THE DUAL ROLE OF MONEY AND OPTIMAL FINANCIAL TAXES

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Abstract:

This paper reconsiders the optimal taxation of money and other financial assets. The optimal tax formulae reflect that money provides liquidity services and is a saving vehicle. In fact, it is useful to reformulate the optimal tax problem to allow for separate taxes on the liquidity and saving functions of money. This reformulation allows one to better understand the original optimal tax problem. The possible optimality of a subsidy on borrowing, for instance, can be explained if it is noted that the theoretically correct measure of savings reflects that money as well as nonmonetary assets can serve as saving vehicles.

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1. *Introduction*

In a classic paper, Friedman (1969) argues that an efficient monetary policy requires that nominal interest rates are set to zero so that the liquidity services provided by money are effectively not taxed. Phelps (1973) instead argues that if only distorting taxes are available, then the liquidity services of money should also be taxed. A considerable literature, including Kimbrough (1986), Faig (1988), Woodford (1990), Guidotti and Végh (1993) and Chari, Christiano and Kehoe (1996), has investigated under what conditions the Friedman rule continues to hold despite the government's need to raise positive revenue with distorting taxes. These conditions relate to how exactly money is modeled and to the set of available tax instruments. In practice, however, most countries maintain positive nominal interest rates and thus effectively tax money holdings.

Money demand is intricately related to the demand for other financial assets such as bank deposits. It is therefore natural to consider the joint taxation of money and deposits, where deposits can be taxed directly or by way of reserve requirements. Seigniorage in conjunction with other implicit or explicit financial taxation is considered by Fry (1981), Siegel (1981), Mourmouras and Russell (1992), Romer (1985), Brock (1989) and Bacchetta and Caminal (1992). This paper extends the analysis of the joint taxation of money and other financial assets. Taking the view that money economizes on shopping costs, this paper explicitly solves for the optimal taxes rates on money and other financial assets. The optimal tax formulae imply that negative holdings of nonmonetary assets, or private sector borrowing, may optimally be subsidized, if money holdings are taxed at a positive rate. At the same time, the money tax may optimally be negative, although generally the tax-inclusive return on money exceeds the tax-inclusive return on other assets.

To understand these results, one has to realize that a tax on money is a joint tax on the liquidity services provided by money and on saving. The tax on nonmonetary assets instead is a straight tax on saving. As noted by Chari, Christiano, Kehoe (1996) and others, a monetary economy can be seen to be equivalent to a 'real' economy, where the liquidity services provided by money are taken to be a separate real good. Along these lines, this paper restates the government's optimal tax problem for the case where the liquidity and saving functions of money are taken to be separate variables. This reformulated optimal tax problem yields straightforward results: the liquidity services provided by money should be taxed at a positive rate, and saving, whether positive or negative, should also effectively be taxed.

Again, consider the result mentioned above that the government may optimally subsidize borrowing, or negative holdings of nonmonetary assets, in the original monetary model. A correct measure of saving includes the saving implicit in money holdings as well as in other assets and thus is larger than the (negative) saving through nonmonetary assets. The corrected measure of saving, thus, may be positive, even if the actual accumulation of nonmonetary assets is negative (i.e. there is borrowing). Thus what looks like a subsidy on borrowing actually may be a positive tax on the theoretically correct measure of saving. Intuitively, the government may wish to subsidize borrowing in order to enable the private sector to hold additional money balances subject to the money tax. A negative tax on money may similarly be explained by the substitutability of money and nonmonetary assets as stores of value.

The taxation of money (seigniorage) and of nonmonetary assets (financial repression) are particularly important in developing countries (see Giovannini and de Melo (1993)). Effective subsidies on government and private sector borrowing by way of low real interest rates tend to coexist with a substantial taxation of money by way of inflation. The interrelationship between taxes on money and other financial assets thus is of particular, but not exclusive, interest for the developing countries. Huizinga (1996) provides some further evidence that some countries have used their systems of two-tiered exchange rates, with separate commercial and financial exchange rates, to effectively subsidize capital inflows, or national borrowing, from abroad. Specifically, the Dominican Republic (in the early 1980s) and South Africa (in the early 1990s) are estimated to have subsidized capital inflows a cost of about one percent of GNP per year. The theoretical analysis in this paper is framed in terms of stylized taxes on money and other financial assets, with direct applications for bank regulation in the form of reserve requirements, capital income taxation and exchange rate policy.[1]

The remainder of the paper is organized as follows. Section 2 presents the basic model and examines the joint taxation of money and other financial instruments in the monetary model where money provides liquidity services and is a saving vehicle. Section 3 examines the equivalent optimal tax problem in the real economy where money only provides liquidity services. Section 4 examines the open economy and, in particular, current account implications of the model, if taxes on nonmonetary assets take the form of border taxes which can be called capital controls. Section 5 concludes.

2. *Taxation in the monetary model*

Consider a small open economy populated by overlapping generations with a life span of two periods so that at each moment two generations are alive. Throughout, the subscripts *1* and *2* refer to the currently alive young and old. Any agent of age i receives an endowment income, y_i, in a particular period. When young, agents consume and accumulate real money balances, m_1, and other assets, b_1, called bonds. When old, agents rid themselves of their previously accumulated asset holdings and again consume. Following Adams and Greenwood (1985) and others, money provides liquidity services. In particular, let a share $v_1(m_1/y_1)$ of the young's endowment income, y_1, be absorbed in transactions so that the young's net-of-transaction-cost endowment income is given by $(1 - v_1)y_1$ where v_1 is a convex function of m_1/y_1 as follows,

$$v_1 = v_1\left(\frac{m_1}{y_1}\right) \text{ with } \quad 0 < v_1(0) < 1, \quad v_1'(0) \geq -1,$$

$$v_1' < 0, \quad v_1'' > 0 \quad \text{if} \quad m_1 < \bar{m},$$

$$v_1' = 0, \quad v_1'' = 0 \quad \text{if} \quad m_1 \geq \bar{m}, \tag{1}$$

This formulation reflects that there are diminishing returns to holding real money balances up a satiation level, $\bar{m}$.[2] The assumption of $v_1'(0) \geq -1$ implies that the accumulation of first period money balances reduces the resources available for first period consumption and bond accumulation, i.e. it reduces $c_1 + b_1$.

Let i^* be the constant international real interest rate. The young are assumed to obtain real returns of $1 + i^* - \tau_m$ and $1 + i^* - \tau_b$ on their money and bond holdings respectively, where τ_m and τ_b are the implicit or explicit tax rates on money and bond holdings reflecting the rate of inflation, income and wealth taxes and perhaps other measures. Note that with $\tau_b > 0$, negative bond holdings, or rather private sector borrowings, are subsidized. The government is assumed to have to raise revenues, $\hat{R} > 0$, each period starting with the period in which the primordial generation reaches old age. These tax revenues can be thought to be spent on a stream of public goods, $\hat{R} > 0$, again starting in the period in which the first generation reaches old age. These assumptions are reflected in the following steady state government resource constraint,

$$\tau_m m_1 + \tau_b b_1 \geq \hat{R} \tag{2}$$

Let c_i be the agent's consumption at age i. The agent's budget constraints when young and old are stated as follows,

$$c_1 = (1 - v_1)y_1 - m_1 - b_1 \tag{3.1}$$

$$c_2 = y_2 + (1 + i^* - \tau_m)m_1 + (1 + i^* - \tau_b)b_1 \tag{3.2}$$

Absent any pre-existing government debts, the country's invariant net foreign asset position, n, is equal to $m_1 + b_1$, and the current account in each period is in balance.

A young agent chooses his money and bond holdings so as to maximize a standard lifetime concave utility function $U(c_1, c_2)$. The optimality conditions regarding the choices of m_1 and b_1 are as follows,

$$v_1' + 1 = \frac{1 + i^* - \tau_m}{1 + i^* - \tau_b} \tag{4.1}$$

$$U_1 = (1 + i^* - \tau_b)U_2 \tag{4.2}$$

From eq. (4.1), we see that money demand, m_1, is independent of preferences. This reflects that money balances are chosen so as to maximize the present value of resources available for consumption using the tax-inclusive interest rate on bonds as the discount rate.

Assuming for now that there are positive money balances with $\tau_m > \tau_b$ (which below is shown to be implied by the optimal tax system), we can check from eq. (1) and (4.1) that money balances, m_1, are negatively (positively) related to the money (bond) tax τ_m (τ_b), while (3.1)-(4.2) imply that bond holdings, b_1, are positively related to the money tax, τ_m, but related in an ambiguous way to the bond tax, τ_b. Next, consumption in either period is negatively related to the tax on money, τ_m, while consumption when young (old) is ambiguously (negatively) related to the bond tax, τ_b. These relationships reflect that either financial tax affects the agent's consumption-saving decision as well as his portfolio choice. The various dependencies of asset holdings and consumption at the two stages of life on the financial taxes are summarized by the following derivatives:

$$\frac{dm_1}{d\tau_m} = -\varepsilon_m m_1 < 0, \quad \frac{dm_1}{d\tau_b} = (v_1' + 1)\,\varepsilon_m m_1 > 0$$

$$\frac{db_1}{d\tau_m} = (p + (v_1' + 1)\,\varepsilon_m)\, m_1 > 0, \quad \frac{db_1}{d\tau_b} = -(v_1' + 1)^2 \varepsilon_m m_1 - (\varepsilon_s - p)\, b_1 \gtrless 0$$

$$\frac{dc_1}{d\tau_m} = -p\, m_1 < 0, \quad \frac{dc_1}{d\tau_b} = (\varepsilon_s - p)\, b_1 \gtrless 0$$

$$\frac{dc_2}{d\tau_m} = -(1 - p_1)\, m_1 < 0, \quad \frac{dc_2}{d\tau_b} = -(1 - p_1 + \varepsilon_s (1 + i^* - \tau_b))\, b_1 < 0$$

where $\varepsilon_m = -\frac{1}{m_1}\frac{dm_1}{d\tau_m} = \frac{1}{m_1}\frac{1}{1 + i^* - \tau_b}\frac{y_1}{v_1''} > 0$ is the semi-elasticity of first period money demand with respect to the money tax, τ_m; where p_2 is the propensity to consume in the first period out of second period income; and where $\varepsilon_s = \frac{1}{b_1}\left(\frac{dc_1}{d\tau_b}\right)^c$ is the compensated derivative of first period consumption, c_1, with respect to the bond tax, τ_b, divided by b_1. The definition of p_2 can be seen to imply that $p_1 = (1 + i^* - \tau_b)p$ is the propensity to consume in the first period out of net-of-transaction-cost first period income. Further, note that ε_s is the compensated semi-elasticity of saving with respect to the bond tax τ_b in the absence of money, as then savings equal $b_1 = (1 - v(0))y_1 - c_1$.

Figure (1) illustrates how money and bond holdings, m_1 and b_1, depend on the set of financial taxes, τ_m and τ_b. First, note that with $\tau_b > \tau_m$ the young optimally accumulate infinite money holdings financed through infinite borrowing. Next, with $\tau_b = \tau_m$ the agent is indifferent between accumulating any level of money holdings equal to or exceeding the satiation level, $\bar{m}$, while bond holdings, b_1, can be of either sign or zero. In the figure, we draw the case where with b_1 is negative with $\tau_b = \tau_m$. In the figure, we further assume that b_1 is negative, if τ_m is slightly above τ_b. Next, different combinations of the tax rates τ_m and τ_b consistent with zero bond holdings, i.e. $b_1 = 0$, (and money holdings below the satiation point) are represented by an upward sloping locus, as $db_1/d\tau_b < 0$ and $db_1/d\tau_m > 0$ with $b_1 = 0$.[3] Note that the position of this locus reflects that $\tau_m > \tau_b$ with $b_1 = 0$. Clearly, above (below) the $b_1 = 0$ locus we have negative (positive) bond holdings, b_1. Again, negative bond holdings imply that the agent is on net borrowing at a tax-inclusive real interest rate $i^* - \tau_b$.

The government faces the problem of choosing the financial tax rates, τ_m and τ_b, so as to maximize the (constant) lifetime utility of any generation subject to its minimum revenue constraint in (2).[4] The government's maximization problem can be stated formally as follows,

$$\text{Max } U(c_1, y_2 + (1 + i^* - \tau_m)m_1 + (1 + i^* - \tau_b)b_1)$$

$$+ \lambda(\tau_m m_1 + \tau_b b_1 - \hat{R}) \tag{5}$$

where λ is the Lagrange multiplier associated with the minimum revenue requirement (2).

The optimality conditions associated with (5) with respect to the money and bond tax rates, τ_m and τ_b, are given as follows,

$$-U_2 m_1 + \lambda\left(m_1 + \tau_m \frac{dm_1}{d\tau_m} + \tau_b \frac{db_1}{d\tau_m}\right) = 0 \tag{6.1}$$

$$-U_2 b_1 + \lambda\left(b_1 + \tau_b \frac{db_1}{d\tau_b} + \tau_m \frac{dm_1}{d\tau_b}\right) = 0 \tag{6.2}$$

Using eq. (2) and (6.1)-(6.2), we can solve for the optimal money and bond tax rates, τ_m and τ_b, as follows,

$$\tau_m = \frac{\theta \hat{R}}{\theta m_1 + b_1} \gtrless 0 \tag{7.1}$$

$$\tau_b = \frac{\hat{R}}{\theta m_1 + b_1} \gtrless 0 \tag{7.2}$$

where

$$\theta = v_1^{/} + 1 + \frac{(dc_1/d\tau_b)^c}{[b_1 + (v_1^{/} + 1)m_1]\varepsilon_m}$$

Clearly, the sign of the expression for θ and thus of the optimal financial tax rates, τ_m and τ_b, in (7.1) and (7.2) depends crucially on the theoretically ambiguous sign of the expression $b_1 + (v_1' + 1)m_1$. To interpret this latter expression, we next analyze the government's optimal tax problem in a reformulated real model where the liquidity services provided by money are taken to be an independent good that can be taxed separately. In this real economy, the government thus can impose separate taxes on the liquidity and saving functions of money. As shown below, the expression of $b_1 + (v_1' + 1)m_1$ then equals first period savings.

3. *Taxation in the real model*

In the model above, both money and bonds are saving vehicles, while bonds are the marginal saving vehicle is response to, say, a change in second period endowment income, y_2. Put differently, the optimal bond holdings, b_1, reflect that money also serves as a store of value. To obtain an money-inclusive concept of first period saving, let the young's savings, s_1, implicitly be defined as follows,

$$c_2 = y_2 + (1 + i^* - \tau_b)s_1 \tag{8}$$

Eq. (8) makes clear that savings, s_1, are defined such that they increase second period consumption, c_2, beyond the second period endowment, y_2. Using (3.2) and (8), we can solve for savings, s_1, as follows,

$$s_1 = b_1 + \frac{1 + i^* - \tau_m}{1 + i^* - \tau_b} m_1 \tag{9}$$

Eq. (9) implies that $s_1 > b_1$, as s_1 is equal to actual bond holdings, b_1, plus any implicit bond-equivalent savings implicit in first period money holdings (this is the last term in (9)). Applying (4.1) and (9), we see that $s_1 = b_1 + (v_1' + 1)m_1$.

In this section, we consider the government's optimal tax problem where the government imposes separate taxes on the liquidity services provided by money and on savings. To this end, let money, m_1, as before, provide liquidity services as reflected in (1), but let us rid money of its store of value function. Specifically, let us assume that the young at the end of period 1 redeem their money holdings (net of any taxes paid on money holdings in the first period) for bond holdings one-for-one. The resulting level of bond holdings at the end of the first period of life then equals the level of savings, s_1. The government now needs to raise revenues, $\hat{R}$, by distorting money and saving taxation. Therefore, the government levies a tax t_m on money holdings, m_1, in each generation's first period of life and a tax t_b on savings, $s_1 = (1 - v(\frac{m_1}{y_1}))y_1 - t_m m_1 - c_1$, in each generation's second period of life. Analogously to (2), the generations-specific government budget constraint is written as,

$$t_m(1 + i^*)m_1 + t_b s_1 \geq \hat{R} \tag{10}$$

The tax rate and tax base definitions across the monetary and real models imply $t_m = (\tau_m - \tau_b)/(1 + i^* - \tau_b)$ and $t_b = \tau_b$. Solving for τ_m, we get $\tau_m = t_m(1 + i^*) + t_b(1 - t_m)$. This expression clearly indicates that τ_m is a dual tax on the liquidity and saving functions of money. Specifically, note that the money tax, τ_m, approaches the sum $t_m(1 + i^*) + t_b$ of the effective taxes on the liquidity and saving functions of money for small values of t_m.

Instead of (4.1)-(4.2), private sector money and savings in the real economy are guided by the optimality conditions $-v_1^{/} = t_m$ and $U_1 = (1 + i^* - t_b)U_2$.

Analogously to (7.1)-(7.2), we now obtain the following optimal financial tax rate expressions,

$$t_m(1 + i^*) = \frac{\hat{\varepsilon}_s \hat{R}}{m_1 \hat{\varepsilon}_s + s_1 \hat{\varepsilon}_m} > 0 \tag{11.1}$$

$$t_b = \frac{\varepsilon_m \hat{R}}{m_1 \hat{\varepsilon}_s + s_1 \hat{\varepsilon}_m} \gtrless 0 \tag{11.2}$$

where $\hat{\varepsilon}_s = [dc_1/t_b]^c/s_1$ is the (compensated) semi-elasticity of savings, s_1, with respect to the saving tax, t_b, and $\hat{\varepsilon}_m = -\frac{1}{m_1}\frac{1}{1+i^*-t_b}\frac{dm_1}{dt_m} = \frac{1}{m_1}\frac{1}{1+i^*-t_b}\frac{y_1}{v_1''} > 0$ is the semi-elasticity of money, m_1, with respect to the tax t_m divided by $1 - i^* - t_b$.[5] The positive sign of t_m in (11.1) indicates that the liquidity services provided by money are to be taxed at a positive rate. From (11.2), we further see that the saving tax, t_b, has the same sign as savings, s_1, which in essence means that savings should be taxed, regardless of whether they are positive or negative (unless they are just equal to zero, in which case only the money tax, t_m, is used). As $t_b = \tau_b$, expressions (7.2) and (11.2) are fully equivalent.

An interesting scenario occurs when savings, s_1, are positive, but bond holdings, b_1, are negative. Following (9), this is possible as money holdings, m_1, are optimally positive. With $s_1 > 0$, the bond tax, $t_b = \tau_b$, is optimally positive so savings are taxed. The negative bond holdings b_1, however, imply that the private sector is effectively borrowing in the first period. Borrowing at a relatively low tax-inclusive rate of return, $1 + i^* - \tau_b$, means that such borrowing is subsidized. Subsidized borrowing, b_1, thus can coexist with positive savings, s_1, that are taxed at a positive rate. Intuitively, the purpose of subsidized borrowing is to enable private agents to hold additional money balances subject to the money tax. In practice, this scenario is implemented if the authorities engineer low tax-inclusive real interest rates (by whatever means) in an inflationary environment.

To conclude this section, let us consider the sign of the optimal money tax, τ_m. Note that the optimal tax formulae (11.1) and (11.2) for t_m and $t_b = \tau_b$ together imply the optimal tax formula (7.1) for τ_m given the relationship $\tau_m = t_m(1 + i^*) + t_b(1 - t_m)$. With t_m in (11.2) always positive, it is easily seen that τ_m is positive with $s_1 \geq 0$ (implying $t_b \geq 0$). Second, τ_m can be of either sign or zero with $s_1 < 0$ (implying $t_b < 0$). Of interest is the case where $\tau_m < 0$ so that money holdings are effectively subsidized as is possible with $s_1 < 0$. In this instance, money holdings are subsidized, as increased money holdings induce agents to increased their (taxed) first period dissaving or borrowing.

4. *Implications for the country's net foreign asset position*

In this section, we consider the implications of the optimal taxation in either formulation of the model for the country's net foreign asset position. To start, let us assume that the government has no pre-existing debts or assets. From (3.1), it is clear that national savings, n, at the time the first generation enters the world is given by $m_1 + b_1$. These national savings also equal the country's net foreign asset position. Note that national savings, n, exceed private savings, s_1, as $n = b_1 + m_1 > s_1 = b_1 + (v_1' + 1)m_1$ with $\tau_m > \tau_b$. The reason is that the private sector saves out of first period income net of the tax, t_m, on liquidity services, while the government is assumed to spend all tax revenues extracted from a generation in that generation's old age on, say, social security. As an implication, a positive net foreign asset position, i.e. $n > 0$, can be consistent with private saving, s_1, being positive, zero, or negative, and therefore the saving tax, $t_b = \tau_b$, being positive, zero or negative. To illustrate, let us assume that the financial tax, τ_b, is implemented as a border tax.[6] Capital exports with $n > 0$ can then be taxed or subsidized (or neither). The possibility of capital exports that are subsidized, which is somewhat puzzling, stems from the assumption on the timing of government spending (see below). Next, $n = 0$ implies that $s_1 < 0$ and therefore $\tau_b < 0$. This means that in the absence of any capital flows the government imposes a just prohibitive capital export subsidy (or capital import tax). Finally, $n < 0$ implies $s_1 < 0$ and therefore $\tau_b < 0$. Capital inflows thus are accompanied by a capital import tax.

To sort out the role of the timing assumption regarding government spending, we can assume alternatively that the government spends all tax revenues from a generation during the generation's youth on, say, education. In particular, let us assume that the government spends $\hat{R}/(1+i^*)$ on some public good during each generation's youth. It is then straightforward to show that national savings, $n = m_1 + b_1 - \hat{R}/(1+i^*)$, and private savings, s_1, have the same sign. In this instance, either a capital inflow (coincident with private dissaving) or a capital outflow (coincident with private saving) are to be taxed.

To conclude this section, let us assume that the government spends part of its resources on debt service. In particular, let us assume that the government has a steady state debt, d, so that it spends i^*d on debt service each period, which implies that resources

$\hat{R} - i^{*}d$ are available for non-debt related spending. The country's net foreign asset position now equals $n = m_1 + b_1 - d$ [$- \hat{R}/(1 + i^{*})$], if government revenues are spent during each generation's old age [youth]. An interesting point, perhaps, is that the optimal domestic tax-inclusive financial returns are related to the overall government revenue requirement, $\hat{R}$, but not to the share of these revenues that is spent on debt service. In other words, the optimal financial taxes depends on how much resources the government needs, and not on how these resources are spent. If optimal financial taxes do not depend on d, then they also do not depend on the size (and sign) of n for a given value of required government revenues $\hat{R}$.

Note that eq. (10) indicates that government revenues from the taxation of nonmonetary assets or financial repression are given by $t_b s_1$. These revenues are non-negative, as t_b and s_1 optimally have the same sign. Recently, Giovannini and de Melo (1993) have presented empirical evidence on the magnitude of financial repression for a set of developing countries. Their measure of government revenues from financial repression is the government debt service savings on domestically held government debt resulting from the fact that the domestic interest rate is lower than the international interest rate on comparable debts. Note that Giovannini and de Melo's measure of revenues from financial repression is zero if the government does not have any domestically held debt, although $t_b s_1$ is generally positive. This discussion suggests that a comprehensive measure of financial repression hinges on a correct measure of saving (or dissaving) and the taxes applied to this measure.

5. *Conclusion*

This paper has examined the joint taxation of money and nonmonetary assets. The optimal tax scheme reflects the dual role of money as a means of payment and a store of value. This paper shows that the authorities may optimally wish to subsidize domestic borrowing, as such borrowing enables agents to accumulate additional money balances subject to the money tax. If a country is a capital importer, the subsidized borrowing can manifest itself as a capital import subsidy.

The present paper assumes that money requires liquidity services. As these liquidity services enhance consumption possibilities they are essentially a productive factor. Alternatively, money can be chosen to yield direct utility. In this instance, the money tax effectively is joint tax on money as a consumption good and money as a store of value. In this instance, it may also be beneficial to introduce separate taxes on money as a consumption good as a saving vehicle to better understand the optimal taxation of money.

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Endnotes

1. Also note that the analysis of this paper can be applied to the profit maximizing problem of, say, a commercial bank that offers its customers a money-like liability, in the form of current accounts, and a nonmonetary liability, in the form of saving accounts.

2. The assumption that there is a satiation level of money balances is immaterial.

3. Here we assume that the $b_1 = 0$ locus indeed exists.

4. The government can be seen as a social planner that maximizes the present discounting value of all private utilities at the international interest rate giving rise to tax smoothing.

5. With equivalent tax-inclusive returns across the two models, we have $\hat{\varepsilon}_s = \frac{b_1}{s_1}\varepsilon_s$ and $\hat{\varepsilon}_m = \varepsilon_m$.

6. Note that a border tax on international capital income is equivalent to a residence-based saving or capital income tax in the absence of physical capital investments.