

**Taxation, Labor Supply Decisions and Human Capital
Accumulation: An Application to Kuwait Economy**

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Dr. Mustafa Babiker (*)

Abstract

Some recent studies on the economic effects of labor vs. capital taxation in endogenous growth environments have reported quite different and often seemingly conflicting results. Using a two-sector model of endogenous growth, this paper investigates the model's features and elasticity assumptions that are consistent with these results. Controlling for all other parameters, it is found that differences in the representation of the labor supply decisions alone are sufficient for the reconciliation of these conflicting results. Applying the framework to simulate the Kuwait economy over the period 1995-2050, the observation that a labor tax is generally associated with a higher welfare cost compared to a capital tax at an equivalent rate whereas the latter has a greater negative effect on economic growth.

الضرائب، قرارات عرض العمل وتراكم رأس المال البشري:
تطبيق على الاقتصاد الكويتي

مصطفى بابكر

ملخص

أوردت بعض الدراسات الحديثة نتائج متباينة وأحياناً تبدو متضاربة عن الآثار الاقتصادية لضريبة العمل مقارنة بضريبة رأس المال في ظل بيئة تتميز بوجود ما يعرف في النظرية الاقتصادية بالنمو الجواني. لتوضيح ما يبدو تضارباً في نتائج هذه الدراسات استخدمت هذه الورقة نموذجاً مبسطاً للنمو الجواني يحتوي على قطاعين لتقصي سمات النموذج وفرضيات المرونة التي تتفق مع هذه النتائج. وفي هذا الإطار نجد بثبت كل معالم النموذج الأخرى أن الاختلاف في تمثيل قرارات العمل لوحده يكفي للتوفيق بين هذه النتائج. بتطبيق النموذج على الاقتصاد الكويتي للفترة 1995-2050 نجد بضريبة العمل ترتبط عموماً بتكلفة أعلى في مستوى الرفاه مقارنة بضريبة مساوية على رأس المال بينما ترتبط بضريبة رأس المال بتكلفة أعلى من حيث معدل النمو الاقتصادي.

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Introduction

The conventional literature on the effects of labor taxation has typically ignored the role of education and human capital accumulation. The recent development in growth theory with the re-interpretation of human capital as an engine of growth, however, has set the path for a richer research on taxation and labor supply decisions. While this research is still in its early stages, it has contributed a better understanding of the distortionary effects of labor taxation. In particular, this research has shown that labor taxes do not only affect the current labor supply decisions but also affect the future supply decisions and the growth rate of the economy. Unfortunately, the details of these effects appear to vary considerably. It is the primary concern of this paper to explain and reconcile these differences. The typical conflicting results in this newly born literature arise in relation to whether labor taxes are more or less distortionary than capital taxes, and to whether labor tax reform or capital tax reform has the most effect on economic growth. Recent papers by Lucas (1990), Pecorino (1994), Devereux and Love (1994), Wang and Yip (1995), and Ihuri (1997) lie within this domain. Although all these authors have used more or less the same conventional setup of two-sector endogenous growth models, their conclusions differ widely.

Lucas (1990) has found that a revenue-neutral replacement of capital tax by labor tax in the US has virtually no effect on the growth rate. In contrast, Pecorino (1994) reports that such a replacement reduces the growth rate of the US economy. Devereux and Love (1994) have concluded that capital tax is the least efficient way of raising revenue compared to either a wage tax or a consumption tax. For Taiwan, Wang and Yip (1995) have shown that a shift from capital to labor income taxation retards economic growth. Not the end of the confusion, Ihuri (1997) states that when bequests are not operative, a tax on human capital does not reduce growth but that a tax on physical capital does.

The frustrating frequency of such conflicting results raises many doubts on the basic setup in these models and greatly undermines the usefulness of the endogenous growth framework for addressing important policy issues such as tax reform. Hence, understanding and sorting out the sources of these conflicting results is an exercise worth pursuing. Stokey and Rebelo (1995) have addressed these sources among the endogenous growth studies that have looked specifically on the tax reform question in the US. They claim that the conflicting results on the effect of tax reform on the US growth rate are solely explainable by the differences in model parameters that have been used in these studies. In particular, they report that parameters such as factor shares, depreciation rates, the elasticity of inter-temporal substitution, and the elasticity of labor supply have critical leverage on the obtainable results in these models.

The objective of this paper, however, is more pedagogical. In contrast with Stokey and Rebelo (1995), the main concern is to investigate empirically the implication of model parameters and assumptions in the generic endogenous growth setup for the conclusions to be drawn on the distortionary effects of labor *vs.* capital taxation. In particular, the objective is to develop and parameterize a simple endogenous growth

model to simulate the Kuwaiti economy based on the generic two sectors growth models in the literature. Also different from the Stokey and Rebelo (1995) study, the focus is not limited to the steady state growth rates but, in addition, encompasses the growth effects during the transition to the steady state. Finally, different from all the aforementioned studies, this analysis, in addition to the growth effects, also accommodates the welfare impacts of taxes in these endogenous growth models. These latter two differences are particularly important and worth further comment at this stage. Firstly, it is posited that the transitional impacts of different taxes on consumption can be quite different in these models even when the steady state impacts are exactly identical. Secondly, in many instances, it is observed that the welfare effects can move in opposite direction to the growth effects when comparing the different tax packages. This suggests that two tax schemes that have identical growth effects may have quite different welfare implications. More importantly, with this simple endogenous model, a range of different outcomes on the distortionary effects of labor *vs.* capital taxation may be generated by only varying the representation of labor supply and the substitutability of labor and capital in the technology producing the consumption good. This range of outcomes accommodates virtually all the seemingly conflicting results in the literature reviewed at the beginning of this section.

The Theoretical Model

The theoretical setup is the standard two-sector model of endogenous growth described in the growth literature (e.g., see Barro and Sala-I-Martin 1995). Given consumption and factor prices, the representative household in the model chooses the optimal paths for consumption, leisure, financial capital, and human capital that solve:

$$\max U(.) = \sum_{t=0}^{\infty} \beta^t U(c_t, l_t) \quad \text{Equation 1}$$

Subject to the dynamic budget constraint:

$$c_t + a_{t+1} + p_{t+1}^h h_{t+1} = (1 - \tau_h) w_t (h_t - l_t) + p_t^h h_t + a_t + (1 - \tau_a) r_t a_t \quad \text{Equation 2}$$

In this representation, c is household consumption; l is leisure or more generally human capital services employed at home; β is the discount factor; a is financial capital; h is human capital; p^h is the relative price of human capital⁽¹⁾; w is the return to human capital (the wage rate); r is the return to financial capital (the interest rate); and τ_h and τ_a are respectively *ad-valorem* tax rates on the returns to human and financial capital.

In addition, it is assumed that all markets are competitive and complete and that firms producing the consumption good as well as those dealing in the education sector face constant return to scale (CRTS) technologies. Hence, in equilibrium, all firms make zero profits and the returns to human and physical capital (w and r) equal their corresponding net marginal products. Furthermore, markets clearance ensure that the

⁽¹⁾ Notice that in Equation 2, it is implicitly assumed that the technology producing the consumption good and the physical capital good are identical, whereas the technology producing the human capital good, i.e. education is allowed to be different.

totals of human and physical capital (h and a) supplied by the household sector equal the corresponding demands by the production sectors (the usual K and H), and that the total amounts of goods produced satisfy the corresponding demands by household, investment, and the education sector. The usual rules of motion for physical and human capital accumulation that are implicitly embedded in Equation 2 can then be explicitly expressed for the whole economy as:

$$K_{t+1} = (1 - \delta_k)K_t + I_t^k \quad \text{Equation 3}$$

$$H_{t+1} = (1 - \delta_h)H_t + I_t^h \quad \text{Equation 4}$$

Where δ is the depreciation rate and I is investment.

Setting up the Lagrangean for the system Equations 1 - 2 and taking the derivatives, the following first order conditions are obtained:

$$\begin{aligned} \text{(i)} \quad c_t: & \quad \beta^t U_1(c_t, l_t) = \lambda_t \\ \text{(ii)} \quad l_t: & \quad \beta^t U_2(c_t, l_t) = \lambda_t (1 - \tau_h) w_t \\ \text{(iii)} \quad a_{t+1}: & \quad -\lambda_t + \lambda_{t+1} [1 + (1 - \tau_a) r_{t+1}] = 0 \\ \text{(iv)} \quad h_{t+1}: & \quad -\lambda_t p_{t+1}^h + \lambda_{t+1} [p_{t+1}^h + (1 - \tau_h) w_{t+1}] = 0 \end{aligned}$$

Where λ is the Lagrangean multiplier associated with the budget constraint, and where the subscripts 1 and 2 denote the partial derivatives with respect to c and l , respectively. From (i) and (ii), the Euler's equation is obtained characterizing the intra-temporal substitution between consumption and leisure:

$$\frac{U_2(c_t, l_t)}{U_1(c_t, l_t)} = (1 - \tau_h) w_t \quad \text{Equation 5}$$

From (i) and (iii), the Euler's equation is obtained characterizing the inter-temporal substitution between present and future consumption, i.e. the equation determining the rate of consumption growth:

$$\frac{U_1(c_t, l_t)}{U_1(c_{t+1}, l_{t+1})} = \beta [1 + (1 - \tau_a) r_{t+1}] \quad \text{Equation 6}$$

From (ii) and (iv), a similar equation is obtained characterizing the inter-temporal substitution between present and future leisure, i.e. the equation determining the growth rate of labor supply:

$$\frac{U_2(c_t, l_t)}{U_2(c_{t+1}, l_{t+1})} = \beta [1 + (1 - \tau_h) \frac{w_{t+1}}{p_{t+1}^h}] \frac{w_t}{w_{t+1}} \quad \text{Equation 7}$$

Finally, from (iii) and (iv) along with (i) and (ii), the condition governing the equilibrium levels of physical and human capital is obtained :

$$(1 - \tau_a)r_t = (1 - \tau_h)\frac{w_t}{p_t^h} \quad \text{Equation 8}$$

To emphasize the role of human capital in this model, consider the implications of an infinitesimal increase in τ_h on the labor supply decisions by inspecting the equilibrium system Equation 5 through Equation 8. Assuming that U is concave in each of its arguments c and l , four distortionary effects of such a tax increase may be verified:

(i) An intratemporal substitution effect:

From Equation 5, the increase in the labor tax rate decreases consumption, increases the demand for leisure, and accordingly reduces the supply of human capital services to the production and education sectors. The size of this effect is controlled by the intra-temporal elasticity of substitution between consumption and leisure.

(ii) An inter-temporal substitution effect:

From Equation 7, the increase in the labor tax rate increases the demand for leisure and reduces the supply of labor. The strength of this effect is essentially governed by the inter-temporal elasticity of substitution.

(iii) A wealth effect:

This works through Equations 5, 6, and 7. An increase in the labor tax rate reduces wealth, which in turn reduces both consumption and leisure, and accordingly increases the supply of human capital services to the market sectors. The size of this effect depends on whether the tax increase is permanent or temporary and on the income elasticity of labor supply.

(iv) An accumulation effect on human capital:

Given the presence of both human and financial capital accumulation in the model, the equilibrium has to satisfy Equation 8, which says that the after tax rates of return on both types of capital should be equal. Increasing the tax rate on the returns to human capital disturbs this condition and sets in motion an adjustment process decreasing the rate of accumulation of human capital and increases that of physical capital, which in turn lowers the return to physical capital. This correction process continues until a new equilibrium is established with a lower level of human capital, a higher level of physical capital, and a lower rate of return on physical capital. But from Equation 6, the lower rate of return on physical capital leads to a lower rate of consumption growth. Thus, the labor tax also has a similar effect on consumption growth as the capital tax.

In effect, the labor supply in this model is a complex function that includes all current and future wage rates, current and future interest rates, the implied current and

future prices of human capital stock, and the intra-temporal and inter-temporal elasticity parameters.

Next to further articulate the effects in (a) through (d) and to provide more specific comparisons of the distortionary effects of labor vs. capital taxation in this model, consider the following specific form of the life time utility function:

$$U(c, l) = \sum_{t=0}^{\infty} \beta^t [\theta \log(c_t) + (1-\theta) \log(l_t)]$$

Where θ is the consumption expenditure share.⁽²⁾

Substituting out using this functional form, the Euler's Equations 5 and 6 may be rewritten as:

$$\frac{(1-\theta) c_t}{\theta l_t} = (1-\tau_h) w_t \quad \text{Equation 5'}$$

$$g_t + 1 = \beta [1 + (1-\tau_a) r_{t+1}] = \beta [1 + (1-\tau_h) \frac{w_{t+1}}{p_{t+1}}] \quad \text{Equation 6'}$$

Where g_t is the consumption growth rate between period t and $t+1$, and where the second equality in Equation 6' is from the equilibrium condition in Equation 8.

From Equations 5' and 6' may be generated most of the recent literature results on labor vs. capital taxation by varying the representation of the labor supply decisions. Firstly, the labor tax creates more number of distortions than the capital tax if there are both labor/leisure choice and human capital accumulation in the model. This is because a labor tax creates two distortions: an intra-temporal one in Equation 5' and an inter-temporal one in Equation 6', whereas the capital tax creates only the inter-temporal distortion in Equation 6'. Secondly, the labor tax is equally distortionary as the capital tax if there is no labor/leisure choice but there is human capital accumulation in the model. This is because Equation 5' is now irrelevant, and from Equation 6', both taxes have similar effects on consumption growth. Finally, the labor tax is undistortionary whereas the capital tax is, if there is no labor/leisure choice and no human capital accumulation in the model. Thus, in principle, there may be different results on the effects of a labor tax and a revenue-equivalent capital tax just because of the differences of our representation of the labor supply decisions in the model. Nevertheless, within the same model structure, the magnitudes as well as the directions of these effects, can differ because of differences in the elasticities assumed. However, such differences in effects are hard to sort out analytically from the framework in Equations 1- 8.

⁽²⁾ This functional form implies that both the intra-temporal and the inter-temporal elasticities are unity.

A Numerical General Equilibrium Model of Kuwait Economy

The Generic Setup

The modeling framework adopted is a stylized Computable General Equilibrium (CGE) model with endogenous physical and human capital accumulation. There is one advantage in the model, GDP, that is produced competitively subject to a Constants Returns To Scale (CRTS) technology. The production technology is represented by a Nested Constant-Elasticity-of-Substitution (NCES) function with physical capital and human capital and natural resource services as inputs. Output in each period is consumed, invested in physical capital, or invested in human capital (Education).

There are two investment sectors in the model: *INV* produces the physical capital, and *EDU* produces the human capital. Physical capital is produced from good *Y* (the GDP) according to a linear technology, and human capital is produced from human capital services (time) combined with *Y* according to a CES technology subject to CRTS. Both physical capital and human capital are accumulable in the usual way subject to depreciation. Accordingly, one unit of capital produced in the current period provides one unit of capital services this period and adds $(1-\delta)$ units to the next period stock of capital. Output of physical capital services is solely allocated to the production of *Y*. In contrast, human time has three different uses: production of *Y*, the production of human capital (education), and the household home-production activity (or leisure).

Final demands are generated by an infinitely lived representative household that maximizes the sum of discounted utilities over time subject to a lifetime budget constraint. In each period, the household derives utility from consuming good *Y* as well as from leisure according to CES preferences subject to intra-temporal substitutions between consumption and leisure (*SIGMA*). In turn, the present amount of utility is traded off against the future amounts of utility according to a CES-representation subject to both a discount factor (β) and an inter-temporal substitution elasticity (*ISUB*). The lifetime budget constraint ensures that the present value of incomes equal the present value of expenditures. The present value incomes are essentially the initial stocks of human and physical capital multiplied by their corresponding first period present value prices.

Benchmark Data and Model Parameterization

The model is calibrated on the 1995 national income accounts data for Kuwait. The data are reported in Table 1 in the form of a rectangular Social Accounting Matrix (SAM) with positive numbers representing output and income flows and negative numbers representing input and expenditure flows. The accounts shown on the columns are :*Y* is the aggregate sector producing GDP; *INV* is the physical capital investment sector; *EDU* is education or human capital investment sector; *W* is the budget allocation sector; *BOP* is the balance of payment account; and *HH* is the household income-expenditure account. The accounts shown on the rows include the factors of production:

K for physical capital; H for human capital; R for oil resource; and L for exogenous labor in addition to accounts FSAV for Net Foreign Saving and DSAV for domestic savings. GDP is produced using the factor services of K, H, R and L and in turn, is allocated to consumption, investment in physical and human capital and to exports. Rents on oil reserves (R) are assessed to be 75% of the returns to capital in the oil sector. Human capital is defined to include Kuwaiti nationals with post secondary education in the labor force and those currently enrolled in secondary and higher education.

The 1995 statistics on human capital are based on Al-Kawaz (2002) and ESCWA economic statistics (1999). Based on these sources, educated labor force among Kuwaiti nationals is estimated to be 30% and expenditure on secondary and higher education is estimated to be 45% of the total government expenditure on education. Returns on human capital are assessed using returns on education estimates from Ali's study (2002), which shows a rate of return in the range of 10%. The exogenous labor supply (L) is mostly expatriate labor force in Kuwait. Based on hours of work leisure and home production, activities are estimated to consume 20% of the potential working hours compared to international standards. The rest of the national economic flows such as consumption, investment, incomes, savings and balance of payment are obtained from the national economic statistics reported by the Statistical Office of the Ministry of Planning.

In addition to the benchmark flows, calibrating the economy on an endogenous growth path requires specifying the baseline GDP growth rate, the initial rate of returns on physical and human capital, the discount rate, and the depreciation rates of physical and human capital. Based on the national statistics, annual growth rates of GDP during 1990-2000 are in the range 2-5%. For this study, a baseline GDP growth rate of 3% is assumed. Depreciation rates reported by national sources for 1995-1998 fluctuate around 5% and based on this, a 5% depreciation rate for physical capital is assumed. For human capital, literature indicates higher depreciation rates compared to physical capital and following the assumption of a 6% depreciation rate for human capital. Based on reported market interest rates and taking into account other transaction costs, a 10% initial rate of return on physical capital is assumed and accordingly, future prices and incomes are discounted at this rate. Based on these estimates, the calibration of the Kuwait economy to a balanced growth path indicates an initial level of investment in human capital of 225m KD (which exactly matches the author's assessment of the education sector) and an initial stock of human capital of 2500m KD. In contrast, the calibration of physical capital to the balanced growth path, implies an initial level of investment of 1600m KD compared to 1368m KD in the benchmark economic flows and an initial stock of physical capital of 20000m KD compared to an exogenous estimate of 17000m KD. This implies that the actual levels of investment and capital stock are within 10% of the required levels for the Kuwait economy to support an initially balanced endogenous growth path.

With respect to the model response-space, the emphasis is on the labor supply elasticity and the substitution elasticity between labor and capital in the production function. Based on the reports of Babiker *et.al* (2003), and Khorshid (2002), these elasticity parameters are assumed default values of 1 and are varied in the sensitivity analyses. The other elasticities in the model are fixed at some empirically plausible

values. For the production function, the top substitution elasticity between natural resources input and the Physical-Human capital bundle is calibrated on a supply price elasticity of unity. For the education sector, the elasticity of substitution between Y and human capital is unity (i.e. Cobb-Douglas), and for the final demand sector the inter-temporal elasticity of substitution ($ISUB$) is assumed to be 0.5.

To close the model, the balance of payment surplus is fixed exogenously and grown at the GDP growth rate. The expatriate labor supply and the natural resource supply are also fixed exogenously and grown at the GDP growth rate, i.e. these production factors are inelastically supplied in the model during each period.

Policy Scenarios and Model Solution

The Kuwait economy is a tax-free economy, i.e. there is no labor nor capital tax. However, to finance the growing demand for public services on a sustainable basis a future need for taxes may arise. To discern the leverage of labor vs. capital tax on welfare and economic growth in such an economy, a policy scenario of 10% tax on labor vs. a 10% tax on capital is simulated. To avoid revenue effects resulting from difference in the size of demand for labor and capital in this economy, tax revenues are recycled as lump-sum to the household sector.

Two sensitivity tests are considered: one with respect to the intra-temporal elasticity of substitution between consumption and leisure ($SIGMA$) and the other with respect to the substitution between the inputs of physical and human capital services in production ($KLSUB$). For the intra-temporal substitution, $SIGMA$ is calibrated to match the exogenous labor supply elasticities (ETA) of 0, 0.1, 0.5, 1 and 2. For $KLSUB$, a low value of 0.5, a central value of 1 and a high value of 2 are considered.

Numerically, the model is formulated and solved as a mixed complementarity problem for the horizon 1995-2050 using GAMS/MPSGE software described in Rutherford (1995, 1999). The full model code is available on demand from the author.

Numerical Results

For the central elasticities case (i.e. $ETA=1$, and $KLSUB=1$), the simulation results of the labor and capital tax scenario are reported in Table 2. The statistics shown include the equivalent variation welfare index (expressed as a percentage of initial period income) and the growth rates of GDP, physical capital and human capital over the model horizon.

Table 2. Capital vs. Labor Taxation: Summary of Welfare and Growth Effects (%)

	Capital Tax	Labor Tax
Welfare (EV)	-0.05	-0.07
GDP Growth	2.89	2.98
K Growth	2.75	2.99
H Growth	2.96	2.79

The first indication of the results is that the welfare cost of labor tax is higher than the welfare cost of the capital tax yet the capital tax effect on GDP growth is far higher than that of the labor tax. The large difference in growth effects is explained by the fact that Kuwait is a capital-intensive economy with a capital/labor ratio in excess of 3. Given this capital intensity, it is understandable that a capital tax would have greater growth effects compared to a labor tax at the same rate. In contrast, with lump-sum rebate of the tax revenues, the main difference between the two taxes with respect to welfare will be their distortionary effects on output and factor prices. With the presence of labor/leisure choice these distortionary effects for the labor tax are seen to outweigh those for the capital tax, resulting in a greater welfare cost for the former. The second indication of the table is the general result that both human and physical capital accumulation are, on the average, negatively affected by the levying of either labor or capital tax in this initially tax-free economy. This is clearly reflected in having the average growth rates under either tax regime being lower than the economy's baseline growth rate of 3%.

To discern the transitional vs. the steady state effects of the tax regime, a model is simulated for a labor tax rate that yields the same average GDP growth effect over the model horizon as the 10% capital tax rate. The effects on GDP and consumption growth rates of this experiment are reported in Table 3 separately for the five decades in the model. The results reveal clearly the sharp differences in the transitional patterns of GDP and consumption growth rates in the two tax regimes even though they have identical study state growth effects. Thus, if this economy were to be observed only near its new steady state, it may be concluded that the two tax regimes have identical growth effects. However, it is obvious from the results that the capital tax has greater impact on consumption growth. On the other hand, the labor tax has greater impact on GDP growth during the first two decades. Hence, it is critical to look at both the transitional and the long term effects when evaluating or comparing tax regimes.

Table 3. Capital vs. Labor Taxation: Transitional and Steady State Effects (%)

	Capital Tax		Labor Tax	
	C_Growth	GDP_Growth	C_Growth	GDP_Growth
1995-2005	2.45	2.77	2.9	2.74
2005-2015	2.74	2.84	2.75	2.86
2015-2025	2.85	2.91	2.84	2.92
2025-2035	2.91	2.95	2.91	2.95
2035-2045	2.95	2.97	2.95	2.97

The policy implication of the results in Table 2 and Table 3 for the Kuwait economy, is the need to weigh the welfare vs. the growth effects when deciding on the appropriate tax scheme. Given the capital intensity of the Kuwait economy, capital taxation would clearly have undesirable effects on economic growth. Yet, for either consumer welfare or revenue reasons, the labor tax may not be attractive as well.

Having considered the welfare and growth effects for the central elasticity case, the sensitivity of these effects to the representation of labor supply decisions and to the substitutability between human and physical capital in the model may now be considered. Table 4 displays sensitivity results on labor supply representation for a version of the model with no human capital accumulation. On the columns are shown four variants of labor supply representations: no labor/leisure choice or a labor supply elasticity of zero ($ETA=0$); a low labor supply elasticity ($ETA=0.1$); a medium labor supply elasticity ($ETA=1$); and a high labor supply elasticity ($ETA=2$). Interestingly, for this empirically plausible range of elasticities, the welfare results replicate exactly the analytical conjectures on the leverage of labor supply representation on the distortionary effects of labor compared to capital taxes. In particular, Table 4 shows that the capital tax is associated with a higher welfare loss than an equivalent labor tax rate when either the model does not include a labor/leisure choice or the labor supply elasticity is low. In contrast, the welfare loss of labor tax is higher than that of an equivalent capital tax rate when the labor supply elasticity is relatively high. More interestingly, in the absence of human capital accumulation, the labor tax has virtually no growth effects on either GDP

Table 4. Capital vs. Labor Taxation: Sensitivity to Labor Supply Representation (%)

	ETA=0	ETA=0.1	ETA=1	ETA=2
Capital Tax:				
Welfare (EV)	-0.04	-0.04	-0.04	-0.04
GDP_Growth	2.88	2.88	2.88	2.88
K_Growth	2.75	2.75	2.75	2.75
Labor Tax:				
Welfare (EV)	0	-0.01	-0.08	-0.1
GDP_Growth	3	3	2.99	2.99
K_Growth	3	3	2.99	2.98

or capital stock whereas the capital tax has the same negative growth effects across the four variants. For the Kuwait context, the labor supply elasticity is probably close to 0.5. Hence, the question of the appropriate tax scheme remains unresolved on this dimension.

Finally, the sensitivity of welfare and growth effects in the main version with respect to the substitution elasticity between human and physical capital in production may now be considered. Table 5 reports the simulation results for this sensitivity exercise. The table suggests that for low substitution elasticity, the capital tax has a greater negative welfare effect compared to an equivalent labor tax rate while the labor tax has a greater negative welfare effect when the substitution elasticity is high. The effects of the two taxes on GDP growth appear insensitive to substitution elasticity. However, their negative effects on physical and human capital accumulations seem to increase with the substitution elasticity. Interestingly, for the high substitution elasticity ($KLSUB=2$) the capital tax induces an increase in the growth rate of human capital and the labor tax induces an increase in the growth rate of physical capital.

Table 5. Capital vs. Labor Taxation: Sensitivity to Capital-Labor Substitutability (%)

	KSUB=0.5		KLSUB=2	
	Capital Tax	Labor Tax	Capital Tax	Labor Tax
Welfare (EV)	-0.04	-0.03	-0.07	-0.12
GDP Growth	2.89	2.98	2.89	2.98
K Growth	2.79	2.96	2.70	3.02
H Growth	2.87	2.84	3.09	2.73

In the Kuwait case, the production processes in the manufacturing sector are largely capital-intensive and thus, there may be limited degree of substitutability between labor and capital. For other sectors of the economy, there may be ample degrees of substitutability between labor and capital. ⁽³⁾

Conclusion

This paper has considered the welfare and growth impacts of labor and capital taxation in a model with endogenous accumulation of human and physical capital. A theoretical framework in the spirit of the standard two-sector growth models has been utilized for characterizing the distortionary consequences of labor and capital taxes in such an environment. The main insights from the theoretical model have suggested that labor taxes may create more number of distortions than capital taxes when there is a labor/leisure choice in the model and less number of distortions otherwise. The magnitudes of distortions will generally depend on the elasticities in the model. Based on this characterization, a numerical general equilibrium model has been synthesized to simulate the Kuwait economy over the horizon 1995-2050 and then used to test the leverage of these elasticities on the distortionary effects of labor and capital taxation. The results from the numerical simulations are found to be in perfect concordance with the analytical insights. In particular, results suggest that the labor tax is associated with a greater welfare loss than a capital tax at an equivalent rate when there is a labor/leisure choice in the model. Under the different labor supply elasticities used, the growth impacts on GDP associated with the capital tax are found to be relatively higher than those associated with the labor tax. The policy relevance of these results for Kuwait is the need to exercise an appropriate balance between the welfare and growth effects when designing a tax scheme in such an initially tax-free economy.

⁽³⁾ To test the leverage of labor heterogeneity, the model is further simulated for the tax experiments with labor being disaggregated into nationals and expatriates. The results, as one would expect, indicate that with labor heterogeneity, the distortionary effects of labor taxation are larger than when labor is treated as a homogenous factor.

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