i$, that is the transformed consumption of agent i.

The effect on efficiency, or the effect on utility of the representative agent, $i = r$, can be measured by comparing

$$\widehat{C}_r = \frac{r^*}{1+r*} \left[\sum_{t=0}^{\infty} \frac{(w_t)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t} \frac{(1-\frac{1}{\varphi})}{(\chi\varphi)^{\frac{1}{\varphi-1}}} + (1+r_0)A_{r0} \right] \tag{8}$$

across policies. As we said efficiency is higher in case 2, or:

$$\sum_{t=0}^{\infty} \frac{(w_t^2)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t} \frac{(1-\frac{1}{\varphi})}{(\chi\varphi)^{\frac{1}{\varphi-1}}} + (1+r_0^2)A_{r0} > \sum_{t=0}^{\infty} \frac{(w_t^1)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t} \frac{(1-\frac{1}{\varphi})}{(\chi\varphi)^{\frac{1}{\varphi-1}}} + (1+r_0^1)A_{r0} \tag{9}$$

where x^1 and x^2 represent respectively the equilibrium values of x in the case 1 and 2.

As the tax on capital income is constant in both experiments for $t \geq 1$, the non-arbitrage condition and the neoclassical production function implies that $\frac{K_r}{N}$, and therefore the marginal productivity of labor, is constant for $t \geq 1$. The constant labor income tax rate then leads to a constant net wage for $t \geq 1$ in every experiment.

For $t = 0$ and using f.o. c.

$$w_0 = (1 - \tau_n)F_{20}\left(\frac{K_{r0}}{N_0}\right)$$
$$N_{r0} = \left(\frac{w_0}{\chi\varphi}\right)^{\frac{1}{\varphi-1}}$$

we can write

$$\chi\varphi N_{r0}^{\varphi-(1-\alpha)} = (1 - \tau_n)(1 - \alpha)K_{r0}^{\alpha}$$

As $\varphi > 1$, then $\varphi - (1 - \alpha) > 0$, and since $\tau_n^2 > \tau_n^1$, then $N_{r0}^2 < N_{r0}^1$ and $w_0^2 < w_0^1$. $\frac{K_{r0}}{N_{r0}}$ increases with the higher tax on labor. By assumption $\tau_{k0}^1 = \tau_{k0}^2$. Therefore we obtain:

Result 1: The elimination of the tax rate on capital income implies that the net real interest rate in period 0 declines, i.e. $r_0^2 < r_0^1$.

Using (9) and result 1 we can say that:

Result 2: The elimination of the tax rate on capital income implies that:

$$\sum_{t=0}^{\infty} \frac{(w_t^2)^{\frac{\varphi}{\varphi-1}}}{(1 + r^*)^t} > \sum_{t=0}^{\infty} \frac{(w_t^1)^{\frac{\varphi}{\varphi-1}}}{(1 + r^*)^t} \tag{10}$$

These two results explain that, for the representative agent, utility increases not due to the return on capital, which declines, but due to the net present value of human capital, which increases although being taxed at a higher rate.

To understand the effects on different agents, we order households by increasing transformed consumption, or utility. If $i > j$, agent i is richer, that

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is it has a higher utility than agent j. Then to compare policy 1 with policy 2 in terms of equity we use the concept developed by Marshall and Olkin (1979): the relative differential dominance. [7] This concept is equivalent to an ordering of distributions of transformed consumption across households by the first order stochastic dominance criteria.

Definition: Policy 2 is equity improving in relation to policy 1 iff policy 2 dominates policy 1 in relative differential, that is :

$$\frac{\widehat{C}_i^2}{\widehat{C}_j^2} < \frac{\widehat{C}_i^1}{\widehat{C}_j^1}, \text{ for } i > j \tag{11}$$

To determine the effect on equity of the elimination of the tax on capital income let us consider two extreme cases: One where agents have identical non-human wealth, i.e. $A_{io} = A_{ro}$, and where the heterogeneity comes just from different labor efficiency levels. On the other extreme agents have identical labor efficiency levels, i.e. $E_i = E_r = 1$, and are differentiated only by different initial levels of non-human wealth.

Note that, using the definition of $\widehat{C}_i$ given in (7), in both extreme cases the transformed consumption, and therefore utility, is the sum of two items: one that is homogeneous across agents and a second one that differentiates agents.

Using (7), we check whether condition (11) is satisfied, after the results 1 and 2. When heterogeneity is in labor efficiency, condition (11) is equivalent to

$$\frac{1 + r_0^2}{\sum_{t=0}^{\infty} \frac{(w_t^2)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t}} > \frac{1 + r_0^1}{\sum_{t=0}^{\infty} \frac{(w_t^1)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t}}$$

On the other side when heterogeneity is caused by different initial financial wealth, condition (11) implies the opposite condition, that is:

$$\frac{\sum_{t=0}^{\infty} \frac{(w_t^2)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t}}{1 + r_0^2} > \frac{\sum_{t=0}^{\infty} \frac{(w_t^1)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t}}{1 + r_0^1}$$

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[7]We show in Correia (1999) that this criteria of comparisons includes the Lorenz criteria. It is equivalent to the Lorenz criteria, or to a first-order stochastic dominance criteria, for any sub-groups of the population.

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Therefore we can state that:

Result 3: The effect on equity of the elimination of the tax on capital depends crucially on the roots of heterogeneity: is equity worsening when agents differ on labor efficiency and, on the contrary, is equity improving when agents differ by the initial stock of financial wealth.

We can easily interpret result 3 in the following way: Individual welfare depends on two items: the present value of a function of net wages, which by result 2 increases with the elimination of capital taxation, and the initial wealth of every agent evaluated at $(1 + r_0)$, which by result 1 declines with the change of policy. In the extreme cases described in result 3, depending on the characterization of households, either the first or the second parcel is homogeneous across households. So, in the case where agents differ by labor efficiency, the first parcel is heterogeneous across households and the second is homogeneous . The opposite occurs when agents are differentiated exclusively by the initial stock of financial wealth.

Because the effect of the elimination of capital taxation on equity depends completely on the roots of households heterogeneity, the question proposed in this section is an empirical one. Cross section data tells us that both wealth and earnings are not equally distributed across households, and that either of the two extreme characterizations above are not plausible empirically. If both these two dimensions characterize the household, we can state that:

Proposition 1[8]: Policy 1 dominates policy 2, if:

a) $\dfrac{\sum_{t=0}^{\infty} \frac{(w_t^2)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t}}{1+r_0^2} \geq \dfrac{\sum_{t=0}^{\infty} \frac{(w_t^1)^{\frac{\varphi}{\varphi-1}}}{(1+r^*)^t}}{1+r_0^1}$ and

b) $\dfrac{E_i^{\frac{\varphi}{\varphi-1}}}{A_{i0}} \leq \dfrac{E_j^{\frac{\varphi}{\varphi-1}}}{A_{j0}}$ for all i and j such that $\widehat{C}_j < \widehat{C}_i$.

Proof. We can rewrite relative utilities as:

$$\frac{\widehat{C}_i}{\widehat{C}_j} = \frac{A_{i0}}{A_{j0}} \frac{[\alpha(p)/\gamma(p)] \frac{E_i^{\frac{\varphi}{\varphi-1}}}{A_{i0}} + 1}{[\alpha(p)/\gamma(p)] \frac{E_j^{\frac{\varphi}{\varphi-1}}}{A_{j0}} + 1}. \tag{12}$$

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[8]This is Proposition 2 in Correia (2010).

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where $\alpha\left(p\right)/\gamma\left(p\right)=\sum_{t=0}^{\infty}\frac{(w_{t})^{\frac{\varphi}{\varphi-1}}}{(1+r^{*})^{t}}/(1+r_{0})$

We can write the percentage change of $\frac{\widehat{C}_{i}}{\widehat{C}_{j}}$ when policy 1 is replaced by policy 2 as[9]

$$\widehat{\frac{\widehat{C}_{i}}{\widehat{C}_{j}}}_{1}^{2} \simeq \widehat{\alpha\left(p\right)/\gamma\left(p\right)}_{1}^{2}\left(\frac{\alpha\left(p^{1}\right)\gamma\left(p^{1}\right)A_{i0}A_{j0}}{v_{i}^{1}v_{j}^{1}}\right)\left(\frac{E_{i}^{\frac{\varphi}{\varphi-1}}}{E_{j}^{\frac{\varphi}{\varphi-1}}}-\frac{A_{i0}}{A_{j0}}\right). \qquad (13)$$

Since policy 2 dominates policy 1 if $\widehat{\frac{\widehat{C}_{i}}{\widehat{C}_{j}}}_{1}^{2}\leq0$, sufficient conditions for this to happen are $\widehat{\alpha\left(p\right)/\gamma\left(p\right)}_{1}^{2}\geq0$ and $\frac{A_{i0}}{A_{j0}}\geq\frac{E_{i}^{\frac{\varphi}{\varphi-1}}}{E_{j}^{\frac{\varphi}{\varphi-1}}}$ for $\widehat{C}_{i}\geq\widehat{C}_{j}$. $\blacksquare$.

Results 1 and 2 guarantee that a) is satisfied when capital taxation is eliminated. Empirical evidence have to be used to verify whether condition b) is satisfied.

From Budria et al. (2002) we use two different set of empirical observations. First, their comparison of the top 1% with the bottom 40% of the distributions for wealth and earnings in the 1980's for the U.S.. And second, the partition of the sample in wealth quintiles from which we compute the average ratio of $\frac{E_{i}^{\frac{\varphi}{\varphi-1}}}{A_{i0}}$ for every quintile.[10] From Table 1 the ratio between the top 1% and the bottom 40% for wealth can be computed. It is 1,335, and the ratio for earnings is 158, so that $\frac{E_{40}^{\frac{\varphi}{\varphi-1}}}{E_{1}^{\frac{\varphi}{\varphi-1}}}\geq\frac{A_{40,0}}{A_{1,0}}$, where 1 and 40 are, respectively, the top 1% and the bottom 40% groups of this two distributions. The positive correlation between wealth and earnings would be sufficient for condition b) of proposition 1 to be satisfied for the two groups.

The information from the partition into quintiles is summarized in Figure 1[11] where the average initial wealth level are displayed on the line (the first

quintile has zero wealth) and efficiency levels are measured by $E_{i}^{\frac{\varphi}{\varphi-1}}$ since, in the model, earnings across households are linear in $E_{i}^{\frac{\varphi}{\varphi-1}}$. It is immediate to see that $\frac{E_{i}^{\frac{\varphi}{\varphi-1}}}{A_{i0}}$ declines with the increase in wealth, although the two characteristics are positively correlated.

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[9]Where $\widehat{X}$ is the percentual change of X, that is $\widehat{X}_{1}^{2}=\frac{X^{2}-X^{1}}{X^{1}}$.

[10]See Tables 1 and 2 in Appendix.

[11]For the first quintile I transformed the negative value of wealth into zero.

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Using those pieces of evidence and proposition 1, as well as the fact that the proposed policy measure increases efficiency, it is immediate to conclude that:

Result 4: Using empirical evidence every agent with a level of welfare below the one of the representative agent is better off with the elimination of capital taxation.

As the representative agent is better off and, for $j < r$, $\frac{\widehat{C}_j}{\widehat{C}_r}$ increases, the utility of household j increases more than the utility of the representative agent.

We prove that, using cross section data, the increase on human wealth and the decline on non-human initial wealth is still equity improving. As the representative agent increases welfare, then every agent with a level of welfare lower than the average increases welfare with the elimination of capital taxation in the small open economy.

How robust is this result to different periods and economies? The described general characteristics of the U.S. distributions of earnings and wealth did not change during the 1990's, and they are common to a large set of European economies, as shown in Budria and Diaz-Gimenez (2007). When trying to infer for developing countries like Latin America data is more scarce. Even if inequalities in education, earnings and income have been extensively studied in Latin America, little is known about the distribution of wealth in this region. However the study of Torche and Spilerman (2008), which focus on the distribution of different assets types across some economic strata, allow us to infer that condition b) of proposition 1 is even more clear in that region. As claimed in that study: " In all countries for which wealth data is available, the Gini index for household wealth exceeds the Gini for household income". Using this evidence we can claim that this result is general for developed and developing countries.

4 The importance of the exogenous real interest rate

The environment of the small open economy described in section 2 is a particular one, in the sense that the real interest rate does not react to the change of policy that is under study. This assumption would no more be true either in the extreme case of a closed economy, or when the change of policy in one country is followed by a significative number of other countries, or in intermediate cases where the country, although being the only one to implement the policy change and being open to capital trade, is not small in the sense that the elimination of capital taxation can affect the equilibrium international real interest rate. We say that in those cases the effective capital mobility is low because, given the change in policy, capital flows are much smaller when compared with the ones in the small open economy just described in section 2. In Garcia-Milá et al (2010), the elimination of capital taxation in a closed economy leads to a decline in welfare of the poorest households of the economy. Their exercise is implemented in an environment which is not Gorman amenable, since preferences are not quasi-homothetic. Therefore it is not feasible the construction of a representative household and changes in the distribution affect equilibrium prices. For the validity of the method applied in the present work it is important to understand whether the results obtained for a small open economy would be maintained in a closed economy. If this was the case then the effects on equilibrium driven by distribution would be first order effects, and the method a bad approximation.

This section develops the same exercise of section 2 but now in a closed economy. Here the change of policy will affect also equilibrium real interest rates, implies a transitional path to the new steady state, and the change in equilibrium has to be computed numerically. When capital taxes are eliminated the economy converges from the steady state path associated with policy 1 to the one associated with policy 2. The equilibrium is characterized by the same set of equations, but the budget constraint is now given by

$$\sum_{t=0}^{\infty} \frac{C_{it}}{(1+r_0)\prod_{s=1}^{t}(1+r_s)} = \sum_{t=0}^{\infty} \frac{w_t E_i N_{it}}{(1+r_0)\prod_{s=1}^{t}(1+r_s)} + A_{i0} \tag{14}$$

Notice that the only difference from (2) is that the net real interest rate is no

more constant and reacts to the change in policy. The resources constraint is now given, for every t, by

$$Y_t = F(K_t, E_r N_{rt}) = C_{rt} + G + K_{rt+1} - (1 - \delta)K_{rt}$$

because $B_{it+1}^* = 0$.

We use the calibration and part of the exercise performed in Correia (2010). That is, $\tau_k = .5^{12}$ and $\tau_n = .23$, which are consistent with $N = .25$ and $G/Y = .19$. Preferences are such the $\varphi = 1.8$, $\chi = 2.34$, $\sigma = 1.001$ and $\beta = .96$. The technology is Cobb Douglas, the share of capital is .4 and depreciation is .1.

The following table summarizes the information necessary for the exercise:

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[12]Note that this tax is on capital income net of depreciation.

Table 1

	$v_r(\lambda)$	α/γ
Benchmark $\tau_k = .5, \tau_n = .23$	5.6(1)	3.7
Elimination of capital taxation $\tau_k = 0, \tau_n = .35$	5.8(1.02)	2.9

where $v_r(\lambda)$ is the welfare value of the representative utility(consumption equivalent in percentage of the benchmark) and $\alpha/\gamma = \sum_{t=0}^{\infty} \frac{(w_t)^{\frac{\varphi}{\varphi-1}}}{\prod_{s=1}^{t}(1+r_s)}/(1+r_o)$.

It is immediate to see that, contrary to what happen in the small open economy, the value of α/γ declines with the elimination of capital taxation[13]. The transition to the new steady state is now characterized by an increasing capital/ labor ratio, therefore by an increasing path of wages and a decreasing path of interest rates. When compared with the case when there is no transition, wages are always lower and interest rates always higher during this transition path. Both contribute to a sign of α/γ in the closed economy different from the one in the small open economy.

Taking into account the described empirical evidence on the joint distribution of earnings and wealth and using proposition 1, the decline in α/γ leads to an increase in inequality.

Then the question is whether, given the increase in efficiency reported in the first column of Table 1,the increase in inequality implies that the poorest households are worse off after the elimination of capital taxation.

Using the endowments of labor efficiency and initial capital for the representative household and for the households in the first and second quintile, the values of utility for the representative agent as well as the values of α/γ given in Table 1, we can use expression

$$\frac{\widehat{C}_r}{\widehat{C}_j} = \frac{A_{i0}}{A_{j0}} \frac{\left[\alpha\left(p\right)/\gamma\left(p\right)\right] \frac{E_i^{\frac{\varphi}{\varphi-1}}}{A_{i0}} + 1}{\left[\alpha\left(p\right)/\gamma\left(p\right)\right] \frac{E_j^{\frac{\varphi}{\varphi-1}}}{A_{j0}} + 1}. \tag{15}$$

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[13]This decline is robust to different preferences, For example the same effect is obtained with preferences isoelastic in consumption and leisure.

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to confirm that welfare of the first and second quintiles decline with the policy. This result establish that the different result in Garcia-Milá et al (2010) comes from the effects of the change of policy on the real interest rates, that occur in the closed economy.[14]

5   Conclusions

We show in this article that the effect on equity of the elimination of the tax rate on capital income depends in a crucial way on the globalization of capital markets. Whether the elimination of capital taxation leads to a change in the path of the real interest rate or to capital inflows into the country makes the whole difference for the result. The first case can occur either because the economy is closed or because, being capital markets open internationally, the change of policy was taken also by other countries. In the second case capital markets are open but the economy acts unilaterally, and is small to influence the equilibrium real interest rate. Theoretically the effect on equity would also depend on the roots of heterogeneity across households, but for the existing empirical evidence on the distribution of households characteristics the result would be well defined, for a given path of the real interest rate.

Given the empirical evidence on the joint distribution of characteristics across households, which relevant moments are quite robust to most developed and developing countries, the elimination of capital taxation in a closed economy, or for a group of small economies, worsens equity, while it improves it in a small open economy. Besides, the effect on efficiency is positive in both cases, being stronger in the small open economy. Both effects imply that the decision to implement that policy leads to a decline in the welfare of the poorest households in an economy where the change of policy does not lead to effective flows of capital across countries. Effective mobility of capital turns this result round. In that case the elimination of capital taxation leads always to an improvement of the welfare of the poorest households, as is the case in the small open economy.

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[14]Also, as said, important for the method used in the present article, the elimination of the effects on equilibrium of the changing distribution are really second order effects and the hypothesis of a representative agent is a good one for the present exercise.

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Table1($Budria\ et\ al.(2002)$)

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Table 2 ($Table7\ in\ Budria\ et\ al(2002)$)

. . . And Ranked by Wealth

Characteristics of Sample Households in Each Wealth Group

Household Characteristics	Households in Wealth Quintiles					Total Sample
	$1st$	$2nd$	$3rd$	$4th$	$5th$	
Average Earnings	16.9	27.7	35.1	42.2	90.1	54.8
Average Wealth	-4.1	19.0	72.6	175.3	$1,177$	288.0

Source: 1998 Survey of Consumer Finances

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Figure 1
Characteristics Distribution