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EXPORT PRICE SETTING FOR SELECTED SECTORS OF THE BELGIAN ECONOMY

by

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Abstract

This paper deals with export price setting behaviour during the period 1963-1981 for selected sectors of the Belgian economy. The general methodology is based on econometric tests of a price setting equation which includes as determinants foreign competitors' prices, domestic costs and other variables such as the rate of capacity utilization. The principal aim of the paper is to focus on methodological issues such as (1) the definition of the index of the foreign competitors' prices; (2) the measurement of the labour cost variable; (3) the econometric technique (the OLS estimates are supplemented by the joint ZELLNER-SURE estimation technique). The empirical analysis is applied to four sub-sectors of Belgian metal industries, to these industries' aggregate and to the aggregate total of manufacturing industries. The results are used to discriminate between price maker or price taker characteristics in the sector's export price setting behaviour.

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1. Introduction

1.1. This paper deals with export price setting behaviour during the period 1963-1981 for selected sectors of the Belgian economy.

It should be read as a progress report on a more extensive piece of research, *Competitiveness and Exchange Rates: The Case of Belgium.*

The aim of our research is to analyse the link between the exchange rate and the competitiveness of the manufacturing sectors of the Belgian economy.

This is done by focusing attention on the interaction between prices, costs (both domestic and foreign) and market shares on foreign and domestic markets.

A crucial question for the Belgian economy is the competitiveness of its industries. The extreme openness of the Belgian economy is well known: imports and exports together amount to 80% of GDP. Therefore, the relationship between exchange rates and competitiveness merits special attention, particularly with respect to its implications concerning exchange rate policy.

Despite the authorities' commitment to pegging the rate in relation to European currencies, the effective Belgian exchange rate has fluctuated quite substantially during the period studied, particularly since 1970; the index of the effective exchange rate jumped from 100 in 1979 to 117 in 1978-1979, and then sank to 110 in 1981, and 98 in 1983, following the 8.5% EMS devaluation of the Belgian Franc in 1982. Thus the question of the potential implications of these relatively large changes in the exchange rate on competitiveness arises naturally.

1.2. During the first phase of this research project, we concentrated on the determination of Belgian export prices. The aim here was to discriminate to what extent Belgian export prices are determined by foreign competitors' prices, production costs, and other domestic variables, such as capacity utilization rates. Applied at a sectoral level, this empirical analysis endeavours to identify, on the one hand, the *price taking* export sectors which produce and sell relatively homogeneous goods with respect to their competitors, and on the other hand, the *price making* export sectors, which have reached a sufficient degree of specialization and have thus gained some autonomy in respect to their competitors.

This price setting behaviour is an important element in any analysis of the link between exchange rates and competiteveness. As is well known, variations in the exchange rates affect the real sector of the economy very differently depending on whether the sector is a price taker or maker.

For a price taking sector, a depreciation of the domestic currency, for example, affects the foreign currency selling price neither on the domestic nor on the foreign markets. Production is supply determined and grows, following depreciation, in proportion to the higher price cost ratio which this increase in the exchange rate involves.

It is thus clear that for a price taking sector, competitiveness refers to relative costs in foreign currency. The relationship between exchange rates and competitiveness has therefore to be modelled on the "cost" side.

For a price making sector, demand (both domestic and foreign) is not infinitely price elastic. A devaluation decreases the foreign currency selling price to the extent that domestic costs react only partially to the devaluation. This change in relative prices, brought about by profit maximising firms, induces the increase in demand which is necessary to fulfil the higher optimal production plans. Therefore, for a price making sector, competitiveness mainly refers to relative prices. The relationship between exchange rates and competitiveness has thus to be modelled on the price side.

1.3. A large volume of literature has already been devoted to the question of differentiating between price makers and takers, [see for example, Kravis and Lipsey (1978); Morel and Steinherr (1978); Artus (1974); Aglietta, Orlean and Oudiz (1981)].

Specific studies including Belgium are Kervyn (1979); Bauwens and d'Alcantara (1983); Pauwels and Van Poeck (1982); Huveneers (1981).

Our research follows the general methodology of these papers, namely the reliance on econometric tests of a price setting equation, with includes as determinants foreign competitors' prices and domestic costs or other variables.

The specific aspects of our empirical research are the following:

(a) The price setting behaviour is analysed at the sectoral level (NACE-CLIO classification). This sectoral level analysis allows us to avoid the hypothesis of a constant sectoral price setting behaviour which

is implicitly made when the analysis concentrates (as is frequently the case) on the aggregate of manufacturing industries.

Differential sectoral reaction patterns can thus be identified, with the ultimate aim of establishing a price maker-price taker sectoral classification.

For the moment, the analysis has been limited to four sub-sectors of metal industries. The aggregate metal industries and the aggregate total manufacturing industries have also been retained for reasons of comparison. Extensions of the analysis to other sectors are planned.

(b) Given the widely held view that the Belgian economy is principally a price taker,[1] special care has been devoted to the specification of the foreign competitors' prices. The index of the competitors' prices has been conctructed as an average of the competitors' prices faced by Belgian exporters on the various markets (countries). For each of these markets, the competitors' price index has again been constructed as an average of the prices set by domestic producers and by the non-Belgian exporters to this market.

(c) This research is based on a relatively recent data base for the export prices of the various countries taken into consideration: — the EEC-VOLIMEX data base. Its main characteristic is that the export price indices are more reliable than the usual export unit values. They are constructed as chained Fisher indices based on SITC-5 unit values, after elimination of those values which show extreme or abnormal variations. They are computed for 22 countries and 23 groups of the NACE-CLIO product classification.

(d) Special attention is devoted to several methodological issues:

(i) the measurement of the cost variable (in this case labour costs) in the price setting equation.

(ii) the sensitivity of the empirical results to the numerary currency, which is selected in order to express price and cost variables in a common currency.

(iii) the econometric technique: the price setting equations are usually estimated for each of the retained sub-sectors using single equation estimation technique. These estimates are supplemented here by the joint ZELLNER-SURE estimation technique based on the pooling of the sectoral data. This estimation technique provides more efficient esti-

[1]This view has been somewhat challenged by some relative price changes (against competitors' prices) which have been observed after the 1982 devalution.

mates, and if necessary, allows for the testing of efficient cross sector constraints.

(iv) the estimation period extends from 1963 to 1981 (the last period for which all the data was available) and thus covers a sub-period of fixed exchange rates and a sub-period of more flexible exhange rates. All data are annual.

2. The Price Setting Equation: Theoretical Considerations and Variable Definitions

2.1. The general specification which is postulated to test the export price setting behaviour for selected sectors of the Belgian industries is quite standard, [see for example, Huveneers (1981), Calmfors and Herin (1979)]

(1) $$PX = F(PX^*, \Omega, Z)$$

PX is the Belgian export price for the product category considered;
PX^* is the foreign competitors' price;
Ω is the vector of domestic costs;
Z is the vector of other variables, such as the capacity utilization rate.

PX, PX^*, and Ω are expressed in a common currency. The empirical definition of these variables is discussed further on.

All the estimations of particular specifications of equation 1 above are made without any dynamic adjustment mechanism. An adjustment mechanism is sometimes postulated on the grounds that prices do not instantaneously clear the market (see for example, the contract price literature) and that they therefore only sluggishly react to changes in their determinants. However, available empirical evidence suggests that adjustment lags are appropriate for quarterly or even semestrial data, but generally not for annual data.

Preliminary tests on our annual data set, moreover, confirmed that the econometric performance of the estimated specification did not improve when the price adjustment period was assumed to be longer than a year.

Equation 1 is specified in a log linear form. To obtain stationarity for the series, the *growth rate* of PX is expressed as a linear function of Z and of the *growth rates* of PX^*, and Ω.

The specific sectors, for which the export price setting equation is estimated, are (in this initial phase of our research) the following:

NACE-CLIO (R44) code	NACE-CLIO groups code	Sectors
19	31	Metal products, except machinery and transport equipment
21	32	Agricultural and industrial machinery
25	34	Electrical goods
27	35	Motor vehicles, automobiles
Equip.	3	Equipment goods & metal products
Tot. manu	Tot. manu	Total manufactured products

The selected sub-sectors belong to the metal products industry, and represent together 27% of Belgian manufactured exports (1981 data). The aggregate equipment goods (30% of total manufactured exports) and the total manufactured exports aggregate are also considered.

2.2. The export prices of the Belgian firms, PX, and of their competitors, PX^*, are defined in the following way:

2.2.1. PX, as well as the export price indices necessary to construct the index of foreign competitors' export prices, are taken from the EEC-VOLIMEX data base. The VOLIMEX price indices are Fisher price indices based on SITC-4 of 5 digits export unit values, (OECD and UN data base) and calculated for the 23 product groups of the NACE-CLIO (R44) product classification. The SITC export unit values are filtered so as to eliminate the values whose variations are considered as extreme or abnormal or to scale them down to average values observed for similar products.

2.2.2. PX^*, the price index of foreign competitors on Belgian export markets, is defined in the following way for sector k.

(2a) $$PX^*_k = \prod_{i \in I} (PX^*_{ki})^{\delta_{ki}} \text{ with } \sum_{i \in I} \delta_{ki} = 1$$

(2b) $$PX^*_{ki} = \prod_{j \in Ji} (PX^*_{kj})^{\lambda_{kij}} \text{ with } \sum_{j \in Ji} \lambda_{kij} = 1$$

Equation 2*a* states that PX_k^* is the weighted geometric average of the competitors' price index faced by the Belgian producers on their different export markets. The export market countries, indexed $i \in I$, have been selected in such a way as to make certain that total Belgian exports of product k to these markets taken together represent at least 80% of total Belgian exports for this product. The weight δ_{ki} refers to the 1975 (normalised) market share of Belgian exports of product k to market country $i(\in I)$.

Equation 2*b* defines the competitors' price faced by Belgian exporters on market $i(\in I)$, PX_{ki}^*.

This price index is again computed as a weighted geometric average of the prices set by the domestic producer of country i and by the other exporters of product k to country i (these competitors are indexed $j \in Ji$). Again, the competitors have been chosen so as to cover at least 80% on non-Belgian sales of product k on market i. The weight λ_{kij} applying to competitor j on market i for product k refers to the corresponding 1975 (normalised) market share in non-Belgian sales of product k on market i.[2]

It should be noted that the domestic producer generally has the largest market share and that therefore the competitors' price on market i is usually dominated by the domestic producers' price.[3]

2.3. The cost variable Ω of the price setting function includes wage costs and other costs. Owing to data availability, only wage costs are considered for the four subsectors taken into consideration at the disaggregated level of analysis. For the aggregate "total manufactured products" the cost of imported intermediary consumption goods (proxied by the unit values of total imports of intermediary consumption goods) is added as an explanatory variable in the price setting equation.

[2]Computations of market shares for product k in country i for the domestic producer, Belgian exports and other countries' exports are based on 1975 VOLIMEX exports volume data as well as on the 1975 input-output coefficients (describing the allocation between domestic producers and total imports of product k) available for the EEC countries, USA, Canada, and Japan.

[3]The domestic producers' price is, given available data, approximated by the relevant country's export price for product k. The approximation implies that no price discrimination is practised between domestic and export markets.

For the wage cost variable, four different definitions have been elaborated:

(i) *WE:* Compensation per employee

$$WE = \frac{\text{WAGE BILL}}{L}$$ where L = number of employees.

(ii) *WH:* Compensation per hour

$$WH = \frac{\text{WAGE BILL}}{H}$$ where H = number of hours effectively worked.

(iii) *ULC*: Unit Labour Cost

$$ULC = \frac{\text{WAGE BILL}}{Q}$$ where Q = output, approximated by value added at constant prices.

(iv) *SULC:* Standard Unit Labour Cost

$$SULC = \frac{WH}{TPR}$$ where TPR = Trend Labour Hour Productivity

These various wage costs have been computed for each of the four subsectors and the two larger aggregates by the following procedure:

> Starting from the data available[4] the compensation per hour, *including* social security taxes, (*WH*) was first computed by applying the appropriate employers' social security contribution rate (information from FABRIMETAL) to NIS compensation per hour.

[4]For the four subsectors and the aggregate "equipment goods", data on the following variables were available (information from NIS): compensation per hour for manual workers, employers' social security contributions excluded, number of hours effectively worked by manual workers, and number of manual workers employed.

The wage bill was then computed as the product of WH and the number of hours worked by manual workers (H). The compensation per wage earner was then obtained by dividing the wage bill by the number of employed manual workers (L)[5].
An approximation for the ULC was then calculated by dividing the wage bill by the sector's output, approximated by its value added at constant prices (at factor cost).
For the standard unit labour cost ($SULC$), hourly trend productivity was computed by using a five year moving average.

These four different definitions of wage costs, computed as consistently as possible given the available data, have been developed to test the sensitivity of the estimation of the price setting function to alternative specifications of the wage cost variable.

A commonly used wage cost variable in a price setting equation is "unit labour costs" [see for example, Kervyn (1979)]. However, the productivity component of ULC is not independent of changes in output, which in turn are not independent of changes in prices. ULC is not, therefore, a truly exogenous variable. Bias in the estimated coefficients of the price setting equation may thus result.[6]

To minimise this potential bias, the three other definitions of wage costs are used as alternatives. Standard unit costs are computed with trend productivity [see Deppler and Ripley (1978), Dornbusch and Krugman (1976), for examples of a price setting equation using this wage cost definition].

[5]Owing to the availability of data, the wage bill and connected wage costs concepts refer only to manual workers. For the aggregate "total manufactured products" the various wage cost measurements were directly taken from the IRES data base. They refer to total employees (manual and intellectual workers). Standard unit labour costs were computed in the way mentioned above.

[6]The direction of the potential bias is difficult to establish. A case can, however, be made that the bias is in favour of "price takership" and against "price makership" (that is to say, a downwards bias on the coefficient of ULC in the price setting equation). To illustrate this, consider the case of price making firms which react to a sectoral wage increase by a general price increase for their products. The induced decline in demand and in output is reflected in increased average labour productivity to the extent that the decrease in output is accompanied by layoffs, or by elimination of the least efficient producers. In this case, the resulting decrease in ULC partially or even totally compensates for the initial wage cost increase. A precise analysis of the adjustment dynamics involved will be necessary to correctly measure the influence of the initial cost impulse on prices. Ordinary estimation techniques can however be expected to lead to a downward bias in the coefficient of wage costs.

Obviously, growth rates in hourly compensation and in compensation per employee come close to the standard unit cost [used for example by Pauwels and Van Poeck (1982)] growth rate to the extent that the growth rate in the corresponding productivity is constant over time. In turn, growth rates in hourly compensation and in compensation per employee differ owing to changes in effective work time.

2.4. The price variables, PX, PX^*, and the various cost variables are expressed in a common currency. The domestic currency is in this respect mostly chosen, without however any clear cut theoretical rationalisation. To test the sensitivity of the results to the choice of the numerary currency, the specification is also estimated with PX, PX^*, and wage costs expressed in dollars.

2.5. Most estimates of the export price setting function are made at this stage of the research with the competitors' price and wage costs as main determinants. However, in a last set of estimations, the degree of capacity utilization is added as explanatory variable for the subsectors and the aggregates for which data were available (source NBB). The way in which the capacity variable is introduced is intended to test the hypothesis that the influence of costs on prices becomes stronger and the influence of competitors' prices becomes weaker when the rate of capacity utilization increases.

3. Empirical Results

3.1. Equation 1, specified at a first stage with competitors' prices and wage costs as the only explanatory variables, is estimated in the following from:

$$(3) \qquad PX^* = \beta_0 + \beta_1 \hat{PX^*} + \beta_2 \hat{W}$$

where PX is the price index of Belgian exports
PX^* is the foreign competitors' price index
W is the labour cost (defined in four different ways)
denotes the annual growth rates

3.1.1. Table I presents the estimation results of equation 3 for the four subsectors considered (indicated by their NACE code in the first column[7]), and for the two aggregates: "equiment goods and metal products", and "total manufactured products". The estimations refer to the specification 3 with *PX*, *PX**, and *W* expressed in Belgian Francs.

For the four subsectors Zellner's SURE joint estimation technique is used; OLS are applied for the two aggregates. A correction for first order autocorrelation of residuals is introduced wherever necessary (this occurs in only a few instances).

OLS results are also presented for the four subsectors, for reasons of comparison. They are reported in appendix, table A, and are discussed briefly when necessary in the text.

Table I (and table A of Appendix I) present the estimates for β_1 (coefficient of the competitors' price *PX**) and for β_2 (coefficient of the labour cost variable *W*) for each of the four definitions of wage cost which are considered: Unit Labour Costs (*ULC*); Compensation per hour (*WH*); Compensation per employee (*WE*); and Standard Unit Labour Cost (*SULC*.) Student *t* statistics are reported beneath the coefficients. The R^2 and *DW* statistics are reported, and also the correlation coefficient between *PX** and *W* in order to signal potential multicollinearity problems.

3.1.1.1. The estimation results reported in Table I can be summarised for the different sectors and aggregates in the following way:

- Starting with sector 21, Agricultural and Industrial Machinery (for which amongst the four subsectors the best fit for equation 3 is obtained), one notes that this sector can clearly be labelled as a "price taker". The coefficient of wage cost is never significantly different from zero at the usual significance levels, whatever the definition chosen for this wage cost.
  The coefficient of the competitors' prices is strongly different from zero and has a value not significantly different from 1. Note that the SURE estimates coincide with the OLS estimates (see Table A, Appendix I) while being more significant.

[7]See Table 2.1 for code definition.

TABLE I

Estimation results with *PX*, *PX and *W* expressed in BF**
SURE estimates for the subsectors and OLS estimates for the aggregates

Products	UNIT LABOR COST (*UCL*)[2] β_1 (*t*)	β_2 (*t*)	R^2	*DW*	${}^rPX^*W$	COMPENSATION PER HOUR (*WH*)[2] β_1 (*t*)	β_2 (*t*)	R^2	*DW*	${}^rPX^*W$
19	0.492 (3.489)	−0.130 (−2.000)	0.459	1.402	0.346	0.224 (1.742)	0.619 (3.852)	0.692	1.925	0.505
21	1.025 (8.769)	−0.063 (−0.812)	0.817	2.082	0.264	0.952 (7.996)	0.099 (0.953)	0.827	2.006	0.299
25	0.401 (1.370)	0.304 (1.556)	0.291	2.214	0.271	0.361 (1.211)	0.317 (1.452)	0.279	2.043	0.447
27	1.044 (9.529)	0.110 (2.161)	0.768	2.344	0.231	1.119 (7.749)	−0.037 (−0.311)	0.768	2.638	0.573
Equip[1]	0.382 (1.849)	0.350 (1.878)	0.480	1.369	0.499	0.706 (5.494)	0.233 (1.982)	0.840	2.374	0.457
Tot manu	0.858 (6.542)	0.027 (0.180)	0.750	1.761	0.311	0.836 (6.902)	0.231 (1.291)	0.774	1.990	0.191

Products	COMPENSATION PER EMPLOYEE (*WE*) β_1 (*t*)	β_2 (*t*)	R^2	*DW*	${}^rPX^*W$	STANDARD UNIT LABOR COST (*SULC*) β_1 (*t*)	β_2 (*t*)	R^2	*DW*	${}^rPX^*W$
19	0.360 (2.296)	0.385 (2.886)	0.411	1.728	0.111	0.066 (0.404)	0.907 (4.275)	0.500	1.876	0.565
21	0.946 (8.234)	−0.009 (−0.120)	0.795	2.117	0.055	0.895 (7.502)	0.179 (1.038)	0.806	2.054	0.403
25	0.485 (1.934)	0.011 (0.054)	0.141	1.985	0.272	0.461 (1.874)	0.340 (1.076)	0.221	2.212	0.434
27	0.701 (4.560)	0.151 (1.529)	0.748	1.862	0.614	0.796 (5.930)	0.197 (1.840)	0.767	2.135	0.455
Equip[1]	0.712 (6.544)	0.411 (3.297)	0.880	2.311	0.338	0.610 (4.816)	0.450 (2.737)	0.865	2.571	0.520
Tot manu						0.897 (5.258)	0.173 (0.707)	0.742	1.904	0.505

Notes
[1]Correction for first order autocorrelation has been necessary for the estimation of the *EQUIP* equation with wage cost defined as *WH* (ρ = 0.32(1.38)), *WE* (ρ = 0.42(1.88)) and *SULC* (ρ = 0.26(1.13)).
[2]For the joint *SURE* estimation of the equations for the 4 subsectors, a correction for first order autocorrelation was introduced for the equation concerning the first subsector (code 19), with wage cost defined as *UCL* (ρ = 0.52(3.18)) and *WH* (ρ = 0.29(1.65)).
β_1 is the coefficient of *PX**.
β_2 is the coefficient of *W*.
${}^rPX^*W$ is the coefficient of correlation between *PX** and *W*.

- Following the decreasing order of the R^2 obtained, the next sector to be considered is sector 27, Motor Vehicles and Automobiles. This sector can also be considered as a "price taker", although slightly less clearly so.
  The coefficient of PX^* is always significantly different from zero, but has a value not significantly different from 1 for wage costs defined as *ULC, WH,* and *SULC*. Concerning *WE*, the β_1 coefficient is significantly smaller than 1.
  The β_2 wage cost coefficient ranges between 0.1 and 0.2. Although quite small it is significantly different from zero for wage costs defined as *ULC* and *SULC*. When OLS results are considered, however, (Table A, Appendix I) β_1 is never significantly different from 1, and β_2 is never significantly different from zero.
- Sector 19, Metal Products, except Machinery and Transport Equipment, shows a maximum R^2 of 0.69. The results depend strongly on the definition of labour cost. The best overall regression performance is obtained with labour cost defined as *WH*, hourly compensation. The sector can, according to these results, be classified as a "dominated price maker", meaning that the sector, although fundamentally a price maker, has to take foreign competition into account (see Kervyn 1979).
  The β_2 cost coefficient is, both for OLS and SURE, quite important (0.6) and significantly so. Foreign price competition nevertheless remains a significant determinant of price setting: β_1, although small (0.2), is significantly different from zero, both for OLS and SURE estimates. The price making character of the sector is corroborated when the next best estimate is considered, with wage cost defined as *SULC*. The coefficient of PX^* comes out more strongly and more significantly in the two other regressions, the reliability of which may however be questioned on grounds of their lower R^2.
- The last sector to be considered, sector 25, electrical goods, is characterised by a relatively low performance of the estimated equation. Broadly speaking, it appears that the β_1 and β_2 coefficients are both in the range of 0.3-0.4, but that the cost coefficients are more often significantly different from zero than the coefficient of PX^* (particularly for the OLS results). The sector might, therefore, tentatively be classified as a "dominated price maker".

Turning now to the two aggregates (only OLS results), the following comments can be made.

- For the aggregate "equipment goods and metal products" (EQUIP), the β_1 coefficient is the highest and the most significant. Wage costs do, whatever the definition, also play a significant role (range: 0.2/0.4). As, moreover, the β_1 coefficient of foreign competitors' prices is significantly smaller than 1, the conclusion can be drawn that the equipment goods sector, although mainly a price taker does have sufficient market power to roll over some fraction of cost increases onto prices.
- For the case of the aggregate "total manufactured products" the diagnosis is clear: the sector is a price taker, costs are never significant. The β_1 coefficient is significantly different from zero. Its value is close to 1, indeed, not significantly different from 1.

To summarise the results obtained from estimation of equation 3 with costs limited to labour costs, it can be noted that the price setting behaviour is clearly appreciated differently at the disaggregated or at the aggregated level of analysis: at the aggregated level, results tend to indicate a price taking behaviour, whereas at the disaggregated level, at least one sector could be identified as mainly a price maker.

Note also that judging from the results obtained for the four subsectors, the general performance of the regression is always lower when the price making characteristics of the sector are strong. This might suggest that the cost definition needs to be extended to other costs.

3.1.1.2. The results have so far been discussed without explicitly concentrating on the incidence of the alternative definitions of labour cost. A first comment to be made in this respect is that the results are indeed sensitive to the definition chosen. Secondly, if one takes as criterion the general performance of the estimation (as measured by the R^2), the compensation per hour (*WH*) appears as the best definition of labour cost (see Table I: R^2 is maximised for *WH* in four out of six cases). Standard unit labour cost (*SULC*) appears as the second best choice. Compensation per employee (*WE*) performs the worst. Thirdly, inspection of the results seems to indicate that the estimate for the labour cost coefficient is generally higher when *WH* and *SULC* are used than when *ULC* are taken. This seems to give some credit to the view that use of *ULC* might bias the results against price-makership (see footnote 6, p. 210).

3.1.1.3. The results reported in Table I are relative to price and cost variables expressed in domestic currency. For export price setting behaviour, i.e., price setting on foreign markets particularly, no clear theoretical argument imposes the choice of the domestic currency as numerary. To test the sensitivity of the results to a price setting function specified for foreign currency export prices, equation 3 is reestimated with PX, PX^*, and W expressed in dollars. SURE estimates are reported in Table B, Appendix I. The following comments can be made. The R^2 of every equation increases quite strongly. A comparison between the correlation coefficients calculated between PX^* and W for the Belgian franc and the Dollar estimates indicates that the increase in R^2 is accompanied by an increase in multicollinearity. This increased multicollinearity, which suggests that BF estimates are to be preferred, does not affect the estimation of the coefficients too much, however.

At the disaggregated level, the coefficient β_2 of labour costs is usually reinforced when the estimation suggests price makership. At the aggregated level, the price taking characteristic of "total manufactured products" is reinforced, whereas the cost component is given additional weight in the "equipment goods" aggregate.

3.2. In the preceding section, the empirical results have shown that the influence of costs on prices was quite important for several subsectors. A commonly held view is that the price-cost margin is dependent on the degree of capacity utilization (D). To test this view the degree of capacity utilization is added to the explanatory variables of the price setting equation in the following way:

$$(4) \qquad P\hat{X} = \gamma_o + \gamma_1 (1 - D).\, P\hat{X}^* + \gamma_2.\, D.\, W\hat{H}$$

where D is the degree of capacity utilisation.

The rationale behind this specification is that the pass through of costs to prices is the stronger, the higher the degree of capacity utilization is. Equivalently, the influence of competitors' prices is the stronger, the lower the degree of capacity utilisation is.

The results of the SURE estimation of equation 4 (OLS for the aggregates) are reported in Table II[8]. Equation 4 uses WH as definition for wage cost, given that this concept has been proved to be superior to the other definitions taken into consideration (see 3.1.1.2). PX, PX^*, and WH are expressed in domestic currency (BF).

[8]Sector 19 is ignored because data on D was not available.

TABLE II

Estimation results with PX^*, W (in BF) and D as explanatory variables SURE estimates for the subsectors and OLS estimates for the aggregates[1]

	$\beta_1 = \gamma_1(1 - D)$				$\beta_2 = \gamma_2 D$				R^2	
		Specific. with D				Specific. with D				
Products	Specific. without D	D Min	$\bar{D}_{(t)}$	D Max	Specific. without D	D Min	$\bar{D}_{(t)}$	D Max	Specific. without D	Specific. with D
21	0.952 (7.996)	1.068	0.837 (8.997)	0.526	0.099 (0.953)	0.189	0.208 (2.448)	0.234	0.827	0.828
25	0.361 (1.211)	0.590	0.360 (2.021)	0.131	0.317 (1.452)	0.313	0.360 (2.034)	0.407	0.279	0.300
27	1.119 (7.749)	0.766	0.372 (3.784)	0.176	−0.037 (−0.311)	0.087	0.103 (0.607)	0.111	0.768	0.549
Equip[2]	0.706 (5.494)	0.715	0.544 (6.552)	0.340	0.233 (1.982)	0.246	0.270 (2.849)	0.298	0.840	0.853
Tot manu	0.836 (6.908)	0.941	0.651 (3.814)	0.394	0.231 (1.291)	0.372	0.421 (1.694)	0.463	0.774	0.632

[1]The DW and rPX^*WH are not reported in the table as they did not give rise to any problems.
[2]Correction for first order autocorrelation has been necessary for the *EQUIP* equation without D (see table I) and with D (in this case $\rho = 0.22$ (0.942)).

For reasons of comparison, the estimation results of equation 3, without capacity utilisation rate, are recalled in Table II. This table also presents the estimated values of the coefficient of PX^*, ($\beta_1 = \gamma 1[1 - D]$) and of $WH(\beta_2 = \gamma_2 D)$, for selected values of D (its minimum, its average, and its maximum).

For the subsectors 21 and 27, Agricultural and Industrial Machinery and Motor Vehicles and Automobiles which have been identified as mainly price-takers, the estimation results for equation 4 are similar to those reported for equation 3 in Table I. For sector 21, the quality of the adjustment barely changes, but the coefficient of labour cost becomes significant, even if it remains small in size. This result somewhat mitigates the clear cut price taking character of the sector. For sector 27, specification of equation 4 seems less appropriate than the specification of equation 3. This occurrence is not so surprising if one considers that it is the capacity to pass through costs on prices which depends on the degree of capacity utilisation. The specification of equation 4 should therefore be less appropriate for a price taker than for a price maker. Sector 25 (electrical goods) confirms this point. For this sector the tentative qualification of "dominated price maker" is reinforced by the results of the estimation of equation 4; the coefficient of costs as well as the coefficient of competitors' prices become significant at the 5% level and the quality of adjustment slightly improves.

A similar conclusion obtains for the equipment goods aggregate; the estimation performance improves, both coefficients become more significant. For "total manufactured products", qualified above as price taker, the coefficient of costs becomes significant at the 10% level, although the lower R^2 indicates that the specification is not appropriate.

To summarise, inclusion of the degree of capacity utilisation as a variable shaping the coefficients of PX^* and WH leads to a general increase in the significativeness of labour costs.

3.3. The price setting function has so far been specified with labour costs as the only cost. We will now endeavour in this last section to enlarge the cost concept, by including in equation 4 the price of imported inputs (PM).

Thus, equation 4 becomes

$$(5) \qquad P\hat{X} = \gamma_0 + \gamma_1(1 - D)\, P\hat{X}^* + \gamma_2.D.W\hat{H} + \gamma_3.D.P\hat{M}$$

Equation 5 is, however, only estimated for the aggregate "total manufactures products". Reliable data on the price of imported inputs for the

TABLE III

Estimation results for "Total manufactured products"
Explanatory variables PX^*, WH, PM (in BF) and D
OLS ($CORC$) results

	$\beta_1 = \gamma_1(1 - D)$			$\beta_2 = \gamma_2 D$			$\beta_3 = \gamma_3 D$			R^2	DW
	D Min	$\bar{D}_{(t)}$	D Max	D Min	$\bar{D}_{(t)}$	D Max	D Min	$\bar{D}_{(t)}$	D Max		
Eq a	0.941	0.651 (3.814)	0.394	0.372	0.421 (1.694)	0.463	—	—	—	0.632	2.236
Eq b	−0.004	−0.002 (−0.023)	−0.001	0.225	0.254 (2.323)	0.280	0.429	0.484 (8.750)	0.533	0.951	2.174
Eq c	0.941	0.651 —	0.394	0.222	0.250 (1.157)	0.276	0.153	0.173 (2.156)	0.191	0.719	1.510

Eq a: Results of estimation without PM (see table II).
Eq b: Results of estimation with PM ($CORC$).
Eq c: Results of estimation with PM and with β_1 constrained to the value taken in Eq a.

specific sectors is unfortunately not available. *PM* is defined as the unit value of manufactured imported input goods (source — NBB).

The results of estimation of equation 5 for the total manufactured products aggregate are reported in Table III. The first line of this table recalls the results of Table II. The introduction of imported input prices strongly increased the R^2 from 0.63 to 0.95. However, it is readily seen that this improvement is accompanied by an increased collinearity between PX^* and *PM*. A clear symptom of this is, moreover, provided by the fact that the competitors' price coefficient is dramatically decreased to zero when *PM* is introduced.

Nevertheless, in an attempt to estimate the additional explanation carried by *PM* in the price setting function, we constrained the coefficient of PX^* to its values estimated for the specification without *PM*.

Not surprisingly, R^2 decreases, but remains still higher than in the case of estimation without *PM*. The coefficent of the price of imported inputs remains significant. This tends to suggest that this cost contributes, although marginally so, to explaining the price setting behaviour of the total manufactured products.

This suggests, in turn, that it may be useful to check for the influence of this type of cost in the price setting behaviour of the other sectors.

4. Conclusion

This paper has dealt with the estimation of an export price setting function for sectors of the Belgian industry of *Equipment Goods and Metal Products*, for these industries' aggregate and for the aggregate of total manufactured products. Is has been shown that the sectors *Agricultural and Industrial Machinery* and *Motor Vehicles and Automobiles* as well as the aggregate *Total Manufactured Products* could be considered as mainly price takers, whereas the sectors *Metal Products* (except machinery and transport equipment) and *Electrical Goods* were characterised as "dominated price makers". For the aggregate *Equipment Goods and Metal Products* the foreign competitors' price plays the dominant role although some influence of costs on prices exists.

In deriving these results the principal aim was not to elaborate a price maker/price taker classification, but to focus on selected methodological issues, particularly the empirical definition of the price setting functions' explanatory variables.

Particular attention was devoted to the definition of the foreign competitors' price index. The use of the VOLIMEX data allowed us to

include for each product, a large number of competitors in the index, and therefore overcome the frequently encountered and rather restrictive hypothesis which considers that German export prices are sufficiently good proxies for competitors' prices faced by Belgian exporters.

The labour cost variable was also taken into consideration. Four definitions were considered, unit labour costs, compensation per hour, and per employee, and standard unit cost. The empirical tests suggest that the compensation per hour, closely followed by standard unit costs, is the adequate concept.

Finally, the relevance of introducing the rate of capacity utilization as a determinant of the capacity to roll over costs onto prices was confirmed for several sectors.

As was noted in introduction to this paper, the results reported here represent the first stage of a research focused on exchange rates and the competitiveness of the Belgian economy. The following items are, in this respect, on the research agenda:

Extensions of the analysis of the price setting behaviour to other sectors;
Inclusion of non labour costs at the disaggregated level;
Extension of the sample period to include 1982 and 1983;
Analysis of the implications of the estimated price setting behaviour for the determination of market shares on export and domestic markets;
Evaluation of the link between exchange rates and competitiveness.

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* *

Appendix 1

TABLE A

Estimation results with PX, PX^* and W expressed in BF
OLS estimates for the subsectors

Products	UNIT LABOR COST (*UCL*)					COMPENSATION PER HOUR (*WH*)					COMPENSATION PER EMPLOYEE (*WE*)					STANDARD UNIT LABOR COST (*SULC*)				
	β_1 (t)	β_2 (t)	R^2	DW	r_{PX^*W}	β_1 (t)	β_2 (t)	R^2	DW	r_{PX^*W}	β_1 (t)	β_2 (t)	R^2	DW	r_{PX^*W}	β_1 (t)	β_2 (t)	R^2	DW	r_{PX^*W}
19[1]	0.572 (3.115)	0.040 (0.042)	0.553	1.518	0.346	0.378 (2.313)	0.508 (2.967)	0.714	1.893	0.505	0.598 (3.082)	0.284 (1.597)	0.470	1.613	0.111	0.342 (1.589)	0.647 (2.392)	0.551	1.671	0.565
21	0.975 (7.422)	−0.014 (−0.150)	0.796	2.097	0.264	0.928 (7.256)	0.124 (1.093)	0.811	1.989	0.299	0.969 (7.635)	0.045 (0.052)	0.796	2.093	0.055	0.921 (6.822)	0.173 (0.889)	0.806	2.034	0.403
25	0.333 (1.138)	0.360 (1.827)	0.293	2.321	0.271	0.236 (0.739)	0.392 (1.695)	0.274	2.146	0.447	0.377 (1.219)	0.323 (1.195)	0.211	2.286	0.272	0.265 (0.824)	0.627 (1.524)	0.251	2.348	0.434
27	0.875 (6.420)	0.090 (1.321)	0.768	2.280	0.231	0.876 (5.154)	0.055 (0.412)	0.743	2.131	0.573	0.816 (4.734)	0.107 (0.943)	0.755	2.030	0.614	0.825 (5.552)	0.160 (1.350)	0.769	2.197	0.455

Note
[1]Correction for first order autocorrelation has been necessary for the estimation of the first subsector (code 19) equation with wage defined as *ULC* ($\rho = 0.35$ (1.54)) and *WH* ($\rho = 0.17$ (0.73)).
β_1 is the coefficient of PX^*.
β_2 is the coefficient of W.
r_{PX^*W} is the coefficient of correlation between PX^* and W.

TABLE B

Estimation results with PX, PX^* and W expressed in \$
SURE estimates for the subsectors and
OLS estimates for the aggregates

Products	UNIT LABOR COST (*ULC*)					COMPENSATION PER HOUR (*WH*)					COMPENSATION PER EMPLOYEE (*WE*)				
	β_1 (t)	β_2 (t)	R^2	DW	r_{PX^*W}	β_1 (t)	β_2 (t)	R^2	DW	r_{PX^*W}	β_1 (t)	β_2 (t)	R^2	DW	r_{PX^*W}
19	0.853 (4.371)	0.139 (1.114)	0.798	1.516	0.782	0.181 (1.047)	0.716 (5.361)	0.885	1.469	0.880	0.564 (3.630)	0.380 (3.553)	0.829	1.926	0.769
21	0.973 (10.174)	−0.032 (−0.429)	0.917	2.115	0.731	0.798 (6.519)	0.120 (1.329)	0.921	2.166	0.853	0.948 (10.306)	−0.011 (−0.166)	0.917	2.112	0.695
25	0.479 (2.109)	0.345 (2.044)	0.699	2.475	0.782	0.132 (0.474)	0.572 (2.956)	0.726	2.480	0.898	0.453 (1.699)	0.334 (1.742)	0.679	2.460	0.872
27	0.796 (10.710)	0.124 (2.264)	0.945	2.158	0.721	0.750 (5.380)	0.150 (1.316)	0.939	1.725	0.919	0.745 (6.836)	0.163 (1.797)	0.938	1.735	0.879
Equip[1]	0.380 (1.679)	0.508 (2.725)	0.870	1.625	0.903	0.617 (3.652)	0.309 (2.454)	0.968	2.122	0.923	0.632 (4.918)	0.336 (3.179)	0.973	2.193	0.897
Tot manu	1.100 (6.220)	0.002 (0.014)	0.899	1.715	0.853	0.961 (5.477)	0.110 (0.937)	0.904	1.978	0.859					

Note
[1]Correction for first order autocorrelation has been necessary for the estimation of the *EQUIP* equation with wage cost defined as *WH* ($\rho = 0.35$ (1.49)) and *WE* ($\rho = 0.35$ (1.56)).
β_1 is the coefficient of PX^*.
β_2 is the coefficient of W.
r_{PX^*W} is the coefficient of correlation between PX^* and W.

List of symbols and data sources

Appendix 2

δ and λ: export market shares (defined in the text: own computations; source: VOLIMEX).

D: degree of capacity utilization (source: NBB).

H: number of hours effectively worked (own computations; source: NIS-Industrial Statistics).

L: number of employees (own computations; source: NIS-Industrial Statistics).

PM: unit value of manufactured imported input goods (source: NBB).

PX: Belgian export price for the product category considered (own computations; source: VOLIMEX).

*PX**: foreign competitors' price for the product category considered (own computations; source: VOLIMEX).

Q: output, proxied by value added at constant price (source: EEC — National Accounts).

SULC: standard unit labor cost (own computations; see text).

ULC: unit labor cost (own computations, except for the total manufactured sector for which source is IRES; see text).

W: wage cost.

WE: compensation per employee (own computations; see text).

WH: compensation per hour (own computations; see text).

Note that the exchange rate used to express prices and costs in a common currency was taken from the OECD publication "Foreign Trade by Countries".

NIS is the "National Institute of Statistics — Belgium".

NBB is the "National Bank of Belgium".

IRES is the "Institut de Recherches Economiques et Sociales", Louvain-la-Neuve.

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