Minimum Wages in Colombia: Holding the Middle with a Bite on the Poor

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Abstract

This paper exploits the long history of the minimum wage in a relatively stable developing economy like Colombia in order to see whether it may alleviate the living conditions of low income families and reduce income inequality. The paper does not only explore how the minimum wage may serve these purposes, but also how it may distort market outcomes to do so. We found significant negative minimum wage effects on both the likelihood of being employed and hours worked for all family members, being it stronger for women, and the young and less educated people. We also found a positive effect on non-head participation especially in families with low human capital. But, more important, we found evidence that the minimum wage ends up being regressive, improving the living conditions of families in the middle and the upper part of the income distribution with net losses for those at the bottom.

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1. Introduction

The Colombian economy, as well as many others in Latin America, has seen in the recent past higher rates of unemployment, an expansion of the informal sector and an increase in poverty and inequality as well as a more volatile macroeconomic environment. As a response, important reforms have been pushed for to make the labor market more flexible and to bring in new tools that warrant social protection without tampering the efficiency brought about by market forces. One institution that seem to survive these trends is the minimum wage.

Much of the empirical work on the minimum wage has focused on its impact on unemployment, however little work has been done to assess its distributional properties. As Freeman (1996) puts it "Minimum wage is not a panacea to poverty and low wages. It does not, in general, increase national output or the rate of growth. It redistributes income." This paper explores not only how minimum wages may serve this purpose but also how it may distort market outcomes to do so.

The justification for minimum wage regulation mostly comes from the intention to provide income support to the poor. In many developing countries, unskilled wages are a higher proportion of income of poor urban people than in developed countries where the poor are more likely to benefit from social income (Lustig and McLeod, 1997). Thus the minimum wage may have a relatively bigger impact in developing economies and may help lifting low income families out of poverty.

Minimum wage laws are routinely used in countries with very different economic and social situation (Shaheed, 1994). In developing countries, minimum wage laws generally apply to a small formal sector and compliance is usually difficult to implement.

However, in Latin America, it has been found that the minimum wage has a strong "spill-over" effect affecting the whole wage distribution, not just those wages around the minimum wage. Furthermore, it does not only change the distribution of wages in the formal sector but also those in the informal sector, acting as a "numerary" in labor contracts (Maloney and Nuñez, 2000 and Neri, Gonzaga and Camargo, 2000).

The large potential of minimum wages to shape the wage distribution, is particularly marked in the Colombian case where there is a clear cliff in the wage density at the minimum wage shifting part of the mass below it towards higher labor incomes. However, there is also evidence of a large unemployment effect.

Attempts have being done to put together employment losses and income gains in order to assess the net contribution of minimum wages as an institution to fight poverty. Most of this work has been based on simulations (Brown, 1996), although recently an alternative approach has been taken which looks at family incomes and poverty. This approach has the advantage of unifying both effects bringing forth the net effect of minimum wages in improving the living conditions of low income families.

We take advantage of the long history of the minimum wage as an institution in the Colombian labor market by looking at the period 1984-2001 which has witnessed important fluctuations in the minimum wage. Using panel data for the seven largest Colombian cities we find a positive effect of minimum wage on family incomes although it is significant only for households above the 20th percentile of the family per-capita income distribution. For those below it, between 10th and 20th percentile, the effect is not significant. More important, those at the bottom of the distribution have significant losses as the likelihood of being poor increases with raises in minimum wages.

The asymmetric effect of the minimum wage along the distribution of family incomes generates an important distributive effect widening the distance between those families at the bottom of the distribution relative to the median income family.

At the individual level, as expected, the minimum wage has a strong effect around the minimum but none, if not a negative effect, for those individuals below the 35th percentile of the individual income distribution with evidence of a spill over effect in the upper part that monotonically decreases toward the top.

The strong negative effect at the bottom of the distribution of the family per-capita incomes as well as some indication of a negative effect for low income workers is backed up by strong evidence of a negative effect of the minimum wage in the likelihood of the household head being employed and in his/her hours worked.

Likewise, non-head members see their hours worked reduced and their unemployment and participation rates increased with increases in the minimum wage. Furthermore, the unemployment effect for non-head members is stronger and the participation effect is weaker the higher the family's human capital.

These results confirm the predictions derived by a model of a labor market segmented by the minimum wage. It not only reallocates workers between the covered and uncovered sectors, but also increases the chances of being unemployed and distorts the household decisions on labor participation. Although the net welfare effect depends on wage elasticities, the evidence suggests that it ends up hurting the living standards of the poor in the Colombian case although lifting the incomes of families in the low- middle and the upper part of the distribution.

This paper is divided into 6 sections. This introduction; a discussion of the distributional effects of minimum wages; a review of the evidence regarding the potential

distributional and poverty alleviation gains that minimum wages may induce; a brief descriptive section of the data used; a fifth section with the results and, finally, some general conclusions.

2. Redistributive Effects of Minimum Wages

Freeman (1996) argues that "the redistributive effects of a minimum wage depend on the labor market and redistributive system in which it operates, on the level of the minimum and its enforcement. At best, an effective minimum wage will shift the earnings distribution in favor of the low-paid…at worst, minimum wages reduce the share of earnings going to the low-paid by displacing many from employment".

Theory leads to no clear predictions as to the effect of the minimum wage on poverty. In the standard neoclassical model, unemployment increases if the wage is exogenously raised: the higher the minimum wage, the higher the cost of production and therefore the lower the demand for work. On the supply side, the higher the minimum wage the higher the potential returns to work compared to the reservation wage and, hence, the more the participation in the labor market.

When a covered and an uncovered sector coexist the effect of the minimum wage becomes cumbersome. As Fields (1994) showed, increases in the minimum wage reduce employment in the covered sector. Workers loosing their jobs in this sector will either work in the uncovered sector or drop out of the labor force as discourage workers, pursuing some non-work alternatives such as school, or unpaid work, depending on their reservation wage. As some of them will still search for a job in the uncovered sector, the equilibrium wage will fall and therefore the employment level will rise in this sector. The final effect will

depend on the elasticity of the labor demand in the covered sector, the elasticity in the uncovered sector and the size of the minimum wage rise (see also Agénor and Aizenman, 1999).

Another possibility is the case of monopsony firms with some market power in the labor market which are price takers in the product market. Such market power may be the result of the firm being the solely employer in the market or of searching conditions. In this case, firms face higher marginal labor costs as they increase their demand, i.e. they face an upper sloping marginal cost of labor. The minimum wage flattens out this curve making it profitable to increase employment as the minimum raises (to a point in which it will reduce it).

A model that closely mimics the predictions of the monopsony model is based on efficiency wage theory. The upper sloping marginal cost curve is derived from a monitoring technology which makes it more difficult to control individuals in the firm as the payroll increases. As a result, the firm uses efficiency wages to induce voluntary effort. Therefore, the introduction of a minimum wage might induce an increase in productivity (less monitoring) which will shift the demand upward and increase the equilibrium level of employment. [1]

Firms can also adjust to minimum wage increases by making conditions harder for workers with marginal productivities below the minimum wage without necessarily firing them (Fraja, 1999). They could also offset the effect of the minimum wage by reducing non-wage compensation (Fraja, 1996). In fact, firms may prefer paying the minimum wage but avoiding other non-wage compulsory contributions by going informal.

[1] See Card, D. and Krueger, A. B. (1994, 1995a, 1995b), Azam (1992) and Robbins (2002) for studies of a positive effect of the minimum wage on employment (the last one in the Colombian case).

A rise in the minimum wage may also decrease the labor supply of other members of the household not affected by the rise and thus contribute to the reduction of unemployment. It might also provide efficiency gains as the reservation wage goes up inducing better productivity matches between firms and workers (Basu, Genicot, and Stiglitz, 1999 and Teulings, 2000).

On the other hand, minimum wages increase the income of those workers whose contracts are pegged to it. If the increases are concentrated in secondary earners belonging to families above the poverty line the minimum wage weakens as a distributional tool. Also, in most countries the lowest-income families usually will not have members whose incomes are tied to the minimum wage so it will be a poor instrument targeting the well being of those families.

The income effect will depend also on "spill-over" effects of the minimum wage in the covered and the uncovered sector wage distributions. In Latin America, it has been found that the minimum wage has a strong "spill-over" effect affecting the whole wage distribution, not just those wages around the minimum wage. Furthermore, it not only changes the distribution of wages in the formal sector but also those of the informal sector, acting as a "numerary" in labor contracts (Maloney and Nuñez, 2001 and Neri, Gonzaga and Camargo, 2000).

Finally, the extent of non-compliance practices may contradict the objective of equality and fairness of the minimum wage. As documented by several studies, most governments appear not to enforce strict compliance with minimum wages (Gindling and Terrell, 1995).[2]

[2] Azam (1997) suggested the positive effects of minimum wages on employment in wheat production could be explained by savings in hiring costs since the farmer avoids non linear wages and warranty that the

To summarize, the following are the main forces that determine the net effect of minimum wages in family incomes:

- Some members will loose their job in the covered sector ending up unemployed with zero contribution to the family income;
- Some workers previously employed in the covered sector might find a job in the uncovered sector and suffer an income loss depending on wage differentials between sectors and "spill-over" effects;
- Some workers who keep their jobs in the covered sector may experience gains in their wages due to raises in the minimum wage. Again, the magnitude of this effect on family incomes will depend on whether there is an "spill-over" effect, and
- Some unemployed members may have longer unemployment spells as the reservation wage increases, some will be encourage to seek employment enter the labor, while others drop out of the labor force.

As there may be many offsetting effects of the minimum wage at the individual, making it hard to estimate its net effect, it makes sense to move away from individuals and look at family incomes to test the overall impact of minimum wages. We would expect that increases in the minimum wage might improve the well being of low income families if the employment effect of the minimum wage is small.

2.1. Evidence on the Redistributive Effects of Minimum Wages

individual will survive on it. By doing so the minimum is supported by the community who has the incentive to monitor compliance by other farmers. This might be the reason why a strong "spill-over effect" has been found in Colombia in the informal (uncovered sector).

Although there are many studies that try to estimate the employment effects of minimum wages, only few have looked at their distributional effects. A survey by Brown (1996) identifies just a handful of papers dedicated to the later. Most of the empirical work that tries to identify the distributional effects of minimum wages has found that it is not very effective in helping low-income families (Newmark, 1997 and 1998). This result holds in part because many of the minimum-wage-paid workers belong to families that are far above the poverty line (Burhhauser, Couch and Wittenburg, 1996).

The empirical work in Latin America has looked at distributional and employment effects separately. Castillo-Freeman and Freeman (1991) found strong employment effects in Puerto Rico after introducing the US minimum wage legislation. Bell (1997) also found large minimum wage elasticities of employment for workers paid near the minimum in the case of Colombia and Mexico using panel data on manufacturing firms. These results are confirm by Maloney and Nuñez (2001) who, in the Colombian case, found a significant positive relation between increases in the minimum wage and the likelihood of becoming unemployed; relationship that abates for those workers earning relatively higher wages.

On the other hand, Maloney and Nuñez (2001) as well as Neri, Gonzaga and Camargo (2000) found, in the Colombian and Brazilian cases, strong positive income effects of changes in the minimum wage over the entire distribution of salaried workers, being relatively lower for those at the top, with the greatest effect occurring below the minimum wage showing important "spill over" effects on the wage distribution.

As for the relation between poverty and minimum wage, the available empirical evidence for Latin America is mixed. Morely (1992) finds that poverty falls with a rise in the minimum but only for periods of recovery whereas De Janvry and Sadolet (1996) find minimum wage poverty alleviation in periods of recession. Using world wide LDC data,

Lustig and McLeod (1996) confirm a negative effect on poverty although with a significant negative effect on employment.

More recently, in a country panel for developing economies, Saget (2001) found that for a constant level of GDP per capita and average wage and controlling for location, a higher minimum wage is associated with a lower national level of poverty and concludes that "the data analysis gives strong support to the proposition that the minimum wage may bring positive results in poverty alleviation by improving the living conditions of workers and their families while having no negative results on employment."

3. Who Earns Minimum Wages in Colombia?

The Colombian law defines the minimum wage as the right of a worker to earn enough to cover not only his basic material, moral and cultural needs but also the needs of his family." Such institution was introduced in 1955 and has been updated following different criteria such us inflation, productivity, and GDP growth, through a bargaining process between government, unions and firms. Its legislature has changed considerably with minimum wages varying between rural and urban and also by firm size. Since 1984 it was unified as a national wage floor.

Most of the studies for Colombia have focused on the relationship between minimum wages, inflation and employment. Few of them though have looked at distributional issues (Maloney and Nuñez, 2001 and Velez and Santamaría, 1999, see also Hernández and Lasso, 1999 for a detailed review). The key question with which this paper is concerned, however, is not with the wage or employment effects of minimum wages, but

rather with whether minimum wages in Colombia achieve the goal of improving living standards for low-income families.

We use quarterly data from the National household surveys (Encuesta Nacional de Hogares) for the period 1984-2001. The survey covers the 7 largest cities Bogotá, Medellín, Cali, Barranquilla, Pasto, Bucaramanga and Manizales and has about 20.000 households per quarter.

We focus on information at the household level. Although the survey has information on domestic workers and boarders as part of the family we excluded them and only consider family members and relatives. As mentioned by Newmark et al. (2003) this might lead to a sample selection bias since a domestic worker´s family living in the household of an employer will not be included in the sample.

We take per-capita income defined as the total family earnings divided by all family members whether or not they have any income. We construct proxies for the family´s human capital and family composition in order to estimate a sort of household mincerian equation. For education we take the maximum level of education among the family members above 12 years of age; for experience the maximum age of members participating in the labor force; for gender composition the proportion of women among the family members; for risk taking behavior the proportion of sef-employed among members above 12 years of age, and for age composition the proportion of young (between 12 and 22) among family members as well as the proportion of children.

We use per-capita income based on all monetary earnings (basically labor earnings including those of self-employed individuals), discharging other household earnings since they seem to have report problems. This is a limitation in the results presented since changes in minimum wages might produce changes in public and private transfer payments

to the family due to changes in employment, hours and earnings. Since monetary earnings are derived from labor contracts, we work with hourly earnings and calculate monthly earnings base on hours worked per week.[3]

As for poverty measures we take the poverty line calculated by the Departamento Nacional de Planeación (National Planning Department). This measure is estimated by city although it does not control for equivalence scales depending on number of individuals and their ages. This might be a problem in case the minimum wage changes the structure of the family over time.[4]

The period 1984-2001 has been chosen since it is marked by strong movements in the minimum wage (Graph 1) including a long downward trend during the 80s and the first half of the 90s which reverts during its second half.

Most of the work is based on cross section data at the family level. The sample includes 900,000 households and excludes families with any employed member reporting missing earnings and families with no members participating either as employed or unemployed.

Table 1 shows that 16.7 % of workers working between 30 and 50 hours per week earn less than the minimum wage and 7.2 % earn exactly the minimum wage. Bogotá and Medellín are the cities with relatively higher wages with less than 11% of workers earning below the minimum wage and they also have a higher proportion of individuals earning exactly the minimum. As expected, young non-heads workers with none to middle education are the ones with a higher percentage earning the minimum. These groups, together with women are also more likely to earn wages under the minimum wage. In

[3] We also looked at monthly earnings and compare it with our estimates based on hourly earnings finding not significant differences between them.
[4] Incomes, minimum wages and poverty lines were deflated using the consumer price index for each city.

contrast, household heads, older workers, and individuals with higher education tend to have earnings above the minimum wage. Finally, we found that among the workers belonging to families in the lower tail of the family per-capita income distribution more than 40% earn below the minimum wage and have higher percentage working at a minimum compared with families up in the distribution (except for those families at the bottom 10%).

Regarding families, table 2 divides them by low-high income based on the poverty line and half the poverty line. Poor families tend to be those with household heads with low education, earning less than the minimum, many with self employed household heads, with a bigger family size and a lower number of members employed.

The fact that 70% of workers living in poor households earn the minimum wage or less shows an important room for the minimum wage to alter the relative living conditions of low income families. However, note that household heads in poor families are over represented by individuals working in the self employment sector which limits the impact of the minimum wage.

3.1. Identifying the Minimum Wage Effect

We use the econometric strategy followed by Neumark, Cunninham and Siga (2003) for Brazil but taking advantage of a much longer span of time and variation in the minimum wage legislation offered by the Colombian case within a relatively more stable macroeconomic environment than in the Brazilian economy.[5]

[5] This is why they limited their analysis to the 1996-2001 post-hyperinflationary period.

The main problem faced with the data at hand is that the minimum wage is set at a national level and there is no variation by economic sector or region. We would like to have a proxy that capture both time series and cross sectional variation on the "bite" of the minimum wage.

As graph 1 shows, the minimum wage decreased during most of the 80s and early 90s suggesting an easing of the minimum wage constraint in the labor market that was reverted toward the end of the 90s. During the same period income inequality both at the family and the individual level (Graph 2) showed a slightly declining trend between 1984 and 1995, after which inequality seems to worsen for the bottom part of the distribution showing a final stable but higher level at the end of the 90s. Hence, one could argue that lower rather than higher levels of minimum wages reduce income inequality.

Nevertheless, as graph 3 shows, the fraction of individuals earning just the minimum increases almost continuously between 1984 and 1995 year in which this fraction drops to the 80s and remains like that for the rest of the decade. In particular, the accelerated increase during the first part of the 90s coincides with strong growths in the construction sector which may partially account for this trend.[6] Therefore, it is hard to assess, from simple inspection, the relation between minimum wage and inequality.

Neumark et al. (2003) suggests a way to capture the minimum wage effect by looking at the fraction of workers that most probably will hold a contract associated with the new minimum wage. This group are, ideally, those whose wage is between the old and the new minimum wage so they are the ones for whom an increase in the minimum wage should also lead to an increase in their wages (since their employers were paying them at or above the minimum before, they are likely to pay them at or above the new minimum wage

[6] It could also indicate an inverse relationship between the minimum wage compliance and its level.

or lay them off). We calculated the fraction of workers between the current real minimum wage and the minimum wage 12 months before (FBM) for each city-survey cell. Graph 4 shows a 7-cities average of this fraction. Negative (positive) values mean a reduction (increase) in the "bite". The graph shows not only that the "bite" has suffered strong changes during the sample period but also that there is significant variation between cities. Both time-series and cross-sectional variation in FBM will be used to better identify how minimum wages affect the distribution of incomes. [7]

We also used a standard real minimum wage to median income ratio to see the robustness of our estimates (RMM). Analogous to taxation the fraction, FBM, will measure changes in the base whereas the minimum median ratio, RMM, will measure changes in the tax rate (Graphs 5 and 6).

4. Unemployment and Participation at the Household Level

The minimum wage effects are the result of offsetting forces: for those with a net gain the income effect more than offset the negative impact that the minimum wage may have in other labor dimensions at the family level such as unemployment and hours worked by its members. Following Newmark et al. (2003) we looked at both household heads and the family group as a whole to explore the family profile of those affected by changes in the minimum wage.

We estimate different features of the labor choices and labor outcomes experienced by the family controlling for family's human capital and family composition as explained in section 3. For household heads we looked at the probability of being employed (salaried

[7] We took real rather than nominal wages since we believe the erosion of the minimum wage within a year due to inflation does relive its binding constraint for contracts spread over the calendar year.

or self-employed), and hours worked. For Non-head members we look at hours worked as well as their unemployment and participation rate. The estimations are based on a pooled sample of all cross sections from the quarterly ENH surveys in the period 1984-2001. We model each labor variable y_j for the j-individual (family) as a mincerian relation where:

$$y_j = \alpha + \beta_1 MB_{jt} + \beta_2 MB_{jt-1/4} + \beta_3 MB_{jt-1/2} + \beta_4 MB_{jt-1} + X_j + Z_j + D_a + D_q + D_c + \varepsilon_j, \quad (1)$$

where $MB_{jt}, MB_{jt-1/4}, MB_{jt-1/2}, MB_{jt-1}$ are the current minimum wage median income ratio, the ratio a quarter before, the ratio 6 months before and the ratio a year before; X_j is a set of human capital variables and Z_j is a set of individual (family) characteristics, this two sets defined as in section 3; and finally D_a, D_q, D_c are annual, quarter (1st, 2nd, 3th, 4th quarter) and city dummies.

As shown in table 3, a mayor finding is that increases in the minimum wage to median income ratio, RMM,[8] increase the likelihood of a household head being unemployed, the main effect occurring in the first quarter. The interactions of RMM and gender, age and education also showed up significant, indicating that the negative effect is larger for women, young people and less educated people. These last findings give robustness to the results given that these groups have a larger proportion of individuals earning around the minimum. Table 3 also shows that the minimum wage bite additionally reduces the number of hours worked by household heads although the effect differs significantly only by age.

[8] We can not use FBM here since it is a measure of a "change" in the minimum wage bite calculated as in footnote 10. Using fractions below the minimum wage is not a straight forward measure of the minimum wage bite: a high fraction may indicate a strong bite although it may indicate low compliance as is evident from table 1.

Table 4, on the other hand, looks at the behavior of members other than the household head. We estimate equation (1) for hours worked by non-heads and use binomial models to look at the determinants of their unemployment rate and their participation rate using family level data. The binomial household unemployment model is a binomial model of the number of non-head unemployed members giving the number of household members participating in the labor force; the binomial participation model looks at the number of members employed or searching conditional on the number of members above 12 years of age.[9]

Clearly, the RMM is inversely related with hours worked by non-heads and positively related with their unemployment and their participation rates. Most of the effect on the unemployment rate depends on the household education level; the higher it is the higher the increase in the unemployment rate as a result of an increase in RMM. Note also, the change in the sign of the education coefficient once the interaction is included highlighting the distorting effect of the minimum wage in the unemployment equation. As for their participation in the labor market, higher RMM increases participation especially of those families with lower education as is captured by the interaction of RMM and education as a proxy for family's human capital; note also a large bias in the education coefficient when omitting the interaction term.

The effect of minimum wages on non-head family members will capture not only demand side (higher costs for the firms), but also supply side effects. This is the case for hours worked and unemployment. In the first case, we adventure the hypothesis that the

[9] The binomial model depicts the number of successful events, x, in n trials where $0 \leq x \leq n$, $E(x) = np$ and $V(x) = p(1-p)n$. In our case, x is the number of family members unemployed (participating in the labor force) and n the number of members participating in the labor force (members older than 12).

reduction in hours worked by non-heads is a demand side effect since the other results indicate that the pervasive effects of the minimum wage specially for the poorer, lower human capital families, should increase their labor supply (as is confirm by the participation model).

Also, the rate of unemployment may increase with raises in the minimum wage via labor demand, labor supply or search factors. The finding that most of the negative employment effect in non-head members is related to the family's human capital is consistent with labor decisions that go beyond the individual and are associated with what is going on in the family group as a whole. Clearly, increases in the minimum wage would increase the reservation wage for every body looking for a job. However, as we saw in table 8 the lower the household head's human capital the higher the negative effect of increases in the minimum wage on his/her probability of being employed. Therefore, those non-heads leaving in a high human capital group will be more prone to wait for a job in the covered sector and, therefore, experience longer spells of unemployment whereas those in low human capital families will have to accept employment in the uncovered-spot sector to offset the family's unemployment shocks due to changes in the minimum wage.

5. Net Income effects

The significant negative effect of the minimum wage on employment and its positive effect on the family's participation rate clearly show that in the Colombian case higher minimum wages induce higher unemployment rates. In this section we test whether the negative employment effects are offset by the income effects that the minimum may have on those that remain employed and on those new comers attracted by a higher search payoff. This is done by looking at the per-capita family income which will sum up both the

zero incomes for the unemployed and the higher incomes induced by the minimum wage for those employed.

We use both proxies, FBM and FMM, to estimate dynamic panel models for each of the different percentiles of the distribution of incomes. We perform a set of estimations both for family per-capita incomes and for worker labor incomes base on annual observations taken from first quarter surveys. For both proxies of the minimum wage bite (MB) we estimate:

$$y^c_{jt} = \alpha + \eta y^c_{jt-1} + \beta MB_{jt} + \mu_j + \lambda_t + \varepsilon_{jt} \qquad (2).$$

Where y^c_{jt} is the income at the c^{th} percentile of the income distribution (per-capita family income and individual income distributions calculated from salaried and self-employed workers) in city j in year t, MB_{jt} is a proxy of the minimum wage bite for each city-quarter pair, μ_j is a city unobservable effect and λ_t is a time specific effect, invariant across cities.[10] In (2) β will be the short run effect whereas $\beta/(1-\eta)$ will be the long run effect.

We estimate equation (2) following Anderson and Hsiao (1982) differences estimator but, since we are working with panels characterized by small n (seven cities) and quite large T (16 observations) we followed the strategy suggested by Robertson y Symons (1992). First we tested for panel unit roots for both the dependent and the independent variables using Hadri and Larsson (2001).[11] We did not reject the null of unit root for any

[10] We also introduced interactions of the minimum wage with dummies for first quarter after introducing legislative changes in the minimum wage in all the models estimated in the paper. We found significant positive effects of minimum wage changes in family incomes in most regressions. However, we choose to present a more parsimonious specification to facilitate interpretation. The results do not differ from those presented here.

[11] Note that the fraction between the current and the past minimum wage is a "change" in the minimum wage "bite" which is the difference in the fractions of workers below the current and the past minimum wage 12

of the variables used in our estimation. In such cases, Robertson et Al.(1992) show that Arellano and Bond (1991) instrumental variables estimator does not work well since lags of the dependent variable in levels will be no correlated with the lags of the dependent variable in differences. They then suggest using lags of the exogenous variables in differences as instruments and so we use lags of the minimum wage bite proxies defined above.

Table 5 shows percentile estimates based on equation (2) for per capital family income distributions. It includes short and long run effects as specified in (2). Note that by estimating (2) in differences we get rid of the city effect but not the time effect so we include time dummies. The table shows significant positive effects for percentiles above 25^{th} using FBM on each percentile, both in the short and in the long run, and above 15^{th} using RMM but not statistically significant effects at the bottom of the distribution. The parameter estimates also suggest an inverted U shape: the gains being close to zero at the bottom of the distribution (percentiles up to the 20^{th}), highest at the middle (percentiles between 25^{th} and 45^{th}) and lower at the top (percentiles from 50^{th} to 90^{th}) which is coherent with minimum wage earners being relatively more representative in families between the 20^{th} and 50^{th} percentiles (table 1).

On the other hand, worker labor income percentile regressions are reported in table 6. Significant effects were found toward the middle of the distribution using FBM. Most of the income gains are concentrated between the 45^{th} and 60^{th} with no significant effects at the bottom and the top. With FMM the gains start at a lower percentile (30^{th}) and are significant all the way up in the distribution, being higher around the middle both in the

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months before. That is, the fraction of individuals whose income 12 months before was below the current minimum wage minus the fraction of them with incomes below the minimum 12 months before. These are the variables that were tested for panel unit roots. The tests are available on request.

short and in the long run. However, no statistically significant effect was found for percentiles lower than 25th, although a negative sign is estimated for those at the bottom (10th, 15th).

5.1. Distributive Effects

Apparently we would think that from the income estimates presented above, a more binding minimum wage will increase inequality at the lower part of the distributions, increasing the gap between the percentiles below the median, and will reduce inequality at the upper part of the distribution of both families and individuals. Yet, it will not alleviate the situation of those families at the bottom and may worsen workers below the minimum.

However, as we can not tell how different the effects between percentiles we can not assess the statistical significance of the distributive effects of the minimum wage. To gauge on this, we estimate the difference between each percentile and the median percentile both for family per-capita incomes and individual labor incomes. Following equation (2) and subtracting y_{jt}^{c} from $y_{jt}^{0.5}$ for any c^{th} percentile of the income distribution we get:

$$y_{jt}^{0.5} - y_{jt}^{c} = \alpha_d + \eta^{0.5} y_{jt-1}^{0.5} - \eta^{c} y_{jt-1}^{c} + (\beta^{0.5} - \beta^{c}) MB_{jt} + \varepsilon_{jt}^{0.5} - \varepsilon_{jt}^{c} \qquad (3)$$

or $$y_{jt}^{0.5} - y_{jt}^{c} = \alpha_d + \gamma(y_{jt-1}^{0.5} - k y_{jt-1}^{c}) + (\beta^{0.5} - \beta^{c}) MB_{jt} + \varepsilon_{jt}^{0.5} - \varepsilon_{jt}^{c}, \qquad (3')$$

where k is a proportional factor that allows us to rewrite (3) in terms of the lagged difference in the percentile distance and estimate (3') combining Anderson and Shiao (1982) and Robertson y Symons (1992) using lagged differences in our proxies for the minimum wage bite FBM and RMM as instruments for the lagged differences in the percentile incomes $\Delta y_{jt-1}^{0.5}$ and Δy_{jt-1}^{c}. Equation (3') allows us to test whether $\beta^{0.5} - \beta^{c} \neq 0$.

Table 7 shows the results for the distribution of per-capita family incomes. Neither FBM nor RMM reflects any changes in distances to the median in the short run (except for an almost significant increase in the distance of the 15th percentile to the median) confirming how similar the estimates for the short term effect are across percentiles in table 5. Therefore, if any distributional effect can be attributed to minimum wages, it will be a long run effect associated with differences in the speed of adjustment of each percentile income to shocks as the long run effects in table 5 suggest.

To explore this hypothesis we followed a different econometric strategy by estimating a long run relationship based on annual data of the form:

$$y_{jt}^{c} = \alpha + \beta_1 MB_{jt} + \beta_2 MB_{jt-1/4} + \beta_3 MB_{jt-1/2} + \beta_4 MB_{jt-1} + \mu_j + \lambda_t + \varepsilon_{jt} \qquad (4)$$

and for the percentile difference to the median (and the 70th percentile):

$$y_{jt}^{0.5} - y_{jt}^{c} = \alpha_d + \beta_1 MB_{jt} + \beta_2 MB_{jt-1/4} + \beta_3 MB_{jt-1/2} + \beta_4 MB_{jt-1} + \varepsilon_{jt}^{0.5} - \varepsilon_{jt}^{c}, \qquad (5)$$

where $MB_{jt}, MB_{jt-1/4}, MB_{jt-1/2}, MB_{jt-1}$ are the current minimum wage median income ratio, the ratio a quarter before, the ratio 6 months before and the ratio a year before. Here the log run effect will be the addition of the β_i coefficients. We take random effects whenever the Houseman test for consistency is passed (see appendix 1). Equations (4) and (5) are non-dynamic versions of (2) and (3') for the per-capita family incomes whose results are shown in Graph 7 (estimations in appendix A).[12] The dark portions of the plots show statistically significant minimum wage effects whereas the dotted ones are insignificant. These

[12] We run the panel with annual percentile levels. In order to exploit the sample we take each quarter annual series for each city as one history and pool all quarter-city histories together for a total of 28 each with 17 time observations. The static model is for the percentile equation:

and for the percentile difference to de median (and the 70th percentile):

estimates are in line with table 5: the minimum wage has a positive long run effect for all percentiles above 25th which are quite the same across percentiles, and has no significant, if not a negative effect, at the bottom of the per-capita family income distribution. Clearly it does not change the shape of the distribution above the 20th percentile (25th for distances to the 70th percentile) since its long run effect on distances to de median (70th percentile) are not significant. However it does increase the gap between the bottom percentiles and the median and the 70th percentiles respectively.

Finally, table 8 shows the results of (3') for the distribution of individual incomes. Both proxies coincide in identifying an increase in the gap between the median individual income and all the percentiles below it and a reduction in the gap for percentiles around the median and above.

How badly the minimum wage may hurt those families at the very bottom of the distribution could not be unveil with the panel data techniques since there are many cero per-capita incomes at percentiles below the 10th. We attempt to measure it by looking at the likelihood of being poor/non-poor by looking at households with per- capita incomes below half and 1/3 of the poverty line. Here again, we used the pooled sample of all the quarterly surveys for the period 1984-2001 and run a mincerian family equation controlling for household human capital and composition as was discussed in section 3. Table 9 shows that an increase in the minimum wage to the median income ratio, RMM,[13] raises the likelihood of being poor. All the other variables have the expected sign. Furthermore, the effect is significantly smaller for those families with higher human capital.

Summarizing, per-capita income estimates suggest that the minimum wage changes during the period 1984-2001 produced important asymmetric effects in the household

[13] See note 8.

income distribution bringing important gains for families well above the bottom of the distribution but with significant losses for those at the bottom.

6. Conclusions

In this study we concentrate on evaluating the effects of the minimum wage on family's well being and on establishing the robustness of the results by looking at the minimum wage effect on head and non-head members.

We find important gains for families in the middle and the upper part of the distribution of family per-capita incomes but none to significantly negative effects for families at the bottom. This creates important distributive effects, increasing the gap between those at the bottom and those up in the per-capita family distribution.

At the individual level, there is a clear "spill over" effect with income gains not only for individuals at percentiles close to the minimum but further up in the individual income distribution. However there is no evidence of a "farol" effect since there are not significant positive effects for individuals at the bottom and there is clear evidence that it increases the probability of unemployment especially for low human capital workers. These results show an asymmetric effect which end up deteriorating the situation of those that the minimum wage is suppose to alleviate.

Beyond the income effects on households, the minimum wage clearly distorts other dimensions of the family's labor profile. For families with lower human capital, an increase in the minimum wage increases non-head participation (maybe a third-bread-giver response to negative family income shocks) and does not change the unemployment rate significantly, although will lower the hours worked. In contrast, for families with high

human capital the participation effect is much lower with increases in their unemployment rate (probably a search-reservation wage effect inducing longer unemployment spells).

It should be left clear that these results are based on labor incomes and therefore nothing can be inferred about whether the net income gains driven by raises in the minimum wage for families relatively high in the distribution are produced at the expense of losses at the bottom. It maybe possible that the Colombian employers have had enough margins to accommodate higher labor costs which may partially account for those gains.

7. References

Agénor, P.R.; Aizenman, J. (1999) "Macroeconomic adjustment with segmented labour markets," *Journal of Development Economics* 58 (2). 277-96, Amsterdam.

Arellano, M.; Bond, S. (1991). "Some tests of of specification for panel data: Monte Carlo evidence and an application to employment equations, *Review of Economic Studies* 58, 277-297.

Azam, J.P. (1992). "The agricultural minimum wage and wheat production in Morocco (1971-89)." *Journal of African Studies* 1 (2). 171-91, Washington.

Azam, J.P. (1997). "Efficiency wage and the family: An explanation for the impact of the agricultural minimum wage in Morocco," *Kyklos* 50 (3): 369-82, Basel.

Anderson, T.W.; Hsiao, C. (1981). "Estimation of Dynamic Models with Error Components," *Journal of the American Statistical Association* 76, 598-606.

Bell, Linda A. "The Impact of Minimum Wages in Mexico and Colombia," Journal of Labour Economics, 1997, Vol. 15, No. 3, pp 103-135

Basu, K.; Genicot, G.; Stiglitz, J.E. (1999). "Household labour supply, unemployment, and minimum wage," *World Bank Policy Working Paper* 2049, Washington.

Brown, C., "The Old Minimum-Wage Literature and Its Lessons for the New," in:
Marvin Kosters (editor). *The Effects of the Minimum Wage on Employment*, 1996, pp. 87-98.

Burhhauser, R. V., Couch, K. A., and Wittenburg, D. C. (2000). "Who minimum
wage increases bite: an analysis using monthly data From the SIPP and the
CPS", *Southern Economic Journal* 67(1). 16–40.

Card, D.; Krueger, A. B. (1994). "Minimum wages and employment: a case study of the fast-food industry in New Jersey and Pennsylvania", *American Economic Review* 84(4). 772–93.

Card, D. ; Krueger, A. B. (1995). *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press, Princeton, NJ.

Card, D. ; Krueger, A. B. (1995b). "Time-series minimum-wage studies: a meta-analysis," *American Economic Review* 85(2). 238–243.

Fraja, G. (de) (1996). Minimum wage legislation, work conditions and employment, CEPR Discussion Paper 1524

Fraja, G. (de) (1999). "Minimum wage legislation, productivity and employment," *Economica*, 66 (264) 473-88, London.

Fields, G.S. (1994). "The unemployment effects of minimum wages," *International Journal of Manpower*, 15.

Freeman-Castillo, A.; Freeman, R.B. (1991). "Minimum Wages in Puerto
Rico: Textbook Case of a Wage Floor?" NBER working paper 3759.

Freeman R. (1996) "The minimum wage as a redistributive tool" *Economic Journal*, 106, may, pp. 639-49.

Gindling, T.H.; Terrell, K. (1995). "The nature of minimum wages and their effectiveness as a wage floor in Costa Rica," 1976-1991, World Development 23 (8). 1439-58, Oxford.

Hernández and Lasso(1999). "El Efecto del Salario Mínimo sobre el Empleo," mimeo, DNP, Colombia.

De Janvry, A; Sadoulet, E. 81996). "Growth, Poverty, and Inequality in Latin America: A Causal Analysis 1970-94," Unpublished paper, University of California, Berkeley.

Hadri K.; Larsson, R (2002). "Testing for Stationarity in Heterogeneous Panel Data Where the Time Dimension is Finite," The University of Liverpool, http://www.liv.ac.uk/www/econacc/livdp/kpsspaftcrolfc.pdf

Lustig, N.C.; McLeod D. (1997). "Minimum wages and poverty in developing countries: Some empirical Evidence," in *Labour Markets in Latin America*, Edwards S. & N. C. Lustig (Eds). pp 62-103, The Brookings Institution Press, Washington DC.

Maloney and Nuñez (2001). Measuring the Impact of Minimum Wages: Evidence from Latin America, mimeo, World Bank.

Morely, Samuel (1995). "Structural Adjsutment and theDeterminants of Poverty in Latin America," in Lustig, Nora (Ed.), *Coping with Austerity: Poverty and Inequality in Latin America,* Washington, DC: The Brookings Institution.

Neri, Marcelo, Gustavo Gonzaga, Jose Marcio Camargo (2000). "Efeitos informais do salário mínimo e pobreza," forthcoming, *Revista de Economia Política*.

Neumark, David; Stchweitzer M.;Wascher, W.(1998). "The effects of Minimum Wages on the distribution of family incomes: a non-parametric analysis.," NBER Working Paper No. 6536

Neumark, David; Wascher, W.(1997). "Do Minimum Wages fight Poverty?," NBER Working Paper No. 6127

Neumark D.; Cunninham, W.; Siga, L. (2003). "The Distributional Effects of Minimum Wages in Brazil: 1996-2001," mimeo, (permission to quote pending).

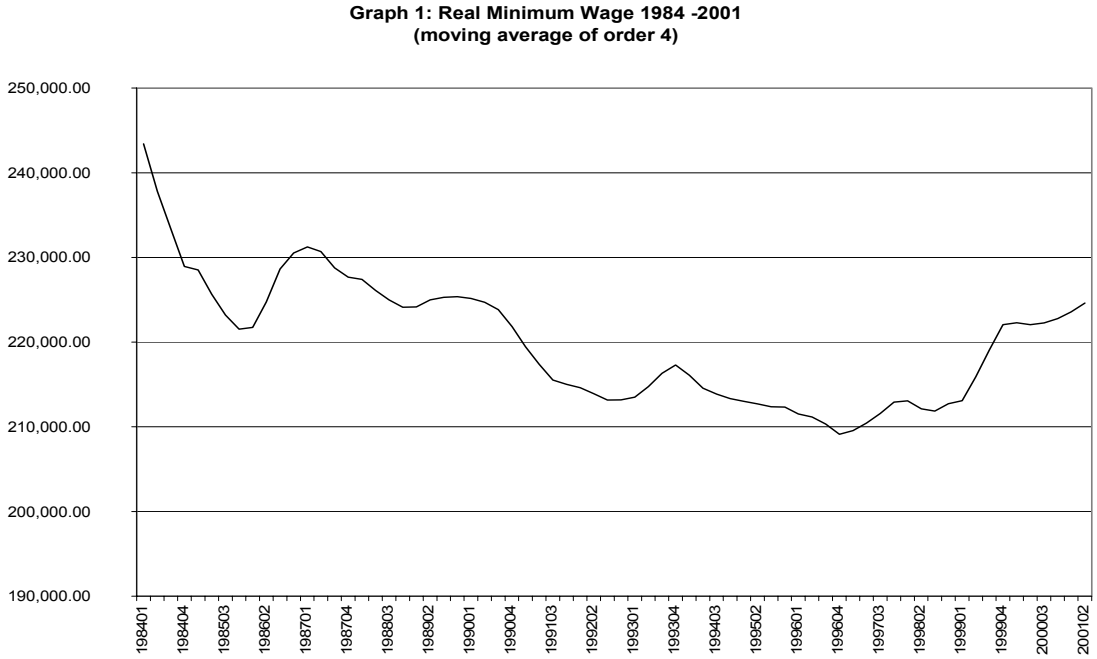
Robertson D.; Symons, J. (1992). Some strange properties of panel data estimators, Journal of Applied econometrics, 7, 175-189.

Saget , C (2001). Is the Minimum Wage an Effective Tool to Promote Decent Work and Reduce Poverty? The Experience of Selected Developing Countries. International Labour Office Employment paper 13, International Institute for Labour Studies, Geneva.

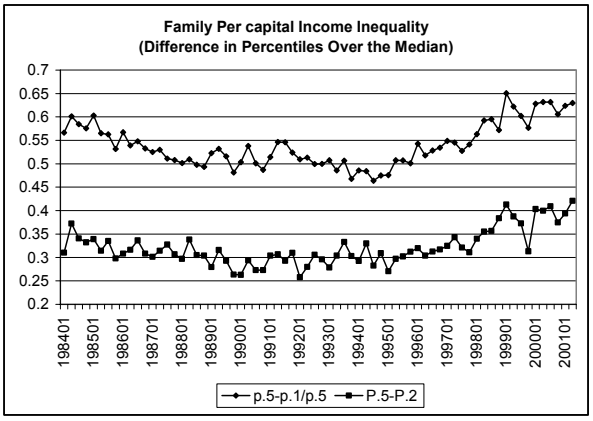
Shaheed, Z. (1994). "Minimum wages and low pay: An ILO perspective," *International Journal of Manpower* 15 (2/3). 49-61, Bradford.

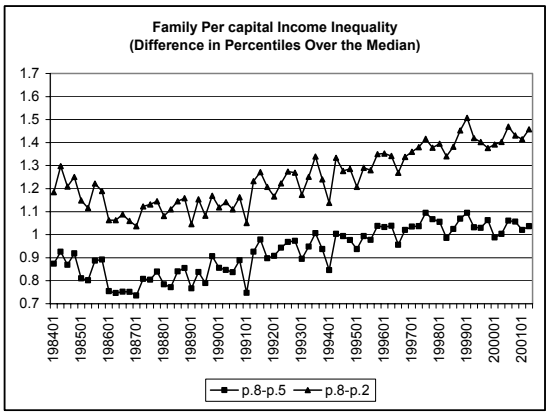
Teulings, C.N.; (2000). "Bridging the gap between "Joe Sixpack" and "Bill Gates": on the efficiency of institutions for redistribution," *De Economist* 148 (5). 603-24, Kluwer Adademic Publishers, The Netherlands.

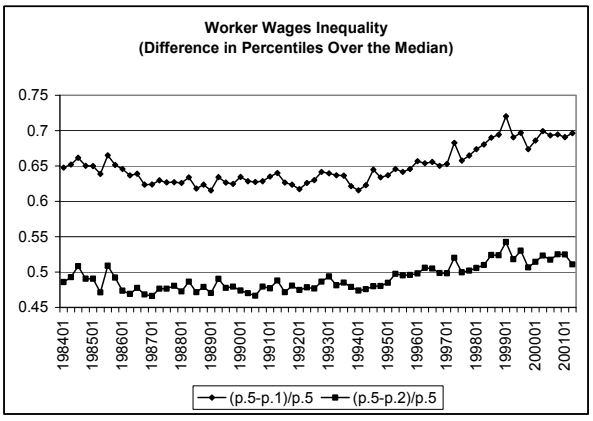
Velez, Carlos Eduardo and Mauricio Santamaria (1999). "Is the Minimum Wage Binding in Colombia?: A Short Note on Empirical Evidence for 1998," mimeo, Latin America and Caribbean Department, IBRD.

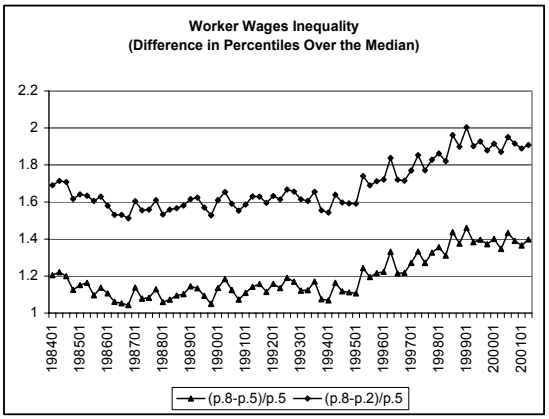


Graph 2: Family Per-capita Income inequality and Worker Wage Inequality

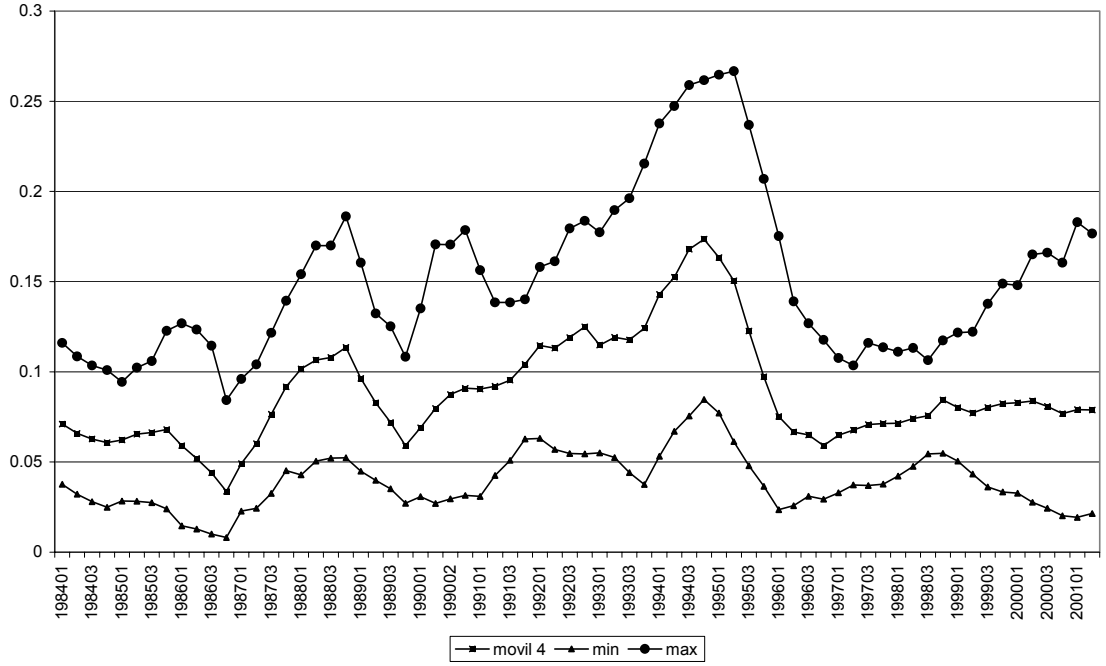




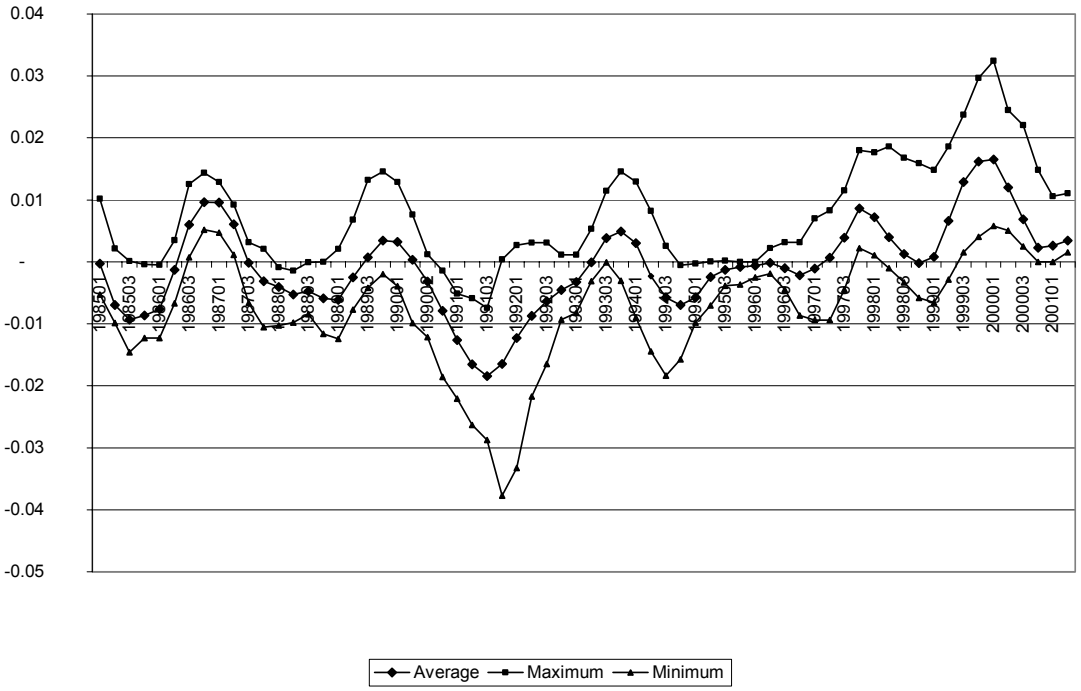




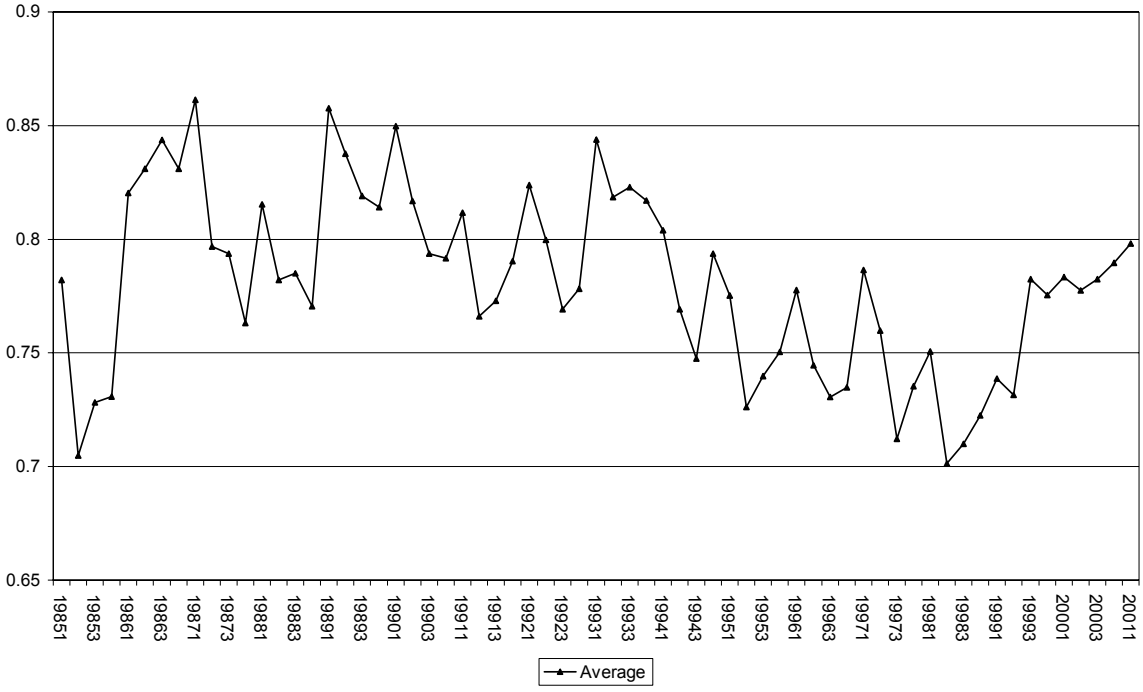
Graph 3: Workers Earning near the Minimum
(Average, min and Max)



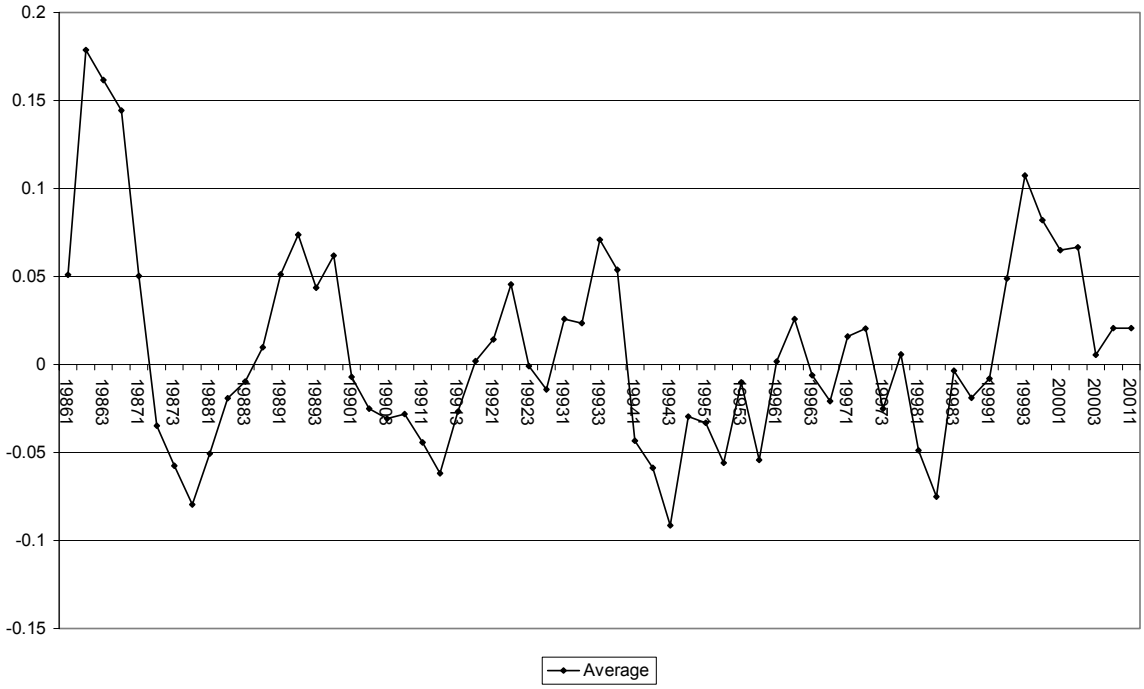
Graph 4: Fraction of Workers Between the Current Minimum and the Minimum 12 months Before
(7-cities max, min and average)



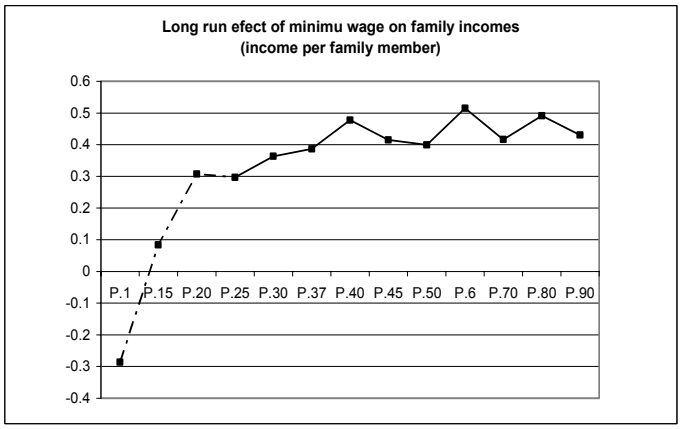
Graph 5: Ratio of Current Minimum Wage to Median Income 12 Months Before (7-cities average)

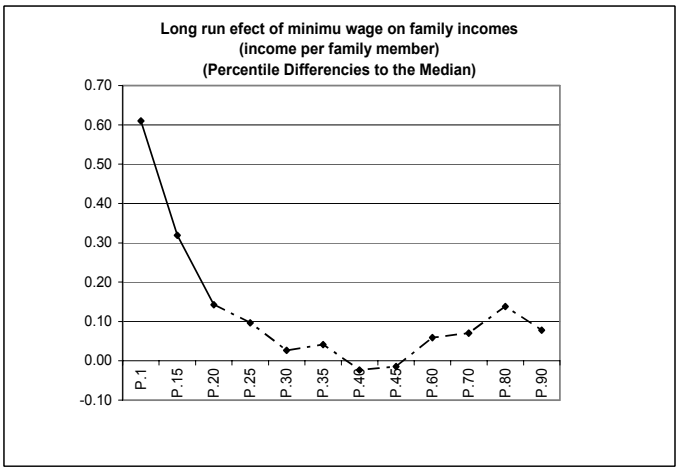


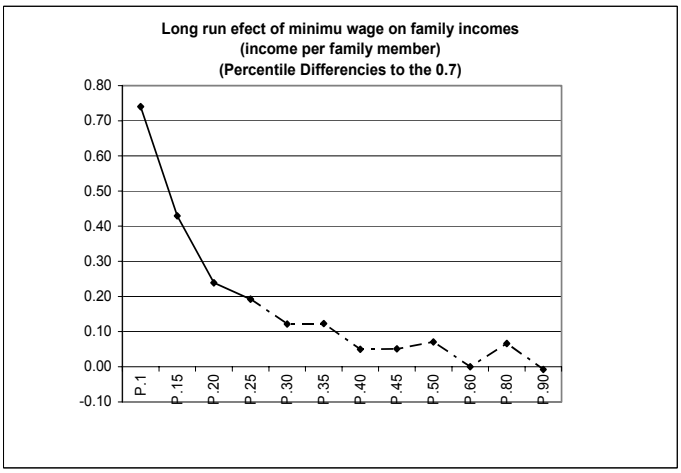
Graph 6: Anual Change in the Ratio of Current Minimum Wage to Median Income (7-cities average)



Graph 7: Long Run Minimum Wage Effects on Family Per-capita Income Distribution







See appendix A for the regression details.

Table 1: Worker Characteristics of those working between 30 and 50 hours a week

	N	<SMM	=SMM	>SMM
All	214,969	16.70	7.21	76.08
By cities				
B/Quilla	28,677	14.59	7.72	77.69
B/Manga	20,631	17.70	6.46	75.84
Bogotá	27,449	9.31	10.72	79.97
Manizales	23,979	17.59	5.27	77.14
Medellín	34,984	10.44	8.30	81.26
Calí	21,796	15.89	8.48	75.63
Pasto	20,991	29.39	3.70	66.91
Demografic groups				
Men	114,726	15.10	7.22	77.68
Women	100,243	18.54	7.21	74.25
Head	90,767	10.70	6.36	82.94
Conyugue	39,113	17.92	6.03	76.05
Single son/dauter	51,160	23.57	8.23	68.20
Widow/divorsed	12,396	17.96	9.16	72.88
Other relatives	20,852	22.91	9.42	67.67
Pensioned	524	12.02	10.11	77.86
12-19 ages	12,736	55.77	8.41	35.82
20-34 ages	106,935	15.60	8.39	76.01
35-49 ages	74,771	11.75	5.94	82.32
>50 ages	20,527	16.23	5.00	78.76
No education	2,322	57.92	7.71	34.37
1-5 years of education	39,866	35.87	10.30	53.84
6-11 years of education	112,526	16.58	9.05	74.36
12-17 years of education	54,546	2.71	1.77	95.53
>17 years of education	5,292	0.64	0.13	99.23
Sector				
Worker without pay	3,544	99.86	0.00	0.14
Salaried worker	211,425	15.31	7.33	77.36
Percentile family per-capita income				
0.1	1,911	86.55	4.66	8.79
0.2	8,858	60.18	11.82	28.00
0.3	13,637	40.33	13.18	46.49
0.4	17,649	29.85	12.92	57.23
0.5	21,420	23.75	10.92	65.32
0.6	24,845	18.76	10.22	71.02
0.7	28,563	13.79	7.92	78.29
>.7	98,086	4.55	3.21	92.23

Table 2: Family characteristics given poor/non-poor
With labor income (include self-employed)

		with poverty line		with 1/2 of poverty line	
	N	Non-Poor	Poor	Non-Poor	Poor
All	295,945	35.18	64.82	66.12	33.88
By city					
B/Quilla	40,697	33.1	66.9	66.7	33.3
B/Manga	28,780	40.5	59.5	72.0	28.0
Bogotá	33,362	40.8	59.2	69.0	31.0
Manizales	32,624	37.7	62.3	67.7	32.3
Medellín	41,029	34.0	66.0	64.8	35.2
Calí	32,071	32.7	67.3	63.4	36.6
Pasto	27,968	38.2	61.8	67.6	32.4
Household head					
Men	214,468	36.5	63.5	68.4	31.6
Women	81,477	31.8	68.3	60.1	39.9
No education	2,009	21.9	78.1	48.7	51.3
1-5 years of education	39,997	20.7	79.3	50.9	49.1
6-11 years of education	191,328	29.8	70.2	64.2	35.8
12-17 years of education	59,965	60.8	39.2	82.2	17.8
>17 years of education	2,632	76.7	23.3	87.3	12.7
Employed	223,772	40.0	60.0	73.4	26.6
Employed with real wage less than minimum	100,138	17.1	82.9	50.5	49.7
Worker without pay	461	21.7	78.3	50.3	49.7
Salaried	119,196	46.3	53.7	80.5	19.5
Self-employed	98,898	33.5	66.5	66.0	34.0
Hosehold head median income	…	361402.2	198422.7	276497.7	142633.3
Average % head incomes in total	…	69.2	80.8	72.7	85.7
Average hours of work if employed	…	215.1	222.4	219.5	219.5
Average number of family members	…	3.8	4.6	4.1	4.7
Characteristics excluding head					
Average employed	…	1.0	0.7	1.0	0.5
Average hours worked	…	166.0	107.0	149.9	77.6

Table 3: Household Head Hours Worked and Probability of Being Employed

	Employment Probability				Hours Worked			
	Coef	P-val	Coef	P-val	Coef	P-val	Coef	P-val
Ratio minimum wage to median individual income=RMM	-0.378	0.029	-1.12	0.01	0.0232	0.425	-0.214	0.01
	(0.173)		(0.442)		(0.029)		(0.079)	
RMM(t-1)	-0.135	0.394	-0.214	0.68	-0.0467	0.047	-0.108	0.18
	(0.159)		(0.526)		(0.023)		(0.080)	
RMM(t-2)	-0.008	0.957	-0.489	0.37	0.0366	0.239	-0.019	0.83
	(0.158)		(0.548)		(0.031)		(0.089)	
RMM(t-3)	-0.096	0.558	-0.26	0.57	-0.0716	0.007	0.062	0.42
	(0.164)		(0.452)		(0.026)		(0.077)	
RMM total efect	-0.617	0.00	-2.083	0.00	-0.058	0.05	-0.279	0.00
Age	0.033	0.00	0.022	0.00	0.008	0.00	0.005	0.00
	(0.002)		(0.004)		(0.000)		(0.001)	
Age^2	-0.0005	0.00	-0.0005	0.00	-0.0001	0.00	-0.0001	0.00
	(0.000)		(0.000)		(0.000)		(0.000)	
Gender (Male=1)	0.332	0.00	-0.218	0.07	0.185	0.00	0.145	0.00
	(0.009)		(0.120)		(0.003)		(0.029)	
Education	0.019	0.00	-0.011	0.34	-0.006	0.00	-0.004	0.07
	(0.001)		(0.011)		(0.000)		(0.002)	
Self-employed	3.301	0.00	3.483	0.03	-0.087	0.00	-0.124	0.00
	(0.158)		(1.625)		(0.002)		(0.030)	
Interaction of RMM with Education a/			0.038	0.01			-0.003	0.39
Interaction of RMM with Age a/			0.015	0.01			0.004	0.00
Interaction of RMM with Gender a/			0.721	0.00			0.053	0.16
Interaction of RMM with Self employed a/			-0.147	0.95			0.049	0.21
Year Dummys		0.00		0.00		0.00		0.00
Quarter Dummys		0.00		0.00		0.00		0.00
City Dummies		0.00		0.00		0.00		0.00
Wald Test		0.00		0.00		0.00		0.00
Shap-Francia						0.50		0.50
Hosmer-Lemeshow		0.00		0.00				

a/ Is the sum of the short run coefficients.

Table 4: Household Employment, participantion and Hours Worked by Non Head Members

	Hours Worked				Household Unemployment Number conditional on family members in the labor force (Binomial Model)				Household Participation Number conditional on family members above 12 years of age(Binomial Model)			
	Coef	P-val	Coef	P-val	Coef	P-val	Coef	P-val	Coef	P-val	Coef	P-val
Ratio minimum wage to median individual income=RMM	-0.060	0.15	-0.171	0.06	0.559	0.00	0.075	0.70	0.002	0.96	-0.003	0.98
	(0.042)		(0.090)		(0.073)		(0.196)		(0.040)		(0.103)	
RMM(t-1)	-0.061	0.11	-0.152	0.10	0.206	0.00	0.405	0.05	-0.022	0.58	0.146	0.19
	(0.038)		(0.092)		(0.072)		(0.210)		(0.040)		(0.110)	
RMM(t-2)	0.036	0.36	0.139	0.12	-0.316	0.00	-0.571	0.01	-0.104	0.01	-0.161	0.14
	(0.039)		(0.089)		(0.074)		(0.209)		(0.041)		(0.110)	
RMM(t-3)	-0.092	0.02	-0.033	0.69	0.356	0.00	0.138	0.47	0.075	0.06	0.465	0.00
	(0.039)		(0.082)		(0.073)		(0.191)		(0.040)		(0.100)	
RMM total efect	-0.177	0.00	-0.217	0.00	0.806	0.00	0.046	0.78	-0.049	0.30	0.447	0.00
Interaction of RMM with human capital (hksm)												
HKRMM			0.011	0.12			0.046	0.01			0.001	0.89
			(0.007)				(0.018)				(0.009)	
HKRMM-1			0.009	0.23			-0.020	0.30			-0.017	0.10
			(0.007)				(0.019)				(0.010)	
HKRMM-2			-0.010	0.15			0.025	0.19			0.006	0.55
			(0.007)				(0.019)				(0.010)	
HKRMM-3			-0.006	0.36			0.020	0.24			-0.038	0.00
			(0.006)				(0.017)				(0.009)	
HKRMM marginal effect			0.004	0.40			0.071	0.00			-0.047	0.00
Education	-0.005	0.00	-0.008	0.02	0.020	0.00	-0.035	0.00	0.027	0.00	0.063	0.00
	(0.000)		(0.003)		(0.001)		(0.010)		(0.000)		(0.005)	
Prop. Women	-0.043	0.00	-0.043	0.00	0.069	0.00	0.070	0.00	-0.137	0.00	-0.137	0.00
	(0.004)		(0.004)		(0.014)		(0.014)		(0.008)		(0.008)	
Experience	0.000	0.00	0.000	0.00	0.005	0.00	0.005	0.00	0.014	0.00	0.014	0.00
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Prop. Self-employed	-0.343	0.00	-0.343	0.00	-1.945	0.00	-1.945	0.00	0.598	0.00	0.597	0.00
	(0.009)		(0.009)		(0.015)		(0.015)		(0.007)		(0.007)	
Prop. Young under 22	-0.077	0.00	-0.077	0.00	0.564	0.00	0.563	0.00	-0.418	0.00	-0.417	0.00
	(0.004)		(0.004)		(0.011)		(0.011)		(0.006)		(0.006)	
Prop. Children	-0.137	0.00	-0.137	0.00	-0.734	0.00	-0.734	0.00	-0.982	0.00	-0.982	0.00
	(0.004)		(0.004)		(0.015)		(0.015)		(0.008)		(0.008)	
Year Dummys		0.00		0.00		0.00		0.00		0.00		0.00
Quarter Dummys		0.00		0.00		0.00		0.00		0.00		0.00
City Dummies		0.00		0.00		0.00		0.00		0.00		0.00
Wald Test		0.00		0.00		0.00		0.00		0.00		0.00
Shap-Francia		0.50		0.50								

Table 5: Family per capita centile income regressions using two proxies for minimum wage bite

Households

Fraction of workers between current and past minimum wages (=Fraction)

	P.10		P.15		P.20		P.25		P.30		P.35		P.40		P.45		P.5		P.6		P.7		P.8		P.9	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
Lagged per-capita income	0.732	0.00	0.730	0.00	0.688	0.00	0.693	0.00	0.727	0.00	0.708	0.00	0.710	0.00	0.709	0.00	0.710	0.00	0.681	0.00	0.654	0.00	0.603	0.00	0.534	0.00
	(0.102)		(0.102)		(0.069)		(0.050)		(0.028)		(0.047)		(0.038)		(0.054)		(0.051)		(0.050)		(0.043)		(0.051)		(0.078)	
Fraction (FMB)	-0.019	0.89	0.037	0.61	0.052	0.34	0.081	0.05	0.087	0.00	0.099	0.00	0.085	0.01	0.097	0.00	0.092	0.00	0.090	0.01	0.089	0.01	0.083	0.02	0.041	0.34
	(0.141)		(0.071)		(0.054)		(0.040)		(0.029)		(0.035)		(0.034)		(0.032)		(0.032)		(0.034)		(0.032)		(0.035)		(0.043)	
Long run effect	-0.070	0.89	0.136	0.64	0.165	0.31	0.263	0.02	0.319	0.00	0.340	0.00	0.294	0.00	0.332	0.00	0.318	0.00	0.281	0.00	0.257	0.00	0.210	0.00	0.088	0.33
Sargan test		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
test first autocorr.		0.07		0.04		0.04		0.05		0.04		0.05		0.05		0.03		0.05		0.03		0.02		0.02		0.02
test second autocorr.		0.57		0.16		0.23		0.25		0.30		0.72		0.77		0.64		0.91		0.93		0.62		0.27		0.96

Change in the minimum-wage/median-income ratio (=Fraction)

	P.10		P.15		P.20		P.25		P.30		P.35		P.40		P.45		P.5		P.6		P.7		P.8		P.9	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
Lagged per-capita income	0.717	0.00	0.736	0.00	0.706	0.00	0.711	0.00	0.743	0.00	0.721	0.00	0.712	0.00	0.703	0.00	0.701	0.00	0.659	0.00	0.623	0.00	0.564	0.00	0.515	0.00
	(0.106)		(0.104)		(0.067)		(0.049)		(0.024)		(0.040)		(0.027)		(0.040)		(0.039)		(0.043)		(0.040)		(0.056)		(0.100)	
Fraction (RMM)	0.327	0.24	0.227	0.17	0.476	0.01	0.611	0.00	0.601	0.00	0.693	0.00	0.660	0.00	0.747	0.00	0.657	0.00	0.699	0.00	0.746	0.00	0.685	0.00	0.487	0.00
	(0.279)		(0.165)		(0.188)		(0.154)		(0.122)		(0.123)		(0.117)		(0.127)		(0.130)		(0.135)		(0.100)		(0.106)		(0.089)	
Long run effect	1.155	0.32	0.858	0.24	1.621	0.00	2.112	0.00	2.338	0.00	2.485	0.00	2.288	0.00	2.517	0.00	2.197	0.00	2.050	0.00	1.978	0.00	1.569	0.00	1.003	0.00
Sargan test		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00
test first autocorr.		0.06		0.04		0.03		0.04		0.04		0.05		0.04		0.03		0.04		0.03		0.02		0.02		0.02
test second autocorr.		0.58		0.15		0.19		0.21		0.26		0.69		0.73		0.57		0.82		0.84		0.69		0.32		0.98

Table 6: Individual wage centile regressions

Workers

Fraction of workers between current and past minimum wages (=Fraction)

	P.10		P.15		P.20		P.25		P.30		P.35		P.40		P.45		P.5		P.6		P.7		P.8		P.9	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	P-v	Coef
Lagged per-capita income	0.723	0.00	0.810	0.00	0.776	0.00	0.746	0.00	0.634	0.00	0.648	0.00	0.597	0.00	0.639	0.00	0.581	0.00	0.572	0.00	0.533	0.00	0.503	0.00	0.481	0.00
	(0.063)				(0.118)		(0.085)		(0.075)		(0.036)		(0.040)		(0.037)		(0.066)		(0.107)		(0.066)		(0.047)		(0.058)	
Fraction (FMB)	-0.012	0.88	-0.017	0.72	0.019	0.69	0.025	0.52	0.022	0.68	0.051	0.42	0.082	0.20	0.102	0.03	0.098	0.03	0.058	0.01	0.017	0.55	0.034	0.36	0.016	0.67
	(0.077)				(0.047)		(0.005)		(0.052)		(0.064)		(0.063)		(0.047)		(0.044)		(0.023)		(0.028)		(0.037)		(0.038)	
Long run effect	-0.044	0.87	-0.087	0.70	0.083	0.71	0.097	0.55	0.060	0.68	0.146	0.40	0.203	0.19	0.282	0.01	0.233	0.00	0.136	0.02	0.037	0.55	0.069	0.35	0.031	0.67
Sargan test		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00		0.99		0.99		0.00		1.00
test first autocorr.		0.02		0.02		0.03		0.04		0.02		0.07		0.03		0.02		0.03		0.02		0.03		0.03		0.03
test second autocorr.		0.74		0.51		0.72		0.32		0.83		0.15		0.72		0.18		0.26		0.30		0.22		0.04		0.67

Change in the minimum-wage/median-income ratio (=Fraction)

	P.10		P.15		P.20		P.25		P.30		P.35		P.40		P.45		P.5		P.6		P.7		P.8		P.9	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	P-v	Coef	P-v	Coef
Lagged per-capita income	0.722	0.00	0.807	0.00	0.764	0.00	0.739	0.00	0.627	0.00	0.627	0.00	0.553	0.00	0.558	0.00	0.493	0.00	0.547	0.00	0.509	0.00	0.682	0.00	0.467	0.00
	(0.063)		(0.090)		(0.122)		(0.117)		(0.076)		(0.027)		(0.047)		(0.042)		(0.083)		(0.098)		(0.070)		(0.057)		(0.065)	
Fraction (RMM)	-0.070	0.80	-0.241	0.35	-0.045	0.79	0.044	0.55	0.278	0.08	0.342	0.02	0.626	0.04	0.794	0.00	0.789	0.01	0.379	0.00	0.281	0.00	0.335	0.05	0.233	0.08
	(0.278)		(0.256)		(0.174)		(0.074)		(0.158)		(0.143)		(0.305)		(0.277)		(0.295)		(0.105)		(0.087)		(0.168)		(0.132)	
Long run effect	-0.253	0.79	-1.244	0.14	-0.248	0.78	0.202	0.58	0.745	0.14	0.916	0.03	1.402	0.04	1.799	0.00	1.557	0.00	0.837	0.02	0.572	0.00	1.053	0.04	0.436	0.07
Sargan test		1.00		1.00		1.00		1.00		1.00		1.00		1.00		0.99		1.00		1.00		0.99		1.00		1.00
test first autocorr.		0.02		0.02		0.05		0.05		0.02		0.04		0.03		0.02		0.03		0.02		0.04		0.02		0.03
test second autocorr.		0.73		0.48		0.29		0.79		0.83		0.64		0.64		0.10		0.30		0.26		0.22		0.07		0.71

Table 7: Centile distance to the median of family percapita incomes and minimum wage bite

Households

Percentile distance from the median

Fraction of workers between current and past minimum wages (=Fraction)

PERCENTIL	P.1		P.15		P.20		P.25		P.30		P.37		P.40		P.45		P.60		P.75		P.80		P.90	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
Difference (-1)	0.760	0.00	0.806	0.00	0.735	0.00	0.669	0.00	0.579	0.00	0.462	0.00	0.303	0.00	0.217	0.00	0.135	0.00	0.279	0.01	0.430	0.00	0.575	0.00
	(0.050)		(0.046)		(0.030)		(0.023)		(0.038)		(0.070)		(0.096)		(0.073)		(0.045)		(0.101)		(0.075)		(0.045)	
Fraction (FMB)	0.049	0.74	0.018	0.70	0.014	0.59	-0.001	0.97	-0.014	0.30	-0.010	0.40	-0.003	0.75	-0.024	0.02	0.015	0.20	0.007	0.81	0.007	0.81	-0.040	0.31
	(0.146)		(0.045)		(0.026)		(0.018)		(0.014)		(0.011)		(0.009)		(0.010)		(0.012)		(0.026)		(0.027)		(0.039)	
Sargan test		0.82		0.93		0.99		1.00		1.00		1.00		1.00		0.96		1.00		1.00		0.99		0.98
test first autocorr.		0.06		0.05		0.06		0.09		0.04		0.02		0.01		0.01		0.02		0.04		0.03		0.02
test second autocorr		0.18		0.91		0.94		0.92		0.83		0.42		0.86		0.83		0.87		0.59		0.55		0.48

Fraction of workers between current and past minimum wages (=Fraction)

	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
Difference (-1)	0.752	0.00	0.795	0.00	0.732	0.00	0.667	0.00	0.577	0.00	0.456	0.00	0.299	0.00	0.214	0.00	0.141	0.00	0.272	0.00	0.432	0.00	0.570	0.00
	(0.048)		(0.042)		(0.029)		(0.019)		(0.037)		(0.067)		(0.098)		(0.075)		(0.049)		(0.080)		(0.065)		(0.049)	
Fraction (RMM)	0.331	0.39	0.170	0.14	0.066	0.30	0.008	0.85	-0.036	0.35	-0.031	0.33	-0.031	0.34	-0.107	0.00	0.061	0.21	0.102	0.44	0.017	0.89	-0.100	0.69
	(0.384)		(0.115)		(0.063)		(0.042)		(0.038)		(0.032)		(0.032)		(0.031)		(0.049)		(0.131)		(0.126)		(0.251)	
Sargan test		0.81		0.93		0.99		1.00		1.00		1.00		1.00		0.97		1.00		1.00		0.99		0.98
test first autocorr.		0.06		0.05		0.06		0.09		0.04		0.02		0.01		0.01		0.02		0.04		0.03		0.02
test second autocorr		0.18		0.90		0.93		0.92		0.78		0.44		0.85		0.80		0.87		0.64		0.49		0.49

Table 8: Centile distance to the median of individual income and minimum wage bite

Workers

Percentile distance from the median

Fraction of workers between current and past minimum wages (=Fraction)

PERCENTIL	P.1		P.15		P.20		P.25		P.30		P.35		P.40		P.45		P.60		P.70		P.80		p.90	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
Difference (-1)	0.917	0.00	0.917	0.00	0.883	0.00	0.831	0.00	0.801	0.00	0.719	0.00	0.554	0.00	0.047	0.79	0.455	0.00	0.438	0.00	0.458	0.00	0.464	0.00
	(0.032)		(0.050)		(0.062)		(0.069)		(0.081)		(0.092)		(0.103)		(0.176)		(0.056)		(0.081)		(0.077)		(0.057)	
Fraction (FMB)	0.017	0.86	-0.002	0.98	0.019	0.63	0.067	0.07	0.067	0.05	0.060	0.07	0.039	0.17	-0.013	0.71	-0.064	0.01	-0.165	0.01	-0.176	0.00	-0.129	0.01
	(0.093)		(0.059)		(0.040)		(0.037)		(0.034)		(0.034)		(0.028)		(0.036)		(0.023)		(0.063)		(0.060)		(0.053)	
Wald test		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Sargan test		0.99		0.98		0.99		0.99		0.99		0.96		0.99		0.95		0.97		0.98		0.97		0.98
test first auti¿ocorr		0.03		0.05		0.01		0.02		0.01		0.01		0.01		0.02		0.07		0.02		0.02		0.04
test second autocorr		0.46		0.94		0.39		0.40		0.53		0.61		0.69		0.16		0.59		0.44		0.18		0.13

Change in the minimum-wage/median-income ratio (=Fraction)

	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
Difference (-1)	0.916	0.00	0.931	0.00	0.886	0.00	0.824	0.00	0.796	0.00	0.714	0.00	0.545	0.00	0.047	0.77	0.406	0.00	0.421	0.00	0.442	0.00	0.442	0.00
	(0.031)		(0.051)		(0.068)		(0.072)		(0.089)		(0.102)		(0.108)		(0.156)		(0.108)		(0.120)		(0.088)		(0.063)	
Fraction (RMM)	0.055	0.86	-0.177	0.49	0.017	0.93	0.246	0.10	0.233	0.12	0.136	0.42	0.103	0.30	-0.073	0.51	-0.362	0.00	-0.640	0.00	-0.623	0.00	-0.516	0.00
	(0.313)		(0.258)		(0.194)		(0.151)		(0.150)		(0.169)		(0.098)		(0.110)		(0.122)		(0.115)		(0.146)		(0.156)	
Sargan test		0.98		0.97		0.99		0.99		0.99		0.95		0.99		0.94		0.97		0.98		0.97		0.97
test first auti¿ocorr		0.03		0.05		0.02		0.01		0.01		0.01		0.01		0.02		0.05		0.02		0.02		0.03
test second autocorr		0.46		0.91		0.39		0.42		0.56		0.61		0.66		0.17		0.62		0.45		0.19		0.13

Table 9: Household likelihood of Being Poor
heteroskedastic probit

	Likelihood of Being Poor with 1/2 of poverty line				Likelihood of Being Poor with 1/3 of poverty line			
	Coef	P-val	Coef	P-val	Coef	P-val	Coef	P-val
Ratio minimum wage to median individual income=RMM	0.074	0.11	-0.169	0.13	0.150	0.00	-0.138	0.25
	(0.046)		(0.111)		(0.052)		(0.121)	
RMM(t-1)	0.211	0.00	0.376	0.00	0.269	0.00	0.455	0.00
	(0.046)		(0.118)		(0.051)		(0.128)	
RMM(t-2)	0.010	0.83	0.104	0.38	0.077	0.14	0.315	0.01
	(0.047)		(0.118)		(0.052)		(0.128)	
RMM(t-3)	0.316	0.00	0.815	0.00	0.342	0.00	0.818	0.00
	(0.046)		(0.109)		(0.052)		(0.119)	
RMM total efect	0.611	0.00	1.126	0.00	0.838	0.00	1.450	0.00
Interaction of RMM with human capital (hksm)								
HKRMM			0.027	0.01			0.033	0.01
			(0.011)				(0.012)	
HKRMM-1			-0.018	0.12			-0.021	0.11
			(0.012)				(0.013)	
HKRMM-2			-0.010	0.41			-0.026	0.05
			(0.012)				(0.013)	
HKRMM-3			-0.053	0.00			-0.052	0.00
			(0.011)				(0.012)	
HKRMM marginal effect			-0.054	0.00			-0.066	0.00
Education	-0.101	0.00	-0.060	0.00	-0.083	0.00	-0.034	0.00
	(0.001)		(0.006)		(0.001)		(0.007)	
Prop. Women	0.381	0.00	0.382	0.00	0.457	0.00	0.459	0.00
	(0.008)		(0.008)		(0.010)		(0.010)	
Experience	-0.006	0.00	-0.006	0.00	-0.007	0.00	-0.007	0.00
	(0.000)		(0.000)		(0.000)		(0.000)	
Prop. Self-employed	-0.338	0.00	-0.340	0.00	-0.309	0.00	-0.312	0.00
	(0.007)		(0.007)		(0.008)		(0.008)	
Prop. Young under 22	0.736	0.00	0.739	0.00	0.565	0.00	0.569	0.00
	(0.008)		(0.008)		(0.009)		(0.009)	
Prop. Children	1.408	0.00	1.414	0.00	0.975	0.00	0.982	0.00
	(0.012)		(0.012)		(0.012)		(0.012)	
Year Dummys		0.00		0.00		0.00		0.00
Quarter Dummys		0.00		0.00		0.00		0.00
City Dummies		0.00		0.00		0.00		0.00
Wald Test		0.00		0.00		0.00		0.00
Number of Observations	666,134		666,134		666,134		666,134	

Appendix A

Family per capita centile income regressions using two proxies for minimum wage bite b/

	P.05		P.1		P.15		P.20		P.25		P.30		P.37		P.40		P.45		P.50		P.6		P.70		P.80		P.90	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v		
RMM Total effect a/	-0.65	0.07	-0.29	0.24	0.08	0.68	0.31	0.10	0.30	0.10	0.36	0.04	0.39	0.03	0.48	0.01	0.42	0.02	0.40	0.02	0.52	0.00	0.42	0.02	0.49	0.01	0.43	0.03
Hausman fixed effects vs random effects		0.03		0.01		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Number of Histories		28		28		28		28		28		28		28		28		28		28		28		28		28		28
Number of observatios		14		14		14		14		14		14		14		14		14		14		14		14		14		14

Centile distance to the median of family percapita incomes and minimum wage bite b/

	P.05		P.1		P.15		P.20		P.25		P.30		P.35		P.40		P.45		P.60		P.70		P.80		P.90	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
RMM Total effect a/	0.88	0.00	0.61	0.00	0.32	0.00	0.14	0.06	0.10	0.11	0.03	0.57	0.04	0.42	-0.02	0.46	-0.01	0.56	0.06	0.10	0.07	0.24	0.14	0.13	0.08	0.57
Hausman fixed effects vs random effects		0.98		1.00		1.00		0.77		0.98		1.00		0.00		1.00		1.00		1.00		0.98		1.00		1.00
Number of Histories		28		28		28		28		28		28		28		28		28		28		28		28		28
Number of observatios		14		14		14		14		14		14		14		14		14		14		14		14		14

Centile distance to the 0.7 centile of family percapita incomes and minimum wage bite b/

	P.05		P.1		P.15		P.20		P.25		P.30		P.35		P.40		P.45		P.50		P.60		P.80		P.90	
	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v	Coef	P-v
RMM Total effect a/	1.04	0.00	0.74	0.00	0.43	0.00	0.24	0.03	0.19	0.04	0.12	0.15	0.12	0.13	0.05	0.51	0.05	0.44	0.07	0.24	0.00	1.00	0.07	0.21	-0.01	0.94
Hausman fixed effects vs random effects		0.99		1.00		0.90		0.11		0.88		0.77		0.92		0.92		0.92		0.98		0.36		0.99		1.00
Number of Histories		28		28		28		28		28		28		28		28		28		28		28		28		28
Number of observatios		14		14		14		14		14		14		14		14		14		14		14		14		14

a/ Is the sum of the short run coefficients.

b/ We run the panel with annual percentile levels. We take each quarter annual series for each city as one history and pool all quarter-city histories together for a total of 28 each with 17 time observations. The static model is for the percentile equation:

$$y_{jt}^{c} = \alpha + \beta_1 MB_{jt} + \beta_2 MB_{jt-1/4} + \beta_3 MB_{jt-1/2} + \beta_4 MB_{jt-1} + \mu_j + \lambda_t + \varepsilon_{jt}$$

and for the percentile difference to the median (and the 70th percentile).

$$y_{jt}^{0.5} - y_{jt}^{c} = \alpha_d + \beta_1 MB_{jt} + \beta_2 MB_{jt-1/4} + \beta_3 MB_{jt-1/2} + \beta_4 MB_{jt-1} + \varepsilon_{jt}^{0.5} - \varepsilon_{jt}^{c}$$

Where $MB_{jt}, MB_{jt-1/4}, MB_{jt-1/2}, MB_{jt-1}$ are the current minimum wage median income ratio, the ratio a quarter before, the ratio 6 months before and the ratio a year before.