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Employment Responses of Skilled and Unskilled Workers at Mexican Maquiladoras: The Effects of External Factors

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Summary. — This paper compares a standard labor demand model to another augmented by the real exchange rate (RER) when studying the growth of dynamic Mexican maquiladoras from 1990 to 2006. The basic question is whether the real value of the peso changes the responses of employment to wages and to capital. In the augmented models, skilled labor employment becomes very sensitive to its own wages. Also, the user cost of capital has a larger negative impact on skilled employment, and a weaker currency has a negative impact on unskilled employment only. Overall, skilled labor benefits relatively more under globalization.

Key words — employment, labor demand, maquiladoras, Mexico, real exchange rate

1. INTRODUCTION

In a global world, foreign capital moves quickly to profit opportunities. Empirical evidence in Ramírez (2006) shows that foreign capital is an important determinant of Mexican wages in the long run through its effects on labor productivity. At the same time, the Mexican peso has become increasingly more responsive to market forces after removal of the peg to the US dollar. This paper examines these two issues within the context of hiring by Mexican maquiladoras, which import inputs (mostly from the United States), process them, and send the product back to the country of origin. [1]

Embedded in this research strategy is the idea that international trade can increase the own-price elasticity of demand for labor. Slaughter (2001) examines US manufacturing from 1961 to 1991 and concludes that demand for US production labor became more elastic overall, a fact not observed for non-production labor. Rodrik (1997) provides a model in which the elasticity of demand for domestic labor increases (in absolute value) with the international mobility of physical capital. Inspired by the *Le Chatelier-Samuelson principle*, the demand for any factor (e.g., labor) becomes more elastic when other factors (e.g., capital) can respond to changes in the economic environment with greater ease.

The decision to examine this question within the Mexican maquiladoras can be justified by the sector's growing importance in the national economy. Figure 1 provides an idea of the increasing relevance of the maquiladora sector to the Mexican economy, as captured by the relative share of maquiladora exports to total Mexican exports (*EXPORTSHARE*) and of imports (*IMPORTSHARE*) for the period 1980–2006. The period depicted in Figure 1 is one decade longer than that covered by the empirical work, but it does provide a longer-term view of the increasing importance of maquiladora activity in total Mexican trade. Figure 1 documents the jump from about 15% in the early 1980s to close to 50% of total exports in the early 2000s; maquiladora imports display similar behavior.

In order to answer how the demand for labor within the maquiladora sector has changed with an increasingly more open Mexican economy, in this paper we estimate several forms of a standard microeconomic labor demand model (with no trade-based considerations) for the maquiladora sector over the period 1990–2006. The period conveys *changing trade under globalization*, with Mexico's exports shifting toward manufactured goods and a substantial increase in vertical specialization and intra-firm trade among the NAFTA partners as surveyed by Kose, Meredith, and Towe (2005). [2]

This article differs from previous studies in three major ways. First, a special role is assigned in this paper to the real exchange rate (*RER*). This variable captures all information in goods and financial markets, especially after the peso crash of December 1994. In fact, the evolution of the real exchange rate is very telling, as the evidence in Fajnzylber and Maloney (2005) has suggested for Mexico. Fullerton and Sprinkle (2005) further suggest that error–correction models capture trade flows between the United States and Mexico well, responding in heterogeneous ways to changes in income, prices, and the exchange rate. Additionally, *RER* influences the Latin American unemployment rate with a pooling coefficient of −0.57, as evidenced by Frenkel and Ros (2006), implying that an appreciation of the *RER* is associated with an increase in the unemployment rate two years later. For Mexico only, the estimated coefficient was −0.86, which suggests that a stronger peso leads to a higher unemployment rate (or lower employment). Theoretical models of the impact of *RER* on wages include Faria and Carneiro (2003).

This set of results linking Mexican labor and financial markets warrants further investigation with respect to the links between employment and the real exchange rate. There are no studies examining these links for Mexican maquiladoras, despite the presumption that the impact of real exchange rate movements should be more significant for relatively more open sectors. [3] While there is no consensus on the perfect measure of trade, Rodríguez and Rodrik (2000) have argued that indicators of "openness" used by researchers are poor measures of trade barriers or are highly correlated with other sources of bad economic performance. Due to the nature of the maquiladoras, tariffs are *not* the correct price measure of trade (or financial) liberalization; we follow representative works on the Mexican economy that employ *RER* as the competitiveness indicator, such as Kamin and Rogers (2000).

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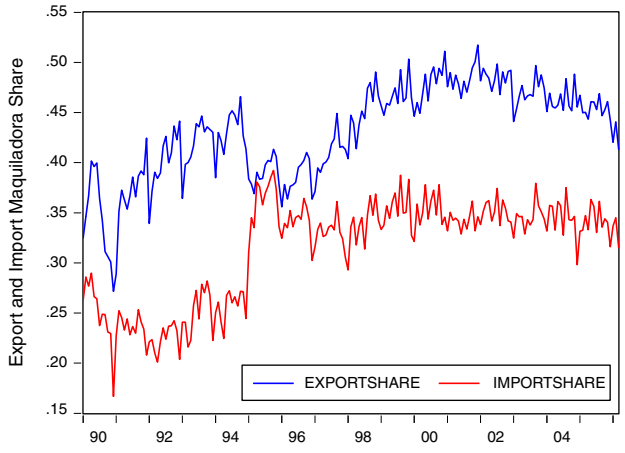

Figure 1. *Maquiladora shares of Mexican exports (EXPORTSHARE) and of Mexican imports (IMPORTSHARE).*

Second, the model estimated herein is a time series version of the panel data methods in Milner and Wright (1998), Greenaway, Hine, and Wright (1999), Mollick (2003), and Fu and Balasubramanyam (2005), with an important modification. Our cointegration-based framework not only handles the non-stationarity features of the data, but does not assume that variations in the user cost of capital can be captured by time dummies under perfect capital markets. Therefore, we allow for US real interest rates to affect the activity of the maquiladoras. As Neumeyer and Perri (2005, p. 345) put it, "the need for working capital to finance the wage bill makes the demand for labor sensitive to the interest rate." Our modification is particularly important for Mexico since Ramírez (2006) reports that private capital and foreign capital have positive effects on the long-run rate of labor productivity growth.

Third, we allow for cross-wage effects on labor demand. While Robertson (2007) finds that Mexican and US production workers are complements, no study has looked at the effects of *cross-wages within the maquiladora industry*. Given the absence of (public) data on perks and incentives, we conjecture that the decision to hire unskilled workers may also depend on the increasingly higher costs of more qualified workers. Skilled wages could thus serve as good proxies for other types of payments. The management literature in Miller, Hom, and Gomez-Mejia (2001) documents that some types of non-wage payments (profit sharing and saving plans) lower turnover at maquiladoras as high-tech firms use advanced manufacturing technologies more intensively.

Focusing on the impressive growth of Mexican maquiladoras from 1990 to 2006, this paper examines whether the competitive peso changes the response of employment to wages and to the price of capital in what we call the augmented model. Several new findings are reported. First, the augmented model adds significant information to the baseline model. Second, the augmented specifications lead to higher price-elasticities of skilled employment to wages. Third, fluctuations in the user cost of capital yield robust complementarities between capital and skilled labor. Fourth, employment responds differently to cross-wage movements: unskilled employment falls with increases in skilled labor wages, but the reverse is not true. Fifth, real exchange rate depreciations contribute to a drop in unskilled employment. Overall, these findings are consistent with the maquiladora labor adjustment being felt more severely by the less skilled.

This paper is organized as follows: Section 2 presents the theoretical framework and Section 3 introduces the data to be applied in the empirical analysis. Section 4 contains the main findings of this article and Section 5 summarizes these results.

2. THE THEORETICAL FRAMEWORK

As in Milner and Wright (1998), we assume the maquiladora firms (indexed by i) in Mexico share a Cobb–Douglas production function as follows:

$$Y_i = A^{\gamma} K_i^{\alpha} L_i^{\beta}, \tag{1}$$

where Y represents real output, K is the stock of capital, L is the number of employees, and A is a productivity factor, whose parameter (γ) allows for changes in the efficiency of the production process. The α and β parameters are factor share coefficients of the inputs.

The profit-maximizing firm (the i subscript is omitted henceforth) will employ K and L at levels such that:

$$MRP_L = w = \partial Y/\partial L = A^{\gamma} K^{\alpha} \beta L^{\beta-1}, \tag{2a}$$

$$MRP_K = r = \partial Y/\partial K = A^{\gamma} \alpha K^{\alpha-1} \beta L^{\beta}. \tag{2b}$$

From (2b), we know that $L^{\beta} = Kr/(A^{\gamma}\alpha K^{\alpha})$, which substituted into (2a) yields:

$$K = (w\alpha L)/(\beta r) = (w/r)(\alpha L)/\beta. \tag{3}$$

Finally, substituting in (1) yields the equation for the i-th firm's output:

$$Y_i = A^{\gamma}[(\alpha L_i/\beta)(w/r)]^{\alpha} L_i^{\beta}. \tag{4}$$

Applying logarithms to both sides of (4) leads to the following equations:

$$\log Y_i = \gamma \log A + \alpha \log \alpha + \alpha \log L_i - \alpha \log \beta + \alpha \log(w/r) + \beta \log L_i, \tag{5}$$

$$\log Y_i = (\gamma \log A + \alpha \log \alpha - \alpha \log \beta) + (\alpha + \beta) \log L_i + \alpha \log(w/r), \tag{6}$$

Dividing through by $(\alpha + \beta)$ and rearranging yields:

$$\log L_i = [-1/(\alpha+\beta)](\gamma \log A + \alpha \log \alpha - \alpha \log \beta) - [\alpha/(\alpha+\beta)] \log(w/r) + [1/(\alpha+\beta)] \log Y_i \tag{7a}$$

or

$$\log L_i = \beta_0 + \beta_1 \log(w/r) + \beta_2 \log Y_i, \tag{7b}$$

where $\beta_0 = [-1/\alpha + \beta]$ $(\gamma \log A + \alpha \log \alpha - \alpha \log \beta$; $\beta_1 = -[\alpha/\alpha + \beta]$; and $\beta_2 = [1/\alpha + \beta]$. Both w and r measure cost factors and Y, if measured by value added in maquiladoras (VA), comprises further items such as raw materials, profits and general expenses. We will employ below W as real wages paid in the maquiladoras and R (the user cost of capital) as the relevant cost of capital for maquiladoras operating in a global environment under global production sharing. To avoid endogeneity problems, we consider US industrial production (YUS) instead of value added in the maquiladoras. This ensures that our measure of demand is completely exogenous to the industry.[4]

If the technical efficiency of the production process increases over time and the competitiveness index measured by the real exchange rate (RER) systematically affects overall production efficiency, the parameter A takes the form:

$$A_t = e^{\delta 0 T} RERt^{\delta 1}, \tag{8}$$