THE BURDEN OF THE PUBLIC DEBT AND LONG-RUN GROWTH*

Ahmed Kooros

"This paper purports to demonstrate that under certain circumstances the rate of interest does not restrain investment decisions. In a subsequent paper, I shall offer the internal rates of return on investment for major sectors of economic activity in Iran".

The Solow-Swan argument has shown that the natural rate of growth will coincide with the warranted rate of growth if factor payments and the capital-labour ratio are allowed to be flexible. Moreover, the Solow-Swan argument assumes perfect foreknowledge so that the actual rate of growth of output is equal to the warranted rate of growth. One important conclusion of the Solow-Swan argument is that a low rate of natural growth is compatible with a high rate of interest; and conversely. However, if one introduces monopolistic rigidities so that factor payments do not respond to real forces, the natural rate of growth will not correspond to the warranted rate of growth. When monopolistic complications are present it is suggested in this paper that government borrowing, through its asset effect, could conceivably bring the two rates together. Then, it will follow, paradoxically, that a high rate of interest on money becomes compatible with a high rate of economic growth. Perhaps the reason that deficit financing has not been considered before as a means of reconciling the two rates of growth is the fear of "the burden of the public debt."

The Vickrey-Modigliani Thesis

A few years ago, there was a resurgence of the classical argument that deficit-financing of public undertakings is fruitless and places a

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"burden" on posterity. The imposition of the burden as a result of debt-financing has been examined and accounted for in many ways. Among others,[1] there is the Ricardian long-run growth argument which has been advanced by Vickery[2] and Modigliani.[3] The Vickrey-Modigliani thesis offers the following explanation: Given a full employment level of income, since a portion of the present net worth sets in motion debt-financed government expenditures, the tangible productive resources for the future will initially be impaired by as much, and this, *pari passu*, will be the extent of the burden imposed on future generations; i.e., debt-financed government expenditures entail a simultaneous curtailment of future capacity if the expenditures are used for current, not capital, outlays. The burden that posterity is to shoulder will be even more if the debt is serviced by levying taxes. That is, since taxes reduce consumption proportional to marginal propensity to consume, the balance of taxable revenues will be equal to the vanished individual net worth. The Vickery-Modigliani thesis suggests explicitly that projects which are financed by selling government securities may prove to be incongruous with growth in the long-run.

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1. For many years, James Buchanan, with whose thesis we are not concerned, has argued that since a debt for financing present public projects imposes coercively the defrayal of service charges on posterity, debt-financing implicitly constitutes a burden. Of course, he takes it that interest charges are paid for by levying taxes. Buchanan pointedly advances the postulate that the "payment of taxes is *per se* a burden - whether or not the taxes offset incentives and resource allocation. Since debt finance postpones the levy of taxes, it obviously shifts the burden to future generations". A debt is unjustifiably burdensome since the individuals who are now forced to pay taxes did not "agree to pay taxes in exchange for public goods ... The fact that taxes are payments is, in itself, sufficient. In this sense, taxes are no different from prices paid in market transactions. The payment of prices for ordinary goods and services is also, *per se*, a burden, (J.M. Buchanan, "The Loans of Public Debt" *The Journal of Public Finance*, 1966, pp. 544-546). What if the service costs of a public debt are also paid for and met by floating additional blocks of public securities? Obviously, this manner of managing the debt would not generate a disheartening burden though it may bring on financial headaches for future administrators especially if the roots of progress of their plans are entangled by statutory debt limits. Further, what if the benefit accrued to future generations exceeds, or is equal to, taxes paid by posterity?

2. W. Vickery, "The Burden of the Public Debt: A Comment," *American Economic Review*, 1960, pp. 132-137.

3. F. Modigliani, "Long-run Implications of Alternative Fiscal Policies and the Burden of the National Debt", *Economic Journal*, 1961, pp. 730-755.

Further, any wasteful diminution of capital capacity which is realised consequentially as a result of reallocation of funds for programmes will- *ceteris paribus* - generate an inflationary pressure on the economy. This is so since the demand for products will not be met by insufficient available capacity.

A formidable pillar of the Vickrey-Modigliani non-monetary growth thesis is that all income in excess of consumption is, in fact, saved and that which is saved necessarily becomes real capital investment. Further, saving behaviour, in reference to the rate of growth of the labour force, determines capital intensity and the latter outlines movements of the interest rate. Hence, any leakage in (augmentation of) the supply of savings - *ceteris paribus* - brings forth a fall (rise) in capital intensity and a rise (fall) in interest rate. Thus, thrift and productivity are the moving factors for wealth-owners in transferring their balances into reproducible capital. In fact, under the Vickrey-Modigliani non-monetary debt model all balances are active and there are no other assets, except real capital, which could influence wealth-owners' portfolio behaviour. That is, there are no monetary complications. If one assumes that money, or objects readily reducible to money, can compete with real capital in forming savers' portfolio choices, one could easily conclude that balances may be in active as well as passive forms. Consequently, wealth-owners may not accept an interest rate on money which is too low.

One of Keynes' most salient contributions was his emphasis on the fact that savers choose between reproducible capital and money, or assets easily convertible to money, in accordance with their expected returns. In fact, substitutability between money, capital and other assets, (i.e., the line of demarcation between passive and active balances), depends upon the risk involved, liquidity and expected returns. Thus, monetary complications may impair the capital-labour ratio and factor payments flexibility. And with this goes the foundation of the Solow-Swan argument. Therefore, in essence the Vickrey-Modigliani thesis, like the Solow-Swan argument, holds in the absence of monetary complications. And the burden of the public debt is due to the divergence of the natural rate of growth from its warranted path.

A Monetary Growth and Debt Model

1. Notations and Definitions:

(1.1) $X_h = \{x_g \in X_h : x_h$ is a possible consumption for the h^{th} household and $u_h(x_h) = u_h : h = 1, \ldots n\}$ *Attainable Consumption Set.*

(1.2) $M = \{m \in M : m = m^1 + m^2$ where m^1 is the active balances and m^2 denotes the passive balances: $m^1 = \sum_h^n m_h^1$; $m^2 = \sum_h^n m_h^2$; $m_h^1 \in M_h^1$; $m_h^2 \in M_h^2$; $M = M_h^1 + M_h^2\}$. *Aggregate Balances Set.*

(1.3) $px_h \leq m_h^1 + m_h^2$ wealth constraint where p is a price vector.

(1.4) $D_f = \{d_f \in D_f$ where d_f is a possible debt plan open to the f^{th} firm, $f = 1, \ldots, m\}$ *Possible Debt Plan Set.*

(1.5) A transformation Φ which maps a set T into itself is said to be upper semi-continuous at x_o if for each open set G containing Φx_o there exists a neighbourhood $N(x_o)$ such that $x \in N(x_o) = > \Phi x \in G$. (This definition coincides with the one given in (1.4) when topologies are metrizable).

2. We adhere to the following assumptions:

(2.1) h satisfies $u_h(x_h)$ subject to the wealth constraint.

(2.2) At period t, resources are fixed in supply. That is, there is no way of augmenting the current resources of a closed economy.

(2.3) The marginal propensity to consume is less than unity and the aggregate consumption set depends on past levels of disposable income so that levying some taxes would reduce both consumption expenditures and net worth proportional to their propensities.

(2.4) Aggregate consumption, $X = (x \in X : x = \sum^n x_h, X = \Sigma x_h\}$. In addition to being income-elastic it is also interest elastic, i.e., $X=X(Y,i)$. For a given level of income a given household, as a result of comparing the present interest rates with the discounted utility of future incomes, will choose between a rapidly growing consumption in the future and a high starting level of consumption which does not grow in the future. Naturally, a high present interest rate, in excess of an expected "normal" rate, will induce the households to consume less today and more in the future. Conversely.

(2.5) In a monetary economy, money and other liquid assets, as stores of value, compete with reproducible capital in determining wealth

owners' portfolio choice.

(2.6) X_h is closed and convex. (i.e., if $x_h^q \in X_h$ and $x_h^q \to x_h^o$, then $x_h^o \in X_h$. If x_h^1 and $x_h^2 \in X_h$ and for some $(1 \geq a \geq 0)$, then $[(1 - a) x_h^1 + ax_h^2] \in X_h$).

(2.7) On the basis of Tobin's findings,[4] all balances are interest as well as income elastic. (i.e., $M = M(Y, i)$.

(2.8) $D = \{d \in D : d = \sum_f^m d_f, D = \sum_f^m D_f \quad d_f \in D_f$ and d_f a possible debt plan open to $f = 1, \ldots, m$, $D = D(Y, i)$. The aggregate debt set is income as well as interest elastic.

(2.9) D is closed and convex. (i.e., if $d^q \in D$ and $d^q \to d^o$, then $d^o \in D$. And if d^1 and $d^2 \in D$ and for some $(1 \geq a \geq 0)$, then $[(1 - a) d^1 + ad^2] \in D$).

(2.10) $0 \in D$. (i.e., an economy may manage to be free of debt).

(2.11) $X(Y, i) \times D(Y, i) = T$ the cartesian product of consumption and debt sets.

(2.12) $\Phi : T \to T$.

(2.13) Kakutani Theorem in R^n: If T is a non-null, compact convex set in R^n and if Φ is an upper semi-continuous mapping of T into itself and the set $\Phi(T)$ is non-null and convex for each (x,d) then for some (x^o, d^o) T we have $(x^o, d^o) \in \Phi(x^o, d^o)$.

3. Results:

According to Debreu if u_h (x_h) is continuous, since X_h is continuous (closed) then, X_h (u_h) will be closed.[5] Clearly on the basis of (2.2) and the closedness of xh, X is closed. Since, on the basis of (2.4) X is in a bounded set then X is non-empty and compact. Since S is the sum of n convex sets, it is also convex. Now, D is in a bounded set by virtue of (2.8). This result in addition to the closed condition of D will make it non-null and compact. It is also convex by assumption. Whence, T is non-null, compact and convex. It is not too difficult to show that Φ is upper semi-continuous.[6] Finally, $\Phi(T)$ is convex since D and X are. All these factors satisfy Kakutani's conditions. Therefore, there exists a fixed point which defines the value of the consumption set subject to balances

4. J. Tobin, "Liquidity Preference and Monetary Policy" *Review of Economics and Statistics*, 1947, pp. 124-131.

5. G. Debreu, *The Theory of Value*, New York, 1962.

6. See C. Berge, *Topological Spaces*, trans. E. M. Patterson. New York, 1963, pp. 109-110.

and the size of the debt. That is, for a unique level of income and interest rate, consumption and debt sets are determined subject to balances. However, according to (2.5) to each interest rate there is a correspondingly unique debt set. Thus, if the rate of interest is caught in the liquidity trap, and if this rate is less than the threshhold minimum rate, the reproducible capital will be excluded from the debt set.

According to (2.3) policies involving tax-financing would considerably restrict current consumption expenditures; they would also reduce the net worth. Nevertheless, if remedial action is to be taken in case of inflationary pressures through the intermediary of taxation, the transferring of funds from household to government will pose no "burden" on any generation. The curtailment of aggregate demand through taxation, or any other fiscal device which would allow the tightening of the money market, will bring spending in balance with the available capacity. However, if taxes are used, not for trying to redress inflationary problems, but to raise revenue for undertaking fiscal measures, and if tax revenues do not come from savers' passive balances, taxes will impose a "burden" not only on those who, proportional to their marginal propensity to consume, will lose command over a portion of their purchasing power, but on posterity by reducing saving balances proportional to the marginal propensity to save. In the same way, counter-cyclical policies involving debt-financing by curtailing the currently available supply of money resources will shift the "burden" of the debt to future generations by impairing current resources.

In a monetary economy, if one assumes a Harrodian minimum rate of return on investment below which investors would not undertake investment projects, there will occur a discrepancy between the capital intensity and the return on capital associated with savings behaviour and the capital intensity associated with the minimum rate. However, in accordance with (2.7) and the fact that open-market operations of public securities influence security prices and interest rates, if one supposes that investors would not embark on new projects if they knew the rate of return on their projects would be less than the Harrodian minimum, government could, by issuing public securities, absorb the difference between what the wealth-owners want to dispose of an what the investors wish to borrow. Hence, it is plausible to suggest that debt-financing, which in general

depresses security prices and raises interest rates, may encourage the owners of pillow-cases, stockings and other objects full of idle balances to part with control of their holdings so that they will be directed to an enlargement of public and private capital. If this is the case, debt-financing of public projects will not impose any burden on any generation. Moreover, since the difference between what the wealth-owners want to dispose of and what they possess is absorbed by the volume of public debt, the warranted rate of growth will be equal to the natural rate of growth. Consequently, a rise in the rate of interest on money, through its asset effect, will be compatible with a rise in the natural rate of growth.

A Graphical Presentation*

In Fig. 1 we illustrate the manner in which the propensity to save and a sound debt policy can maintain the full employment level of economic tempo in a monetary economy. To do this, we suppose a continuous Cobb-Douglas production function, (which implies the prevalence of pure competition), and a constant growth rate of population. The vertical axis measures various rates. The horizontal axis measures savings-investment as a proxy for capital intensity. All axes measure positive values of the variables.

The marginal physical product curve, in accordance with usual assumptions about production function, sloping downward, is convex to the origin and asymptotic to the horizontal axis; i.e., the rate of interest will never become negative.[7] We also suppose that the stock of capital changes at the warranted rate of growth so that the desired stock of capital is equal to actual capital. Hence, the schedule of the marginal efficiency of capital relates different rates of discount to its corresponding level of the warranted capital intensity. Of course, the fundamental assumption is that entreprenuers would prognosticate the level of income accurately so that the actual line of advance will not depart from the warranted one. As a proxy for the warranted marginal efficiency schedule,

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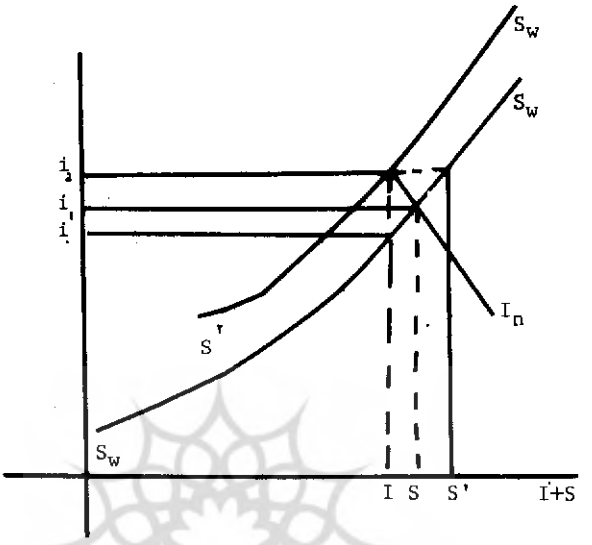
* The diagram was suggested to me by Franklin V. Walker.

7. This assumes perfect foreknowledge. The equality might be brought about through "indicative" planning which performs the "function of determining the rate of growth which might be realized in the future", c.f. F. Hahn and F.P.R. Brechling (eds.) *The Theory of Interest Rates*, 1965.

curve SS_w represents the saving schedule at the warranted rate[8].



Curve I_n represents the investment demand schedule for a given rate of population growth.

If reproducible capital is the only asset that wealth-owners include in their portfolio, the market rate of interest will be i_1 and the natural rate will be equal to the warranted rate. But, if there are other assets which could compete with reproducible capital in wealth-owners' portfolio, a rate of return on capital below some critical rate, the Harrodian minimum rate, would force wealth-owners to substitute other assets for capital. In Fig. 1, this minimum rate is i_2. Accordingly, diminishing returns to capital have lowered the marginal efficiency of capital to the point where *ex ante* investment falls short of saving at the existing rate of interest. This rate is below the threshhold minimum rate at which investors will undertake projects; i.e., a discontinuity in the investment

8. The saving schedule levels off at i which represents a liquidity trap being equal to the round-trip of transacting money and securities. This assumption is made by virtue of Tobin's, Latane's, and our own findings presented elsewhere. (See J. Tobin "Money and Economic Growth" *Econometrica*, 1965; H.A. Latane, "Cash Balances and the Interest Rate... A Pragmatic Approach" *Review of Economics and Statistics*, 1951, pp.456-460; A. Kooros, "Demand for Money: A Non-linear Estimation," Paper presented to the Annual Meeting of the Econometric Society, December 1967.

demand schedule. The excess of saving will mean that final markets are not cleared and the natural rate is different from the warranted rate of growth. Thus, we have the depression-prone disequilibrium of the Harrod scheme. However, this disequilibrium can be avoided if the excess saving is absorbed by government borrowing and returned to the spending stream through government expenditures, thus clearing final markets; i.e., SS_w should move to the position of $S'S'_w$. This drives up the rate of interest to i_2 without affecting investment. Notice that the natural rate and the warranted rate are equal and that a high rate of interest on money is associated with a high rate of growth and conversely. It appears that a sound policy is to absorb whatever passive balances are created once the marginal efficiency of capital falls short of the minimum required rate of return on capital. Thus, under this condition it is not in floating government securities that future generations will inherit a burden. Of course, the converse is to be done when the warranted rated lags behind the natural growth rate.

There are, however, some other options, that one could mention. For instance, the government could possibly create new money to absorb IS', the difference between investment demand and saving at the warranted rate; which means that the rate of growth of capital will be reduced to $S'S'_w$.[9] Of course, the result would be the same as in the previous case.But there is one fundamental difference. Whereas this procedure works only where there is an organised money and capital market, our attempt will work in all economies, whether or not they possess organised money and capital markets. When applied to developing economies, our argument becomes interesting. A developing economy lacks consistent money and capital markets. It is also plagued with the disparity between the warranted rate and the natural rate. If we attempt to reconcile the two rates by floating government securities, not only do we achieve equilibrium in the sense of harrod, we will also pave the way for the establishment of a system of discounting. The economic histories of the U.S.A., Japan and the industrialised countries of the West attest to the fact that a complete system of discounting is one of the most important ingredients of economic growth in the real sense. Thus our argument seems to be more general than the one which endeavours to equate the warranted rate to the natural rate via money creation.

9. J. Tobin, "Money and Economic Growth", *Econometrica*, 1965, p. 670.