A Model of Output and Investment for a Small Export Economy with Trade Preferences (Quotas), Imperfect Capital Market, and Transaction Costs

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For a small economy, there is no alternative for sustained growth other than through exports. The key problem for analysis and policy therefore concerns the factors determining investment in export expansion and diversification. The analysis presented here focuses sharply on this problem.

A.1 Assumptions

1.1 All firms are "rational": they seek to maximize profits subject to the given economic (and political) environment that they face.

1.2 There exists a representative exporting firm such that the export sector is a scalar multiple of the firm.

1.3 Exporters operate under a system of trade preferences and can sell on the world market all that they produce at a fixed price, up to the limit determined by a given quota.

1.4 There is a "cost of doing business" (transaction costs), derived from factors external to the firm and located in the social and physical infrastructure in which the firm operates.

1.5 At any moment, there is a given stock of capital, K, specific to the export sector and non-transferable.

1.6 There is an unlimited supply of labor L at the given wage, w.

1.7 Supply of imported and domestic inputs is perfectly elastic at the given input prices, c and a.

1.8 The economic environment consists of the following conditions that are independently given:

e: exchange rate (domestic vs. foreign currency)
P: world price of exports (in foreign currency)
c: price of imported input, X_f
a: price of domestic input, X_d
w: wage rate
B: export quota (in physical units)
τ_1: rate of indirect tax (export duty)
τ_2: rate of direct tax on profits
$Q = F(K, X_f, X_d, L)$: production function
$\phi(Q)$, $\phi' > 0$: cost of doing business

1.9 The unit period of time is chosen so as to correspond to the gestation period of investment.

A.2 The Output Decision

In a given period, firms can produce up to a level constrained by the size of the existing capital stock and by the quota. The decision problem is:

Maximize Π, subject to

(i) conditions 1.5, 1.6, 1.7, 1.8
(ii) $K = u\,\bar{K}, \quad 0 < u \leq 1$
(iii) $Q = mB, \quad 0 < m \leq 1$

where

(1) $$\Pi = [e(1-\tau_1)PQ - ecX_f - aX_d - wL - rK - \phi(Q)](1-\tau_2)$$

Two possible solutions of this problem are of interest, corresponding to the equilibrium values of u and m. The knife-edge case of u = 1, m = 1 is ignored. Consider each of these in turn.

Case 1 Supply Constrained Case

u = 1: full utilization of capital
m < 1: underutilization of quota

First order conditions

$$\frac{d\Pi}{dX_f} = V\frac{\partial F}{\partial X_f} - ec = 0$$

$$\frac{d\Pi}{dX_d} = V\frac{\partial F}{\partial X_d} - a = 0$$

$$\frac{d\Pi}{dL} = V\frac{\partial F}{\partial L} - w = 0$$

where

$$V = e(1-\tau_1)P - \phi' > 0$$

Solution of these equations yields the quantity of the inputs X_f, X_d, L. In turn, the quantity of output is obtained from solution of:

$$F\ (X_f,\ X_d,\ L,\ \bar{K}) = Q$$

The marginal conditions for an optimum input-output combination are consistent with standard results. But these particular conditions serve to identify clearly the role of indirect tax and transaction costs as discounts on the marginal valuation of the marginal product, hence on the marginal revenue of exporters. Consequently, output and profits are lower in this case than they would otherwise be in the absence of these discounts.

Comparative Statics

For the comparative static analysis, denote equilibrium values with an asterisk. Then, by differentiation, we get:

$$\frac{d\Pi^*}{d\tau_1} = -e(1-\tau_2)PQ^* < 0$$

$$\frac{d\Pi^*}{d\tau_2} = -\frac{\Pi^*}{1-\tau_2} < 0$$

$$\frac{d\Pi^*}{de} = [(1-\tau_1)PQ^* - cX_f^*](1-\tau_2) > 0$$

$$\frac{d\Pi^*}{dP} = e(1-\tau_1)(1-\tau_2)Q^* > 0$$

$$\frac{d\Pi^*}{dc} = -e(1-\tau_2)X_f^* < 0$$

$$\frac{d\Pi^*}{da} = -(1-\tau_2)X_d^* < 0$$

$$\frac{d\Pi^*}{dw} = -(1-\tau_2)L^* < 0$$

$$\frac{d\Pi^*}{d\bar{K}} = [V\frac{\partial F}{\partial \bar{K}} - r](1-\tau_2) > 0$$

$$\frac{d\Pi^*}{dB} = 0$$

It follows that profits are negatively related to all input prices and tax rates, and positively related to (a) the price of output, (b) the exchange rate, (c) the stock of capital. Given the supply-constraint, a change in demand has no effect on output or profits.

Case 2 Demand Constrained Case

u < 1: underutilization of capital
m = 1: full utilization of quota

First Order Conditions

The first order conditions are the same as case 1. But, in this case, output is determined by the quota so that

$$F(X_f, X_d, L, K) = B$$

Comparative Statics

$$\frac{d\Pi^*}{d\tau_1} = -e(1-\tau_2)PB < 0$$

$$\frac{d\Pi^*}{d\tau_2} = -\frac{\Pi^*}{1-\tau_2} < 0$$

$$\frac{d\Pi^*}{de} = [(1-\tau_1)PB - cX_f^*](1-\tau_2) > 0$$

$$\frac{d\Pi^*}{dP} = e(1-\tau_1)(1-\tau_2)B > 0$$

$$\frac{d\Pi^*}{dc} = -e(1-\tau_2)X_f^* < 0$$

$$\frac{d\Pi^*}{da} = -(1-\tau_2)X_d^* < 0$$

$$\frac{d\Pi^*}{dw} = -(1-\tau_2)L^* < 0$$

$$\frac{d\Pi^*}{D\bar{K}} = 0$$

$$\frac{d\Pi^*}{dB} = (V - \frac{w}{\partial F/\partial L})(1-\tau_2) > 0$$

The comparative statics results are the same as in the previous case, except that a change in the capital stock has no effect on profits, while a change in demand (the quota) has a positive effect.

A.3 Investment and Growth

The investment-decision problem may be approached in different ways, depending on the long term goals of the firm and the nature of the capital market in which the firm operates. Here, it is assumed that:

2.1 The objective of the firm is to grow.

2.2 A proportion of current profits is retained as a reserve fund for growth. Accordingly, define:

$R(\Pi)$ = profit retention policy

2.3 The firm can also borrow outside funds, B. Total investment, I, is governed by the constraint:

(2) $$I = R(\Pi) + B$$

2.4 The capital market is imperfect: the interest rate on borrowed funds is an increasing function of the amount borrowed:

(3) $i = i_0 + \beta(B), \qquad i_0 > 0, \ \beta' > 0$

where i_0 is the interest rate on government bonds and the difference $\beta(B) - i_0$ is a measure of the prevailing premium in the capital market.

2.4 There is a well defined demand for investment, uniquely related to the expected profitability of investment. Accordingly, the demand for investment is obtained by solution of the capital-budgeting formula:

(4) $$I = \sum_{t=0}^{t=\infty} \frac{\pi_t^e}{(1+q)^t}$$

where the discount rate q is the marginal efficiency of capital.

2.5 Firms are myopic: expectations are formed by extrapolating current conditions. Thus, expected profitability is related to current profitability:

(5) $$\pi^e = E(\Pi), \ E' > 0$$

2.6 Equilibrium of investment requires that

(6) $$i = q$$

In accordance with these conditions it is possible to derive a solution of the investment decision-problem as follows. The equilibrium level of current profits Π^* is determined by solution of the maximization problem in (1). Given Π^*, equations (2) to (6) determine equilibrium values of I^*, B^*, i^*, q^*. The nature of the one-period solution in terms of the equilibrium rate of investment is illustrated in Figure 1.

With investment thus determined, the capital stock increases by the amount I^*. This, in turn, determines output possibilities in the next period. The sequential solution for each period, given the evolution of the exogenous variables, determines the time path of exports.

A.4 Results

The preceding analysis thus gives rise to the following results.

For the explanation of export growth, it is necessary to distinguish between two possible regimes. These are as follows.

Regime 1

The export sector is supply constrained. In this case, the time path of exports is predictable from the function:

$$(7) \qquad Q = Q \{ i_o, \beta(.), \tau_1, \tau_2, e, P, c, a, w, F(.), \phi(.), E(.) \}$$

where the signs of the first derivatives are given by solution of the model as specified above (time subscripts are omitted).

Thus, the factors which govern the outcome in this case are:

Financial conditions: i_0, $\beta(.)$
Tax structure: τ_1, τ_2
Exchange rate policy: e
Trade preferences: P
Input-price configuration: c, a, w
Technology (productivity): F(.)
Transaction costs: $\phi(.)$
Expectations (entrepreneurial dynamism): E(.)

Regime 2

The export sector is demand constrained. Then, exports are given by the function

$$(8) \qquad Q(t) = Q \{ B(t) \}, \quad Q' > 0$$

which depends uniquely on the conditions (trade preferences) governing evolution of the quota.

These results provide a framework for hypothesis testing and are in principle capable of such testing with appropriate empirical data. They also serve to identify sharply the relevant parameters and impact effects that need to be considered in the formulation of economic policy aimed at influencing growth and export performance. But before doing that, it is necessary and useful to take some further steps in the analysis.

A.5 The Capital Market

The assumption that the capital market is imperfect is consistent with available empirical evidence and with a large cumulative analytical literature that confirms the principle of credit rationing by banks. It is represented here by by an upward sloping supply curve of investment

funds to borrowers.

This condition entails, in principle, that the marginal lending rate on borrowed funds increases on the incremental amount borrowed or, for a standardised loan per borrower, on loans to differentiated borrowers. This could be for reasons of "increasing risk" (as indicated in early work by Kalecki, 1936) or for reasons of adverse selection among differentiated borrowers (Stiglitz and Weiss, 1981).

A key analytical result in this context is that the credit market does not clear, in the Walrasian sense, at the lending rate which is optimal for banks. The lending rate and corresponding loan volume which allows banks to maximize expected returns for a given pool of borrowers rations out some borrowers with investment projects that would be profitable at that lending rate. This has the consequence that the aggregate amount of investment is lower than it would otherwise be and the growth of output is correspondingly lower.

The existence of credit rationing in this sense implies that the supply curve of capital becomes vertical at an interest rate below the market-clearing equilibrium rate in Figure 1. In that case, the amount of investment and corresponding growth of output that would be observed is (for a given pool of borrowers) independent of factors on the demand side and is wholly dependent on the conditions of supply of credit and the structure of the capital market. So far as the amount of investment is concerned, the level of the lending rate is not a factor determining the outcome.

A.6 Trade Preferences

In this analysis, trade preferences have an effect regardless of which of the two regimes exists. The effect operates through the price of output in Regime 1 and through the level of the quota in Regime 2. In this sense, trade preferences are a pervasive factor influencing the outcome.

Being pervasive, trade preferences may have attendant effects worth further consideration, in particular on the level of entrepreneurial dynamism ("animal spirits"). A plausible hypothesis is that they contribute to investment inertia. Specifically, trade preferences create a structure of incentives for investment in favour of sheltered activities that yield relatively risk-free returns and against riskier investment in unsheltered activities. Consequently, the overall rate of investment is lower than it would otherwise be and firms are less responsive to changes in the relevant variables. Firms that have adapted to this environment may prove incapable of withstanding the pressures of international competition when the regime changes to one of open competition for markets.

Removal of trade preferences and liberalization of the trade regime entail a difficult process of adjustment to new conditions. It calls for new behavior on the part of firms, in terms of innovation in production processes and new products as well as strategies of marketing,

financing, and investing, in order to deal with the challenge of international competition. In economic policy, it calls for an all round orientation to building and sustaining international competitiveness as the key principle of policy.[1]

A.7 Transaction Costs

Transaction costs are a decisive factor affecting the outcome. Specifically, as shown here, they enter as a discount on the marginal revenue function of exporters. Consequently, profits are lower than they would otherwise be, so is output, and the rate of investment is correspondingly reduced.

Transaction costs, in the sense used here, derive from factors that are external to the firm. They are located in the social and physical infrastructure in which the firm operates. Concretely, they relate to a variety of factors, ranging from time delays in customs for delivery of inputs and shipment of output, bureaucratic procedures of government, bribes, and the like, to provision of security services, transportation facilities, water supply, sewage. As a cost, they constitute external diseconomies which become internalised within the firm. Insofar as they relate to public goods, they derive from "public-goods failure".

The policy problem is to find effective ways of reducing these costs and of creating, instead, external economies that lower costs all round in the economy.

As specified here, transaction costs are an increasing function of the level of output. This implies an hypothesis that smaller economies suffer less from this problem. This hypothesis is worth further study.

A.8 Qualifications and Extensions

The results presented above are derived from what is strictly speaking a partial equilibrium analysis, given that the analysis does not explicitly consider interaction effects between the export sector and the rest of the economy. This feature is not in itself a shortcoming of the analysis. In fact, it may accurately describe the empirically relevant setting of an export enclave, such as the Export Processing Zones in the Caribben Basin. In that case, the crucial policy issue that is raised is: how to extend the linkages between the export enclave and the rest of the economy and what policies may be effective for that purpose. Alternatively, one might consider the model as one of an economy completely oriented to production for export.

Insofar as the export sector is integrated into other sectors of the economy, a number of additional considerations arise, as follows.

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[1] For a relevant discussion of some of the issues of economic policy for a Caribbean country (Jamaica) in this new environment, see Harris (1995b).

(a) The investment decision would be based on calculations of the relative profitability of investment, i.e. relative to alternatives in other sectors of the economy. Viewed from the standpoint of domestic investment, the relevant alternatives would be in the import-substituting sector and in non-tradeables. Investment in exports constitutes an attractive alternative only if it yields a higher return than other alternatives, allowing for differential risk and transfer costs. But alternative rates of return may not be directly observable. In an imperfect capital market, the market interest rate by itself would not be an adequate guide. Thus, there arises here a serious information problem which, quite apart from other factors such as investment inertia, may constitute an impediment to investment in exports.

(b) Supply of imported inputs may be constrained by the balance of foreign payments, which in turn depends on the aggregate value of exports. If this constraint is binding, it would introduce a simultaneity problem or feedback effect on the supply side.

(c) There may be a limited supply of skilled labor, so that the wage rate depends on demand for labor. This creates another possible source of feedback on the supply side, depending on the relative size of the export sector.

On the basis of the "small country" assumption, it is customary to suppose that the price of exports is exogenous to the export decision. But this presumption is potentially misleading. It clearly depends on the level of aggregation of products. For specific products (and in so-called niche markets), sales of exports may depend on selling price because of product differentiation by quality and marketing strategy, so that export market-share becomes endogenous to the output and investment decision. This consideration is likely to be significant for some product lines and not others, depending on both production and market factors. It is clearly relevant in considering possibilities for diversification away from traditional exports, in which case product differentiation and sales strategy become a crucial component of the strategy for export expansion.

An important qualification concerns the representative firm assumption on which the analysis is based. In practice, firms differ in terms of key characteristics that have a direct bearing on investment and export performance, for instance, scale of production, technology, quality of management, financial capacity, risk aversion, access to information. These differences matter for analysis if there are significant changes over time in composition of the population of firms due to entry and exit. They also matter for the design of economic policy.

A crucial aspect of the differentiation of firms is the role that initial (own) capital plays in access to the capital market and in loan terms. This aspect is brought out very sharply in the present analysis through the specification of factors governing the determination of investment from the side of finance.

Finally, the time path of exports may be subject to recurrent shocks due to changes in the exogenous variables. This raises interesting analytical and policy questions about the mechanism of transmission of such shocks and how to ensure stability. These issues are not considered here,

but the model allows room for them to enter. Specifically, in an unstable economic environment, increased risk and uncertainty associated with long term investment in productive assets (a) may push up the risk premium in the capital market and (b) reduce expected profitability of investment. The myopic form of expectations may itself be an adaptation to such an environment. These adjustments may have an effect throughout the economy, so as to reduce investment all round. The effect is likely to be especially strong in the export sector, so that there are compositional effects as well, involving flow of investment funds out of exports into other sectors (nontradables, like construction and real estate investment).

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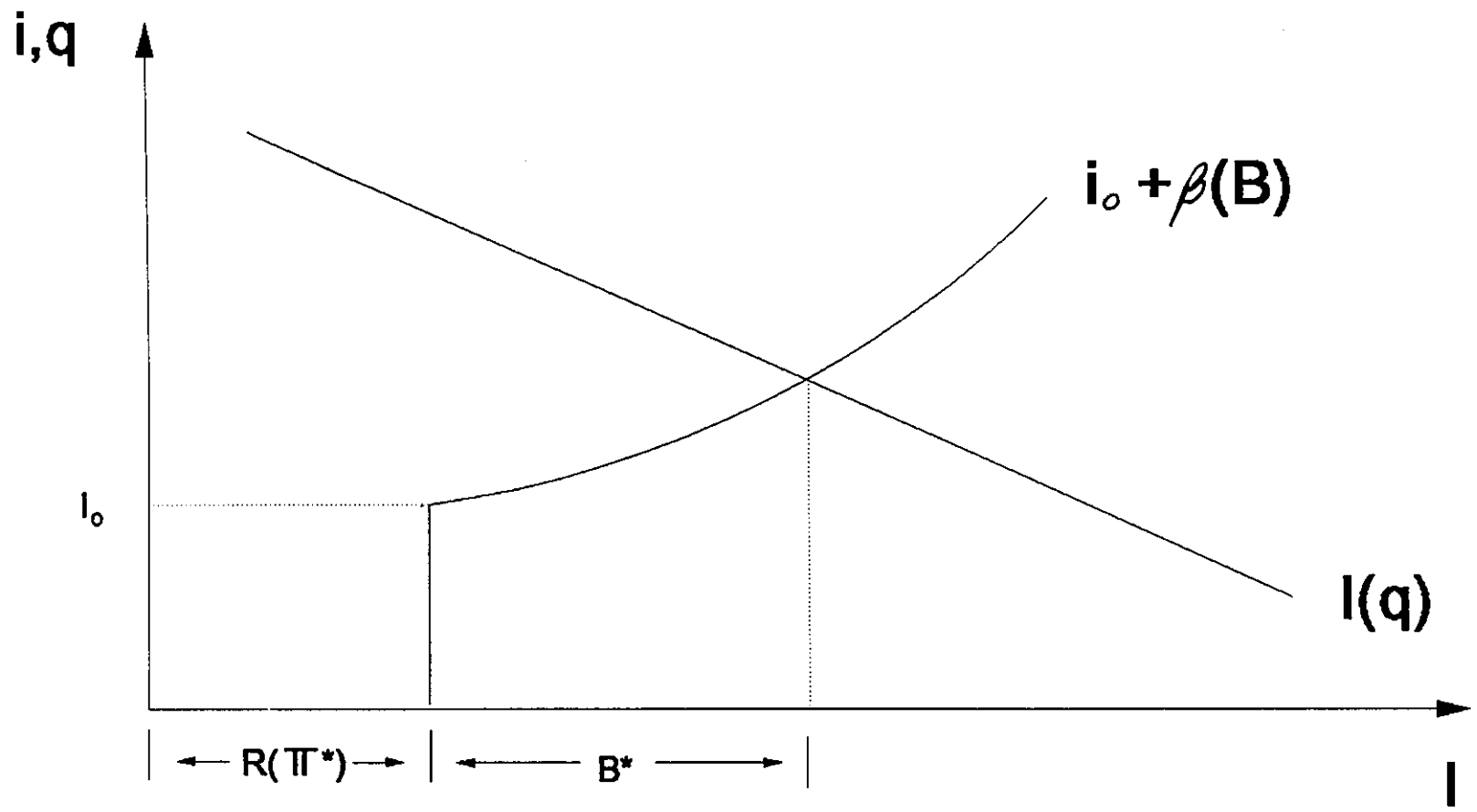

Figure 1. The Investment Decision