Disentangling the Effects of Large Minimum Wage and VAT Changes on Prices: Evidence from Mexico

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Economics of Informality

October 20th, 2022

The views expressed are those of the authors and not necessarily those of Banco de México.

Research Summary

- **What we do**
  - Study the effects on prices of doubling the minimum wage and halving of the value-added-tax (VAT) rate in Mexico's northern border.
  - Develop an identification strategy to disentangle the effects of the minimum wage and the VAT on prices.

- **What we find**
  - The higher minimum wage is associated with economically and statistically significant increases in the prices of VAT goods.
  - The VAT rate reduction is associated with lower prices for VAT goods.
  - The increments in prices due to the minimum wage hike were more than offset by the decreases associated with the VAT.
  - The share of informal labor in the production of different goods plays a role in the impact of the minimum wage on prices.

Motivation

- Large tax reductions and increases in the minimum wage have been gaining attention around the world as policies to increase the net incomes of lower-skilled workers.
- Understanding their effect on prices is essential to evaluate their effects on workers' purchasing power.

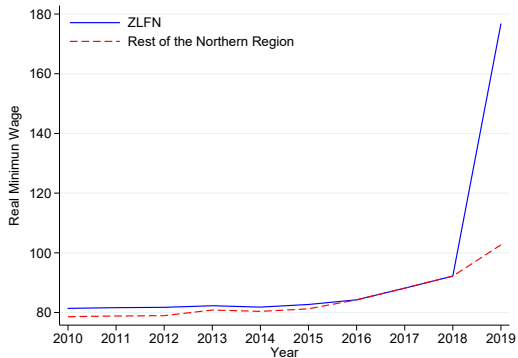
Literature and Contribution

- **Effects of the minimum wage on prices:** US: MacDonald and Aaronson (2006), Aaronson et al. (2008), MaCurdy (2015), Leung (2021), Renkin et al. (2020). Other countries: Lemos (2008), Harasztosi and Lindner (2019).
- This paper:
  - Sudden, large minimum wage increase in a middle income country.
  - Simultaneous minimum wage and VAT reforms.
  - Different effects for different types of goods.
- **Effects of VAT on prices:** Politi and Mattos (2011), Benedek et al. (2015), Kosonen (2015), Benzarti and Carloni (2019).
- This paper:
  - Identification strategy to separate VAT effect from minimum wage effect.
  - VAT effect materializes quickly.
- **Literature for Mexico:** Mariscal and Werner (2018), Racimo (2018), Campos-Vazquez and Esquivel (2020), Bachas et al. (2020)
- This paper:
  - Separates the effects of the minimum wage increase and the VAT reduction.

Context: The 2019 Northern Border Stimulus Policies

- The minimum wage increased by different percentages in the northern border and the rest of the country in January 2019:
  - Northern border (ZLFN): 88.36 to 176.72 pesos/day (↑ 100%).
  - Rest of the country: 88.36 to 102.68 pesos/day (↑ 16.21%).

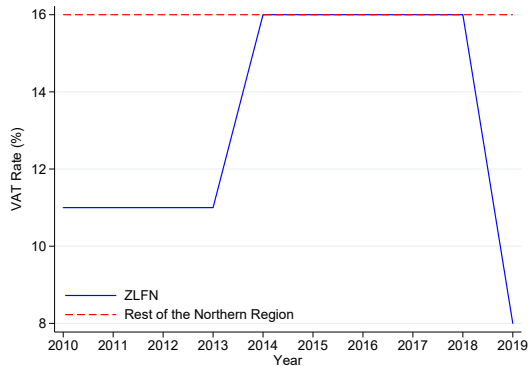
Figure: Real daily minimum wage (January 2019 pesos)



Context: The 2019 Northern Border Stimulus Policies

- At the same time, a fiscal credit of 50% of the Value-Added Tax (VAT) was introduced in the ZLFN.
  - ZLFN: 16% ↓ to 8%.
  - Rest of the country: No change.

Figure: VAT Rate



Empirical Challenges

- Traditional difference in difference comparisons would not separate the effects of the simultaneous minimum wage and VAT changes.
- There are several reasons why the impact of a higher minimum wage on prices could be different between VAT and Non-VAT goods.
  - A different degree of compliance with minimum wage regulation across industries.
  - Differences in labor market power (Azar et al., 2019; Munguia Corella, 2020)

Table: Ratios of formal to informal workers by industry. 2018 Q4.

VAT	# of industries	Mean	Percentile 25	Median	Percentile 75
Yes	24	12.11	0.74	2.08	15.38
No	5	0.48	0.16	0.18	0.22
Mixed	6	2.75	0.27	1.31	2.60

Source: ENOE, authors' calculations. Each observation is a 3-digit NAICS industry. We consider a worker informal if their employer does not contribute to social security. We exclude industry 339, Miscellaneous Manufacturing, because ENOE does not have data of workers in this industry.

Data

- Prices data: Product level microdata from the National Consumer Price Index dataset (INPC, from its spanish acronym) collected by INEGI.
  - Semi-monthly, Jan 2017 - Dec 2019.
  - More than a hundred thousand goods and services (items) at the national level.
  - Item example: “Orange soda of brand X sold by store W in Mexico City”.
  - A good (or service) is a group of items. For example: “Soda”.

- Labor market data: Social security records from the Mexican Social Security Institute (IMSS).
  - Employer-employee administrative dataset of formal workers.
  - We match the labor market data to the prices data.

Empirical Strategy

Identification strategies to estimate:

1. the effect of the minimum wage increase on the price of VAT goods;
2. the effect of the minimum wage increase on the price of Non-VAT goods;
3. the effect of the VAT reduction on the price of VAT goods.

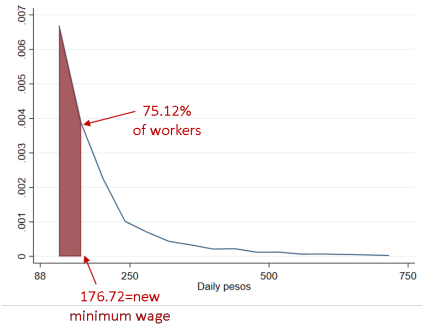
Joint estimation of the effects for standard errors.

1. Effect of the Minimum Wage Increase on the Price of VAT Goods

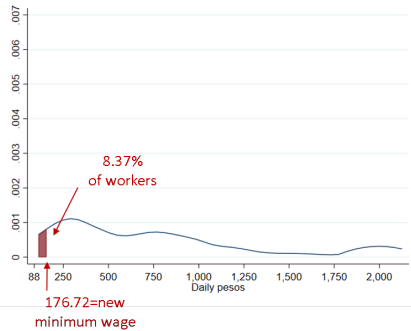
- We compare prices between sectors with a different fraction of workers "affected" by the minimum wage increase within the ZLFN.

Figure: Wage densities and fraction affected: selected sectors. Dec 2018.

(a) Food Services and Drinking Places



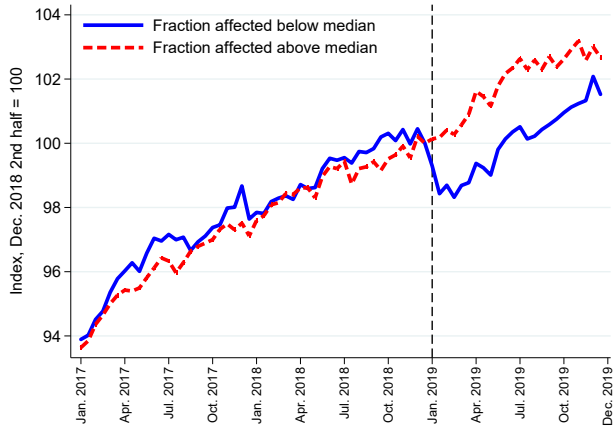
(b) Air Transportation



Source: IMSS, author's calculations. For the left panel, the x-axis is truncated at 750 pesos.

1. Effect of the Minimum Wage Increase on the Price of VAT Goods

Figure: Prices of VAT goods in the northern border (ZLFN)

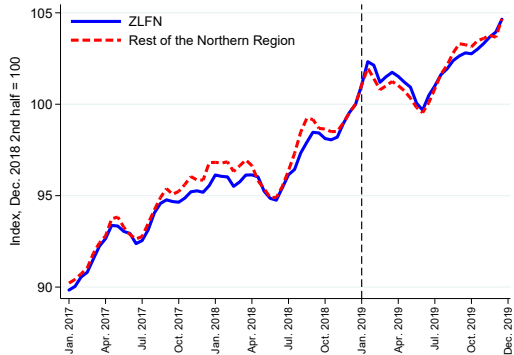


Source: Authors' calculations, Banco de Mexico, INEGI and IMSS. Each line is the simple average of price indexes across items that are subject to VAT. The average excludes the price indexes for energy, government services, housing and education. The median fraction of workers affected by the minimum wage increase across items was 18.84% in the 2nd half of December 2019. The solid line plots price indexes for items with fraction affected below the median. The dashed line plots price indexes for items with fraction affected above the median.

2. Effect of the Minimum Wage Increase on the Price of Non-VAT Goods

- We compare the behavior of prices between the border municipalities and the rest of the northern region.

Figure: Prices of Non-VAT goods in the northern border (ZLFN) and the rest of the northern region

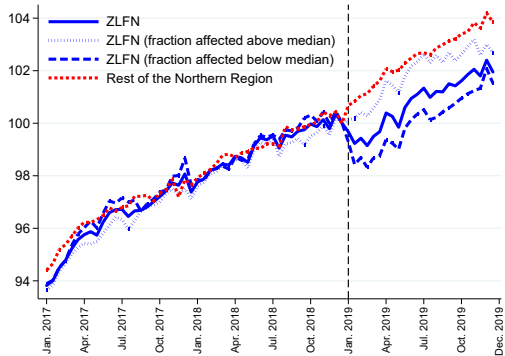


Index, Dec. 2018 2nd half = 100. Source: Authors' calculations, Banco de Mexico, INEGI and IMSS. Each line is the simple average of price indexes across goods that are not subject to VAT. The average excludes the price indexes for energy, government services, housing and education.

3. Effect of the VAT Reduction on the Price of VAT Goods

- We compare the price evolution of VAT items between the border municipalities and the rest of the northern region.
- We subtract the MW effect from 1. to obtain the VAT effect.

Figure: Price indexes for VAT goods in the northern border (ZLFN) and rest of Northern Region



Joint Estimation

$$
\begin{aligned}
Y_{jct} = \delta_0 &+ \theta_{FA}^{VAT} FA_{g(j)} \times VAT_j \times Post_t \times ZLFN_c \\
&+ \theta_{MW}^{NONVAT} Post_t \times ZLFN_c \times (1 - VAT_j) \\
&+ \theta_{VAT}^{VAT} Post_t \times ZLFN_c \times VAT_j \\
&+ \delta_1 Sale_{jct} + \delta_2 Sale_{jct} \times VAT_j + \delta_3 Sale_{jct} \times ZLFN_c \\
&+ \delta_4 Sale_{jct} \times VAT_j \times ZLFN_c + \delta_{c,g(j)} + \delta_{t,VAT_j} + \xi_{cjt}.
\end{aligned}
$$

- The variable $ZLFN_c$ is 1 in the northern border, 0 otherwise,
- The variable $FA_{g(j)}$ is the fraction affected for good g for item j,
- $Post_t = 1$ in 2019, 0 otherwise, and
- The variables $\delta_{c,g(j)}, \delta_{t,VAT_j}$ are city-good fixed effects and time effects separated for VAT an Non-VAT goods.
- Standard errors two-way clustered by city and good.

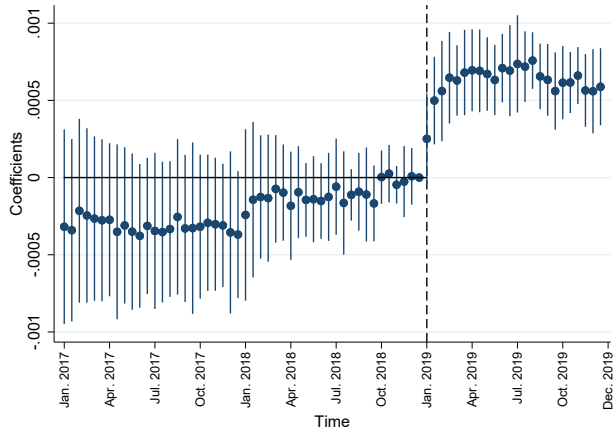
Results

Table: Joint Estimation Results

Coefficient	All goods	Food	Non-Food	Services
θ_{FA}^{VAT}	0.00084**	0.00003	0.00055***	0.00048***
	(0.00014)	(0.00033)	(0.00017)	(0.00013)
θ_{MW}^{NONVAT}	0.00244	0.00620*	-0.00602	-0.00361
	(0.00288)	(0.00333)	(0.00876)	(0.00473)
θ_{VAT}^{VAT}	-0.03910***	-0.02060	-0.0325***	-0.01300
	(0.00642)	(0.01320)	(0.00604)	(0.01130)
N	1,350,240	304,880	620,404	158,654
R^2	0.365	0.242	0.200	0.260
Time × VAT fixed-effects	Yes	Yes	Yes	Yes
City × good fixed-effects	Yes	Yes	Yes	Yes
Sale dummies and interactions	Yes	Yes	Yes	Yes
# of Sectors	36	4	19	15
Mean fraction affected	30.53	33.78	24.91	53.59
Implied θ_{MW}^{VAT}	0.02568	0.00105	0.01363	0.02588

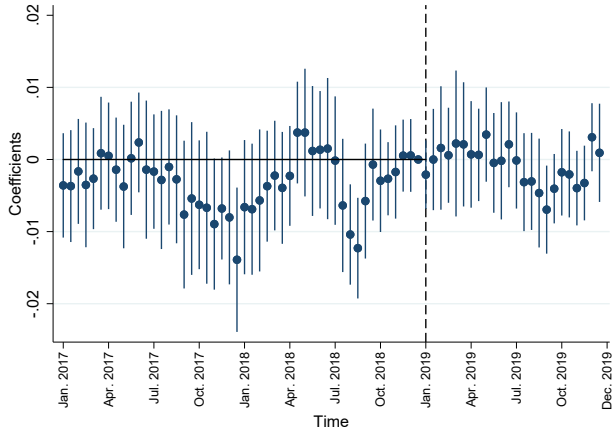
Author's calculations. Each column corresponds to a separate estimation with the goods belonging to each category. "Mean fraction affected" is the average fraction of workers affected by the minimum wage increase across VAT items in the ZLFN for this category in the second half of December 2019. "Implied θ_{MW}^{VAT}" is the product of θ_{FA}^{MW} and mean fraction affected, the average effect of the minimum wage on the price of VAT goods in the ZLFN. Standard errors two-way clustered by good and industry in parentheses. *: p<0.1, **; p<0.05, ***: p<0.01. Robustness

1. Dynamic Estimates: Minimum Wage on VAT Goods



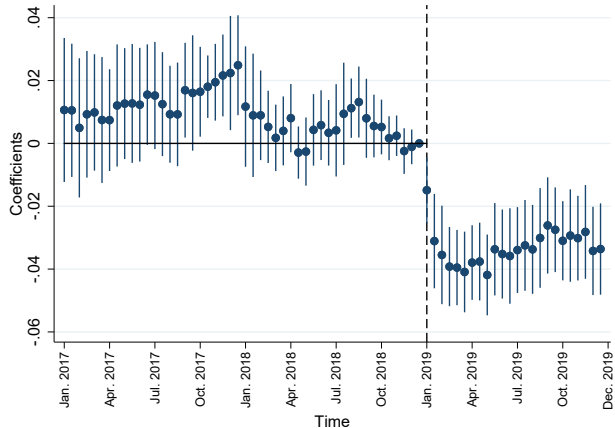
Source: Author's calculations. The dots correspond to coefficient estimates from dynamic specifications of the joint estimation. Vertical bars are confidence intervals at the 95% level. The vertical segmented line corresponds to Jan 2019, 1st half.

2. Dynamic estimates: Minimum Wage on Non-VAT Goods



Source: Author's calculations. The dots correspond to coefficient estimates from dynamic specifications of the joint estimation. Vertical bars are confidence intervals at the 95% level. The vertical segmented line corresponds to Jan 2019, 1st half.

3. Dynamic Estimates: VAT on VAT Goods



Source: Author's calculations. The dots correspond to coefficient estimates from dynamic specifications of the joint estimation. Vertical bars are confidence intervals at the 95% level. The vertical segmented line corresponds to Jan 2019, 1st half.

Heterogeneity of MW effect on VAT goods by sector informality

Coefficient	All	Low informality	High informality
	(1)	(2)	(3)
Fraction affected on VAT goods (α_1)	0.000841***	0.00161***	0.000997***
	(0.000143)	(0.000405)	(0.00015)
Minimum wage on Non-VAT goods (β_1)	0.00244	-0.00556	0.00370
	(0.00288)	(0.0092)	(0.00375)
VAT on VAT goods (δ_1)	-0.0391***	-0.0483***	-0.0483***
	(0.00642)	(0.00867)	(0.00867)
N	1,350,240	1,350,240	1,350,240
R^2	0.365	0.365	0.365
# of sectors	36	18	18
Time X VAT fixed-effects	Yes	Yes	Yes
City X Good fixed-effects	Yes	Yes	Yes
Sales dummies and interactions	Yes	Yes	Yes

Source: Column (1) shows the baseline results. Columns (2) and (3) show the effects on low-informality and high-informality sectors from a regression that interacts the minimum wage terms with a dummy variable for sectors with above-median and below-median labor informality rates. We use the average informality rate of the municipalities in the ZLFN in 2018, obtained from the National Occupation and Employment Survey (ENOE). Strictly speaking, the survey is not representative at this level, but the results are similar if we use the informality rates for Tijuana or for the State of Baja California, which are included in the ZLFN and for which the survey is representative. The coefficients on Fraction affected on VAT goods on columns (2) and (3) are statistically different at the 10% level. Standard errors clustered by good and city in parentheses. *: $p<0.1$, **; $p<0.05$, ***: $p<0.01$.

Concluding Remarks

- We find significant increases in prices in the ZLFN due to the higher minimum wage ($\hat{\varepsilon} = 0.025$) , and decreases because of the VAT reduction ($\hat{\varepsilon} = 0.49$).
- The VAT reduction more than offsets the increase in prices from the minimum wage increase. Overall Inflation Effect
- There are substantial differences in the effects of the minimum wage between VAT and Non-VAT goods, which may be due to differences in compliance with labor regulation. This is important for evaluating the effect of minimum wages in countries with labor informality.
- Higher prices are only a part of the picture to understand the impact of a higher minimum wage.

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Extras

Robustness

- More flexible fixed effects, industry-specific trends.
- VAT goods with a high fraction affected could be more likely to be sold in informal establishments prone to tax evasion.
  - If this were the case, their price would not decrease because of the VAT rate drop (overestimating the effect of the minimum wage increase).
  - However, we do not find a significant correlation between the fraction affected and the share of informal establishments at the industry level.
  - Estimates robust to time by formal establishment effects.
- There may be heterogeneous VAT pass-through.
  - Goods with higher fraction affected may be less reactive to VAT.
  - Use external VAT pass-through estimates from Mariscal and Werner (2018). No correlation with fraction affected.
  - No effect of the minimum wage on counterfactual prices with VAT effects implied by external VAT pass-through estimates.
- Results are similar if we use only cities close to the northern border as controls.

Back to Results

Overall Effect on Inflation in the Northern Border

- We estimate that both policies reduced the ZLFN's average price level by 1.37% in 2019 (-1.68,-1.05).
- The minimum wage increase accounts for a 1.13% increase (0.77,1.49) if we only consider VAT goods.
- Adding the effect on Non-VAT goods, the minimum wage accounts for a 1.2% increase (0.66,1.75)
- The VAT reduction effect on CPI from the goods in our sample is -1.84% (-2.41,-1.27)
- Adding the effect on gas prices implies an addition 0.73% decrease, for an overall effect of -2.57% (-3.14,-2.00)

Back to Conclusion