The Impact of Import Competition on Employment and Wages in Swiss Manufacturing

JAVIER SUÁREZ*

1. INTRODUCTION

The impact of trade on labour markets has become one of the hottest issues in the debate over globalization, giving rise to a considerable amount of studies. Although Switzerland is known for its remarkable labour market performance during the past decades, recent evolutions of the Swiss labour market, such as the significant rise of unemployment and the apparently increasing of wage dispersion between or within groups of workers, have motivated questions and some anxieties. The most cited factors explaining these unfavourable outcomes are immigration of unskilled workers, educational failures, technological changes and increased international trade with low-wage developing countries.

In this study we investigate, as a first step, the role of international trade on Swiss labour market. Several studies have tried to measure the partial equilibrium effects of import competition on employment and wages, most of them concerning the United States. One of the first attempt is GROSSMAN (1982) who analyzed the impact of tariff protection on nine U.S. manufacturing sectors. He found that the sensitivity of employment to the domestic price of imports (tariff inclusive price) varies significantly across sectors, whereas industry wages are fairly unresponsive. Other cross-industry studies found significant effects of changes in import competition on employment, but smaller ones on wages. For instance REVENGA (1992) found large and significant effects on both employment and wages. Her estimated import price elasticities range from 0.24 to 0.39 for employment and from 0.06 to 0.09 for wages. FREEMAN and KATZ (1991) get similar results: an increase of 10% in the import penetration ratio leads to a 5.45% decline in employment and a 0.59% decline in real wages.

* Trade Policies Review Division, World Trade Organization, e-mail: javier.suarez@wto.org. This is a revised version of a paper presented at the annual conference organized by the «Troisième cycle romand en économie politique», Gstaad 2–5 March 1998. I thank Jaime de Melo, Marcelo Olarreaga, conference participants and an anonymous referee for very helpful comments. Any remaining errors are mine.

1. For a recent survey of this literature see CLINE (1997).
2. FERRO LUZZI and SILBER (1998) documented recent patterns of wage dispersion between and within gender groups, and found some evidences of increasing dispersion.
3. GASTON and TREFLER (1994) and more recently COLLINS (1998) provide a comprehensive survey of studies on the U.S. market.
By contrast to the long history of research on U.S. labour markets, studies focusing on European countries are scarce. Following Grossman (1982), Neven and Wyplosz (1996) have estimated employment and wage equations at an aggregate level for France, Germany, the United Kingdom and Italy. In order to isolate the effect of import competition from developing countries, they distinguished prices of imports from developing countries and import prices from developed countries. Their results are not very conclusive, although they have found most often an import competition pressure from developed countries area, but imports from developing countries do not seem to exert either a significant or a negative pressure on employment and wages. As in a number of other studies, the authors pointed out the difficulty of disentangling trade from technology effects. In all these studies, estimates vary from no effect to a significant effect on employment and wages. However, even when the effect is significant, its magnitude is small relative to the evolutions of labour markets.

In the present study we investigate the effect of international competition on employment and wages in seven Swiss manufacturing sectors from 1966 to 1986. We find that import competition has had a small impact on employment and wages. In a majority of industries, a toughening of import competition tends to reduce employment and to hurt workers' wages. In either case, the estimated coefficients are of relatively small magnitude. Employment and wage elasticities with respect to import prices range from -0.18 to 0.17. These results are consistent with those found for other countries. The paper is organized as follows. Section 2.1 presents the theoretical framework and model specification underpinning our estimated equations, section 2.2 describes data, while the regression results are presented and discussed in section 2.3. Finally, section 3 concludes with qualifications.

2. IMPACT OF IMPORT PRICES ON EMPLOYMENT AND WAGE

This section presents the model that links import penetration and manufacturing employment and wages. Product demand changes in an industry are expected to induce employment to change in the same direction, with wage adjustment regulating the magnitude of job variations. The wage responses to shifts in demand is likely to depend on the mechanism of wage settings. In a competitive decentralized wage setting system, the magnitude of wage response to shifts in supply or demand of labour depends on their elasticities. In the presence of a non-competitive labour market in an industry (with collective bargaining, an efficiency wage or rent-sharing) wages will differ from market-clearing rates. As noted by Freeman and Katz (1991) wage responses can be either higher or lower under unionised markets than under competitive markets. It is not clear whether wage response should be larger or smaller in unionised markets than in competitive ones, as the outcome would depend on the objective function of labour unions and on the labour bargaining process. For instance an union may choose to maintain wages at expenses of jobs or on the contrary choose to offer larger wage concessions to preserve
employment. To investigate the impact of import competition on wages and employment, we estimate reduced-form, industry-level, wage and employment equations. The reduced-forms are derived from a standard competitive model of labour demand and supply which determine factor allocations and factor prices across sectors. This allows us to measure directly the sensitivity of sectoral employment and wage levels to shifts in imports supply. The approach follows closely the one proposed by Grossman (1982) and applied among others by Revenga (1992), Ramu (1994), Gaston and Trefler (1994), and Neven and Wyplosz (1996).

2.1. Model specification

Consider a standard two-factor, multi-good model with imperfect substitutability between domestic and imported goods. Let $Q_i^s$ be the output of the importable sector $i$ produced with the input of labour, $L_i$, and capital, $K_i$. The technology is represented by a constant return to scale Cobb-Douglas production function:

$$Q_i^s = \Gamma e^{\pi t} K_i^{\gamma_1} L_i^{\gamma_2},$$

where $\gamma_1$ and $\gamma_2$ are positive, $\pi$ is the rate of Hicks-neutral technological progress and $t$ denotes time. Factor demands in each industry are derived from profit maximisation solutions:

$$L_i = \frac{\gamma_1 P_i Q_i}{w_i},$$

$$K_i = \frac{\gamma_2 P_i Q_i}{r_i},$$

where $P_i$ is the price of production good $i$, $r_i$ and $w_i$ are respectively the rental rate of capital and the wage rate prevailing in sector $i$. Note that aggregate stocks of capital and labour are taken to be exogenous, and imperfectly mobile between sectors. The fractions of capital and labour supplied to each sector are functions of sectoral $i$ real reward:

$$K_i = K_a \left( \frac{r_i}{P_i} \right)^{\theta} \quad \text{with } \theta > 0,$$

$$L_i = L_a \left( \frac{w_i}{P_a} \right)^{\psi} \quad \text{with } \psi > 0,$$

4. Thus we treat them as non-traded factors although it is not exactly the case. However, even for Switzerland which has a very high ratio of foreign workers, this assumption is not so unrealistic as foreign workers permits are delivered on a discretionary basis.
where \( L_a \) and \( K_a \) denote aggregate stocks of labour and capital and \( P_a \) is the aggregate price level. Domestic production good \( i \) is supposed to be an imperfect substitute for both other domestically produced goods and imported good produced by the same industry abroad and selling domestically at the tariff-inclusive price \( P_i^m \). The demand for industry \( i \)'s production (which at equilibrium is equal to its output) is then given by:

\[
Q_i^d = \Delta \left( \frac{P_i^m}{P_i^a} \right)^{\delta_1} \left( \frac{P_a}{P_i^a} \right)^{\delta_2} Y^{\delta_3} \quad \text{with} \quad \delta_1 < 0, \quad \delta_2 < 0 \quad \text{and} \quad \Delta > 0, \tag{6}
\]

where \( Y \) is the real national income. The six equations above define the endogenous variables \( Q_i, L_i, K_i, r_i, w_i \) and \( P_i \) as functions of the parameters and the exogenous variables \( Y, P_a, K_a, L_a \) and \( P_i^m \). In principle these equations could be estimated in this form, but given the difficulty of collecting a consistent data set and that we are interested in the final effect of shifts in foreign supply (i.e. changes in import prices) on domestic employment and wages, we may solve out this six equations and estimate directly the reduced-form equations of employment and wages. This leads to the following reduced equations:

\[
\ln(L_i) = \alpha_{1i} + \alpha_{2i}t + \alpha_{3i} \ln K_a + \alpha_{4i} \ln L_a + \alpha_{5i} \ln \left( \frac{P_i^m}{P_a} \right) + \alpha_{6i} \ln Y, \tag{7}
\]

\[
\ln \left( \frac{w_i}{P_i^a} \right) = \beta_{1i} + \beta_{2i}t + \beta_{3i} \ln K_a + \beta_{4i} \ln L_a + \beta_{5i} \ln \left( \frac{P_i^m}{P_a} \right) + \beta_{6i} \ln Y. \tag{8}
\]

The coefficients of particular interest are \( \alpha_{5i} \) and \( \beta_{5i} \), they measure the elasticity of domestic employment and wage with respect to the price of import competing good. According to the model both coefficients should be positive indicating that import competition pressure (i.e. a decline in import prices) pushes wage and employment down. The mechanism underlying this adjustment is the following. The downward shift in foreign supply causes a substitution in demand to the imported good and a fall in domestic demand. This in turn induces a fall in domestic price and in the derived demand for factors of production. The repartition between employment and wage downwards depends upon the elasticities of sectoral factor supplies. Note that although these reduced forms are derived from a competitive supply and demand model, their interpretation is not so restrictive. As noted by Revenga (1992) similar equations could be derived from different models of union wage settings and from other non-competing models.

5. All parameters are specified in the Appendix.
2.2. Data description

The estimations are seriously constrained by availability of data. We need data at the industry level on employment and wages as well as prices of imported goods. We use unit value indices of imports as proxies for import prices series. These indices were calculated by Marañon (1991) from the values and quantities of imports at the 6-digit level. These proxies have well-known shortcomings. For instance as some trade flows are very low and variable, the composition of imports can fluctuate a lot, affecting significantly the unit value indices. Availability of these indices constrains us to seven manufacturing sectors which represented 48% of industrial employment in 1975. These sectors are (1) food, drinks and tobaccos industries; (2) textile industry; (3) paper industry; (4) leather and shoes industry; (5) chemical industry; (6) mineral extraction; (7) metallurgical industry. For sectoral employment we use the quarterly indices published by the Federal Statistical Office. We use average hourly earnings as the measure of wages. These series were taken from various issues of the Annual Survey on Earnings and Wages made by the Federal Office of Industry, Arts and Crafts, and Labour. The aggregate capital and labour stocks are taken from Burgenmeier (1992), the former is evaluated in millions of 1970 francs, the latter represent yearly total worked hours (in thousands). The GDP deflator is taken as the aggregate price level, and deflated GDP as national income. Our data set covers the time period from 1966 to 1986. Although this period is quite short for testing the stationarity of the series, we performed augmented Dickey-Fuller statistics testing for the presence of unit roots in our series. For most of the series we can not reject the null hypothesis (i.e. the presence of unit root) and the optimal lag length (given by the Akaike information criterion) varies between 2 and 7 for the different series. Given the limited time-period, rather than introducing lags, we choose to conduct the estimations in first differences.

2.3. Estimations

We estimated simultaneously equations [7] and [8] for all sectors (to which we added an error term) using the Seemingly Unrelated Regressions method which accounts for correlation between error terms. The estimations were conducted for variables expressed in first differences as Revengh (1992) and Gaston and Trefler (1994) rather than in levels as Grossman (1982) and Neven and Wyplosz (1996).

The employment indices by sector reflect total employment without distinction of category of workers whereas we dispose of sectoral wages for white and blue collar workers. For this reason we performed two series of estimations one with total employment and white collar wages as dependent variables, and the other with total employment and blue collar wage. All of the coefficients, with exception of that on time trend variable, are to be interpreted as elasticities.
2.3.1 Constrained elasticities

In a first set of estimations we impose the same elasticity of industry-level employment and wage to all variables, i.e.: \( \alpha_{ki} = \alpha_{kj} \) and \( \beta_{ki} = \beta_{kj} \) for \( k = 2, \ldots, 6 \). By doing so we assume that the only industry specific response is captured by the constant. Constraining the estimations this way is useful, it reduces the number of parameters to estimate (which is an advantage given the limited panel data we have) and also it allows us to compare our results with other studies. Results are reported in Table I.

Table I: Constrained Employment and Wage Elasticities

<table>
<thead>
<tr>
<th>Variable</th>
<th>Blue collar</th>
<th>White Collar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employment</td>
<td>Wage</td>
</tr>
<tr>
<td>Capital stock</td>
<td>-0.856**</td>
<td>0.493**</td>
</tr>
<tr>
<td></td>
<td>(0.132)</td>
<td>(0.188)</td>
</tr>
<tr>
<td>Labour force</td>
<td>-0.175</td>
<td>0.403</td>
</tr>
<tr>
<td></td>
<td>(0.157)</td>
<td>(0.221)</td>
</tr>
<tr>
<td>Import price</td>
<td>0.010</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Real GDP</td>
<td>0.675**</td>
<td>-0.008</td>
</tr>
<tr>
<td></td>
<td>(0.082)</td>
<td>(0.117)</td>
</tr>
</tbody>
</table>

Notes: Simultaneous estimations of wage and employment equations were performed using Zellner’s seemingly unrelated regression (SUR) method; numbers in parentheses are standard errors; dependent variables and regressors are expressed in natural logs.

** Coefficient significant at the 0.01 level.
* Coefficient significant at the 0.05 level.

As sectoral employment by type of worker is not available we use, for both estimations, total employment indices.

Average hourly earnings of blue collars.

Average monthly earnings of white collars.

The employment elasticities we obtained are consistent with our underlying model.\(^7\) As noted earlier the employment estimations reported correspond to total employment estimated simultaneously first with blue collar wage and then with white collar wage. This

---

6. This «fixed effect» specification has been used by REVENGA (1992), RAMA (1994) and NEVEN and WYPLOSZ (1996) among others. We should note that in our case we do not have exactly the «fixed effect» model specification since we allow for correlation between the terms error by estimating the equations simultaneously using the SUR method.

7. Recall that, as described in the Appendix, we expected positive elasticities for labour force, import price and real GDP, while the elasticity of employment with respect to capital stock can be of either sign.
explains the very similar result we obtained for both employment estimations. We found a strong elasticity of employment to real GDP, an increase of 1 point in real GDP increases employment of 0.7 to 0.8 point. The substitution of the two factors of production is reflected in the negative elasticity (−0.8 to −0.7) of sectoral employment to aggregated capital stock. The import price elasticity of employment is positive: a 10% point reduction in import price reduces employment by 0.1%.

Coefficients of wage equations are consistent with our expectations, although most of them are not significantly different from zero. It should be pointed out that when capital stock increases by 10%, white collar wage increases by 14% while blue collar wage increases only by 5%. This result could reflect a higher complementarity between white collar workers and capital than between blue collar ones and capital. With respect to the impact of import prices on wages, we found the expected result that import competition has a negative impact on both category of workers’ wages although the coefficient are not significantly different from zero.

These constrained estimates suggest that import competition have a negative impact on both, production and non-production, workers’ wage while its effect on employment is ambiguous. However these results should be qualified since they were obtained under the strong assumption that all sectors have the same elasticities. In the next section we relaxed this constraint and allow for full industry-specific reactions.

2.3.2 Industry-specific reaction

In this section we relax the restriction that the elasticities of employment and wages are identical across industries. Given the large number of parameters we did not report all the estimations. In Table II, we reported the industry-specific elasticities of employment and wages with respect to import price. The coefficients are in a majority positive, as predicted by our model. The first striking result we get is that there are large disparities across industries. The sensitivity of both employment and wages varies significantly across industries.

When we look at employment elasticities we get a negative impact of import competition in three sectors out of seven. In the paper industry, an increase in import competition of 10% reduces employment by 0.5%, while in food and leather industries this competition rises employment by respectively 0.4% and 1.2%. The effect on employment in the other sectors is not significant. It should be noted that, although these results are not very conclusive, they are close to those found in others studies. In either case these elasticities are quite small, so that a large change in import prices would be needed to affect significantly industrial employment.

8. For instance, at an aggregate sectoral level and with a constrained specification, NEVEN and WYPLOSZ (1996) also found negative employment and wage elasticities with respect to import price for some European countries.
Table II: Industry-specific Import Price Elasticity of Employment and Wages

<table>
<thead>
<tr>
<th>Variable</th>
<th>Blue-collar Employment a</th>
<th>Wage b</th>
<th>White Collar Employment a</th>
<th>Wage c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food, drink and tobacco</td>
<td>-0.045**</td>
<td>-0.184**</td>
<td>-0.034**</td>
<td>0.028*</td>
</tr>
<tr>
<td>Textiles</td>
<td>0.004</td>
<td>0.057**</td>
<td>0.050</td>
<td>-0.014</td>
</tr>
<tr>
<td>Paper</td>
<td>0.016</td>
<td>-0.104**</td>
<td>0.048**</td>
<td>-0.011</td>
</tr>
<tr>
<td>Leather and shoes</td>
<td>-0.122**</td>
<td>-0.026</td>
<td>-0.062</td>
<td>0.174**</td>
</tr>
<tr>
<td>Chemicals</td>
<td>0.021</td>
<td>0.079**</td>
<td>0.017</td>
<td>-0.062*</td>
</tr>
<tr>
<td>Mineral extraction</td>
<td>0.139</td>
<td>-0.024**</td>
<td>0.037</td>
<td>0.020*</td>
</tr>
<tr>
<td>Metalurgical</td>
<td>-0.003</td>
<td>0.052**</td>
<td>-0.006</td>
<td>0.081**</td>
</tr>
</tbody>
</table>

Notes: Simultaneous estimations of wage and employment equations were performed using Zellner’s seemingly unrelated regression (SUR) method; numbers in parentheses are standard errors; dependent variables and regressors are expressed in natural logs.

** Coefficient significant at the 0.01 level.
* Coefficient significant at the 0.05 level.

a As sectoral employment by type of worker is not available we use, for both estimations, total employment indices.
b Average hourly earnings of blue collars.
c Average monthly earnings of white collars.

The more consistent set of results concerns white collar wages. With the exception of chemicals industry, all the significant elasticities for this category of workers are positive, and range from 0.02 for mineral extraction to 0.17 for leather industry. This relative homogeneity of wage responsiveness to import competition across sectors suggests a relatively high degree of inter-sectoral labour mobility of non-production workers.

The picture for production workers’ wage (i.e. blue collars’ wage) is quite different. We find significant coefficient for six sectors but half are negative.9 These elasticities range from −0.18 in food sector, to 0.08 in chemicals industry.

These disparities of blue collar wage sensitivity to import competition suggest that production workers are not very mobile across sectors. This low mobility of production workers could be partially explained by immigration policy since yearly, seasonal or frontier work permits constrain the foreign worker to a specific job in a sector.

9. NEVEN and WYPLOSZ (1996) found wage elasticities ranging from −0.011 to 0.017 and half are negative.
One can draw two main conclusions from these estimated elasticities. The first is that they differ a lot across sectors not only in magnitude but also in their sign. The second is that these elasticities are relatively small suggesting that albeit the impact of import competition is probably significant it is certainly not overwhelming.

3. CONCLUSION

In this paper we have performed a simple econometric exercise in which we estimated reduced form employment and wage equations for a panel of seven Swiss industries. We estimated two wage equations, for blue collar and for white collar workers. We put a particular emphasis on the elasticities of employment and wages with respect to the domestic price of imports. These coefficients reflect the sensitivity of the domestic industry labour market to import competition. A majority of the estimated coefficients are positive, reflecting a negative impact of import competition but our main result is that all the elasticities have a relatively small magnitude. As in many other studies, our results suggest that import price variations have very little incidence on domestic labour market.

Some qualifications are in order. First, the sample of manufactures represents less than half of total industrial employment. It can not be exclude that other industrial sub-sectors had been more affected by import competition. In the same order, by estimating aggregate effects we are not able to capture specific firm level reactions. Another serious qualification comes from our wage and employment data, we use average levels of employment without skill distinction, we could not investigate skill intensities changes.

REFERENCES


SUMMARY

This paper explores the impact of import competition on wage and employment at the industry level in Switzerland. We estimated reduced-form wage and employment equations for a panel of seven Swiss manufacturing sectors. Our analysis relies on a basic partial equilibrium relationship that relates changes in import price to domestic factor price and factor demand changes. Results are consistent with those found for other countries. A majority of the coefficients are significantly positive, reflecting a negative impact of import competition on both employment and wages, but our main result is that
all the elasticities have a relatively small magnitude. As in several other studies, our results suggest that import price variations have had very little incidence on domestic labour market.

ZUSAMMENFASSUNG

RESUME
Le présent article examine les conséquences de la concurrence par les importations sur les salaires et l’emploi dans le secteur suisse de l’industrie. A cette fin, des équations en forme réduite sont estimées pour les salaires et l’emploi. Ces équations sont utilisées pour une analyse dite «panel» englobant sept branches industrielles suisses. L'analyse se base sur des relations d’équilibre partiel mettant en relation les variations des prix à l’importation et les variations des prix et de la demande de facteurs domestiques. Les résultats obtenus sont consistance avec ceux d’analyses étrangères comparables. La plupart des coefficients examinés sont significativement positifs, indiquant une influence négative de la concurrence par les importations sur l’emploi et les salaires. Cependant, le résultat principal est que toutes les elasticités sont relativement faibles. En accord avec les résultats de diverses autres analyses, ceci implique que les variations des prix à l’importation n’ont que peu d’influence sur le marché du travail domestique.
APPENDIX: SPECIFICATION OF THE COEFFICIENTS

The coefficients of the reduced form equations [7] and [8] can be written down in terms of the structural parameters of our model. For the employment equation we have:

$$\alpha_{1i} = A\left[\gamma_1(\psi + 1)\theta \ln y_1 + (\theta + 1)\gamma_2 \psi \ln y_2 + \ln \Gamma(\psi + 1)\right] - A\left[\ln \Delta (\gamma_1 \psi + \gamma_2 \theta + 1)\right], \quad (A-1)$$

$$\alpha_{2j} = -A\pi \psi (\delta_1 + \delta_2 + 1)(\theta + 1), \quad (A-2)$$

$$\alpha_{3i} = -A\pi \psi (\delta_1 + \delta_2 + 1), \quad (A-3)$$

$$\alpha_{4i} = -A[(\delta_1 + \delta_2)(\theta (\gamma_1 - 1) - 1) + \gamma_1 \theta], \quad (A-4)$$

$$\alpha_{5i} = -A\psi \delta_1 (\theta + 1), \quad (A-5)$$

$$\alpha_{6j} = A\psi \delta_1 (\theta + 1), \quad (A-6)$$

where $A = \left[-\gamma_1(\psi + 1)(\delta_1 + \delta_2 + \theta) - \gamma_2(\theta + 1)(\delta_1 + \delta_2 - \psi)\right]^{-1}$. The usual theoretical restrictions on the structural parameters (i.e. positive marginal products of factors, constant returns to scale, positive cross-price elasticities of demand between domestic and imported production and between all other domestic goods, positive elasticities of factor supplies with respect to real factor rewards and positive income elasticity of demand in each sector) imply that $\alpha_{4i}$, $\alpha_{5i}$ and $\alpha_{6i}$ are positive, while $\alpha_{4i}$, $\alpha_{2j}$ and $\alpha_{3i}$ can be of either sign.

For the wage equation, the expression of the coefficients in terms of the structural parameters are the following:

$$\beta_{1i} = A\left[\gamma_1(\psi + 1)\theta - \gamma_2 \theta - 1 + \gamma_1 \theta + \ln \Delta(1 + \theta) - A[(\delta_1 + \delta_2 + 1)(\delta_1 + \delta_2 - \psi)]\right]. \quad (B-1)$$

$$\beta_{2i} = -A\pi (\delta_1 + \delta_2 + 1)(\theta + 1), \quad (B-2)$$

$$\beta_{3i} = -A\gamma_1(\delta_1 + \delta_2 + 1), \quad (B-3)$$

$$\beta_{4i} = A[\gamma_1(\delta_1 + \delta_2 - \gamma_2 - \theta)], \quad (B-4)$$

$$\beta_{5i} = -A\delta_1 (\theta + 1), \quad (B-5)$$

$$\beta_{6i} = A\delta_1 (\theta + 1). \quad (B-6)$$

As for employment equation, given the usual theoretical assumptions, we should have $\beta_{5i}$ and $\beta_{6i}$ positive, while $\beta_{4i}$ should be negative. The sign of the other parameters is undetermined.