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# Export Supply, Capacity, and Relative Prices

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**A model applied to data on Turkey and Morocco suggests that prices and capacity have more influence on export supply than domestic demand does. Can a case be made for placing less emphasis on contractionary macroeconomic policies to achieve sustainable external balance?**

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In the neoclassical approach to specifying an export supply equation, relative prices and capacity are assumed to play a crucial role in domestic firms' decisions to supply exports.

In the Keynesian approach, the willingness of domestic firms to supply foreign markets is considered to be largely a function of domestic demand pressure. Keynesian analyses do not allow for the impact of relative prices.

Faini blends the two approaches in the model he has applied to Turkey and Morocco — countries chosen because of the shifts they have both undergone in their trade incentive structure, and despite the dearth of data on export supply behavior in developing countries.

In Faini's model, a firm is assumed to choose, first, the level of productive capacity and, then, one period later, to determine production and allocation between foreign and domestic markets on the basis of realized prices, demand conditions, and installed capacity.

Faini's conclusion: Both prices and capacity are significant determinants of export supply. If further studies confirm that relative prices have a significant influence (and domestic demand pressure a weak influence) on export supply — an argument can probably be made for placing less emphasis on contractionary macroeconomic policies as a means of achieving a sustainable external balance. Evidence to support such a conclusion is insufficient, but further research is warranted.

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## INTRODUCTION

A cursory review of the empirical literature on trade suggests a distinction between two main approaches to the specification of an export supply equation: the neoclassical approach in which relative prices, and capacity, are assumed to play a crucial role in affecting the supply decision, and the Keynesian approach, in which the willingness of domestic firms to supply foreign markets is considered to be largely a function of domestic demand pressure, with prices relegated mostly to the backstage. Surprisingly, very few attempts have been made to integrate the two approaches, whereas studies inspired by the neoclassical approach implicitly assume that domestic prices are all that is needed to capture domestic demand pressure. Keynesian analyses simply do not allow for the impact of relative prices. Except for a handful of noteworthy contributions (e.g., Aspe and Giavazzi 1982), the few studies that have tried to overcome this dichotomy have ended up simply juxtaposing the two sets of variables without providing a truly unified treatment of the two approaches.

Further, a discussion of how to derive an export supply function from a well-defined set of relevant hypotheses on technology and market structure has been remarkably absent from the applied literature. Although it is true that the work of Kohli (1978) and later of Diewert and Morrison (1986) has helped root export decisions more firmly in well-received microeconomic theory, their models are implicitly based on the assumption of market-clearing prices and leave no role for domestic demand pressure. Even, at a theoretical level opinions on the role of domestic demand

pressure diverge widely. For example, in an early study, Wells (1964) claimed that domestic demand pressure should not enter an export supply equation because prices already reflect domestic market conditions.<sup>1/</sup> But this argument is no longer compelling because we work with an imperfectly competitive market structure. Even with a perfectly competitive framework, it may be argued that prices are rigid in the shortrun (Zilberfarb 1980) and therefore will not reflect changes in domestic demand pressure. Furthermore, domestic demand pressure need not be accommodated only by price variations; other factors (e.g., inventories, delivery delays) may also enter into play. When those factors move together with prices, excluding them is likely to produce bias favoring price elasticity. The empirical evidence for this tendency is provided by Artus (1973) and Zilberfarb (1980) who have been able to detect a significant negative effect of domestic demand pressure on exports for the United Kingdom, United States, Federal Republic of Germany, and Israel. This observation appears to be consistent with the evidence discussed in Goldstein and Khan (1978) on slow adjustment of prices. However, to complicate matters, Dunlevy (1980) and Hayes and Stone (1983) find a significant, but positive, effect of capacity utilization on export supply, a finding that still requires some theoretical and statistical explanation.

From a theoretical choice model of the firm, this paper derives the conditions under which capacity utilization may affect export supply. In our model, the firm chooses first, the level of productive capacity and then, one period later, determines production and allocation between domestic and foreign markets on the basis of realized prices, demand conditions, and installed capacity. Following the empirical firm's

literature (Holt et. al. 1960, Fair 1969), it is assumed that the cost of a man period is a function of the number of hours worked, possibly reflecting the existence of overtime payments when actual hours exceed a given norm ("standard" hours). As a result, unexpected upward shifts in domestic absorption will, if the wage function is strictly convex, lead to higher costs and lower exports.

The model is applied to Turkey and Morocco. Evidence on export supply behavior in developing countries is even more scarce and systematic than it is for industrial countries,<sup>2/</sup> despite the undisputed role that supply factors play in determining export performance for these countries. Turkey and Morocco were selected because of the significant shift that both countries have undergone in their trade incentive structure.

This paper is organized as follows: Section 1 outlines the model and shows that even in an equilibrium model with market-clearing prices, domestic demand pressure can still play a role in the export supply decision. Section 2 offers a cursory review of export policy and performance in Turkey and Morocco and sets the stage for an econometric analysis of both the capacity and the export supply decision which is presented in Section 3. The last section offers some conclusions.

### 1. Modeling Export Supply

It is not difficult to understand why export supply studies have been few. The issues surrounding the behavior of exporters are inherently difficult and not yet fully understood. We know for instance that production for export depends on existing productive capacity, yet we do

not have a satisfactory measure of capacity, nor can we determine on purely a priori grounds whether we should rely on a sectoral or on aggregate indicator of capacity. More fundamentally, the capacity decision is intertwined with the unresolved issue of expectation formation, which, particularly in the context of highly variable policy environments, is bound to be nearly intractable. Relative prices represent another major influence on export supply, and in this area too we have only limited knowledge about what prices to include. Furthermore, seldom do we get adequate information about the structure of export incentives, and seldom are we able to build a satisfactory indicator of the "effective" (i.e., subsidy corrected) price for exports.

Similar limitations made our choice of an indicator of domestic demand pressure also difficult. Although many possibilities spring to mind, usually the model provides little or no indication in this respect. In the model given below we have attempted to answer, at least partially, the questions discussed above. Indeed the choice of the capacity variable, of relative prices, and of the indicator of capacity utilization are all dictated by the model itself, thus putting welcome restrictions on the specification search. Also, an attempt is made to endogenize the capacity decision.<sup>3/</sup> This issue is likely to be extremely important in contexts in which, as in most developing countries, resources are relatively immobile.

The representative firm in our model is assumed to face perfectly competitive output and factor markets and to be constrained by a putty-clay technology. The firm aims at maximizing the present discounted value of its cashflow, that is, its net worth. It derives its revenues from sales

in domestic and foreign markets. Following Powell and Gruen (1968) and de Melo and Robinson (1987), commodities produced for domestic and foreign consumers are not assumed to be perfect substitutes, but are related by a constant elasticity transformation (CET) curve. Installed capacity determines the position of this curve. Finally, wage costs are assumed to be a convex function of the ratio of hours worked to standard hours. Formally, the firm's problem can be expressed as follows:

$$\max \sum \left( \frac{1}{1+i} \right)^{t+1} \left\{ P_t^X X_t + P_t Q_t - w_t (h_t/h_t^n)^\tau L_t h_t^n - q_t I_t \right\} \quad (1)$$

$$\text{s.t.} \quad X_t^{1-k} + A Q_t^{1-k} = B (F_t h_t)^{\beta+1} (1-k) e^{ut} \quad (2)$$

$$F_t = \sum_{v=-M}^t (1-\delta)^{v-t} I_v f(k_v)/k_v \quad (3)$$

$$L_t = \sum_{v=t-M}^t (1-\delta)^{v-t} I_v/k_v \quad (4)$$

where  $P^X$ ,  $P$ , and  $Q$  denote export, domestic, and investment goods prices respectively, and  $X$ ,  $Q$ ,  $L$ , and  $I$  indicate exports, production for the domestic market, labor input, and investment. Labor costs ( $w(\ )$ ) are assumed to be a function both of the capacity utilization rate (i.e. the ratio of actual ( $h$ ) to standard ( $h^n$ ) hours) and of the amount of labor inputs measured at a normal rate of utilization ( $Lh^n$ ). Also,  $i$  is the discount rate,  $F$  represents hourly capacity, and  $k_v$  denotes the capital/labor ratio on vintage equipment installed at  $t-v$ . Finally

$\tau = -\frac{1}{k}$  is the elasticity of the CET curve,  $A$  and  $B$  are constants,  $\beta$  is a return to scale factor,<sup>4/</sup> and  $\delta$  is the depreciation rate. Equation 2 is the CET curve between exports and domestic goods, whose position is a



function of output (i.e.,  $Fh$ , hourly capacity times hours) and a stochastic term ( $u_t$ ). Equations 3 and 4 are the putty-clay definition for hourly capacity ( $F$ ) and labor demand ( $L$ ), respectively.  $M$  denotes the age of the oldest vintage in use. The firm maximizes equation 1 subject to the constraints described by equations 2-4. To preserve analytical tractability, but at the expense of theoretical cohesiveness, we assume that the maximization problem can be broken into two stages. In the first stage the firm makes its investment (and capacity) decision by setting actual hours equal to normal hours. Then, for given capacity, the firm will determine production and sales. Even though this procedure may not be optimal, it can be rationalized by the existence of installation and delivery lags. The procedure highlights the role of capacity as a strategic choice taken with reference to normal operating hours. After setting  $h = h^n$  and taking a linear approximation around sample mean values of the function  $w(\quad)$ , the model can be solved by standard techniques. If we form the Lagrangian of the problem, rearrange the summation to start at  $-M$ , then, after some manipulation of the first-order conditions, we find that in the steady state

$$F_t h^n = g(q_t, \bar{w}_t)^{\frac{1-k}{\beta+k}} \left\{ \frac{1-k}{P_t^X} + \frac{1-k}{(P_t/A)} \right\} \frac{k}{k+\beta} \frac{k-1}{k+\beta} h_n \quad (5)$$

where  $g_t$  is a monotonically increasing function of factor prices and  $\bar{w}$  is the present value of "normal" wage costs<sup>5/</sup> associated with a machine over its economic life. Equation (5) can be used to identify the determinants

of capacity. Consider first the simplest case, where constant returns to scale apply, that is,  $\beta = 0$ . Then, by recalling that  $k < 0$ , (given that, as mentioned earlier,  $k = -1/\tau$  where  $\tau$  is the elasticity of the CET curve), it can be easily checked that an increase in factor prices will lead, through a higher level of  $g(\quad)$ , to a lower  $F_t h^n$ , while higher values of  $P_t^X$  and  $P_t$  will be associated with higher capacity. The unchanged with  $\beta < 0$ , (i.e., under decreasing returns to scale) or with  $\beta > 0$ , provided that  $\beta + k < 0$  (i.e., assuming that increasing returns to scale are not too strong). In general, therefore, the capacity decision is negatively (positively) related to factor (output) prices. Under the same conditions an increase in normal hours will lead to higher capacity.

In the second stage of the problem, the firm will determine production, that is, actual hours, and its allocation among domestic and foreign markets taking the level of hourly capacity as given. Actual and normal hours now differ. If we assume that  $(h/h_n)^b$  is an argument of the labor cost function  $w(\quad)$  and pursue our linear approximation, then it can be shown that:

$$X = \left\{ \frac{P^X}{w_1} (Fh_n)^{\beta+1} (h/h_n)^{-(b-1-\beta)} \right\}^\tau \cdot \text{Constant } e^{u_t} \quad [6]$$

where  $u_t$  was previously defined as a stochastic shock to the CET function while  $w_1$  is the derivative with respect to  $(h/h_n)^b$  of the labor cost function. Eq. [6] highlights the determinants of the export supply decision. Relative prices, defined as the ratio of the export price to wages ( $w_1$ ), affects exports with an elasticity equal to  $\tau$ . The exports'

response to changes in capacity ( $Fh^n$ ) is given by  $(\beta+1)\tau$ . If constant returns to scale prevail ( $\beta=0$ ), the export elasticities with respect to relative prices and capacity are equal. Finally, the last term in bracket ( $h/h^n$ ) captures the effect of unexpected shocks. Notice that no assumption has been made on whether domestic markets clear. Still, even with fully market-clearing prices, our model suggests that a capacity utilization term belongs in the export supply equation to capture the rising costs associated with higher utilization of a given capacity. This hypothesis can be easily tested. Suppose that constant returns to scale prevail ( $\beta=0$ ). Then if  $b-1=0$ , i.e. if wage costs are a linear function of operating hours, there will be no effect of demand pressure on exports. The result is fairly intuitive. Indeed, if wage costs per worker increase at a constant rate with the number of hours worked, the cost per hour per worker is constant and does not depend on the rate of capacity utilization. Finally, an interesting possibility should be noticed. If  $\beta > b-1$ , that is, with relatively strong increasing returns to scale, higher capacity utilization by allowing the firm to better exploit economies of scale and to reduce marginal costs, will lead to higher exports. This somewhat paradoxical possibility cannot be well captured in a perfectly competitive model. It would carry over, however, to a noncompetitive framework<sup>6/</sup>, which may explain why a positive effect of capacity utilization on exports has sometimes been identified in the literature.

## 2. Macroeconomic Developments and Export Performance in Turkey and Morocco

A few interesting analogies can be drawn between the Moroccan and the Turkish experience regarding trade policy. Since the 1960s both

countries have engaged in a policy of import substitution with the objective of fostering industrialization. The policy was based on high and variable tariffs and, quantitative restrictions on imports, supplemented by investment incentives designed to promote capital accumulation through lower capital costs while also extending the benefits of industrial growth to the poorest regions. The results have not always been satisfactory, especially for Morocco, gross domestic product (GDP) where manufacturing's share increased only from 16.0 percent in 1967 to 17.0 percent in 1973.

A major overhaul of the incentive system designed to strengthen the industrialization effort was undertaken in 1971 in Turkey and in 1973 in Morocco. The expansion of the set of incentives available for industry was accompanied by an increasingly restrictive import policy. Nonessential imports were severely curtailed, with the non-oil import share of consumption goods decreasing from 16.5 percent in 1972 to 10.2 percent in 1980 in Morocco and virtually disappearing in Turkey by the end of the 1970s, after declining from 9.6 percent in 1961 to 4.7 percent in 1972.

The turmoil of the early 1970s apparently did not provide a major incentive to policymakers in either country to change their policy orientation. This is particularly evident for Turkey. Expansionary macroeconomic policies, even in the wake of the first oil shock, allowed the country to grow at a very respectable rate (7 percent on average between 1974 and 1976), but such policies also brought unsustainable external imbalances, growing levels of foreign indebtedness, and high inflation rates. From 1973 to 1979, the real exchange rate with respect to the U.S. dollar appreciated by 25 percent, while export profitability, measured as the ratio of the subsidy-corrected export price to domestic

wages, declined by more than 50 percent. Not surprisingly, both traditional and non-traditional exports stagnated. The current account balance as a percent of gross national product (GNP) in Turkey moved from a surplus of 2.3 percent in 1973 to a deficit of 6.9 percent in 1977, culminating in the foreign debt crisis of 1979.

Paradoxically, the fact that the crisis struck Turkey relatively early, before the major deterioration of the international economy, was almost a blessing for the country. Policymakers were forced to undertake major structural reforms in a still relatively favorable international environment. Since 1979, the import regime has been increasingly liberalized and export promotion has been given new impetus, first through an elaborate array of export subsidies, later through changes in the exchange rate policy. From 1979 to 1983, export profitability, which, had previously suffered a major decline, increased by more than 50 percent. The export response was swift. Fueled also by a booming demand from Middle Eastern countries, real manufacturing exports increased at an average rate of 41.6 percent between 1980 and 1984.

The Moroccan case was, to some extent, different because the early 1970s brought a major increase in phosphate prices (the major foreign exchange earner for the country). Nevertheless, many analogies with the Turkish experience can still be made. Although the phosphate price boom proved to be short lived, it introduced a long-lasting attempt to promote growth and industrialization through higher public spending. Growth was high, (8.9 percent on average between 1975 and 1977), but was accompanied by a rapid deterioration of both the current account, with a deficit in 1977 of 16.5 percent of GDP, and the public budget. The real exchange rate

appreciation brought on by expansionary macroeconomic policies took a toll on manufacturing exports, whose growth rate declined from 15.8 percent between 1969 and 1974 to 9.4 percent between 1975 and 1978. Export profitability declined by 20 percent from 1975 to 1978.

In 1978 a payment crisis forced Moroccan authorities to take adjustment measures. However, the policy changes were relatively subdued and not comparable in scope to those that would occur in Turkey a year later. An effort was made to reduce nontariff barriers on imports, with the overall coverage ratio of nontariff barriers declining from 72.6 percent in 1979 to 57.7 percent in 1982. However, tariff rates continued to increase, mostly to finance an unabated level of public expenditure. The appreciation of the real exchange rate was not reversed, and exports, not surprisingly, continued to stagnate.

After an initial improvement in the wake of the short-run stabilization program in 1978, macroeconomic conditions deteriorated rapidly, with the current account deficit reaching 12.7 percent of GDP in 1982. In 1983, a new payment crisis erupted, forcing Moroccan authorities to take both emergency and structural adjustment measures. In the following years tariff rates were reduced, the import regime was liberalized, investment incentives were revised<sup>71</sup>, and a more flexible exchange rate was pursued, with the real exchange rate decreasing from 100 in 1980 to 87.5 in 1985.

It is perhaps too early to analyze the response of exports. Reliable deflators are available only up to 1985. It remains true, however, that exports of manufactured consumption goods increased at a

healthy average rate of 11.5 percent in 1984 and 1985. The overall performance of manufactures exports was less satisfactory because of depressed conditions in the phosphate-derived-products market.

### 3. The Results

#### The estimating equations

For estimating purposes, it has been assumed that investment goods are subject to a one-period delivery and installation lag. Thus the firm must decide on its desired capacity one period in advance (say at  $t-1$ ), which will do on the basis of its expectations about the value of relevant variables at time  $t$ . These expectations are in turn a function of the firm's information set at  $t-1$ . At time  $t$  the firm will determine its output level on the basis of newly acquired information. There are several reasons, including expectational errors about prices and supply shocks ( $U_t$  in equation 2), why output and capacity may be different. However, if we assume rational expectations, output and capacity will differ only by a white noise term ( $\epsilon_t$ ):

$$\ln(F h_t) = \ln(F h^{\alpha}) + \epsilon_t \quad (7)$$

Then to recover a measure of capacity we need only to take the fitted valued of a regression of output on the determinants of capacity. To avoid estimating a highly nonlinear relationship,<sup>8/</sup> it is assumed that capacity is a log-linear function of its determinants and that expectations about the exogenous variables are formed simply on the basis of their past values. The estimating equation then becomes

$$\ln (Fh)_t = a_0 + \sum_{i=1}^m a_{1i} w_{t-i} + \sum_{i=1}^m a_{2i} q_{t-i} \quad (8)$$

$$+ \sum_{i=1}^m a_{3i} (i_{t-i} - \hat{w}_{t-1}) + \sum_{i=1}^m a_{4i} P_{t-i} + \sum_{i=1}^m a_{5i} P^x_{t-i} + \epsilon_t ,$$

where  $\bar{w}$ , the present discounted value of wage costs over the lifetime of a machine, has been broken into the wage level and the nominal interest rate deflated by (expected) wage inflation ( $\hat{w}$ ). It is possible also to allow for intermediate inputs. Suppose that these are a fixed proportion of total output, that is, a Leontief technology prevails. Then, by taking a simple first-order approximation, it can be shown that an extra term in  $p^M/(p^x + p)$ , where  $p^M$  is the domestic price of intermediates, needs to be added to equation (8) to allow for the impact of changes in  $p^M$ .

The fitted value from equation 8 can be taken as an estimate of capacity. Once  $Fh^N$  is determined, capacity utilization can also be simply derived as the residual from equation 8. Indeed  $\ln(h/h^N) = \ln(Fh) - \ln(Fh^N)$ . Taking logs in equation 6 and substituting the calculated value of  $Fh^N$  and  $h/h^N$ , the export supply equation can be simply estimated as well.

### The data

The model has been applied to annual data for manufacturing exports from Turkey and Morocco, with the exclusion in the latter case of phosphate-derivative products. The price of export goods was corrected to allow for various export subsidies, whose value was taken from Milanovic (1986) and Yagci (1984) for Turkey and directly computed by the author for Morocco (see Appendix). Finally, in the construction of the price of



investment goods to be used in equation 8, an attempt was made to allow for the wide array of investment incentives. In particular it was possible for both Turkey and Morocco to quantify the impact of accelerated depreciation, regional incentives, and interest rate rebates.

### The results

The output equation (equation 8) was estimated first with the addition of another term to allow for the cost of imported inputs and of a time trend to capture the effect of technological progress and changes in normal hours. The results are presented in table 1. Several problems arose in measuring output and factor prices. For example, it was not possible for either country to rely on a true price index for domestic output sold on domestic markets. Instead, only the GDP deflator for manufacturing was available. This index also includes the price of output sold on foreign markets, and its use is likely to exacerbate the multicollinearity with the export price. The problem was to some extent addressed by testing and imposing that the coefficients on  $p^X$  and  $p$  are equal for Turkey and by dropping  $p^X$  for Morocco on the ground of statistical insignificance.

For factor prices the minimum wage and the average wage rates were used for Morocco and Turkey, respectively as a proxy of hourly labor costs at a normal operating rate (see footnote 5). The choice was dictated by data availability. Both the minimum and the average wage rates are likely to present significant shortcomings. The minimum wage measure does not allow for the possibility that workers are paid more, even under normal operating hours, and the average rate measure blurs the effects of normal

**Table 1: The Output Equation Applied to Turkey and Morocco<sup>a/</sup>**

	Turkey (1963-83 estimated period)	Morocco (1968-85 estimated period)
Constant	-91.4 (69.6)	-89.6 (5.88)
ln w(t-1)	-.30 (.08)	-.24 (.11)
ln q(t-1)	-	-.15 (.067)
ln p(t-1)	.10 (.04)	.39 (.068)
ln p <sup>X</sup> (t-1)	.10 <sup>b/</sup>	-
Time	.049 (.037)	.050 (.003)
ln (expsub + 1) <sup>c/</sup>	.43 (.21)	.64 (.53)
[p <sup>M</sup> /p + p <sup>X</sup> ] (t-1)	-	-.07
ln Y(t-1)	.58 (.31)	(.07) -
$\bar{R}^2$	.994	.987
DW	1.76	2.29
LM Test (X <sup>2</sup> <sub>1</sub> )	.69	.50
Chow Test F <sub>1,14</sub>	.54	.82 <sup>d/</sup>
Hendry Test (X <sup>2</sup> <sub>1</sub> )	.55	2.17

<sup>a/</sup> Standard errors in parenthesis.  
<sup>b/</sup> Constrained coefficient.  
<sup>c/</sup> Export subsidy.  
<sup>d/</sup> F<sub>1,10</sub>

and overtime pay. Finally, for Morocco we were able to gather detailed information on the set of investment incentives available to industry for incorporation in the price of investment goods (see Appendix B), but for Turkey we were only able to allow for a subset of the investment incentives. In particular, the impact of industrial regulations, which drive a wedge between shadow and observed capital costs and thus undermine the adequacy of the latter indicator, completely escaped our analysis. It was not surprising, therefore, to find that the price of investment goods was not a significant determinant of output in Turkey (and was thus dropped from the estimating equation). However, wage costs in the two countries and investment goods prices in Morocco turned out to be important determinants of output. As expected the other variables the time trend was associated with a positive coefficient for both countries which was well determined for Morocco. It was not possible to identify a significant impact of interest rate on output.

Finally for Turkey, the effective price of export was broken into its two components, the market price and (one plus) the subsidy rate. It was interesting that the hypothesis that the coefficients on these two variables are equal could be rejected on a one-sided test ( $F_{1,15} = 2.58$ ), thus providing some indication that export subsidies, perhaps because of their lower variability, have a greater impact on output than does the uncorrected export price. For Morocco, the tax exemption for exports did not appear to significantly affect the output decision.

The statistical performance of the output equation for both Turkey and Morocco was satisfactory. Both equations are stable ( $F_{1,14} = .54$  for

Turkey and  $F_{1,10} = .82$  and Morocco) and predict well ( $X^2_1 = .54$  and 2.17). The LM test does not indicate any sign of autocorrelation in the residuals ( $X^2_1 = .69$  and .50).

The fitted value and the residuals from the output equation were then used as indicators of capacity and capacity utilization, respectively. Following Pagan (1984), the actual level of output was not replaced by its fitted value as a right-hand-side variable; rather the latter was used as an instrument for the former. Thus the procedure is designed to yield consistent estimators of the true standard errors. Regarding the residual from equation 8, in our model, the assumption that the error terms in equations 8 and 6 are uncorrelated does not seem to be warranted. Indeed any shock to the export supply function is likely to affect the output choice, as well as the level of capacity utilization. An instrumental variable procedure was also retained here, with total GDP acting as an instrument for our measure of  $(h/h^N)$ . Finally, the exogenous variables of the export demand equation (world demand and competitors' prices) were used as instruments for  $p^x$ . The results of estimating equation 6 are presented in table 2. The equation for Turkey for the 1963-83 period was estimated first. The hypothesis that  $\beta = 0$ , that is, the hypothesis that the coefficients on the price and the capacity variables are equal, was tested first and could not be rejected at a comfortable significance level ( $X^2_1 = .07$ ) by a Gallant-Jorgenson test. Even in the unconstrained version of the model both prices and capacity appear to be very significant determinants of the export supply decision. The constrained coefficient is equal to 3.4 and is well determined. Although the coefficient on capacity utilization has the right sign, it is not well determined.

**Table 2: The Export Supply Equation for Turkey and Morocco<sup>a/</sup>**

	Turkey (1963-83)	Turkey (1968-83)	Morocco (1968-85)
Constant	-18.7 (2.03)	-22.5 (4.49)	-19.0 (2.47)
Relative Prices ( $\tau$ )	3.40 (.23)	3.82 (.50)	1.62 (.89)
Capacity ( $\tau(1+\beta)$ )	3.40 <sup>b/</sup>	3.82 <sup>b/</sup>	3.83 (.29)
Capacity Utilization ( $-\tau(b-1-\beta)$ )	-5.19 (7.20)	-8.92 (7.66)	-3.03 (3.03)
$\bar{R}^2$	.917	.79	.95
DW	1.79	2.03	2.85
Sargan Test ( $X^2_3$ )	6.89	5.24	2.08
Godfrey Test ( $X^2_1$ )	5.83	1.94	1.73
Chow Test ( $X^2_1$ )	1.50	.18	1.66

<sup>a/</sup> Standard errors in parenthesis.

<sup>b/</sup> Constrained coefficient.

To allow for the possibility of an asymmetric response to shocks, where the wage function is strictly convex for actual hours greater than normal hours but linear (i.e., with  $b = 1$ ) otherwise, a new indicator of capacity utilization using only the positive values of the residual from equation 8, and zero otherwise, was constructed. However, we noted no significant improvement in the performance of the equation. The statistical properties of our estimates appear to be relatively satisfactory. The Sargan (1964) test did not provide any indication that the instruments were correlated with the error term, while the Chow test, in version IV (Kiviet 1986), appears to suggest that the equation was performing well out of the sample. There were, however, some indications of residual autocorrelation, as shown by the Godfrey (1978) test.

A possible explanation for the less than fully satisfactory results could stem from the poor quality of some of the statistical information used for the 1963-1983 period. When the equation was reestimated for the 1968-1983 period, the performance of the equation improved considerably. Again, it was not possible to reject the hypothesis that  $\beta = 0$  ( $X^2_1 = .24$ ). The estimate of  $\tau$ , the elasticity of the CET curve, was slightly higher (3.8) than the estimate for the previous period and still quite well determined. Interestingly, the coefficient on capacity utilization also came closer to being significant with a t-stat of 1.13, even more so when the asymmetric version of the wage cost function was used ( $t = 1.30$ ). Moreover, there was no sign of residual autocorrelation or, more generally, of misspecification, as detected by the Godfrey, Sargan, and Chow tests. Finally, had we estimated the equation without allowing for the possible endogeneity of output, its statistical

performance would have deteriorated markedly, with both the Sargan and the Godfrey tests pointing to the existence of some form of misspecification.

Data on Morocco was then used to estimate the export equation (equation 6). As a measure of  $W_1$ , that is, the sensitivity of labor costs to capacity utilization, first the minimum wage rate and then the consumer price index (CPI) were used. Both indicators can provide only a very imperfect approximation to  $W_1$ . The estimates were not particularly sensitive to either of these two indices, but both the Chow ( $X^2_1=2.96$ ) and Godfrey ( $X^2_1 = 3.73$ ) tests pointed to a serious misspecification problem in the equation using the wage rate. Thus we report only the results using the CPI. For Turkey, both capacity and relative prices turn out to be significant determinants of the export supply decision. Again, although the coefficient on capacity utilization has the right sign, it is not well determined. Moreover, it was not possible to impose the restriction that  $\beta = 0$  ( $X^2_1 = 13.0$ ). The statistical properties of the equation, as indicated by the usual battery of statistical tests, were satisfactory, with no obvious indication of misspecification.

### CONCLUSIONS

The main results of this paper can be summarized as follows:

At a theoretical level it is difficult to determine a priori whether domestic demand pressure will significantly affect export supply decisions. In our model the crucial parameter in this respect is represented by the degree of convexity in the wage function. From our results it could be argued that, at least for Turkey and Morocco, wage costs do not rise at an increasing rate with the increase in hours worked. (It would be interesting to check whether this result extends to other developing countries as well). For industrial countries, which have a less elastic labor supply, we would expect domestic demand pressure to have a significant impact.

Both prices and capacity are significant determinants of export supply. It has been difficult, however, to detect a significant impact from relative prices, especially for developing countries. Indeed, the evidence on export supply behavior in developing countries is scarce. It appears that the impact of prices can be more clearly identified when an adequate measure of the real effective exchange rate for exports is used that also allows for the various export subsidies. (See for example the analysis by Balassa et al. (1986) on Greece and Korea.)

The policy implications of our results are also worth mentioning, particularly as they relate to the relative role of expenditure-switching and expenditure-reducing policies in the design of adjustment programs. If it were confirmed that relative prices play a significant role in affecting



export supply, while the impact of domestic demand pressure continued to be weak, then it could probably be argued that less emphasis should be placed on contractionary macroeconomic policies as a means of achieving a sustainable external balance. But our results in this respect must be interpreted with utmost care. Our indicator of domestic demand pressure suffers from many shortcomings, in particular because it does not allow for the possibility of irreversible investment and prolonged capacity underutilization. Also, the coefficient on domestic demand pressure, albeit statistically insignificant, still suggests a sizable effect of capacity utilization on exports for both Turkey and Morocco. Thus, any firm conclusion must await the test of more comprehensive research. Such research should also aim at extending our model to cope with noncompetitive market structures and so better accommodate the possibility that increasing returns to scale prevail. Further, the capacity of the model to describe export supply in other countries should also be analyzed.

Footnotes

- 1/ According to Wells (1964), a further argument in support of this view is that domestically consumed goods and exportable goods are differentiated products. But this argument appears to rest on very extreme assumptions about the immobility of productive resources across sectors. A firmer ground for insulating the export supply decision from domestic conditions is to assume constant returns to scale in production (as, for instance, in Balassa et al. [1986]). It strains credibility, however, to assume linear, homogeneous production relationships in the short run when capacity is fixed.
- 2/ A remarkable exception is the contribution by Balassa et al. (1986), which focuses on Greece and Korea.
- 3/ The choice of the capacity variable in the export supply equations is seldom derived from the model itself. Although some studies have gone to some pain to gather data on the relevant capital stock variable, in most cases either a simple time trend or an index of production is used. In the latter case, no allowance is made to correct for the obvious simultaneity bias. To our knowledge, nowhere has an attempt been made to endogenize the capacity decision.
- 4/ More precisely if  $\beta = 0$ , increases in the productive capacity of the firm will be associated with an equiproportional shift of the CET curve. If  $\beta < 0$  ( $> 0$ ), the curve will shift less (more) than proportionally.
- 5/ Formally  $\bar{w}_t = \sum_{v=t}^{t+M} \left[ \frac{1}{1+i} \right]^{v-t} (1-\delta)^{v-t} w_2$ , where  $w_2$  is the derivative with respect to  $L$  of the labor cost function.
- 6/ For instance, along the lines suggested in the Cuthberston (1986) study.
- 7/ The new investment code, enacted in 1983, was associated with a major reduction in benefits for industry, especially in the Casablanca area.
- 8/ Even if the simplest assumptions are made, that is, a Cobb-Douglas ex ante production function, the resulting output equation turns out to be highly nonlinear (Nickell 1978).

Appendix A

Data Appendix

A. Turkey

- X: Manufacturing exports (United Nations Trade System)
- pX: Manufacturing unit values (United Nations)
- sub: Export incentives (Milanovic 1986; Yagci 1984)
- w: Wages (World Bank 1975, 1982)
- i: Lending rate (on medium-term credit by commercial banks)
- Fh: Manufacturing value added, 1968 prices (World Bank 1975, 1982)
- PINT: Price of imported inputs (1969-1983: Turkey Central Bank; pre-1969: value from auxiliary regression)
- p: GDP deflator for manufacturing (World Bank 1975, 1982)
- q: Investment goods price (see Appendix B)

Instruments:

- YW: Weighted average total manufacturing imports of 10 main trading partners
- PW: Weighted average wholesale prices of 10 main trade partners

B. Morocco

- X: Exports of finished products (Direction de la Statistique)
- pX: Unit values for exports of finished products (Direction de la Statistique)
- Fh: As sub (a)
- p: As sub (a)
- sub: Export incentives (tax exemptions for profit on export sales, computed as total profits in manufacturing times exports share in total sales times corporate tax rate/exports.) All data are taken from the industrial census
- w: Industrial minimum wage rate

**i:** Lending rate from the Banque National de Development Economique (BNDE)

**PINT:** Unit value of imported semifinished products (Direction de la Statistique)

**q:** Investment goods price (see Appendix E)

**Instruments:**

**YW:** as sub (a)

**PW:** international Manufacturing Unit Value (MUV)

## Appendix A

### Cost of Capital Calculations

#### A. Morocco

Capital costs have been significantly affected by the various incentives offered to Moroccan industrial firms through the investment code.

Many provisions of the investment codes have aimed at redressing regional imbalances. As a result, capital costs have varied significantly across regions. Regional boundaries, however, have been defined in different ways by the various codes. In the following discussion, three zones have been distinguished for the whole period: zone I, the Casablanca area; zone II, the Fez area; and zone III, the Tangier area. The 1983 code combined the Fez and Tangier areas. These three zones cover the quasi-totality of the investment expenditures approved under the codes.

Also note that the following discussion focuses on the impact of the incentive system on investment decisions in new plants only.

The 1973 code. The main provisions of the 1973 code were: (a) custom duty and indirect tax exemption on imports of investment and intermediate goods; (b) full (50-percent) corporate tax exemption in zone III (II) and accelerated depreciation allowances in zone I for new firms (for existing firms, the corporate tax exemption is granted for a 10-year period beginning with their creation date); (c) 5-year exemption on the patent tax (basically a capital levy); and (d) 2-percent interest rate rebates on (BNDE) loans.

The 1983 code. The main provisions of the 1983 code were: (a) custom duty and indirect tax exemption on imports of investment goods and intermediate goods for all firms except new firms located in the Casablanca area; (b) a 50-percent corporate tax exemption for firms in zones II and III; (c) a 5-year exemption from the patent tax for new firms in zones II and III; (d) abolition of the accelerated depreciation allowances; (e) elimination of interest rate rebates for firms in zone I.

#### The Cost of Capital.

Assuming that interest payments are fully tax deductible for the firm (an appropriate assumption for Morocco), the cost of capital (c) can be shown to be equal to

$$c = q (r (1 - \gamma) + \gamma_p + \delta) , \quad (1)$$

where q is the price of investment goods, r is the lending interest rate,  $\gamma$  is the corporate tax rate,  $\gamma_p$  is the patent tax rate, and  $\delta$  is the depreciation rate. In computing q, allowance must be made for the system of fiscal and financial incentives. Since 1973, depreciation allowances

and tax holidays have the main components of the incentive package. Therefore

$$q = q_M (1 - ts)/(1 - \gamma) , \quad (2)$$

where  $q_M$  is the market price of investment goods, and  $ts$  denotes the present discounted value of present and future tax savings from fiscal depreciation allowances. It can be shown that, with linear depreciation allowances,  $ts$  is equal to:

$$ts = \gamma \frac{1}{T} \left[ 1 - \left( \frac{1}{1 + r(1 - \gamma)} \right)^T \right] \frac{1}{r(1 - \gamma)} , \quad (3)$$

where  $T = 20$  (10) for structure (equipment) under normal depreciation schedules. With accelerated depreciation, the values of  $T$  are 50 percent lower.

#### Empirical Implementation.

The lending rate charged by BNDE has been used as a proxy for  $r$ . Except for zone I after 1983, the value of  $r$  has been reduced by 2 percentage points to allow for the effect of the interest rate rebate. A basic value of 48 percent has been used for the corporate tax rate. Allowance has been made, however, for the effect of the national solidarity tax after 1980 and for the various tax holidays in zones II and III. Finally, the unit value of imported investment goods and the implicit GDP deflator for construction have been used as measures of the price of equipment and structure, respectively.

Applying this methodology yields six indices of the cost of capital (one for each zone for both types of capital goods). To aggregate those indices, base 1980 weights were used. However, following enactment of the 1983 code, which substantially increased capital costs in the Casablanca area, investment shifted significantly away from zone I. Thus, using 1980 weights will, to some extent, overestimate the most recent increase in capital costs.

#### B. Turkey

A procedure similar to the one described for Morocco was applied to Turkey. The main fiscal incentive for industry was a first-year investment allowance for firms. The value of these allowances before 1979 was 30 percent for standard and 50 percent for less developed regions. The allowances were increased by 10 percent for both areas after 1979. Little information was available for interest rate rebates, which appear to have been modest, given the shortage of funds.

In computing the corporate tax rate, the basic rate, the withholding tax, and the fiscal balance tax have all been taken into account. The GDP deflator for investment has been taken as a proxy for the price of investment goods. Only a small share of investment has been directed to less developed regions. A 20-percent share has been used throughout.

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