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Effects of Inflation on Poverty in Mexico

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Abstract: This paper examines the effects of inflation on poverty in Mexico, with the use of two measures of poverty: the percentage of the population living in households with per capita labor income below the nutritional poverty line, and the poverty gap. Using a panel of cities from 1993 to 2009, it estimates a fixed-effects model at the city level, and finds that inflation increases both measures of poverty. The paper explores both linear and non-linear polynomial growth effects of inflation on poverty. Both, the linear and the non-nonlinear models show a negative effect of inflation on poverty. According to the linear model, a 10% annual increase in the National Price Index generates a 9.4% growth in poverty. Considering the non-linear model, after inflation surpasses 15%, poverty shows polynomial growth in response to inflation increments. Inflation has a similar effect on the poverty gap.

Keywords: Inflation, growth and development.
JEL Classification: D24, H40, O14

Resumen: Estudio los efectos de la inflación sobre la pobreza en México. Utilizo dos medidas de pobreza: el porcentaje de la población viviendo en un hogar con un ingreso laboral per cápita menor a la línea de pobreza alimentaria y la brecha de pobreza. Utilizando un panel de ciudades de 1993 a 2009, estimo un modelo de efectos fijos de ciudad. Encuentro que la inflación aumenta las dos medidas de pobreza. Exploro efectos lineales y no lineales de la inflación sobre la pobreza. El modelo lineal y el no lineal sugieren un efecto negativo de la inflación sobre la pobreza. De acuerdo al modelo lineal, un 10% de aumento en el INPC genera un aumento de 9.4 % en la pobreza. Considerando el modelo no lineal, después de que la inflación pasa el 15 por ciento, la pobreza muestra un crecimiento polinomial con el crecimiento de la inflación. El impacto de la inflación sobre la brecha de pobreza observa un comportamiento similar.

Palabras Clave: Inflación, crecimiento y desarrollo

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1. Introduction

If wages rise more slowly than the price of the household market basket, inflationary processes can generate a reduction in real household labor income and increase the prevalence of poverty. Indeed, it has been documented that the balance of payments crisis in the 1980s and 1990s was accompanied by important inflationary processes, and consequently by decreases in real labor income (see, for example, Cardoso, 1992). Given that the main source of household income in developing countries comes from labor (Fields, 1990), it has also been suggested that inflation exacerbates poverty. Poorer families are more vulnerable to strong inflationary processes, as they have fewer income options and lack access to formal credit market.\(^1\) The income of poor households is just sufficient to cover minimum needs, and even small decreases in income can cause serious problems in the household’s economy.

According to information from the National Occupation and Employment Survey (ENOE, in spanish), in 2009 only 35% of Mexican workers were formal waged employees (with social security paid by the employer); the rest consisted of self-employed workers or informal waged employees (with no social security). Nearly all workers below the poverty line are informal. Labor regulations and collective bargaining, which could slow down the reduction in real income during inflationary processes, thus have no effect on the low-income segments of the population. This issue is an important one in the debate about the primary mandate of the Banco de México: to maintain a low rate of inflation.

\(^1\) According to the National Household Survey on Living Standards (Encuesta Nacional sobre Niveles de Vida de los Hogares) 2005 (Rubalcava and Teruel, 2008), only 35.5% of households have access to formal credit. The percentage of households with such access decreases as household income drops. A household is considered to have access to formal credit if at least one household member has a credit card or has received at least one loan from a bank or other financial institution.
This paper analyzes the effects of inflation on poverty in Mexico during the period from 1993 to 2009. Poverty, the dependent variable, is measured in two ways. The first measure is the percentage of individuals living in households where per capita real wage income is below the poverty line. The second is the poverty gap, which is the mean distance below the poverty level, as a proportion of that level; for households whose per capita labor income is above the poverty level, the gap is assigned a value of zero. Inflation, state-level GDP, and city time trends are included as explanatory variables.

The data show time variation and, because Mexico is a large, heterogeneous country, the variables also reflect regional variation. I estimate a fixed-effects model in order to take advantage of the data characteristics and control for the presence of observed and unobserved time-invariant heterogeneity across cities that can be correlated with the dependent and independent variables. The estimate shows that an increase in inflation increases poverty in Mexico. I analyze both linear and nonlinear relations between inflation and poverty. According to the linear model, a 10% annual increase in the National Price Index generates a 9.4% growth in poverty. The nonlinear relation suggests that inflation begins to affect poverty at a rate of approximately 15%; above that level, its impact increases more than proportionally. In addition, a 1% increase in GDP translates into a 1.4% reduction in poverty.

This paper is organized as follows. The next section presents a short literature review to provide a context for the study. Section 3 presents the data, a detailed explanation of the poverty measures used, and the method used to combine series from two different sources. Section 4 provides a descriptive analysis, and the model and its results are presented in Section 5. Section 6 presents a counterfactual exercise, and Section 7 some conclusions.
2. Literature review

The effects of inflation on poverty in developing countries have been analyzed in the economic development literature (Ferreira et al., 2010; Easterly and Fischer, 2001; Martínez Trigueros, 1998; Ferreira and Ravallion, 2008; Perry et al., 2006). Valero-Gil and Valero (2008) and Székely (2005) have examined the case of Mexico. A positive relation between inflation and poverty has been found in all these studies.

Ferreira et al. (2010) study the impact of inflation, welfare programs and economic growth by sector on poverty, in Brazil using data from the survey on household income and expenditures for the period 1985-2004. They use a fixed-effects econometric model with data at the city level, and find that a reduction in inflation as well as the expansion of social assistance transfers contributed to a decrease in poverty during the study period. Easterly and Fischer (2001), in a study of 42 countries from 1981 to 1993, find that inflation reduces the share of the total wage bill of the lowest quintile of the income distribution and increases poverty. Ferreira and Ravallion (2008), in a literature review of poverty, note that in India, China, and Brazil, inflation slows the rate of poverty reduction. Martínez Trigueros (1998), in a study of over 100 countries (including Mexico), found that a 10% increase in inflation translates into an 8% increase in poverty. The World Bank poverty report (Perry et al., 2006), presents evidence indicating that inflation leads to poverty increases in various developing countries. In the case of developed countries, the relation between inflation and poverty is not so clear. However, Powers (1995), in a study of the United States, establishes that inflation increases poverty when measured by household consumption.\(^2\)

\(^2\) A possible reason why the relation is less clear in developed countries may be that the depth of financial markets in these countries provides families with a degree of insulation from temporary income shocks.
The evidence for Mexico is limited. Valero-Gil and Valero (2008) study the effect of changes in food prices on poverty during the period 2006-2009 and find that higher prices translate into greater poverty. Székely (2005) establishes a positive correlation between inflation and poverty. The purpose of this paper is to contribute to this limited evidence regarding the impact of inflation on poverty in Mexico. The data used also make it possible to compare the effects of the 1995 crisis (GDP -6.2%) and the 2009 crisis (GDP -6.1%). The drop in GDP was similar in both crises. However, as the next section will show, the increase in poverty in 2009 was lower. This is the first study that considers the most recent economic cycle in an analysis of the relationship between inflation and poverty.

3. Data

The National Survey of Household Income and Spending (ENIGH, in Spanish) is generally used to measure poverty in Mexico because it contains information of both, monetary and non-monetary total income. Monetary income includes labor income, remittances, other household transfers, rents, government transfers, and other categories. Census data is also used in poverty analysis in Mexico. For example, Hanson (2007) uses the population and housing censuses of 1990 and 2000, while Cortés et al. (2003), Valero-Gil and Valero (2008), and Goñi, López, and Servén (2006) compile poverty statistics with data from the ENIGH. Székely (2005) makes use of the ENIGH, the population census, and other household surveys taken at irregular intervals. However, ENIGH and Census data contains only low-frequency data. ENIGH is generally carried out every two years, which makes poverty analysis across
economic cycles difficult and reduces the amount of available data needed for this study.3 On the other hand, the National Survey of Urban Employment (ENEU, in Spanish) and the ENOE, provide detailed information on household members’ labor income every quarter since 1988.4 Given that I am interested in studying poverty and inflation throughout the economic cycle, I use ENEU for the period 1988-2004 and ENOE for 2005-2010. The ENEU and ENOE surveys contain only labor income information. This is a disadvantage. However, I argue that to estimate poverty using only labor income is relevant too for several reasons: 1) using decomposition methodologies, it has been demonstrated that inequality in labor income is more important than inequality from all other sources of income combined as an explanation of total inequality (Fields, 2004); 2) in general, poor people in developing countries obtain little income from sources other than employment; 3) labor income plays an important role in social mobility (Fields, 2004); 4) despite the increase in government transfers to poor households in recent years, the only way to increase household income in the long term is by increasing labor income. Therefore, Fields (various works) and Hanson (2007), among others, have used labor income in their analysis of poverty.

I obtained State-level GDP data from INEGI’s national accounts statistics, and the data on inflation at city level from the Banco de Mexico.5 I link the cities with their correspondent state to match inflation and GDP data. GDP data at state level for the period of study is only

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4 The ENEU was carried out from 1987 to 2004. In 2005 it was replaced by the ENOE.

5 The GDP data used in this paper correspond to the INEGI GDP series at 2003 prices. INEGI has updated the GDP series to 2008 prices, reflecting the new economic structure. The disadvantage of this update is in the measurement of prior years: the greater the distance from the base year, the less accurate is the measurement of GDP (INEGI, 2015). I decided to work with the 2003 series because that year is closer to the midpoint between the 1995 and 2009 crises. These crises were fundamental to identification of the effects of interest, and it is therefore necessary to have comparable measures for each crisis. However, the results with the GDP series at 2008 prices do not differ qualitatively from those presented in this paper.
available with annual frequency. Therefore, regressions include annual frequency data. However, all descriptive data presented in this paper have quarterly frequency.

**Poverty measurement**

Two measures of wage poverty are constructed. The first is the percentage of individuals in a city living in households in which per capita real labor income is less than the real value of the basic food market basket defined by the National Council for the Evaluation of Social Development Policy (CONEVAL) (Annex 1). The second is the poverty gap, the mean per capita labor income of all households below the poverty line in a particular city and quarter, as a percentage this mean represents to the poverty line level. The poverty gap complements traditional poverty measures since it considers the average income of households below the poverty line and therefore provides an idea of the intensive margin of poverty in a particular city. In Mexico, the official poverty measure is defined by the CONEVAL, and is calculated using both monetary and non-monetary total income. Monetary income includes labor income, remittances, other household transfers, rents, government transfers, and other categories. Non-monetary income includes items such as production for own consumption and imputed rent on housing. CONEVAL also publishes a measure of labor income poverty using a methodology similar to that used in this study. In Annex 2, I present a comparison between both series. Even though the set of cities is not exactly the same between the two measures of poverty, the evolution of both series is similar. Household per capita income is calculated as the sum of the labor income of all household members divided by the number

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6 The National Council for the Evaluation of Social Development Policy (CONEVAL) is an independent federal agency that provides data on poverty and social policy in Mexico.
of persons in the household. Nominal incomes are deflated using the Consumer Price Index (CPI). The period base is 2008. Thus, a household is considered to be below the poverty line if its monthly per capita income is less than MXN 949.50 in 2008 pesos. It should be noted that the results of this study do not depend on the poverty threshold.

**Comparability of the ENEU and the ENOE**

The data used in this study are from ENEU, from the first quarter of 1988 to the fourth quarter of 2004. At that point ENEU was replaced by ENOE, from which data was taken from the first quarter of 2005 through the fourth quarter of 2009. Both surveys were conducted on a quarterly basis at the household level. However, there were methodological differences and changes to the questionnaires that require significant adjustments to make the data comparable.

The first problem lies in changes in the conceptual framework and measurement in ENOE. These changes include a difference in the identification of individuals as employed. In ENEU, the classification of being employed mainly depended on the respondents: respondents indicating that they had worked during the reference week were considered employed. In ENOE, however, only “labor service providers or suppliers” (INEGI, 2005) are considered to be employed. This definition implies a demand for the labor services offered by workers. Thus, unlike the ENEU, the ENOE does not consider such persons as windshield washers, car washers, or street performers as part of the employed population (even if such

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7 To calculate this average, all household members were counted, including children. Alternatively, children could be assigned a smaller weight to account for children's lesser food consumption (for example, children under 12 could be assigned half the weight of adults). Similar results were obtained in regressions using weighted data.

8 Different robustness tests were implemented, varying the level of the poverty line, with no significant change in results.
respondents identify themselves as employed). These occupational categories are considered by the ENOE to be “disguised begging,” and the income of these individuals is counted as transfers between households. In order to obtain a consistent series over time, such persons who are not counted in ENOE as being employed are thus excluded from ENEU sample. Another important difference has to do with age and urban characteristics. ENEU considers that an individual can be economically active from the age of 12, while INEGI raised this age to 14 in ENOE. Consequently, the present study excludes workers aged 12-13 from the ENEU data. Also, throughout the study period, various cities were added or removed from the sample. Thus, the results could be biased if a group of cities with particular features (e.g., cities in the north of Mexico) was added or removed from the sample in a given quarter. Therefore, cities that were not included in the surveys throughout the entire period of study were taken out of the sample. Only data from urban areas is included, because rural areas were added to the labor survey beginning only in the second quarter of 2000. Then, this study does not include rural and isolated communities where poverty is more prevalent. However, this paper only considers urban data because it is crucial for this study to have a long time span in order to analyze inflation through the economic cycle.

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9 They are the employed with the codes 7212, 7213, and 7219 of the Mexican Classification of Occupations (CMO). They include windshield cleaners, car washers without an establishment, and street performers such as clowns and jugglers, who work on public streets.

10 The following cities are included: Acapulco, Aguascalientes, Campeche, Chihuahua, Colima, Cuernavaca, Culiacan, Durango, Guadalajara, Hermosillo, Leon, Merida, Mexico City (Distrito Federal), Monterrey, Morelia, Oaxaca, Puebla, Querétaro, Saltillo, San Luis Potosí, Tampico, Tepic, Tijuana, Toluca, Tuxtla Gutiérrez, Veracruz, Villahermosa and Zacatecas. Both, ENEU and ENOE are representative at city level. These cities represent about 80% of the population of cities with more than 15,000 inhabitants. Irapuato, Tlaxcala, Cancun, La Paz, Ciudad del Carmen, Pachuca and Mexicali are excluded because do not remain in the sample throughout the full period of study.

11 The National Employment Survey (ENE) was implemented from the second quarter of 2000 to the fourth quarter of 2004, simultaneously with the ENEU. Both surveys were replaced by the ENOE in the first quarter of 2005. The ENE included rural areas.
4. Descriptive analysis

Figure 1 presents the annual change in poverty and GDP in Mexico from 1993 to 2010. It shows similar annual GDP decreases in the 1995 and the 2009 crises (8.8% and 9.6%, respectively), considering the quarters of each with the greatest decrease (the average annual decreases were 6.2% and 6.1%, respectively). However, poverty increased considerably more in 1995 than in 2009 (40.3% vs. 18.7%, in the quarters of greatest decrease during each crisis). Furthermore, poverty grew for a longer period of time in 1995 than in 2009, and at a greater rate after the point of maximum annual change.

Figure 1. Real GDP and percentage of poverty

(Annual change in percent)

*Right-hand axis shows inverted scale.
Source: Author's calculation with data from INEGI. Average poverty of cities of the sample used in this paper. Real GDP at 2003 prices. The data on poverty are from a regression of the sample used in this study.
The preliminary evidence explaining this pattern of GDP and poverty can be found in the evolution of inflation. Figure 2 shows the evolution of inflation and poverty from 1993 to 2010. In the 1995 crisis, annual inflation reached its highest point of 48.7% in the fourth quarter of that year. In the 2009 crisis, the CPI trend increased slightly, but this rise was much smaller in relative terms than that observed in 1995. Given the similar decrease in GDP in 1995 and in 2009, the much greater increase in poverty in 1995 than in 2009, inflation seems to be a factor that impacted the poverty level. In addition, this important variation over the period of study could benefit the estimation of coefficients.

Figure 2. CPI and percentage of poverty

(Annual change in percent)

Source: Author's calculation with data from the Banco de México and INEGI. Average poverty of cities of the sample used in this paper.
In order to further illustrate this relationship between inflation and poverty, Figure 3 presents a comparison of the evolution of GDP, the CPI, and the percentage of poverty in the two crises. The index for each variable has as its base the quarter in which the last annual increase in GDP was observed prior to the crisis. As the figure shows, the evolution of GDP was similar in both crises. In contrast, the CPI and the percentage of poverty followed different trajectories during both crisis. In 1995, the CPI registered a cumulative increase of approximately 100% in the ten quarters after the onset of the crisis, while poverty showed an increase of approximately 90% in the first seven quarters. In the 2009 crisis, however, the CPI increased moderately, approximately 6% in the four quarters after the onset of the crisis, and poverty reached a maximum annual increase of 18% over a similar period.
Figure 3. Comparison of the 1995 and 2009 crises: GDP, CPI, and percentage of poverty

(Index: 1994.IV = 100 and 2008.III = 100)

Source: Author's calculation with data from the Banco de México and INEGI. Average poverty of cities of the sample used in this paper.

5. Econometric model

The data present time variation and, because Mexico is a large, heterogeneous country, they also present regional variation. In order to take advantage of the data characteristics and control for the presence of observed and unobserved time-invariant heterogeneity across cities, which could be correlated with poverty and inflation, I estimate a fixed-effects model at the city level.\(^{12}\) I use two measures of poverty as dependent variables, and inflation by city

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\(^{12}\) Variables that may be correlated with both, inflation and poverty at regional level not included in the control variables represent a threat to this identification strategy. However, in order to bias the results, these variables must change significantly during the period of study. In panel fixed effects models, only variables that present meaningful change during the period of study contribute with information to the regression. For example, regional infrastructure could cause lower inflation and lower poverty, nevertheless is unlikely that this variable fluctuates significantly during the period of study. As a result, even if infrastructure is correlated with the variables of interest, do not represent a source of bias. This precisely the main advantage of panel fixed effects model.
and regional GDP as independent variables. City time trends are also included. All continuous variables are in logarithms. Standard errors are clustered at the city level. A similar identifying strategy has been used in other studies about inflation and poverty (see, for example, Ferreira et al., 2011 and Ravallion and Datt, 1996); these studies, however, analyzed only linear effects. GDP data at state level is available only at annual frequency, therefore, annual frequency data is used in the regressions.

As observed in the descriptive statistics, Mexico during the study period went through stages of high price volatility and high levels of inflation, with an evident positive correlation between inflation and poverty, followed by periods of low and stable inflation. As this could suggest a non-linear relation between the variables of interest, linear and non-linear specifications are estimated. Equation (1) shows the model estimated in this study:

$$\Delta \ln Pob_{it} = \gamma_1 \Delta \ln CPI_{it} + \gamma_2 \Delta \ln CPI^2_{it} + \gamma_3 \Delta \ln GDP_{it} + \gamma_4 t trend_i + \pi_i + u_{it}$$ (1)

where:

- $i t$ is city and time;
- $Pob_{it}$ is one of the two poverty measures;
- $CPI_{it}$ is the consumer price index in the city $i$;
- $GDP_{it}$ is the state GDP corresponding to the city $i$;
- $t trend_i$ is a time trend specific to each city; and
- $\pi_i$ is the fixed effect by city.

The prefix $\Delta$ denotes the change from one year to the next, therefore the variable $\Delta \ln CPI_{it}$ is inflation, and $\Delta \ln GDP_{it}$ is the annual growth rate of a particular state. This is a commonly used specification (see, for example, Ravallion and Datt, 1999, and Ravallion, 2006) and simplifies the interpretation of the coefficients.
Results

Columns 1 to 5 of Table 1 present five regressions with the percentage of poverty as a dependent variable. In Columns 6 to 10 the poverty gap is a dependent variable. For each measure of poverty, controls are added sequentially. The basic specification includes only inflation. In subsequent regressions, inflation squared (non-linear model), a general trend, and a city trend are added.

The results show several interesting features. First, inflation increases the percentage of poverty and the poverty gap, an effect that is robust to different specifications. In particular, the linear model indicates that 10% increase in inflation generates a growth in poverty of approximately 9.4%. The same change in inflation increases the poverty gap in 11.8%. This result suggests that inflation affects relatively more households below the poverty line. This is consistent with published evidence for Mexico, which describes a disproportionate effect of inflation on the poor (Goñi, López, and Servén, 2006, and Valero-Gil and Valero, 2008).

Table 1: Fixed-effects regressions with poverty as a dependent variable, 1993-2009

<table>
<thead>
<tr>
<th></th>
<th>Percentage of Poverty</th>
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<th>Povery Gap</th>
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<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
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<td>(10)</td>
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<td>Inflation</td>
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<td>-1.739***</td>
<td>-1.516***</td>
<td>-1.627***</td>
<td>1.176***</td>
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<td></td>
<td>0.0129***</td>
<td>0.00549***</td>
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<td>(0.00166)</td>
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<td>(0.00157)</td>
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<tr>
<td>Constant</td>
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<td>-0.0943***</td>
<td>-0.0850***</td>
<td>-0.0174</td>
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<td>(0.00218)</td>
<td>(0.0078)</td>
<td>(0.0440)</td>
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</table>

Notes: Annual frequency data. Cities included in the regression: Acapulco, Aguascalientes, Campeche, Chihuahua, Colima, Cuernavaca, Culiacan, Durango, Guadalajara, Hermosillo, León, Merida, Mexico City (Distrito Federal), Monterrey, Morelia, Oaxaca, Puebla, Querétaro, Saltillo, San Luis Potosí, Tampico, Tepic, Tijuana, Toluca, Tuxtla Gutierrez, Veracruz, Villahermosa, and Zacatecas.
The main results are robust to the inclusion of diverse controls: general trend (equation 3), GDP by state (equation 4), and in place of general trend, the inclusion of a trend by state (equation 5). Among the equations that include the squared inflation term, the preferred estimation is the number 5 because including a trend by state further contributes to capture regional heterogeneity, results in an increased $R^2$, and does not notably change the significance of the rest of the variables.

It is important to emphasize that the main motivation for estimating the quadratic model is to analyze in more detail the relationship between inflation and poverty during periods of high inflation and volatility, such as the one observed during 1995 in Mexico. Furthermore, macroeconomic stability cannot be taken as granted neither in Mexico nor in any other country. Macroeconomic stability is achieved through a sustained period of responsible fiscal and monetary policy. Unfortunately, we can see recent examples of countries in Latin America that lost this macroeconomic stability with severe consequences for inflation, which reached two-digit levels, as well as important increases in poverty. In order to further analyze the impact of inflation on poverty in the non-linear model, Figure 4 presents the quadratic function of inflation of specification (5):

$$\Delta lnPob_{it}=0.02-1.627*\Delta lnCPI_{it}+8.749*\Delta lnCPI_{it}^2$$

This figure allows us to analyze the effects of inflation on poverty at different inflation levels. According with the non-linear model, it can be seen that inflation starts to affect poverty when it reaches a rate close to 15%. Above inflation of 15% level, as inflation increases, its impact on poverty grows more than proportionally.
Another important result is that the elasticity of the two poverty measures to changes in the state GDP is greater than 1. A 10% increase in the state GDP reduces poverty by 14% and the poverty gap by 17%. This highlights the importance of economic growth in reducing poverty.

In sum, the results indicate that inflation is an important determinant of poverty. In accordance with the non-linear model, which best fits the data, when inflation is at relatively low (one-digit) levels, it has no significant effects on poverty. However, when it reaches two-digit levels, it has an increasing effect on poverty. These results reinforce the importance of maintaining low levels of inflation, particularly in developing countries characterized by a high prevalence of poverty. Indeed, the informal employment of many families in developing countries like Mexico, with low income and no access to credit (see, for example, Alcaraz, Chiquiar, and Ramos Francia, 2011), makes them especially vulnerable to price increases.
6. **Counterfactual exercise**

The interpretation of coefficients can be difficult in nonlinear models. In order to gain a better intuitive understanding of the effects of inflation on poverty, I perform a counterfactual analysis. Using estimated coefficients of the equation that corresponds to column (5) of Table 2 I obtain the fitted values using the original historical data, and then I modify the inflation data following two criteria: 1) *What if Mexico did not experience an inflationary process during the crisis of 1995?* From 1995 to 2001, in each city where inflation continues with a downward trend, I kept the observed inflation figures after 2001. 2) *What if the economic crisis of 2009 came with an inflationary process similar to that observed in 1995,* each city experienced inflation similar to that observed in 1995 (see Figure 5). In both cases, I maintain the observed GDP values. I obtain the fitted values corresponding to these two counterfactual scenarios, and I compare the fitted values from each exercise with the fitted data obtained from the original series. I obtained the fitted total levels of poverty by estimating the fitted values for each city and aggregating the data weighted by the population of each city. The results of these exercises are shown in Figures 6a, 6b, and 6c.
Figure 6a presents actual and fitted values of equation (5) of Table 2 with original data. The model predicts reasonably well the increase in poverty observed in the 1995 and 2009 crises. For 1995, it captures the fact that poverty increased as a result of the reduction in GDP and a strong increase in inflation. In 2009, poverty levels rose again as a consequence of the reduction in GDP (similar to the observed in 1995) and inflation increased, but only marginally, remaining below five percent. The model underestimates the observed reduction in poverty from 2001 to 2003, but beginning in 2004 it predicts the observed stabilization of poverty levels. Figure 6b shows the fitted values assuming counterfactual (1). Under these assumptions, poverty would have increased in 1995 as a consequence of GDP reduction, but at much lower levels that the poverty observed in that year. Predicted poverty subsequently shows a downward trend until 2000. It should be emphasized that this reduction is attributed to the strong economic growth observed beginning in 1996. This growth was motivated in part by the depreciation of the peso, which fostered exports while reducing imports. The predicted values of poverty show a mild increase in 2002 and 2003, as a consequence of the
weak economic performance observed in this period, and again in 2009 as a result of the economic crisis. Table 2 shows the difference between the fitted values of the model with the original data and the two counterfactual exercises. The persistence of the high level of poverty observed after the 1995 crisis means that the cost of the high inflation in that crisis lasted until the beginning of the 2000s, by which time inflation converged to a stable path (see Figure 2). Finally, Figure 6c shows counterfactual exercise (2): if the 2009 economic crisis had been accompanied by an inflationary process similar to that registered in 1995, poverty would have increased 8 percentage points more compared to the observed trajectory (see Table 2).

Figure 6.

a) Observed and fitted data from regression 5
% Poverty

b) Fitted data assuming low inflation since 1995
% Poverty

c) Fitted data assuming the 2009 crisis had the inflation observed in 1995
% Poverty

Source: Author’s calculations.
Table 2: Differential with respect to fitted value (percent poverty)

<table>
<thead>
<tr>
<th>Year</th>
<th>Counterfactual: low inflation since 1995</th>
<th>Counterfactual: 2009 crisis with 1995 inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1995</td>
<td>-9.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1996</td>
<td>-22.4</td>
<td>0.0</td>
</tr>
<tr>
<td>1997</td>
<td>-19.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1998</td>
<td>-18.3</td>
<td>0.0</td>
</tr>
<tr>
<td>1999</td>
<td>-16.5</td>
<td>0.0</td>
</tr>
<tr>
<td>2000</td>
<td>-15.1</td>
<td>0.0</td>
</tr>
<tr>
<td>2001</td>
<td>-11.7</td>
<td>0.0</td>
</tr>
<tr>
<td>2002</td>
<td>-7.6</td>
<td>0.0</td>
</tr>
<tr>
<td>2003</td>
<td>-5.3</td>
<td>0.0</td>
</tr>
<tr>
<td>2004</td>
<td>-3.7</td>
<td>0.0</td>
</tr>
<tr>
<td>2005</td>
<td>-4.5</td>
<td>0.0</td>
</tr>
<tr>
<td>2006</td>
<td>-3.2</td>
<td>0.0</td>
</tr>
<tr>
<td>2007</td>
<td>-2.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2008</td>
<td>-0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2009</td>
<td>0.3</td>
<td>8.2</td>
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</table>

Two relevant important conclusions may be drawn from the counterfactual exercise. First, the strong inflationary process observed as consequence of the balance of payments crisis of 1995 did not immediately dissipate, but took some years to return to stable low levels; as a result, poverty levels remained high and it took seven years to reduce poverty to levels similar to those observed before the crisis. This was true even though GDP recovered in less than two years. Second, although poverty increased in 2009 as a consequence of the severe economic crisis, it would have increased an additional 8 percentage points if that crisis had included high inflation.

7. Conclusions

I estimate the effects of inflation on poverty in Mexico, using a fixed-effects model at the city level, exploring linear and non-linear relationships. In addition to inflation, regional GDP growth and time trends by city are included as explanatory variables. The
results of different specifications consistently show that inflation increases two measures of poverty. The linear model suggests that a 10% inflation translates into an increase in poverty of 13% and a growth of 17% in the poverty gap. The non-linear model, suggests that in an economy, when inflation crosses the 15% mark, it begins to show an effect, and from that level on, as inflation grows its effect on poverty increases more than proportionally. Another finding worth noticing is that a 1% increase in GDP reduces poverty by 1.4%.

Mexico and other Latin American countries have registered low inflation for the past several years. Nevertheless, this situation should not be taken for granted. Extended periods of low inflation requires strict fiscal discipline and a monetary policy specifically aimed at containing inflation. Some Latin American countries, such as Argentina and Venezuela, have recently registered two-digit inflation levels, which could considerably increase poverty in these countries. The results of this study underline the importance of monetary policy implemented by the central banks of developing countries to control poverty and maintaining conditions for economic development. Finally, it is also relevant to note that low and stable inflation alone cannot fade poverty. In addition of a stable macroeconomic environment it is required a set of structural reforms aimed to mitigate market failures that hamper social mobility and economic growth see for example Chiquiar and Ramos Francia (2009) and Perry et al. (2006).
References


Annex 1
Base Food Market Basket
(Consumption per person)

<table>
<thead>
<tr>
<th>Item</th>
<th>Consumption (g/day)</th>
<th>Unit cost ($/100g)</th>
<th>Daily cost</th>
<th>Item</th>
<th>Consumption (g/day)</th>
<th>Unit cost ($/100g)</th>
<th>Daily cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average cereals and cereal products</td>
<td>284</td>
<td>2.08</td>
<td>5.90</td>
<td>Average fats and oils</td>
<td>34</td>
<td>3.91</td>
<td>1.33</td>
</tr>
<tr>
<td>Tortillas and corn products</td>
<td></td>
<td></td>
<td></td>
<td>Fats and oils</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat flour</td>
<td></td>
<td></td>
<td></td>
<td>Average roots and tubers</td>
<td>46</td>
<td>2.09</td>
<td>0.96</td>
</tr>
<tr>
<td>Pastry (pan dulce)</td>
<td></td>
<td></td>
<td></td>
<td>Potatoes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>White bread</td>
<td></td>
<td></td>
<td></td>
<td>Average legumes</td>
<td>62</td>
<td>2.24</td>
<td>1.39</td>
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<tr>
<td>Breakfast cereal</td>
<td></td>
<td></td>
<td></td>
<td>Beans</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cookies and crackers</td>
<td></td>
<td></td>
<td></td>
<td>Other dried legumes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pasta for soup</td>
<td></td>
<td></td>
<td></td>
<td>Average vegetables</td>
<td>103</td>
<td>2.59</td>
<td>2.67</td>
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<tr>
<td>Rice</td>
<td></td>
<td></td>
<td></td>
<td>Fresh vegetables</td>
<td></td>
<td></td>
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<tr>
<td>Prepared rice and other prepared cereals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Average meats</td>
<td>110.4</td>
<td>6.98</td>
<td>7.71</td>
<td>Average fruits</td>
<td>115.7</td>
<td>1.43</td>
<td>1.65</td>
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<td></td>
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<td>Pork</td>
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<tr>
<td>Poultry</td>
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<tr>
<td>Fish and seafood</td>
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<tr>
<td>Average dairy products</td>
<td>165.4</td>
<td>2.30</td>
<td>3.80</td>
<td>Average sugars</td>
<td>58</td>
<td>1.90</td>
<td>1.10</td>
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<tr>
<td>Milk</td>
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<td></td>
<td></td>
<td>Cane sugar</td>
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<td>Other dairy products</td>
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<td></td>
<td></td>
<td>Honey and other sweeteners</td>
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<tr>
<td>Average eggs</td>
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<td>2.56</td>
<td>1.15</td>
<td>Average processed foods</td>
<td>15</td>
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<td>Eggs</td>
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<td></td>
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<tr>
<td>Total daily cost</td>
<td>31.65</td>
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<td></td>
<td>Average soft drinks</td>
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<td>3.33</td>
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<td>Total monthly cost</td>
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<td></td>
<td>Soft drinks</td>
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</table>

Note: The base period used by CONEVAL is the month of August 2008, while in the present study the base is the annual average for 2008. The daily cost is the sum of the basic market basket items. The monthly cost is the daily cost multiplied by 30.
Source: Author's calculation with data from the Banco de México and CONEVAL.
* Poverty is the average poverty estimated in this paper. Includes the following cities: Acapulco, Aguascalientes, Campeche, Chihuahua, Colima, Cuernavaca, Culiacán, Durango, Guadalajara, Hermosillo, León, Mérida, Mexico City (Distrito Federal), Monterrey, Morelia, Oaxaca, Puebla, Querétaro, Saltillo, San Luis Potosí, Tampico, Tepic, Tijuana, Toluca, Tuxtla Gutiérrez, Veracruz, Villahermosa, and Zacatecas.

Note: Coneval’s indicator of labor poverty is representative at national level and includes rural and urban areas (see http://www.coneval.org.mx/Medicion/Paginas/ITLP_ITLP_IS.aspx)