The impact of US manufacturing imports from China on employment in the Mexican manufacturing sector

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Abstract

Since 2001 the manufacturing sector of Mexico has experienced a reduced growth rate. This study estimates the impact of U.S. and Chinese industrial activity on the demand for labor in the manufacturing sector of the northern border states of Mexico. With data on industrial activity, Chinese exports, wages and the peso-dollar exchange rate, a time series cointegration model is developed. The results show that exports from China to the USA and manufacturing wages have affected labor demand negatively, while factors such as theU.S. industrial production and the exchange rate tend to encourage manufacturing activity.

Key words: Industrialization, Mexican Manufactures, Chinese Exports, Labor Demand

JEL Classification: F1, F15, F4, J23

Introduction

Chiquiar, Ramos-Francia y Fragoso (2007) pointed out that the increasing penetration of the Chinese manufacturing exports in the US market responds to the loss of comparative advantages of the Mexican manufactures. Therefore, it appears that the expansion of the Chinese exports has had a negative impact on the US demand for Mexican manufacturing exports. Particularly, Chinese exports have surpassed those of Mexican in goods such as computers, telecommunications equipment, finished metallic shapes, glassware, televisions, and control instruments. Mexico has the advantage in agricultural products, auto-parts, automobile engines and televisions (Mendoza, 2010). Hence, it is important to point out that the localization, the low wages compared to those paid in the USA and the exchange rate have allowed the Mexican automobile and autoparts exports to have a large share of the US market.

However, Chinese exports continue to show greater competitiveness than those of Mexico based on an undervalued exchange rate and lower wages than those paid in Mexico, although that advantage seems to be shrinking. From this perspective, the present paper has the objective of estimating the impact of the U.S. demand for Mexican manufactures on the labor demand in the manufacturing sector of the Mexican economy, as well as considering the effect of the penetration of the Chinese manufactures in the U.S. market and the commercial and wage policies of China.

2. The expansion of Chinese exports and their impact on Mexico's exports to the USA

The total Chinese exports to the world increased at a rapid rate of 13.9% between 2005 and 2010 (Figure 1), which imposed obstacles for the future growth of the Mexican manufacturing sector. It is important to emphasize the negative effect of the rapid penetration of the Chinese manufacturing exports on the growth perspective of Mexican manufacturing exports to the USA. Between 1990 and 2006 the average rate of growth of the Chinese exports in dollars to the USA reached 14.4%, while Mexican exports were 9.6%. In fact, since the beginning of 2003, the exports from China to the USA have shown a greater value than the ones from Mexico (Figure 2).

2. Competitiveness, wages and exchange rates in Mexico and China

The labor costs of Chinese manufactures have been kept low when compared to the wages paid in American industry. In fact, Chinese wages are located near the levels of some developing economies and below those paid in the Mexican economy. Figure 1 illustrates the manufacturing wages paid both in Mexico and China as compared to the wages in the USA.

Both the Chinese and the Mexican economies have the possibility of competing in the US market for manufactured goods. However, the manufacturing wages paid in the Chinese economy have been a factor of competitiveness with respect to those paid in the Mexican economy, particularly during the period 2004-2012. Nevertheless, it is important to point out that since2008,Chinese manufacturing wages have increased continuously, and thereby reducing that cost advantage. According to our estimations, the average Chinese wage has reached $4.50 dollars per hour which is therefore converging with that of Mexico at $5.27, while in the USA wages reached an average of $27.65 (Figure 4).

Another goal of the exchange rate policy implemented by the Chinese government is related to the objective of having the yuan undervalued with respect to the dollar thus increasing the competitiveness of Chinese manufactures in the US market. Given the elevated trade and current account deficits, it has been considered that the yuan should appreciate against the currencies of the economies that are the main trading partners with China (Makin, 2008). However, the policy of the Chinese government has been to invest the foreign assets that have been accumulated as international reserves, in order to avoid the loss of competitiveness that would be brought about by the appreciation of the currency.

In that sense, the Mexican manufacturing exports to the USA have also been affected by the depreciation of the yuan which has made Chinese exports cheaper in dollars than Mexican exports. For the period 2004-2012 the average exchange rate between the peso and the dollar was $11.57 pesos per dollar, while for the case of the yuan-dollar, the average exchange rate was $7.14, which showed a more depreciated peso than yuan with respect to the dollar.

3. The performance of Mexican manufactures

The recent behavior of Mexican manufactures shows a severe decrease in labor employment of 6.4% in 2008, which represented a reduction of 38,891 manufacturing jobs, which in turn

diminished the total employment from 3,289,196 jobs to 3,250,305 between 2007 and 2008.*This declining trend continued in 2009, when the rate of growth of labor employment only reached 1.9%.

From 2009 to 2011 there was a mild recovery, in whichthe annual growth rates amounted to 4.9%, 1.8% and 2.3%, respectively. This weak recovery could not offset the severe decline of the years 2007, 2008 and 2009. As a result the average growth rate of labor employment in the manufacturing sector of Mexico exhibited a negative rate of -0.3% in that three year period.

4. Methodological and theoretical aspects

In order to estimate the effect of the Chinese manufacturing exports, the wages, and the exchange rate of China on the demand for labor in the manufacturing sector of Mexico, this paper uses a cointegration analysis, an autoregressive vector approachand an impulse-response function.Empirically, the specification of the model of the Mexican manufacturing labor demand is presented in a logarithmic form as follows:

$$LN(TME_{mxt}) = \mathrm{C}_0 + \beta_1 \mathrm{LN}(\mathrm{WMX}_t) + \beta_2 \mathrm{LN}(\mathrm{WCH}_t) + \beta_3 \mathrm{LN}(\mathrm{WUS}_t) + \beta_4 \mathrm{LN}(\mathrm{YP}_t) + \beta_5 \mathrm{LN}(\mathrm{CIUSG}_t) + \mathrm{u}_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

LNTME= labor employed in the Mexican manufacturing sector at time t;
LN(CIUSG) = Chinese manufacturing exports share to the industrial production of the USA;
LN(YP) = Mexican peso/dollar share to yuan/dollar exchange rate;
LNWCH, LNWUS, LNWMX = manufacturing wages of China, EUA and México
u = error;
LN = natural logarithm

5. Cointegration analysis

With the aim of evaluating whether the empirical model fulfills the necessary unit roots conditionsto determine if the series of both the dependent and independent variables are stationary and cointegrate over time, a set of different tests were undertaken. In the first place, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were estimated, in order to identify if the series are stationary I(0) or present a linear trend or unit root I(1). For the same purpose, in addition, a Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test was estimated based on the null hypothesis that the series are stationary.

The variables were logarithmically transformed, and subsequently the ADF and the PP test were applied, including a constant and a trend. The results, according to the critical values of the statistics t*(tau) and Mackinnon showed that all the series of the variables considered in the model, in first differences, did not reject the null hypothesis that, at the 1% and 5% level of confidence. In addition to the ADF and PP tests, a KPPS was also estimated, and it corroborated the same results obtained in the previous tests, since the non-stationary null hypothesis was rejected and the series of the variables can be considered non-stationary; therefore a VAR model can be estimated.

The variables considered were total labor employment in the manufacturing sector; the average manufacturing wage in Mexico, China and the USA; the Chinese exports as a share of the GDP of the USA, the manufacturing output of the USA, the ratio of the peso-dollar exchange rate to the yuan-dollar exchange rate, and the manufacturing exports of China to the USA.

5.1 Cointegration analysis of the model series

In order to evaluate the behavior over time of the variables considered in the study of the changes of labor employment of the manufacturing sector of Mexico, a non-stationary vector autoregressivemodel was estimated. The methodology allows a flexible analysis of the dynamic interrelationship of the series of the model. Basically, the model,based on thevariables of interest in the study, is estimated as follows:

$$Y_t = A_1 Y_{t-1}, \dots, +BX_t + \varepsilon_t$$

Where:

Y_t= vector (Nx1) of non-stationary variables,in this case the labor employment in the manufacturing sector of Mexico
A_1,….A_p y B = matrix coefficients to be estimated
P = number of lags included in the VAR model
X_t = vector of exogenous variables
ε= vector (Nx1) of error terms normally and independently distributed*e*

Based on the empirical criteria supported by the autocorrelation tests for monthly data, ten lags were used to estimate the model. Subsequently, with the purpose of fulfilling the required assumptions,different diagnostic tests were undertaken. As a starting point, the stability of the model was evaluated usingthe root of the characteristic polynomial of the VAR. The results, based on 10 lags, showed that the eigenvalues were located inside the unitary circle, which satisfies the stability condition of the VAR (Table 7).

AGranger causality test was estimated to evaluate whether the endogenous variable could also be treated as the exogenous variable. Based on the Wald statistic applied to the variables of the VAR model, the results showed that the null hypothesis for the manufacturing labor employment is not rejected and, therefore, it does not affect the other explanatory variables of the model.

In order to determine whether the series of the model are cointegrated and jointly move over time, a Johansen cointegration test for the VAR model was estimated (Tables 12 and 13). The results of the trace and maximum eigenvalue statistics showed that the variables of the model have at least two cointegration equations (Helmut, 2007). Hence, the test supports the model and allowsthe continuation ofthe estimation of the short term impact of the variables related to the commercial and exchange rate policies of China on the labor employmentof Mexican manufacturing.

5.2 Mexican manufacturing labor employment and the impulse response function

The impulse-response function modelpermitsthe identification the effect of a change of one standard deviation on each variable of the model, by using the dynamic structure of the VAR, which modifies the value of all the endogenous variables (Pesarany Shin, 1998). The impulse-response functions were estimated for a period considering 12 monthly lags. There are five relevant functions in the analysis of the effect of a shock in the VAR model, which excludes the zero value in the interval and are statistically significant.

The response of the variables showed a negative adjustment of the labor employment in the manufacturing sector of Mexico as a result of a change in the industrial production of the USA, the share of the peso-dollar exchange rate with respect to the yuan-dollar exchange rate and the real wage in the manufacturing sector of Mexico,USA and China. Therefore, the results of the impulse-response function support the theoretical assumption of a negative correlation between the costs of Mexican labor and the expansion of the manufacturing sector in Mexico.

Table 14 shows the response of the variables of the model to a one standard deviation innovation. In particular, the variable of interest is the response of theMexican labor employment in the manufacturing sector to innovations in the explanatory variables. In the first place, the results show a negative effect on Mexican manufacturing employment due to changes in the share of the Chinese manufacturing exports in the industrial production of the USA. Thisimpact attenuates in three months;a posterior recovery is not appreciated in the response function. Additionally, an increase in the average wage in the US manufacturing sector also negatively affects the Mexican manufacturing labor employment with a monthly lag.

Regarding the impact of the average manufacturing wage of the Chinese manufacturing sector on the Mexican manufacturing sector, the results showed a positive relationship, which implies that Mexican labor employment increases when there is a shock from the Chinese average wage changes. Finally, concerning the exchange rate policy of China, an impact derived from an increment in the ratio of the yuan-dollar to the peso-dollar exchange rates produces a positive response inMexican labor employment. This result suggest that the exchange rate policy of China aimed at undervaluing its currency has a competitive effect on the Mexican manufacturing exports to the USA, and therefore negatively affects the labor employment of that Mexican economic sector.

Conclusions

Two of the factors of competitiveness of the Chinese economy that have supported its rapid export expansion have been the undervalued exchange rate and its low nominal wage policies. As a consequence, the manufacturing wages of China have been historically lower than the manufacturing wages of Mexico, and the undervalued yuan-dollar exchange rate has given Chinese exports a monetary factor of competitiveness with respect to the appreciated and somewhat inflexible peso-dollar exchange rate.

In order to evaluate the impact of the exogenous variables on the demand for labor in the manufacturing sector,several impulse-response functions were estimated. According to the results, the demand for labor in the Mexican manufacturing sector responds negatively to

innovations derived from an increase in Chinese manufacturing exports to the USA and to a rise in the USaverage manufacturing wages. On the other hand, Chinese average manufacturing wages positively impactedlabor employment in Mexico. Finally, an increase in the share of the exchange rate of the yuan-dollar to the peso-dollar exchange rate also has a positive effect on labor employment in the manufacturing sector of Mexico.

It is possible to conclude that the Chinese manufacturing sector has become an important competitor for Mexican manufacturing exports to the USA, with China surpassing Mexico as a commercial partner of the USA in important manufactures such as generators, transformers, electrical equipment, computers, telecommunications and metallic products. However, exports related to the automobile industry in Mexico have been able to compete with the Chinese exports. This paper shows the importance of the competitive advantage of China which related to the historically low wages paid in the Chinese economy as compared to the wages paid in Mexico. Additionally, the policy of maintaining an undervalued yuan with respect to the dollar has also provided competitive advantages to the Chinese manufacturing exports.