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Abstract

This paper presents estimates of the competitive effects of trade liberalization on domestic pricing behaviour of Tunisian manufacturing industries. The theoretical framework is based on a dynamic flexible adjustment model of price determination in a small open economy. It investigates the process of adjustment in price level toward a desired level. The adjustment process is both industrial and time-specific. The empirical results show that, in the long run, domestic price responds greatly to import penetration, followed by demand pressure. There was a negative effect from import competition on domestic price. Trade policy is a viable policy option to promote competitiveness.

Keywords: dynamic model; domestic price; trade liberalization; panel data; speed of adjustment; Tunisia

JEL Classification Numbers: C33; E31; F14; L60

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1. INTRODUCTION

Understanding the way policy changes affects domestic price over time requires a model that incorporates the dynamic adjustment process. Models that include dynamic adjustments are certainly not new in the literature. As a rule, although restrictive, the speed of adjustment is modelled as a constant parameter assuming the same speed across units (industries in this case) and over time. This is the case, even with panel data models, where other variables are also affected by time and units of analysis. In this paper, the analysis is based on a model of domestic price that incorporates a speed of adjustment which is both time- and industry-variant, that is, a flexible adjustment model. The model is applied to a panel of six Tunisian manufacturing industries observed during 1983–2003. The Tunisian manufacturing sector makes a good case study since it has evolved through periods of market regulations, as well as trade liberalization.

The Tunisian manufacturing sector has been the subject of various shocks and policy-related changes. During the import substitution period (before 1986), the manufacturing sector evolved through a highly regulated economic environment. These controls had both a direct and an indirect bearing on how the manufacturing sector used resources. The resulting low degree of competition has caused the quality of Tunisian products which were targeted at the domestic market to remain, as a rule, below international standards. Consequently, firms are often not equipped or managed so as to compete on quality, but rely on occupying limited and small market niches. For a selection of previous studies of the Tunisian manufacturing sector and its evolution over time, see Sekkat (1996).

Until 1986, i.e. during the import substitution era, the government's regulations fostered from the national and domestic business points of view satisfactory results. However, the context became less favourable, notably between 1984 and 1986, because of several factors such as the fall in oil prices, and conflicts between the government and trade unions in 1978, 1980, and 1984. Furthermore, it created some undesirable side effects, namely inefficiency resulting from the oligopolistic market structure (as indicated by its high concentration ratio) and excessive protectionism of domestic industry from import competition. This led to a call for trade liberalization. However, it was not until the mid 1980s that the Tunisian government started to seriously implement trade liberalization as a way to improve the efficiency of the Tunisian economy.

The state proceeded with a comprehensive public investment policy based on borrowing so massively that Tunisia was threatened by the emergence of a financial crisis. In 1987, in exchange for financial assistance from the World Bank and the International Monetary Fund (IMF), the government accepted conditions which led to the adoption of a structural adjustment program. Thus, the Tunisian government turned towards liberalization of the economy and redirected its development strategy in order to place more emphasis on the private sector. In addition, parallel to its accession to the General Agreement on Tariffs and Trade/World Trade Organization (GATT/WTO) and its membership of the Maghreb Customs Union on July 17, 1995, Tunisia became the first country in the Middle East and North Africa (MENA) to sign a Free Trade Agreement with the European Union (EU).

The import liberalization in Tunisia was pursued in two stages. The first phase was implemented during the period from the early 1990s, and was accomplished by liberalization of import licensing and reduction of tariff rates. Both of these measures were intended to provide competitive pressure on domestic industries. The second phase of import liberalization was launched in 1995 and took the form of a then new five-year tariff reduction program. During this period, a more extensive and accelerated tariff reduction program than that during the first phase was implemented.

The benefits to Tunisia from this trade liberalization should be substantial, and should pass through various channels (see Papi and Zazzaro, 2000). In addition to enhanced international competitiveness, trade liberalization leads to lower prices for imported goods. Here we briefly mention the static and dynamic the price effects and effects related to the inflow of foreign direct investments. The static price effects are the effects resulting from a better allocation of existing resources. The dynamic price effects are effects that are a result of the greater competitiveness of markets, goods, and factors, as well as the expansion of potential markets and the full exploitation of scale and scope economies. The last type of effects is a result of increased inflow of foreign and increased domestic investments stimulated by policies of trade liberalization. An increased inflow of foreign direct investments contributes to knowledge transfers, opportunities to gain professional expertise, and commercial contacts. However, it might also increase the aggregate demand and become a problem when economy is overheating; leading to government interventions in the form of increase in government expenditure or cuts in taxes to reduce the negative effects of foreign direct investments.[2] The

[2] We would like to thank an anonymous referee for making this point.

effects discussed above will cause re-allocation of production factors to sectors with greater competitive advantages and, consequently, a general strategy for reform and modernization will develop. A striking example of this is the plan for industrial restructuring and modernization (mise à niveau program). The aim of this plan is to prepare Tunisian manufacturing firms for the liberalization of markets and for the greater competition that will arise. This program has been accompanied by generous tax breaks for investment in the exporting sector, progressive rationalization of the regulatory framework, and general infrastructure for development.

The literature on dynamic price models with applications to developed economies is extensive. Major contributions to the literature include Domberger (1979, 1980, 1981) with application to England, Kardasz and Stollery (1988) to Canada, Encaoua (1983) to OECD countries, and Encaoua and Michel (1986) to France, and Shaanan and Feinberg (1995) analyzing U.S. data. In contrast, there are only a few empirical studies in the context of developing countries. These limited empirical studies in general look at the effect of trade liberalization on domestic prices in developing countries. These analyses are divided into three sets of empirical studies as follows.

The first group is largely based on cross-section data. These examine, among other things, whether trade liberalization had led to reduced price-cost margins or not. The first group consists of four studies from a World Bank project. These studies, conducted by Foroutan (1992) and Levinsohn (1993) with the case of Turkish manufacturing, Harrison (1990) with the case of Cote d'Ivoire' and Grether (1992) with Mexico, provide indirect evidence of the competitive effect of trade liberalization on domestic price. Their findings are based on the limited experience of a few developing countries (Turkey, Cote d'Ivoire, and Mexico) in the early phases of trade liberalization during the period before mid-1980s. As it is well known, more serious trade liberalization in these countries started to be implemented from the mid-1980s and continued through the mid-1990s. Therefore, the generality of their conclusions may be subject to question.

The second group uses time-series data to examine the pricing behaviour of manufactured goods during trade liberalization. These studies include one study by Corbo and McNelis (1989) and two studies by Yang and Hwang (1994, 2001a) in a slightly different context.

The third group includes the second study of Yang and Hwang (2001b)[3]. This study, using static panel data for 18 manufacturing sectors, indicates that there was a restraining effect from import competition on domestic prices in Korea. While interesting, these studies examined the response of domestic prices to changes in external or import prices during the period of trade liberalization. In such studies, as expected by Yang and Hwang (2001b), one can best examine whether the response of domestic prices happens to coincide with the stated episode of trade liberalization. However, since it is difficult to control the other factors already existing before the episode of trade liberalization and those coming after it, it is difficult to be certain about the true competitive effect of trade liberalization.[4] On the other hand, all these studies which are related to both developed and developing countries omit the dynamic aspects of price changes and each uses a restrictive static model specification.

The limitations listed above suggest that there is a need for a comprehensive and systematic analysis of the competitive effect of import liberalization in developing countries, which pursued trade liberalization during the period from the early 1980s through the mid-1990s, the period during which more serious import liberalization has been implemented. The analysis should include both static as well as dynamic models that incorporate a flexible speed of adjustment which is both a time- and industry-variant and account for industrial heterogeneity in responses. Thus, the main objective of the present paper is to examine empirically the effect of trade liberalization on the domestic pricing behaviour of Tunisian manufacturing. This, together with the use of panel data techniques, will in turn partially fill the existing gap in the literature that neglects industrial heterogeneity.

Similarly, the literature on dynamic adjustment in panel data framework is extensive (e.g. Arrelano and Bond, 1991; Baltagi and Griffin, 1997; Judson and Owen, 1999; Nerlove, 2000). In this paper, a different dynamic price model is specified. The difference is in estimation of unobservable target prices in terms of observable determinant variables and with a flexible speed of adjustment parameter. The adjustment parameter facilitates movements towards the targeted prices and can be a function of trade policy and industry characteristic variables. Shifts in the dynamic price model are allowed to capture non-neutral shifts referring to adjustments other than those related to technological changes. This approach permits evaluation of policies that are designed to enhance trade liberalization,

[3] Effects of Trade Liberalization on Domestic Prices: The Evidence from Korea, 1983-1995.

[4] Yang and Hwang(1994) present evidence showing that apparent substantial effects of trade liberalization in the study of Corbo and McNelis (1989) is largely due to the effect of inflation.

domestic price flexibility, and industrial performance. In addition, the model has been successfully applied to other forms of dynamic adjustment models within a panel data framework. Examples of such cases are the applications to dynamic adjustment in capital structure of Swedish micro and small firms (Heshmati, 2002) and optimality in the use of labour in Estonian manufacturing (Masso and Heshmati, 2004).

The rest of the paper is organized as follows: The basic methodological approach, together with specification and estimation of the model, are discussed in Section 2 and 3. Interpretations of the results are explained in Section 4. Section 5 describes the data and variables used in the analysis. This is followed, in Section 6, by discussion of the results. Section 7 is the summary and conclusion.

2. THE MODEL

Domestic price is the variable whose variations we are interested in. The empirical analysis involved estimation of a flexible price adjustment model for a sample of industries from which the rate of adjustment and optimal level of price could be derived. In order to obtain statistical estimates of the rate of adjustment and optimal price, this concept must be given a precise quantitative definition. To this aim, we consider that the actual change in price is given as some fraction of the desired change, that is, of the price adjustment which would restore equilibrium. Under ideal conditions, the observed level of price, P_{it}, should equal the optimal level of price, P_{it}^{*}. The subscript i and t denote industry and time periods. In a dynamic setting, this implies that changes in price from the previous to current period should equal the changes required for the industry to be at optimal level of price at time t, i.e. $P_{it} - P_{i,t-1} = P_{it}^{*} - P_{i,t-1}$. However, if adjustment is costly or sluggish, the price market does not allow for full adjustment and partial adjustment will be undertaken. This non-full adjustment can be represented as:

(1) $$(P_{it} - P_{i,t-1}) = \theta(P_{it}^{*} - P_{i,t-1})$$

where θ_{it} is the adjustment parameter, which varies both over time and across industries. θ_{it} represents our measure of the rate of price change or fractional adjustment in actual price towards the optimal level. The adjustment is called flexible because of its variability in the industry and time dimensions. Taking into account the adjustment process which is the industry and time variant, an industry at disequilibrium prices follows an adjustment process best described by the above partial adjustment model where P_{it} adjusts to its desired level P_{it}^{*} at a flexible rate θ_{it}. The size of θ_{it} $(0 \leq \theta_{it} \leq 1)$ determines the degree of price adjustment.

The parameter θ_{it} can be viewed as the speed of adjustment, a higher θ_{it} denoting a higher speed of adjustment. If $\theta_{it} = 1$, then the entire required adjustment is made within one single period. However, since the optimal price itself may shift over time, at any intermediate time a value of 1 does not have any implications for future optimality. If $\theta_{it} < 1$, the adjustment is only partial and, finally, if $\theta_{it} = 0$, there is no adjustment and the industry is at the optimal level of price.

It is to be noted that in the economic literature on dynamic relations the speed of adjustment is modelled as constant parameter. In this paper, we model this parameter as being it is both time-and industry-variant. Allowing the speed of adjustment to vary with i and t is justified in that different industries are found to adjust their policy differently over time, when they are exposed to a change in economic environment. Firms are also heterogeneous in their adjustment behaviour and also different in the way they are exposed to trade policy and competitive pressure. The heterogeneity might also be a result of different preferential policies.

Contrast this with a standard dynamic adjustment model where θ_{it} is the same for all i and t and P_{it}^{*} is constant. In a standard partial adjustment model there is some rigidity in the convergence process, i.e. in the movement from P_{it} to P_{it}^{*}. First, no target level of price is specified. Second, it is assumed that all information needed is retained from the lagged value of the dependent variable and that all deviations are random noise. Here we exclude these strong assumptions and make the model more realistic by estimating target price level and allowing for heterogeneity in price adjustment behaviour among the sample industries.

In traditional dynamic models P_{it} tends to attain P_{it}^{*} when t goes to infinity and $0 < \theta < 1$ but it is constant across i and over t. Convergence of P_{it} to P_{it}^{*} is thus asymptotic. In this case, this inherent rigidity is, thus, relaxed by allowing θ_{it} to vary over time and industry. An inefficient industry may reduce its inefficiency faster by adjusting some of the factors that cause this inefficiency. In the present paper, convergence is not necessarily asymptotic. Industries control their speed of adjustment to attain the target price level by adjusting some of the variables affecting θ_{it}. The speed of adjustment is, therefore specified as function of its determinants, expressed as:

(2) $$\theta_{it} = g(Z_{it}, t : \gamma)$$

where γ is a vector of the fixed coefficients associated with the effects of determinants of adjustment in price level. The Z is a vector of determinant variables characterising the industry or trade policies. Time trend t is an important element in the function and captures neutral shifts in the speed of adjustment over time. Note that although γ is a vector of fixed parameters in this case, but θ_{it} varies over both i and t.

In logarithms, and appending a fixed effect two-way (industry and time) error component structure, the model in equation (1) can be rewritten as:

(3) $$ln\,P_{it} = (1 - \theta_{it})\,ln\,P_{i,t-1} + \theta_{it} ln\,P_{it}^{*} + \varepsilon_{it}$$

(4) $$\varepsilon_{it} = \mu_i + \lambda_t + v_{it}$$

where all variables are defined as in above, μ_i are unobservable industry-specific effects capturing industry's price heterogeneity, λ_t are unobservable time-specific effects reflecting temporal variations in prices, and v_{it} is the statistical random error term capturing random shocks and left out variables assumed to be identically and independently distributed with mean zero and constant variance. Important features of model (3) worth emphasizing are that it is dynamic and θ_{it}, the adjustment parameter, is both time- and industry-variant. The unobservable but estimated P_{it}^{*} is also allowed to vary over time and across industries. By allowing θ_{it} to vary over time, the effects of technological change in the production process, the trade policy changes and the price decisions of firms are captured.

3. SPECIFICATION AND ESTIMATION

The price model is dynamic in nature. The panel data have the advantage of allowing better understanding of the dynamics of price adjustment. The dynamic relationship is characterized by the presence of a lagged dependent variable among the regressors. Estimation of the error component model in equations (3) and (4) is developed in two directions. First, the fixed effects (FE) model, where μ_i and λ_t are assumed to be fixed and correlated with the explanatory variables. Secondly, random effects (RE) model, where μ_i and λ_t are assumed to be random and uncorrelated with the explanatory variables. Efficiency, unbiasedness, and consistency of parameter estimates are properties affecting the choice of model (see Hsiao, 2003 and Baltagi, 2001). In this study, due to the closed nature of the small sample, the industry effects are assumed to be fixed and represented by industry dummy variables and the time effects are replaced by time dummies. The random error component v_{it} is by tradition assumed to be independent and identically distributed with mean zero and constant variance, σ_v^2.

To specify the determinants of equilibrium price, we assume that Tunisia is a small open economy and that domestically produced and imported goods are imperfect substitutes. These assumptions imply that the domestic equilibrium price depends on domestic costs, C_{it}, and domestic demand, D_{it}. To capture the liberalization effect on the price decisions of firms and to explain the domestic equilibrium price variation, we introduce the rate of import penetration, M_{it} in the relation. Unit cost is defined as the sum of unit intermediate consumption and unit wages remunerations. The domestic demand variable is defined as the sum of production and import less stock variation. The import penetration rate is measured as import divided by the sum of production and import less export. (See Section 5 for more details).

The domestic equilibrium price in equation (1), P_{it}, was approximated by a flexible translog function as shown:

(5)
$$\begin{aligned} \ln P_{it}^* = {} & \beta_0 + \beta_C \ln C_{it} + \beta_D \ln D_{it} + \beta_M \ln M_{it} + \beta_T T \\ & + \frac{1}{2}\left\{ \sum_j^J \sum_k^K \beta_{jk} \ln X_{jit} \ln X_{kit} + \beta_{TT} T^2 \right\} + \sum_j^J \beta_{jT} \ln X_{jit} T + \mu_i \end{aligned}$$

where the term $\{...\}$ contains the square and interaction terms associated with the matrix $X = \{C, D, M\}$ of J explanatory variables defined previously. The $\beta : s$ are constant unknown parameters to be estimated. Their subscript indicates which X variable they are associated with. The square terms captures non-linearities in the determinants' impacts on price, while their interaction indicates substitution or complementarity among the explanatory variables. The variable T is a trend used to capture the effect of technological and policy changes or shift in the price function over time. The starting point for the trend is 1983. It runs from the value of 1 in 1983 to the value of 21 in 2003. In order to allow sufficient time heterogeneity with keeping the number of parameters at a low level, for the intercepts we use time dummies (TD) while for the interaction with other variables a time trend (T). The advantage of this formulation is that it is flexible and captures well the year-to-year variations in prices.

The translog specification was tested using an F-test against alternative Cobb-Douglas and generalized Cobb-Douglas functional forms with squares but no interaction terms. The test results indicated translog as the preferred functional form.

In turn, the speed of adjustment, i.e. model (2) can be expressed as:

$$(6) \qquad \theta_{it} = \gamma_0 + \gamma_T T + \gamma_{TT} T^2 + \sum_i \gamma_i ID_i$$

where ID_i, T and T^2 are vectors of industry dummy variables, a time trend and its square. Since the focus is on the behaviour of θ_{it} over time and across industries, it has been specified as a flexible function of time by relating it to time trend and industry dummies. It should be noted that for the estimation, we do not impose any restriction on the time effects in the optimal price and those of the speed of adjustment. These time effects are allowed to be different across the two equations (5 and 6).[5]

4. INTERPRETATION OF THE RESULTS

The log derivative of domestic price with respect to log explanatory variables interpreted as elasticities of optimal price with respect to changes in domestic cost and demand and rate of import penetration (*C*, *D*, and *M*) are computed from equation (5) as:

$$(7) \qquad E_C = \frac{\partial \ln P_{it}^*}{\partial \ln C_{it}}, \; E_D = \frac{\partial \ln P_{it}^*}{\partial \ln D_{it}}, \; E_M = \frac{\partial \ln P_{it}^*}{\partial \ln M_{it}}$$

where the expected signs of E_D and E_M are negative, while those of E_C are positive. The negative E_D effect is a result of decline in unit cost and a better utilization of scale of production. The negative E_M effect is due to declining competition, while the positive E_C effect is a result of increase in domestic production cost. In the present model, the dynamic price function (5) is allowed to shift over time. This, as has been noted, captures the effect of technological change on the level of price. Thus, the exogenous rate of technological change

[5] We introduced the absolute difference between the observed and optimal prices as an explanatory variable determining the speed of adjustment in prices. The distance variable was found to cause severe convergence difficulties and also endogeneity bias and subsequently removed from the model specification.

is defined in terms of a shift in the price function. From model (5) technological or trade policy change (TC) or shift in the optimal price equation over time is derived as the log derivative of price with respect to time as: [6]

$$(8) \qquad TC = \frac{\partial \ln P_{it}^{*}}{\partial t} = (\lambda_t - \lambda_{t-1}) + \beta_{CT} \ln C_{it} + \beta_{DT} \ln D_{it} + \beta_{MT} \ln M_{it}$$

If the rate of TC is positive, it implies that technology is regressive from a domestic market welfare point of view resulting price increase, and when negative it indicates technical progress with price declines as a result.

Often economic performance is characterized by the rate of technological change; Van Brabant (1988) and Bogomolov (1987) compared the technical change between East and West European economies. In their study, technological backwardness is marked for the East in comparison with the industrialized economies of Western Europe. It is also pointed out that East European manufactured goods lacked sufficient quality and technical sophistication to be marketable in the western markets. In particular, Monkiewicz (1989) and Winiecki (1988) provide evidence for declining prices and quality of East European engineering products, reflecting their technological backwardness.

In this study, we aim to test the direct effect of exogenous changes on the formation of prices among industries. In similarity with a production case notation, the overall price effect can be decomposed into three components. The pure or neutral component, which derives as $PTC_t = \lambda_t - \lambda_{t-1}$, and it captures the year to year erratic changes in prices. It reflects shift in the price function over time due to technological advancement and not necessarily linked to any specific underlying factor. The non-neutral component is function of the determinants of price and derives as $NTC = \beta_{CT} \, ln \, C_{it} + \beta_{DT} \, ln \, D_{it}$. It reflects shifts over time associated with specific cost, supply and demand factors. It determines the part of change due to supply and demand, which affects domestic prices.

The import penetration augmented component of the change is derived as $STC = \beta_{MT} \, ln \, M_{it}$. It detects changes introduced through liberalization and import penetration. The *STC*

[6] The term 'technical change' is taken from the production and cost literature where effects of technological changes on for instance production structure is captured by a time trend or a vector of time dummies representing time (see Chambers 1988). The time variable is then interacted with the input variables to capture non-neutral shifts due to biased technological changes where over time production technology become input using or input saving. In similarity with a production function case where technological changes shifts the production function over time, in our case trade policy, trade relation and technology induce changes in the level production, supply, demand and thereby domestic prices over time.

component measures how the effect of trade liberalization and openness is transmitted through import penetration to the temporal shift in prices. The coefficient of the interaction of time and M, β_{MT}, indicates the direction of bias. A positive coefficient suggests an increasing import penetration technology, while a negative coefficient suggests a decreasing development. The later enhances competitiveness in the domestic market.

The most immediate effect of trade liberalization is a reduction in the extent to which domestic manufacturers can operate in protected markets. The reduction or elimination of trade barriers and tariffs turn any markets that were previously highly imperfect into markets that are now more contestable, and hence generate lower prices and reduced excessive producer rents.

An additional effect of trade liberalization is a rapid inflow of foreign technology as a result of both inflow of FDI and increased imports of goods and services. The new technologies being introduced through FDI include among others new practices of management and new forms of work organisation. The inflowing technology is assumed to be skill-biased because it is mainly designed and developed in the industrialised world with skill intensive technology and skill-biased new technology (Berman *et al.*, 1998). The incorporation of new technologies will therefore be accompanied by a change in labour demand in favour of skilled workers. This change will be transmitted immediately in factor production costs and influences pricing policies. If large enough, this shift can outweigh the reduction in the demand for skilled labour that is predicted by traditional trade theory. Robbins (1996) has termed the effect of the inflowing technology resulting from trade liberalization the ‘skill-enhancing trade hypotheses‘. When the gap between existing and newly imported technology is large, trade reform could have an even greater effect on skill demand in a developing country than it does in an industrialised country (O’Connor and Lunati, 1999).

A variation of this theme is the conjecture that, even if the technology to be transferred is neutral, the transitional process of transferring and installing new technologies may be skill-biased (Pissarides, 1997). In this case, the effect on the returns to human capital will be temporary and skilled workers benefit only during the transition period to the new, higher, technological level and then the effect on production costs and prices will be temporary. Goldin and Katz (1998) reach a similar conclusion; they argue that the demand for skilled labour can follow a technological cycle. The demand rises when new technologies and machinery are introduced, but it declines once the other workers have learned how to use the new equipment. Thus, the introduction of new technologies and machinery causes temporary increase in the production costs and hence domestic prices.

These theories predict that the effect of the increase in the relative demand for skilled labour will be to increase the relative wages and thus increase costs and prices. The magnitude of the effect will vary according to the elasticities of costs of skilled and unskilled labour, and the elasticity of substitution.

5. THE DATA

The data used in this study have been assembled using a diversity of sources, such as the national accounts of the Tunisian National Statistic Institute (INS) and statistics coming from the Quantitative Economy Institute (IEQ). This was to allow the construction of an integrated database of industrial price and trade statistics. Thus, there is a panel on six manufacturing industries from 1983 to 2003. These six industries are included in the Free Trade Agreement of 1995 between Tunisia and the EU. The industries included are: food processing industry, textiles, clothing and leather industry, oil and gas products industry, mineral industry, mechanical electric industry, and other manufacturing industry (including paper and pulp, plastics, etc.).

The data contain information on price index of sales, unit intermediate consumption, unit wages remunerations, production, stock variation and trade statistics. The dependent variable is measured as price index of sales (P). The independent variables in the dynamic price model are the unit costs (C), demand (D) and import penetration rate (M). Unit cost is defined as the sum of unit intermediate consumption and unit wages remunerations. The demand variable is defined as the sum of production and import less stock variation. There are transferred to fixed 1990 prices using the producer price index. The import penetration rate is measured as import divided by the sum of production and import less export.

In the estimation, three economic regimes are accounted for, that is, pre-trade liberalization (before 1986), trade liberalization (1986–1994), and post-liberalization (after 1994) periods. The post-liberalization period refers to the signing of the Free Trade Agreement with the EU. These periods are captured separately because they represent three different economic regimes. A time trend (t) is used to capture the effects of the exogenous rate of technological change or possible shifts in the price over time. In addition, N-1 industry dummies are used to capture unobservable industry-specific effects and T-1 time dummies are used to capture unobservable time-specific effects. The summary statistics are reported in Table 1.

Import penetration exhibits the largest dispersion, while price index exhibits the least variations. Looking at Pearson correlation coefficients among the variables, we find that collinearity among the explanatory variables of costs, demand and import penetration rate are not a major problem. Correlation between costs and demand is about -0.203, between costs and import penetration rate -0.013 and between demand and import penetration 0.037.

6. EMPIRICAL RESULTS

The dynamic model in equation (3) is estimated assuming a flexible adjustment parameter (6) which is both industry and time-variant. The variation can be accommodated by making the adjustment parameter a function of the time and industry variant variables. Here for the specification we use a time trend, squared time trend, and industry dummies.

For a comparison, a restricted dynamic model where the adjustment parameter is a simple constant, as it is in traditional dynamic models, and a time trend static price model were also estimated. The time trend static model is to be considered as a benchmark model, while the restricted dynamic model is corresponding to an intermediate model or the inflexible adjustment model found in the literature. The three models are estimated using fixed effects panel data models. The two dynamic models are non-linear and require a non-linear iterative procedure to estimate them, while the static model is estimated using linear least squares dummy variable estimation method.

In comparison with simpler functional forms, a Cobb-Douglas or generalized Cobb-Douglas, the translog models had smaller standard errors, higher frequency of significant coefficients and it serves as the accepted model specification. The elasticities of prices with respect to the changes in the explanatory variables are variable across industries and over time and are consistent with the predictions by economic theory. The parameter estimates of the three models are reported in Table 2.

6.1 The optimal level of domestic prices

The unobservable optimal level of domestic prices is estimated using observable determinants for each point of the data. In the static model, with the exception of demand square and interaction between demand and time, all other explanatory variables, their squares and interactions are statistically significant at the less than 10% levels of significance. For the dynamic restricted model, the demand squared, interactions between demand and time, costs and demand and costs and import penetration are statistically insignificant. In the unrestricted model, the insignificant variables are interaction between costs and demand, costs and time and demand and time. The unobservable industry and time effects are not all significant in the three models.

A closer look at the coefficients of the static and dynamic models shows that the parameters associated with industry dummies, time trend, and those associated with the adjustment function, θ_{it}, are statistically significant at conventional levels of significance. Likelihood ratio test results indicate that the unrestricted dynamic model is preferred to the restricted one where the adjustment parameter is constant across firms and over time. The analysis of the results will be subsequently based on the static and unrestricted dynamic model specifications, where the static model serves as a benchmark model.

The parameters of the translog model cannot individually be interpreted directly, due to the presence of interaction and square terms. The elasticities of price with respect to costs, demand, import penetration rate, and rate of technical change were, therefore, computed. All elasticities evaluated at the mean values for each year, for each economic regime, by industry and at the overall sample mean are reported in Table 3 for the static model and in Tables 4 and 5 for the dynamic long-run and short-run versions, respectively. Also calculated and reported in the same way in Table 4 is the speed of adjustment parameter (θ_{it}).

6.2 Price elasticities and the exogenous rate of price changes

This sub-section discusses the elasticities of price with respect to costs, demand, and import penetration rate, reported in Table 3 for the static model and in Table 4 for the unrestricted dynamic case. The short-run elasticities (Table 5) are simply the long-run multiplied by the speed of adjustment. The long-run elasticities reflect the full adjustment to the desired level of price, while the short-run elasticities reflect the short-run responses in domestics' prices to inter-periodical changes in the explanatory variables. The subsequent discussion will be based on the long-run elasticities. The long-run perspectives to exogenous changes and subsequent adjustments in industrial policy and firms' behaviour in response to these changes is more relevant and consistent with the objectives of firms and those of this study.

The signs of the average elasticities, of demand (E_D) and of import penetration rate (E_M) are, as expected negative; but the sign of the average costs elasticities (E_C) is negative, this implies that increase in costs does not increase prices. This result, despite not being consistent with economic theory, it reflects economic environment in Tunisia. It can be explained by indirect evidence of the competitive effect of trade liberalization on domestic prices. Thus, Tunisian prices before the serious movements of liberalization were administrated, and under such circumstances the margin rate is important. The import penetrations reduce significantly the increase in industrial prices and thereby the margin rate.

Cost price elasticity:

Development of cost is a major source of price changes and variations in the price responsiveness of industries to changes in production cost among industries and over time. The elasticities with respect to costs have a sample mean (and standard deviation) value of -0.752 (0.472) for the static model and -1.823 (1.471) in the unrestricted dynamic model. Individually, the costs elasticities range from -1.292 to -0.208 by industry and from -0.870 to -0.482 by year for the static model. In the unrestricted dynamic model, these elasticities range from -2.643 to -0.927 across industries and from -2,727 to -1.198 over time. These are interpreted as percentage price responsiveness to percentage changes in labour and material costs. The unexpected negative sign of cost elasticity might be due to the effects of liberalization of the trade and subsequent increased competition in both the goods and factor markets. It can also be a result of improved factor productivities of capital and labour that compensate and allow for a simultaneous increase in factor cost and decline in prices.

The industries differ greatly in their price responses to changes in cost. In both of the static and dynamic models, the mechanical electric industry has the greatest elasticity in absolute value followed by other manufacturing industry, Mineral industry, food processing industry and textiles, clothing and leather industry. Over time or by period, we conclude that these elasticities are in the major part of time in static or in dynamic models decreasing slightly in absolute value.

Demand price elasticity:

The signs of demand elasticities are negative which is in conformity with the economic theory. In contrast, these elasticities are decreasing over time. In the static model, demand elasticities are less variable across industries and range from -0.950 to -0.351. The Mineral industry has the greatest elasticity (-0.950), followed by other manufacturing industry (-

0.714), and mechanical electric industry (-0.669). The lowest elasticity is -0.351 for textiles, clothing and leather industry. Over time, demand elasticities increase until 1987 and after that these elasticities decrease slightly. Over periods, these elasticities are also decreasing.

In unrestricted dynamic model, the long-run elasticities show that the greatest price responds to demand is in mineral industry (-0.761), and other manufacturing industry (including paper and pulp, plastics, etc) (-0.269). It is least responsive in the food processing industry (-0.039). In similarity with the static model, the small and positive demand elasticity in the case of textiles, clothing and leather industry (0.007) can be explained by the high level of protection associated with this industry.

Although a time trend was used for the interaction between demand and time variable, a less systematic pattern is observed in the price elasticities with respect to demand over time. There is more industry variation in the elasticities than over time. Turning to the elasticities by period, there is evidence that price was more responsive to demand during 1983–1985 and 1986–1994 than 1995–2003. During the first two economic phases, the elasticities with respect to demand were -0.331 and -0.272, respectively. A lower responsiveness (-0.131) in the phase 1995–2003 was a priori expected.

Import penetration price elasticity:

The import penetration rate is used to examine empirically the effect of trade liberalization on the domestic pricing behaviour and in particular the competitive effect of import liberalization in Tunisia. The import penetration rate elasticity in the static model range from -0.653 to 0.121 and has a mean value of -0.388 and a standard deviation of 0.213 across industries. The mean import penetration elasticities range from -0.621 to 0.040 across industries and range from -0.460 to -0.356 over time.

Over time, these elasticities are decreasing until 1999 and increasing after that. By period, import penetration elasticities are decreasing but at a lower rate in period 2 to 3.

The long-run price elasticity with respect to import penetration is -0.149 with standard deviation of 0.427 and the range is from -0.647 to 0.417. It exhibits less overtime variation than across industries. Price responsiveness to import penetration rate is more pronounced in mechanical electric industry, the food processing industry, the group of other manufacturing industry, and mineral industry - with elasticities of -0.647, -0.539, -0.374 and -0.045, respectively. This result suggests that there was a negative, and hence restraining, effect of import competition on domestic prices in the three manufacturing sectors. Thus, it is clear that import competition not only affects profit rates in developing countries [see the World Bank studies reported by Tybout (1992)] but price behaviour as well.

The import penetration rate elasticity for textiles, clothing and leather industry, and oil and gas products industry, unlike other industries, are positive. This is explained by the slight movement of liberalization in these sectors.

Over time, a weak and positive in the long run import penetration rate elasticity was noted in 1984 (0.033). As early as 1985, this elasticity becomes negative and on the increase in absolute value but it remained at 10% between 1985 and 1992. In 1992 this elasticity exceeded the 10% and reached 33% on 2003. This result reflects the economic reality in Tunisia. So the process of liberalization finally started at the second half 1980s. Thus, before 1987 the pricing is marked again by state intervention and for that the competitive effect of import did not have important pressure on pricing. In 1995, this process accelerated by the creation of a liberal trade zone with Europe union.

The import penetration rate elasticity by period are relatively small and positive during the 1984–1985 phase (0.013) compared with -0.095 and –0.239 during the following two phases. With state intervention dominating the 1984–1985 periods, it is not surprising that this elasticity is less important and positive. This result also indicates that in a liberalized environment, industry must take into account the competitive effect of foreign entry. An increased competitive following foreign entry reduces the prices to a new equilibrium level.

Exogenous rate of price change:

Turning to the exogenous rate of price change (TC), the effect of technological change on domestic prices is defined as shift in prices over time. It can be shown that the long-run sample mean value of the elasticity presented in Table 4 is positive, 0.072, a result of a global price increase.

The results in Table 4 show that, the mean neutral or pure component of price change (PTC) by industries and over time is positive and it is the dominant component of the overall change rate followed by the scale-augmenting component. Thus, the technology transferred in Tunisia is, to a large extent, time neutral. Therefore, the transitional process of transferring and installing new technologies is mainly skill-biased. As a result, the effect on the returns to human capital will be temporary and skilled workers would benefit only during the transition period to the new, higher, technological level. When prices follow immediately the costs, the production costs, and then prices, rise when new technologies and machinery are introduced.

This is due to the increase of demand for skilled workers, but it declines once the other workers having learned how to use the new equipment. This result can be explained by the industrial structure in Tunisia. Tunisia is not a country with heavy industries that may contain important technology innovations.

Results in Table 4 show that the effect of technological change is important in the pre-liberalization period and in the first years of liberalization period. The explanation of this result is that these years are marked by an exogenous rate of technological change because serious steps along liberalization of the Tunisian economy were taken in the middle of 1990s. The years, notably between 1984 and 1986, were marked by the less favourable economic and policy environment. Several factors such as the fall in oil prices, and conflicts between the government and trade unions in 1978, 1980, and 1984 had major impacts on the economic conditions. Furthermore, these factors created some undesirable side effects, namely inefficiency resulting from the oligopolistic market structure (as indicated by its high concentration ratio) and excessive protection of domestic industry from import competition. The speed of adjustment in prices is positive and significantly correlated (0.369) with the shift in prices over time. The numbers in parentheses is the correlation coefficient.

To sum up, static and long-run results show that demand elasticities are decreasing over time but negative and the import penetration elasticities are negative and increasing over time. The long-run elasticity values show that price is more responsive to import penetration, followed by demand and least by costs. Analysis of the shift in prices over time, and in particular the neutral shift, shows that generally the technology transferred in Tunisia is neutral increasing prices and Tunisian manufacturing faced stronger effects from exogenous rate of price changes in the pre-liberalization period and in the first years of liberalization period. This result might be enriched by the introduction of several others variables (such as foreign direct investment which is not accounted for in this study because of lack of data).

During the 1994–2003 periods, price formation was due mostly to import penetration growth rather than demand pressure. In the first periods, price growth was mainly from demand growth. The presence of point elasticities with unexpected signs is a consequence of calculation of elasticities at each data point, where at a number of points the regulatory conditions are violated. The smooth switches in the size and signs over time are a consequence of the non-neutral interaction of time trend with the right-hand variables.

6.3 Speed of adjustment

The results of the speed of adjustment parameter are reported in Table 4. The sample mean speed of adjustment is 0.479, with a relatively large standard deviation (0.375), indicating the presence of large industrial heterogeneity in the speed of adjustment in price formation. Industries close to the mean adjust 47.9% of their deviations of the equilibrium prices (observed prices equal the optimal) in every year.

There is a wider variation in the time behaviour of the price adjustment parameter among industries. At the same time, there are similarities in the level and temporal patterns of speed of price adjustment across industries. Mean rate of price adjustment among the sample industries ranges from 0.473 to 0.486.

Over time, there is a general increase in the speed of adjustment and at an increasing rate (see Figure 1). This is, in part, a reflection of the use of time trend and its square to capture the patterns of shifts in the speed of adjustment over time. As expected, adjustment was faster during post-liberalization 1995–1996 periods (85.4%). It was almost constant (0.9%) during the pre-liberalization 1983–1985 phase - most likely reflecting the tight market price regulations. The patterns suggest that during reform period, markets have become more flexible as the higher speed of adjustment indicates. The adjustment was at 20.9% during liberalization period.

In all industries, a systematic relationship between exogenous rate of price changes and adjustment rates was found, indicating a process of convergence in price formation or adaptation of the Tunisian manufacturing industry to the international market.

7. SUMMARY AND CONCLUSIONS

This study was concerned with two important issues. First, modelling domestic prices with a flexible adjustment parameter, and secondly, measuring the effect of import competition on domestic prices in Tunisian manufacturing industries. Analysis of these issues is important to the understanding of how price markets functions and it is useful as a guide to policy formulation and evaluation of industries competitiveness following changes in the industrial and trade policy regimes.

The domestic prices was modelled as a function of costs, demand and import penetration rate. The import penetration rate is used to detect competitive effect of trade liberalization on domestic prices. The adjustment parameter was permitted to change over time as well as by industries to form a flexible speed of adjustment in the domestic prices.

The discussion of the results was mainly based on the long-run estimates obtained from the unrestricted dynamic price adjustment model. The long-run sample means elasticities indicate that domestic prices respond greatest to import penetration rate, followed by demand and then least by costs. Analysis of the effects of exogenous rate of price change, and particularly the neutral shift in prices over time, shows that generally the technology transferred to Tunisia is characterized as neutral; the transitional process of transferring and installing new technologies is mainly skill-biased and Tunisian manufacturing is influenced by such effect in the pre-liberalization period and in the first years of liberalization period. This analysis can be enriched by the introduction of other determinants such as foreign direct investment.

Our results suggest that there was a negative, and hence restraining, effect of import competition on domestic prices in the Tunisian manufacturing sectors. Thus, as shown in other studies, import competition not only affects profit rates in Tunisia but price behaviour as well. Trade liberalization increases competitive pressures on domestic firms, and thus creates incentives for reducing costs of production through technological progress.

Considering that manufacturing sectors in many developing countries, including Tunisia, are in general characterized by high concentration and market power and that their domestic markets have been heavily protected by various import restrictions, it is not surprising to find a larger effect of trade policy change on domestic prices.

Industries had least control on pricing during the first decade after the independence. The excessive protectionism and subsidies might have contributed to higher regulations that prevented reductions in the excess market force in the pre-liberalization period (before 1986), with almost no adjustment (0.9%). In the remaining years the speed of adjustment is increasing - with a mean value of 20.9% in liberalization period. The speed of adjustment was greatest during the post-liberalization (85.4%) compared to the earlier periods.

The results support the conclusion that under the liberalization period domestic prices have become more flexible, and that firms are able to adjust to new conditions much faster. As such, the whole discussion becomes part of a broader debate about price flexibility. This study is subject to some caveats worth mentioning, especially on the application side. This study in the absence of firm level data uses sector level manufacturing data. The assumption is that the production structures are the same within the sector. A disaggregation of the data to sub-sectors or an application to firm level data would be advantageous as this would capture heterogeneity in the production functions and pricing behaviour.

In spite of the above mentioned shortcomings, the framework developed here is important in that it could be used for policy purposes as it identifies the different industries responses to the competitive effects following increased openness. The study also sends a methodological message that when modelling the adjustment process in a panel data framework, the speed of adjustment must be made flexible. Modelling the speed of adjustment in this fashion offers an added opportunity, when identification and estimation of its impacts are desirable. Furthermore, this model can also be adapted easily to other forms of dynamic relationship.

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Table 1. Summary statistics of the Tunisian manufacturing data.

Variable	Definition	Mean	Std Dev	Minimum	Maximum
A. Dependent variable:					
P	Price index	113.291	29.983	55.862	177.200
B. Independent variables:					
C	Unit costs	0.649	0.239	0.231	1.131
D	Demand	25.608	17.144	1.899	72.161
M	Import penetration rate	0.498	1.368	-3.773	10.122
N	Number of industries	6			
T	Number of period	21			
NT	No. of observations	126			

Data sources: INS

Table 2. Translog parameter estimates, dependent variable is domestic price, n=126 observations. Dependent variable is domestic price level.

	Static model		Restricted dynamic model		Unrestricted dynamic model	
Parameter	Estimate	Std Err	Estimate	Std Err	Estimate	Std Err
A. Price equation						
$ß_0$	6.6582	0.3610	6.9300	0.6983	-3.8437	8.1489
$ß_C$	-0.7117	0.1468	-1.3676	0.3421	-1.9791	0.4793
$ß_D$	-1.0595	0.2211	-1.1301	0.4256	-0.9418	0.2633
$ß_M$	0.1270	0.0396	0.2012	0.0793	0.1309	0.0687
$ß_{CC}$	-0.4906	0.2110	-0.7693	0.4137	-0.7707	0.2825
$ß_{DD}$	0.0677	0.0467	0.0725	0.0898	0.1411	0.0741
$ß_{MM}$	-0.0042	0.0014	-0.0053	0.0028	-0.0102	0.0062
$ß_{CD}$	-0.2900	0.1350	-0.2873	0.2594	-0.0859	0.2338
$ß_{CM}$	0.1117	0.0651	-0.0850	0.1379	-0.9630	0.2592
$ß_{CT}$	0.0211	0.0064	0.0219	0.0123	0.0075	0.0137
$ß_{DM}$	-0.2136	0.0697	-0.3089	0.1368	-0.2029	0.0981
$ß_{DT}$	0.0001	0.0049	0.0038	0.0094	-0.0036	0.0117
$ß_{MT}$	0.0149	0.0037	0.0119	0.0071	-0.0154	0.0068
λ_{1985}	0.0101	0.0406	-0.1375	0.0893	21.2909	18.2188
λ_{1986}	0.0616	0.0484	-0.0547	0.0992	12.4443	9.6431
λ_{1987}	0.1810	0.0566	0.0964	0.1115	11.2374	8.6775
λ_{1988}	0.3192	0.0663	0.1953	0.1327	10.4923	8.2507
λ_{1989}	0.4881	0.0773	0.3609	0.1533	10.2858	8.1281
λ_{1990}	0.5603	0.0910	0.3538	0.1852	10.0378	8.0111
λ_{1991}	0.6065	0.0990	0.4169	0.1983	10.0498	8.0013
λ_{1992}	0.7285	0.1105	0.5225	0.2209	10.0953	7.9823
λ_{1993}	0.7668	0.1191	0.5441	0.2381	10.1185	7.9746
λ_{1994}	0.8088	0.1361	0.5499	0.2724	10.1298	7.9685
λ_{1995}	0.8823	0.1540	0.6719	0.3025	10.2248	7.9655
λ_{1996}	0.9264	0.1702	0.6784	0.3352	10.2335	7.9602
λ_{1997}	0.9924	0.1782	0.7390	0.3506	10.2853	7.9580
λ_{1998}	1.0343	0.1901	0.7597	0.3742	10.3149	7.9561
λ_{1999}	1.0943	0.2039	0.7489	0.4048	10.3416	7.9550
λ_{2000}	1.2166	0.2242	0.8933	0.4413	10.4016	7.9522
λ_{2001}	1.2775	0.2421	0.9080	0.4778	10.4282	7.9507
λ_{2002}	1.3007	0.2585	0.9299	0.5088	10.4592	7.9520
λ_{2003}	1.3353	0.2738	0.9630	0.5376	10.4867	7.9513
μ_{IME}	0.2945	0.0929	0.4515	0.1845	0.2334	0.1421
μ_{THC}	-0.4408	0.2040	-0.6974	0.3994	-1.5759	0.3199
μ_{ID}	-0.2798	0.0903	-0.2435	0.1740	0.0155	0.1552
μ_{PPG}	-0.9552	0.1510	-1.2237	0.3009	-1.4041	0.2402
μ_{MM}	-1.6752	0.2369	-1.7899	0.4566	-1.0870	0.2731
B. Speed of adjustment equation						
θ_0			0.3658	0.0684	-0.0252	0.0464
θ_{Trend}					-0.0009	0.0201
$\theta_{Trend\ squared}$					0.0034	0.0014
$\theta_{Mechanical\ electric\ industry}$					0.0032	0.0043
$\theta_{Textile,\ clothing\ and\ leather}$					0.0052	0.0056
$\theta_{Other\ manufacturing}$					-0.0094	0.0087
$\theta_{Oil\ and\ gas\ products\ industry}$					0.0088	0.0081
$\theta_{Mineral\ industry}$					-0.0064	0.0063
Adj R-Sq	0.9434		0.9720		0.9887	
RMS error	0.0043		0.0461		0.0368	

Notes: in the dynamic model 1983 and 1984 are dropped due to the use of lag dependant variable and reference year. Food industry is the reference industry. C indicates unit cost, D demand and M import penetration rate. The $\beta : s$ are slope parameters, $\lambda : s$ and $\mu : s$ time (dummy) and industry effects in the price model, while $\theta : s$ are the time (trend) and industry effects in the speed of price adjustment model.

Table 3. Mean elasticities of price with respect to cost, import penetration, demand and time calculated from the static model parameter estimates, n=126 observations.

Characteristics	E_C	E_M	E_D	TC
A. Mean by industry				
Food industry	-1.231	-0.456	-0.575	0.065
Mechanical electric industry	-1.292	-0.507	-0.669	0.074
Textiles, clothing & leather	-0.208	-0.621	-0.351	0.051
Other manufacturing industry	-0.966	-0.347	-0.714	0.070
Oil and gas products industry	-0.321	-0.440	-0.452	0.052
Mineral industry	-0.493	0.040	-0.950	0.090
B. Mean by year				
1984	-0.870	-0.460	-0.699	-0.001
1985	-0.844	-0.436	-0.760	0.013
1986	-0.852	-0.407	-0.712	0.051
1987	-0.669	-0.409	-1.024	0.141
1988	-0.804	-0.402	-0.725	0.140
1989	-0.707	-0.409	-0.795	0.176
1990	-0.879	-0.395	-0.500	0.070
1991	-0.799	-0.394	-0.559	0.043
1992	-0.843	-0.397	-0.559	0.120
1993	-0.843	-0.373	-0.581	0.037
1994	-0.809	-0.381	-0.574	0.040
1995	-0.778	-0.374	-0.568	0.071
1996	-0.738	-0.371	-0.539	0.041
1997	-0.713	-0.364	-0.544	0.063
1998	-0.679	-0.353	-0.535	0.038
1999	-0.686	-0.356	-0.524	0.056
2000	-0.701	-0.366	-0.482	0.119
2001	-0.678	-0.374	-0.482	0.058
2002	-0.659	-0.365	-0.454	0.019
2003	-0.482	-0.383	-0.756	0.046
C. Mean by period				
Pre-liberalization, 1983-1985	-0.857	-0.448	-0.729	0.006
Liberalization, 1986-1994	-0.801	-0.396	-0.670	0.091
Post-liberalization,1995-2003	-0.679	-0.367	-0.543	0.057
D. Overall sample mean and std deviations				
Mean	-0.752	-0.388	-0.618	0.067
Std dev.	0.472	0.213	0.356	0.050

Notes: Elasticity of prices with respect to cost (E_C), import penetration (E_M), demand (E_D) and time (TC).

Table 4. Mean long-run price elasticities, speed of adjustment and rate of price change calculated using unrestricted dynamic model parameter estimates.

Characteristics	E_C	E_M	E_D	PTC	NTC	STC	TC	Adj.speed
A. Mean by industry								
1. Food industry	-2.040	-0.539	-0.039	0.075	-0.014	0.010	0.071	0.479
2. Mechanical electric	-2.643	-0.647	-0.082	0.075	-0.014	0.010	0.071	0.481
3. Textiles, clothing,	-0.927	0.417	0.007	0.075	-0.022	0.010	0.063	0.483
4. Other manufacturing	-2.263	-0.374	-0.269	0.075	-0.012	0.010	0.073	0.473
5. Oil and gas products	-0.971	0.294	-0.142	0.075	-0.018	0.010	0.067	0.486
6. Mineral industry	-2.093	-0.045	-0.761	0.075	-0.006	0.018	0.088	0.475
B. Mean by year								
1984	-2.038	0.033	-0.300	0.000	-0.013	0.010	-0.003	0.010
1985	-2.284	-0.008	-0.361	1.000	-0.013	0.010	0.997	0.008
1986	-2.033	-0.021	-0.324	0.010	-0.012	0.010	0.008	0.026
1987	-3.444	-0.068	-0.622	0.010	-0.012	0.010	0.008	0.056
1988	-2.144	-0.057	-0.332	0.010	-0.013	0.010	0.007	0.093
1989	-2.485	-0.049	-0.402	0.010	-0.013	0.010	0.007	0.136
1990	-1.198	-0.071	-0.111	0.010	-0.013	0.018	0.015	0.187
1991	-1.473	-0.069	-0.171	0.012	-0.014	0.012	0.011	0.244
1992	-1.548	-0.143	-0.151	0.045	-0.014	0.012	0.044	0.308
1993	-1.630	-0.186	-0.173	0.023	-0.014	0.012	0.021	0.379
1994	-1.644	-0.190	-0.163	0.011	-0.014	0.011	0.008	0.456
1995	-1.626	-0.195	-0.160	0.095	-0.014	0.011	0.091	0.541
1996	-1.508	-0.181	-0.138	0.009	-0.015	0.011	0.005	0.632
1997	-1.542	-0.197	-0.142	0.052	-0.015	0.011	0.048	0.730
1998	-1.497	-0.197	-0.139	0.030	-0.015	0.011	0.025	0.835
1999	-1.501	-0.233	-0.118	0.027	-0.015	0.011	0.022	0.947
2000	-1.384	-0.260	-0.066	0.060	-0.016	0.013	0.057	1.000
2001	-1.437	-0.278	-0.060	0.027	-0.016	0.012	0.022	1.000
2002	-1.317	-0.280	-0.036	0.031	-0.017	0.013	0.028	1.000
2003	-2.727	-0.329	-0.316	0.027	-0.017	0.010	0.020	1.000
C. Mean by period								
1. Pre-liberalization	-2.161	0.013	-0.331	0.500	-0.013	0.010	0.497	0.009
2. Liberalization	-1.956	-0.095	-0.272	0.016	-0.013	0.012	0.014	0.209
3. Post-liberalization	-1.616	-0.239	-0.131	0.040	-0.016	0.011	0.035	0.854
D. Overall sample mean and std deviations								
Mean	-1.823	-0.149	-0.214	0.075	-0.014	0.011	0.072	0.479
Std dev.	1.471	0.427	0.388	0.214	0.005	0.006	0.214	0.375

Notes: Elasticity of prices with respect to cost (E_C), import penetration (E_M), demand (E_D) and time (TC). Neutral (PTC), non-neutral (NTC) and scale (STC) components of price change. Speed of annual adjustment in prices (Adj.speed) as share of the gap between optimal and observed levels of prices.

Table 5. Mean short-run price elasticities and rate of technical change calculated using unrestricted dynamic model parameter estimates.

Characteristics	E_C	E_M	E_D	PTC	NTC	STC	TC
<u>A. Mean by industry</u>							
1. Food industry	-0.963	-0.304	-0.001	0.022	-0.007	0.010	0.025
2. Mechanical electric	-1.269	-0.365	-0.010	0.025	-0.007	0.010	0.028
3. Textiles, clothing,	-0.372	0.172	0.045	0.027	-0.012	0.010	0.026
4. Other manufacturing	-1.053	-0.216	-0.110	0.029	-0.006	0.010	0.033
5. Oil and gas products	-0.521	0.084	-0.068	0.031	-0.009	0.010	0.032
6. Mineral industry	-0.535	-0.009	-0.262	0.029	-0.003	0.012	0.038
<u>B. Mean by year</u>							
1984	-0.020	0.000	-0.003	0.000	-0.000	0.010	0.010
1985	-0.018	0.001	-0.003	0.173	-0.000	0.010	0.183
1986	-0.049	0.001	-0.007	0.010	-0.000	0.010	0.020
1987	-0.180	-0.002	-0.032	0.010	-0.001	0.010	0.019
1988	-0.195	-0.004	-0.030	0.010	-0.001	0.010	0.019
1989	-0.332	-0.006	-0.053	0.010	-0.002	0.010	0.018
1990	-0.225	-0.012	-0.021	0.010	-0.003	0.010	0.018
1991	-0.358	-0.015	-0.041	0.003	-0.003	0.009	0.009
1992	-0.475	-0.043	-0.046	0.014	-0.004	0.010	0.019
1993	-0.616	-0.069	-0.065	0.009	-0.005	0.010	0.013
1994	-0.749	-0.085	-0.074	0.005	-0.006	0.009	0.008
1995	-0.878	-0.104	-0.086	0.051	-0.008	0.010	0.053
1996	-0.952	-0.113	-0.086	0.005	-0.009	0.010	0.006
1997	-1.126	-0.143	-0.103	0.038	-0.011	0.010	0.037
1998	-1.250	-0.164	-0.115	0.025	-0.013	0.010	0.022
1999	-1.421	-0.220	-0.111	0.025	-0.015	0.011	0.021
2000	-1.384	-0.260	-0.066	0.060	-0.016	0.013	0.057
2001	-1.437	-0.278	-0.060	0.027	-0.016	0.012	0.022
2002	-1.317	-0.280	-0.036	0.031	-0.017	0.013	0.028
2003	-2.727	-0.329	-0.316	0.027	-0.017	0.010	0.020
<u>C. Mean by period</u>							
1. Pre-liberalization	-0.019	0.000	-0.003	0.087	-0.000	0.010	0.097
2. Liberalization	-0.353	-0.026	-0.041	0.009	-0.003	0.010	0.016
3. Post-liberalization	-1.388	-0.210	-0.109	0.032	-0.013	0.011	0.030
<u>D. Overall sample mean and std deviations</u>							
Mean	-0.786	-0.106	-0.068	0.027	-0.007	0.010	0.030
Std dev.	1.005	0.283	0.198	0.040	0.007	0.003	0.040

Notes: Elasticity of prices with respect to cost (E_C), import penetration (E_M), demand (E_D) and time (TC). Neutral (PTC), non-neutral (NTC) and scale (STC) components of price change. The short run elasticities are the long-run elasticities multiplied by the speed of adjustment at each point of the data.

Figure 1. Speed at which the observed prices are adjusted to the optimal prices, 1983-2003. A rate of 0.85 means domestic prices are adjusted by 85% of the gap between the two prices in a given year.