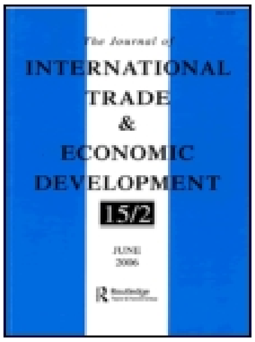

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Estimating the pro-competitive gains from trade liberalization: an application to Mexican manufacturing

Jean-Marie Grether

University of Geneva and University of Neuchâtel

Abstract

An original two-stage method is proposed to estimate the pro-competitive gains from trade liberalization. In a first step, I estimate the sensitivity of the price–cost margins of domestic firms to changes in the effective rate of protection, on the basis of a structure–performance relationship. This parameter is later exploited in a second step, where the cost of protection is calculated on the basis of a simple partial equilibrium model where domestic and foreign goods are imperfect substitutes. Applied to the Mexican case, this estimation reveals that protection removal depresses margins significantly and suggests that important additional gains can be expected from pro-competitive forces.

Keywords

Trade liberalization, pro-competitive gains

1. INTRODUCTION

The 'new' theoretical literature in international trade has substantially broadened the scope of the gains from trade and trade policy reform suggested by the standard classical and neoclassical trade theories. Among the predicted gains are the exploitation of economies of scale and the pro-competitive effect predicted by monopolistic competition models.[1] In contrast to this flourishment of theoretical models, empirical analysis has been scant.[2] Quite independently, a rich empirical literature has developed in industrial organizations, with a number of studies attempting to evaluate what has become known as the 'import discipline hypothesis'. This hypothesis conjectures that, after controlling for structure (e.g. the degree of concentration in the industry), the more intense are the pressures from imports, the lower will be the industry-level price–cost-margins, or alternatively the 'better' the performance.

Address for correspondence:
Université de Genève, Dept d'Economie politique, 102 Boulevard Carl Vogt, 1211 Genève 4, Switzerland.

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These structure–performance (SP) studies in the tradition of Bain (1951) fell out of favour with the advent of the 'new' industrial organization literature based on rigorous microfoundations.[3] At the same time, despite the relatively strong empirical support found for the import–discipline hypothesis, these studies have also been criticized on empirical grounds. First, most studies were carried out on a cross-section basis at the industry level. Second, the proxy variables for the intensity of competition from foreign supply (usually the import penetration rate) were less than satisfactory. Third, the precise meaning of the explained variable was also ambiguous: was a high price–cost margin an indicator of efficiency, as suggested by Demsetz (1973) or rather, as supposed by the SP model, an indicator of market power? As a result, without entering into the details of the selected econometric specifications, the interpretation of the results from these studies was delicate and it is fair to say that one was left with a feeling of lack of robustness in many cases.

This paper is in the tradition of the SP studies, although its primary focus is to look for evidence of the supposed pro-competitive effects of trade liberalization. Taking advantage of detailed plant level data for Mexican manufacturing firms during the widespread reforms of the mid-1980s, it looks for evidence of pro-competitive effects among the determinants of price–cost margins, both at the industry and at the plant level. The traditional import penetration rate indicator is compared with the less frequently used effective rate of protection. The latter seems a better candidate to estimate pro-competitive effects because it is a direct measure of protection and can also be interpreted as the degree of overpayment to primary factors by comparison with international standards. The paper is divided in two substantial parts. First, I explore systematically the determinants of price–cost margins on the basis of the panel data mentioned above. Second, having identified a relatively robust presence of market power linked to the degree of exposure to foreign competition, I develop a simple partial equilibrium model that assesses the likely empirical importance of this effect in the total welfare estimates of the costs of protection.

After a brief outlook at the trade liberalization process in Mexican manufacturing, Section 2 provides estimates of price–cost margins determinants at the sector level. As temporal variation is the most relevant one when analyzing pro-competitive effects, the results from the within estimator are emphasized. It turns out that the significance of the import penetration rate is, in general, disappointing, but the effective rate of protection exhibits a highly significant impact on margins. These findings are further confirmed in Section 3, which considers alternative estimators and different sets of regressors. Another source of ambiguity (the Demsetz effect) is lifted in Section 4, where plant level regressions suggest that price–cost margins do reflect market power in Mexican manufacturing. The robust finding of this detailed SP analysis is that the reduction in effective protection has indeed depressed margins.

This result is later exploited in the final part of the paper, where Section 5 develops a model that extends the traditional estimates of the costs of protection to the imperfect competition case. This partial equilibrium approach provides estimates of the welfare gains implied by total removal of protection when pro-competitive effects are at work. Generally speaking, total welfare gains fluctuate between 0.5% and 2.0% of total expenditure, 20% of which being attributable to pro-competitive effects. Furthermore, pro-competitive forces could imply important additional gains in case unproductive rent seeking activities proved to be substantial. Final comments follow in Section 6.

2. DETERMINANTS OF MARGINS AT THE INDUSTRY LEVEL

2.1 The Mexican trade liberalization

Mexico's trade policy reorientation is part of a wider process of economic reforms carried out under the De la Madrid and Salinas administrations. The reforms started in the 1980s, with the bulk of trade liberalization carried out in three years (see Table 1).[4] It was initiated by an important cut in quantitative restrictions in July 1985, followed by a first round of tariff reduction in April 1986 and completed by a second round in December 1987. Although drastic, these changes were not accompanied by an increase in the import rate, which remains inferior to 10% over the period. A possible source of explanation of this low response in imports could be the weakness of demand, which is also reflected by production levels below their long run trend. However, the decisive factor has certainly been the strong real depreciation of the Mexican peso implemented with the trade policy reforms (more than 60% on average during the 1986–87 period). The direct exposure to international competition was thus dampened across-the-board, with the increase in imports only occurring once the real exchange rate started appreciating. However, this happened after the end of the sample period. After taking exchange rate protection into account,[5] the reduction of average effective protection appears to have been quite substantial (close to 50% when comparing the 1984–85 period to the 1986–87 period), even though the dispersion in effective protection did not reduce much. It is therefore reasonable to presume that these changes in the competitive environment have affected the firms' behaviour and profitability.

2.2 Specification of the SP model

The impact of trade liberalization on sectoral profitability is analyzed on the basis of the following equation, which has been estimated at the 2-digit industry level over the 1984–87 period:

Table 1 Import penetration and protection in Mexican manufacturing (unweighted averages of 40 sectoral values – standard deviations in parentheses)

Annual average	*1984*		*1985*		*1986*		*1987*	
1. trend in production[a]	–3.90 (8.37)		1.82 (6.93)		–2.75 (6.12)		–0.85 (4.79)	
2. imports over domestic consumption[b]	0.08 (0.12)		0.09 (0.12)		0.08 (0.11)		0.07 (0.09)	
3. index of real exchange rate[c]	110.9		106.8		155.9		169.8	
Half-year average[d]	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*
4. tariffs	n.a.	n.a.	33.83 (20.30)	37.09 (18.36)	30.84 (11.10)	30.41 (11.63)	28.55 (9.50)	14.11 (5.38)
5. coverage of import licences[e]	n.a.	n.a.	91.82 (11.51)	39.2 (35.31)	39.51 (35.34)	33.32 (34.77)	27.17 (32.78)	15.44 (31.04)
6. effective rate of protection[f]	31.99 (74.40)	37.68 (83.68)	54.76 (126.72)	31.92 (86.63)	20.41 (56.38)	22.17 (67.93)	21.22 (61.25)	31.98 (81.87)

n.a.: Not available
a Percentage of deviation from the predicted value of a trend of manufacturing production fitted over the 1980–89 period.
b Trade figures are deflated by the index of real exchange rate in order to correct for currency undervaluation.
c On the basis of a world CPI for 133 countries; 1970 = 100; an increase means a real depreciation of the Mexican peso.
d Value in June/December in the case of the effective rate of protection and for the first/second semester in the case of tariffs and import licences.
e Percentage of the production subject to import licences or reference prices.
f Original estimates are based on price comparisons, so they include the effects of NTBs. The percentage of the currency undervaluation is added to the original figures in order to capture exchange rate protection.

Sources: Own calculations based on: 1, 3: Banco de México (1991); 2: Casar Perez (1993) for imports and exports, INEGI (1989) for gross output; 4, 5: SECOFI (1992); 6: Ten Kate and de Mateo Venturini (1989)

$$\mathrm{PCM}_{jt} = \beta_0 + \beta_1 \mathrm{HERF}_{jt} + \beta_2 \mathrm{KQ}_{jt} + \beta_3 \mathrm{COMP}_{jt} + \varepsilon_{jt} \tag{1}$$

where PCM_{jt} is the price–cost margin of sector j, year t, HERF is the Herfindahl index of concentration, KQ is the capital–output ratio, COMP is the indicator of foreign competitive pressure (either IMP, the import penetration rate; ERPA, the annual average of the effective rate of protection; or ERP4, its value in the fourth quarter) and ε_{jt} is a white noise. The main data source is an (unpublished) annual industrial survey of INEGI. Trade flows are borrowed from Casar Perez (1993) and ERPs are taken from Ten Kate and de Mateo Venturini (1989).[6]

As a starting point, simple OLS estimates of (1) are obtained. It is expected that β_1 will be positive as collusive behaviour is generally favoured by concentration. As PCM includes payment to fixed factors, it should be positively linked with capital intensity. Finally, as more exposure to foreign competitors should depress margins, β_3 is expected to be negative when using IMP but positive in the case of ERP.

This standard specification in the SP tradition cannot handle the possibility that a number of other factors are susceptible to affect the margins, such as scale economies, product differentiation or wage negotiations. With adequate proxies, one could attempt to control explicitly for these effects by adding more regressors.[7] The availability of panel data offers the alternative of treating these variables as unobservable, time-invariant effects which are captured by industry dummies. In this case, which is equivalent to centring all variables over their temporal mean, the inter-industry or 'between' variation of margins due to other factors is captured by the dummies, while the intra-industry or 'within' variation of PCM is captured by the other regressors. These within estimates reflect therefore the influence of the regressors over time, which is precisely the dimension of major interest when evaluating the impact of a trade liberalization process.

2.3 Empirical results

Results for the OLS estimator are reported in the first two rows of Table 2. As expected HERF and KQ are positively correlated with PCM, while the impact of IMP is negative. However, the coefficient of the ERP terms (either ERPA or ERP4) surprisingly turns out to be significantly negative. Why should a higher protection be linked with a lower profitability? A possible explanation derives from the fact that OLS estimates are based on total PCM variation, which is mostly across industries, not through time.[8] Therefore, if one thinks of this correlation in terms of a simple cross-section, it may just suggest a reversed causation in which ERP is (negatively) determined by PCM. In other words, protection would have been preferentially granted to low profitability sectors, probably the ones with less comparative advantage, which is not unrealistic in a country that followed an import substitution strategy for decades. Of course, other effects are probably at work, and the weak explanatory power of the OLS regressions calls for prudence. However, a simple way to check if our interpretation is correct is now to turn to the within estimates, which rely exclusively on temporal variations, and for which the legacy of the import substitution period should not bias the ERP coefficient.

Results for the within estimator are a lot more satisfactory in terms of explanatory power ($\bar{R}^2$ larger than 0.95), thus confirming that most of the PCM variation is due to time-invariant, industry-specific effects captured by the dummy variables. The coefficient of HERF remains almost identical and strongly significant. The impact of KQ becomes now significantly negative. As we are dealing with temporal variation, this is probably due to variations

Table 2 PCM empirical determinants: OLS and within estimates (standard errors in parentheses, ** significance at the 99% level, * significance at the 95% level)

	Intercept	*HERF*	*KQ*	*IMP*	*ERPA*	*ERP4*	$\bar{R}^2$	*F stat*	*Nb. obs.*
OLS	0.253** (0.022)	0.281** (0.080)	0.099** (0.031)	–0.152* (0.076)			0.12	8.12	160
	0.239** (0.020)	0.302** (0.080)	0.111** (0.031)		–0.022* (0.011)		0.12	8.17	160
	0.239** (0.020)	0.304** (0.080)	0.110** (0.031)			–0.025* (0.012)	0.12	8.25	160
within[a]	0.225** (0.016)	0.353** (0.076)	–0.031* (0.017)	0.007 (0.070)			0.971	125.55	160
	0.223** (0.012)	0.317** (0.075)	–0.035* (0.016)		0.010* (0.004)		0.972	131.51	160
	0.222** (0.011)	0.257** (0.075)	–0.043** (0.016)			0.020** (0.005)	0.974	142.73	160

a 39 industry dummies not reported (globally significant) in capacity utilization: under idle capacity, an increase in production and profits can occur without affecting capital stock, thus implying a negative correlation between profits and measured capital intensity. The coefficient of both ERP variables becomes significantly positive, suggesting that cross-industry variation must indeed be ruled out to unveil the pro-competitive effects of trade liberalization. There also seems to exist an 'end of year effect', probably linked with inflation,[9] as the estimated coefficient of ERPA is 50% smaller than that of ERP4. Finally, the coefficient of IMP becomes positive and loses its significance. This could be related to the weak temporal variation of IMP mentioned at the beginning of this section. However, here again, one could also incriminate reversed causation: when protection is removed, imports will be attracted to the higher profitability sectors. Unlike the ERP case however, it is not possible simply to correct for this effect by including industry dummies.[10]

So far, results are consistent with expectations and point to the benefits of estimating the SP model with panel data. They suggest that the temporal decrease in effective protection has indeed depressed margins in Mexican manufacturing industries. They also confirm that the use of effective protection is more recommendable than that of import penetration,[11] not only because it provides a direct measure of trade policy influence, but also because it seems to be less affected by simultaneity bias than the other proxy when dealing with temporal variation. But how trustworthy are these estimates? The next two sections address several empirical shortcomings in more detail. It turns out that the alternatives which are considered generally strengthen these preliminary results. From now on, in order to simplify presentation, results for ERPA will not be reported.[12]

3. ROBUSTNESS AND ALTERNATIVE SPECIFICATIONS

3.1 Robustness

It could first be argued that the within estimator does not rely on all available variation and thus is not fully efficient. An efficient estimation can be obtained by considering the industry-specific effects as random. Results for this alternative GLS (or random-effects) regression, provided in Table 3, turned out to be very close to those of the within regression. Therefore, even when relying on the technique that minimizes the asymptotic variance of estimates, the coefficient of IMP remains not significantly different from zero, and that of ERP remains positive and strongly significant.

Second, this result can still be questioned as GLS estimates are biased if the error term is correlated with some of the regressors. Such a correlation can be tested with a Hausman (1978) test based on the difference between GLS and within estimates. This is the sense of the m statistic that appears in Table 3. In the IMP case, m is lower than the critical value of 11.3 at the 99%

Table 3 PCM empirical determinants: alternative estimators (standard errors in parentheses, ** significance at the 99% level, * significance at the 95% level)

	Intercept	*HERF*	*KQ*	*IMP*	*ERP4*	$\bar{R}^2$	*F stat*	*Nb. obs.*	*m stat*
GLS	0.027** (0.002)	0.333** (0.070)	–0.023 (0.016)	–0.022 (0.064)		0.14	9.53	160	6.54
	0.026** (0.002)	0.261** (0.070)	–0.033* (0.016)		0.018** (0.005)	0.21	14.85	160	9.67
First differences	–0.000 (0.003)	0.354** (0.077)	–0.043* (0.021)	–0.098 (0.085)		0.18	9.95	120	
	–0.000 (0.003)	0.256** (0.079)	–0.052** (0.020)		0.021** (0.006)	0.26	14.97	120	
Second differences	–0.006 (0.004)	0.411** (0.086)	–0.042* (0.021)	0.040 (0.079)		0.25	9.87	80	
	–0.004 (0.003)	0.301** (0.085)	–0.051** (0.019)		0.021** (0.006)	0.36	15.59	80	

GLS: $\bar{R}^2$ and F statistic based on the transformed variables version of the estimator; *m* statistic corresponds to the Hausman test.

level, suggesting that the GLS estimates are unbiased. Less clear evidence emerges in the ERP case, as the null hypothesis of no correlation is just rejected at the 95% level (for a critical value of 9.5) but not at the 99% level. GLS estimates of the ERP case could thus be affected by misspecification.

There are, however, several reasons to have confidence in the within estimates of Table 2. First, there is no strong evidence of correlation with the regressors and, even if it were the case, within estimates would, in general, still be consistent. Of course this would not hold if measurement errors were shown to be the source of the problem. To take this eventuality into account, I estimated the same equations in first and second differences. The results are reported in the second part of Table 3, and proved again to be quite similar to those obtained in the fixed-effects specification. Following the interpretation of Griliches and Hausman (1986), this suggests that errors of measurement are not an important source of bias and that within estimates can reliably be considered as consistent. Moreover, it confirms that the ERP coefficient captures a temporal link between the reduction of protection and the subsequent adjustment in margins.

3.2 Alternative specifications

Apart from estimation procedures, a number of alternative specifications were also implemented. These are inspired from other SP studies and summarized in Table 4. They deal with changes of indicators (PCM over value-added instead of gross output), inclusion of more regressors (interactive terms, squared concentration, export rate or time dummies) or elimination of outliers and influential observations.[13] The basic outcome of these comparisons is that, whatever the specification, the impact of ERP remains highly significant: after controlling for other factors, a 0.1 decrease in the ERP leads to an approximate decrease of 0.002 in PCM (the overall average value of both ERP4 and PCM is approximately 0.3, with a strong variation between sectors). This result can thus be considered as generally robust.

4. DETERMINANTS OF MARGINS AT THE PLANT LEVEL

A last set of regressions is run at the plant level. This provides not only an additional basis for comparison but also a test on what PCM is actually measuring. As pointed out in the introduction, there is indeed a controversy in the SP literature about the proper interpretation of the margins–concentration positive link: does it reflect market power (the traditional view) or efficiency differences between firms? According to the latter view, initially presented by Demsetz (1973), the more efficient the firm is, the higher its margins, the faster its growth and the larger its market share. At the industry level, this leads to a positive relationship between aggregate margins and

Table 4 PCM empirical determinants: alternative specifications (within estimates) (standard errors in parentheses, ** significance at the 99% level, * significance at the 95% level)

HERF	*KQ*	*IMP*	*ERP4*	$\bar{R}^2$	*F stat*	*Nb. obs.*	*Additional variables or special treatment*			
							HERF*IMP	HERF*ERP4		
0.228**	–0.033*	–0.110		0.22	12.41	160	0.960*			
(0.077)	(0.014)	(0.072)					(0.334)			
0.317**	–0.047**		0.030**	0.32	19.64	160		–0.048**		
(0.066)	(0.013)		(0.005)					(0.016)		
							$HERF^2$			
0.358**	–0.031*	0.007		0.18	9.86	160	–0.007			
(0.067)	(0.014)	(0.060)					(0.020)			
0.262**	–0.042**		0.020**	0.28	16.41	160	–0.008			
(0.066)	(0.014)		(0.004)				(0.019)			
							Year dummies			
							1984	1985	1986	1987
0.332**	–0.062**	–0.024		0.24	8.38	160	0.007*	0.000	–0.010**	0.003
(0.065)	(0.017)	(0.058)					(0.003)	(0.003)	(0.003)	(0.003)
0.252**	–0.065**		0.017**	0.31	11.35	160	0.005	–0.000	–0.008**	0.003
(0.065)	(0.016)		(0.004)				(0.003)	(0.003)	(0.003)	(0.003)

							EXPR (exports over gross value of output)
0.353**	−0.032*	0.002		0.18	9.83	160	0.007
(0.066)	(0.014)	(0.067)					(0.043)
							dependent variable: PCM calculated over value-added rather than gross output
0.736**	−0.004	−0.070		0.20	14.60	160	
(0.116)	(0.004)	(0.107)					
0.583**	−0.005		0.034**	0.29	22.45	160	
(0.115)	(0.003)		(0.008)				
							exclusion of 16 outliers and influential observations (criteria of studentized residuals and covariance ratio)
0.533**	0.002	0.005		0.11	7.04	144	
(0.119)	(0.016)	(0.059)					
0.496**	−0.023		0.022**	0.24	16.01	144	
(0.111)	(0.016)		(0.004)				

In all cases, $\bar{R}^2$ and F statistic are based on the transformed variables version of the estimator (deviations from the mean) concentration which reflects technological heterogeneity rather than collusive behaviour.[14]

Following Schmalensee (1985), the availability of plant level data makes it possible to distinguish between both interpretations, on the basis of a simple SP regression. If the price–cost margin depends basically on the plant's market share, while industry dummies are non-significant, then technology is the explanation. In the opposite case, where most of the explanatory power comes from the industry dummies, variations in margins are most probably due to differences in competitive practice across sectors.

The other objective of this section being to pursue the comparative analysis of foreign competitive pressure at the plant level, the following equation has been specified:

$$\mathrm{PCM}_{ijt} = \beta_0 + \beta_1 \mathrm{SHARE}_{ijt} + \beta_2(\mathrm{SHARE}_{ijt})^2 + \beta_3 \mathrm{KQ}_{ijt} + \beta_4 \mathrm{COMP}_{jt} + \varepsilon_{ijt} \qquad (2)$$

where SHARE_{ijt} is the plant i (sector j) market share in year t and the other variables have already been defined in Section 2.

Starting from the 'naive' model which only includes times dummies as regressors (Model 1), the first four columns of Table 5 illustrate that both market share and industry dummies effects are important in the Mexican case. When added separately (Models 2 and 3), the increase of explanatory power generated by each type of variables is substantial,[15] although three times more important in the case of industry dummies. When both factors are included in the same regression (Model 4), the null hypothesis of global non-significance is strongly rejected (F values of 144.8 for SHARE terms and 30.55 for industry dummies). Therefore, it can indeed be argued that part of PCM variation among Mexican manufacturing firms is due to technological differences. However, once these 'Demsetz effects' are controlled for by the use of the plant's market share, there remains a substantial part of PCM variation which is significantly explained by fixed effects at the industry level, suggesting that non-competitive practices do matter and are reflected in PCM values too.

Earlier results are not invalidated, but harder to interpret unambiguously. Reconsider the issue, but this time at the plant level: are these non-competitive practices temporally correlated with exposure to foreign competition? This question is addressed in the last two columns of Table 5. Broadly speaking, they are in line with findings at the industry level. The sign, significance and absolute value of ERP (Model 6) are almost identical with those obtained in the previous tables. The coefficient of IMP is just not significant at the 95% level, thus confirming its tendency to be less significant than ERP. Why is it still less significant (and even positive) at the industry level? Industry rationalization may be the cause: more competition from imports may have accelerated the elimination of small inefficient firms

Table 5 PCM empirical determinants: plant-level analysis (standard errors in parentheses, ** significance at the 99% level, * significance at the 95% level)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Intercept	0.252** (0.004)	0.231** (0.004)	0.214** (0.009)	0.202** (0.009)	0.204** (0.009)	0.133** (0.023)
SHARE		1.781** (0.101)		1.799** (0.106)	1.793** (0.106)	1.796** (0.106)
$(\text{SHARE})^2$		−2.599** (0.231)		−2.874** (0.246)	−2.864** (0.246)	−2.874** (0.246)
KQ					−0.001** (0.0002)	−0.001** (0.0002)
IMP					−0.182 (0.094)	
ERP4						0.024** (0.007)
Industry dummies	no	no	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	no	no
$\bar{R}^2$	0.0005	0.029	0.097	0.120	0.122	0.123
F-stat	2.9	66.6	29.5	35.4	37.0	37.1
Nb.obs.	11132	11132	11132	11132	11132	11132

thus raising the average profitability of the remaining ones, an effect that cannot be corrected for at the industry level. However, this conjecture is hard to verify, and other effects may be at work.[16]

In any case, findings at the plant level suggest that there is still substantial market power among Mexican manufacturing firms although trade liberalization has induced them to behave more competitively. In a sense, this result should not appear surprising in light of the low import penetration rate in manufacturing during the sample period (see Table 1). Even though this pro-competitive effect does not appear to be very strong, it is significant, and therefore legitimates further analysis to get an order of magnitude of its relative importance in terms of welfare gains.

5. WELFARE GAINS FROM TRADE LIBERALIZATION

This section uses a simple partial equilibrium representation of Mexican manufacturing to get a handle on the welfare benefits of pro-competitive effects. More specifically, each manufacturing sector is supposed to include three types of goods which are imperfect substitutes: imports (good Y), exports (good Z) and a domestic good (X). To isolate pro-competitive effects, the domestic good is considered as non-traded, the domestic market is characterized by imperfect competition, and international markets are assumed perfectly competitive (international prices of traded goods, p_Y^*, p_Z^*, are therefore exogenous). There is no distortion in the market for good Z. An *ad valorem* tariff, t, is imposed on the imports of good Y, leading to a higher domestic price, $p_Y > p_Y^*$. Imperfect competition among the producers of good X leads to a price mark-up, m, between the consumer's price of good X, p_X and its marginal cost, $\tilde{p}_X$. For analytical tractability, the only substitution effects (in demand or supply) which are considered are those occurring within a particular sector. Although restrictive, this assumption is justifiable in a partial equilibrium framework.

5.1 Derivation of the welfare indicator

Under these assumptions, the benefits from trade liberalization can be analysed independently sector by sector. The welfare effects of trade liberalization for a typical sector are represented in Figure 1.

The primary effect of a tariff reduction (from t_0 to t_1) is to reduce the domestic price of imports (from p_Y^0 to p_Y^1), thus generating the usual net welfare gains represented by the areas ABCD and EFGH under the initial (income-compensated) demand curve and the domestic supply curve for good Y. If trade liberalization induces domestic producers of good X to behave more

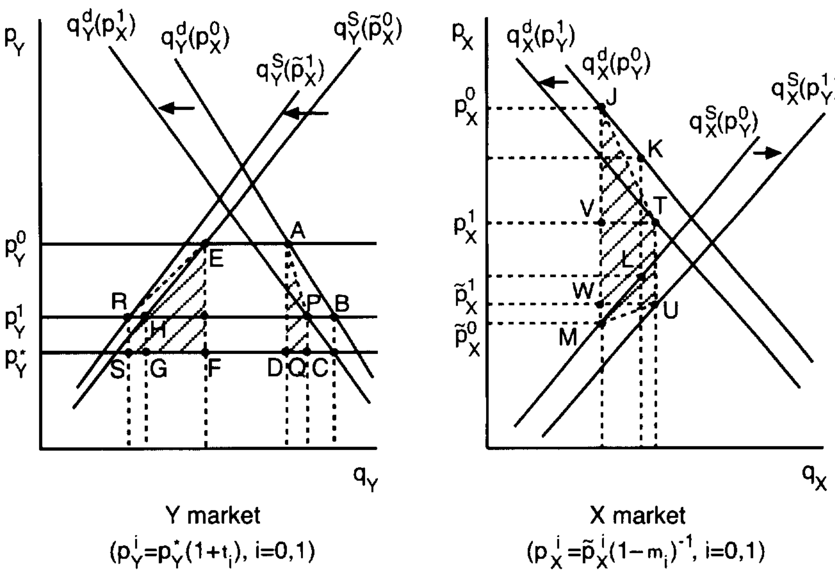

Figure 1 Welfare effects of trade liberalization

competitively, a decrease in the price mark-up (from m_0 to m_1) will occur, leading to a welfare gain given by area JKLM. This would be all if cross-price elasticities were not taken into account. But as trade liberalization has led to a decrease in p_X and p_Y, and – in the case depicted by Figure 1 – to an increase in $\tilde{p}_X$, substitution effects are expected to shift both demand schedules to the left and the supply schedule of good $X(Y)$ to the right (left). These cross-price effects ultimately lead to a final equilibrium for which welfare changes must be redefined. Following Burns (1973),[17] the net welfare gains generated by trade liberalization are finally given by areas APQD and EFSR for good Y and JTUM for good X.

In deriving the algebraic expression corresponding to these welfare gains, it is important to note that p_Y is simply determined by the arbitrage equation, $p_Y = p_Y^*(1+t)$, while p_X and $\tilde{p}_X$ are simultaneously determined by the mark-up expression, $mp_X = p_X - \tilde{p}_X$, and the equilibrium condition, $q_X^s(\tilde{p}_X, p_Y) = q_X^d(p_X, p_Y)$. Total differentiation of these equations when m and t are allowed to vary leads to the following relationships (identifying the rate of change of the corresponding variable with a '^'):

$$\hat{p}_Y = \frac{\mathrm{d}t}{1+t} \tag{3a}$$

$$\hat{p}_X = \gamma_0 \frac{\mathrm{d}t}{1+t} + \gamma_1 \frac{\mathrm{d}m}{1-m} = \hat{p}_X^t + \hat{p}_X^m \tag{3b}$$

$$\hat{\tilde{p}}_X = \gamma_0 \frac{\mathrm{d}t}{1+t} + \gamma_2 \frac{\mathrm{d}m}{1-m} = \hat{\tilde{p}}_X^t + \hat{\tilde{p}}_X^m \tag{3c}$$

where $\gamma_0 = (\eta_{XY} - \varepsilon_{XY})/(\varepsilon_{XX} - \eta_{XX})$, $\gamma_1 = \varepsilon_{XX}/(\varepsilon_{XX} - \eta_{XX})$, $\gamma_2 = \eta_{XX}/(\varepsilon_{XX} - \eta_{XX})$ and η_{ij} (ε_{ij}) is the elasticity of the demand (supply) of good i with respect to the price of good j ($i, j = X, Y$).

The first right-hand side term of (3b), $\hat{p}_X^t$, is the rate of change in p_X implicated by the sole change in t, m remaining constant. It is thus a 'pure substitution' effect. The second term, $\hat{p}_X^m$, is the rate of change in p_X resulting from a change in m, t remaining constant. In our context, it will be referred to as a 'pure pro-competitive' effect. The same decomposition applies to $\hat{\tilde{p}}_X$. The usual assumptions about elasticities imply that $\gamma_0 > 0$, $\gamma_1 > 1$ and $\gamma_2 < 0$. Therefore, a trade liberalization associated with a fall in mark-up leads to a decrease in p_Y and p_X, but has an ambiguous impact on $\tilde{p}_X$.

It is also convenient to define the demand for imports, $q_Y^{ds} = q_Y^d - q_Y^s$, and its corresponding elasticities, noted φ_{Yj} ($j = X, Y$). The (direct) price elasticity, φ_{YY}, does not present any difficulty. But when turning to the cross-price elasticity, it is important to distinguish between the two sources of change in p_X ($\tilde{p}_X$) mentioned above. Simple algebra shows that:

$$\varphi_{YY} = \frac{d\ \ln\ (q_Y^{ds})}{d\ \ln\ (p_Y)} = [\beta_Y^d \eta_{YY} - \beta_Y^s \varepsilon_{YY}] \tag{4a}$$

$$\varphi_{YX}^{t} = \frac{d\ \ln\ (q_Y^{ds})}{d\ \ln\ (p_X)}\bigg|_{dm=0} = [\beta_Y^d \eta_{YX} - \beta_Y^s \varepsilon_{YX}] \tag{4b}$$

$$\varphi_{YX}^{m} = \frac{d\ \ln\ (q_Y^{ds})}{d\ \ln\ (p_X)}\bigg|_{dt=0} = \left[\ \beta_Y^d \eta_{YX} - \beta_Y^s \frac{\gamma_2}{\gamma_1} \varepsilon_{YX}\ \right] \tag{4c}$$

where β_Y^d (β_Y^s) is the ratio between $p_Y q_Y^d$ ($p_Y q_Y^s$) and the value of imports ($p_Y q_Y^{ds}$).

The first two elasticities have unambiguous signs ($\varphi_{YY} < 0$ and $\varphi_{YX}^{t} > 0$). However, in the 'pure pro-competitive' case (φ''^{m}_{YX}), a fall in m reduces the wedge between p_X and $\tilde{p}_X$, leading to an ambiguous impact on the demand of imports.

On the basis of the previous definitions, a few more lines of straightforward algebra shows that the net welfare change on each market, ΔW_i ($i = X, Y$), is given by:

$$\Delta W_X = \Omega_X \left[\ (\gamma_1 \eta_{XY} - \gamma_2 \varepsilon_{XY})\hat{p}_Y + \frac{1}{2}(\eta_{XX}\hat{p}_X^{m} + \varepsilon_{XX}\hat{\tilde{p}}_X^{m})\ \right] \tag{5a}$$

$$\Delta W_Y = \Omega_Y\, [\varphi_{YY}\hat{p}_Y + \varphi_{YX}^{t}\hat{p}_X^{t} + \varphi^{m}_{YX}\hat{p}_X^{m}] \tag{5b}$$

where $\Omega_X = [p_X q_X^d] \left[\ m + \frac{1}{2} m\hat{p}_X^{t} + \frac{1}{2}(\hat{p}_X^{m} - (1-m)\hat{\tilde{p}}_X^{m}\ \right]$,

$$\Omega_Y = [p_Y q_Y^{ds}] \left[\ \frac{t}{1+t} + \frac{1}{2}\hat{p}_Y\ \right]$$

and both coefficients can be shown to be positive.[18]

Both equations for ΔW_i are simple to interpret. Leaving out the pro-competitive effects temporarily, the direct impact of trade liberalization is a net gain from tariff reduction in the market for good Y, represented by the first term between brackets in (5b).[19] The fall in p_Y induces substitution effects which shift the demand and supply schedules in the market for good X, and whose net impact on quantity (and therefore on welfare) is ambiguous, depending on the relative importance of both cross-price elasticities. This is represented by the first term between brackets in (5a). These substitution effects having depressed both p_X and $\tilde{p}_X$, the demand for imports decreases, leading to a welfare loss represented by the second term between brackets in (5b). Finally, when the pro-competitive effects from trade liberalization are introduced, they lead to a welfare gain in the market for good X and to a last set of substitution effects in the other market, whose net impact on welfare is ambiguous. This is the meaning of the remaining terms in both equations.

5.2 Simulation results

Estimates of the overall benefits from trade liberalization can now be derived on the basis of the previous expressions. Data come from the same sources as in the previous sections.[20] The pro-competitive link is introduced assuming that $dm = 0.02dt$, which is precisely what is suggested by the empirical analysis. In the absence of other information, the domestic production of good Y is supposed to be negligible. This implies that $\varphi_{Yj} \equiv \eta_{Yj}$ $(j = X, Y)$, while the distinction between (4b) and (4c) disappears, and the expenditure on good X is approximated by the difference between the gross value of domestic output less exports.

Arbitrary values have been set for each type of elasticity. To keep things simple, the absolute value of all direct elasticities (η_{XX}, η_{YY}, ε_{XX}) is supposed to be equal, either to 0.5 (low elasticity case) or 2.0 (high elasticity case). The values of cross-price elasticities of demand are defined as: $\eta_{YX} = -0.5\eta_{XX}$ and $\eta_{XY} = (p_Y q_Y^d / p_X q_X^d)\eta_{YX}$ (to remain consistent with Shephard's lemma and Young's theorem). Finally, a peculiarity of the analysis, due to our simplifying assumptions, is that cross-price effects cancel out on the market of good X if $\varepsilon_{XY} = -\eta_{XY}$. Therefore, two alternatives are considered: $\varepsilon_{XY} = -0.5\eta_{XY}$ (low cross-price elasticity of supply) and $\varepsilon_{XY} = -2\eta_{XY}$ (high cross-price elasticity of supply).

In Table 6, results of simulations are reported in the case of total elimination of tariffs ($dt = -t_0$). Summing up the effects over all sectors, results are expressed as a percentage of total expenditure on manufacturing goods. It appears generally that welfare gains represent between 0.5% and 2.0% of total expenditure. This is not uncommon in these types of studies, where the welfare gains from the removal of distortions are restricted to Harberger triangles.

Focusing first on the direct impacts (first two rows of Table 6), the overall gain (sixth column) rises from 0.45 to 1.80% when considering the high elasticity case. This is not a surprise, given that, under our assumptions, the welfare gains are proportional to (direct) price elasticities. What looks more interesting is that pro-competitive effects represent a rough 20% of total gains. This suggests that, even if the absolute decrease in the price of the domestic good is relatively modest, it affects such an important share of total manufacturing expenditure that pro-competitive gains turn out not to be negligible in the aggregate.

The introduction of cross-price elasticities slightly mitigates this outcome. The gains derived from market Y are lower by 10% to 20%, which is basically due to the substitution effects represented by the second term of (5b) (the third one is quite negligible). Stronger variations appear in the

Table 6 Welfare gains from trade liberalization in Mexican manufacturing (% of the 1986–87 average level of total manufacturing expenditure)

		Domestic good (X)		*Imported good (Y)*		*Total effect*		*Transfers*	
direct elasticity (a)	*cross-price elasticity (b)*	*without PCEs (c)*	*with PCEs*	*without PCEs*	*with PCEs*	*without PCEs*	*with PCEs*	*without PCEs*	*with PCEs*
low	0.00	0.00	0.07	0.38	0.38	0.38	0.45	0.00	1.01
high	0.00	0.00	0.29	1.51	1.51	1.51	1.80	0.00	1.01
low	low	–0.06	0.02	0.33	0.33	0.28	0.35	0.35	1.37
low	high	0.11	0.17	0.29	0.29	0.40	0.46	0.71	1.72
high	low	–0.23	0.07	1.34	1.32	1.11	1.39	0.35	1.37
high	high	0.43	0.70	1.17	1.15	1.60	1.85	0.71	0.72

(a) $\varepsilon_{XX} = 0.5$ (low) or $\varepsilon_{XX} = 2.0$ (high), assuming that $\varepsilon_{XX} = -\eta_{XX} = -2\eta_{YX} = 2[(p_X q_X^d / p_Y q_Y^d)\eta_{XY}]$
(b) $\varepsilon_{XY} = -0.5\eta_{XY}$ (low) or $\varepsilon_{XY} = -2\eta_{XY}$ (high)
(c) PCEs: pro-competitive effects ($dm \neq 0$).

market for good X. In the optimistic case of high cross–price elasticity of supply, the net benefits in both markets become quite comparable in magnitude. However, in the opposite case, welfare gains are considerably reduced, and even become negative if no pro-competitive forces are at work. This could be a source of concern, to the extent that adjustments in supply are slower than changes in demand because of factor market rigidities or institutional constraints. Still, aggregate net gains are not strongly affected by the introduction of substitution effects, their range widening to 0.35% downwards (low elasticity case) and 1.85% upwards (high elasticity case), and the share of pro-competitive effects varying between 13 and 20% of the total.

Finally, it could be argued that the imperfect nature of competition may have led to an important waste of resources devoted to capture rents, and that we failed to capture these effects. Although it is beyond the scope of this chapter to analyze in detail the cost of unproductive rent seeking activities, a crude way to estimate their magnitude is to calculate the area $p_X^0 \mathrm{JV} p_X^1 + \tilde{p}_X^1 \mathrm{WM} \tilde{p}_X^0$ in Figure 1 (assuming that only the extra rents created by protection give rise to unproductive activities). These figures appear in the last column of Table 6, and turn out to be either greater or at least similar in magnitude to the net welfare gain implied by trade liberalization.

Generally speaking, the potential gains from total trade liberalization in Mexican manufacturing appear to be substantial, although they would probably remain inferior to 2% of total expenditure. Direct elasticities influence the overall result, while cross-price elasticities modulate the relative importance of the domestic market in the final outcome. Whatever the case, the presence of pro-competitive forces does contribute positively to welfare gains, to an extent that varies between 13% and 20%. Finally, although our estimates are very rough, they suggest that the reduction of unproductive rent-seeking activities may be potentially important in the Mexican case.

6. CONCLUDING REMARKS

According to the majority of models provided by the new trade theory, trade liberalization is beneficial not only because it improves resource allocation but also because it induces more competition. However, the empirical evidence regarding this phenomenon is quite unsatisfactory. First, estimates of pro-competitive effects through SP studies are still scant for developing countries. Second, most empirical specifications rely on indirect proxies of foreign competitive pressure rather than on precise measures of trade policy instruments, and fail to provide robust estimates of pro-competitive effects. Third, the majority of existing studies focus on pro-competitive effects, neglecting the issue of pro-competitive gains. This paper is an attempt to curtail the three types of deficiencies.

Its focus is on Mexico, one of the most symptomatic trade liberalization experiences in the developing world in the past decade. Generally speaking, the evidence suggests that the reduction of collusion among domestic firms has been important. At the industry level, and focusing on temporal variation, a positive and strongly significant correlation was found between ERP and profitability, while variations in IMP did not significantly affect margins. These results were found to be robust to various specifications or estimation procedures. They suggest that trade liberalization does indeed have a pro-competitive effect, as suggested by the new trade theory. Moreover, the import penetration rate previously used in many studies appears not to be the best indicator to capture this phenomenon. This may be partly due to reversed causation (higher profitability attracts imports), although technological differences may also be part of the explanation.

It is worth stressing again that plant level data allowed us to disentangle the role of these competing influences. It was found that PCM variations reflect technological differences between firms as well as market power. Once one corrects for these technological effects, the import rate coefficient becomes almost significant negatively, suggesting that industry rationalization (higher imports raising the average profitability through the elimination of inefficient firms) also explains the non-significance of IMP at the industry level. Furthermore, the ERP coefficient remains strongly significant and positive, and our results suggest that, in spite of the imperfections of PCM as an indicator of market power, our findings at the industry level can indeed be interpreted in terms of competitive behaviour.[21] Once again, the robust outcome of this analysis is that domestic producers systematically reduced their margins when effective protection was falling, whether or not the fall in protection was associated with an increase in import penetration.

The analysis is completed by estimates of the welfare gains implied by these pro-competitive effects. The analytical framework which is followed, relying on a partial equilibrium representation of the manufacturing sector, is basically aimed at providing a simple link between SP relationships and welfare indicators. It suffers from important drawbacks which should be kept in mind in interpretations and are suggestive of further research efforts. In particular, perfect competition is assumed in the outside world, and the analysis is static, failing to capture the dynamic gains from trade liberalization. However, although tentative, the results are worth considering as estimates of the magnitude of the (static) pro-competitive gains implied by trade liberalization. In absolute terms, they appear to reach between 0.1 and 0.3% of total manufacturing expenditure, and they could amount for up to 20% of the net welfare gains derived from total trade liberalization. Refinements of the welfare estimator to include variable returns to scale and entry/exit of firms would probably not modify these estimates by a large extent, given the relatively low estimated value of the PCM-ERP link.

Finally, this paper offers an alternative interpretation of the PCM-ERP link. It could be argued that what has been estimated is not the impact of protection on competitive behaviour but rather an accounting relationship between the distributive share of (profits and) capital (PCM) and the degree of overpayment to primary factors by comparison with international standards (ERP). Viewed in this perspective, our results do provide information about competitive behaviour as they show that when the degree of overpayment (or effective protection) is shrinking, primary factor payments are not reduced equiproportionally, as the capital share declines. This suggests then that capital remuneration is tending towards its opportunity cost, implying a more competitive environment. This interpretation also provides information about the redistributive implications of trade liberalization. In the Mexican case, the results support the predictions of the traditional Ricardo-Viner model of international trade where, in the short run, the relative rewards to fixed factors decline in import-competing industries.

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APPENDIX

Data preparation and construction of variables[22]

All domestic variables used in the analysis (PCM, HERF and KQ) were elaborated on the basis of a plant-level manufacturing survey collected by Mexico's Instituto Nacional de Estadística, Geografía e Informática (INEGI). Within each 2-digit Mexican National Accounts (MNA) category, the original survey included all plants sorted by decreasing order up to a rough 80% of cumulated value-added of the group. The original sample provided annual observations on 3218 plants during the 1984–90 period. One tenth of the 22442 observations involved (less than 5% of total original value-added) were eliminated by applying several selection criteria (non-negativity of key-variables, odd observations, incomplete series, plants entering/leaving the sample more than once). Moreover, the last three years had to be dropped as the effective rate of protection data were not available. All data were aggregated in 40 sectors according to the industrial classification used by Casar Perez (1993), which either replicates the 2-digit MNA categories or regroups two of them.

All variables were expressed in real terms using appropriate price deflators, generally available at a 2 or 4-digit MNA classification level. Estimates of total capital stock were obtained by summing the replacement cost of its components and the capitalized value of the rent at an approximate annual discount rate of 10%. In the survey, all primary materials and the gross value of the output of products relative to subcontracted work appeared in the record of the plant that ordered the job, not in the one which actually realized the work. The accounted value-added and output of the plants involved in subcontracted work (more than 45% of all observations) was therefore biased. Fortunately, data on income from (and expenditure on) subcontracted work were also available. Therefore, assuming that these figures reflected the value-added from subcontracted activities, and that the ratios of valued added to output and primary materials to total inputs were both constant through time and among plants of all 2-digit MNA categories, it was possible to correct for this bias.

Using subscripts *i*, *j*, *t* for the plant, the sector and the year respectively, the following variables were constructed:

$$\text{PCM}_{jt} = \frac{\text{VA}_{jt} - \text{TLPM}_{jt}}{\text{GVO}_{jt}}; \quad \text{KQ}_{jt} = \frac{\text{TKS}_{jt}}{\text{GVO}_{jt}}; \quad \text{HERF}_{jt} = \sum_{i=1}^{m_{jt}} \left[\frac{\text{GVO}_{ijt}}{\text{GVO}_{jt}} \right]^2$$

where VA is value-added, TLPM total labour payments, GVO gross value of output, TKS total capital stock and m_{jt} the total number of plants in sector *j*, year *t*.

Data for the effective rate of protection (ERP_{jt}) were taken directly from the original figures of Ten Kate and de Mateo Venturini (1989) plus the percentage of under-valuation derived from the index of real exchange rate published by Banco de México (see Table 1 and Note 5). The import rate, IMP_{jt}, was calculated as $M_{jt}/(Y_{jt} + M_{jt} - X_{jt})$ where Y is the gross value of output published by INEGI (1989) while M (X) are the import (export) values published by Casar Perez (1993) and deflated by the index of real exchange rate to correct for under-valuation of the Mexican currency.

NOTES

1 For models emphasizing economies of scale effects, see Ethier (1982) and Horstmann and Markusen (1986). For models emphasizing pro-competitive effects, see for example Krugman (1979).
2 The evidence seems to suggest little scope for unexploited economies of scale, even for developing countries (see Tybout and Westbrook, 1996).
3 Some attempts were made to give a theoretical rationale to SP equations, in particular the conjectural variations model of Cowling and Waterson (1976) and its various extensions. However, it is now accepted that the notion of conjectural variation is conceptually wrong in a static game where no reaction is possible (see for example Tirole, 1988).
4 A more detailed analysis can be found, *inter alia*, in Ten Kate (1992) for trade policy or Aspe (1992) for macroeconomic adjustment.
5 The under-valuation of the Mexican currency induces various measurement biases that have been corrected on the basis of the index of the real exchange rate elaborated by Banco de México. On one hand, trade flows expressed in national currency are

overvalued, so they have been deflated by this index. On the other hand, the peso under-valuation reduces the wedge between the international and the domestic price on which ERP calculations are based. Therefore, it reduces ERP estimates while protection actually increases. A crude way to correct for this bias has been to add the percentage of under-valuation to the original ERP figures.

6 See the Appendix for more details on data preparation and construction of variables.

7 See for example the studies of de Ghellinck *et al.* (1988) or Conyon and Machin (1991).

8 Total variance can be decomposed as:

$$\frac{1}{NT}\sum_{j=1}^{N}\sum_{t=1}^{T}(\text{PCM}_{jt}-\text{PCM}_{..})^2=\frac{1}{N}\sum_{j=1}^{N}(\text{PCM}_{j.}-\text{PCM}_{..})^2+\frac{1}{NT}\sum_{j=1}^{N}\sum_{t=1}^{T}\mu_{jt}^2$$

where $\text{PCM}_{j.}$ is the temporal average margin of sector j, $\text{PCM}_{..}$ the global average margin over all sectors and μ_{jt} the deviation of sector j margin from its temporal average ($\text{PCM}_{j.}$) in year t. The first term of the right-hand side is the inter-industry (or 'between') variation of PCM, which in the sample represents more than 95% of total variance.

9 Estimates of annual PCM are based on nominal figures, which attribute more weight to the last quarters during inflationary periods.

10 Although I did not explore it due to data availability, a systematic way to address the endogeneity of IMP and ERP would be to add two more equations (as those proposed by Trefler, 1993) and estimate simultaneously the whole system. The alternative provided by the GMM procedure (e.g. Conyon and Machin, 1991) was not possible with such a short sample period.

11 In the within variation case, the explanatory power of both specifications is best compared with the $\bar{R}^2$ figures based on the transformed variables, which is 50% higher when using ERP instead of IMP (0.28 versus 0.19).

12 In most cases, they remain very similar to those obtained with ERP4 (apart form the magnitude of the coefficient, which is roughly 50% smaller).

13 Those were detected applying the usual tests (studentized residuals and covariance ratio); but as their exclusion did not affect our main results and as there was no obvious economic reason to discard these particular sectors they were finally kept in the sample.

14 See the formal treatment of Clarke and Davies (1982), on the basis of an extension of the model of Cowling and Waterson (1976).

15 The absolute level of the adjusted R^2 remains low in comparison with the results of Section 2 but is in fact quite satisfactory given the size of the sample (similar magnitudes can be found in, for example, Roberts and Tybout, 1996).

16 Regressions at the plant level give more weight to industries with a high number of plants and, for some reason (e.g. because they were overprotected in the past or because of selection bias), these may have experienced the strongest competition from imports.

17 The idea of Burns is to treat the shift in demand curves originated by simultaneous price changes as the sum of many small movements along linear paths. Given that the income equivalent of a utility change is exactly given by the area to the left of the demand curve, this leads to the trapezes considered in Figure 1. The linearity of the adjustment paths may be criticized on theoretical grounds, but given the imperfect nature of data, it is of little practical importance. The same methodology is followed to determine the change in producer surplus generated by the shift of the supply curves.

18 The stronger the trade liberalization, the higher the absolute value of $\hat{p}_Y$. However, at most, the value of $\Omega_Y/p_Y q_Y^{ds}$ can fall to $0.5t/(1+t)$, which remains positive. The sum

of the first two terms of $\Omega_X/p_Xq_X^d$ is necessarily superior to $0.5m$, while in the third term, $\hat{p}_X''' - (1-m)\hat{p}_X'''$ can be replaced by $p_X[dp_X - d\tilde{p}_X]$, whose absolute value cannot exceed m.

19 In the case of total removal of tariff protection ($dt = -t_0$), summing up this term over all sectors, leads to an aggregate welfare gain given by 0.5 GDP $\sum \alpha_i \eta_{YY}^i (r_i)^2$, where i stands for sector i, $r_i = t_i/(1+t_i)$ and α_i is the share of imports of sector i in GDP. This is the usual, general equilibrium, equivalent variation measure of the cost of protection (e.g. Vousden, 1990, p. 225).

20 Figures correspond to the average of the 1986–87 period. The tariff rate t is approximated by the effective rate of protection (ERP) plus the rate of the Mexican peso's under-valuation (see Table 1). The price mark up m is approximated by the price–cost margin (PCM) minus the capital rental ratio (0.1 times the average capital/output ratio of the corresponding sector). It is assumed that dm/dt = dPCM/dERP.

21 An alternative would have been to try to infer market power statistically, as done by Ståhlammar (1991), Harrison (1994) or Levinsohn (1993).

22 This appendix is a condensed version of a more extensive presentation available from the author.

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