# Mexican real wages and the U.S. economy[☆]

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## ARTICLE INFO

## ABSTRACT

This article examines real wage determinants from 1996 to 2014 across Mexican states. Real wages are determined in equilibrium by combining labor supply (years of education and population growth) and labor demand (mostly external factors) forces. Panel data models provide two main results. First, years of education and U.S. real GDP appear to be reliable predictors of wages in fixed effects models, with very marked changes after the U.S. 2008–2009 financial crisis and stronger effects on northern Mexican states. Second, dynamic panels confirm the role of foreign forces: positive from the U.S. economy and negative from the real exchange rate.

## 1. Introduction

The U.S. economy plays a very significant role in the Mexican economy. This influence has expanded following the economic liberalization of Mexico that started in the mid-1980s and accelerated with the enactment of the North America Free Trade Agreement (NAFTA) in 1994. The literature addressing the effects of U.S. economic activity on the Mexican economy has studied this relation from different angles including, for instance, trade and welfare effects from tariff reductions (Caliendo and Parro, 2014), FDI (Cuevas et al., 2005), labor immigration and remittances (Mandelman and Zlate, 2012), and productivity (Cabral and Mollick, 2011). On the labor market, in particular, Robertson (2000), Gambrill (2005), Mishra (2007), and Chiquiar (2008) have examined the effects of factors such as NAFTA, migration, and regional differences.

A body of literature links financial or currency crises to the labor market. There are a good number of papers on the Mexican economy, particularly following the currency crisis of 1995 as a natural experiment. Kehoe and Ruhl (2009) construct a multisector growth model calibrated to the Mexican economy in order to analyze its 1994–95 crisis. Their model rationalizes the fact that the sudden stop of capital

flows into a developing country tends to be followed by a rapid switch from trade deficits to surpluses, real exchange rate depreciation, and decreases in output and total factor productivity. Labor market effects include the reallocation taking place from the nontraded to the traded sector. Pratap and Quintin (2011) use household survey data during the 1994–1995 Mexican crisis to show that workers who switched industry or occupation during the crisis lost on average about 10% of their hourly earnings relative to workers who did not move. Other studies conduct panel evidence for emerging market economies. Gallego and Tessada (2012) examine job flows from a sectoral panel dataset for four Latin American countries and find that sudden stops are characterized as periods of lower job creation and increased job destruction with heterogeneous effects across sectors. For a panel of 20 countries, Maarek and Orgiazzi (2013) find that the currency crisis dummy has a negative effect on the labor share (the ratio of wages and salaries to value added, calculated from industrial surveys), controlling for education, investment/value added and openness measures. For other specific country evidence, Mehta and Sun (2013) calculate Indonesian inter-industry wage differentials during the Asian Financial Crisis, while Rodgers and Menon (2012) show for the Philippine labor market that real wages fall more dramatically (than

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employment): about 6% during the price surges and 3–4% during the financial crisis of 2008–2009.[1]

A common point in these studies is how an exogenous shock, such as the currency crisis of 1995 in Mexico or the Asian crisis of 1997–98, is transmitted into the labor market (wages or employment). In equilibrium models of the labor market, real wages should reflect the marginal product of labor. In empirical studies, however, labor productivity is often used due to the complexities in measuring the capital stock needed to calculate total factor productivity. Recent studies have explored the links between real wages and labor productivity. Using a panel of 86 countries having at least 10 years of consecutive data on real wages during 1970–2010, Teimouri (2015) reports that real wages (and labor productivity, to a lesser extent) fall after a large depreciation of the nominal exchange rate. Mollick and Cabral (2015) consider human capital (years of education) or labor productivity as the fundamentals of earnings for panels of Mexican states and find that overall migration flows have greater effects on wages than FDI inflows. In an application of this model to the effects of the rising violence in Mexico, Cabral et al. (2016) study labor productivity across Mexican states as a function of real wages and several shift factors, including measures of drug-related crimes. For (endogenous) wages and labor productivity using dynamic panel methods, total crime displays a negative and statistically significant effect on labor productivity after President Calderón started the war against drug cartels from 2007 onwards.

While previous studies have addressed real wage dynamics, the impact of the recent financial crisis on Mexican wages may have amplified some effects and mitigated others. This paper attempts to fill this gap given the more recent financial crisis of 2008–2009 and its effects on the Mexican economy. Dealing with this research topic is important because, due to its size and relevance to the Mexican economy, some fluctuations - particularly those affecting the tradable sector - in the U.S. economy could possibly be absorbed into the Mexican labor market. U.S. economic fluctuations have an effect on Mexico's net exports in at least two ways: the direct effect associated with the U.S. economy as a major trading partner and an indirect effect through the weaker peso bringing up higher prices, which reduces real wages. In the latter case, the price of labor requires an analytical framework grounded on economic fundamentals (and exogenous shocks) that will have an effect on the real economy of the neighbor economy. Employing a very simple equilibrium model of the labor market, we identify both channels in this paper using static and dynamic panel data models.[2] The question becomes not only the degree of response of Mexican wages to the U.S. economy but how the financial crisis alters these responses. This paper therefore provides

a different angle from the identification of effects of the financial crisis on financial markets. For the most recent financial crisis, in particular, several contributions exist on emerging financial markets, such as the stock volatility of Latin American countries (especially Mexico) documented by Dufrénot et al. (2011); stock markets of BRICs responding to NYSE and DAX indices examined by Bekiros (2014); or estimates of contagion and dynamic linkages from U.S. stock markets to developed and emerging markets reported by Hemche et al. (2016).

For evidence of global financial effects on the labor market using state-level data, in this paper Mexican real wage dynamics is examined from 1996 to 2014, a period right after the Mexican crisis of 1995 and including the 2007–2009 financial crisis in the U.S. In Mexico, the relevance of the U.S. economy as its major trade partner and source of foreign capital is clear. Also, the period contains more than 20 years of NAFTA, which undoubtedly increased the trade interdependence between the two economies. Figs. 1 and 2 show, respectively, the total exports and the trade share of Mexican exports to the U.S. relative to the total of Mexican exports, as well as the total FDI inflows and the share from the U.S. compared to total FDI inflows into Mexico. The integration and dependence of Mexico on the U.S. economy are clear, with 84% and 48% on average of total trade and FDI inflows, respectively, for periods observed. We pay particular attention to the influence of the U.S. economy on Mexico's regional wages, allowing for years of education and a variety of controls used before in the literature. Fixed effects models suggest that years of education and U.S. real GDP appear to be reliable predictors of wages, with very marked changes after the U.S. 2008–2009 financial crisis and stronger effects on Mexican states geographically closer to the U.S. Dynamic panels indicate no effects from human capital but very robust positive demand effects due to U.S. real GDP and negative effects due to the real exchange rate on wages.

## 2. An illustrative model

A textbook model of the labor market in Abel et al. (2011) typically has real wages (the marginal product of labor) in the vertical axis and quantity of workers in the horizontal axis. Changes in real wages imply movements along the labor demand ($L_d$) curve or along the labor supply ($L_s$) curve. Shift factors of labor demand to the right include productivity and capital stock (assumed to complement labor). Shifts to labor supply to the right include higher working-age population and participation rate and to the left include increases in wealth and expected future real wages. With this picture of the labor market, to motivate our empirical model below we propose a simple model of the labor market inspired by Mishra and Spilimbergo (2011). We first assume a labor supply function as follows:

$$L_s = (W/P)^\gamma \, \text{EDU}^{\delta 1} \, \text{POP}^{\delta 2}, \tag{1}$$

where: W stands for nominal wages, P is the price level, and the shift factors are average years of education (EDU) of workers at a given state and the population growth rate (POP). For the parameters in (1), $\gamma > 0$ (price movement along the supply function), $\delta 1 < 0$ (increase in wealth increases the amount of leisure workers can afford, shifting labor supply to the left), and $\delta 2 > 0$ (increase in population represents a shift to the right in supply). The unit of analysis is a state within Mexico. While (1) abstracts from foreign wages in the labor supply curve, as did Mishra and Spilimbergo (2011), or from taste parameters as noted by an anonymous referee, some very traditional forces are considered, particularly human capital and net migration to a given state captured by population growth.[3] For example, wages of individuals in a city are estimated by Moretti (2004) on years of schooling as well as the percentage of college educated workers in the labor force of the city. Human capital spillovers are estimated by letting labor productivity depend on the share of educated workers in a city. In our

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[1] In addition to pure labor market effects on wages and employment, effects of currency crises can be seen on the expenditure side of consumers as well as on wage inequality. On consumption, for Mexico in the volatile 1990s, McKenzie (2003) looks at household adjustment after the currency shock and Attanasio and Székely (2004) estimate that Mexican households react to temporary shocks by reducing the consumption of goods that represents longer-run investment in human capital. For Indonesia in 1998, when GDP fell by 12%, Thomas et al. (2004) estimate the effect on education of the next generation, when, on average, household spending on education declined, most dramatically among the poorest households. Heltberg et al. (2013) conduct field research from sites in 17 developing countries to verify how workers cope with the food, fuel, and financial crises during 2008–2011. For how coffee-producing households in Mexico respond to the low coffee prices prevailing around 2003, see Rodríguez-Padrón and Burger (2015). On wage differentials, Araújo and Paz (2014) employ the unexpected 1999 Brazilian exchange rate devaluation to identify the effects of exporting on Brazilian manufacturing firm-level wages using employer-employee linked data and find that the shock increased the average wage gap between the high and low productivity firms.

[2] Another indirect channel through which Mexican wages might be affected is migration. Whenever economic activity in the U.S. is booming, wages in Mexico tend to move up because of a higher demand for Mexican products, but also because migration to the U.S. increases. As labor demand rises in the U.S., labor supply in Mexico declines and this puts pressure on to move salaries higher in Mexico. In the empirical models below, we allow for migration forces to the extent that population growth changes across states.

[3] In the model by Mishra and Spilimbergo (2011) with nominal exchange rates affecting foreign wages, as long as the parameter of labor market integration is different from zero for a given level of foreign wages an increase in the real exchange rate reduces the domestic labor supply due to emigration.