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The Effects of the Minimum Wage on Earnings and Employment in Brazil

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Sara Lemos[1]

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ABSTRACT

This paper analyzes the effects of the minimum wage on both, earnings and employment, using a Brazilian rotating panel data (Pesquisa Mensal do Emprego - PME) which has a similar design to the US Current Population Survey (CPS). First an intuitive description of the data is done by graphical analysis. In particular, Kernel densities are used to show that an increase in the minimum wage compresses the earnings distribution. This graphical analysis is then formalized by descriptive models. This is followed by a discussion on identification and endogeneity that leads to the respecification of the model. Second, models for employment are estimated, using an interesting decomposition that makes it possible to separate out the effects of an increase in the minimum wage on number of hours and on posts of jobs. The main result is that an increase in the minimum wage was found to compress the earnings distribution, with a moderately small effect on the level of employment, contributing to alleviate inequality.

1. INTRODUCTION

Employment and earnings are two important macroeconomic variables in capitalist societies. To increase the level of these variables is always among the aims of the Government. One institutional variable that can be used by the Government to influence earnings and employment is the minimum wage. The possibility of using the minimum wage as an instrument of macroeconomic policy immediately asks for its effects on employment

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and earnings. The direction and magnitude of this effect - the elasticity - provides the quantitative and qualitative information to the question of the effects of the minimum wage on the level of both, employment and earnings. The knowledge of these elasticities might enable the Government to use the minimum wage as an instrument of macroeconomic policy against poverty, inequality and unemployment.[2]

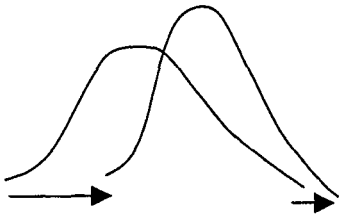
The aim of this paper is to estimate these elasticities. Their expected directions and magnitudes are as follows. On one hand, the elasticity of the minimum wage with respect to the other wages/earnings is expected to be positive because workers bargain to maintain their relative wages. However, its magnitude is expected to vary across the earnings distribution, once the minimum wage is expected to have stronger impact on the lower tail of the distribution. This is because different occupations compare their wages to the wages of different reference groups. And different groups do not react identically in presence of a minimum wage increase (Grossman, 1983).

Thus, we can expect different elasticities for different percentiles of the earnings distribution. An increase in the minimum wage would affect the earnings distribution in two ways: a) shifting the distribution to the right, pushing its mean up, and b) changing the shape of the distribution, because of the change in its variance. The change in its variance is due to the different elasticities across the distribution. As higher elasticities are expected in lower percentiles, the change in its variance is such that the distribution becomes less disperse. This change in the shape of the earnings distribution would imply a nonparallel shift of the distribution to the right.[3] Other things equal, this shift is expected to reduce inequality.

On the other hand, there is no consensus about the direction of the elasticity of the employment with respect to the minimum wage, which might be either negative or nonnegative. The standard neoclassical model predicts a negative elasticity if the minimum

[2] See Dinardo, Fortin and Lemieux (1994) and Card and Krueger (1995) for issues on the effect of the minimum wage on inequality. Or see the original article of Stigler (1946).

[3] The following figure illustrates what is meant by nonparallel shift of the distribution to the right:



wage is fixed above the level of the equilibrium wage in a perfect competitive labour market (if fixed at the exact equilibrium level or below, it does not have any effect). This is because in order to afford higher wages employers would have to lay off some workers. This theory is supported by empirical evidence showing that "a 10% increase in the minimum wage reduces teenage employment by one to three percent" (Brown etc. all, 1982, p.524). An update of Brown's et al. survey by Wellington (1991), concludes that the employment effects of the minimum wage are negative but small: 10% increase in the minimum wage would lower teenage employment by 0.06 percentage points. More recently, Deere et al. (1995), Kim and Taylor (1995) and Neumark and Wescher (1995) also found negative effects. However, new empirical evidence, which still needs stronger theoretical support, has found nonnegative elasticities (Card, 1992a and 1992b; Katz and Krueger, 1992; Machin and Manning, 1993; Card Katz and Krueger, 1994; Card and Krueger, 1994, 1995 and 1998; Bernstein and Schmitt, 1998 and Dickens et al., 1999). A minimum wage increase needs not reduce employment, and might increase it if the wages are lower than the productivity of workers. This could happen in a monopsonistic model[4], where firms are paying wages below the marginal productivity of the worker (Dickens et al, 1999; Dickens et al, 1995c).

It is important to notice that employment is going to be affected not only because of the change in the minimum wage itself, but also because of the changes in the wages/earnings, via changes in the minimum wage. In other words, employment can be thought of as being a function of both, the minimum wage and wages/earnings. And wages/earnings, as being a function of the minimum wage: $N = f[mw, w(mw)]$. Thus, the aim here is to estimate the reduced form of this as yet unidentified structural model.

Given the nature of the relationship between these variables, the goal of macroeconomic policy is to change the shape of the wage/earnings distribution but not to destroy jobs. If the elasticity of the other wages with respect to the minimum wage and the elasticity of employment with respect to the minimum wage have opposite signs, the Government might have to decide among two compromising goals: increasing the level of

[4] This model is attractive because it is general enough to allow the minimum wage to have either a negative or a nonnegative effect on employment. It is also attractive because: 1) it can explain the existence of a spike in the empirical earnings distribution; 2) it distinguishes between the elasticity of labour supply to an individual firm (which determines its monopsony power) and the elasticity of labour supply to the market as a whole (which determines the employment effects of an increase in the minimum wage); 3) it allows an analysis of the way in

employment or increasing the level of wages. On the other hand, if both elasticities are positive, or positive and nonnegative respectively, an increase in the minimum wage is likely to be desirable. In the case where an increase in the minimum wage has nonnegative or no significant effect on employment, its effects on inequality will strongly depend on its effects on the shape of the earnings distribution. If the employment elasticity is zero, this can be used as an identifying restriction to identify the effect of the minimum wage on inequality, as in Dinardo et al (1996). If the employment elasticity is negative, it is still possible to study the effects of the minimum wage on inequality, but then an exercise of calibration is required, to take into account the negative impact on employment.[5]

Thus, this paper is going to estimate the effect of the minimum wage on both, employment and earnings. It is organized as follows. The second section after this introduction presents the data. Section 3 is a descriptive section, which first describes the behaviour of the minimum wage, setting it into context in Brazil (section 3.1), and then presents some descriptive statistics (section 3.2) and descriptive models (section 3.3). Section 4 discusses identification and endogeneity and estimates the earnings model (section 4.1) and the employment models (section 4.2). Section 5 concludes.

2. DATA

This paper analyses the effects of the minimum wage in Brazil, using Brazilian data to estimate the earnings and employment elasticities. The data used is a rotating panel data for Brazil called PME (Monthly Employment Survey) which has a similar design to the US CPS (Current Population Survey). From 1982 to 1998, PME interviewed over 8 million people across the six main Brazilian metropolitan regions: Bahia (BA), Pernambuco (PE), Rio de

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which different firms in the same market are differentially affected by the minimum wage (Dickens Machin and Manning, 1994 and 1999).

[5] It is Important not to forget that the effects of the minimum wage on inequality depend also on who earns the minimum wage (see Card and Krueger, 1995).
Furthermore, in any case, the speed and the magnitude of the increase play an important role. For example, a more desirable effect on the level of employment, in case of wages lower than the marginal product, might be reached with a policy that combines successive small increases instead of one single large increase, that could lead to lay offs (see Card and Krueger, 1995; Dickens, Machin and Manning, 1997; and Machin and Manning, 1994, 1996). Thus, a minimum wage increase program should suggest a schedule of time and optimal percentages to maximize the employment and the effects against inequality and poverty, as well as mechanisms to enforce and monitor it.

Janeiro (RJ), Sao Paulo (SP), Minas Gerais (MG) and Rio Grande do Sul (RS). Its monthly periodicity is essential for the analysis of the Brazilian labour market because wages bargaining during the sample period occurred yearly, bi-yearly, quarterly and even monthly, depending on the level of the inflation rate and stabilization plan in vigor.

Each metropolitan region is composed of towns and cities, divided into Census sectors. PME first selects sectors and then households within sectors. The selection of households in the sectors is conducted with probability proportional to the number of households in every sector. This is so to guarantee random sampling, once the probability of selection of each household within a metropolitan region is constant regardless of the size of the city/town where the household is located (IBGE, 1983).

Then a panel is defined as a set of households divided into four subsets, P1, P2, P3, P4. A second and a third panel of the same length are selected, without coincident households, and also divided into four subsets (Q1, Q2, Q3, Q4 and R1, R2, R3, R4). The rotating scheme substitutes one of the subsets of the panel every month. That is, in month t+1, panels P1, P2, P3, P4 started off in month t, are substituted by P1, P2, P3, Q4. In month t+2, panels P1, P2, P3, Q4 are substituted by P1, P2, Q3, Q4. And so on, in such a way that in the 13th month, panels P1 P2 P3 P4 are back in the survey before they are definitely excluded[6]. In this fashion, it is guaranteed that a) 75% of the households will be common to

[6] The following table illustrates the rotating panels scheme:

year/month	week			
1988	1	2	3	4
May	P1	P2	P3	P4
June	P1	P2	P3	Q4
July	P1	P2	Q3	Q4
August	P1	Q2	Q3	Q4
September	Q1	Q2	Q3	Q4
October	Q1	Q2	Q3	R4
November	Q1	Q2	R3	R4
December	Q1	R2	R3	R4
1989				
January	R1	R2	R3	R4
February	R1	R2	R3	P4
March	R1	R2	P3	P4
April	R1	P2	P3	P4
May	P1	P2	P3	P4

every two consecutive months[7], and b) that every couple of years 100% of the sample is repeated. This scheme allows not only monthly and yearly comparisons, but also seasonal comparisons (IBGE, 1983).

According to the above scheme, every household is interviewed for 4 consecutive months, is out of the survey for 8 consecutive months, and is again interviewed for another 4 consecutive months, when is then definitely excluded from the survey. That is, within a period of 16 months, a household is interviewed 8 times (IBGE, 1991)[8]. From the household selected, around 20% of the sample is dropped for non-response. From the remaining sample, around 50% were interviewed 4 times consecutively and around 13% were interviewed eight times consecutively, on average across metropolitan regions.

At a more detailed level, it is important to remember that PME is a household, not an individual survey. There is no guarantee that the same individual lives in the same household for 16 consecutive months; or that the same individual, within a household, answers all the interviews. But some controls allow for checking whether the survey is following the same individual over time. After differencing earnings, around 25% of the data for the whole period is lost, on average, across metropolitan regions. This is because individuals which are not followed for subsequent months are dropped. An individual could not be observed for a subsequent month either because he lost his job (or because he never had a job in the survey period) or because of the rotating panel scheme (two observations are lost, rather than one, because the individual is not observed for 8 consecutive months, but for 4 and 4, with 8 months interval in between.[9]

Comparisons of demographics and economics across regions indicate that the data does not show selectivity bias in any direction. Also, comparisons of demographics and economics between people interviewed four and eight times show no bias.[10]

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[7] Although conceptually 75% of the households should always be common to two consecutive months, practical problems provoked twice the break of the flow. 1) In August of 1988 the sample of PME was reduced by 20%, excluding Census sectors and households within Census sectors. 2) In October of 1993, because of the new Census, a new sample for the PME was selected. From October of 1993 to January of 1994 this new sample was slowly implemented. Thus the panels of January of 1994 are 100% different from the ones of January 1993. A part from this two big changes, whenever the selection of new panels in a particular sector was exhausted, the sector was substituted. Also, the impossibility of interviews in areas of extreme violence lead to the substitution of households within Census sectors.

[8] For a detailed description of the data, see IBGE (1983) and (1991).

[9] The same differencing, considering the three breaks in the panels above mentioned, keeps respectively around 77%, 75% and 73% of the data, on average, across metropolitan regions.

[10] For a detailed analysis on selectivity bias and non-response attrition on PME, see Neri (1996).

To deflate nominal variables in the PME, the deflator chosen was INPC[11] (National Consumers Price Index), calculated by IBGE (Brazilian Institute of Statistics and Geography), the same institution that conduces PME. This index was desegregated at regional levels, so that the regional data could be deflated by regional deflators. This was an attempt to reduce measurement error likely to arise from the deflation of nominal data in a high inflationary environment disregarding regional inflation rate variations. [12]

Finally, the data on the minimum wage was obtained from the Brazilian Labour Ministry.

3. DESCRIPTIVE ANALYSIS

3.1 MINIMUM WAGE AS MACROECONOMIC POLICY IN BRAZIL

As mentioned above, the main motivation for the study of the effects of the minimum wage on both employment and earnings is the possibility of its use as social macroeconomic policy against inequality poverty and unemployment. But that is not the only role played by the minimum wage in Brazil. The minimum wage can be regarded as the cost of a production input (labour) [either as the cost of a minimum wage worker or as affecting the cost of workers earning more than one minimum wage (workers higher up in the earnings distribution), as discussed in the introduction], and therefore, it can affect prices. Because of this, the minimum wage can be used as stabilisation macroeconomic policy against inflation (Camargo, 1984; and Macedo and Garcia, 1978). This is particularly true if the minimum wage assumes a role of indexor, as happened in Brazil in the last few decades. In such high inflationary environment, with distorted relative prices, agents took the official increases in the minimum wage as a signal for their bargain on prices and wages/earnings. Carneiro and Faria (1998) argue that with the introduction of the first official wage macroeconomic policy

[11] The choice of the deflator and the deflation method are very important in a high inflationary process context such as the one experienced in Brazil in the last 20 years. The inflation rate from 01.1982 to 09.1998 was 5,338,550,750,980%. To see more about the issues evolved in deflation of wages in presence of high inflation, see Neri (1995). Also see discussion on the choice among INPC versus IPCA (Wide Consumer Price Index) on a forthcoming paper on the effects of the minimum wage on earnings and employment in presence of high and low inflation.

[12] Because the INPC is centered on the 15th of the month, and the wages are usually paid at the beginning of the month, a geometric mean of two subsequent months was used as an attempt to center the INPC on the 1st of the month (the geometric mean of the INPC in months t and t-1 is the INPC centered at the first day of month t). This geometric mean was computed for every regional index, after disagregating the INPC.

in the 60's, the minimum wage was used not only as stabilisation policy but also as co-ordinator of the wage policy.

Thus the minimum wage was alternatively used as social or stabilisation macroeconomic policy in Brazil. The choice depended a) on whether the Government was populist or conservative, b) on the level of inflation; and c) on the bargain power of the workers at every point in time. The more populist the Government, the lower the inflation and the stronger the bargaining power of workers, the more the minimum wage tended to be used as social rather than as stabilisation policy.

Although a proper discussion of the role of the minimum wage in Brazil is far beyond the scope of this paper[13], it might be instructive to briefly place the minimum wage into context in the Brazilian economy. The minimum wage was first introduced in 1940 as a social policy. Its level was such as to provide the minimum diet, transport, clothing and hygiene for an adult worker. The price of this minimum basket was different across the country, such that there was 14 different levels for the minimum wage, with the highest levels for the Southwest (SE) and the lowest for the Northwest (NE) (Foguel, 1997). Wells (1983, p. 305) believes that the initial levels of the minimum wage were "generous relative to existing standards" once about 60 to 70% of workers earned below these initial levels. On the other hand, Saboia (1984) and Oliveira (1981) believe that the minimum wage did not rise but rather legitimated the low wages of the unskilled.

Although the minimum wage was set to buy a minimum basket, most often this did not seem to be a worry when adjusting its nominal value. Roughly, the evolution of the real minimum wage was: a) a dramatic decrease from 1940 to 1951; b) a steep increase from 1952 to 1961; c) a decrease from 1962 to 1974; d) an increase from 1974 to 1979 and stabilisation until 1982; e) a decreasing tendency, oscillating with the different stabilisation plans, from 1983 onwards..

The real minimum wage decreased dramatically during the 40's because its nominal value was not adjusted between 1943 and 1952, while the inflation was around 160%, combination which lead the minimum wage to reach its lowest level ever. On the other hand, the combination of the economic boom during the 50's, the high productivity, the strong unions and the social-populist governments, in a favourable environment for increasing

[13] For a detailed description of macroeconomic policy in Brazil, see Abreu (1992).

wages, lead the minimum wage to reach its highest level ever. In the following years (from 1962 until 1974) wages decreased, and so did the minimum wage, as a result of the recession combined with rising inflation and rather defensive than stronger unions (Singer, 1975). The minimum wage then was 40% lower than in the 50's. In its early existence the real minimum wage was used as a social policy whose level was strongly associated with the alternance of populist and conservative governments (Velloso, 1988 and Bacha, 1979). This role changed when the dictatorship Government installed in 1964 associated the high inflation with increases in the wages. Thus, a recessive wage macroeconomic policy was implemented, whose one of the main strategy was to control the increases in the minimum wage (Macedo and Garcia, 1978), with nominal minimum wage adjustments below the inflation. The minimum wage was transformed "from a social policy designed to protect the worker's living standard into an instrument for stabilisation policy (Camargo, 1984, p.19).

The boom in the late 60's increased wages, however by much less than the increase in productivity (Foguel, 1997). This increase was not accompanied by an increase in the minimum wage, which remained stable. In a more favourable environment, and also due to the pressure of accelerating inflation, the level of the real minimum wage was preserved from 1974 until 1979, with yearly adjustments just about right to compensate the inflation. In 1979, the wage policy changed substantially. Bi-yearly adjustments of 110% of the inflation were given to workers who earned in the range of 1 to 3 minimum wages. Lower percentual of adjustment were given as the range of earnings was higher up in the earnings distribution. Soon the minimum wage became an indexor for all kinds of contracts. This policy lead the economy to superindexation. And even after its use as indexor was forbidden by law in 1987, the minimum wage continued playing a major role in prices and wages/earnings bargaining.

With the inflation back in the early 80's, the priorities of the macroeconomic policy were essentially combating the inflation. Several stabilisation plans, orthodox and the most heterodox ones, lead to a series of different wages policy. The minimum wage continued being used as a component of the wage macroeconomic policy even after the end of the dictatorship regime in 1985, with some sporadic and unsuccessful attempts to use it as a social policy. The importance of the minimum wage was not only because of the indexation of the economy, but also because pensions and retirement paid by the government were related to

the minimum wage.[14] Because of this, the level of the minimum wage had an impact on the Government's budget. This impact combined with the fiscal crisis did not allow the government to give more generous adjustments to the minimum wage.

In 1983 the percentual of increase of wages of workers earning in the range of 1 to 3 minimum wages went down to 100% rather than the previous 110% of the inflation. In 1984 the minimum wage became national. The different levels across the country had slowly been converging to a national level over previous years. In 1988 the new Constitution (after the military regime) fixed the national minimum wage by law as to provide the minimum diet, accommodation, education, health, leisure, clothing, hygiene, transport, and retirement to an adult worker and his family.

From 1986 to 1994 the minimum wage was systematically decreased, due mostly to the persistency of high levels of inflation. The minimum wage suffered two major decreases in 1983 and 1987 (Reis, 1989), despite of the attempt of 15% increase by Plano Cruzado, in February of 1986, frustrated by the acceleration of the inflation (Velloso, 1988). Under Plano Cruzado, all wages should be increased automatically whenever the accumulated inflation was higher than 20%. The minimum wage was adjusted twice according to this rule, but still, by the implementation of Plano Bresser, in June of 1987, the minimum wage was 25% lower than in March of 1986. Under Plano Bresser, wages should be frozen for 3 months and then monthly indexed by past inflation. The monthly indexation preserved the level of the real minimum wage from September of 1987 until the implementation of Plano Verao, in January of 1989, when prices were again frozen. From May of 1989 onwards the minimum wage was

[14] Carneiro and Henley (1998) argue that the minimum wage became less important as a coordination instrument in the 80's and that its effect in the long run on the real wages became less and less important. But this is not a new debate in Brazil. The 1970 Populational Census showed an increase in inequality in the country. This increase in inequality was associated with the systematic decreases in the minimum wage since 1940, and in particular, after the 1964 recessive wage macroeconomic policy. The minimum wage was identified as determining the evolution of wages (Souza and Baltar, 1980; Wells, 1983; and Saboia 1983), although some would disagree on that (Macedo and Garcia, 1978). But even though Macedo e Garcia (1979) tried to minimize the role of institutional variables, and in particular the role of the minimum wage, on the increase in inequality, specially for the SE, where the demand for labour increased, they afirm that the unimportance of the minimum wage in the NE was not so evident.

Attempts to explain the effect of the minimum wage on wages/earnings were made in a neoclassical and structuralist framework [see structural theories of CEPAL (Comission for the Development of Latin America), of University of Campinas (SP, Brazil), and in particular, see Souza (1980a, 1980b) and Tavares (1975 adnd 1985)], as well as using Lewis' theory of the subsistence wage (Lewis, 1954). Not only the association of the minimum wage with inequality was extensively discussed in Brazil, but also the association of decreasing minimum wage, signalizing decreasing wages, driving a

adjusted monthly, what once more preserved its real value at the level of the beginning of Plano Verao. However, the dramatic acceleration of the inflation in the beginning of 1990, just before Plano Collor, was responsible for a big fall in the minimum wage. Under Plano Collor, initially no systematic rules for indexation were announced, strategy which had to be abandoned because the inflation could not be maintained at low levels. Another big fall followed from non adjustment of the nominal minimum from March to May of 1990. From then on the minimum was adjusted monthly until February of 1991. Once more the non adjustment of the nominal minimum wage, combined with 65% inflation from March until August of 1991 induced another big fall. In September 1991, the indexation was restricted to workers who earned in the range of 1 and 3 minimum wages. The minimum wage was adjusted quarterly until December of 1992. In 1993 the minimum wage was adjusted bi-monthly until June and then monthly, as the inflation was persistent. In March of 1994 a daily indexor for prices and wages was introduced as prelude for the Plano Real implemented in July of 1994. In September of 1994 the minimum wage was adjusted and was then frozen until April of 1995, which induced a fall in its real value once the inflation was not null in the period. In May of 1995, with the inflation stabilised, the minimum wage was increased by 42%. Since then the minimum wage has been yearly adjusted, with low but not null inflation. Under Plano Real, with the stabilisation of the inflation, the minimum wage has not been used explicitly as stabilisation policy.

Table 3.1 and graph 3.1a summarize the behaviour of the real minimum wage from 1982 until 1998 (period for which the data for this paper is available). Before the first stabilization plan (Cruzado Plan, February of 1986) the nominal minimum wage was adjusted every 6 months (May and November). From then on, it was erratically adjusted, depending on the current adjustment rules of successive stabilization plans (Cruzado Plan II, June of 1986; Bresser Plan, June of 1987; Verao Plan, January of 1989; Verao Plan II, May of 1989; Collor Plan, March of 1990; Collor Plan II, January of 1991; and Real Plan, July of 1994). Under the Real Plan, the adjustments became yearly (May). The highest level of the real minimum wage, within the period, according to table 3.1, was in November of 1982 (R$255.06), before the acceleration of the inflation. Its value decreased continuously, during

functional redistribution of income in favour of profits, as in instrument of capitalist accumulation (Ramos and Reis, 1991)

a long period of high inflation, reaching its lowest level in August of 1991 (R$82,21). It then presented a positive tendency followed by a large single decrease when the Real Plan was implemented[15]. At that time, it was fluctuating around R$100,00[16], and, since then, its nominal value has been increased in about 5 to 12% per year.

3.2 DESCRIPTIVE STATISTICS

The behaviour of real variables is mainly influenced by the inflation in the period. The high inflation, combined with nominal earnings adjustments lower than the inflation, induced: 1) large decreases in the real minimum wage; 2) high variation in both, real earnings and real minimum wage.

The behaviour of the real minimum wage in the period is shown in table 3.1 for the whole country and in graph 3.1, for the whole country and per regions. The highest level of the real minimum wage is in SP, where the level of inflation is the lowest. On the other hand, the lowest level of the real minimum wage and highest level of inflation are in PE and BA. More generally, the real minimum wage is higher, and the inflation rate is lower in Southeast (SE) [RJ, SP and MG] and South (S) [RS], than in Northeast (NE) [BA and PE]. Although the level of the real minimum wage differs, its pattern of behaviour is very similar across regions (see graph 3.1).

The variation in the real earnings and real minimum wage for each region and for the whole country over time, are shown in graph 3.2. The pattern of the behaviour of real average earnings is very similar in all regions and it is also similar to the behaviour of the minimum wage. PE presents the smoothest pattern and the lowest level of real earnings, while SP presents the most variable pattern and the highest level. Another way to look at the variation in real earnings as compared with variation in the real minimum wage is to look at what Machin and Manning (1994) call "toughness" of the minimum wage. Toughness is defined as the ratio of the real minimum wage and the real average earnings, which is the key variable in

[15] At that time there was two currencies in the country: Cruzeiros Reais and URV (Real). The inflation measured in Cruzeiros Reais was much higher than the inflation measured in Reais, as it was the idea behind the plan. Although the IBGE published the inflation measured in Reais in July of 1994, in this paper this rate was corrected (in 21.99%) for the inflation in Cruzeiros Reais in July of 1994.

[16] The real minimum wage and earnings values in this paper are in Reais of December of 1997. When the Real plan was implemented, the nominal value of the minimum wage was around R$70,00, which in terms of Reais of December of 1997 is R$100,00. (The exchange rate of Reais to US dollars was one to one when the Real Plan was implemented, and it was approximately 1,70, in September 1999).

many minimum wage studies (Brown et al., 1982). This measure is shown in table 3.1 and graphed in graph 3.3, also for every region and for the whole country over time. Again, the pattern is very similar in all regions. Now SP presents the smoothest pattern and the lowest level, and PE the most variable pattern and the highest level. All these figures show a similar pattern of variation in both, real minimum wage and real earnings, suggesting that both variables can be related. It also shows high variation in the real minimum wage, what contributes for the efficiency of the estimators discussed below.

While the toughness shows how the minimum wage and the mean of the earnings distribution are associated, a more complete and informative picture is given by analyzing the association of the minimum wage with various percentiles of the earnings distribution. Graph 3.4 shows the 5th, 10th, 50th, 90th, 95th percentiles and the mean of the earnings distribution for the whole country, as well as ratios of the 90-10, 90-50 and 10-50 percentiles. This is to show that the pattern of the 10th percentiles of the earnings distribution are similar to the pattern of the minimum wage in graph 3.1. Graph 3.5 shows the pattern of the 10th percentile of earnings distribution for the whole country and per region. This resemblance is not that strong for percentiles higher up in the distribution. This is shown numerically in table 3.2 that shows the correlations between the real minimum wage and the percentiles and mean of the earnings distribution for every region. These correlations confirm the graphical analysis (graphs 3.4 and 3.5) that the minimum wage is more strongly correlated with lower than with higher percentiles of the earnings distribution. It also shows that the correlations between the minimum wage and the 10th percentile are stronger in NE than in SP. Important to note that the minimum wage is expected to impact more poor than rich regions. In particular, changes in the minimum wage are expected to induce a bigger change in earnings of poor (NE) than of rich regions (SE and S, in particular, SP). Thus, the conceptual question here is how changes in the minimum wage changes earnings, that is, how the changes of variables are related, rather than their relation in levels. That is the economic reason why specifications in first-differences are chosen over specifications in levels.

Graphs 3.4g to 3.4i also show ratios of the percentiles of the earnings distributions for the whole country. The pattern of the ratio of the 10th to 50th percentiles (graph 3.4i) is roughly negative and then positive, which is the same pattern of the real minimum wage in graph 3.1. In reality, there is quite a resemblance between the ratio of the 10th to 50th

percentiles and the behaviour of the minimum wage (graphs 3.4i and 3.1). This resemblance is reassuring of the correlation between the minimum wage and the 10th percentile of the earnings distribution showed above. The ratios of the percentiles 90th to 10th (graph 3.4g) has the opposite pattern. Both set of ratios, 50th to 10th and 90th to 10th, together, being a measure of inequality, suggest that inequality increased and then decreased over the sample period.

Another way to measure inequality is to look at the growth rate of different percentiles of the earnings distribution. Table 3.3 shows the average earnings growth rate per month for the mean and 5th, 10th, 50th, 90th, 95th percentiles for the whole country and for every region.[17] The average earnings growth rate over the whole sample period is negative for most percentiles in all regions. This is probably due to over three decades of high inflation. An evidence of the influence of high inflation on earnings growth is given when the sample period is split into high (04.82 to 08.94) and low (09.94 to 09.98) inflation periods. That is, before and after Real Plan. In presence of high inflation, inequality seems to have risen, with earnings decreasing at a higher rate at the bottom than at the top of the distribution for all regions. Incidentally, the minimum wage had an important role in high inflation periods, being used as an indexor and as stabilization policy, as mentioned in section 3.1. In low inflation, inequality seems to have decreased. The negative growth rates for all regions observed in the high inflation period turned into positive for RJ, SP and RS in the low inflation period. This is reassuring of the percentile ratios figures above, which show that inequality increased and then decreased over the sample period. The figures on growth rate of percentiles also suggest that inequality is increasing across regions, with NE becoming relatively poorer. Not only NE is becoming relatively poorer, but it also presents the highest levels of inequality across the country. This is shown in table 3.4, by the Gini coefficient, which is a standard measure of inequality. This coefficient does not change much when the whole sample period is split between high and low inflation periods.

The above figures, particularly a) the higher correlation of the minimum wage with lower percentiles of the earnings distribution; b) the resemblance in the tendencies of the minimum wage and the ratios of percentiles; c) the raise in inequality in presence of high

[17] This is done by regressing the various percentiles and the mean of the earnings distribution on a trend, or, alternatively, the differences of the percentiles and the mean of the earnings distribution on a constant. Although many of the coefficients were not significant in the specification in differences, it was still

inflation coinciding with the largest decreases on the minimum wage; d) the higher correlation of minimum wage and earnings in NE than in SE associated with higher inequality in NE than in SE; suggest that the minimum wage might play a role in explaining some of the inequality in the period.

A measure of the bite of the minimum wage is the percentage of people earning one minimum wage, namely "spike".[18] Table 3.1 shows that the spike varies roughly between 2% and 9% for the whole country.[19] But from the above pieces of evidence, the biggest spikes in the earnings distribution are expected to be in the NE, and the smallest ones in SP. That is because the minimum wage is expected to impact more poor than rich regions. For the very same increase in the minimum wage, more people are expected to be affected in a poor than in a rich region. That is what graphs 3.6 and 3.7 to 3.9 show, reassuring the above figures on correlation. Graph 3.6 shows the evolution of the size of the spike over time for every region and for the whole country. And graphs 3.7 to 3.9 show the actual spike in the distribution of earnings for one particular year of high inflation, 1992, for the whole country, PE and SP[20]. The vertical line (which is in some cases completely covered by the spike) is the value of the minimum wage in every month. Graphs 3.6, 3.8 and 3.9 show that the spikes in NE are bigger than in SE and S and that they are particularly small in SP for the whole period. Also, a) the percentage of people earning a minimum wage or less and b) the percentage of people earning less than a minimum wage follow the same pattern as the percentage of people earning one minimum wage (spike).

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preferred over the specification in level, because the robustness of the estimates in levels could be due to spurius association. Anyhow, the patterns, either in levels or in differences, do not differ substantially.

[18] Because of rounding approximations, more precisely, spike is defined as the percentage of people earning in the range $[(-0.02MW + MW) \leq earnings \leq (+0.02MW + MW)]$.

[19] From March to June of 1994, there is no a punctual minimum wage. This is because the minimum wage was fixed in 64.79 URV, but paid in Cruzeiros Reais, which was the official currency in the country. The value of the minimum wage in Cruzeiros Reais depended upon the day of payment, because the value of the URV was daily adjusted according to the daily inflation in Cruzeiros Reais.

In the literature, the minimum wage (MW_t) is usually converted in Cruzeiros Reais by the URV of the last day of the month ($month_t$). However, in this fashion, the spike can not be captured, once the MW_t is usually paid at the beginning of $month_{t+1}$, rather than at the last day of $month_t$. Thus, in this paper, MW_t is converted in Cruzeiros Reais by the average URV of the first 7 days of $month_{t+1}$. The average of the first 7 days of the $month_{t+1}$ was chosen because, by law, the payment of the MW_t must be done at the latest at the 5th working day of $month_{t+1}$ (CLT, art. 459, law 7855/89).

[20] Here the histograms are computed and graphed using nominal data, once the size of the spike is the same regardless whether it is computed from nominal or real data.

Concerning the size of the spike and average earnings, PE has the highest spike and the lowest average earnings and SP has the lowest spike and the highest average earnings (see graphs 3.6 and 3.2). Both, the size of the spike and the value of the real minimum wage affect the average wage. First, the more people earning the minimum wage, the bigger the spike, and the smaller the average earnings. Average earnings are lower, the higher the spike, because the mean is influenced by the mass in the spike, which is in the lower tail of the distribution. Second, the lower the level of the real minimum wage the lower the average earnings. This shows that the minimum wage is tough. Table 3.1 shows how the size of the spike reacts to increases in the minimum wage, as well as the reaction of the toughness. Note in particular, that in August of 1991, when the minimum wage reached its lowest level within the period, spike jumps from 1.02% to 6.07%, and toughness jumps from 11.11% to 23.35%. Regarding toughness as a measure of inequality, a positive and strong correlation between spike and toughness suggests that the bigger the spike, the higher the inequality. That is what table 3.5 shows.

Graphs 3.10 to 3.12 show the Kernel estimation of the earnings distribution for the whole country and for PE and SP for a particular year of high inflation, 1992. These graphs show the earnings distribution before and after an increase in the minimum wage. In 1992, according to table 3.1, the minimum wage was increased every fourth month: January, May and September of 1992 and again in January of 1993. Graphs 3.10d,h,l to 3.12d,h,l show the change in the shape of the distribution after every adjustment in the minimum wage. The earnings distribution becomes less disperse due to changes in the lower tail. This nonparallel shift to the right of the distribution of earnings is an evidence of the effect of an increase in the minimum wage on earnings.

In fact, in the remaining months, when there is no increase in the minimum wage, the distribution becomes more disperse. This happens because when the nominal minimum wage is not increased, but the inflation is high, it is as if the real minimum wage was actually decreased. And if an increase in the minimum wage shifts the distribution of earnings nonparallely to the right, a decreased is expected to shift it to the left. In years of low inflation, for example, a non increase in the nominal minimum wage does not shift the distribution to the left. This is what graphs 3.13 to 3.15 show. These graphs show the Kernel estimation of the earnings distribution for the whole country and for PE and SP for a

particular year of low inflation, 1984[21]. In 1984, according to table 3.1, the minimum wage was increased every sixth month: May and November. Graphs 3.13d, j to 3.15d, j show the change in the shape of the distribution after every adjustment in the minimum wage. Again, the earnings distribution becomes less disperse due to changes on the lower tail. But in the remaining months of 1984, when there is no increase in the nominal minimum wage and the inflation is yet not so high such as to "induce" a decrease in the real minimum wage, the distribution does not shift to the left.

The Kernel estimation of the earnings distributions present this pattern of behaviour over the whole sample period, what is a reassuring evidence that the minimum wage affects earnings. It is also a reassuring evidence that the minimum wage has a higher impact on poorer than on richer regions. The behaviour of the Kernel densities is in line with the above analysis.

3.3 DESCRIPTIVE MODELS

As a counterpart of the graphical Kernel estimation of the earnings distribution, a very descriptive model was estimated. The simplest descriptive model of earnings as a function of the minimum wage is:

$$lrearn_{it} = \alpha + \beta lrmw_t + u_{it}, \qquad i = 1,..,8millions,\ t = 1,...,169$$

where, $lrearn_{it}$ is the logarithm of real earnings for individual i in time period t and $lrmw_t$ is the logarithm of real minimum wage on time period t common to all individuals. The month data goes from May of 1984, to May of 1998, adding up to 169 time periods.

Let the following model be the aggregated version of the above model. Aggregating by time period and per region:

$$\overline{lrearn}_{rt} = \alpha + \beta lrmw_{rt} + \overline{u}_{rt}, \qquad r = 1,..,6,\ t = 1,...,169$$

where $\overline{lrearn}_{rt}$ is the mean of the logarithm of real earnings of all individuals in region r in time period t, and $lrmw_{rt}$ is the logarithm of the real minimum wage in region r in time period t. Although the nominal minimum wage is a constant across regions and individuals,

[21] A forthcoming paper analyses the effects of the minimum wage in periods of low and high inflation.

the real minimum wage varies across regions because the data was deflated with regional deflators, which themselves vary across regions.[22]

This aggregation is done not only for the mean, but also for the 5th, 10th, 15th, 20th, 25th, 30th, 35th, 40th, 45th, 50th (median), 90th, 95th percentiles of the earnings distribution. In this fashion, a more complete picture of the effect of the minimum wage on earnings is obtained. That is because not only the effect of the minimum wage on the mean of the earnings distribution can be estimated, but also the effect of the minimum wage on various points across the distribution can be estimated (Dickens et al., 1999).

Month and year dummies were added up to the specification. The month dummies try to capture seasonal effects, while the year dummies try to capture common macro shocks (productivity shocks, for example) allowing for them to be different every year. Also, stabilization plan dummies were added up to the specification, as an attempt to capture common macro shocks under each stabilization plan. As mentioned above, the whole period can be divided into six subperiods according to the five stabilization plans plus an early period with no stabilization plan. Each of these stabilization plans had very particular rules, specially the most heterodox ones. In Cruzado plan, for example, the prices were frozen by law; in Collor Plan, the savings were confiscated, etc.[23] Thus, these macro shocks were probably similar within and very different across plans (the behaviour of prices, taxes, investments, unemployment, etc.). All these time dummies, namely year, month and stabilization plan dummies, are included as an attempt to separate out the effect of other macro variables from the effect of the minimum wage on earnings.[24]

The only macro variable which was explicitly added up to the specification is past inflation. That is because inflation was a driving force in the economy within the period. Almost all of the macroeconomic policy, including the minimum wage policy, was around the

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[22] See discussion on identification in section 4.1.1.

[23] Again, for a detailed description of macroeconomic policy in Brazil, see Abreu (1992).

[24] Also a dummy for structural change was included in October 1988, when the new Constitution was promulgated. This is because the new Cosntitution changed two main aspects of the number of working hours:

a) the working week was shortened from 48 to 44 hours;
b) there was a new option of working day available in the labour market: instead of the old 8 daily hours of work (with 2 hours break for lunch), workers could now work 6 consecutive hours.

Controlling for these changes is important because of the likely effect on the average number of hours worked and on employment rate - variables here used to measure employment - as well as on earnings. In this way, the impact of these structural changes on average hours of work and on employment rate is not confused with a change in the minimum wage.

stabilization of the inflation rate at low levels. As showed in the previous section, inflation strongly influenced the behaviour of real earnings and real minimum wage. Another reason to include past inflation as a regressor is to attempt to separate out the effect of the minimum wage from the effect of inflation. This is because, as mentioned above, the minimum wage was used as an indexor, thus, it might be capturing the effect of inflation. By including inflation explicitly, the coefficient of the minimum wage will be measuring that portion of the minimum wage change which was made not merely to compensate inflation.

Thus, the model was estimated for each and all of these percentiles, for the median and for the mean, including year, month and stabilization plan dummies, as well as past inflation:

(1) $\overline{lrearn}_{rt} = \alpha + \beta lrmw_{rt} + \Sigma\delta_k month_k + \Sigma\gamma_l year_l + \Sigma\tau_m estab_m + \pi inpcv_{rt-1} + \overline{u}_{rt}$,

$k = 1,...,12$, $l = 1,...,15$, $m = 1,....,6$

The unrestricted version of this pooled model, where all the coefficients are allowed to differ across regions, is:

(2) $\overline{lrearn}_{rt} = \alpha_r + \beta_r lrmw_{rt} + \Sigma\delta_{rk} month_k + \Sigma\gamma_{rl} year_l + +\Sigma\tau_{rm} estab_m + \pi_r inpcv_{rt-1} + \overline{u}_{rt}$

However, for the same conceptual reason why correlations (table 3.2) were computed in changes, versions of the above models in changes are estimated. That is, once more the interest might be on the effect of changes in the minimum wage in changes in earnings, rather than their relationship in levels. This allows for analysis of the dynamics of the earnings distribution over time given the behaviour of the minimum wage. Additionally, differencing reduces the variables to stationarity, avoiding spurious regression. Thus, models 3 and 4 are:

(3) $\Delta\overline{lrearn}_{rt} = \alpha + \beta\Delta lrmw_{rt} + \Sigma\delta_k month_k + \Sigma\gamma_l year_l + \Sigma\tau_m estab_m + \pi inpcv_{rt-1} + \Delta\overline{u}_{rt}$,

(4) $\Delta\overline{lrearn}_{rt} = \alpha_r + \beta_r\Delta lrmw_{rt} + \Sigma\delta_{rk} month_k + \Sigma\gamma_{rl} year_l + +\Sigma\tau_{rm} estab_m + \pi_r inpcv_{rt-1} + \Delta\overline{u}_{rt}$

where the dummies and the constant are added up after differencing, as well as past inflation. The constant can be seen as the base dummy rather than the trend from the model in levels.

The structure of the errors in the above models is heteroskedastic and serially correlated in the models in levels[25]. Regarding serial correlation, models 1 and 2 were corrected for serial correlation of the errors within panels, assuming an autorregressive process of order 1, AR(1), specific to each region. Regarding heteroskedasticity, two sources could be identified: a) at a micro/desegregated level, $lrearn_{irt}$ is heteroskedastic because of

the nature of the conditional distribution of real earnings, and b) at a macro/aggregated level, $\overline{lrearn}_{rt}$ is heteroskedastic because of the aggregation per region.

Heteroskedasticity arises from the aggregation per region because averages computed over a larger sample size have smaller variance, even if at the lowest micro level ($lrearn_{irt}$), earnings were homoskedastic. In other words, an average computed over a larger sample size is more reliable than an average computed over a smaller sample size. Thus, if the sample size is assumed to be proportional to the size of the regional labour market, average earnings in bigger regions (whose sample size are larger) are more reliable than average earnings in smaller regions (whose sample size are smaller). It follows that the appropriate correction for the heteroskedasticity arising from the aggregation is formalized by Weighted Least Squares (where the weights are root sample size), which gives heavier weight to more reliable information. Incidentally, the weighting can be justified at economic grounds as well, if the coefficient of the minimum wage in the pooled regression is regarded as an weighted average of the regional coefficients. In this case, if once more the sample size is assumed to be proportional to the size of the regional labour market, the weights would be capturing the importance of each regional labour market in estimating the pooled coefficient. While weighting takes care of the heteroskedasticity arising from the aggregation, on the top of it, the standard errors were also White-corrected, to take care of the heteroskedasticity of $lrearn_{irt}$.

The estimates of the coefficients of the minimum wage of models 1 and 2, and models 3 and 4 are, respectively, in tables 3.6a and 3.6b, and also in graph 3.16. Note that the pattern does not change much from levels to differences (compare graphs 3.16a in levels with 3.16b in differences). Note in particular graph 3.16c, that graphs the coefficients of the pooled regression in levels and in differences. Graph 3.16d emphasizes the bigger impact of the minimum wage on PE than on SP, as before.

The results are very reassuring of the above analysis. Firstly, the minimum wage has a stronger impact on the lower percentiles of the earnings distribution, shifting the distribution nonparallely to the right. Dickens et. al (1999) found the same compressing effect when estimating a similar specification. Just as it was suggested graphically by the Kernel

[25] See below for comments on serial correlation of the errors.

distribution estimation (graphs 3.10 to 3.15), this is an evidence of the effect of the minimum wage on inequality. Roughly, an increase in the minimum wage affects the 10th percentile almost ten times more than it affects the 90th percentile of the earnings distribution for the whole country (see table 3.6b and graph 3.16c). Secondly, the minimum wage has a stronger effect on the earnings distribution of NE (poor) than of SE and S, with its smallest effect for SP (rich) (see tables 3.6 and graphs 3.16).[26]

The coefficients of the minimum wage are mostly significantly different from zero being more robust: a) for lower than for higher percentiles; b) for NE than for SE and S; and c) for the models in levels than for the models in differences. The coefficient of past inflation is significant and robust, in particular, in the specification in differences.[27]

The significance and robustness of the time dummies varies across regions and across the distribution, being more robust for the pooled regression (more degrees of freedom). The year and month dummies are mostly significant in levels. In differences, the year dummies are mostly significant for 1986 to 1989 and 1994 to 1995. These are years of acceleration of the inflation and subsequent stabilization plans (Cruzado in 1986 and Real in 1994). The January, February, March, June, July, September and December month dummies are mostly significant in differences, suggesting that important seasonal patterns are present. These are months of Holidays and Carnival, except for September, where important worker categories

[26] Although the coefficient of the pooled regression can be regarded as an weighted average of the regional coefficients, a poolability test for the above restricted and unrestricted models was implemented. The result is that the hypothesis that the coefficients do not differ across regions could only be rejected for the 10th, 15th, 20th and 25th percentiles. As an attempt to produce a more robust poolability test, the unrestricted model was SP alone versus all the remaining regions pooled together. Again, the hypothesis that the coefficients do not differ could only be rejected for the 10th and the 15th percentiles. That is, the data does not have enough variability to reject the poolability higher up in he distribution (as well as in the 5th percentile)..

The null hypothesis of these poolability tests is that there is no unobserved regional effects, in other words, $H_o : f_r = 0$. In fact, the above results are in line with prior expectations, because any potential f_r in the model in levels was wiped out when the model was first differenced, which is the case for models 3 and 4. In other words, the regional fixed effect affects the variables in levels but not in differences.

Note that Chow test can only be used under the assumption of errors independent and identically distributed (iid). As discussed above, $\Delta \bar{u}_{rt}$ are assumed independent. Also, the heteroskedasticity arising from the aggregation per region was corrected by weighting the model by the regional sample size. However, the errors might not be identical, because of some heteroskedasticity still left. Thus, care should be taken when interpreting these tests, which were here reported as an attempt to justify the pooled coefficient beyond its interpretation as an average coefficient.

[27] As robustness check, models 1 to 4 were estimated a) using INPC rather than IPC per region, b) using regional IPCA rather than regional IPC as a deflator, c) omitting past inflation from the equation, d) omitting the stabilization plan dummies from the equation. The estimates are fairly robust to the above

negotiate wages. The stabilization plan dummies are mostly significant in levels, except for plan Bresser, and are mostly significant for plans Cruzado, Bresser and Verao in differences. The constant, which can be seen as the base dummy, is significant and very robust in levels and mostly significant in differences.

Summarizing, all the pieces of evidence in this descriptive section (3.1, 3.2 and 3.3) of the strong correlation between the minimum wage and the lower percentiles of the earnings distribution suggest that the minimum wage explains some of the inequality in the period. Also, it suggests, as expected, that the minimum wage has a stronger effect in poorer than in richer regions.

The above models have only described a statistical relationship between earnings and minimum wage. The question asked was: *if a person is taken at a random from the population, what is his expected (predicted) earnings, given the level of the minimum wage?* Of more interest would be to estimate a causal relationship between earnings and minimum wage. The question to be asked would then be: *if the same person is taken from the population (that is, with the same characteristics), knowing which region he comes from (poor/rich region), that is, controlling for regional effects, and the minimum wage is increased by 1%, by how much would his earnings be increased?* An attempt to answer this question requires a discussion on identification and on endogeneity, which is presented in the next section.

4. IDENTIFICATION AND ENDOGENEITY

4.1 EARNINGS EQUATION

4.1.1 identification

The nominal minimum wage in Brazil is national, not regional.[28] That is, the minimum wage is a constant across regions and individuals on a given month, and therefore,

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changes in the specification: the signs of the coefficients remain the same, and their magnitude is roughly the same, as well as their significance.

[28] Regional minimum wages existed until April of 1984 when they turned into a national minimum wage. For this reason, in this paper, the period used for estimations is from May 1984 onwards. A forthcoming paper on regional minimum wages studies the advantages and disadvantages of regional minimum wages as opposed to a national minimum wage in Brazil.

it does not vary across regions. The real minimum wage varies across regions, though, because the nominal (constant) minimum wage was deflated with regional deflators, which vary across regions. This variation, however, cannot be regarded as genuine variation in the minimum wage, but rather as artificial variation completely driven by the variation in the deflators. Had the data been deflated by a national rather than by regional deflators, the real minimum wage would be a constant, just like the nominal minimum wage is. In this sense, the real minimum wage can be regarded as a constant in the identification discussion which follows. Put differently, in the purely descriptive models of section 3.3, the variation driven by the regional deflators does not identify β.

β is not identified at regional level or over time. First, it is not identified at a regional level, because there is no regional variation. Within a month, the minimum wage is a constant, and therefore, cannot explain variations in earnings. Second, it is not identified over time, despite of the time variation, if no restriction on time is imposed. Suppose that the stabilization plan, month and year dummies in the models of section 3.3 were replaced by one dummy for every time period. This would be a much less restrictive way to model the effect of the other macro variables on earnings. Then β would not be identified at all, because of perfect multicollinearity between the 169 time period dummies and the minimum wage.

In the models of section 3.3, β is only identified because the effect of the other macro variables on earnings is modeled by the use of stabilization plan, month and year dummies. That is, β is identified *ad hoc*. A more restrictive way to model these macro variables would be by a linear trend. In this case, deviations from the linear trend would be assumed entirely due to the effect of the minimum wage. Put differently, the minimum wage would be the only macro variable affecting earnings nonlinearly. β would again be identified *ad hoc,* which does not guarantee that the effects of the minimum wage could be distinguished from the effects of other macro variables on earnings. That is, there is no guarantee that β is capturing the effect of minimum wage on earnings only. Thus, to identify β, $lrmw_{rt}$ will be substituted

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The descriptive statistics in section 3, however, were computed from April of 1982 onwards, because then regional comparisons were made. In fact, PME is available since 1980, but it suffered a major change in its questionnaire in 1982. New variables were included, and some suffered definition changes.

by the logarithm of the spike (as defined in section 3.1), $lspike_{rt}$[29], as an alternative specification for model 3 in section 3.3:

(5) $\Delta \overline{lrearn}_{rt} = \alpha + \beta \Delta lspike_{rt} + \Sigma \delta_k month_k + \Sigma \gamma_l year_l + \Sigma \tau_m estab_m + \pi inpcv_{rt-1} + \Delta \overline{u}_{rt}$,

Now, even if 169 dummies for each of the 169 time periods were included, in a very flexible way to model the effect of the other macro variables on earnings, β would still be

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But most importantly, major improvements in statistics related to non-response and attrition were introduced (Neri, 1996). For this reason, data on PME earlier than April of 1982 will not be used here.

[29] The best that can be said about the relation between spike and real minimum wage is that: $spike = a + brmw + cx + u$, where x stands for other variables. Therefore, the correlation between spike and real minimum wage could be rather small if the other variables are important in explaining the behaviour of the spike and/or if the error term has a large variance (which amounts to saying that the model is largely ignorant about what determines the behaviour of the spike).

At an intuitive level, apart from minimum wage, the other variables x that determine spike are:

a) populational factors - some groups are more likely to earn a minimum wage than others, for example, black, women, students, etc.,
b) institutional factors - due to particularities of the Brazilian labour market, some categories of workers are more likely to earn a minimum wage, for example, civil servants, workers in the building construction, maids, etc.,
c) inflation rate,
d) unemployment rate (and associated size of the informal market, because in the Brazilian labour market, unemployed workers in the formal market might migrate to the informal market),
e) bargaining process (where variables like marginal productivity, level of activity, price of other factors, unions activities, etc. play a role).

Assuming that i) the minimum wage, the unemployment and inflation rate, and the populational and institutional factors are constant over time, and ii) that the bargaining process does not pull anyone in or out of the minimum-wage-worker status, it is hard to think of other factors that would affect the percentage of workers earning one minimum wage, namely, the spike. Thus, these are probably the most important variables in determining the spike. Ideally, this model should be formalized, but to concentrate on the main issues, only the raw correlation between spike and minimum wage is here presented:

correlation between MW and spike - regional inpc

region	BA	PE	MG	RJ	SP	RS	pooled
levels	-0.20	-0.03	0.52	0.29	0.38	0.23	-0.06
differences	0.38	0.47	0.41	0.54	0.39	0.41	0.40

The above correlations suggest that the use of the spike as proxy to real minimum wage is better in differences. This could be thought of as one additional reason to specify models in differences rather than in levels.

Note that a perfect proxy to the minimum wage, say, with correlation 1, would then be a constant across regions, within a month, and would therefore suffer from the same problems as the minimum wage itself. Considered this, the above figures on correlation suggest that spike is a reasonable proxy for the minimum wage.

As it was suggested above, the minimum wage is expected to impact more poorer than richer regions. For the very same increase in the minimum wage, more people are expected to be affected in a poor than in a rich region. Graphs 3.6 and 3.7 to 3.9 show that the size of the spike is bigger for NE than for SE and S. Also the above table shows that changes in the minimum wage are more correlated to changes in the spike in SP and than in PE. Similar proxy has been used by Card (1992a): "fraction [of workers earning below and above the minimum wage] of affected workers in each state." (p.31).

identified. This is because $lspike_{rt}$ does vary across regions, while $lrmw_t$ was a constant across regions within a month. $lspike_{rt}$ captures the regional effects of an increase in the minimum wage. And this regional variation, which was missing in the models of section 3.3, identifies β.

The above model was weighted by the regional sample size to correct for heteroskedasticity arising from the aggregation (and also the standard errors were White-corrected) as well as for economic reasons, in the same fashion as for the models in section 3.3. Regarding serial correlation, graph 4.1 shows the correlograms of the residuals of the model 5 in levels and in differences. The correlogram of the model in differences (graph 4.1b) suggests that the residuals can be regarded as independent in this first approach.[30] This graphical analysis was investigated by regressing the residuals on its past lags and regressors, that is, a LM test for high-order correlation. When 24 lags were included, the coefficients of this regression were not systematically significant, being either not statistically different from zero or statistically different but mathematically very close to zero. When only the first and the second lags of the residuals were included, the null hypothesis of no serial correlation could not be rejected. All these evidences suggest to be reasonable to proceed as if $\Delta\bar{u}_{rt}$ were independent over time.[31]

The estimates of model 5 is in table 4.1. The results are in line with the above analysis so far. The estimates of the coefficients of the spike are robust and significant at lower percentiles, and they are also larger for lower percentiles. In higher percentiles they are not only very tiny, but also insignificant and sometimes negative. In other words, there is no spillover effect higher up in the distribution.

The coefficients are significant and about the same magnitude up to the 20th percentile of the earnings distribution. The weighted regional average correlation between spike and real earnings is 0.041% for those in the 10th percentile of the earnings distribution on average. This correlation goes down to 0.016% for those in the 20th percentile.

[30] It is likely that some variable integrated of order one, I(1), was left out of the model, for example, technological progress or labour-capital ratio. This could be an explanation for the serial correlation of the errors in the model in levels, despite of the inclusion of month and year dummies. First differencing then differences out this omitted variable.

[31] See below for more on serial correlation of the errors.

The coefficient of past inflation is significant and fairly robust. The significance and signs of the stabilization plan, month and year dummies depend on the percentile regression, but roughly, they behave like in the models of section 3.3. The stabilization plan dummies are mostly significant for all stabilization plans. The month dummies are mostly significant for months of Holidays and Carnival, and for May, September and November, data-base months for important worker categories wage negotiations. The year dummies are significant for 1986 to 1989 and 1994 to 1995, years of acceleration of the inflation and subsequent stabilization plans (Cruzado in 1986 and Real in 1994). The constant, which can be seen as the base dummy, tends to be significant and more robust to higher percentiles.

4.1.2 endogeneity and robustness check

So far, only descriptive models have been estimated. The next step is an attempt to estimate causal effects rather than correlations. That is, to estimate consistent estimates, correcting for potential correlations between observables and unobservables. In other words, correcting for endogeneity.

If in the above models the unobservables were modeled as one way component error, and the endogeneity was accepted to be due to the correlation between the unobservable regional effect and spike, then panel data techniques could be used to produce consistent estimates. Consider the one way component regression model:

$$\overline{lrearn}_{rt} = \alpha + \beta lspike_{rt} + \Sigma\delta_k month_k + \Sigma\gamma_l year_l + \Sigma\tau_m estab_m + \pi inpcv_{rt-1} + \overline{u}_{rt} + f_r,$$

where f_r is a regional effect, fixed over time.

First-differencing wipes out the regional effect f_r[32]. The first difference of the above model is simply model 5 above. Incidentally first differencing, as argued above, not only avoids spurius regression, but also is the conceptual interest here, i.e., the relationship in changes (Card, 1992a; Card and Krueger, 1994; Dickens, Machin and Manning, 1999).

However, the endogeneity in this model is not coming only from the correlation between $lspike_{rt}$ and f_r. $lspike_{rt}$ is also correlated with $\overline{u}_{rt}$, that is, $lspike_{rt}$ is assumed

[32] The other alternative to wipe out the regional fixed effect f_r is to perform a Within Groups transformation, once the T dimension is large enough to allow for consistency. Within Groups or Dummy-Variable Regression is particularly attractive in this context because it requires only 6 dummies (one per

endogenous, because it is simultaneously determined with earnings. Once the minimum wage is increased, the bargain of workers for relative wages determines their position in the earnings distribution. This is also the process that determines who earns one minimum wage, that is, who is at the minimum wage in the earnings distribution. In other words, this is the process that determines the size of the spike. Therefore, spike and earnings are simultaneously determined, and spike is endogenous in model 5. All the dummy variables are assumed exogenous, and past inflation is assumed weakly exogenous.

To estimate the above model, once the sample size is large enough to allow for consistency, Instrumental Variable Estimation method is used to produce consistent estimates. Because this is a panel data model, instruments for $\Delta lspike_{rt}$ naturally arise from within the model. Once the errors $\Delta\bar{u}_{rt}$ are assumed independent over time, lags of the $lspike_{rt}$ or $\Delta lspike_{rt}$ which are correlated with $\Delta lspike_{rt}$ but not correlated with $\Delta\bar{u}_{rt}$ fulfill the properties of exogenous instruments.

Having allowed for regional variation, the effect of the minimum wage is no longer confused with the effect of other macro variables. Having ruled out the regional effects, the effect of the minimum wage is no longer confused with regional macro effects. And finally, having corrected for endogeneity bias, a consistent estimate is then produced. β is thus identified.[33]

The instrumented version of model 5 is model 6. The first two columns of table 4.1 show the estimates of the coefficient of spike before (model 5) and after (model 6) instrumenting. The pattern of signs, magnitudes and significance of the estimates across the distribution is similar in both models. However, instrumenting corrects the coefficients for downwards bias. Holding other things constant, an increase in the size of the spike of 1% increases real earnings by 0.041% of those in the 10th percentile of the earnings distribution on average before instrumenting, and by 0.080% after instrumenting. This average regional

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region) to be added up to the equation, not consuming too many degrees of freedom. See results on Within Group estimation of the employment equation on tables 4.2 to 4.5.

[33] The reason why this section is entitled robustness check, is because although there is no reason to believe that past lags of spike are endogenous, they might be perpetuating some endogeneity. This is because in high inflationary context, month data might have some "memory". Thus, an instrument whith real exogenous variation, correlated with spike and affecting earnings only via spike would be required to genuinely correct for endogeneity bias. In the absence of such an instrument, the Instrumental Variables estimates here presented are regarded as robustness check only.

effect goes down to 0.016% for those in the 20th percentile before, and to 0.062% after instrumenting.[34]

Also, the pattern of significance of the past inflation, time dummies and the constant in model 6 is similar to that of model 5 described above.

The next step is to check the sensitivity of the estimates to the introduction of populational control variables to account for groups who are likely to be earning a minimum wage or earnings in some how related to the behaviour of the minimum wage. For example, the national retirement insurance in Brazil fixes the payment of retired people in terms of minimum wages. Young people, women, illiterate, etc. are groups likely to be earning the minimum wage. Because of particularities of the Brazilian labour market, some groups are likely to earn a minimum wage, for example, civil servants, workers in the building construction, maids, etc. Earnings in the informal sector are also very much influenced by the behaviour of the minimum wage[35]. Thus the following variables were included as controls: percentage of young people, percentage of women, percentage of informal sector workers,

[34] The same alternative specification changes promoted in models 1 to 4 (see footnote 25) were promoted in models 5 to 7 below. and once more, the estimates are found to be fairly robust to these changes.
Also, models 6 and 7 were estimated using different sets of instruments, as shown below, with results reasonably robusts:

alternative sets of instruments for the regression for the mean data

instruments	coef	t	corr(X,Z)	uhat's t (Hausmann test)	
OLS	**0.006**	1.048			
$lspike_{rt}$					
lags 1 to 3	**0.012**	0.978	strong	-0.547	
lags 1 to 4	**0.026**	2.261	strong	-1.830	
lags 2 to 4	**0.100**	3.865	good	-3.585	
lags 2 to 5	**0.073**	2.989	OK	-2.729	
lags 2 to 6	**0.063**	2.610	poor	-2.361	
lags 2 to 12	**0.030**	2.032	strong	-1.662	
$\Delta lspike_{rt}$					
lags 1 to 3	**0.031**	2.480	strong	-2.139	**see table 4.1*
lags 1 to 4	**0.018**	1.419	strong	-1.072	
lags 2 to 4	**0.084**	3.200	good	-2.989	**see table 4.1*
lags 2 to 5	**0.071**	2.726	good	-2.513	
lags 2 to 6	**0.025**	1.420	strong	-1.102	
lags 2 to 12	**0.013**	0.876	good	-0.571	

note: the t statistics here presented for Two-step Least Square (Haussman) might not coincide with the Instrumental Variable t statistics in table 4.2, but the estimates of the coefficients are the same, once both methods are equivalent.

percentage of urban areas workers, percentage of retired people, percentage of illiterate people, percentage of people who have a second job and unemployment rate. The populational variables help to control for region-specific characteristics that might be correlated with the spike. Similarly, the unemployment rate helps to control for region-specific macro shocks that might be correlated with the spike. The unemployment rate is a business cycle variable commonly used as a measure of demand for labour (Brown et al., 1982). The model to be estimated is now:

(7) $\Delta \overline{lrearn}_{rt} = \alpha + \beta \Delta lspike_{rt} + \Sigma \delta_k month_k + \Sigma \gamma_l year_l + \Sigma \tau_m estab_m + \pi inpcv_{rt-1} + \lambda_1 \Lambda controls + \lambda_2 urate + \Delta \overline{u}_{rt}$

All the controls are assumed exogenous, because they are determined by populational factors[36]. This model is instrumented in the same fashion as model 6. The estimates of the coefficients of the spike are in the third column of table 4.1. Again, the pattern of signs, magnitudes and significance of the estimates across the distribution, in model 7, is similar to the ones in models 5 and 6. The estimates of the coefficients of the spike were not substantially affected by the inclusion of controls. Holding other things constant, an increase in the size of the spike of 1% increases real earnings by 0.080% of those in the 10th percentile of the earnings distribution, on average, before controlling for populational factors, and by 0.086% after controlling. This average regional effect goes down to 0.062% for those in the 20th percentile before, and to 0.071% after controlling for populational factors.

Also, the pattern of significance of the past inflation, time dummies and the constant in model 7 is similar to the one of models 5 and 6 described above. The coefficients of the control variables are mostly significant.

Models 6 and 7 were also estimated using the second to the fourth lags of $\Delta lspike_{rt}$ rather than the first to the third, to check for the possibility that the first lag is still a endogenous instrument, although from the assumption of independence of $\Delta \overline{u}_{rt}$ there is no reason to believe that the first lag is endogenous. Regard it as, again, a robustness check to

[35] For analysis of the role of the minimum wage in the informal sector, see, among many possible references, Foguel (1997).

[36] It can be argued that the unemployment rate is endogenous because employment and earnings are simultaneously determined. Therefore, it needed to be instrumented for, otherwise the bias could be spread out to the other coefficients in the model. However, the unemployment rate is here being regarded as a control, that is, the estimated β is conditional on a given unemployment rate. Of course there is doubt on the relevance of β thus estimated for macroeconomic policy, once the unemployment rate can never be

alternative set of instrument. The pattern of behaviour across the distribution is the same, although the coefficients are now larger and less robust (see fourth and fifth columns of table 4.1).

Summarising, instrumenting and controlling for populational factors increase only marginally the magnitude of the estimates of the coefficients of spike, and do not affect their sign or their significance.

Concluding, these results can be seen as robustness checks for the descriptive models estimated above. The main conclusions hold: a) the effect of spike on the earnings distribution seems to be significant only at the bottom of the distribution, being stronger for lower percentiles.

4.2 EMPLOYMENT EQUATION

4.2.2 spike as independent variable

As discussed in the introduction, the study of the effects of the minimum wage on inequality requires the analysis of the effect of the minimum wage not only on earnings but also on employment. The next step is then to estimate the effect of the spike (which is here used as a proxy to minimum wage, as discussed above) on employment.

The total effect of a change in the spike on employment can be decomposed into two other effects. The total adjustment on employment due to changes in the spike can be seen as the result of the adjustment a) in the number of hours worked and b) in the number of jobs. This can be written as:

$$\frac{\sum_{i=1}^{N} hour_i}{N} = \frac{\sum_{i \in e}^{N} hour_i}{N_e} \frac{N_e}{N},$$

controlled for, but it is rather simultaneously determined. But let it be here regarded as given, just as an exercise of robustness check.

where $\frac{\sum_{i=1}^{N} hour_i}{N} = \overline{T}$ is the average hours of work for the working population[37], $\frac{\sum_{i \in e}^{N} hour_i}{N_e} = \overline{H}$ is the average hours of work for the employed, N_e is the sample size of the employed, N is the sample size of the working population, and $\frac{N_e}{N} = E$ is the employment rate.

Let the decomposition equation be written as a function of the spike:

$\overline{T}(spike) = \overline{H}(spike)E(spike)$

Taking logarithms and deriving with respect to the spike, the total employment elasticity (ε_T) is found to be equal to the hours elasticity (ε_H) plus the job elasticity (ε_E):

$$\frac{\partial \overline{T}}{\partial spike}\frac{spike}{EH} = \frac{\partial \overline{H}}{\partial spike}\frac{spike}{EH} + \frac{\partial E}{\partial spike}\frac{spike}{EH}$$

$\varepsilon_T = \varepsilon_H + \varepsilon_E$.

"To measure the employment effect of the minimum wage, the ratio of employment to population is used most often as the dependent variable" (Brown et al., 1982, p.497). However, the above decomposition suggests to use not only the employment rate as a dependent variable, but also the average hours of work for the working population and for the employed as dependent variables as well. Thus, three specifications for the employment equation naturally arise, following from the discussion of the earnings equation above:

(i) $\Delta l\overline{T}_{rt} = \alpha + \beta \Delta lspike_{rt} + \Sigma \delta_k month_k + \Sigma \gamma_l year_l + \Sigma \tau_m estab_m + \pi inpc_{rt-1} + \Delta \overline{u}_{rt}$

(ii) $\Delta l\overline{H}_{rt} = \alpha + \beta \Delta lspike_{rt} + \Sigma \delta_k month_k + \Sigma \gamma_l year_l + \Sigma \tau_m estab_m + \pi inpc_{rt-1} + \Delta \overline{u}_{rt}$

(iii) $\Delta lE_{rt} = \alpha + \beta \Delta lspike_{rt} + \Sigma \delta_k month_k + \Sigma \gamma_l year_l + \Sigma \tau_m estab_m + \pi inpc_{rt-1} + \Delta \overline{u}_{rt}$

where T, H and E are in logs, as well as spike.

Unlike for the earnings equation, each of the three above specifications of the employment equation was estimated simply for the mean aggregated data, rather than for each

[37] Working population is defined as people: a) employed who worked in the week before the week of the interview, b) employed who did not work in the week before the week of the interview, but did have a job,

percentile of the employment distribution. Various alternative specifications were estimated: Within Groups (WG), Ordinary Least Square on the first difference (OLS Δ), on the twelfth (Jan 1991 - Jan 1992) difference (OLS Δ^{12}) and on both, the first and the twelfth differences (OLS $\Delta\Delta^{12}$). And for each of these alternative specifications, lags of the dependent variable were included as regressors, because an increase in the minimum wage might not affect employment contemporaneously, but in future periods (Brown, 1982; and Neumark and Wascher, 1992). That is because inability to adjust other inputs instantaneously would create lagged responses in employment. Thus, the above models were estimated with the inclusion of 0, 1, 2, 6, 12 15, 18 and 24 lags, once such large T dimension on monthly data allows for adding up quite a few lags. Also, adding up lags of the dependent variable to the specification reduces serial correlation.

In the descriptive model (see table 4.2a), the total employment elasticity ranges from -0.007 to -0.003 for the various specifications, being mostly statistically significant. In decomposing this elasticity in hours and jobs elasticities, the hours elasticity ranges from -0.006 to -0.002 and the jobs elasticity ranges from -0.002 to 0.0, again, mostly statistically significant. Thus, the total effect is negative but small: the effect on number of jobs is very close to zero, and the effect on number of hours worked is negative and small. Because the job elasticity is so tiny, the total elasticity is mainly determined by the hours elasticity. Holding other things constant, an increase in the size of the spike of 1% decreases employment by 0.007% on average at the most (consider the lower limit of the range), which is mainly due to a decrease in the number of hours worked. However, this is a correlation, rather than a causal effect, once the model is purely descriptive.

Regarding serial correlation, the first four rows of Graphs 4.2 show correlograms of the residuals of the population average hours worked equation ($\overline{T}_{rt}$), for its four alternative specifications: WG, OLS Δ, OLS Δ^{12} and OLS $\Delta\Delta^{12}$. The eight columns show how these correlograms change when 0, 1, 2, 6 12, 15, 18 and 24 lags of the dependent variable are included as regressors. Similarly, the last four rows of Graphs 4.2 show correlograms of the

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and, c) unemployed who looked for a job in the week before the week of the interview. Here a) plus b) is referred to simply as employed, and c) as unemployed.

residuals of the unemployment rate equation (E_{rt}).[38] These correlograms suggest that the inclusion of lags as well as differencing, in particular twelfth-differencing, reduces serial correlation considerably and affects the seasonal pattern.[39]

The structure of the errors is crucial in choosing which lag of the endogenous variable could be used as an exogenous instrument. In this context, Sargan test can be regarded as a test for serial correlation. In fact Sargan test is a test for the validity of the instruments as well as mispecification. However, if the instruments are lags of the endogeneous variables, Sargan test becomes a test for serial correlation. This is because failing the Sargan test means that the serial correlation in the errors turned into endogeneous instruments, lags of the endogeneous variables which would otherwise (in absence of serial correlation) be exogeneous instruments.

Thus, to test for the serial correlation of the residuals, or putting differently, to check whether the coefficients were consistently estimated, Sargan test was performed in all the employment models. The idea is to assume that the serial correlation of the residuals is due to mispecified dynamics regarding the dependent variable (assuming that the model is correctly specified otherwise). In this case, as lags of the dependent variable were included as regressors, the serial correlation would eventually disappear and residuals serially uncorrelated would rise. If that is true, the model with no lagged dependent variable would fail Sargan, and as lags of the dependent variable were added up, eventually the null hypothesis of no serial correlation would be accepted.

Thus, it was assumed that there was enough lags of the dependent variable included in the model such that the errors would be independent over time. In this fashion, the first and further lags of $\Delta lspike_{rt}$ would not be correlated with the errors, and could therefore be used as exogenous instruments. However, just as for the earnings equation, the same models were estimated using the second and further lags as exogenous instruments, rather than the first lag. That is for producing robustness checks, because the first lag might still be an endogeneous instrument. The instrumented versions of table 4.2a are shown in table 4.3a and 4.4a. Table

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[38] There are three specifications for the employment equations: (i) $\overline{T}_{rt}$, (ii) $\overline{H}_{rt}$, and (iii) E_{rt}. The correlograms of equation (ii) have the same behaviour as equation (i), as they are both average hours equations.

[39] The correlograms of residuals for the employment equations, where spike is substituted by toughness as alternative proxy for the minimum wage, discussed in the next section, have roughly the same pattern of behaviour as in the employment equations where spike is the proxy for the minimum wage, shown in Graphs 4.2.

4.3a shows results for instrumenting the model using the first and further lags of $\Delta lspike_{rt}$ as instruments, and in table 4.4a shows the same results using the second and further lags of $\Delta lspike_{rt}$ as instruments. Sargan test results were reported along with the instrumented models.[40]

For the same reasons as in the earnings models, the employment models were weighted by the regional sample size and the standard errors were White-corrected. In the instrumented model (see 4.3a) the WG and OLS Δ^{12} estimates are not statistically different from zero. The OLS Δ and OLS $\Delta\Delta^{12}$ total employment elasticity are mostly significant and range from -0.023 to 0.002, although even then, as more lags of the dependent variable are added up, the coefficients become not significant. The jobs elasticity is once more ranging from -0.003 to 0.00, and the difference is the hours elasticity. The pattern of results does not change much when the set of instruments is changed to start from the second lag of $\Delta lspike_{rt}$ (see table 4.4a). The WG and OLS Δ estimates are now not significantly different from zero, and OLS Δ^{12} and OLS $\Delta\Delta^{12}$ estimates are mostly statistically significant, again, tending not to be as more lags of the dependent variable are added up. These total employment elasticities range from -0.046 to 0.031. The magnitude of the job elasticity does not change, and the difference is the hours elasticity. Holding other things constant, an increase in the size of the

[40] The obtained results can be regarded as preliminary if further improvements can be made in either the model or in the Sargan test formula. It was assumed that by adding up lags of the dependent variable to the model, eventually the "true" model would be identified, in the sense that no other form of mispecification would be causing serial correlation of the errors. Obviously, any serial correlation left after correctly specified dynamics regarding the dependent variable would fail Sargan test. Thus, by improvement in the model, it is meant no misspecification concerning functioncal form, omitted regressors, omited dynamics of the minimum wage (see for example Newmark and Washer, 1992), et.; or even incorrect pooling of the data.

Also, further complications might cause Sargan test to reject (not reject) the null hypothesis when it should not reject (reject) it. Firstly, the straigth aplication of a cross section Sargan test formula to a large T small N panel data might not be appropriated. Secondly, the variance that enters the Sargan test formula is wrong in presence of heteroskedastic errors. Because of this, White-corrected errors were plugged into the Sargan test formula (in fact the errors were also weighted, in the sense that errors from the weighted models were plugged into the Sargan formula). The same problem rises in presence of serial correlation of the errors, say, MA(2). In this case, even if the model is correctly instrumented (see tables 4.4), the variance is again wrong, and so is the Sargan test (in fact, even the t test is wrong). In this case, errors Newey-White corrected would need to enter the formula, in a context of large T small N panel data. Thus, care must be taken in interpreting the Sargan test results reported in tables 4.4. All these aspects in choosing the appropriate formula for the Sargan test can affect the acceptance of the null hypothesis.

Having made these qualifications, the results (see tables 4.2 to 4.5) seem to be very robust regardless of the presence of autocorrelation and the associated failure of the Sargan test due to endogeneous instruments. In fact, the results are quite robust regardless of the specified dynamics and estimation method, as discussed below, which is very reassuring.

spike of 1% decreases employment by 0.007% before and by 0.046% after instrumenting, on average, at the most (consider the lower limit of the range). These decrease on employment is due to a decrease of 0.002% on the number of jobs, before and after instrumenting, with the remaining effect being due to a decrease in number of hours worked.

Finally, just like for the earnings equation, table 4.5a shows the instrumented version of table 4.3a controlling for percentage of young people, percentage of women, percentage of people in the informal market, percentage of retired people, percentage of students, percentage of workers in building construction, percentage of workers in the transformation industry and percentage of civil servants as groups likely to have their earnings related to the minimum wage. The inclusion of controls in the instrumented equation does not change the above pattern of signs, significance and magnitudes.

Sargan test failed the average hours worked models in difference when instrumented with the first lag (see table 4.3a and 4.5a) even when 12, 15, 18 and 24 lags of the dependent variable were added up. However, it did not reject the null hypothesis when instrumented with the second lag (see table 4.4a) for the specifications that includes 12, 15 and 18 lags of the dependent variable, as it was expected. The null hypothesis was not rejected in the WG specification when a reasonable number of lags of the dependent variable was added up to the specification, regardless of the set of instrument (see tables 4.3a to 4.5a). The null hypothesis was not rejected for the employment rate model regardless of the set of instruments, specification and method of estimation, which suggests residuals not serially correlated.

The variety of specifications presented in this section can be regarded as a robust way to estimate the employment elasticity. The results were fairly robust to changes in the specification, which can be seen as a robustness check.[41] The total effect of increases in spike on employment is small and negative, coming mainly from a negative effect on hours worked, and from a tiny negative effect on number of jobs.[42]

At last, table 4.6a shows long run estimates of the total employment elasticity obtained from the above models. Given the various alternative specifications, all the estimates are less

[41] Just as for the earnings equation, these models were estimated omitting past inflation as regressors, and also omitting the stabilization plan dummies. Once more, the estimates are robust to these specification changes.

[42] A forthcoming paper on the effects of the minimum wage under high and low inflation, investigates what could be an explanation for this small negative effect. The idea is that under high inflation, an increase in

than 0.2, and mostly, less than 0.05. Holding other things constant, an increase in the size of the spike of 1% decreases employment by less than 0.2% (0.05%) in the long run.

4.2.2 toughness as independent variable

All the employment equation models are again estimated with toughness (as defined in section 3.2) replacing spike as an alternative specification (Dickens et al., 1999). The results are in tables 4.2b to 4.6b.

In the descriptive model (see table 4.2b), the total employment elasticity ranges from -0.007 to 0.015 for the various specifications, being mostly not significantly different from zero. In decomposing this elasticity in hours and jobs elasticities, the hours elasticity ranges from -0.007 to 0.017, being mostly not significant; and the jobs elasticity ranges from -0.011 to 0.0, being mostly statistically significant. Once more the dominant effect seems to come through the hours elasticity. Holding other things constant, an increase in the size of the spike of 1% decreases employment by 0.007% on average at the most (consider the upper limit of the range), which is mainly due to a decrease in the number of hours worked. However, this is a correlation, rather than a causal effect, once the model is purely descriptive.

In the instrumented model (see 4.3b) the total employment elasticity ranges from -0.087 to 0.057 for the various specifications, mostly significantly different from zero. The jobs elasticity ranges from -0.024 to 0.006, and the difference is the hours elasticity, whose effect is once more dominant. The pattern of results does not change much when the set of instruments is changed to start from the second lag of $\Delta lspike_{rt}$ (see table 4.4b), although the estimates are now mostly not significantly different from zero. The total employment elasticity ranges from -0.968 to 0.090. The jobs elasticity ranges from -0.040 to 0.028, and the difference is the hours elasticity, whose effect is once more dominant. Holding other things constant, an increase in the size of the spike of 1% decreases employment by 0.007% before and by -0.968% after instrumenting, on average at the most (consider the upper limit of the range). These decrease on employment is due to a decrease of 0.011% on the number of jobs, before and of -0.040 after instrumenting, with the remaining effect being due to a decrease in number of hours worked.

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the nominal minimum wage is not necessarily accompanied by increase in the real minimum wage, which is ultimately the variable that could provoke a stronger negative effect on employment.

Again the inclusion of controls in the instrumented equation does not change the above pattern of signs significance and magnitudes, as it can be seen in comparing tables 4.3b and 4.5a. Sargan test did not reject the null hypothesis for most of the models (see table 4.3b, 4.4b and 4.5b), specially for the models instrumented with the first lag.

Once more the results were fairly robust to changes in the specification, which can be regarded as a robustness check.[43] The total effect of increases in toughness on employment is small and negative, coming mainly from a negative effect on hours worked.

At last, table 4.6b shows the same long run estimates shown in table 4.6a, now for toughness. Given the various alternative specifications, all estimates are again less than 1, and mostly less than 0.5. Holding other things constant, an increase in the size of the spike of 1% decreases employment by less than roughly 0.5% in the long run.

5. CONCLUSION

This paper analyzed the effects of the minimum wage on both, earnings and employment in Brazil. In section 3.1 the minimum wage was placed into context in the Brazilian economy. This gave room for the discussion of the minimum wage not only in its ordinary role of social macroeconomic policy against poverty, inequality and unemployment, discussed in the introduction, but also as stabilization macroeconomic policy against inflation. The data was presented (in section 2) and summarized in terms of descriptive statistics in section 3.2. The estimation of Kernel densities showed graphically that an increase in the minimum wage compresses the earnings distribution, by shifting the distribution nonparallely to the right (pushes its mean up and decreases its variance), as expected. The Kernel densities also suggest that this shift is more relevant in poor (NE) than in rich (SE and S) areas. This graphical analysis was formalized by descriptive models in section 3.3, where the (descriptive) elasticity of earnings with respect to the minimum wage was higher: a) for lower than for higher percentiles of the earnings distribution and b) for the NE than for the SE. This is just another way to state the results that the Kernel densities analysis had already suggested, what could not be different. From the results of section 3, two conclusions can be drawn.

[43] Once more these models were estimated omitting past inflation as repressors, and also omitting the stabilization plan dummies, with robust results for these specification changes.

First, changes in the minimum wage have a bigger impact on the earnings of low-paid than of high-paid workers, which suggests empirically that the minimum wage can be used as a policy against inequality in Brazil. Second, the minimum wage is a more efficient policy against inequality in the NE than in the SE and S of Brazil.

Although models in section 3.3 are a good description of the effect of the minimum wage on earnings, they are not identified. Section 4.1.1 discussed identification and reespecification of the earnings model, proposing a proxy for minimum wage, namely, spike. Section 4.1.2 discussed endogeneity and produced robust estimates for the effect of the minimum wage on earnings. The main conclusion from section 3 holds in section 4.1: changes in the minimum wage compress the earnings distribution, affecting more low-paid than high-paid workers, and therefore having an effect on inequality.

Despite of the good news so far, the other side of the question needed also be analyzed. The effect of changes in the minimum wage on changes on employment was analyzed in section 4.2. Various specifications and techniques were used to estimate this effect using a decomposition that made it possible to separate out the effects of an increase in the minimum wage on the number of hours worked and on the posts of jobs (section 4.2.1). Also, all the employment specifications were reespecified using toughness, rather than spike as an alternative proxy to the minimum wage (section 4.2.2). The range of results showed that the effect of changes in the minimum wage on employment is negative but small, and not always significant.

If the effect of an increase in the minimum wage on employment was null, there would be only the good news of the compressing effect of the minimum wage on the earnings distribution. As an increase in the minimum wage seems to have a small but adverse effect on employment, this has to be taken into account when using the minimum wage as a policy against inequality.

Summarizing the results, an increase in the minimum wage was found to compress the earnings distribution, with a moderately small adverse effect on the level of employment. This is an evidence that the minimum wage does affect inequality. That is, the minimum wage does not destroy too many jobs and it increases the earnings of low paid, but not of high paid workers.

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table 3.1 - nominal and real minimum wages, toughness and spike in brazil 1982-1998

R$1,00 is approximately US$1,70

years	$ change	current MW (MW nominal changes in bold)	real MW (10 biggest in large font 10 smallest in small font) (R$ 12.1997)	toughness MW / average earnings (earnings of the whole country)	spike % of people earning MW
Apr-82		11928	189.41	17.91%	4.21%
May-82		**16608**	**249.56**	24.73%	3.15%
Jun-82		16608	**232.28**	22.39%	3.30%
Jul-82		16608	218.02	22.46%	2.94%
Aug-82		16608	206.12	21.77%	2.80%
Sep-82		16608	196.08	20.15%	2.67%
Oct-82		16608	188.14	19.00%	2.48%
Nov-82		**23568**	**255.06**	23.93%	3.64%
Dec-82		**23568**	**239.39**	19.02%	2.92%
Jan-83		23568	220.31	19.84%	3.82%
Feb-83		23568	202.60	21.41%	3.74%
Mar-83		23568	188.36	20.45%	3.80%
Apr-83		23568	176.34	19.32%	3.48%
May-83		**34776**	**243.66**	25.88%	5.44%
Jun-83		34776	224.22	24.46%	5.43%
Jul-83		34776	201.69	23.39%	5.01%
Aug-83		34776	182.22	22.19%	4.54%
Sep-83		34776	164.87	20.79%	4.65%
Oct-83		34776	148.95	19.54%	4.41%
Nov-83		**57120**	**225.04**	27.72%	5.32%
Dec-83		57120	208.75	22.53%	4.02%
Jan-84		57120	192.32	23.93%	4.93%
Feb-84		57120	174.55	22.02%	4.60%
Mar-84		57120	159.78	20.63%	4.43%
Apr-84		57120	145.25	18.73%	4.37%
May-84		**97176**	**226.52**	28.91%	5.33%
Jun-84		97176	207.86	26.76%	5.22%
Jul-84		97176	188.97	24.60%	4.67%
Aug-84		97176	174.07	22.63%	4.46%
Sep-84		97176	158.46	21.30%	4.25%
Oct-84		97176	143.06	19.23%	4.16%
Nov-84		**166560**	221.86	27.73%	4.79%
Dec-84		166560	199.89	22.84%	3.98%
Jan-85		166560	178.66	23.78%	4.91%
Feb-85		166560	160.66	21.49%	4.39%
Mar-85		166560	145.59	19.90%	4.38%
Apr-85		166560	133.11	18.18%	4.66%
May-85		**333120**	**246.71**	31.02%	6.52%
Jun-85		333120	**228.99**	28.22%	6.41%

Jul-85		333120	209.58	25.75%	5.64%
Aug-85		333120	189.27	23.59%	5.22%
Sep-85		333120	170.61	20.88%	4.97%
Oct-85		333120	**154.90**	19.12%	4.59%
Nov-85		**600000**	248.50	26.71%	9.18%
Dec-85		600000	216.02	22.62%	8.04%
Jan-86		600000	188.09	21.90%	8.56%
Feb-86		600000	165.29	19.00%	6.78%
Mar-86	**Cz$**	**804**	204.45	23.27%	9.22%
Apr-86		804	201.63	21.36%	8.51%
May-86		804	200.25	20.52%	7.83%
Jun-86		804	197.54	19.64%	7.62%
Jul-86		804	196.22	19.04%	7.29%
Aug-86		804	193.62	18.12%	6.84%
Sep-86		804	191.09	17.57%	6.15%
Oct-86		804	188.62	16.75%	5.73%
Nov-86		804	183.88	15.95%	5.35%
Dec-86		804	175.07	13.81%	4.35%
Jan-87		**964.8**	187.61	17.18%	1.44%
Feb-87		964.8	163.18	16.03%	2.12%
Mar-87		**1368**	202.22	20.52%	3.50%
Apr-87		1368	172.13	18.09%	3.72%
May-87		**1641.6**	169.11	18.10%	3.40%
Jun-87		**1969.92**	165.82	19.13%	7.25%
Jul-87		1969.92	143.84	17.72%	6.66%
Aug-87		**1970**	133.65	16.21%	4.87%
Sep-87		**2400**	153.38	17.86%	3.60%
Oct-87		**2640**	154.84	17.76%	2.53%
Nov-87		**3000**	155.84	17.15%	3.96%
Dec-87		**3600**	163.43	16.21%	2.13%
Jan-88		**4500**	175.58	19.56%	3.12%
Feb-88		**5280**	176.15	19.26%	2.29%
Mar-88		**6240**	177.27	19.25%	2.45%
Apr-88		**7260**	174.83	19.02%	2.60%
May-88		**8712**	176.98	19.20%	2.46%
Jun-88		**10368**	175.36	19.32%	3.07%
Jul-88		**12444**	171.40	18.36%	3.00%
Aug-88		**15552**	176.18	18.11%	2.97%
Sep-88		**18960**	173.23	17.64%	3.25%
Oct-88		**23700**	171.00	17.58%	3.66%
Nov-88		**30800**	174.18	16.62%	3.64%
Dec-88		**40425**	178.18	15.18%	4.94%
Jan-89		**54374**	181.40	18.91%	4.43%
Feb-89	**NCz$**	**63.9**	169.61	19.73%	5.76%
Mar-89		63.9	152.87	17.71%	5.41%
Apr-89		63.9	143.43	15.41%	4.51%
May-89		**81.4**	162.64	16.24%	5.93%
Jun-89		**120**	194.81	19.52%	6.59%
Jul-89		**149.8**	189.80	18.88%	5.84%
Aug-89		**192.88**	187.54	17.59%	4.41%
Sep-89		**249.48**	180.00	17.13%	5.32%
Oct-89		**381.73**	200.02	15.39%	4.90%

Nov-89		**557.33**	203.68	15.35%	4.53%
Dec-89		**788.18**	192.36	13.45%	5.22%
Jan-90		**1283.95**	196.17	13.41%	4.85%
Feb-90		**2004.37**	179.08	13.46%	6.89%
Mar-90		**3674.06**	184.28	17.84%	5.29%
Apr-90	**Cr$**	3674.06	127.24	15.57%	5.30%
May-90		3674.06	115.17	14.00%	4.49%
Jun-90		**3857.76**	110.46	12.82%	4.05%
Jul-90		**4904.76**	124.72	14.07%	6.08%
Aug-90		**5203.46**	118.26	13.34%	3.30%
Sep-90		**6056.31**	121.67	14.01%	5.12%
Oct-90		**6425.14**	112.33	12.84%	3.63%
Nov-90		**8329.55**	126.21	14.83%	3.60%
Dec-90		**8836.82**	113.55	12.98%	3.00%
Jan-91		**12325.6**	131.82	16.01%	3.53%
Feb-91		**15895.46**	140.98	19.37%	5.30%
Mar-91		**17000**	130.14	18.97%	5.19%
Apr-91		17000	120.04	17.39%	3.84%
May-91		17000	113.43	15.47%	3.04%
Jun-91		17000	104.25	13.59%	1.64%
Jul-91		17000	**93.52**	12.71%	1.13%
Aug-91		17000	**82.21**	11.11%	1.02%
Sep-91		**42000**	175.55	23.35%	6.07%
Oct-91		42000	148.42	19.86%	6.44%
Nov-91		42000	119.88	16.03%	5.48%
Dec-91		42000	**95.69**	12.98%	3.77%
Jan-92		**96037.33**	175.05	25.82%	6.68%
Feb-92		96037.33	139.80	21.78%	5.61%
Mar-92		96036.33	113.61	17.31%	5.16%
Apr-92		96037.33	**93.73**	14.12%	5.43%
May-92		**230000**	182.97	23.08%	7.75%
Jun-92		230000	149.16	20.49%	7.07%
Jul-92		230000	122.81	18.58%	6.84%
Aug-92		230000	100.48	14.73%	6.58%
Sep-92		**522186.94**	185.20	24.84%	6.55%
Oct-92		522186.94	148.14	20.95%	6.36%
Nov-92		522186.94	**119.01**	16.62%	5.74%
Dec-92		522186.94	95.81	12.03%	3.83%
Jan-93		**1250700**	180.44	23.60%	6.81%
Feb-93		1250700	142.35	19.33%	6.43%
Mar-93		**1709400**	154.19	20.57%	6.61%
Apr-93		1709400	120.48	15.56%	6.25%
May-93		**3303300**	182.51	23.47%	6.23%
Jun-93		3303300	141.96	18.30%	6.06%
Jul-93		**4639800**	152.57	19.80%	6.28%
Aug-93	**CR$**	**5534**	137.68	16.58%	5.98%
Sep-93		**9606**	177.72	21.12%	6.51%
Oct-93		**12024**	164.93	19.98%	8.70%
Nov-93		**15021**	152.56	17.95%	7.90%
Dec-93		**18760**	139.22	15.87%	4.78%
Jan-94		**32882**	174.90	20.40%	6.10%
Feb-94		**42829**	161.63	18.60%	7.19%

Mar-94	**URV 64.79**	**60322.7295**	160.52	17.06%	4.56%
Apr-94		**85776.74**	159.66	17.57%	5.02%
May-94		**121534.3778**	158.42	18.01%	5.22%
Jun-94		**178172.5**	159.66	20.20%	6.56%
Jul-94	**R$**	**64.79**	114.38	15.60%	7.35%
Aug-94		64.79	98.85	14.42%	5.77%
Sep-94		**70**	105.10	15.37%	7.10%
Oct-94		70	102.93	15.47%	6.95%
Nov-94		70	100.04	14.42%	7.05%
Dec-94		70	**97.76**	13.22%	5.67%
Jan-95		70	**96.25**	13.87%	6.13%
Feb-95		70	**95.08**	13.28%	6.32%
Mar-95		70	**93.85**	12.77%	6.17%
Apr-95		70	**91.96**	12.29%	5.83%
May-95		**100**	128.43	16.84%	8.25%
Jun-95		100	125.74	16.46%	7.62%
Jul-95		100	122.89	16.24%	7.44%
Aug-95		100	120.79	15.87%	7.26%
Sep-95		100	119.48	15.51%	7.18%
Oct-95		100	117.96	15.39%	6.85%
Nov-95		100	116.27	15.05%	6.57%
Dec-95		100	114.46	14.10%	6.06%
Jan-96		100	112.71	14.65%	6.57%
Feb-96		100	111.50	14.45%	6.41%
Mar-96		100	110.95	14.35%	6.11%
Apr-96		100	110.27	14.16%	5.74%
May-96		**112**	122.16	15.45%	3.27%
Jun-96		112	120.58	15.07%	3.96%
Jul-96		112	119.08	14.60%	3.79%
Aug-96		112	118.07	14.70%	3.51%
Sep-96		112	117.77	14.69%	3.59%
Oct-96		112	117.53	14.77%	3.70%
Nov-96		112	117.11	14.91%	3.66%
Dec-96		112	116.72	14.02%	3.25%
Jan-97		112	116.06	14.82%	3.76%
Feb-97		112	115.33	14.89%	3.93%
Mar-97		112	114.69	14.96%	3.79%
Apr-97		112	113.96	14.44%	3.19%
May-97		**120**	121.66	15.19%	5.02%
Jun-97		120	121.39	15.16%	5.17%
Jul-97		120	121.06	15.06%	5.28%
Aug-97		120	120.97	14.91%	5.14%
Sep-97		120	120.93	14.95%	5.50%
Oct-97		120	120.70	14.68%	5.07%
Nov-97		120	120.43	14.76%	5.16%
Dec-97		120	120.00	13.79%	4.48%
Jan-98		120	119.15	14.75%	4.79%
Feb-98		120	118.33	14.85%	5.01%
Mar-98		120	117.73	14.88%	5.19%
Apr-98		120	117.17	15.10%	4.38%
May-98		**130**	126.20	16.49%	3.84%

table 3.2 - correlations between the real MW and the percentiles and mean of the earnings distribution

percentiles	BA	PE	MG	RJ	SP	RS
levels						
p05	0,58	0,54	0,22	0,68	0,56	0,75
p10	0,82	0,68	0,64	0,82	0,50	0,64
p50	0,71	0,76	0,45	0,58	0,54	0,47
p90	0,65	0,61	0,38	0,53	0,37	0,29
p95	0,61	0,60	0,34	0,54	0,36	0,29
rmean	0,65	0,68	0,39	0,57	0,44	0,38
differences						
dp05	0,44	0,47	0,56	0,57	0,46	0,76
dp10	0,76	0,42	0,75	0,88	0,32	0,74
dp50	0,48	0,33	0,32	0,25	0,19	0,30
dp90	0,22	-0,04	0,07	0,10	0,10	0,22
dp95	0,17	0,02	0,17	0,11	0,10	0,20
dmean	0,31	0,10	0,20	0,22	0,16	0,31

table 3.3 - growth rate of percentiles of the earnings distribution - diferences

pctiles	BA	t	PE	t	MG	t	RJ	t	SP	t	RS	t	pooled	t
whole sample														
p5	-0,13%	-0,14	-0,15%	-0,17	-0,02%	-0,03	-0,12%	-0,15	-0,10%	-0,15	-0,14%	-0,15	-0,11%	-0,18
p10	-0,10%	-0,11	-0,27%	-0,35	-0,11%	-0,11	-0,04%	-0,04	-0,15%	-0,25	-0,06%	-0,08	-0,15%	-0,17
p50	-0,16%	-0,24	-0,15%	-0,27	-0,06%	-0,10	-0,06%	-0,09	-0,13%	-0,21	0,00%	0,01	-0,14%	-0,31
p90	-0,26%	-0,37	-0,10%	-0,14	-0,07%	-0,11	-0,17%	-0,25	-0,05%	-0,08	0,06%	0,09	-0,08%	-0,15
p95	-0,19%	-0,28	-0,10%	-0,14	-0,05%	-0,08	-0,14%	-0,19	-0,10%	-0,15	-0,03%	-0,04	-0,14%	-0,28
mean	-0,22%	-0,37	-0,17%	-0,32	-0,17%	-0,34	-0,12%	-0,23	-0,17%	-0,30	-0,02%	-0,04	-0,14%	-0,32
high inflation														
p5	-0,02%	-0,03	-0,10%	-0,15	-0,30%	-0,39	-0,46%	-0,39	-0,33%	-0,32	-0,33%	-0,28	-0,13%	-0,14
p10	-0,11%	-0,11	-0,15%	-0,25	-0,43%	-0,39	-0,52%	-0,55	-0,45%	-0,34	-0,24%	-0,26	-0,10%	-0,11
p50	-0,06%	-0,10	-0,13%	-0,21	-0,33%	-0,58	-0,52%	-0,74	-0,34%	-0,46	-0,07%	-0,11	-0,16%	-0,24
p90	-0,07%	-0,11	-0,05%	-0,08	-0,18%	-0,28	-0,32%	-0,40	-0,38%	-0,47	-0,07%	-0,08	-0,26%	-0,37
p95	-0,05%	-0,08	-0,10%	-0,15	-0,16%	-0,27	-0,38%	-0,45	-0,37%	-0,44	-0,09%	-0,11	-0,19%	-0,28
mean	-0,17%	-0,34	-0,17%	-0,30	-0,26%	-0,45	-0,40%	-0,65	-0,34%	-0,53	-0,08%	-0,12	-0,22%	-0,37
low inflation														
p5	-0,10%	-0,15	-0,37%	-0,35	-0,33%	-0,32	0,52%	0,66	0,53%	0,64	0,49%	0,46	-0,15%	-0,17
p10	-0,15%	-0,25	-0,33%	-0,30	-0,45%	-0,34	0,80%	1,17	0,85%	0,65	0,54%	0,68	-0,27%	-0,35
p50	-0,13%	-0,21	-0,51%	-0,65	-0,34%	-0,46	0,46%	0,66	0,58%	0,63	0,25%	0,43	-0,15%	-0,27
p90	-0,05%	-0,08	-0,48%	-0,57	-0,38%	-0,47	0,25%	0,41	0,27%	0,22	0,46%	0,59	-0,10%	-0,14
p95	-0,10%	-0,15	-0,46%	-0,57	-0,37%	-0,44	-0,05%	-0,07	0,35%	0,27	0,17%	0,18	-0,10%	-0,14
mean	-0,17%	-0,30	-0,46%	-0,59	-0,34%	-0,53	0,24%	0,53	0,20%	0,24	0,17%	0,50	-0,17%	-0,32

table 3.4 - Gini coefficient

region	BA	PE	MG	RJ	SP	RS	pooled
whole sample	0,57	0,56	0,56	0,54	0,51	0,51	0,55
high inflation	0,56	0,56	0,55	0,52	0,51	0,51	0,55
low inflation	0,57	0,56	0,56	0,54	0,50	0,51	0,55

table 3.5 - correlations between toughness a and spike

region	BA	PE	MG	RJ	SP	RS	pooled
levels	0,44	0,16	0,53	0,49	0,49	0,18	0,62
difference	0,44	0,51	0,48	0,61	0,43	0,39	0,48

table 3.6a - estimates of the coefficients of the minimum wage of models 1 and 2

pctiles	pooled	t	BA	t	PE	t	MG	t	RJ	t	SP	t	RS	t
p5	**0,481**	21,810	**0,422**	7,909	**0,522**	10,343	**0,475**	10,718	**0,506**	13,364	**0,359**	8,011	**0,605**	15,028
p10	**0,516**	25,654	**0,664**	16,773	**0,449**	10,014	**0,702**	17,353	**0,796**	23,738	**0,244**	5,740	**0,467**	13,778
p15	**0,488**	25,487	**0,894**	30,361	**0,640**	20,949	**0,558**	15,413	**0,571**	16,347	**0,213**	5,231	**0,351**	10,228
p20	**0,428**	22,016	**0,642**	16,442	**0,762**	23,417	**0,475**	11,843	**0,392**	11,266	**0,176**	4,256	**0,325**	9,587
p25	**0,367**	20,689	**0,483**	11,935	**0,573**	16,112	**0,392**	11,080	**0,394**	11,993	**0,203**	5,196	**0,263**	7,340
p30	**0,298**	17,513	**0,383**	9,383	**0,417**	14,086	**0,382**	10,636	**0,339**	9,880	**0,168**	4,477	**0,258**	7,271
p35	**0,256**	14,996	**0,395**	9,766	**0,332**	10,610	**0,308**	8,266	**0,286**	7,763	**0,132**	3,393	**0,207**	5,901
p40	**0,274**	16,022	**0,376**	9,372	**0,273**	8,401	**0,317**	8,746	**0,290**	7,338	**0,187**	5,019	**0,248**	6,371
p45	**0,252**	14,976	**0,368**	10,265	**0,270**	7,918	**0,305**	9,382	**0,287**	7,319	**0,191**	4,566	**0,154**	4,555
p50	**0,233**	13,449	**0,337**	7,996	**0,247**	7,148	**0,254**	6,543	**0,218**	6,068	**0,168**	4,304	**0,197**	5,568
p90	**0,126**	6,447	**0,189**	3,774	**0,043**	0,881	**0,140**	3,572	**0,079**	1,696	**0,128**	3,004	**0,166**	3,780
p95	**0,155**	7,343	**0,198**	3,898	**0,088**	1,639	**0,169**	3,838	**0,124**	2,334	**0,105**	2,352	**0,174**	3,854
mean	**0,270**	21,203	**0,381**	13,279	**0,308**	12,935	**0,302**	12,247	**0,297**	10,614	**0,172**	5,935	**0,230**	8,612

table 3.6b - estimates of the coefficients of the minimum wage of models 3 and 4

pctiles	pooled	t	BA	t	PE	t	MG	t	RJ	t	SP	t	RS	t
p5	**0,401**	15,111	**0,337**	4,854	**0,426**	6,479	**0,361**	6,773	**0,457**	7,837	**0,275**	4,751	**0,579**	8,993
p10	**0,471**	14,138	**0,591**	7,823	**0,331**	6,998	**0,663**	7,678	**0,764**	15,009	**0,122**	2,143	**0,408**	5,992
p15	**0,433**	13,431	**0,864**	16,993	**0,608**	11,385	**0,468**	7,137	**0,502**	7,483	**0,124**	3,505	**0,281**	6,847
p20	**0,348**	11,741	**0,574**	8,718	**0,755**	14,700	**0,396**	5,497	**0,301**	4,911	**0,066**	1,475	**0,255**	6,298
p25	**0,293**	13,548	**0,402**	6,195	**0,542**	8,182	**0,306**	7,229	**0,323**	8,338	**0,121**	3,454	**0,202**	6,865
p30	**0,227**	12,800	**0,256**	4,785	**0,349**	8,312	**0,302**	6,534	**0,257**	6,115	**0,080**	2,574	**0,185**	5,238
p35	**0,173**	9,371	**0,314**	8,653	**0,256**	5,460	**0,220**	5,480	**0,182**	4,961	**0,030**	0,726	**0,133**	3,602
p40	**0,193**	10,758	**0,293**	5,296	**0,209**	5,252	**0,222**	6,940	**0,203**	5,523	**0,113**	2,993	**0,163**	3,956
p45	**0,172**	10,081	**0,270**	6,360	**0,210**	5,085	**0,227**	6,436	**0,184**	4,436	**0,098**	2,213	**0,096**	3,082
p50	**0,144**	8,976	**0,267**	6,868	**0,170**	3,900	**0,153**	5,143	**0,126**	3,376	**0,087**	2,314	**0,113**	2,441
p90	**0,051**	2,797	**0,124**	2,118	**-0,033**	-0,759	**0,067**	1,819	**-0,003**	-0,053	**0,056**	1,367	**0,095**	2,279
p95	**0,077**	4,102	**0,119**	2,206	**-0,016**	-0,342	**0,126**	2,409	**0,064**	1,385	**0,037**	0,924	**0,130**	3,339
mean	**0,195**	14,343	**0,307**	7,700	**0,236**	8,818	**0,228**	8,530	**0,211**	7,727	**0,089**	3,372	**0,163**	5,787

table 4.1 - estimates of the coefficients of the spike of models 5, 6 and 7

	OLS		IV			IV			IV			IV		
			$\boxed{\Delta lspike_{rt}}$			$\boxed{\Delta lspike_{rt}}$			$\boxed{\Delta lspike_{rt}}$			$\boxed{\Delta lspike_{rt}}$		
			lags 1 to 3			**lags 1 to 3**			**lags 2 to 4**			**lags 2 to 4**		
	no controls		**no controls**			**controls**			**no controls**			**controls**		
	model 5		model 6			model 7			model 6			model 7		
pctiles	**coef**	t	**coef**	t	*s*	**coef**	t	*s*	**coef**	t	*s*	**coef**	t	*s*
p5	**0,035**	3,296	**0,037**	1,435	*27,627*	**0,046**	1,709	*29,501*	**0,213**	2,070	*13,677*	**0,223**	2,056	*14,215*
p10	**0,041**	3,664	**0,080**	3,235	*14,991*	**0,086**	3,356	*14,246*	**0,157**	1,844	*18,172*	**0,161**	1,821	*18,382*
p15	**0,031**	2,929	**0,083**	3,488	*9,625*	**0,087**	3,533	*9,817*	**0,137**	1,668	*14,223*	**0,145**	1,682	*14,445*
p20	**0,016**	1,883	**0,062**	2,808	*9,494*	**0,071**	3,105	*8,990*	**0,102**	1,644	*14,796*	**0,111**	1,703	*15,368*
p25	**0,001**	0,065	**0,036**	1,864	*9,831*	**0,039**	1,912	*10,106*	**0,077**	1,467	*17,304*	**0,080**	1,437	*18,390*
p30	**0,000**	0,062	**0,034**	1,943	*17,307*	**0,040**	2,150	*16,886*	**0,105**	1,628	*15,872*	**0,108**	1,609	*16,372*
p35	**0,003**	0,487	**0,039**	2,064	*10,282*	**0,044**	2,194	*11,828*	**0,081**	1,526	*17,415*	**0,090**	1,571	*18,747*
p40	**-0,003**	-0,432	**0,035**	1,958	*8,539*	**0,039**	2,099	*8,619*	**0,087**	1,436	*10,006*	**0,087**	1,403	*11,461*
p45	**-0,002**	-0,320	**0,009**	0,511	*23,040*	**0,016**	0,907	*20,920*	**0,076**	1,304	*17,038*	**0,079**	1,315	*15,966*
p50	**-0,003**	-0,359	**0,033**	1,986	*10,686*	**0,035**	2,109	*11,374*	**0,084**	1,713	*8,065*	**0,097**	1,806	*6,919*
p90	**-0,008**	-1,124	**0,010**	0,521	*4,108*	**0,013**	0,638	*3,794*	**0,033**	0,560	*4,829*	**0,036**	0,622	*4,402*
p95	**-0,001**	-0,111	**0,042**	1,942	*1,996*	**0,049**	2,241	*1,947*	**0,048**	0,994	*8,630*	**0,052**	1,070	*8,941*
mean	**0,005**	0,873	**0,033**	2,605	*18,620*	**0,037**	2,803	*18,083*	**0,086**	1,793	*15,134*	**0,089**	1,787	*15,064*

table 4.2a - estimates of the coefficients of the spike

	0 lags		1 lag		2 lags		6 lags		12 lags		15 lags		18 lags		24 lags	
	coef	t	coef	t	coef	t	coef	t	coef	t	coef	t	coef	t	coef	t
WG																
β_T	-0,006	-2,887	-0,003	-1,889	-0,003	-1,610	-0,003	-1,450	-0,003	-1,942	-0,004	-1,921	-0,003	-1,814	-0,003	-1,422
β_H	-0,004	-2,096	-0,003	-1,525	-0,002	-1,296	-0,002	-1,048	-0,003	-1,483	-0,003	-1,496	-0,002	-1,338	-0,002	-1,068
β_E	-0,002	-3,908	-0,001	-1,600	-0,001	-1,845	-0,001	-2,124	-0,001	-2,391	-0,001	-2,647	-0,001	-2,646	-0,001	-3,000
$\beta_T = \beta_H + \beta_E$	-0,006		-0,003		-0,003		-0,003		-0,003		-0,004		-0,003		-0,003	
OLS 1st differencing																
β_T	-0,003	-1,207	-0,004	-1,629	-0,004	-1,909	-0,005	-2,177	-0,004	-1,734	-0,004	-1,689	-0,004	-1,654	-0,004	-1,871
β_H	-0,003	-1,084	-0,003	-1,322	-0,004	-1,566	-0,004	-1,958	-0,004	-1,513	-0,004	-1,485	-0,004	-1,448	-0,003	-1,567
β_E	0,000	-0,816	-0,001	-1,845	-0,001	-1,936	-0,001	-1,467	0,000	-1,381	0,000	-1,313	0,000	-1,123	0,000	-1,305
$\beta_T = \beta_H + \beta_E$	-0,003		-0,004		-0,004		-0,005		-0,004		-0,004		-0,004		-0,004	
OLS 12th differencing																
β_T	-0,004	-2,017	-0,003	-1,736	-0,003	-1,682	-0,003	-1,463	-0,002	-0,972	-0,003	-1,827	-0,003	-1,890		
β_H	-0,003	-1,611	-0,003	-1,481	-0,003	-1,465	-0,002	-1,176	-0,002	-0,943	-0,002	-1,532	-0,002	-1,494		
β_E	-0,001	-2,402	0,000	-0,934	0,000	-1,123	0,000	-1,434	0,000	-0,878	-0,001	-1,723	0,000	-1,269		
$\beta_T = \beta_H + \beta_E$	-0,004		-0,003		-0,003		-0,003		-0,002		-0,003		-0,003			
OLS 1st and 12th differencing																
β_T	-0,004	-1,476	-0,004	-1,705	-0,004	-1,796	-0,007	-2,971	-0,005	-2,373	-0,004	-1,785	-0,005	-2,321		
β_H	-0,004	-1,487	-0,004	-1,483	-0,003	-1,510	-0,006	-2,849	-0,005	-2,300	-0,003	-1,747	-0,004	-2,202		
β_E	0,000	-0,004	0,000	-1,317	0,000	-1,363	0,000	-1,159	0,000	-1,323	0,000	-0,830	0,000	-0,859		
$\beta_T = \beta_H + \beta_E$	-0,004		-0,004		-0,004		-0,007		-0,005		-0,004		-0,004			

table 4.2b - estimates of the coefficients of the toughness

	0 lags		1 lag		2 lags		6 lags		12 lags		15 lags		18 lags		24 lags	
	coef	t	coef	t	coef	t	coef	t	coef	t	coef	t	coef	t	coef	t
WG																
β_T	-0,007	-1,153	-0,002	-0,417	0,001	0,247	0,001	0,204	-0,003	-0,631	-0,003	-0,556	-0,002	-0,267	-0,005	-0,921
β_H	0,004	0,637	0,004	0,648	0,006	1,106	0,006	1,062	-0,001	-0,125	0,000	-0,085	0,001	0,244	-0,002	-0,400
β_E	-0,011	-6,732	-0,003	-2,737	-0,003	-2,646	-0,002	-1,914	-0,002	-1,724	-0,002	-1,654	-0,002	-1,612	-0,003	-1,966
$\beta_T = \beta_H + \beta_E$	-0,007		0,001		0,003		0,004		-0,003		-0,002		-0,001		-0,005	
OLS 1st differencing																
β_T	0,010	1,780	0,015	2,739	0,009	1,616	0,007	1,428	0,008	1,475	0,009	1,616	0,010	1,818	0,003	0,599
β_H	0,011	1,954	0,017	3,069	0,010	1,934	0,009	1,695	0,009	1,764	0,010	1,882	0,011	2,070	0,005	0,947
β_E	-0,001	-0,907	-0,001	-1,418	-0,001	-1,440	-0,001	-1,293	-0,001	-0,720	-0,001	-0,719	0,000	-0,407	-0,001	-0,708
$\beta_T = \beta_H + \beta_E$	0,010		0,016		0,009		0,007		0,008		0,009		0,011		0,004	
OLS 12th differencing																
β_T	-0,004	-0,512	-0,005	-0,579	-0,003	-0,308	-0,003	-0,290	-0,008	-1,148	-0,004	-0,648	-0,005	-0,747		
β_H	0,003	0,417	0,002	0,187	0,003	0,327	0,003	0,390	-0,001	-0,095	0,002	0,282	0,001	0,165		
β_E	-0,008	-4,434	-0,003	-2,385	-0,003	-2,397	-0,003	-2,559	-0,005	-3,659	-0,004	-3,343	-0,004	-2,963		
$\beta_T = \beta_H + \beta_E$	-0,004		-0,002		0,000		0,000		-0,006		-0,003		-0,003			
OLS 1st and 12th differencing																
β_T	-0,007	-0,587	0,011	1,098	0,008	0,887	0,000	-0,004	0,001	0,124	-0,003	-0,451	-0,003	-0,497		
β_H	-0,007	-0,617	0,013	1,314	0,012	1,347	0,005	0,637	0,007	0,928	0,002	0,333	0,002	0,227		
β_E	0,000	0,227	-0,001	-0,512	-0,002	-1,145	-0,003	-1,950	-0,003	-2,228	-0,003	-2,363	-0,003	-1,798		
$\beta_T = \beta_H + \beta_E$	-0,007		0,012		0,010		0,003		0,003		-0,001		-0,001			

table 4.3a - estimates of the coefficients of the spike (IV (1st lag))

	0 lags			1 lag			2 lags			6 lags			12 lags			15 lags			18 lags			24 lags			
	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	critical s
WG																									
β_T	-0,002	-0,560	7,624	0,000	-0,052	12,892	0,001	0,329	10,899	0,002	0,558	10,736	0,001	0,189	10,260	0,000	-0,061	10,758	0,000	0,108	10,164	0,003	0,656	16,499	12,838
β_H	0,001	0,176	7,433	0,001	0,317	11,557	0,002	0,542	10,121	0,003	0,695	9,309	0,002	0,435	9,181	0,001	0,178	9,598	0,001	0,338	8,860	0,002	0,700	15,780	12,838
β_E	-0,003	-3,289	1,533	0,000	-0,852	1,748	0,000	-0,408	2,241	0,000	-0,712	3,516	-0,001	-0,948	3,002	-0,001	-1,333	2,203	-0,001	-1,363	2,554	-0,002	-1,813	1,786	12,838
$\beta_T = \beta_H + \beta_E$	-0,002			0,001			0,002			0,002			0,001			0,000			0,000			0,001			
1st differencing																									
β_T	-0,014	-1,944	23,816	-0,013	-1,973	22,474	-0,011	-1,876	17,435	-0,003	-0,502	22,356	-0,004	-0,929	27,088	-0,004	-0,747	27,611	-0,004	-1,008	24,412	-0,002	-0,414	24,623	12,838
β_H	-0,014	-1,903	23,548	-0,013	-1,940	21,741	-0,012	-1,963	15,969	-0,004	-0,686	20,378	-0,004	-0,880	24,677	-0,003	-0,730	25,493	-0,005	-1,043	22,210	-0,002	-0,461	24,559	12,838
β_E	0,000	-0,147	2,063	0,000	-0,094	2,436	0,000	0,498	3,068	0,001	1,332	2,501	0,001	0,984	2,875	0,001	0,972	2,964	0,001	1,179	3,042	0,001	1,549	2,127	12,838
$\beta_T = \beta_H + \beta_E$	-0,014			-0,013			-0,012			-0,003			-0,003			-0,003			-0,004			-0,001			
12th differencing																									
β_T	-0,001	-0,353	17,350	0,000	-0,086	17,527	0,000	0,037	17,050	0,002	0,453	19,206	0,003	0,870	22,514	-0,002	-0,558	18,151	-0,003	-0,802	21,953				12,838
β_H	0,000	0,070	16,151	0,001	0,191	16,236	0,001	0,247	15,983	0,002	0,696	17,725	0,003	0,925	20,396	0,000	-0,159	18,179	-0,001	-0,435	21,668				12,838
β_E	-0,001	-1,707	2,251	0,000	-0,753	2,067	0,000	-0,588	2,322	-0,001	-0,818	2,189	0,000	-0,713	9,391	-0,001	-1,352	4,067	-0,001	-0,963	3,817				12,838
$\beta_T = \beta_H + \beta_E$	-0,001			0,000			0,000			0,002			0,002			-0,001			-0,002						
1st and 12th differencing																									
β_T	-0,023	-3,165	19,309	-0,019	-2,736	23,395	-0,015	-2,619	20,331	-0,006	-1,182	33,627	-0,004	-0,905	13,780	-0,003	-0,682	17,780	-0,006	-1,476	18,026				12,838
β_H	-0,023	-3,167	19,917	-0,018	-2,684	24,166	-0,016	-2,722	20,145	-0,008	-1,518	32,273	-0,005	-1,042	12,551	-0,003	-0,801	16,393	-0,006	-1,539	16,581				12,838
β_E	0,000	0,042	1,751	0,000	-0,066	1,274	0,001	0,655	1,440	0,001	1,805	3,053	0,001	1,845	3,943	0,001	1,759	3,874	0,001	1,234	2,846				12,838
$\beta_T = \beta_H + \beta_E$	-0,023			-0,018			-0,016			-0,006			-0,003			-0,002			-0,005						

table 4.3b - estimates of the coefficients of the toughness (IV (1st lag))

	0 lags			1 lag			2 lags			6 lags			12 lags			15 lags			18 lags			24 lags			
	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	critical s
WG																									
β_T	-0,041	-2,466	4,761	-0,036	-2,369	5,319	-0,034	-2,179	4,144	-0,030	-1,793	3,413	-0,030	-1,825	1,589	-0,038	-2,347	1,357	-0,046	-2,631	0,454	-0,028	-1,680	0,298	7,879
β_H	-0,017	-1,102	11,175	-0,023	-1,547	8,670	-0,022	-1,496	6,559	-0,019	-1,228	4,542	-0,025	-1,571	1,374	-0,033	-2,122	1,127	-0,039	-2,383	0,276	-0,023	-1,474	0,182	7,879
β_E	-0,024	-5,374	11,884	-0,005	-1,428	0,254	-0,003	-1,095	0,001	-0,002	-0,623	0,150	-0,002	-0,592	0,732	-0,003	-0,767	0,167	-0,004	-0,860	0,226	-0,006	-1,200	0,440	7,879
$\beta_T = \beta_H + \beta_E$	-0,041			-0,028			-0,026			-0,021			-0,027			-0,036			-0,043			-0,029			
1st differencing																									
β_T	0,042	2,575	0,488	0,046	2,959	0,123	0,034	2,221	0,684	0,041	2,604	0,417	0,051	3,710	1,872	0,057	4,123	2,438	0,048	3,456	4,200	0,035	2,503	1,881	7,879
β_H	0,042	2,562	0,407	0,045	2,961	0,235	0,032	2,076	1,077	0,039	2,468	0,528	0,047	3,561	1,807	0,053	3,937	2,401	0,044	3,228	3,991	0,032	2,367	1,753	7,879
β_E	0,000	-0,028	0,165	0,000	0,174	0,189	0,001	0,555	0,256	0,001	0,408	0,015	0,002	0,950	0,060	0,002	0,932	0,172	0,003	1,156	0,200	0,003	0,929	0,005	7,879
$\beta_T = \beta_H + \beta_E$	0,042			0,046			0,033			0,040			0,050			0,055			0,047			0,035			
12th differencing																									
β_T	-0,057	-2,901	7,751	-0,055	-2,959	4,647	-0,055	-3,006	4,647	-0,049	-2,654	5,156	-0,063	-2,780	13,056	-0,072	-3,533	6,752	-0,087	-3,823	6,112				7,879
β_H	-0,043	-2,319	5,736	-0,046	-2,496	3,944	-0,045	-2,548	3,878	-0,041	-2,243	4,253	-0,051	-2,343	9,251	-0,062	-3,155	4,659	-0,073	-3,458	4,487				7,879
β_E	-0,014	-2,746	5,008	-0,002	-0,525	0,376	-0,002	-0,423	0,111	-0,002	-0,522	0,142	-0,005	-1,021	3,873	-0,003	-0,612	2,965	-0,002	-0,269	2,593				7,879
$\beta_T = \beta_H + \beta_E$	-0,057			-0,048			-0,047			-0,043			-0,056			-0,065			-0,075						
1st and 12th differencing																									
β_T	-0,048	-1,798	0,009	-0,058	-2,449	0,362	-0,025	-1,177	3,058	-0,048	-2,289	2,035	-0,066	-2,965	4,661	-0,069	-3,307	5,458	-0,062	-3,116	5,296				7,879
β_H	-0,054	-2,030	0,002	-0,064	-2,692	0,773	-0,025	-1,187	4,974	-0,040	-1,992	2,093	-0,060	-2,724	3,770	-0,061	-3,016	4,790	-0,056	-2,926	5,091				7,879
β_E	0,006	1,336	0,656	0,005	1,212	1,569	0,003	0,633	1,878	0,000	-0,031	0,205	0,001	0,163	0,268	0,001	0,111	0,286	0,004	0,691	0,323				7,879
$\beta_T = \beta_H + \beta_E$	-0,048			-0,059			-0,022			-0,040			-0,059			-0,060			-0,052						

table 4.4a - estimates of the coefficients of the spike (IV (2nd lag))

	0 lags			1 lag			2 lags			6 lags			12 lags			15 lags			18 lags			24 lags			
	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	critical s
WG																									
β_T	-0,002	-0,560	7,624	0,001	0,243	21,656	0,001	0,177	19,470	0,002	0,433	26,330	-0,001	-0,142	13,947	0,001	0,290	12,065	0,002	0,633	12,447	0,005	1,040	33,939	16,750
β_H	0,001	0,176	7,433	0,001	0,346	20,767	0,001	0,274	19,028	0,003	0,794	27,253	0,000	0,065	13,704	0,002	0,509	10,392	0,003	0,889	10,545	0,004	0,893	31,186	16,750
β_E	-0,003	-3,289	1,533	0,000	-0,145	7,352	0,000	0,022	4,107	0,000	0,074	4,255	-0,001	-0,955	9,308	-0,001	-0,873	5,523	0,000	-0,391	4,281	0,000	-0,342	0,856	16,750
$\beta_T = \beta_H + \beta_E$	-0,002			0,001			0,001			0,003			0,000			0,001			0,003			0,003			
1st differencing																									
β_T	-0,005	-0,368	23,818	-0,002	-0,181	25,688	0,003	0,258	24,542	-0,006	-0,524	27,797	0,006	0,619	18,050	0,018	0,929	12,635	0,013	0,749	10,330	0,002	0,237	28,576	14,860
β_H	-0,003	-0,233	23,351	-0,001	-0,100	25,532	0,003	0,264	23,594	-0,002	-0,152	28,783	0,005	0,611	22,289	0,017	0,962	10,413	0,015	0,793	6,286	0,007	0,696	26,154	14,860
β_E	-0,002	-0,710	1,483	-0,002	-0,680	3,752	-0,002	-0,633	2,501	-0,001	-0,512	3,502	-0,001	-0,364	5,900	0,000	0,209	2,391	0,003	1,059	4,999	-0,001	-0,181	0,875	14,860
$\beta_T = \beta_H + \beta_E$	-0,005			-0,003			0,001			-0,003			0,005			0,017			0,018			0,006			
12th differencing																									
β_T	-0,011	-1,725	12,065	-0,012	-2,101	14,435	-0,013	-2,260	11,301	-0,006	-1,387	13,316	0,007	1,408	64,589	-0,007	-1,763	24,860	-0,011	-2,208	9,920				14,860
β_H	-0,009	-1,503	11,005	-0,011	-2,046	12,642	-0,012	-2,348	9,556	-0,005	-1,275	12,017	0,005	1,146	57,948	-0,009	-2,077	20,878	-0,010	-2,112	8,371				14,860
β_E	-0,002	-1,469	1,940	0,000	-0,341	4,179	0,000	0,228	6,920	0,000	-0,127	2,052	0,000	-0,009	44,430	-0,001	-0,876	9,251	0,000	-0,303	2,558				14,860
$\beta_T = \beta_H + \beta_E$	-0,011			-0,011			-0,012			-0,005			0,005			-0,010			-0,010						
1st and 12th differencing																									
β_T	-0,046	-2,654	11,751	-0,043	-2,825	12,177	-0,030	-2,229	16,889	-0,026	-2,839	26,718	-0,015	-1,960	22,156	0,000	0,031	32,676	0,031	1,464	4,173				14,860
β_H	-0,045	-2,652	12,371	-0,043	-2,849	12,130	-0,031	-2,353	16,633	-0,024	-2,822	30,663	-0,014	-1,725	24,340	-0,003	-0,342	31,587	0,030	1,475	3,057				14,860
β_E	-0,001	-0,346	1,599	0,000	0,150	7,680	0,000	0,215	8,142	0,000	0,182	4,176	-0,001	-0,336	4,426	0,001	0,400	9,347	0,002	0,799	5,095				14,860
$\beta_T = \beta_H + \beta_E$	-0,046			-0,043			-0,030			-0,023			-0,015			-0,002			0,031						

table 4.4b - estimates of the coefficients of the toughness (IV (2nd lag))

	0 lags			1 lag			2 lags			6 lags			12 lags			15 lags			18 lags			24 lags			
	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	critical s
WG																									
β_T	-0,032	-2,045	25,476	-0,020	-1,298	18,954	-0,030	-1,572	8,643	-0,031	-1,292	4,253	-0,028	-1,626	15,068	-0,030	-1,526	11,995	-0,016	-0,842	11,011	-0,019	-0,925	20,540	14,860
β_H	-0,007	-0,492	35,525	-0,013	-0,926	19,939	-0,029	-1,441	7,764	-0,022	-0,887	4,654	-0,027	-1,589	14,515	-0,029	-1,565	13,638	-0,016	-0,908	10,533	-0,015	-0,730	15,767	14,860
β_E	-0,025	-5,673	11,152	-0,002	-0,595	5,101	0,000	-0,111	3,147	0,002	0,432	2,371	-0,001	-0,280	8,423	-0,002	-0,502	3,976	-0,001	-0,234	3,127	-0,001	-0,171	0,658	14,860
$\beta_T = \beta_H + \beta_E$	-0,032			-0,015			-0,029			-0,019			-0,028			-0,031			-0,018			-0,016			
1st differencing																									
β_T	-0,034	-1,846	12,128	-0,036	-1,810	12,409	-0,039	-2,041	10,214	-0,043	-1,852	7,283	0,090	1,088	3,521	0,046	1,462	9,290	0,054	1,639	7,535	-0,009	-0,460	8,701	12,838
β_H	-0,036	-1,933	13,741	-0,037	-1,834	14,117	-0,040	-2,103	11,800	-0,041	-1,876	9,401	0,032	1,049	11,820	0,042	1,421	9,574	0,053	1,685	6,870	-0,012	-0,619	7,967	12,838
β_E	0,002	0,690	1,198	0,001	0,359	4,275	0,001	0,333	2,489	0,001	0,329	2,239	0,007	1,769	3,406	0,005	1,421	0,364	0,012	1,912	0,721	0,004	0,869	0,945	12,838
$\beta_T = \beta_H + \beta_E$	-0,034			-0,036			-0,039			-0,040			0,039			0,047			0,065			-0,008			
12th differencing																									
β_T	-0,968	-1,011	0,010	-0,106	-1,138	28,867	-0,321	-1,857	3,589	-0,210	-1,961	5,542	-0,521	-2,474	3,074	-0,124	-2,444	20,830	-0,149	-1,701	12,891				12,838
β_H	-0,928	-0,998	0,046	-0,133	-1,252	23,256	-0,294	-1,866	3,960	-0,214	-1,898	6,071	-0,482	-2,417	3,105	-0,185	-2,592	9,753	-0,120	-1,664	15,905				12,838
β_E	-0,040	-0,858	3,381	0,015	0,666	1,405	0,028	0,813	2,525	-0,012	-0,462	1,063	-0,012	-0,978	40,634	-0,002	-0,233	8,732	0,011	0,488	1,631				12,838
$\beta_T = \beta_H + \beta_E$	-0,968			-0,117			-0,266			-0,226			-0,494			-0,186			-0,109						
1st and 12th differencing																									
β_T	-0,671	-1,024	0,565	-0,267	-1,715	4,154	-0,113	-1,513	9,142	-0,320	-1,155	4,267	-0,296	-2,451	3,801	-0,307	-2,100	6,463	-0,201	-1,803	4,178				12,838
β_H	-0,684	-1,026	0,486	-0,282	-1,816	3,598	-0,137	-1,727	7,900	-0,334	-1,178	4,262	-0,258	-2,573	4,816	-0,259	-2,494	6,697	-0,152	-1,795	6,298				12,838
β_E	0,013	0,384	0,485	0,023	0,647	5,178	0,024	0,674	5,348	0,011	0,228	2,240	-0,012	-0,931	0,757	-0,004	-0,314	7,256	0,006	0,357	2,161				12,838
$\beta_T = \beta_H + \beta_E$	-0,671			-0,260			-0,113			-0,323			-0,270			-0,263			-0,146						

table 4.5a - estimates of the coefficients of the spike (IV (1st lag) and controls)

	0 lags			1 lag			2 lags			6 lags			12 lags			15 lags			18 lags			24 lags			
	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	critical s
WG																									
β_T	-0,003	-0,745	7,044	-0,001	-0,232	12,972	0,001	0,157	10,756	0,002	0,416	10,892	0,000	-0,007	10,479	-0,001	-0,228	10,972	0,000	-0,073	10,396	0,002	0,507	16,692	12,838
β_H	0,000	0,045	6,946	0,001	0,204	11,651	0,002	0,434	10,074	0,002	0,622	9,530	0,001	0,317	9,132	0,000	0,093	9,464	0,001	0,245	8,718	0,002	0,631	15,590	12,838
β_E	-0,003	-3,571	1,216	-0,001	-1,281	1,786	0,000	-0,857	2,400	-0,001	-1,203	3,964	-0,001	-1,410	3,680	-0,001	-1,818	2,894	-0,001	-1,728	3,197	-0,002	-2,227	2,089	12,838
$\beta_T = \beta_H + \beta_E$	-0,003			0,000			0,001			0,002			0,000			-0,001			0,000			0,000			
1st differencing																									
β_T	-0,014	-1,983	24,367	-0,013	-1,975	22,850	-0,012	-1,922	17,997	-0,003	-0,529	23,622	-0,004	-0,906	28,488	-0,004	-0,755	28,826	-0,004	-0,992	25,321	-0,002	-0,409	26,030	12,838
β_H	-0,015	-1,994	24,269	-0,014	-1,996	22,216	-0,013	-2,069	16,562	-0,004	-0,776	21,686	-0,004	-0,955	25,788	-0,004	-0,826	26,372	-0,005	-1,108	22,916	-0,002	-0,559	25,591	12,838
β_E	0,000	0,308	2,415	0,000	0,369	2,650	0,001	0,925	3,373	0,002	1,748	2,729	0,001	1,521	3,073	0,001	1,550	3,210	0,001	1,697	3,186	0,002	2,056	2,282	12,838
$\beta_T = \beta_H + \beta_E$	-0,014			-0,013			-0,012			-0,003			-0,003			-0,003			-0,004			-0,001			
12th differencing																									
β_T	-0,001	-0,392	15,535	0,000	-0,133	15,902	0,000	-0,016	15,474	0,001	0,391	17,590	0,003	0,914	21,451	-0,002	-0,516	17,744	-0,002	-0,700	21,564				12,838
β_H	0,000	0,066	14,288	0,001	0,183	14,490	0,001	0,232	14,297	0,002	0,676	15,975	0,003	0,995	19,002	0,000	-0,070	17,212	-0,001	-0,297	20,757				12,838
β_E	-0,001	-1,878	2,238	-0,001	-1,004	2,328	-0,001	-0,860	2,522	-0,001	-1,074	2,468	-0,001	-0,953	10,290	-0,001	-1,708	4,822	-0,001	-1,239	4,573				12,838
$\beta_T = \beta_H + \beta_E$	-0,001			0,000			0,000			0,001			0,002			-0,001			-0,002						
1st and 12th differencing																									
β_T	-0,023	-3,141	18,116	-0,019	-2,730	22,459	-0,015	-2,614	19,270	-0,006	-1,191	31,956	-0,004	-0,921	13,579	-0,003	-0,712	17,861	-0,006	-1,468	17,899				12,838
β_H	-0,023	-3,154	18,334	-0,019	-2,700	22,977	-0,016	-2,745	18,846	-0,008	-1,545	30,452	-0,005	-1,078	11,998	-0,004	-0,845	15,958	-0,006	-1,555	15,971				12,838
β_E	0,000	0,233	2,191	0,000	0,138	1,667	0,001	0,832	1,908	0,002	1,925	3,599	0,001	1,966	5,292	0,001	1,873	5,207	0,001	1,376	3,837				12,838
$\beta_T = \beta_H + \beta_E$	-0,023			-0,019			-0,016			-0,006			-0,003			-0,002			-0,006						

table 4.5b - estimates of the coefficients of the toughness (IV (1st lag) and controls)

	0 lags			1 lag			2 lags			6 lags			12 lags			15 lags			18 lags			24 lags			
	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	coef	t	s	critical s
WG																									
β_T	-0,042	-2,593	5,256	-0,038	-2,486	5,768	-0,036	-2,288	4,575	-0,030	-1,868	3,830	-0,031	-1,918	1,838	-0,038	-2,373	1,536	-0,046	-2,645	0,595	-0,027	-1,621	0,337	7,879
β_H	-0,019	-1,222	11,920	-0,025	-1,661	9,227	-0,024	-1,605	7,084	-0,020	-1,308	4,996	-0,026	-1,657	1,603	-0,033	-2,133	1,330	-0,039	-2,391	0,411	-0,022	-1,426	0,238	7,879
β_E	-0,024	-5,445	11,877	-0,004	-1,349	0,144	-0,003	-1,033	0,009	-0,002	-0,506	0,178	-0,002	-0,542	0,745	-0,003	-0,848	0,223	-0,004	-0,852	0,274	-0,006	-1,164	0,461	7,879
$\beta_T = \beta_H + \beta_E$	-0,042			-0,029			-0,027			-0,022			-0,028			-0,036			-0,043			-0,027			
1st differencing																									
β_T	0,043	2,582	0,644	0,046	2,976	0,054	0,035	2,217	0,485	0,042	2,655	0,285	0,050	3,664	1,389	0,055	4,018	1,942	0,047	3,332	3,404	0,033	2,354	1,482	7,879
β_H	0,043	2,603	0,496	0,046	2,997	0,161	0,032	2,095	0,898	0,040	2,541	0,420	0,047	3,554	1,418	0,052	3,872	1,999	0,043	3,158	3,354	0,031	2,280	1,483	7,879
β_E	-0,001	-0,238	0,422	0,000	-0,021	0,473	0,001	0,334	0,610	0,001	0,219	0,101	0,002	0,762	0,001	0,002	0,787	0,014	0,002	0,964	0,038	0,002	0,750	0,038	7,879
$\beta_T = \beta_H + \beta_E$	0,043			0,046			0,033			0,041			0,049			0,054			0,046			0,033			
12th differencing																									
β_T	-0,058	-3,028	5,974	-0,057	-3,144	3,402	-0,057	-3,182	3,407	-0,052	-2,824	3,820	-0,063	-2,860	10,719	-0,073	-3,667	4,851	-0,086	-3,935	4,490				7,879
β_H	-0,044	-2,419	4,403	-0,048	-2,636	2,946	-0,047	-2,675	2,880	-0,043	-2,362	3,224	-0,051	-2,383	7,504	-0,062	-3,231	3,340	-0,072	-3,540	3,317				7,879
β_E	-0,014	-2,865	3,911	-0,003	-0,670	0,088	-0,002	-0,574	0,003	-0,003	-0,697	0,011	-0,006	-1,223	2,898	-0,004	-0,912	1,875	-0,003	-0,514	1,557				7,879
$\beta_T = \beta_H + \beta_E$	-0,058			-0,050			-0,049			-0,045			-0,057			-0,066			-0,075						
1st and 12th differencing																									
β_T	-0,054	-2,060	0,040	-0,062	-2,629	0,155	-0,028	-1,332	2,287	-0,049	-2,412	1,199	-0,067	-3,062	3,593	-0,070	-3,439	3,936	-0,062	-3,219	4,076				7,879
β_H	-0,059	-2,263	0,000	-0,067	-2,841	0,511	-0,027	-1,303	4,176	-0,041	-2,077	1,374	-0,060	-2,787	3,094	-0,061	-3,097	3,698	-0,055	-2,987	4,146				7,879
β_E	0,005	1,143	1,112	0,005	1,065	2,265	0,002	0,504	2,713	-0,001	-0,207	0,534	0,000	-0,073	0,032	-0,001	-0,160	0,021	0,002	0,455	0,041				7,879
$\beta_T = \beta_H + \beta_E$	-0,054			-0,062			-0,025			-0,042			-0,060			-0,061			-0,053						

table 4.6a - long run estimates of the total employment elasticity (spike equations)

model	0 lags	1 lag	2 lags	6 lags	12 lags	15lags	18 lags	24 lags
WG	-0,006	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,001
WG IV(1st lag)	-0,002	0,000	0,001	0,001	0,000	0,000	0,000	0,001
WG IV(2nd lag)	-0,002	0,001	0,000	0,001	0,000	0,001	0,001	0,003
WG IV(1st lag) and controls	-0,003	-0,001	0,000	0,001	0,000	0,000	0,000	0,001
OLS 1st diff	-0,003	-0,006	-0,019	0,006	0,001	0,001	0,001	0,001
1st diff IV(1st lag)	-0,014	-0,022	-0,049	0,003	0,001	0,001	0,001	0,000
1st diff IV(2nd lag)	-0,005	-0,002	0,003	-0,006	-0,001	-0,002	-0,001	0,000
1st diff IV(1st lag) and controls	-0,014	-0,022	-0,051	0,004	0,001	0,001	0,001	0,000
OLS 1st diff	-0,004	-0,003	-0,003	-0,002	-0,002	-0,002	-0,002	
1st diff IV(1st lag)	-0,001	0,000	0,000	0,001	0,003	-0,001	-0,002	
1st diff IV(2nd lag)	-0,011	-0,008	-0,008	-0,004	0,008	-0,004	-0,008	
1st diff IV(1st lag) and controls	-0,001	0,000	0,000	0,001	0,003	-0,001	-0,002	
OLS 1st diff	-0,004	-0,007	-0,033	0,005	0,002	0,001	0,001	
1st diff IV(1st lag)	-0,023	-0,032	-0,128	0,005	0,002	0,001	0,001	
1st diff IV(2nd lag)	-0,046	-0,034	-0,025	-0,140	0,016	0,000	-0,003	
1st diff IV(1st lag) and controls	-0,023	-0,032	-0,127	0,005	0,002	0,001	0,001	

table 4.6b - long run estimates of the total employment elasticity (toughness equations)

model	0 lags	1 lag	2 lags	6 lags	12 lags	15lags	18 lags	24 lags
WG	-0,007	-0,002	0,001	0,001	-0,002	-0,002	-0,001	-0,003
WG IV(1st lag)	-0,041	-0,025	-0,023	-0,019	-0,017	-0,022	-0,027	-0,016
WG IV(2nd lag)	-0,032	-0,012	-0,016	-0,015	-0,015	-0,016	-0,009	-0,010
WG IV(1st lag) and controls	-0,042	-0,026	-0,024	-0,019	-0,018	-0,022	-0,027	-0,015
OLS 1st diff	0,010	0,025	0,035	-0,009	-0,004	-0,002	-0,002	-0,001
1st diff IV(1st lag)	0,042	0,076	0,127	-0,054	-0,012	-0,015	-0,012	-0,008
1st diff IV(2nd lag)	-0,034	-0,029	-0,040	-0,027	-0,009	-0,008	-0,008	0,004
1st diff IV(1st lag) and controls	0,043	0,077	0,131	-0,055	-0,012	-0,015	-0,012	-0,007
OLS 1st diff	-0,004	-0,004	-0,002	-0,002	-0,008	-0,003	-0,004	
1st diff IV(1st lag)	-0,057	-0,044	-0,044	-0,036	-0,066	-0,055	-0,065	
1st diff IV(2nd lag)	-0,968	-0,085	-0,194	-0,107	-0,655	-0,077	-0,104	
1st diff IV(1st lag) and controls	-0,058	-0,046	-0,046	-0,037	-0,066	-0,055	-0,065	
OLS 1st diff	-0,007	0,019	0,066	0,000	0,000	0,001	0,001	
1st diff IV(1st lag)	-0,048	-0,093	-0,182	0,034	0,028	0,015	0,012	
1st diff IV(2nd lag)	-0,671	-0,177	-0,092	-0,568	0,341	0,046	0,215	
1st diff IV(1st lag) and controls	-0,054	-0,097	-0,198	0,036	0,029	0,016	0,012	

FUNDAÇÃO
GETULIO VARGAS
EPGE
Escola de Pós-Graduação em
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SEMINÁRIOS
DE PESQUISA
ECONÔMICA

The Effects of the Minimum Wage on Earnings and Employment in Brazil

Anexo do Seminário

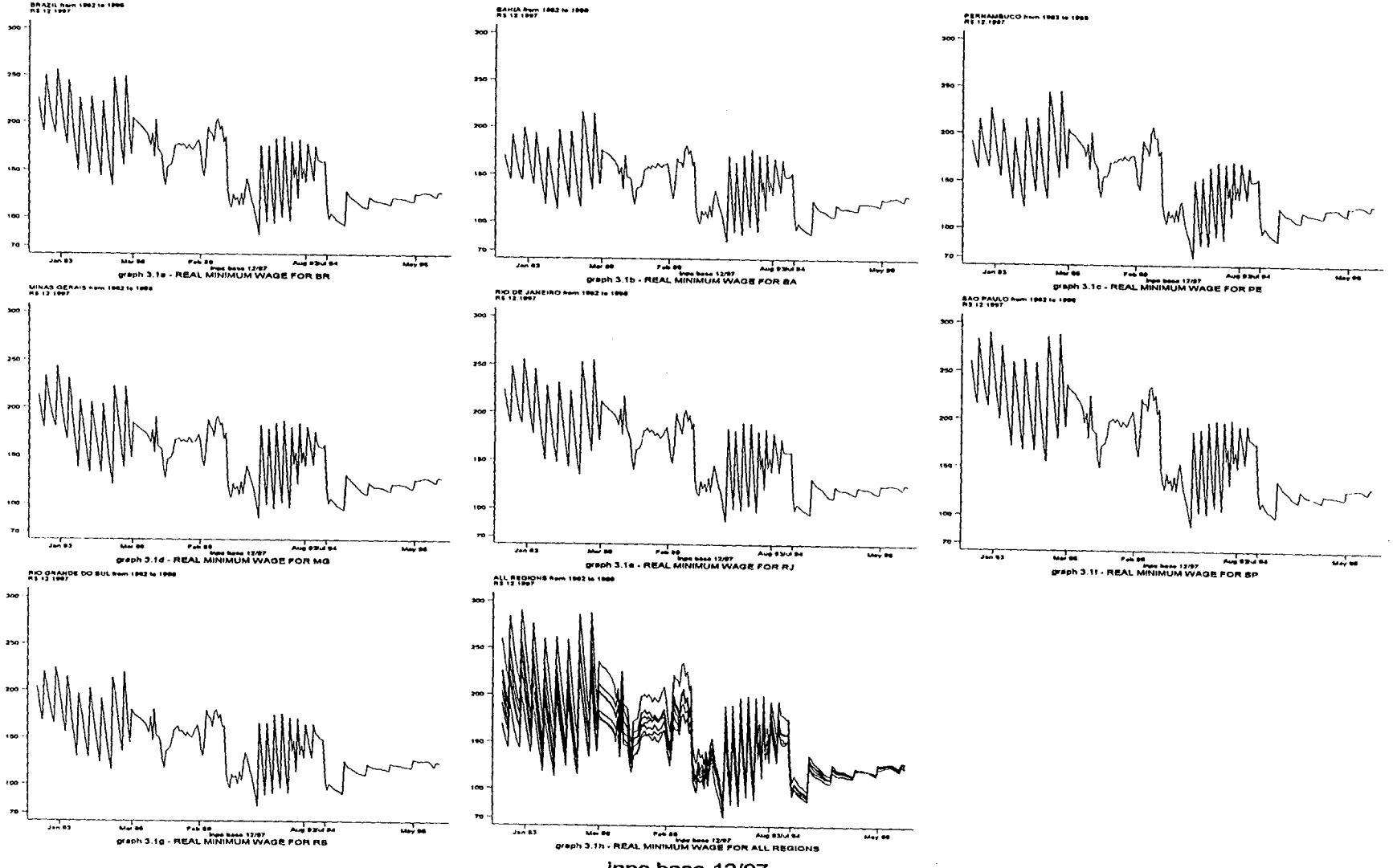
Profª. Sara Lemos
(University College London – UCL)

LOCAL
Fundação Getulio Vargas
Praia de Botafogo, 190 - 10° andar - Auditório

DATA
02/03/2000 (5ª feira)

HORÁRIO
16:00h

Coordenação: Prof. Pedro Cavalcanti Gomes Ferreira
Email: ferreira@fgv.br - ☎ (021) 559-5834



inpc base 12/97

graph 3.1 - REAL MINIMUM WAGE FOR BRAZIL AND FOR ALL REGIONS

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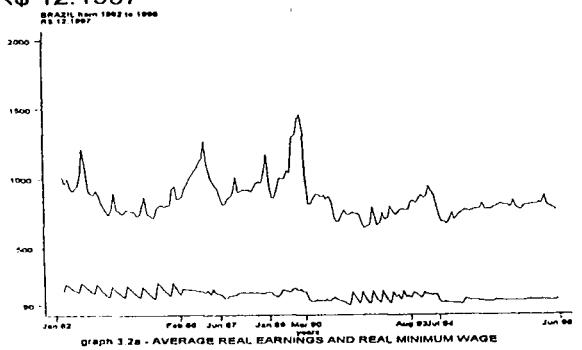
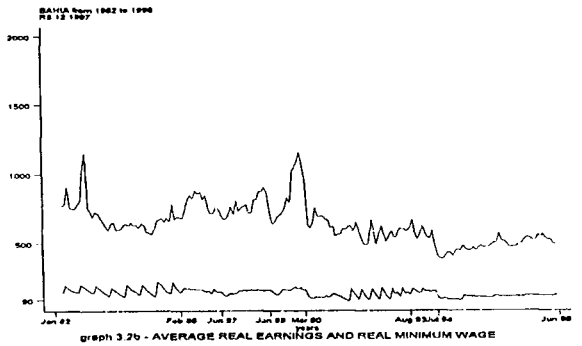
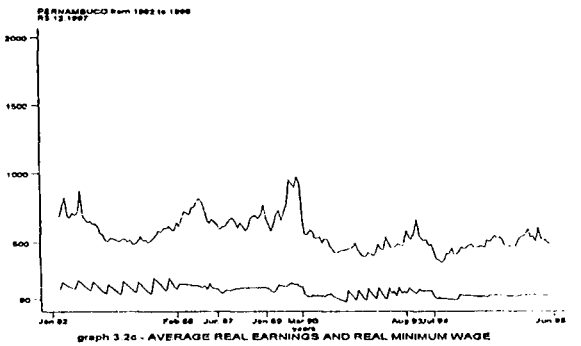
BRAZIL AND REGIONS from 1982 to 1998
R$ 12.1997



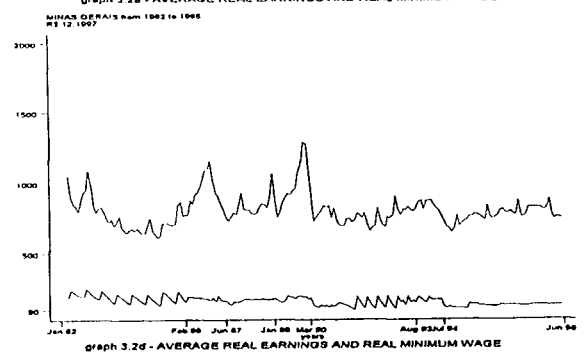
graph 3.2a - AVERAGE REAL EARNINGS AND REAL MINIMUM WAGE



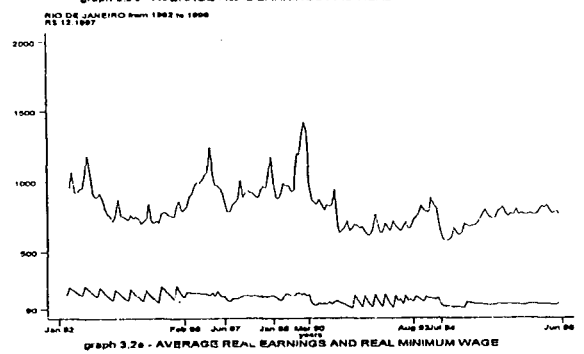
graph 3.2b - AVERAGE REAL EARNINGS AND REAL MINIMUM WAGE



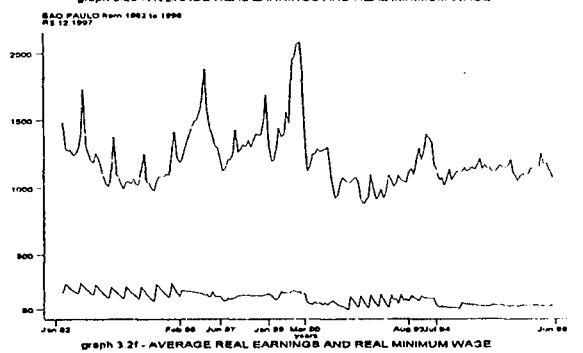
graph 3.2c - AVERAGE REAL EARNINGS AND REAL MINIMUM WAGE



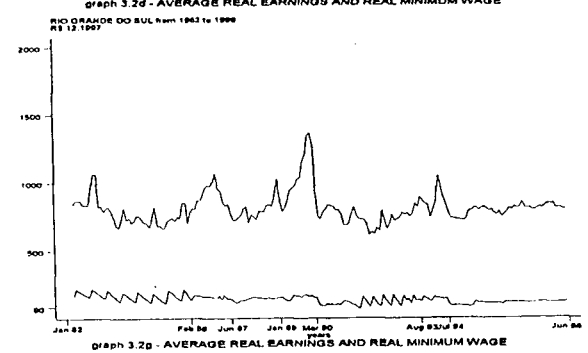
graph 3.2d - AVERAGE REAL EARNINGS AND REAL MINIMUM WAGE



graph 3.2e - AVERAGE REAL EARNINGS AND REAL MINIMUM WAGE



graph 3.2f - AVERAGE REAL EARNINGS AND REAL MINIMUM WAGE



graph 3.2g - AVERAGE REAL EARNINGS AND REAL MINIMUM WAGE

graph 3.2 - REAL MINIMUM WAGES AND AVERAGE REAL EARNINGS

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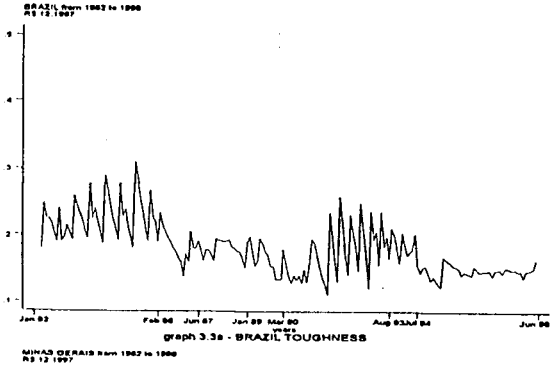
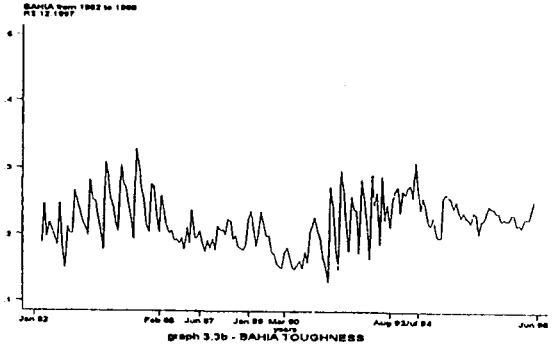
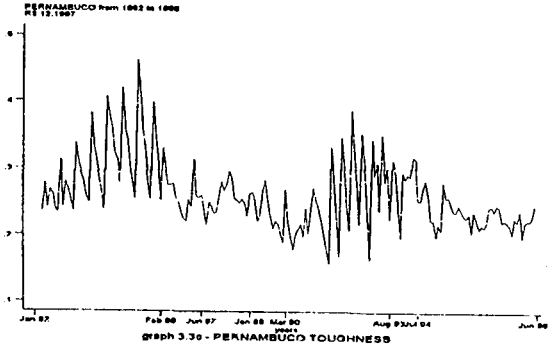


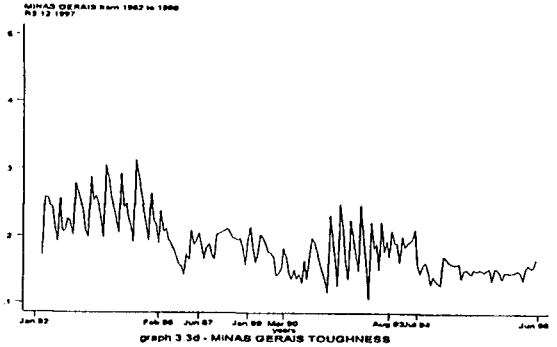
graph 3.3a - BRAZIL TOUGHNESS



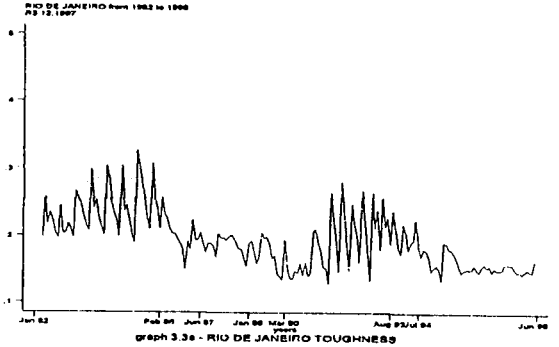
graph 3.3b - BAHIA TOUGHNESS



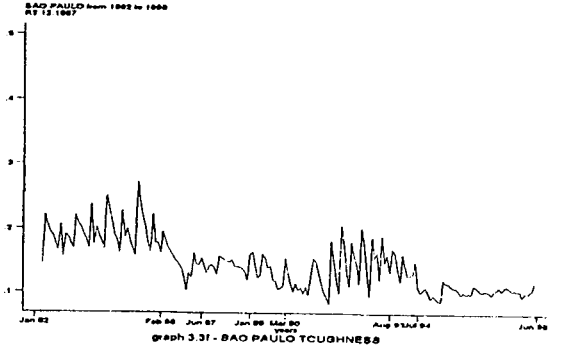
graph 3.3c - PERNAMBUCO TOUGHNESS



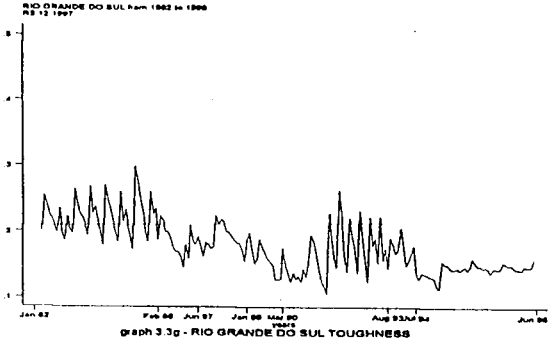
graph 3.3d - MINAS GERAIS TOUGHNESS



graph 3.3e - RIO DE JANEIRO TOUGHNESS



graph 3.3f - SAO PAULO TOUGHNESS



graph 3.3g - RIO GRANDE DO SUL TOUGHNESS

graph 3.3 - TOUGHNESS: ratio real mw / real average earnings

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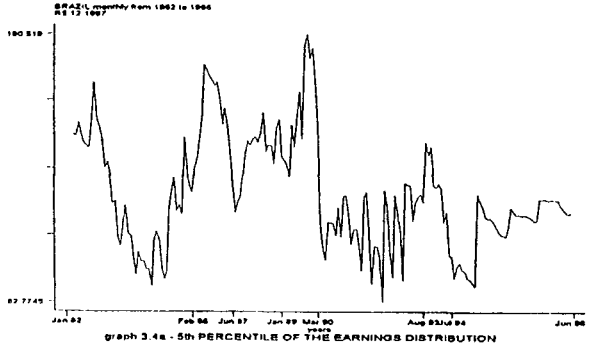
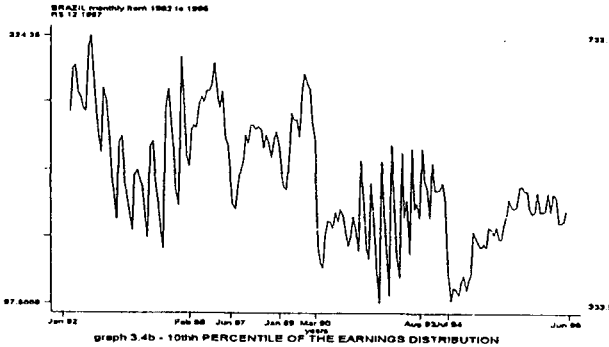
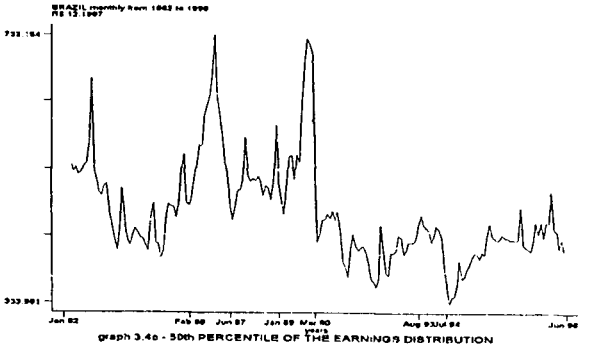
R$ 12.1997



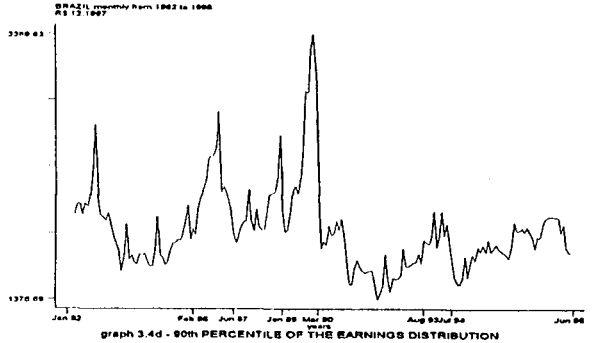
graph 3.4a - 5th PERCENTILE OF THE EARNINGS DISTRIBUTION



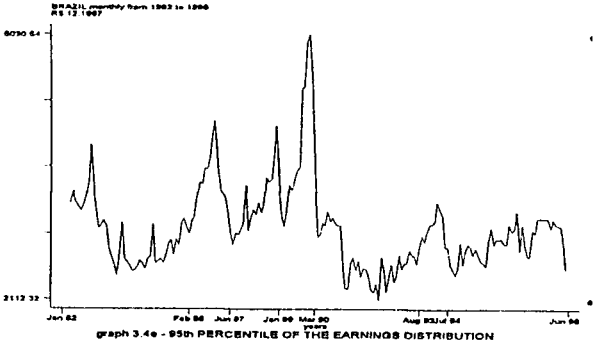
graph 3.4b - 10th PERCENTILE OF THE EARNINGS DISTRIBUTION



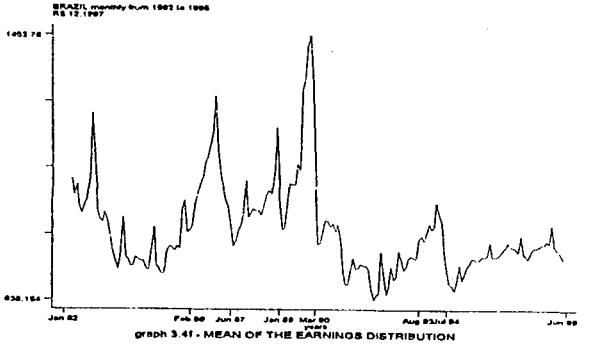
graph 3.4c - 50th PERCENTILE OF THE EARNINGS DISTRIBUTION



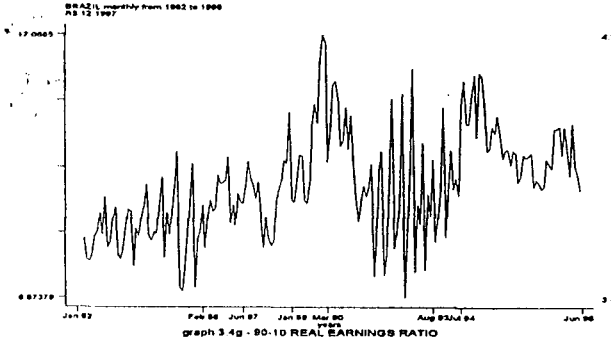
graph 3.4d - 90th PERCENTILE OF THE EARNINGS DISTRIBUTION



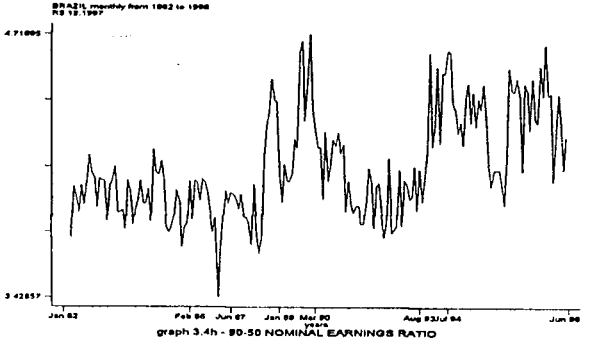
graph 3.4e - 95th PERCENTILE OF THE EARNINGS DISTRIBUTION



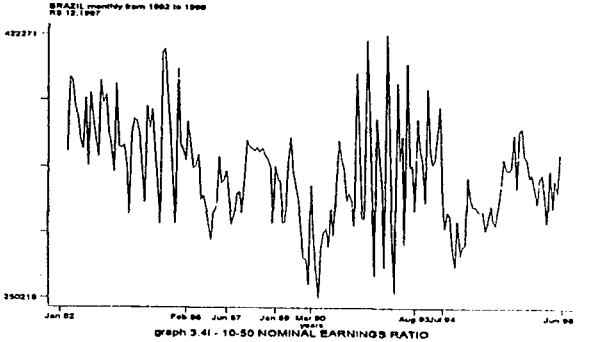
graph 3.4f - MEAN OF THE EARNINGS DISTRIBUTION



graph 3.4g - 90-10 REAL EARNINGS RATIO



graph 3.4h - 90-50 NOMINAL EARNINGS RATIO



graph 3.4i - 10-50 NOMINAL EARNINGS RATIO

graph 3.4 -MEAN PCTILES AND PCTILE RATIOS OF THE EARNINGS DISTRIBUTION

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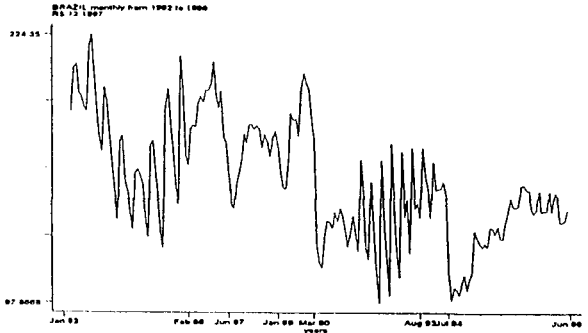
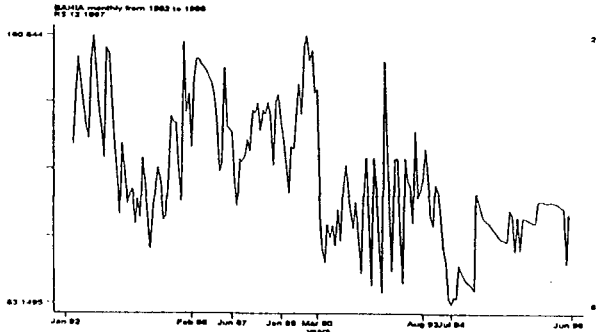
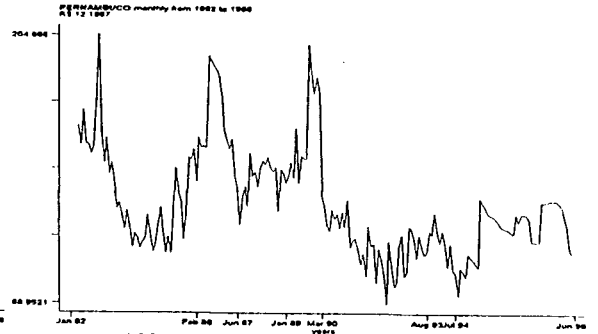


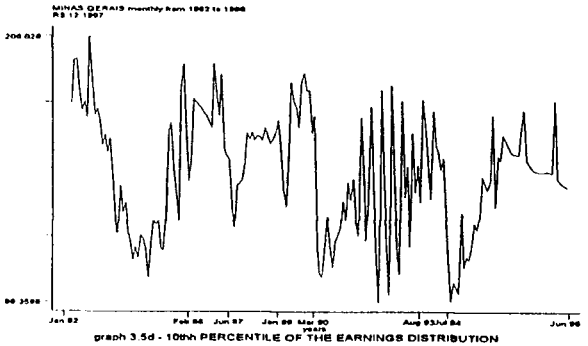
graph 3.4b - 10thh PERCENTILE OF THE EARNINGS DISTRIBUTION



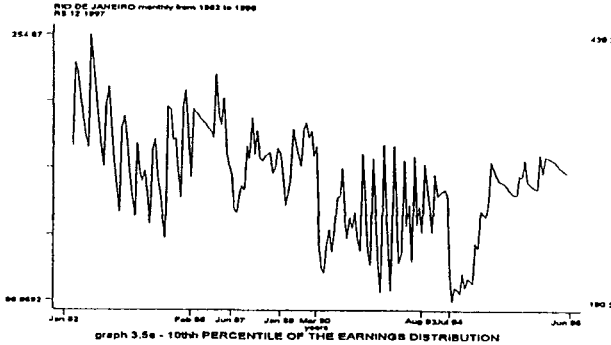
graph 3.5b - 10thh PERCENTILE OF THE EARNINGS DISTRIBUTION



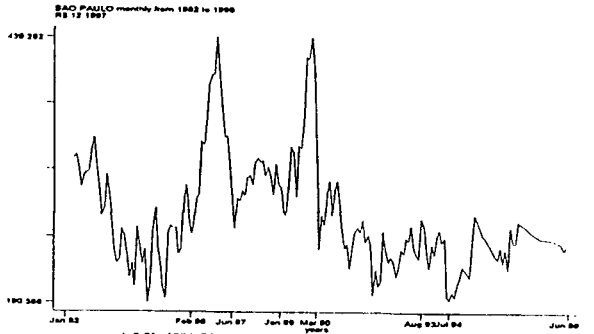
graph 3.5c - 10thh PERCENTILE OF THE EARNINGS DISTRIBUTION



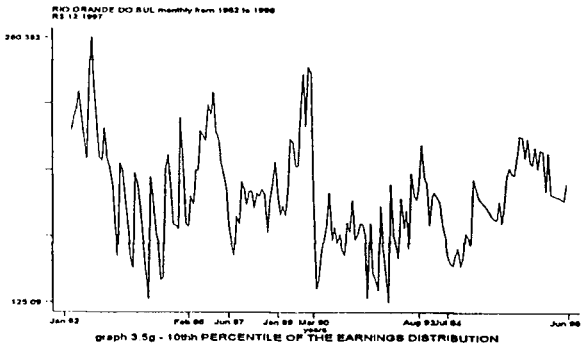
graph 3.5d - 10thh PERCENTILE OF THE EARNINGS DISTRIBUTION



graph 3.5e - 10thh PERCENTILE OF THE EARNINGS DISTRIBUTION



graph 3.5f - 10thh PERCENTILE OF THE EARNINGS DISTRIBUTION



graph 3.5g - 10thh PERCENTILE OF THE EARNINGS DISTRIBUTION

graph 3.5 - 10th PCTILE OF THE EARNINGS DISTRIBUTIONS

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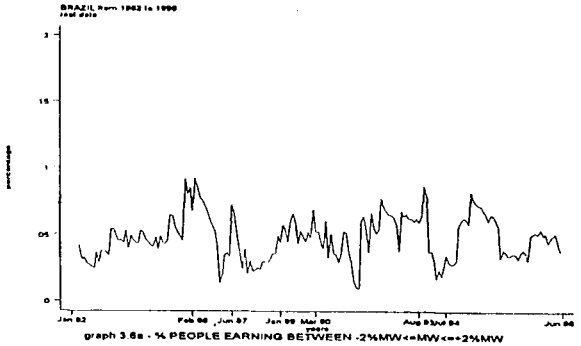
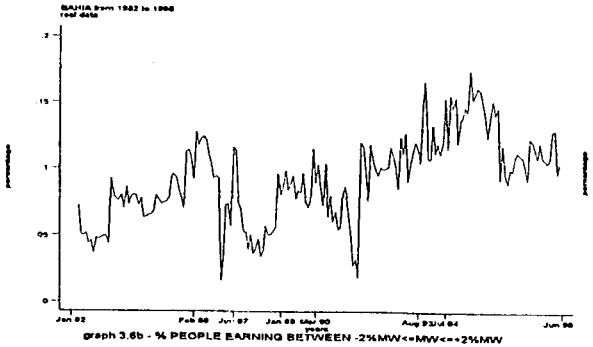
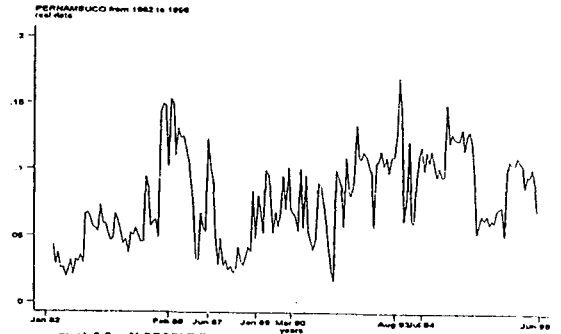
All regions and BRAZIL from 1982 to 1998
real data



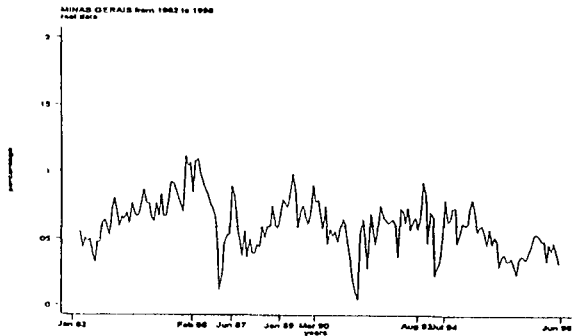
graph 3.6a - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW



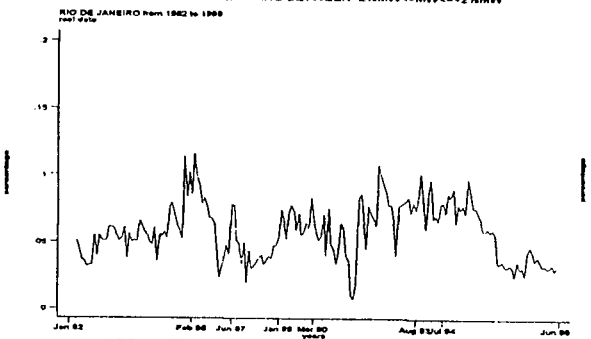
graph 3.6b - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW



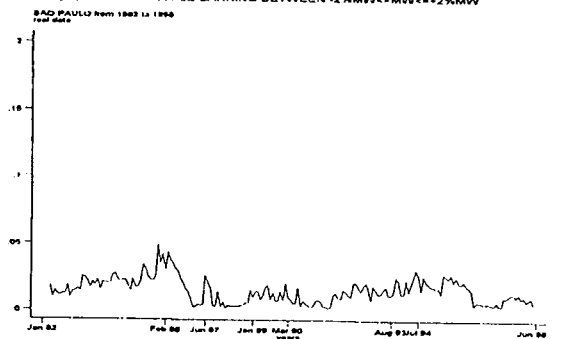
graph 3.6c - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW



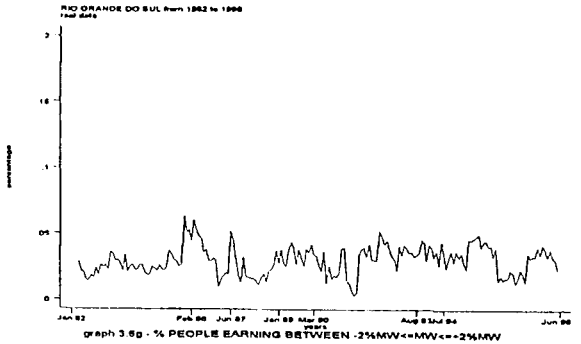
graph 3.6d - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW



graph 3.6e - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW



graph 3.6f - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW



graph 3.6g - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW

graph 3.6 - % PEOPLE EARNING BETWEEN -2%MW<=MW<=+2%MW

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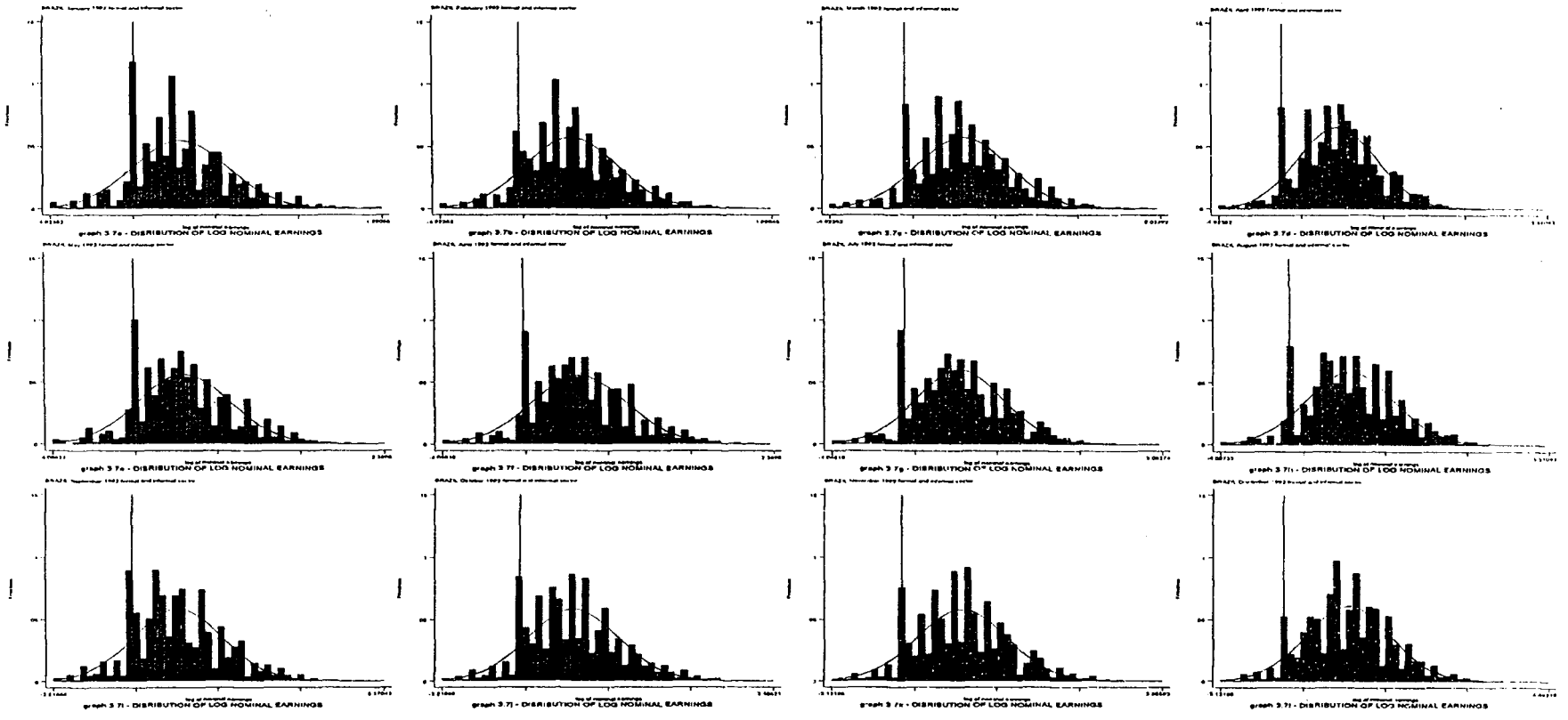
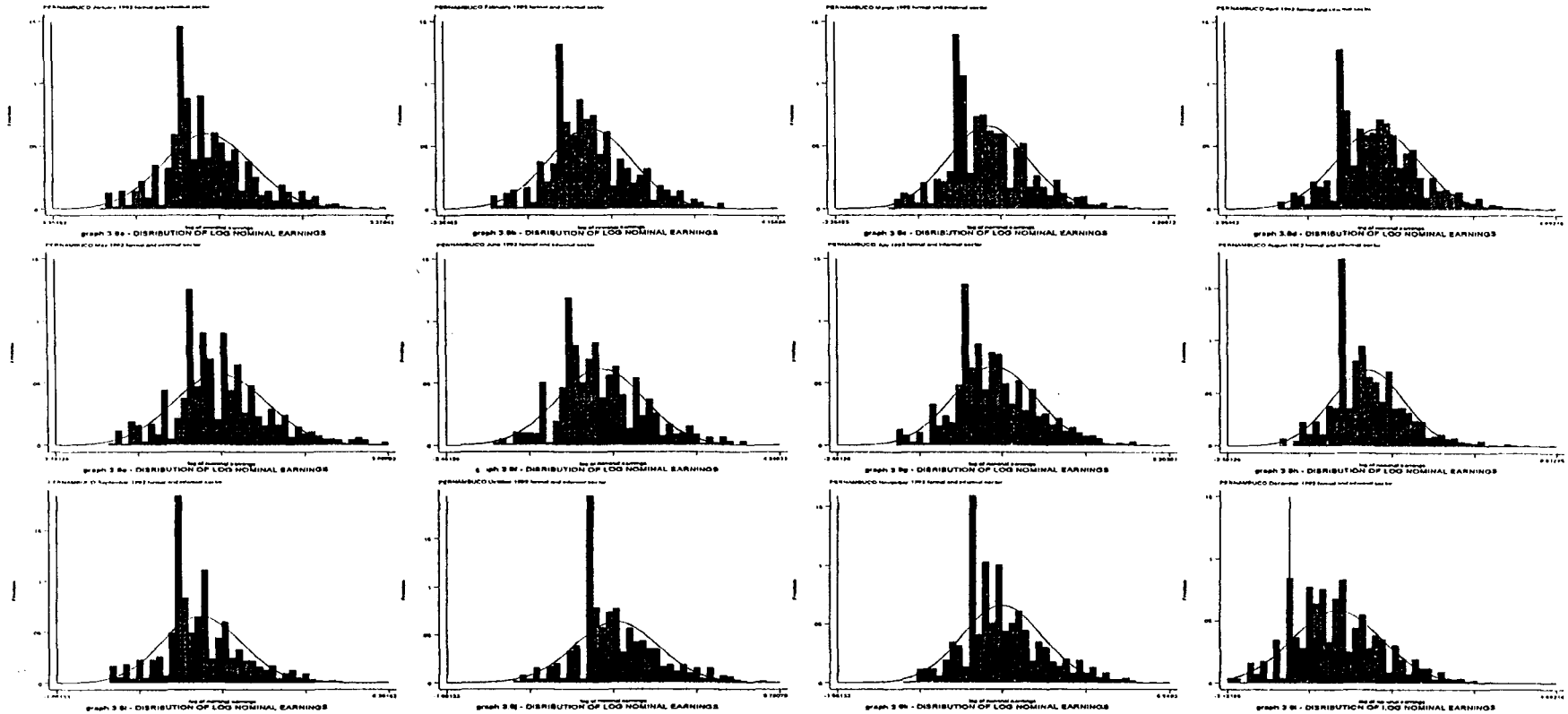
BRAZIL PER MONTH 1992



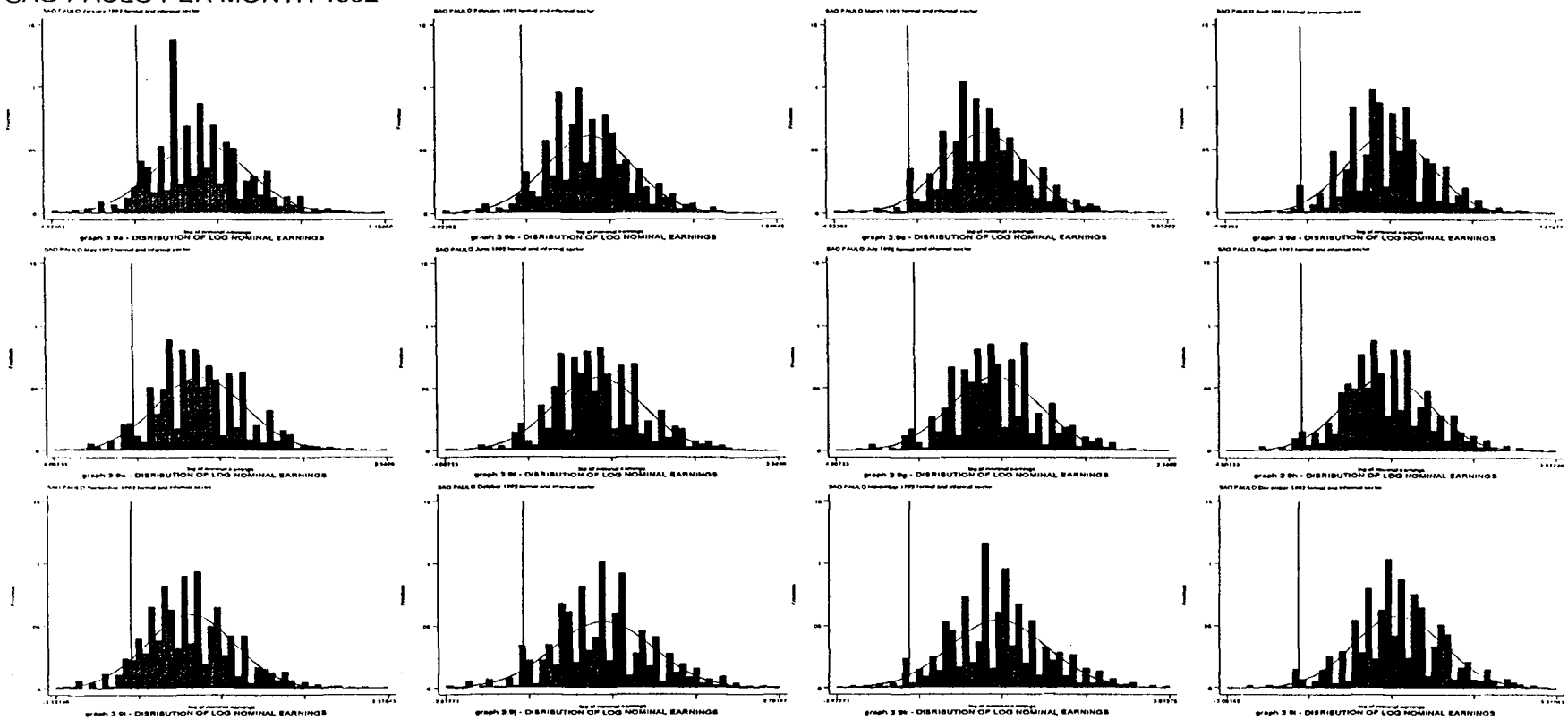
graph 3.7 - DISTRIBUTION OF LOG NOMINAL EARNINGS

PERNAMBUCO PER MONTH 1992



graph 3.8 - DISTRIBUTION OF LOG NOMINAL EARNINGS

SAO PAULO PER MONTH 1992



graph 3.9 - DISTRIBUTION OF LOG NOMINAL EARNINGS

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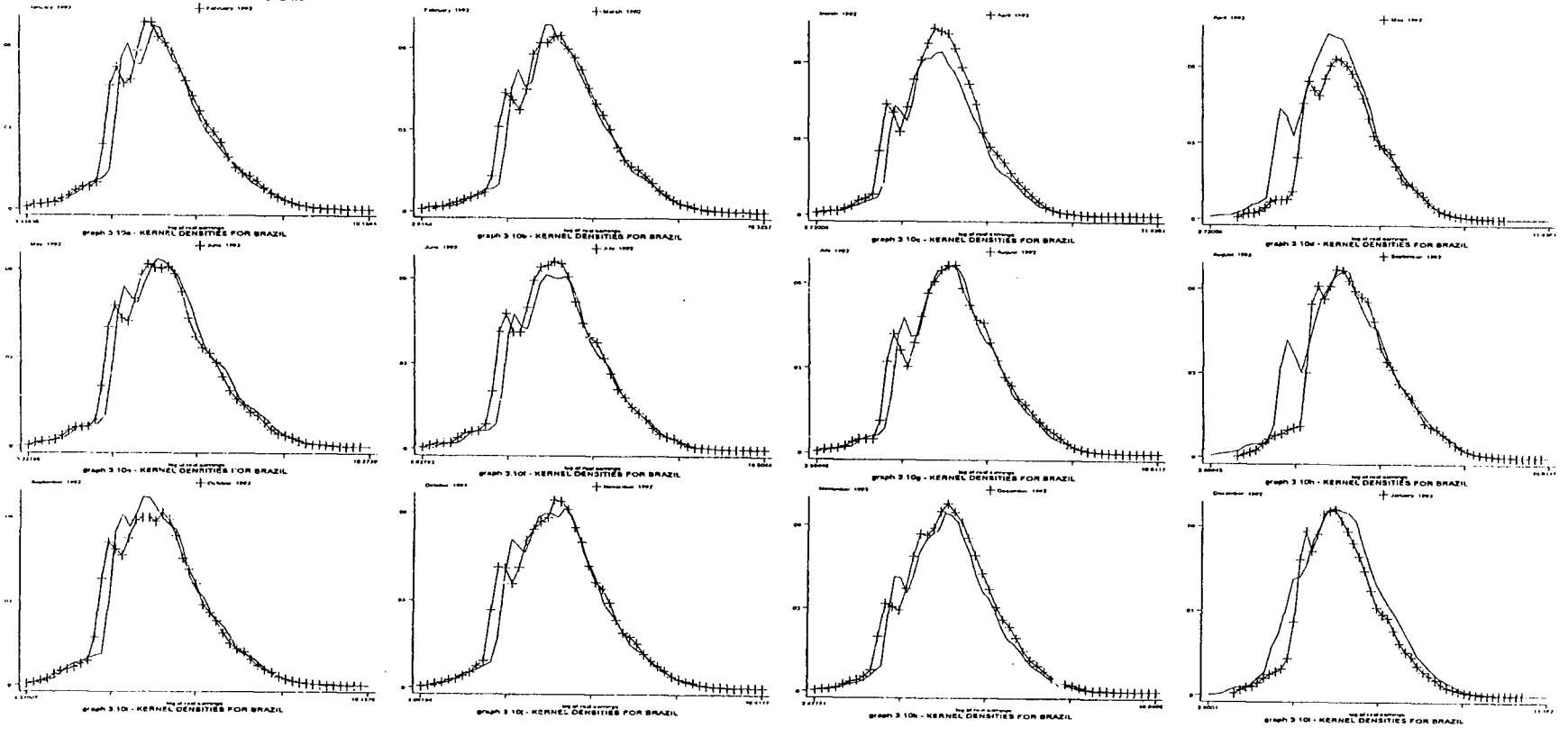
BRAZIL PER MONTH 1992



graph 3.10 - KERNEL DISTRIBUTION OF LOG REAL EARNINGS

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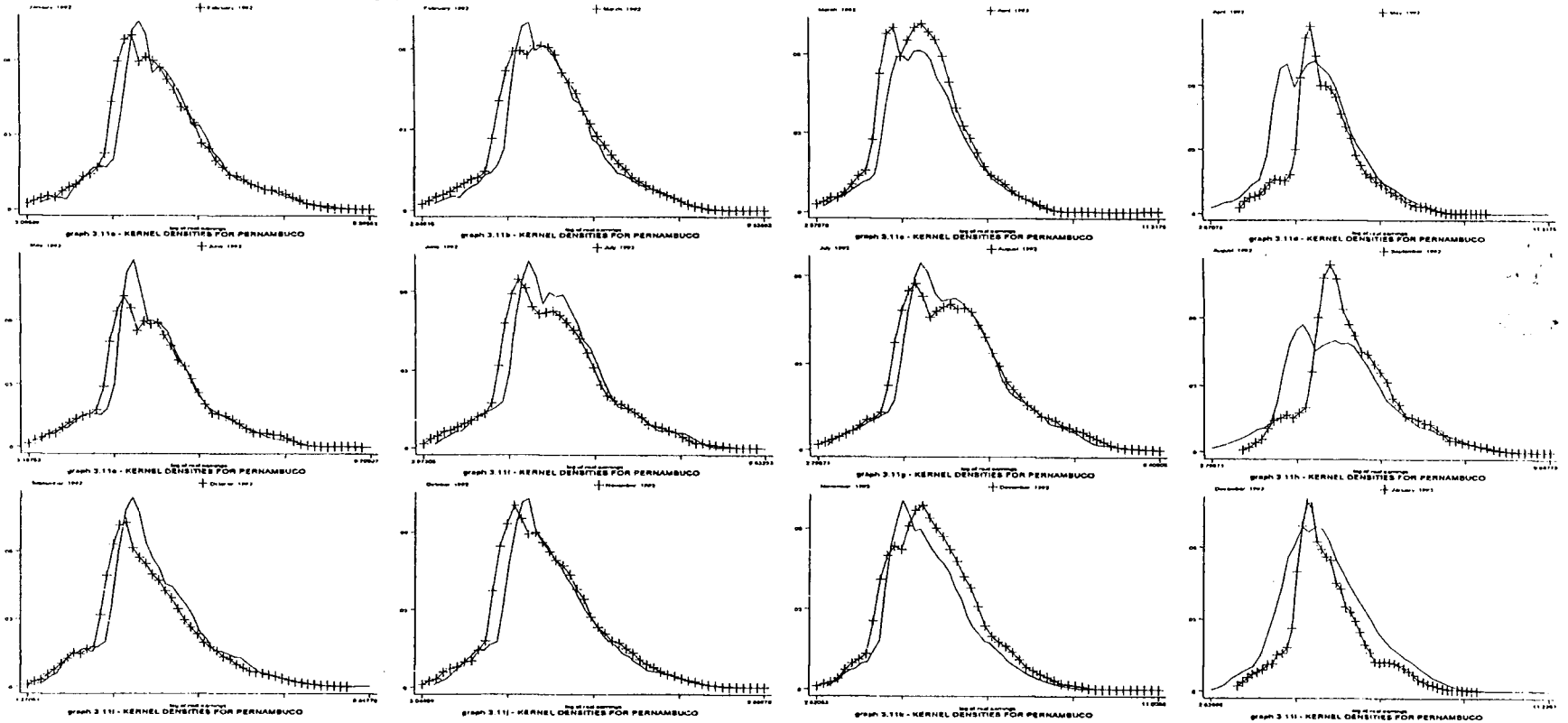
PERNAMBUCO PER MONTH 1992



graph 3.11 - KERNEL DISTRIBUTION OF LOG REAL EARNINGS

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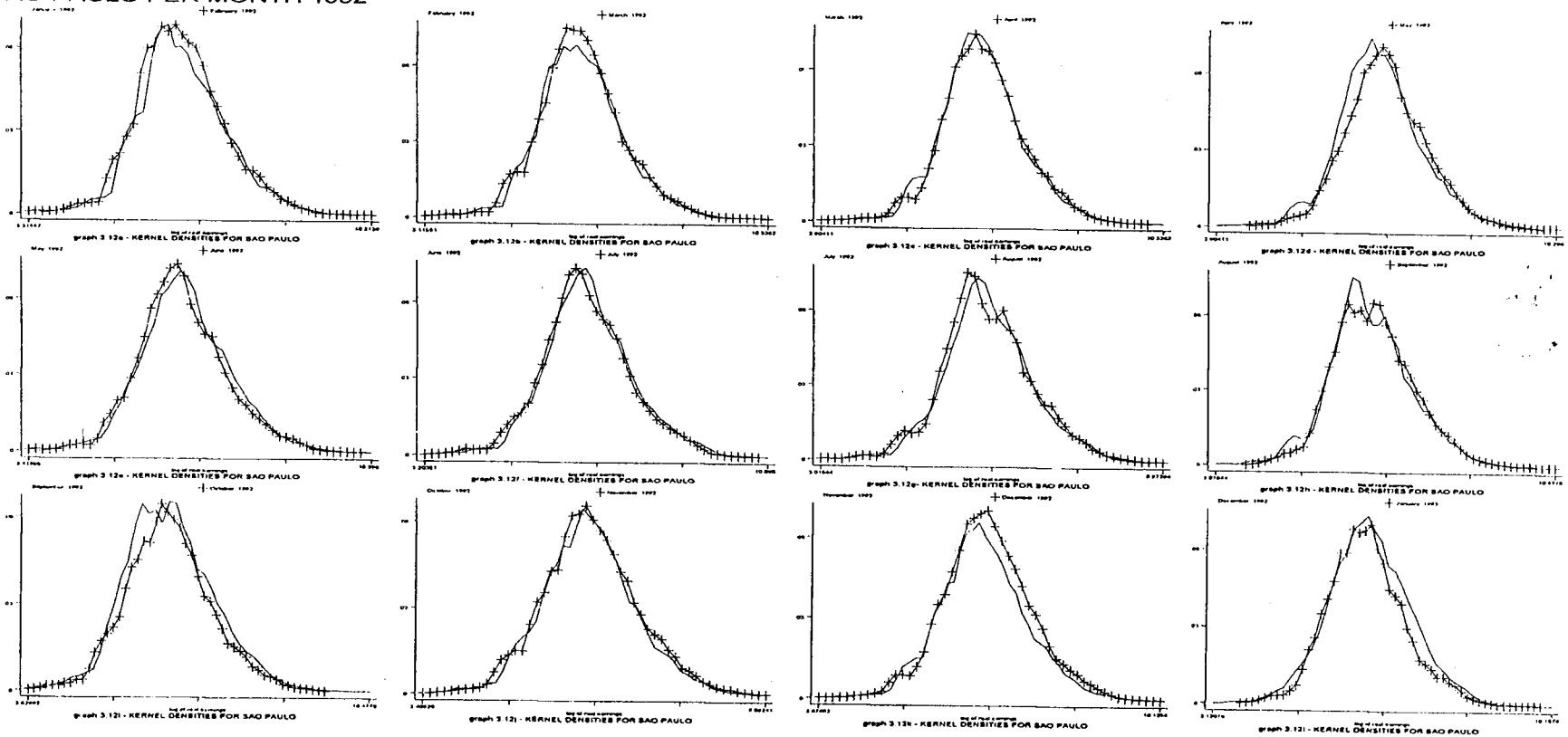
SAO PAULO PER MONTH 1992



graph 3.12 - KERNEL DISTRIBUTION OF LOG REAL EARNINGS

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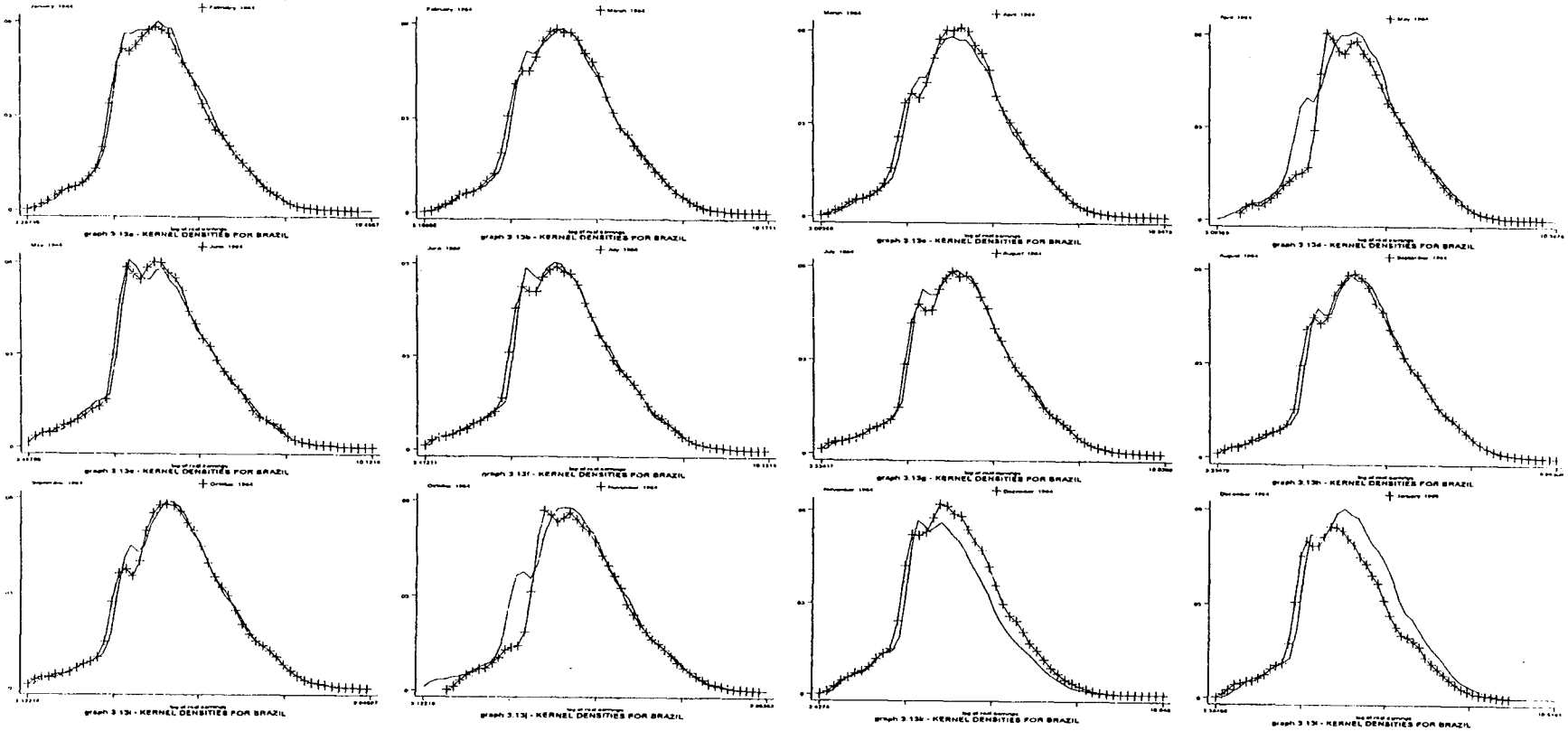
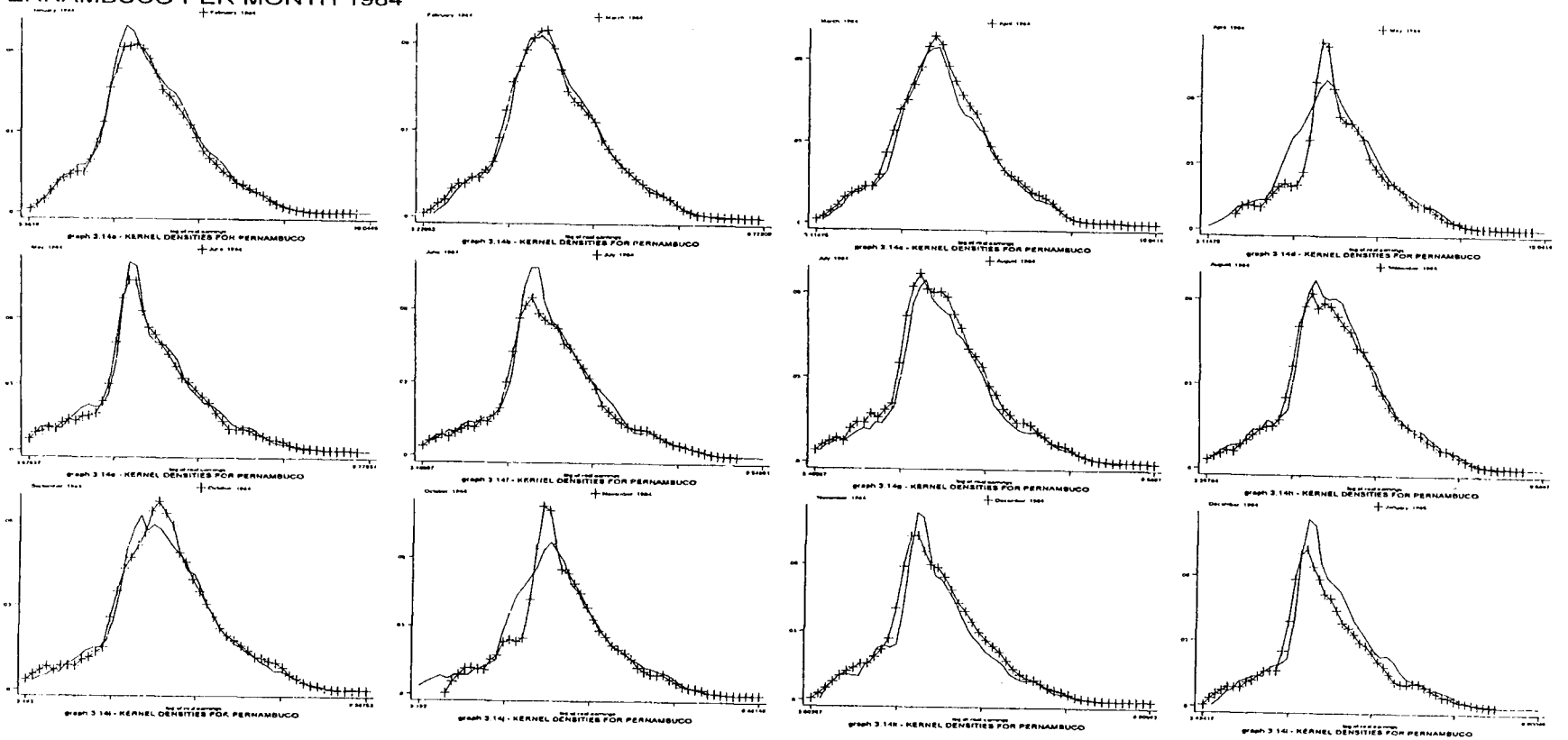
BRAZIL PER MONTH 1984



graph 3.13 - KERNEL DISTRIBUTION OF LOG REAL EARNINGS

PERNAMBUCO PER MONTH 1984



graph 3.14 - KERNEL DISTRIBUTION OF LOG REAL EARNINGS

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FUNDAÇÃO GETULIO VARGAS
BIBLIOTECA
ESTE VOLUME DEVE SER DEVOLVIDO À BIBLIOTECA
NA ÚLTIMA DATA MARCADA

N.Cham. **P/EPGE SPE L557e**
Autor: Lemos, Sara.
Título: The effects of the minimum wage on earnings and
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