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Behavior analysis of real wages in Mexico (1995-2018)

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ABSTRACT

Objective: To determine through econometric analysis which variables —inflation, real exchange rate, unemployment, and consumption— have a major impact on workers' wages and, therefore, on production.

Design/Methodology/Approach: We developed a multiple linear regression model for the behavior of macroeconomic variables in Mexico from 1995 to 2018, using the ordinary least squares method (OLS) and the Gretl statistical package.

Results: The analysis of the model showed that inflation, exchange rate, and unemployment are highly significant, unlike consumption. For the model of real wages in Mexico, we obtained a 0.87 coefficient of determination —*i.e.*, the variables included in the model account for 87% of the wages' behavior. The relation of consumption, unemployment, and inflation to wages was as expected. Regarding the exchange rate, the result was the opposite of the expectations. The wage-unemployment elasticity had the greatest impact.

Study Limitations/Implications: The database used was the main limitation because it relies on official sources, which lack data and show inconsistencies.

Findings/Conclusions: The study helped to determine whether or not the proposed variables affected the national economic growth. Mexico is not a first-world country than can offer high salaries; therefore, the Mexican economy must continue to grow, before it reaches a higher *per capita* income. In this regard, it is essential to consider the extent to which the new government's proposals will be able to face the reality: very few and very low-quality jobs are created, despite what the official figures say.

Keywords: Minimum wage, inflation rate, unemployment rate, exchange rate.

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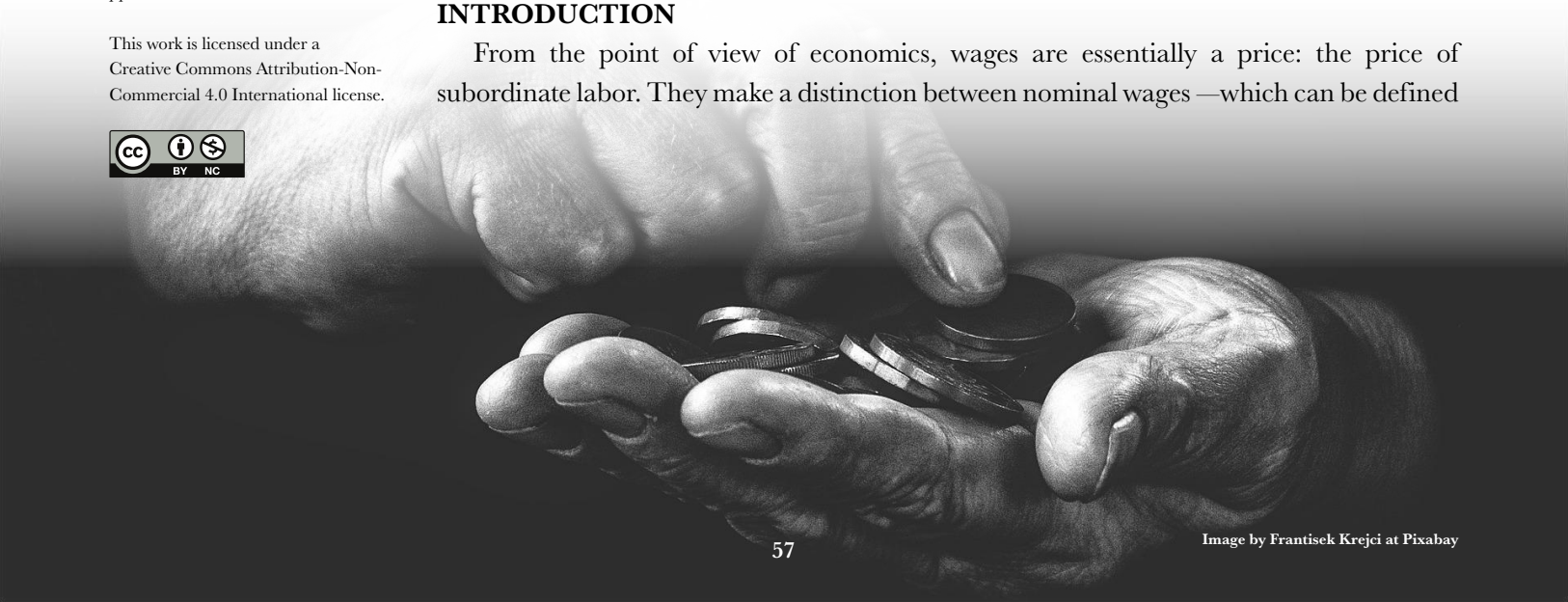
INTRODUCTION

From the point of view of economics, wages are essentially a price: the price of subordinate labor. They make a distinction between nominal wages —which can be defined



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as "the flow of income in a currency that an individual receives"— and real wages —which refer to "the flow of goods and services that an individual may acquire with a monetary wage once the effect of inflation is deducted" (Buen and Valenzuela, 1997). According to the International Labour Organization [ILO] (OIT, 2020): "From the standpoint of economy, wages are an important part of labor costs and an essential variable for business competitiveness that needs to be analyzed, along with its relation to other factors like employment, productivity, and investment". Until 2014 the need to raise minimum wages was not understood. Nevertheless, implementing such a measure immediately or through a presidential decree could cause an endless inflationary spiral.

Consistent with the new wage policy, in 2019, the Mexican government reached for the second consecutive year the necessary consensus with the labor and business sectors, benefitting millions of workers (Secretaría del Trabajo y Previsión Social, 2019). In 2020, a 20% increase in the minimum wage resulted in $123.22 pesos per day. However, despite increases in recent years, this wage is still one of the lowest in the world. According to a study implemented by the global discount portal for online purchases Picodi.com, Mexico ranked 40th out of 54 countries, attaining a level similar to that of Vietnam (INFOBAE, 2020).

According to Aguirre (2020): "low wages favor exports at the expense of the purchasing power of workers. With better salaries, the virtuous circle of domestic consumption would have vastly improved this country's economy and increased tax collection".

The impact of an exogenous increase in minimum wages could have negative consequences on the overall economy, beyond inflation which would involve changes in the opposite direction. In particular, an increase in minimum wages that does not take into account the overall economic conditions would have redistributive effects. While some workers who earn the minimum wage would have a higher income, others could lose their formal employment. Moreover, this effect would intensify on those workers who could be potentially hired by companies. Additionally, the disintegration of the labor market into the informal sector could result in lower productivity. This diversion toward informality would negatively affect the development of physical and human capital and the adoption of new technologies, which, in turn, would result in lower growth in the future. A lower economic growth and higher informality would reduce the potential tax collection of the country, which would stress public finances (Banco de México, 2016a).

To minimize the negative economic consequences, the economic agents needed to understand that an increase in minimum wages does not imply that their expectations will be harmed. Therefore, increases were necessarily moderate and interpreted not as an adjustment in the cost of living, but as a change in the relative price of the workforce with lower earnings (Banco de México, 2016a).

In 2017, minimum wages increased by 9.58% (from $73.4 to $80.04). Considering the inflation for that year (6.77%), the purchasing power achieved a small gain (2.5%). In 2018, minimum wages increased by 10.39% and Banxico managed to reduce and control inflation at 4.83%; consequently, the purchasing power increased by more than 5%. In 2019, minimum wages increased by 16.21%, and inflation reached 2.83% —a >13% increase in purchasing power. The real annual salary growth results from the difference

between wages and inflation. For example, if inflation reaches 5% and the wage increase is 8%, then the difference would be 3%, which is the real increase in purchasing power (Banco de México, 2016b).

The decrease in purchasing power can be clearly determined from the current inflation/minimum wage relation. This decrease may seem to render purchasing power less representative or important. However, when considered in its strictly real aspect, it becomes very relevant. Unlike other economic indicators, the unemployment rate is expressed in terms of people —*i.e.*, the number of persons that do not have a job at the time of the survey but who are looking for one (Gómez, 2014).

MATERIALS AND METHODS

For this research, secondary sources were used and a database with the annual data for macroeconomic variables in Mexico from 1995 to 2018 was developed, using constant prices from 2010. The information came from World Bank and INEGI databases.

An econometric approach was employed because it enables the development of models that help to analyze relations in economic theory, explaining the behavior of one variable in terms of others. Log-Log models where the elasticity of Y concerning X is attributed to $\beta 1$ were used and interpreted as a 1% increase in X related to a $\beta 1$% change in Y.

An econometric model is an economic model that includes the necessary specifications for its empirical utilization. The development of the econometric model included three stages. First, we specified the hypotheses to measure the phenomenon; then we estimated the values through data analysis, and we contrasted the established hypotheses; and finally, we evaluated the estimates based on economic, statistical, and econometrical criteria. A statistical contrast —between correlation coefficient and contrast tests— was carried out to check if the analyzed data and the results were significant, in order to determine not only the existence of the relation, but its nature.

According to Díaz and Llorente (2013): "Based on the sources of information, we established the relations between the variables considered the most relevant for the explanation of the behavior of the dependent variable. In most cases, economic theory does not explicitly establish the mathematical form of economic relations. Determining the function that links the variables considered in the analysis will clarify which type of relation exists between them. Subsequently, such knowledge will constitute the basis that justifies the adoption of economic measures". The ordinary least squares method (OLS) was used to obtain the estimators. When the function is well specified, one can make a correct estimate that takes into consideration different factors, such as the properties of the estimators, the object of the economic research, etc. (Gujarati, 2010). Estimation is a strictly technical stage that requires knowledge of various econometric methods, their operational hypotheses, and their economic implications (Díaz and Costa, 1994).

Wage functional relation (S_t)

There is an understandable concern in Mexico to improve the well-being of the low-income population, especially those living in poverty, hence the implementation of public policies that seek to increase the income of the most vulnerable. Other methods that help

to reduce poverty include employment and training programs, outreach programs, and quality of public health and education services.

Wages are one of the most important variables for the country, since they reflect the population's overall purchasing power, which highly impacts production.

The wage functional relation in Mexico is calculated using the following formula:

$$LNS_t = f\left(LNTC_t,\ LNINF_t,\ \ LNC_t,\ LNU_t\right)$$

Where: LNS_t=Natural logarithm of wages in Mexico (pesos per day); $LNTC_t$=Natural logarithm of exchange rates in Mexico (peso-dollar); $LNINF_t$=Natural logarithm of annual inflation in Mexico (percentage); LNC_t=Natural logarithm of actual total consumption in Mexico (millions of dollars); LNU_t=Natural logarithm of unemployment rate in Mexico.

Structurally:

$$LNS_t = \pounds_0 + \pounds_1 LNTC_t + \pounds_2 LNINF_t + \pounds_3 LNC_t + \pounds_4 LNU_t + \xi 1$$

Economic production directly affects wages. When production increases, wages also increase and therefore purchasing power increases. Consequently, there must also be a direct relation with consumption since more goods can be acquired when wages go up.

As for unemployment, the contrary result is expected, because the increase in minimum wage will cause a decrease in unemployment. Regarding inflation, a direct relation is expected since the price instability erodes the purchasing power of people and inhibits economic growth and development. Finally, a direct relation with exchange rates is expected, because, in practice, currency appreciation causes an increase in wages, leading to more purchasing power and more consumption.

RESULTS AND DISCUSSION

The Gretl statistical package (2020) was used to analyze the real wages model in Mexico. First, the statistical results based on the parameters of the resulting equations were analyzed. Then the economic results based on the coefficients and their relation to the estimators of economic theory were analyzed. Finally, the results were analyzed based on the resulting elasticities.

Statistical results

Table 1 was developed with the output of the Gretl software. The following variables were very significant: inflation (calculated t value: −8,027), exchange rate (calculated t value: −5,232), and unemployment (calculated t value: −3,210). Meanwhile, consumption was not significant (calculated t value: <1).

Regarding the equation for real wages in Mexico, the coefficient of determination has a value of R^2=0.87, meaning that the variables included in the equation account for 87% of the econometric model. In other words, 87% of the variations in wages were influenced

Table 1. Analysis of variance of the real wages model.

	Coefficient	Standard deviation	t-statistic	p-value	
Constant	11.3665	1.20505	9.432	<0.0001	***
l_C	0.0222138	0.0555262	0.4001	0.6936	
l_INF	−0.387036	0.0482154	−8.027	<0.0001	***
l_TC	−1.37172	0.262177	−5.232	<0.0001	***
l_U	−0.508974	0.158534	−3.210	0.0046	***
*** Denotes significance at 1%; ** Denotes significance at 5%; *Denotes significance at 10%					
Mean dependent variable		3.873694	D.T. of the dependent variable		0.364615
Sum of squares of residuals		0.332519	D.T. of regression		0.132291
R-squared		0.891252	R-squared corrected		0.868358
F (4,19)		38.92915	p-value (the F)		6.64e-09
Log-likelihood		17.29483	Criterion of Akaike		−24.58965
Criterion of Schwarz		−18.69938	Criterion of Hannan-Quinn		−23.02696
rho		0.189972	Durbin-Watson		1.503411

Source: Developed by the authors based on the GRETL output.

by the changes in consumption, inflation, exchange rates, and unemployment recorded in the country during the analysis period.

Finally, as seen in Table 2, the model lacks heteroscedasticity. In short, it presents significant variables and complies with the normality of residuals. Therefore, it is an adequate model.

Economic results

The analysis of the structural coefficients makes clear the relation between estimators and economic theory, which is implicit in the following equation:

$$S=11.3665+0.0222138C-0.387036INF-1.37172TC-0.508974U$$

Consumption and wages had the expected relation. When this variable increased, wages increased too, and *vice versa*. The opposite was true regarding the exchange rate: there is an inverse relation, rather than the one expected. The inflation-wages relation shows that,

Table 2. Contrasts in the real wages model.

Contrast of normality of the residuals- Null hypothesis: [The error has a Normal distribution].	Contrast statistic: Chi-square (2)=0.422621 con valor p=0.809522
Contrast of the specification RESET- Null hypothesis: [The specification is adequate].	Contrast statistic: F(2, 17)=5.95588 with p-value=P(F(2, 17)>5.95588)=0.0109568.
Contrast statistic: F(2, 17)=5.95588 with p-value=P(F(2, 17)>5.95588)=0.0109568.	Contrast statistic: LMF=0.821939 with p-value=P(F(1, 18)>0.821939)=0.376591
Contrast of the heteroscedasticity the White- Null hypothesis: [No heteroscedasticity].	Contrast statistic: LM=17.1161 with p-value=P(Chi-square (14)>17.1161)=0.250043

Source: Developed by the authors based on the GRETL output.

when inflation decreases, wages increase and vice versa, corroborating the hypothesis. The unemployment variable also behaved as expected.

An analysis that rigorously followed theory could show that increasing wages would be highly counterproductive. The minimum wage is not generalized: just a percentage of the population earns it. The current wage (W) is very different from the real wage, since workers are interested in what they can buy with their salary, not in the amount they earn —in other words, the wage:price (W:P) ratio, which is also known as purchasing power. An increase in W (*i.e.*, the current wage) causes an increase in consumer prices, basic consumer goods, and fuels. An increase in W can even affect all goods, which can cost more than they did before the current salary was raised, causing short and medium-term inflation, unless several fiscal or monetary policies are implemented. If we really want to increase wages over prices, the following conditions are required: higher productivity, appreciation of the peso, a stable exchange rate, and economic growth and development.

Economic interpretation of structural elasticities

Elasticity is a fundamental concept in economics: the percentage change in one variable (Y) in response to the percentage change in another (X). Most specifications consider that elasticity is not constant, since it depends on the concrete values of the explanatory variable (X) and the response variable (Y). Transformations applied to the variables affect the expression of elasticity (Alonso, 2009). The concept of *ceteris paribus* is essential for the analysis of elasticities in any given model; this concept enables the study of a variable isolated from the rest, in order to best observe how it changes when the other variables remain constant. Regarding wage elasticity, with a 10% increase in consumption, wages would rise by 0.20%. In the case of inflation, wages would decrease by 3.8%. Regarding exchange rates, wages would decrease by 13%. Finally, a 10% increase in the unemployment rate would mean a 5% decrease in wages.

Wages and employment are essential for development and social stability in any country, since labor with fair, decent, and sufficient wages guarantees a good quality of life among the population. However, labor is fractured in Mexico, because working conditions are precarious. The economy gravitates toward informality which creates few jobs or jobs that do not offer a decent salary or economic or social benefits and do not guarantee access to social security or quality education. A potential, yet very interesting contradiction arises: on the one hand, few formal jobs are created, but, on the other hand, according to unemployment statistics, the situation is better in Mexico than in European countries or in the United States. The low unemployment rates are a result of the way unemployment and informal employment are measured.

CONCLUSIONS

Fair wages are a sign of a healthy economy, but that is not the case in Mexico. For the same reason, the minimum wage has been raised gradually over the years. This increase depends on productivity, balance of payment, GDP *per capita*, and job supply and demand.

The databases used imposed some limitations on this research. Developing a longer-term database could make it easier to find and analyze an econometric model.

Nevertheless, the regression had an acceptable coefficient of determination. Although it was useful for the analysis and explanation of the behavior of the study variables, new variables can be introduced in future research, in order to enhance the explanatory power of the model. The following variables can be included to obtain better results: United States wage, number of migrants, and education level.

Unemployment, consumption, and inflation yielded results consistent with the hypotheses (*i.e.*, direct relations in each case). In contrast, the exchange rate did not behave according to our proposal and presented an inverse relation.

To conclude, we must understand that we are not yet a first-world country that can offer high salaries. Several goals must be met before that happens. We must wait for the Mexican economy to continue growing before a high *per capita* income can be achieved. In this regard, it is essential to consider the extent to which the new government's proposals will be able to face reality: very few and very low-quality jobs are created —despite what the official figures say.

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