

An Estimation of Jobs Lost in Mexico during 2020 as a Result of the COVID-19: a Cointegration Approach**Estimativa de empregos perdidos no México em 2020 como resultado do COVID-19: uma abordagem de cointegração**

DOI:10.34119/bjhrv3n3-147

Recebimento dos originais:01/05/2020

Aceitação para publicação:05/06/2020

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ABSTRACT

An estimation of jobs lost in the formal sector during 2020 in Mexico is presented. In order to obtain the jobs lost figure, a labor demand as function of output and real wage is estimated according to the cointegration approach. The main result is that 205,863 jobs of permanent workers insured at the Mexican Social Security Institute will be lost by each percentage point that Mexican GDP drops in 2020 as a consequence of the quarantine needed to avoid the Covid-19 spreads even further. If the Mexican GDP drops 8.2% in 2020 about 1.69 million of this kind of jobs would be lost.

Key words: Labor market, applied econometrics, economic effects of Covid-19

RESUMO

É apresentada uma estimativa dos empregos perdidos no setor formal durante 2020 no México. Para obter o número de empregos perdidos, uma demanda de mão-de-obra em função do produto e do salário real é estimada de acordo com a abordagem de cointegração. O principal resultado é que 205.863 empregos de trabalhadores permanentes segurados no Instituto Mexicano de Seguridade Social serão perdidos a cada ponto percentual em que o PIB mexicano cair em 2020, como consequência da quarentena necessária para evitar ainda mais a expansão do Covid-19. Se o PIB mexicano cair 8,2% em 2020, cerca de 1,69 milhão desse tipo de emprego seria perdido.

Palavras-chave: Mercado de trabalho, econometria aplicada, efeitos econômicos do Covid-19

1 INTRODUCTION

The COVID-19 outbreak that took place in China by the end of 2019 turned out in the most dangerous pandemic since the Spanish flu in 1918. Due to the speed of the infections growth and the mortality rate, the governments of almost all countries had to ask their people to keep themselves at home. The Mexican government considers quarantine as its main strategy to face the pandemic because it prevents people from getting the virus and avoids hospitals to saturate. The latter allows some hospitals to have room for the new infected patients until the pandemic disappears.

This strategy aims to save lives but it has an important opportunity cost: the main economic variables as production, employment, exports are collapsing since the quarantine began. There are several estimations about Mexico's Gross Domestic Product (GDP) contraction in 2020, some of them forecast two digits drop¹. This is easy to understand if we consider the massive closure of factories, businesses, schools, shops, cinemas, tourism facilities, among others. Only essential activities as health care, food supplies, transport, oil extraction and refining and the government investment projects can continue during the pandemic. If the Mexican GDP falls deeply, then some businesses will shut down, many jobs will be lost, many people will not be able to pay their credits and probably some commercial banks will face bankruptcy. The latter would feed back in more financial instability that would discourage national and foreign investment even more, which would deepen the GDP's fall. Moreover, the minimum wage in real terms has increased in the last two years and this fact will exacerbate the unemployment in the 2020 economic crisis.

¹ See Table 5.

The aim of this paper is to estimate the jobs that will be lost in the formal sector of the Mexican economy in 2020. A theoretical model that was developed and published in 2019² is re-estimated using different time series and incorporating more observations. The new estimated elasticities in this paper are used to anticipate the jobs loss in the formal sector as a consequence of the GDP's fall and the increase in the real wage. The paper is organized as follows: in the next section we discuss labor demand estimations by other authors. In section 3, we develop the theoretical model, we present sources of information and the new econometric estimation. In section 4 we present several scenarios defined by different percentage drops in the Mexican GDP and an increase in the minimum wage in real terms. In the last section we present some final remarks.

2 MEXICAN LABOR DEMAND ESTIMATIONS: A BRIEF SURVEY

When the Mexican labor markets are studied, researchers focus mainly on the labor supply using information about the economically active population and different unemployment definitions: Hernández Laos, E. and N. Garro Bordorano (2000), Samaniego, N. (2001) and Peralta, E. (2010). On the other hand, Lapa Guzmán J. and Baltazar Escalona J. (2017) estimate an econometric model for labor demand using ordinary least squares with working population, wages, investment, imports and public expenditure on education. These authors made an estimation using first differences, moving averages and dummy variables to deal with investment and imports seasonality in some quarters. The authors carried out cointegration tests and conclude that there were 3 or 4 cointegration equations but they did not report any cointegration vector.

3 THEORETICAL MODEL, TIME SERIES AND THE COINTEGRATION EXERCISE

We follow a non Walrasian approach in the sense that all observations are on the labor demand³. If there is a price different from the one that clears the market in perfect competition the quantities demanded and supplied will be different, this does not prevent from making transactions but they will be on short size of the market. We support this assumption on the fact that the annual average growth rate of the economically active

² Jimenez and Carreño (2019).

³ See Benassy, Jean Pascal (1986).

population (4.7%) has been more than twice the annual average rate of the economy (2.1%) since 1982.

The model is based on Rosen and Quandt (1978) work. We removed the time trend that Rosen and Quandt used to represent technological progress.

Variables definitions:

Y: output

L: labor

K: capital

W: nominal wage

P: producer price

α : output elasticity with respect to labor. Where $0 < \alpha < 1$.

We assume a Cobb-Douglas production function:

$$(1) Y_t = L_t^\alpha K_t^\beta$$

The next equation arises from equating labor marginal productivity to real wage:

$$(2) \alpha L_t^{\alpha-1} K_t^\beta = \frac{W_t}{P_t}$$

We obtain from equation (1):

$$K_t = \left(\frac{Y_t}{L_t^\alpha} \right)^{\frac{1}{\beta}}$$

We substitute capital in equation (2):

$$(3) L_t = \alpha \frac{Y_t}{W_t/P_t}$$

Equation (3) is expressed in natural logarithms:

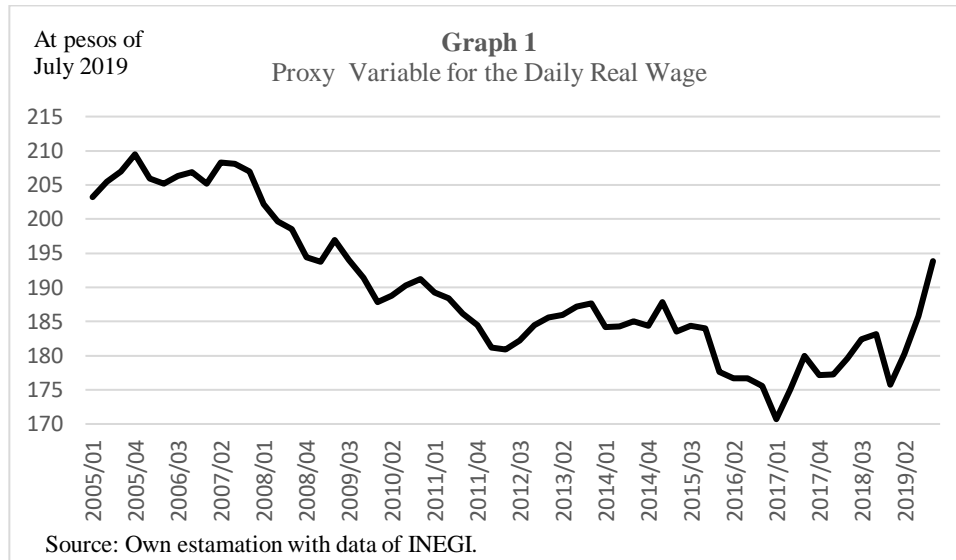
$$(4) \ln L_t = \ln \alpha + \ln Y_t - \ln \left(\frac{W_t}{P_t} \right)$$

It is more convenient to estimate equation (4) instead of equation (2) because we want to focus on how output and the real wage determine employment in the formal sector. If we considered capital in the estimation, we would have face two problems: the lack of reliable data on capital and an assumption of which proportion of capital is idle.

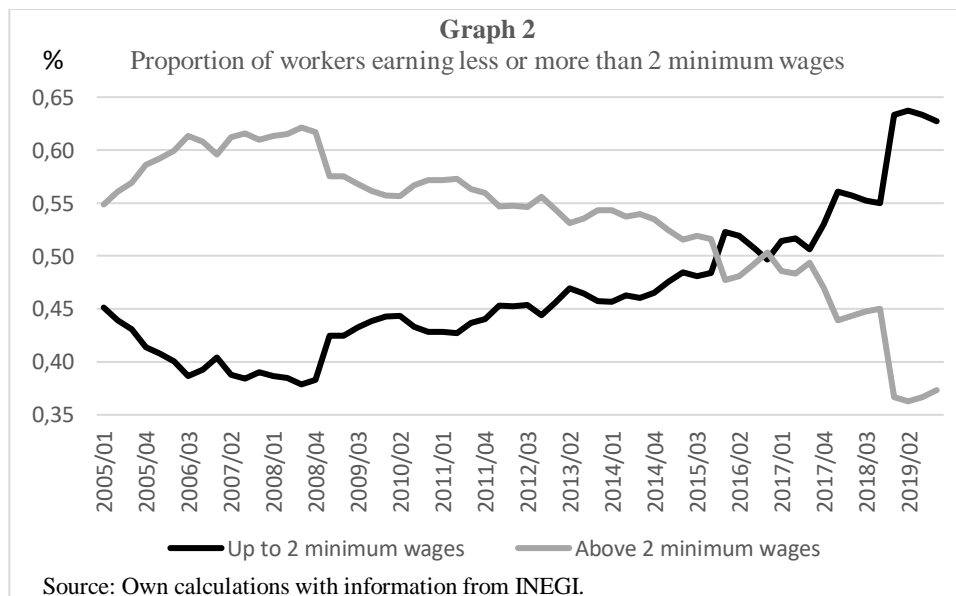
The frequency of the data is quarterly. The statistical information is for the period between the first quarter of 2005 and the fourth quarter of 2019. The source for employment data is the number of permanent workers insured at the Mexican Social Security Institute (IMSS for its initials in Spanish). The source of output data is the seasonally adjusted GDP at 2013 prices published by the National Institute for Statistics, Geography and Computing (INEGI for its initials in Spanish). We decided not to use the salary information provided by IMSS because firms have strong incentives to under declare salary information to reduce i) social security payments and ii) payments for a local contribution known as the payroll tax. This information does not capture how employment reacts when real wages change. For this reason, we estimated a nominal wage series as a proxy variable with the information provided by the National Occupation and Employment Survey carried out by INEGI. As a matter of fact, the period under study was defined by the availability of the latter information. The survey's questionnaire asks workers to classify their income in one of five intervals: i) up to one minimum wage, ii) more than one and up to two minimum wages, iii) more than two and up to three minimum wages, iv) more than three and up to five minimum wages and v) more than five minimum wages. The survey reveals a percentage for each of these five intervals but it does not reveal the corresponding average. We assume that the average wage in the first interval es 1 minimum wage, in the second interval es 1.8 minimum wages, in the third interval is 2.6 minimum wages, in the fourth interval is 3.4 minimum wages and in the fifth interval es 5.2 minimum wages. We made this assumption because the higher the interval for the wage is, the more likely the average wage is closer to the lower limit of the corresponding interval. In this way we can get a weighted average of the wages the five intervals.

Every year, the Mexican government announces the minimum wage increase. By law, the increase has to be paid for workers in the first interval since the beginning of each year. For the other four intervals, we assume that the increase is split in four parts, each at the beginning of the quarter. Later we obtained the real wages series dividing nominal wage

by the producer price index (July 2019 = 100)⁴. The current federal administration has increased the minimum wage above expected inflation in 2019 and 2020. The increment for the former year is still depicted in the last year of Graph 1 and the increment for 2020 will be used as an input for the estimation of the jobs that will be lost in 2020.



We must remark that the decrease in the real wage is the result of a drastic change in the proportions of workers with low and high wages. The proportion of workers that earn up to two minimum wages rose from 40% in first four years of the sample to reach 63% in 2019. On the other hand, the proportion of workers that earn more than two minimum wages drop from 60% in the first four years of the sample to 37% in 2019 (see Graph 2)



⁴ We built this proxy variable instead of using the contribution base salary in order to incorporate the prevailing conditions in the labor market. In fact, the wage level we estimate is about a half of the contribution base salary registered by IMSS.

In order to check the causality among the variables that are used for the cointegration exercise we report the Granger causality test⁵ in Table 1.

Table 1			
Pairwise Granger Causality Tests			
Sample: 2005:1 2019:4			
Lags: 5 Null Hypothesis:	Obs	F-Statistic	Probability
Y does not Granger Cause L	55	5.0748	0.0009
L does not Granger Cause Y		0.8354	0.5318
W does not Granger Cause L	55	3.9576	0.0048
L does not Granger Cause W		0.6562	0.6584
W does not Granger Cause Y	55	1.4866	0.2136
Y does not Granger Cause W		0.4800	0.7892

Table 1 reports that the null hypothesis that “output does not cause labor” and “wage does not cause labor” are rejected. This means that Y and W series precede statistically L series.

The next step is to identify the integration order⁶ of each series. In an autoregressive equation as (5) we can test if $\rho=1$:

$$(5) Y_t = \rho Y_{t-1} + \varepsilon_t$$

Where ε_t is white noise. If $\rho=1$ equation (5) would represent a random walk. If $\rho < 1$ then Y_t is stationary or integrated of order zero $I(0)$. The Dickey Fuller (DF) test considers as null hypothesis $\rho-1=0$ and finds out if there is a unit root. This test is applied to an equation like (6):

$$(6) \Delta Y_t = \delta Y_{t-1} + \varepsilon_t$$

The DF test tries to prove that δ is negative using ordinary least squares. The rejection of the null hypothesis ($\delta = 0$ which implies that the series is integrated of order one $I(1)$) is in favor of the alternative hypothesis ($\delta < 0$) which implies that the series is stationary or integrated of order zero $I(0)$. The augmented Dickey Fuller test includes lagged variables to eliminate error autocorrelation.

⁵ See Enders (2010)

⁶ See Juselius (2006).

$$(7) \Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^k \delta_i \Delta Y_{t-i} + \varepsilon_t$$

The number “k” is determined in order to avoid error autocorrelation. The test procedure is the same using a t-student probability distribution to check if the null hypothesis is rejected. The results of the DF test are reported in Table 2.

Variable	Lags	Test Statistic	%	Critical Values
Ln L	1	2.06	1%	-2.61
Ln W/P	2	-0.26	5%	-1.95
Ln Y	0	2.81	10%	-1.61

The results reported in Table 2 determine that the test statistics are not in the rejection area, which means that the null hypothesis is not rejected and the 3 series are I(1). The number of lags is automatically determined according to the Schwarz Information Criterion with 4 lags as maximum. In order to discard higher orders of integration, we repeat the test for the three variables but in first differences. The results are on Table 3.

Variable	Lags	Test Statistic	%	Critical Values
Ln L	4	-2.41	1%	-2.61
Ln W/P	1	-4.83	5%	-1.95
Ln Y	0	-5.95	10%	-1.61

All the test statistics are in the rejection area which means that the first differences are I(0), that is consistent with the fact that original series are I(1).

The next step is to carry out the Johansen cointegration⁷ test for these three variables. The results of this test are reported in Table 4.

⁷ Cointegration in this case means that a linear combination of I(1) series results in a I(0) series which implies that the three variables move together in time. For a formal definition of cointegration and an explanation of the Johansen cointegration test see Banerjee et al (1993).

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Probability
None*	0.430	36.357	24.276	0.001
At most 1	0.052	3.734	12.321	0.749
At most 2	0.011	0.633	4.130	0.487

* Denotes that the null hypothesis is rejected at 5%.

The first row of table 4 shows that the null hypothesis that there is no cointegration equation is rejected. The second and third rows show that there are one or two cointegration equation.

We consider one cointegration equation:

$$(8) \ln L_t = +1.175 \ln Y_t - 0.558 \ln \left(\frac{W_t}{P_t} \right)$$

$$(0.02624) \quad \underline{(0.08111)}$$

Equation (8) shows that the signs of the cointegration equation are consistent with the theoretical model. The standard errors are reported in parentheses⁸. The corresponding elasticities are the estimated coefficients themselves.

4 SCENARIOS FOR THE MEXICAN GDP CONTRACTION IN 2020 AND THE ESTIMATION OF JOBS LOST.

Permanent workers insured at the Mexican Social Security Institute averaged 17,520, 232 in 2019. For each percentage point of GDP drop, 205,863 permanent jobs in the formal sector will be lost. Table 5 shows several scenarios for the Mexican GDP in 2020 considered by some institutions, banks and other sources.

⁸ Equation (4) has a constant while equation (8) does not. As the estimation is natural logarithms the fact that the constant is zero in equation 8 only means that α is around 1.

Table 5	
Forecasts for the Contraction of Mexico's GDP in 2020	
Date	Institution or Bank
7-apr-20	Centro de Estudios Económicos del Sector Privado
25-may-20	Bank of America
14-may-20	VALMEX
14-may-20	Credit Suisse
21-apr-20	Citi Banamex
25-may-20	PNUD
01-may-20	JP Morgan Investment Bank
04-may-20	Banco de México's survey
22-apr-20	BBVA
24-apr-20	Instituto Mexicano de Ejecutivos de Finanzas
14-apr-20	IMF
21-apr-20	CEPAL (Upper limit)
12-apr-20	World Bank
	Promedio

Source: Made with internet information.

The Economic Commission for Latin America (CEPAL for its initials in Spanish) expects Mexican economy to have the second worst performance among all the countries in Latin America and the Caribbean, despite CEMLA's forecast is not that bad. The arithmetic average of the contraction rates expected for the Mexican GDP in 2020 is -8.2%, this figure implies that around 1.69 million of formal and permanent jobs are going to be lost.

There is also a negative impact in employment due to the increase in minimum wage for 2020 because almost a quarter of workers earn this salary according to the last available National Occupation and Employment Survey. We made an estimation of an increase in the real wage due to the increment in minimum wage for workers in the first interval and no increment even of nominal wage for all for workers in the other four intervals defined in section 3. Under these assumptions, the real wage has increased 0.27%, which implies that around 25,000 additional permanent jobs in the formal sector will be lost. Summing the effects of the contraction of output and the increase in real wage in 2020, the Mexican economy would lose 9.77% of permanent formal employments with respect to the average level reached the previous year. This means that Mexicans will lose 4 years of generating permanent jobs in the formal sector because the employment average in 2020 will be similar to the average registered in 2016.

5 FINAL REMARKS

There is an increasing number of economic analysts that think that it will take at least 4 year to recover GDP and employment levels reached in 2018. Last April, 555,247 jobs of workers insured at IMSS were lost. It is the largest figure the institute has ever registered within a month. In the period January-April 2020, the net loss of jobs was of 493,746. This figure can be disaggregated in 161,752 permanent jobs and 331, 994 temporary jobs. Furthermore, the picture for the next months is discouraging. The Covid-19 infections are growing very fast by mid-May 2020 and Mexico has already more deaths from Covid-19 than Iran. Simultaneously, the USA government is putting pressure on the Mexican government to reopen a lot of manufacturing factories to supply inputs to the American automotive and aerospace industries, mainly. This implies that Mexico faces a lose-lose situation. If Mexico does not reopen factories, its firms can be substituted by other firms from other countries as USA suppliers, affecting even more the employments drop in Mexico. On the other hand, if Mexico reopens factories without flattening the Covid-19 infections curve, these will grow even faster and it would be very likely that factories have to close again, eventually, unless Mexican government decides to accept the humans lives cost.

The dilemma is to protect people's lives or to protect their jobs. Mexicans would like to go back to January 2020 to make things quite different.

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