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Perfect Capital Mobility, Taxation, Money Illusion, and Devaluations

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1. INTRODUCTION

Are devaluations contractionary? This question has been with us for a long time. The conventional Keynesian economist holds the view that if devaluation is demand-expansionary, then both output and balance-of-payments will improve with devaluation. Experience, however, shows contrary outcomes. For example, Sheehy (1986), who has covered 16 Latin American countries, concluded that devaluation was highly contractionary in these countries. Edwards (1986), on the other hand, has covered 12 less developed countries (LDCs) and found that devaluations are contractionary in the impact period, while in the long-run they all become neutral. Hamarious (1989) has used the data for the periods 1953–73 and 1975–84 and has covered twenty-seven countries and six devaluation episodes to study the effects of devaluations upon prices and the trade balance. He found that in over 80 percent of the cases, devaluation causes a net improvement in the trade balance both in the impact period and in the middle period. The study concluded that the effects of devaluation upon the trade balance last for two to three years. Such results seriously challenge the theoretical results derived by the conventional economist.

A great deal of effort has been made to give a theoretical explanation of these contractionary effects of devaluation. The first thing which naturally comes to our mind is that devaluation may not be demand-expansionary. Secondly, although devaluation may be demand-expansionary, yet due to strong negative supply-side effects of the exchange rate there could be an adverse effect of devaluation upon output and payments balance. To explore the possible supply-side effects of the exchange rate, economists have developed a few models which deal explicitly with the supply-side effects of the exchange rate. Buffie (1986); Lizondo and Montiel (1989); Gylfason and Schmid (1983); Calvo (1983) and Lai and Chang (1989) are the important examples in this context. Buffie (1986) derived the result that if the system is stable, then devaluation cannot both contract employment and reduce the payments balance. Calvo (1983) and Larrian and Sachs (1986) have derived the result that devaluation will exert

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contractionary effects only if the local equilibrium is unstable. Lai and Chang (1989) have derived the result that currency devaluation has a negative impact on output if workers are freed from money illusion. Gylfason and Schmid (1983) show that if the real wage is assumed to be constant, then devaluation contracts the real income.

In this paper, we extended the work of Lai and Chang. Lai and Chang demonstrated that it is the degree of money illusion coupled with the tax system (proportional versus progressive) which probably explains the contractionary effects of devaluation. When workers are free of any money illusion, it is shown that devaluation necessarily contracts the output. However, when workers have some degree of money illusion, then tax-induced aggregate supply-side effects may give rise to contractionary effects of devaluation. We have developed a model which contains the Lai and Chang model as a special case. We improved the Lai and Chang model on at least seven points. However, due to space limitations, we are not reporting these changes. Interested readers may read Ali (1991) for details.

After this introduction, we now move to the next section of this paper where we discuss our model.

2. THE MODEL

Aggregate Demand

The demand side of the model is represented by the following equations:

$$Q = C(Q^d) + I(r) + G + X\left(\frac{ep^x}{P}\right) - \frac{ep^{im}}{p} IM\left(\frac{ep^{im}}{p}, Q^d\right) \quad \ldots \quad (1)$$

$$Q^d = [Q - t(pQ)\, Q - S]\, p/g \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

$$g = (1 - \alpha)p + \alpha ep^f \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$\frac{M}{g} = L[Y, (1 - t(pQ)r] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

$$Y = \frac{pQ}{g} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Supply Side

The supply side of the model is represented by:

$$Q = Q(N, \overline{K}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$$W = pQ_N(N, \overline{K}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

$$W\ (1 - t(pQ)) = h(N, g) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

Government Budget Constraint

The government budget constraint is represented by:

$$G = t(pQ)Q + S \qquad \ldots \qquad (9)$$

Dynamics

The dynamics of the model are determined by the following balance-of-payments equation:

$$\dot{M} = p\left[X\left(\frac{ep^{x}}{p}\right) - \frac{ep^{im}}{p} IM\left(\frac{ep^{im}}{p}, Q^{d}\right)\right] + K(r - r^{f} + \dot{e}/e) \qquad \ldots \qquad (10)$$

The notation is as follows:

- Q domestic output;
- Q^{d} disposable income;
- C consumption expenditure;
- t income tax rate;
- p domestic currency price of domestic good;
- I investment expenditure;
- r domestic interest rate;
- G government expenditure;
- e nominal exchange rate measured in domestic currency;
- p^{f} foreign currency price of imports;
- L real money demand;
- M nominal money supply;
- K net capital inflow;
- $\dot{M}$ balance-of-payments surplus;
- α proportion of expenditure on foreign good;
- g consumer price index;
- W nominal wage rate;
- Q_{N} marginal productivity of labour ;
- $h\,(\,)$ inverse labour supply function;
- $Q\,(N)$ production function;
- N level of employment or number of hours worked;
- $X\,(\,)$ export expenditure;
- $IM\,(\,)$ import expenditure;
- Y scale variable in the money demand function;
- $\dot{e}$ time derivative of the exchange rate;
- S lump-sum tax; and
- r^{f} foreign rate of interest;

Equation (1) represents the equality between supply and demand for the domestically produced good, Q, whose price is p. The variables C and I represent the consumption of domestic and foreign goods by private agents. G represents government expenditure. As usual, private consumption and investment are specified as functions of disposable income and rate of interest, respectively. Also, it is assumed that along with the terms of trade, ep^f/p, the demand for imports depends on disposable income, while the demand for exports is defined as a function of the terms of trade and foreign income. For simplicity, we assume that foreign income is fixed, and it is therefore omitted. Equation (2) determines the disposable income of private agents. $t(pQ)$ is the tax function and S is a lump-sum tax.

Equation (3) is the standard consumer price index (CPI). Equation (4) is the standard LM equation. It stipulates equilibrium in the money market. It is assumed that the demand for money is negatively related to the interest r and positively related to output. Following Salop (1974) and Ahtiala (1989), the scale variable in the money demand function, Y, is defined in terms of basket of good. Similarly, the demand for money is specified as a function of after-tax interest rate. Furthermore, to maintain consistency, we also defined the level of money stock, M, in terms of the basket of good.

As far as the supply side of the model is concerned, Equation (6) shows that output is produced by involving only labour as the variable factor. Equations (7) and (8) represent labour demand and supply, respectively. The demand for labour is obtained by solving the firm's profit maximisation problem. The supply is obtained by maximising labour's utility function, defined with after-tax real income and leisure as arguments, subject to the time constraint.

Equation (9) states that government budget is always in balance. $t(pQ)Q$ measures the total tax revenues while S is a lump-sum subsidy which keeps the government budget continuously balanced.

The last Equation, (10), introduces some dynamics into the system. It determines the balance of payments, which is defined as the sum of current and capital accounts. It also explains the spending and earning of foreign exchange.

This completes the basic introduction of the model. In the impact period, there are ten endogenous variables $Q, Q^d, p, r, N, W, g, S, Y$, and $\dot{M}$, which could be derived by solving Equations (1) through (10). We are assuming throughout that the country in question is importing only final consumption goods, and that the labour market clears at every point in time. Although it introduces a stock-flow mis-specification problem, for simplicity we ignore international debt-service payment and the wealth effects.

3. PRELIMINARY MANIPULATIONS

As usual, throughout the analysis we are assuming that:

$$1 > c = \frac{\partial c}{\partial Q^d} > 0 \qquad I_r = \frac{\partial I(r)}{\partial r} < 0$$

$$L_Y = \frac{\partial L}{\partial Y} > 0 \qquad 1 > m^d = \frac{-\partial IM}{\partial Q^d} > 0\,,\ m^d < c$$

$$L_r = \frac{\partial L}{\partial r} < 0 \qquad B_\tau = I\overline{M}\ (\eta_x + \delta_e - 1) > 0$$

$$h_g = \frac{\partial h(N,g)}{\partial g} \geq 0 \qquad h_w = \frac{\partial h(N,g)}{\partial W} > 0$$

$$K_r = \frac{dK}{dr} \geq 0 \qquad \delta = h_g g/h$$

where

c: is marginal propensity to consume;

$\eta_x \;=\; \dfrac{dX(ep^x / p)}{d(ep^x / p)}.\dfrac{ep^x}{\overline{X}}$ export price elasticity;

δe is price elasticity of imported goods; and

$I\overline{M}$ is initial value of imports.

Bar represents the initial value of the variable.

δ is the parameter which measures the degree of money illusion: $\delta = 0$ means that workers have perfect money illusion, $\delta = 1$ implies no money illusion, and $0 < \delta < 1$ indicates that workers are suffering from partial money illusion. We first represent the model in the following compact form which will be helpful in deriving stability conditions and comparative static results:

$$\begin{pmatrix} 1 & -z_1 & 0 \\ 1 & -\phi p & 0 \\ -B_2 & -B_1 & 1 \end{pmatrix} \begin{pmatrix} dlnQ \\ dlnp \\ d\dot{M} \end{pmatrix} = \begin{pmatrix} z_4 & z_2 & z_3 \\ 0 & \phi_e & 0 \\ B_4 & B_3 & B_5 \end{pmatrix} \begin{pmatrix} dlnM \\ dlne \\ dlnG \end{pmatrix} \quad \ldots \quad \ldots \quad (11)$$

Where $z^{'s}$, $\phi^{'s}$, and $B^{'s}$ are functions of the model parameters. However, due to space limitations, we are not reporting these lengthy expression.

4. STABILITY ANALYSIS

By applying Cramer's rule on (11) and after doing a series of manipulations, we can derive that the system will be stable if and only if

$$\frac{d\dot{M}}{MdlnM}=\frac{z_4}{\Delta}\left[m^d Q^d\alpha+B_\tau-\overline{B}+\frac{m^d Q_N h}{\phi}\left((1-\alpha)\delta-1+\frac{\eta t}{1-t}\right)\right]+$$

$$\frac{K_r\overline{\gamma}_1}{z_0\Delta}\left[-B_\tau+(c-m^d)(\overline{Q}-\overline{G})\alpha-\phi_p(1-c+m^d)\right]<0 \quad \ldots \quad (12)$$

where:

$$\Delta=z_1-\phi_p$$

Using (12) it can be shown that in a perfect capital mobility regime the model will be stable if and only if

$$\lim_{K_r\to-\infty}\frac{1}{K_r}\frac{d\dot{M}}{MdlnM}=\frac{\overline{\gamma}_1}{z_0\Delta}\left[-B_\tau+(c-m^d)(\overline{Q}-\overline{G})\alpha-\phi_p(1-c+m^d)\right]<0 \quad \ldots \quad (13)$$

From (13) it is evident that regardless of the tax system, the model may not be necessarily stable if Δ has a negative value. However, if we assume the plausible set of parameter values, for example, $\alpha=0.30$, θ_L (labour share in total output) $=0.75$, $t=0.5$, $\eta_x=1.1$, $\delta_e=0.95$, υ^d (real wage elasticity of labour demand) $=1$, $IM=0.3$, $c=0.9$, $m^d=0.6$, $r=0.10$, ε^s (real wage elasticity of labour supply) $=0.1$, a (income elasticity of money demand) $=1$, σ (interest elasticity of investment demand) $=0.34$, θ (interest elasticity of money demand) $=0.25$, and $P=Q=1$ initially, then for non-progressive taxation the model will necessarily be stable if Δ is negative. Furthermore, for progressive taxation Δ must have a positive value for stability if and only if η has a value greater than 12.2, which is highly restrictive. For this reason, in the analysis below, we assume that for all taxation regimes the system is table under $\Delta<0$.

Assuming stability of the system, we now derive some comparative static results which follow from devaluation of the domestic currency.

5. COMPARATIVE STATIC RESULTS

Applying Cramer's rule on (11) and set $K_r\to-\infty$ we get

$$\lim_{K_r\to-\infty}\frac{1}{K_r}\frac{dlnQ}{dlne}=\frac{Q_N h}{Q^2\phi\,\Delta\,\Omega_0}\left[((c-m^d)(\overline{Q}-\overline{G})\alpha-B_\tau)\left(\delta-1+\frac{\eta t}{1-t}\right)\right]\ldots \quad (14)$$

where:

$$\Omega_0=1-c+m^d$$

From (14), the following propositions can easily be derived:

PROPOSITION 1. In a perfect capital mobility regime, if workers have no money illusion and if the taxes are proportional, then devaluation will be neutral.

By setting $\delta=1$ and $\eta=0$ we will get $dlnQ/dlne=0$ which shows that devaluation is neutral.

PROPOSITION 2. In a perfect capital mobility regime, if workers have no money illusion, then under a plausible set of parametric values, devaluation will decrease the output for progressive taxation while it increases the output for regressive taxation.

Set $c = 0.9$, $m^d = 0.6$, $\alpha = 0.3$, $\overline{IM} = 0.3$, $\overline{G} = 0.25$, and $\overline{Q} = 1$ in (14) it can be shown that for progressive taxation (regressive taxation) output will increase with devaluation if and only if $\eta_x + \delta_e - 1 < 0.0225$ ($\eta_x + \delta_e + 1 > 0.225$). This shows that if we assume $\eta_x = 1.1$, $\delta_e = 0.95$ (as we did previously), then for progressive taxation output will decrease with devaluation, while it will increase for progressive taxation.

PROPOSITION 3. If workers have some degree of money illusion $1 > \delta < 0$, then the degree of money illusion plays a crucial role in determining the output effect of devaluation.

From (14) it can be seen that

$$\frac{dlnQ}{dlne} \gtrless 0 \text{ as } ((c-m^d)(\overline{Q}-\overline{G})\alpha - B_\tau)\left(\delta - 1 + \frac{\eta t}{1-t}\right) \gtrless 0 \qquad \ldots \qquad \ldots \qquad (15)$$

for non-progressive taxation $\eta \leq 0$ it can be shown that

$$\frac{dlnQ}{dlne} \gtrless 0 \text{ as } \eta_x + \delta_e - 1 \gtrless \frac{(c-m^d)(\overline{Q}-\overline{G})\alpha}{\overline{IM}}$$

and with plausible parameter values defined above, the above condition will necessarily be satisfied, which shows that output will increase with devaluation. Furthermore, with the same set of parameter values, it can further be shown that for progressive taxation output will increase (decrease) with devaluation if the aggregate supply function is positively sloped (negatively sloped). The reader can show that the aggregate supply function is positively sloped (negatively sloped) if $\delta - 1 + \eta t/(1-t) > 0$ ($\delta - 1 + \eta t/(1-t) < 0$) which obviously depends upon the degree of money illusion.

7. CONCLUSION

The findings of this paper reveal that along with stability the output effect of devaluation depends upon certain other characteristics of the model, such as money illusion and the tax system.

We found that money illusion and the tax system play crucial roles in determining the effects of devaluation. In our model a high degree of money illusion is associated with low supply-side effects of exchange rates, and *vice versa*, while the tax system coupled with the degree of money illusion determines the slope of the aggregate supply function for goods. We found that if workers are free of any money illusion and if the tax system is proportional, then the stability of the model ensures that output will decline with devaluation. This is the same result which is derived by Lai and Chang (1989).

It is found that perfect capital mobility coupled with the tax system plays a crucial role in determining the effects of devaluation on output. In our model, perfect capital mobility suppresses the contractionary demand-side effects of exchange rates which stem from both the transaction and speculative demand for money. Consequently, the likelihood that devaluation will be expansionary is increased. However, we noticed that in case of no money illusion, devaluation is neutral for proportional taxes, contractionary for progressive taxes, and expansionary for regressive taxes.

The main conclusion of this paper is that the supply-side effects of the tax rate coupled with the supply-side effects of the exchange rate seriously challenge the conclusions of the orthodox devaluation literature. Given that modern macroeconomic models involve more sophisticated analyses of the labour market, we feel that we have demonstrated that there is a need to develop a model involving such features as efficiency wages or wage contracts, to further explore the importance of the supply-side implications of the tax system when there is exchange rate devaluation.

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Comments

The paper addresses an important issue: Are devaluations contractionary? Within the context of a small, open economy like Pakistan, which relies mainly on its cotton exports, the question posed by the paper is relevant. Its relevance is seen by the observation that the cotton interests and other sheltered industries have repeatedly lobbied for devaluations as a tool to improve the trade balance.

The theoretical framework of the paper employs micro-foundations for the macro questions which it attempts to answer. The paper follows the approach taken by Lai and Chang and extends their model by showing it as a special case. The theoretical model employs an aggregate demand side, an aggregate supply with its usual production function and wage relationships, a government budget constraint, and a balance-of-payments equation.

The government budget constraint absolves one from including high powered money—a usual caveat of typical government budget constraints. The paper would thus be limited to answering the question that it raises, and its budget constraint is not the best suited to directly examining the much-publicised relationship between trade and fiscal deficits. In this paper, the relationship is examined indirectly at best, and the apparent shortcoming of the paper is redressed to a degree by the strong focus of the paper on taxation issues. As is well-known, Pakistan collect substantial indirect taxes through import duties. The paper would predict that the degree of money illusion and the type of taxation regime would determine the output effects of devaluation.

In the model, with perfect capital mobility, the likelihood that devaluation would be expansionary is increased. The author's conclusions rest on whether taxes are proportional, progressive, or regressive. I consider this feature of the paper to be its strength. However, I am deeply sceptical of devaluations having expansionary effects on output. Pakistan's previous devaluations are a case in point. The following table would be suggestive of the net impact of devaluation on the rupee value of the trade deficit.

Period		Trade Balance % Changes	Depreciation % Changes
1972/73 – 1976/77	↓	7,758%	107.9%
1977/78 – 1981/82	↓	123.8%	6.6%
1982/83 – 1987/88	↓	1.2%	38.5%
1988/89 – 1991/92	↓	27.4%	29.3%
1992/93 – 1994/95	↑	14.8%	18.8%

The above empirical evidence clearly shows that the devaluation, the trade balance improvement, and the output growth chain is not visible in Pakistan, in spite of repeated and large devaluations.

The evidence is not at odds with, and supports, the main conclusion of the paper that "supply-side effects of the tax rate coupled with the supply-side effects of the exchange rate seriously challenge the conclusions of the orthodox devaluation literature"—that devaluations are expansionary.

It would be useful and interesting to see an empirical representation of the model, though I cannot see how the present model would lend itself to such a test. A tax-based model such as this can prove particularly useful in the context of Pakistan, and those economies which rely heavily on their taxation revenues from import duties—but for this to be accomplished, the model would have to be formulated empirically with all its econometric restrictions.

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