The Evolution of Industrial Earnings Inequality in Mexico and Brazil

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Abstract
We use industrial data to derive estimates of the pattern of change in wage inequality in Mexico and Brazil. Using the group decomposition of Theil's T statistic we present monthly series of measurements of change in the dispersion of industrial wages for Brazil (1976 through 1995) and for Mexico (1968 through 1997). Both countries show increases in wage dispersion over time, and we find a strong negative correlation with the rate of real economic growth, suggesting that real per capita income growth is important in the determination of movements in inequality. Heterodox plans seem to reduce inequality in the short-run.

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1. Introduction

A great many things have been written about inequality on the basis of evidence that may charitably be described as thin. As the recent monumental work of Deininger and Squire (1996) makes clear, the measurement of household and personal income inequality for most countries has been sporadic and of deeply uneven quality.[1] Even where these authors judge the data to be of acceptable quality, the number of observations is generally too few to permit useful time-series analysis. Over a quarter century from 1970 to 1995 Deininger and Squire find only 14 acceptable estimates for Brazil and only 5 for Mexico.

Yet the importance of these two countries is manifest. They are the second and third largest nations in the Americas. Since 1970 they have both been laboratories for wide-ranging experimentation: in the transition from import substituting to export-promoting trade regimes, in the management of external debt, in both orthodox and heterodox battles against inflation. Moreover they represent widely varying political regimes; Brazil has made a perilous transition from military to civilian rule, while Mexico continues to struggle over the future form of what is today the world's oldest surviving one-party government.

This paper presents measurements of change in the dispersion of industrial wages for Brazil from 1976 through 1995, and for Mexico from 1968 through 1997. For both countries we present *monthly* series, and in the case of Mexico we have monthly data corroborated by a separate annual series for 1970 to 1992 and additional monthly series for 1987-1995. Our measures are constructed by applying the group-wise decomposition of Theil's T statistic to official wage data

grouped by industry, yielding estimates that we believe to be reasonable measures, not of the level, but of the *change* in inequality of manufacturing wages through time.

Our concern is with changes rather than levels of inequality. The straightforward reason is that changes are measurable from aggregated industrial data sets and levels are not. And, it turns out, changes may be measured from this data with considerable precision. Many casual observers believe that there is something distinctive about the movements of an "inter-industrial" measure of wage dispersion, that such a measure is likely to convey information that is quite different from what one would observe were actual micro-data available. In fact this is not generally so. For classification schemes meeting some basic conditions of coverage and consistency through time, the between groups component of a Theil index covaries closely with the unobservable movement of the whole distribution; since each individual is a member of some group, changes in the dispersion of individual earnings necessarily affect the dispersion of the means of groups to which individuals belong. This would, indeed, be true of any consistent categorization; the advantage of industrial classifications is merely that they are widely available and generally reliable, since most governments collect employment and payroll data from manufacturing establishments routinely.

Both countries show increases in wage dispersion over time. Both Brazil and Mexico experienced dramatic increases in inequality following the 1982 debt crisis and, in Mexico's case, again in the crises of 1986 and 1994. For both countries, the change in wage inequality shows a strong negative correlation with the rate of real economic growth; inflation has little effect except insofar as growth crises are also inflationary in both countries. This finding suggests partial corroboration

of the Kuznets hypothesis relating inequality to growth, on the assumption that both countries are on the downward-sloping portion of the inverted U-curve.

Brazil displays evidence that determined measures of heterodox stabilization – measures that typically combine fiscal restraint with lower interest rates, monetary reform and incomes policies – work to reduce inequality in the wage structure. This is true of each Brazilian stabilization plan. Whether it is also true of the mixed orthodox-heterodox *Pacto de Solidaridad Economica* in Mexico beginning in December 1987 is harder to say. On the other hand purely orthodox austerity policies -- those that combine fiscal and monetary restriction while eschewing incomes policy -- clearly increase inequality, because they so dramatically reduce growth and increase unemployment. Mexico's liberalization and accession to GATT in 1986 was associated with a sharp rise in inequality, though some of that may have been due to the sharp fall in oil prices that occurred at the same time. It is too early to gauge the long-term effects of the NAFTA on Mexico. However, while it is clear that the short-term effects on inequality of the peso and political crises of the NAFTA's opening year were catastrophic, there was a substantial recovery from those dark days in 1996 and 1997.

2. Previous Work on Inequality in Each Country

Kuznets (1955) first attempted to relate economic growth with inequality in the context of economic development. Exploring the historical relationship of income distribution and per-capita output, Kuznets proposed an inverted U-Curve: that high growth in early development is

inequality-increasing, with the relationship taking the opposite form as broadly-based industrialization is achieved. Hirschman (1964) proposed a model to account for the Kuznets conjecture: that "unbalanced growth" characterizes early development and implies a tradeoff between equity and growth, while the balancing out of industrialization in later stages implies equalization.

These perspectives assume that there is a causal relationship from growth to income distribution. This causal direction has been reversed in more recent models. In Aghion and Bolton (1994) and Perotti (1993), the inverted-U arises due to imperfections in the capital market: the rich and the poor have different patterns of investment which, in the initial stages of development, benefit mainly the rich. But as growth occurs due to this investment, the poor have increasingly more opportunities and returns to investment increase for poorer people; thus trickle-down generates equalization eventually. More recently, Galor and Tsiddon (1996) develop a general equilibrium model in which growth and inequality are both endogenous. The argument is similar, and endogeneity is achieved by considering human capital alongside physical capital markets.

These efforts have been surrounded by deep ambiguity concerning the conclusions from empirical studies. Early empirical explorations (Paukert, 1973; Ahluwalia, 1976) provided confirming evidence of the Kuznets conjecture, as did the works of Adelman and Robinson (1989) and Brenner et al. (1991). Ahluwalia provides the essential framework, which amounts to fitting a quadratic form to measures of income level and inequality. But since Fields (1980) exposed the sensitivity of the conclusions to the particular statistical method used to test the hypothesis, a

large array of contradictory results have appeared. Anand and Kanbur (1993) show that, if the Kuznets hypothesis is tested using regression, the functional form determines the conclusion.[2]

We therefore doubt that there is much to be gained from pursuing cross-sectional analysis of the Kuznets hypothesis, though the Deininger and Squire data set will no doubt provide fuel for such studies well into the future. Ram (1997) is an example; using data only from 19 developed countries, this study finds a U-curve rather than an inverted U.

In general, the empirical literature on inequality and growth remains inconclusive. Part of the problem concerns the data. Most studies are international cross-sections, which strive to use comprehensive measures of inequality for each country, such as Gini coefficients derived from household surveys. These are rarely available on a regular time-series basis. And though Kuznets himself began with a cross-country comparison, his hypothesis is not really about the relationship between inequality and the level of income per capita across countries. It is not a proposition that poor countries will be more (or less) unequal than rich ones, nor that at a given income level, countries with higher (or lower) degrees of inequality will have either faster or slower rates of economic growth. It is, rather, a proposition about developments within a single country, from a given historical starting point and institutional conditions. As such, only tracing the co-evolution of inequality and growth through time can truly test the Kuznets hypothesis.

There is a wider literature that has attempted to explain the movement of inequality through time, but it remains substantially *microeconomic* in character and centered on the developed economies.

The North American literature in this area is now vast; in a useful survey, Lawrence (1996) has

concluded that slow economic growth is the major single cause of rising inequality in the United States; but Lawrence does not refer to Kuznets.

Brazilian studies of income distribution tend to follow those of the U.S. in an emphasis on human capital and education differentials. Yet time-series estimates of changes in inequality in Brazil are sporadic. In a major step forward, Almeida Reis and Barros (1989) obtained a full Theil estimate for the years 1976-1986 from the *Pesquisa Nacional de Amostra a Domicilio (PNAD)*, with a sample of over 50,000 workers. Their series shows inequality falling during the high-growth period through 1981 and rising afterward with the arrival of the IMF in Brazil, austerity policies and the debt crisis.[3] Similar arguments have been made about Mexico, though with an even greater shortage of hard evidence; Aspe and Beristain (1984) attempted a heroic "first estimate of the evolution of inequality in Mexico" with data for only three years.

3. The Measurement of Change in Inequality from Industrial Data: Methods and Sources

Our general approach follows the work of Theil (1972), who demonstrates that his T statistic can be decomposed into the sum of between-group and within-group dispersion for any partition of the data into mutually exclusive and exhaustive groups. An ordinary table of average wages by sector or industry is such a partition; hence data from this source can be used to compute a lower-bound Theil estimate, which we call T′. (See the Appendix for details.) Such a decomposition cannot be achieved with a Gini coefficient or Atkinson measure of inequality, but is uniquely a feature of measures that are multiples of a generalized entropy measure, as Shorrocks has proved (1980, 1984). Of qualifying measures, the Theil T is the most familiar and the most intuitive.

If the group structure is consistent from year to year, then annual measures of T′ from an industrial census form a time-series, a statistical "grid" overlying the distribution of manufacturing wages or earnings. Ministries of labor and other statistical agencies routinely collect such statistical grids, indeed they form one of the most prevalent types of economic data. Since the data are collected by establishment and are based on actual payrolls, they are generally reliable measures of what they purport to measure, namely average money-earnings and employment by industrial group.

With only a few groups covering thousands of workers apiece, the proportion of wage dispersion that is between groups, and therefore measured by T′, is only a small part of total wage dispersion. But since T′ converges to T as decomposition into larger numbers of groups proceeds, the change in T′ or Δ T′ must necessarily converge to ΔT. While it is possible to construct artificial examples where the two series move in opposite directions, even a small amount of disaggregation seems almost always sufficient to get the direction of movement right.[4] Moreover, since industrial groupings are not wholly arbitrary, but rather do tend to segment workers into categories that are internally homogeneous and stratified by wage-level, the between-group components of T contain more information than would be true if classification were random. Thus convergence T′ to T and of ΔT′ to ΔT will be more rapid than under an industrial than under random grouping, and the chance of a misleading reading is actually less, not more, because the classification scheme has economic content.[5]

It follows that the time-series of a lower-bound Theil estimate constructed from data grouped by

industrial sector can serve as a reasonable approximation of the movement of a broader -- but unobservable -- measure of wage dispersion, including the unobserved within-group dispersion. Such is the appeal of micro-data to most economists, however, that we are aware of few previous efforts to exploit this straightforward property of industrial census data to track the evolution of inequality. Thus there are large and easy gains to be had in the field.[6] The particular advantage of this approach lies in the ability to construct dense time-series estimates. Since errors in data collection and fluctuations due to calendar irregularities and natural events tend to offset each other from one month to the next, moving averages of monthly series are likely to be an especially robust approximation of underlying trends.

In the case of Brazil, we have data of apparently high quality from the IBGE from January 1976 though December 1995. The data cover average wages on a monthly basis for seventeen major industrial sectors; thus the degree of inter-sectoral detail in the Brazilian data is substantial, while the time-series detail is very rich. The data are weighted by monthly employment for the purpose of computing T′. Experiments with computing a fixed-employment-weighted Theil measure showed that the practical difference between the two series is confined to the period from 1982 through 1984, when the relative employment of industries with wage rates near the middle of the dispersion declined sharply. In this situation we are inclined to trust the variable-weighted measures: in that period of rapidly rising unemployment in core manufacturing, overall inequality surely rose by more than the increase in wage dispersion *per se*.

Mexico presented the greatest data challenge. In the end we developed no less than five distinct

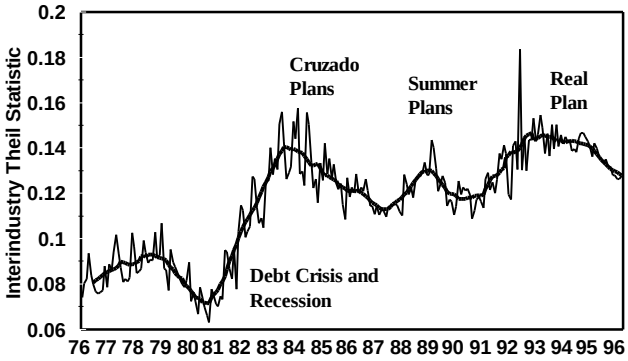
between group Theil measures for Mexico, derived from three distinct sources of data. These were: the OECD Structural Analysis (STAN) database, for which Mexico has supplied annual information going back to 1970, yielding fixed-weight and variable-weight estimates of T′ based on annual earnings; a monthly survey of 129 4-digit SIC industries from INEGI, the *Instituto Nacional de Estadistíca Geografia e Informatica*, for the years 1987 through 1995 covering wages and earnings, and a monthly survey covering earnings in 9 major sectors, from the Labor Information System for the Manufacturing Sector of the Banco de Mexico for the full period from 1968 through February, 1999. We found that in general Theil measures computed from these data sets were highly correlated with each other, though differences emerge in the amplitude of change measured at particular times.

A comparison of the fixed and variable-weighted annual T′ s from the Bank of Mexico series again revealed evidence that broad inter-sectoral shifts in employment were a contributor to changes in wage dispersion in Mexico, but the situation differs from that in Brazil. In the early and mid-1970s -- a time of relative prosperity in Mexico -- there was a substantial increase in the employment share of relatively low wage industries. As these industries expanded the *below-average-wage* share of their *own* employment, their industry-average wages fell, and thus a Theil measure calculated with fixed 1970 employment weights shows increasing inequality, while a measure based on the actual employment weights shows an inequality decline. In this case, as in the Brazilian analysis but for a different reason, the variable-weighted measure showing declining inequality is clearly the more appropriate measure, since low-wage workers were being drawn

into industry from agricultural and services sectors where, no doubt, wages were even lower. This phenomenon repeats itself in the late 1970s during the oil boom.

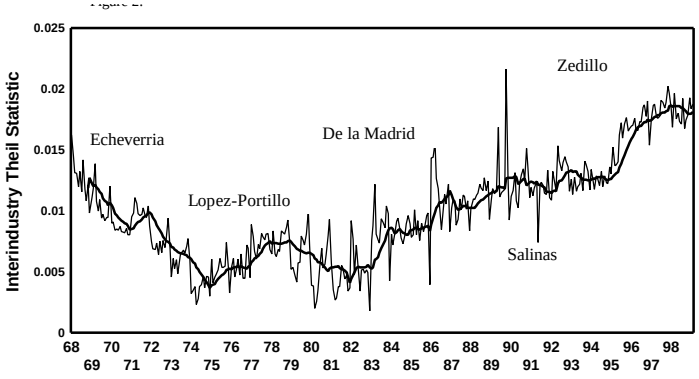
4. Time-Series Measurements of Inequality for Brazil and Mexico

Figure 1 shows our estimate of monthly changes in wage dispersion for Brazil. The figure shows a slight decline in inequality in the late 1970s, followed by a sharp increase in the early 1980s. Inequality in the Brazilian wage structure then stabilized from 1985 through 1987, bumped up



again in 1988, stabilized, bumped up sharply in 1992, and finally stabilized again in 1994-1995. Some years show a severe saw-tooth pattern in the dispersion of wages from month to month, whereas in other years within-year variation is virtually absent.

Figure 2 presents our monthly measure of wage inequality in Mexico from the Banco de Mexico database, with a smoothed moving average of the same series superimposed. The measures show wage compression in Mexico from 1970 through 1976, a bump up in the mid-1970s that was offset by the end of the decade, a sharp rise in the early 1980s, and then a further pattern of rising



inequality from 1984 through 1989, particularly in 1986. This upward movement was briefly arrested in 1989-90, the early period of the *Pacto.* The series makes a further sharp jump in 1995, with the Chiapas crisis. A T′ computed from Mexico's submissions to the STAN for 1970-1992 shows a similar pattern, except that the STAN data places the larger rise in inequality in the crisis of 1986 and less emphasis on the crisis of 1982.

Either way, there is a plain correspondence to Mexican political history. The years 1970 through 1976 were a time of strongly pro-labor policy under the administration of President Luis Echeverria; significant wage compression was the result. Crisis however erupted in the years following the oil shocks, producing rising inequality under President Lopez Portillo until, in the late 1970s, Mexico discovered vast new reserves of oil. Then it was off to the races again, but only briefly: the debt crisis of 1982 rudely ended the reverie of oil-based prosperity. Under

President Miguel de la Madrid, Mexico struggled with the debt crisis and responded by opening to the North and joining the GATT: with the result of a vast increase in inequality. President Carlos Salinas, taking office in late 1988, presided over an economy whose wage structure was no longer locally determined. The Salinas years saw high but comparatively stable inequality until the rude shock of 1994; under Zedillo inequality rose sharply at first, but then declined in 1997 and 1998.

Our measures of the evolution of inequality can be deployed to evaluate the relationship between inequality and economic growth. As noted previously, Kuznets long ago postulated that such a relationship would exist: positively-sloped in early stages of development and negatively sloped later on. Mexico and Brazil are middle-income countries, and so on the Ahluwalia (1976) estimates of where the turning point occurs the relevant part of the Kuznets hypothesis suggests that the *change* in inequality and the *change* in economic growth will be negatively related in Mexico and Brazil: faster per capita economic growth will reduce inequality, and recession, or negative growth, should increase it.

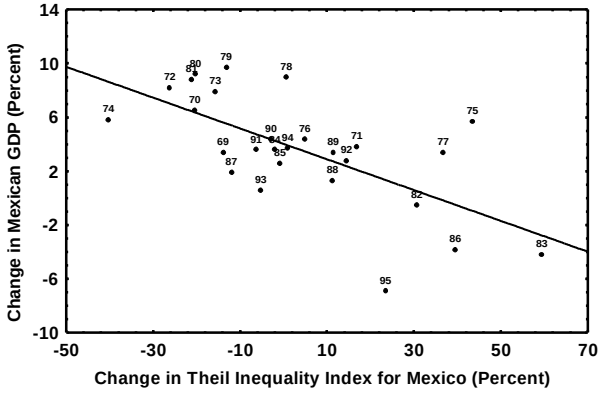
This quasi-Kuznets hypothesis can also be derived in a different way, through an argument about monopoly power in an unequal and dualistic developing country. Under industrial dualism, cartelized sectors buy labor peace with relatively high and also stable wages; competitive sectors experience volatility. Such a world clearly implies that a rise in growth will strengthen the weak, and recession will strengthen the strong (in relative terms). It is worth noting that this model is not easily reconciled with the notion of a trade-off between equity and efficiency, nor with the idea that export-led industrialization generates higher growth rates but more unequal distributions,

while import-substituting models generate equality but slow growth. Such ideas would imply structural change in the relationship between growth and inequality as liberalization proceeds: clearly, a testable proposition, bearing on the general argument that export-led development is structurally superior to import-substituting industrialization.

We are therefore led to specify a model linking changes in inequality directly to the movement of macroeconomic and political variables. For Mexico these include especially the growth of real gross domestic product and inflation, the former because we believe along the lines argued above that growth in output generally strengthens the poor in relative terms, while recessions generally hurt the poor more than they hurt the rich. We have no brief for the inclusion of inflation, but many observers do link inflation to inequality and this hypothesis seems important to test. Inclusion of other variables depends partly on the availability of data; we were able to obtain matched time-series for industrial production and the minimum wage in Mexico on a monthly basis, and for the real exchange rate after 1986. Industrial production is just another measure of growth. The role of the legal minimum wage seems obvious. And in the case of the real exchange rate, we believe that a rise in real exchange rates tends to undermine import-competing industries relative to exporters, thus increasing inequality, as a rule. Finally we are interested in the possible independent effects of increases in wage inequality in the United States on Mexico.

Table 1 presents two regression models for Mexico, for the annual series from the Bank of Mexico (averages of monthly data) and secondarily from that of the STAN, both over the years

1970 - 1992. We estimate the change in inequality measured by these series as a function of the Mexican inflation rate, the Mexican real growth rate, and of the change in a measure of dispersion of U.S. wages. The results account for about half of the variation in the change of T′ for Mexico. Our preferred series is the first of these two, which relates the change of inequality in Mexico to the change in real GDP. Clearly the effect is very strong: higher growth reduces inequality in Mexico, as Figure 3 illustrates. Neither of the other variables is significant in the multiple regression.



Variable	T′ from Banco de Mexico	T′ from STAN
Intercept	21.3 (8.39)**	-4.19 (3.44)
Inflation	-.08 (.186)	.50 (.21)**
Real GDP Growth	-.72 (.186)***	-.18 (.21)
US Inequality	NA	.50 (.16)***
R2	.46	.55
D-W	1.77	2.06

Table 1. Regression Analysis of Change in Theil Measures: Mexico (1970-1992).

The second equation illustrates the sensitivity of the specification to small differences in measurement. Particularly, the STAN-based series strongly emphasizes the rise in inequality associated with the 1986 opening, joining to the GATT, and the decline in oil prices of that year. The result is that in this equation inflation and US inequality are the significant determinants of Mexican inequality, while growth drops out. We interpret this as indicating the instability of the regression plane in the presence of collinear regressors. It is obvious that inflation is associated with crisis in Mexico, and that rising inequality in the U.S. occurs at moments when economic growth is likely to be negative in all of North America. By the same token, however, the fact that alternative measures of growing inequality in Mexico are well explained by alternative indicators of crisis strengthens our confidence in the macroeconomic determination of movements in inequality generally speaking.

Split-sample tests on the regression in the second column show that neither the Mexican inflation rate nor U.S. wage structure affected the Mexican wage structure before 1987. Afterward, despite very few degrees of freedom, these tests indicate that rising U.S. inequality is a determinant of Mexican wage patterns. With the alternative Bank of Mexico series, the case is not so clear -growth in GDP and a time trend remain the important determinants throughout the period under study, and the model does not show structural change in the middle 1980s.

Table 2 takes a closer look at the period after 1987, using monthly data and the level value of the Bank of Mexico Theil T′ measure. Consistently measured unemployment data being unavailable for Mexico, we were restricted to a measure of industrial production, inflation, a measure computed by one of us of the real valuation of the peso vis-a-vis the dollar, and the nominal value of the minimum wage. The latter is a political tool, set centrally by the Federal Government, as in the United States. All monthly variables were smoothed with a 12-month moving average process.

In the regression, all of the variables are significant and show the expected sign, that is to say they are consistent with the results found for the United States. However, in addition to these, we included a monthly expansion of the time-series measure of the CPS Gini coefficient for the United States, as a test for whether rising inequality in the U.S. affects Mexico independently of Mexican macroeconomic conditions. The results are consistent with this possibility. In this case, the Durbin-Watson test reveals strong serial correlation in the residuals, indicating that our standard errors may be higher than reported.

Variable	T from Banco de Mexico (Monthly)
Intercept	.005 (1.66)
US Gini Coefficient (Level)	.525 (.127)***
Real Exchange Rate	4.67 (.518)***
Industrial Production	-.882 (.283)***
Minimum Wage	-3.77 (.593)***
Inflation	.670 (.108)***
R-Squared	.81

Table 2. Regression Analysis of Level of Theil Measure: Mexico 1987-95

In sum, there apparently was a change of regime in Mexico in 1986, but it did not change the structural relationship between growth and inequality. Rather, it changed the structural relationship between U.S. economic growth and Mexican economic growth, with the result that Mexico's macro-performance and its wage structure became (in statistical terms) more dependent on that of the U.S. This result is rather in favor of the raw Kuznets hypothesis and contrary to the export-led development hypothesis popular in recent years.

High inflation, frequent changes of currency and political instability bedevil the collection of long time series on macroeconomic matters for Brazil. We are able to present evidence on only two

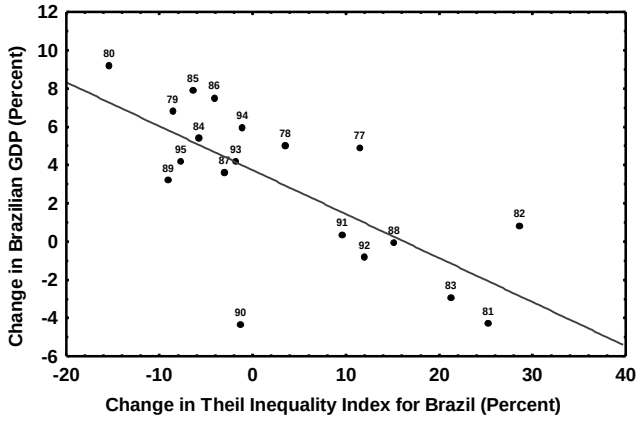
variables: the growth rate of Gross Domestic Product, and a measure of inflation, plus a constant term measuring the trend. In addition, we include a dummy for the five years when Brazilian inflation exceeded 1000 per cent per annum, partly on the grounds that such inflation measures tend to be unreliable. Hyperinflation also may have had different structural effects on the economy than "regular" Brazilian inflation in the range of 200 percent.

The results are presented in Table 3. There is a strong upward constant trend in Brazilian inequality as the intercept term reveals. Nevertheless, the data show that the growth rate of real GDP is a dominant determinant of the movement of inequality in Brazil about this trend; to put it another way, growth in Brazil must be strongly positive for inequality not to rise. There is also weak evidence that hyperinflation may compress the Brazilian manufacturing wage structure. Measures of U.S. inequality had no direct effect on this equation. These results quite resemble the results from the Bank of Mexico series for Mexico, 1970 - 1992.

Variable	T′ from IBGE
Intercept (Trend rate of Change)	12.5 (2.77)***
Growth of Real GDP	-.83 (.16)***
Rate of Inflation	.38 (.30)
Hyperinflation (Inflation >1000 %)	-.67 (.31)**
R-Squared	.65
D-W	1.56

Table 3. Regression Analysis of the Change in Inequality in Brazil: 1976-1995.

It is clear that for a smoothed version of our monthly inequality series, the change in gross domestic product has a strong linear association with changes in inequality in Brazil, with an R-value of -.73, and of -.91 if just three outliers 1977,1978 and 1982 are excluded. Figure 4 presents a summary of this result and illustrates the need for strong positive growth in Brazil - generally speaking above 3 percent per annum at least, if inequality is not to increase. Table 4 presents a business cycle periodization of inequality and growth for Brazil, showing among other things the catastrophic effect on inequality of negative growth in Brazil. In this case the bivariate R-value is -.93, with all data accounted for.



Periods	Average Annual GDP Change	Average Annual Theil Change
Jan 79 - Dec 80	7.7	-12.1
Jan 81 - Dec 83	-2.4	25.1
Jan 84 - Dec 87	4.0	-4.8
Jan 88 - Dec 88	-0.1	11.2
Jan 89 - Dec 89	3.2	-7.0
Jan 90 - Dec 92	-1.6	6.8
Jan 93 - Dec 95	4.3	-3.5

Table 4. Inequality and GDP Growth in Brazil; Rates of Change By Business Cycle.

Inflation is not a significant determinant of changing wage dispersion in Brazil on a year-over-year basis. However, we find that inflation does affect the within-year variation of inequality in Brazil -- those saw-tooth patterns are produced by hyperinflation. A final regression exercise in Brazil tests the effect of the various stabilization programs: the Cruzado and Bresser Plans, the two Plans Verao (Summer Plans), the two Collor plans (leading up to the impeachment of Fernando Collor in 1991), the transition to the Real Plan and the Real Plan itself, beginning in July, 1994.[7] Our specification is very simple: we suppose a rising trend for inequality in Brazil as the previous regression suggests, and ask whether these stabilization plans help to stop it. We do not include other macro variables because there is a strong presumption that stabilization plans work in part through their effects on inflation and real growth.

The results are presented in Table 5 and they are strongly significant in every case. They tend to

show that the Real Plan is indeed the most successful stabilization program in Brazil to date, as the present government has claimed. Unfortunately, the Real Plan was implemented from a base of the highest inequality in modern Brazilian history. Moreover, if our estimates are correct, it will not prove strong enough to withstand the secular trend toward rising inequality in Brazil, unless accompanied by strong per capita income growth for a sustained period of time.

Variable	Beta	Std Error of Beta	T Statistic
TREND	1.500	.097	15.34
CRUZADO	-.221	.043	-5.03
BRESSER	-.255	.049	-5.15
VERAO1	-.144	.040	-3.60
VERAO2	-.317	.046	-6.77
COLLOR1	-.363	.048	-7.46
COLLOR2	-.463	.074	-6.24
TRANSIT TO REAL	-.352	.058	-5.97
REAL	-.602	.071	-8.37

Table 5. Regression Analysis of Stabilization Plans in Brazil; Dep. Variable: T′.

Mexico and Brazil thus appear to conform to the downward sloping portion of the Kuznets curve. More rapid growth, roughly corresponding to positive economic growth per capita, reduces inequality; real GDP growth below the rate of population growth tends to increase it, and

recessions are inequality disasters. There is no particular reason in this data to suspect that the trade regime *per se* matters. If liberalized trading regimes could produce high rates of growth --as they did, for example, in Asia until mid-1997 -- they would reduce inequality. The problem is that both Mexico and Brazil have experienced low growth following liberalization. To put it another way, liberalization in Latin America has failed to deliver the high rates of growth that had previously been achieved under less liberal trading regimes.

5. Conclusions for Reflection, Policy, and Further Research

First, we believe that the use of industrial data to derive approximate estimates of the pattern of change in wage inequality, using the group decomposition of Theil's T statistic, is a promising innovation with potentially wide application. Galbraith (1996) has produced similar estimates for 22 OECD countries, Ferguson and Galbraith (1996) have produced estimates for the United States from 1920 to 1947; Conceição, Galbraith and Garza-Cantu (in progress) have produced annual estimates for nine Latin American countries, and Galbraith (1998) describes the U.S. case in detail.

Second, our evidence suggests that for Brazil and for Mexico, real per capita income growth is a dominant force in the determination of movements in inequality. Strong per capita growth reduces inequality, while depressions, slumps, exchange crises and tight policies increase it. In this respect, Mexico's transition to trade liberalization in 1986 was also a transition toward a flexible inter-industrial wage structure. In the actual circumstances Mexico faced, including the collapse

of oil prices at the same time, this proved disastrous for wage solidarity in Mexico, just as the debt crisis had proved a disaster for an already drastically unequal social structure in both Mexico and Brazil.

Third, we see evidence that heterodox stabilization plans work to slow the rise of inequality, and even to reduce inequality, other things equal, to a moderate extent. This evidence is strongest for Brazil, which has the most complex history of such plans. On the other hand, these measures are at best palliatives. Heterodox stabilization plans have slowed the rise of inequality but cannot stop it. They, are however, clearly superior to orthodox stabilization plans, which reduce income growth and yield serious increases in inequality every time.

Fourth, there is at least some evidence that wage patterns in Mexico have come to track those of the United States, perhaps even independently of the effect of U.S. macroeconomic conditions on Mexican macroeconomic conditions. This seems to be a phenomenon that dates to the opening of 1986 coinciding with Mexico's adherence in that year to the GATT. If the interdependency has been increased any further by the NAFTA, the effects of that set of legal changes remain to be seen. It may be that this direct channel will not withstand scrutiny; in our other measure of Mexican inequality we find evidence of the same growth-inequality mechanism that we observe for Brazil. Nevertheless it seems to us that, whether the effects are direct or indirect, the data support what Mexicans have long known: they live very far from God, and very close to the United States. Brazil is a little farther away, but not so far that the interdependence of macroeconomic conditions between Brazil and the United States can be ignored.

We do not see in the rising interdependence of American wage structures a clear verdict against trade liberalization *per se*. Put another way, an open development strategy for Mexico, in particular, might have proceeded without vastly increasing inequality if it had produced strong economic growth and low inflation, and had inequality not been rising in the United States. The problem -- for Brazil, Mexico and the United States -- is that expanding trade and liberalization have occurred in the context of stagnation, crisis and hard times, substantially at the same time and doubtless emanating in large part from policy decisions taken in the United States. We leave it to others to argue whether this could have been avoided, or whether under the circumstances either Mexico or Brazil had any other option. However that may be, the implications for the responsibilities of the United States toward well-being throughout the Americas are very clear.

Appendix 1: Theil Index Formulas

Originally drawn from information theory, Theil's T has the following formula:

$$T= (1/n)\Sigma(Y_i /\mu) \log(Y_i /\mu) \qquad (A1)$$

Here, n is the number of individuals, Y_i is each person's income, and μ is average income for the whole population. "Log" is the logarithm (base 10). T is a well-known measure of dispersion. The formula for computing T from grouped data is:

$$T = \Sigma(p_i \mu_i /\mu)\log(\mu_i / \mu) +\Sigma(p_i \mu_i / \mu)T_i \qquad (A2)$$

where now p_i is the proportion of workers employed in the i-th group, μ_i represents the average income for the i-th group, μ represents average overall income, and T_i is the Theil T as measured strictly within the i-th group. The grouped Theil statistic is the weighted sum of that part of inequality that occurs between groups and a part that occurs within groups. The formula for T', the between-group-Theil statistic, is just the first (between-group) element in the formula for computing the Theil T from grouped data:

$$T' = \Sigma(p_i \mu_i /\mu)\log(\mu_i / \mu) \qquad (A3)$$

Since the within-group element in variation is omitted, this is obviously a lower-bound estimate of dispersion. Our monthly series are available from the authors on request.

References

Adelman, Irma and S. Robinson, 1989, "Income distribution and development", in Hollis. Chenery and T. N. Srinivasan (eds.), *Handbook of Development Economics*, vol 1. Amsterdam: Elsevier Science, North Holland.

Aghion, Philippe and Patrick Bolton, 1994, "A trickle-down theory of growth and development with debt-overhang." Working Paper, London School of Economics.

Ahluwalia, Montek S, 1976, "Inequality, poverty and development." *Journal of Development Economics*, vol 6, 307-342.

Aitken, Brian J., Ann Harrison and Robert E. Lipsey, 1995, "Wages and Foreign Ownership: a comparative study of Mexico, Venezuela and the United States, Cambridge: NBER Working Paper No. 5102.

Alesina, Alberto and Dani Rodrik, 1994, "Distributive politics and economic growth." *Quarterly Journal of Economics*, vol. 109, n. 2, 465-490.

Amadeo, Edward and José Camargo. 1991 "Mercado de Trabalho e Dança Distributiva". In *Distribuição de Renda no Brasil*. Rio de Janeiro: Ed. Paz e Terra, 187-206.

Anand, Sudhir, and S. M. R. Kanbur, 1993, "Inequality and development: a critique." *Journal of Development Economics*, vol. 41, n.1, 19-43.

Aspe, Pedro, 1993. *El Camino Mexicano de la Transformacion Economica*, Fondo de Cultura Economica, Mexico DF.

--- and Paul E. Sigmund, eds., 1984. *The Political Economy of Income Distribution in Mexico*, from the series "The Political Economy of Income Distribution in Developing Countries" edited by Henry Bienen. New York: Holmes and Meier.

--- and Beristain, 1984, "Toward a First Estimate of the Evolution of Inequality in Mexico," in Aspe and Sigmunds, eds., *op. cit.*, pp. 31-97.

Gonzales Baker, Susan, 1989, *Many rivers to cross: Mexican immigrants, women workers, and the structure of labor*

markets in the urban Southwest, 1961-1989. Austin: The University of Texas at Austin, Ph.D. Dissertation.

Balke, Nathan S. and Daniel J. Slottje, 1994. "A Macroeconometric Model of Income Inequality in the United States," in J.H. Bergstrand et al., eds., *The Changing Distribution of Income in an Open U.S. Economy*, Elsevier Science, pp. 244-278.

Bean, Frank D., 1986, *Undocumented Mexican immigrants and the earnings of other workers in the United States*. Austin: The University of Texas.

Bénabou, Ronald, 1996, "Inequality and Growth." NBER Working Paper 5658.

Berman, Eli, John Bound, and Zvi Griliches, 1994. "Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufactures," *Quarterly Journal of Economics*, Vol. 109 (May), 367-397.

Blanchflower, David G., Andrew J. Oswald and Peter Sanfey, 1996. "Wages, Profits and Rent-sharing," *Quarterly Journal of Economics*, February, No. 1., 227-251.

Borjas, George J. and Valerie A. Ramey, 1994. "The Relationship Between Wage Inequality and International Trade," in J.H. Bergstrand et al., eds., *The Changing Distribution of Income in an Open U.S. Economy*, Elsevier Science, 215-241.

Bortz, Jeff, 1988. *Los salarios industriales en la Ciudad de Mexico, 1939-1975*. Mexico, DF: Fondo de Cultura Economica.

Bound, John and George Johnson, 1992 "Changes in the Structure of Wages in the 1980s: An Evaluation of Alternative Explanations" *American Economic Review*, Vol. 82, June, 371-92.

Brenner, Y. S., Hartmut Kaelbe and Mark Thomas, 1991, *Income Distribution in Historical Perspective*. Cambridge University Press.

Bresser Pereira, Luiz Carlos and Yoskiaki Nakano, 1990. "Hyperinflation and Stabilization in Brazil: The First Collor

Plan," Paper presented to the workshop on Economic Problems of the 1990s, Knoxville, University of Tennessee, June 28-July 4.

Buffie, Edward F., 1988. "Mexico 1958-1986: From Stabilizing Development to the Debt Crisis", mimeo.

Danziger, Sheldon and Peter Gottschalk 1995, *America Unequal*, Cambridge: Harvard University Press.

Deininger, Klaus and Lyn Squire, 1996, "A New Data Set Measuring Income Inequality", World Bank Economic Review; Vol.10, n. 3, September, 565-591.

do Valle Silva, Nelson, "Updating the Cost of Not Being White in Brazil," in Pierre-Michel Fontaine, (ed.), *Race, Class and Power in Brazil*, Los Angeles: UCLA, CAAS, 1985, 42-55.

Dornbusch, Rudiger and Mario Henrique Simonsen, 1986. "Inflation Stabilization with Incomes Policy Support", New York: Group of 30.

Rudiger Dornbusch, 1988. "Mexico: Stabilization, Debt and Growth" mimeo, MIT.

---, 1990. "From Stabilization to Growth," NBER Working Paper n. 3302, March.

Rudiger Dornbusch, Federico Sturzenegger and Holger Wolf, 1991. "Extreme Inflation: Dynamics and Stabilization, *Brookings Papers on Economic Activity*, n. 2, 1- 84.

Feenstra, Robert C., and Gordon Hanson, 1995. "Foreign Direct Investment and Relative Wages: Evidence from Mexican Maquiladoras," Cambridge, NBER Working Paper, n. 5122, May.

Fernandez de Castro, Rafael, 1993, *Sectoral Labor Effects of NAFTA*. Austin: University of Texas, UNAM and ITAM. Library of Congress catalog 93-77210.

Fields, G. S., 1980, *Poverty, Inequality and Development*. New York: Cambridge University Press.

Fishlow, Albert, 1972. "Brazilian Size Distribution of Income." *American Economic Review*, Vol. 2, n. 62, 391-402.

Ferguson, Thomas and James K. Galbraith, 1997, "The American Wage Structure, 1920-1947.", The University of

Texas at Austin, mimeo.

James K. Galbraith, 1998. *Created Unequal: The Crisis in American Pay*, New York: The Free Press.

--, 1996a. "Uneven Development and the Destabilization of the North," *International Review of Applied Economics*, Vol. 10, n. 1, 1996, 107-120.

--, 1996b. 'Inequality and Unemployment: An analysis across time and countries." Forthcoming in Victoria Chick and Soumitra Sharma, eds. *Keynes Fifty Years After and Beyond*," Aldershot: Edward Elgar.

Galbraith, James K. and Jiaqing Lu, "Linear Decomposition of Multiple Time Series," 1997, The University of Texas at Austin, manuscript.

Galbraith, James K. and Paulo Du Pin Calmon, 1990. "Relative Wages and International Competitiveness in U.S. Industry", Austin: Lyndon B. Johnson School of Public Affairs Working Paper No. 56.

--, 1994, "Industries, Trade and Wages," in Michael Bernstein and David Adler, *Understanding American Economic Decline*, New York: Cambridge University Press, 1994, 161-198.

--, 1996. "Wage Change and Trade Performance in U.S. Manufacturing Industries," *Cambridge Journal of Economics*, Vol. 20, n. 4, July, 433-450.

Galbraith, James K. and Junmo Kim, forthcoming, "The Legacy of the HCI: An Empirical Analysis of the Korean Industrial Policy." *Journal of Development Economics*.

Galor, Oded and Daniel Tsiddon, 1996, "Income distribution and growth: the Kuznets hypothesis revisited", *Economica*, Vol. 63, s103-s117.

Galor, Oded and Joseph Zeira, 1993, "Income distribution and macroeconomics." *Review of Economic Studies*, Vol. 60, 35-52.

Garcia Rocha, Adelberto, 1986, *La Desigualidad Economíca*, El Colegio de Mexico, Centro de Estudios Económicos.

Gollas, Manuel, 1982, "La Desigualdad del Ingreso Familiar: Origen y Causas" in *Economia Desigual: Empleo y*

Distribucíon en México. Consejo Nacional de Ciencia y Tecnologia, México.

Gould, David, 1996, *Immigrant links to the home country: implications for trade, welfare and factor returns.* New York: Garland Studies on Industrial Productivity.

Hanson, Gordon and Ann Harrison, 1995. "Trade, Technology and Wage Inequality," NBER Working Paper No. 5110, Cambridge: NBER, May.

Juhn, Chinhui, Kevin M. Murphy and Brooks Pierce, 1993. "Wage Inequality and the Rise in Returns to Skill," *Journal of Political Economy*, Vol. 101, n. 3, 410-442.

Hinojosa-Ojeda, Raul and Sherman Robinson, 1992. "Labor Issues in a North American Free Trade Area," (Paper presented at the Brookings Institution Conference: "NAFTA: An Assessment of the Research," Washington, April 9-10.

--, 1991. "Alternative Scenarios of U.S.-Mexico Integration: A Computable General Equilibrium Approach."

Hirschman, Albert, 1964. *The Strategy of Economic Development*, New Haven: Yale University Press.

Katz and Summers, 1989. "Industry Rents: Evidence and Implications," Brookings Papers on Economic Activity: Microeconomics, 209-290.

Kuznets, Simon, 1966, *Modern Economic Growth*: *Rate, Structure and Spread*, New Haven: Yale University Press.

Kuznets, Simon 1955, "Economic Growth and Income Inequality." American Economic Review, Vol. 65, n. 1, March, 1-28.

Langoni, Carlos, 1973. *Distribuição de Renda e Desenvolvimento Econômico no Brasil*. Rio de Janeiro: Ed. Expressão e Cultura.

Lawrence, Robert Z. and Matthew Slaughter, 1993. "Trade and U.S. Wages in the 1980s: Giant Sucking Sound or Small Hiccup?" *Brookings Papers on Economic Activity: Microeconomics*, 161-210.

Lawrence, Robert Z., 1996. *Single World, Divided Nations? International Trade and OECD Labor Markets*. Paris:

Brookings Institution Press/OECD Development Centre.

Leamer, Edward E., 1992."Wage Effects of a U.S. Mexican Free Trade Agreement," Cambridge: National Bureau of Economic Research Working Paper #3991, January 20.

--, 1995, "A Trade Economist's View of U.S. Wages and Globalization, mimeo.

--, 1996, "In Search of Stolper-Samuelson Effects on U.S. Wages," National Bureau of Economic Research Working Paper No. 5427, Cambridge: NBER, January.

Li, Hongyi, Lyn Squire and Heng-fu Zou, 1996, "Explaining international and intertemporal variations in income inequality.", Working Paper, Policy Research Department, The World Bank.

Lovell, Peggy,1993. "The Geography of Economic Development and Racial Discrimination in Brazil," *Development and Change*, Vol. 24, n. 1, 83-101.

McLeod, Darryl and John Welch, 1991. "Real Exchange Rates and Investment Booms in Mexico," Federal Reserve Bank of Dallas, *North American Free Trade: Proceedings of a Conference*, Dallas: Federal Reserve Bank of Dallas.

Ministry of Finance, Brazil, 1995 "The Real: A Twelve-Month Balance Sheet" available at http://www.fazenda.gov.br/ingles/real02voo.html

Paukert, F., 1973, "Income distribution at different levels of development: a survey of evidence." *International Labor Review*, Vol. 68, 97-125.

Perez-Lopez, Jorge, 1991. "The North American Free Trade Agreement: Implications for U.S. Workers", prepared for presentation as A Conference on New Foundations for the U.S. Immigration System and the Labor Force: National and International Perspectives, sponsored by the Bureau of International Labor Affairs and the Assistant Secretary for Policy, U.S. Department of Labor, September 19-20.

Perotti, R., 1992, "Fiscal policy, income distribution, and growth." *American Economic Review*, Vol. 82, 311-316.

--, 1993, "Political equilibrium, income distribution and growth: theory and evidence." *Review of Economic Studies*,

Vol. 60, 755-66.

--, 1994, “Income distribution and investment.” *European Economic Review*, Vol. 38, 827-835.

Persson, Torsten and Guido Tabellinin, 1994, “Is inequality harmful for growth? Theory and evidence.” *American Economic Review*, Vol. 84, 600-621.

Pozos Ponce, Fernando, 1992, *Economic Restructuring, employment change and wage differentials: the case of Guadalajara and Monterrey, 1975-1989.* PLACE: Manuscript.

Ram, Rati, 1997. “Level of Economic Development and Income Inequality: Evidence from the Post-War Developed World”, *Southern Economic Journal*, Vol. 64, n. 2, 576-588.

Ramos, Lauro, 1995. “Interindustry Wage Differentials” Discussion Paper No. 374, Instituto de Pesquisa Economica Aplicada, Brasilia, May.

Ramos, Lauro e José Almeida Reis, 1995. “Salário Mínimo, Distribuição de Renda e Pobreza no Brasil”. *Pesquisa e Planejamento Econômico*, Vol. 25, n. 1, April, 99-114.

Reis, José Almeida and Ricardo Barros. 1989. “Distribuição da Educação e Desigualdade Salarial.” Discussion Paper n. 178. Rio de Janeiro: Instituto de Pesquisa Economica Aplicada, Brasilia.

Reyes Heroles, Jesus F., 1984, “The Distribution of Labor Income in Mexico” in Aspe and Sigmund, eds., *The Political Economy of Income Distribution in Mexico,* New York: Holmes and Meier, pp. 129-186.

Saboia, João,1985. “ A Controvérsia sobre o Salário Mínimo e a Taxa de Salário na Economia Brasileira.” *Revista de Economia Política*, Vol. 5, n. 2, April - June.

Robinson, Sherman, Mary E. Burfisher, Raul Hinojosa-Ojeda and Karen E. Thierfelder, 1991. "Agricultural Policies and Migration in a U.S.-Mexico Free Trade Area: A Computable General Equilibrium Analysis," California Agricultural Experiment Station, Giannini Foundation of Agricultural Economics, Working Paper No. 617, December.

Sachs, Jeffrey, 1985. "External Debt and Macroeconomic Performance in Latin America and East Asia" *Brookings*

Papers on Economic Activity, n. 2, 523-573.

Shorrocks, Daniel, 1980. "The Class of Additively Decomposable Inequality Measures," *Econometrica*, Vol. 48, n. 3, 613-625.

--------, 1984. "Inequality Decomposition by Population Subgroups. *Econometrica*, Vol. 52, n. 6, 1369-85.

Sola, Lourdes,1991. "Heterodox Shock in Brazil: *Tecnicos*, Politicians and Democracy," *Journal of Latin American Studies*, February, 163-180.

Taylor, Lance, 1987. "Varieties of Stabilization Experience," Marshall Lectures at Cambridge University, 6-7 May.

Telles, Edward and Nelson Lim, forthcoming. "Does Who Classifies Race Matter?: Self vs. Social Classification of Race and Racial Income Inequality in Brazil." *Demography*.

Theil, Henri, 1972. *Statistical Decomposition Analysis: With Applications in the Social and Administrative Sciences*, Amsterdam-London: North Holland Publishing Company.

Van Ginneken, Wouter, 1980. "Socio-economic Groups and Income Distribution in Mexico," London: International Labor Organization, Croom Helm.

Wood, Adrian J. B., 1994. *North-South Trade, Employment and Inequality*, Oxford: Clarendon Press of Oxford University Press.

Endnotes

[1] In Appendix 2 in Figures A1 and A2 we show the full range of Deininger and Squire estimates of Gini coefficients for Brazil and Mexico.

[2] The two obvious functional forms to account for the non-linearity implied by the inverse-U curve are squaring the independent variable ($y= ...x^2$), or using its inverse ($y=...1/x$). There is no theoretical reason to prefer one to the other, and the results, when compared, are contradictory.

[3] More recently, the *Instituto Brasileiro de Geografia e Estatistica* (IBGE) has published Gini statistics based on the PNAD for the years 1983-1995, omitting 1991 and 1994 when no survey was conducted. These calculations appear to show rising inequality in the middle and late 1980s, with some decline in 1995.

[4] So long as group means are dispersed about the global mean, any force that raises inequality in general will tend to move high-average-wage group averages up and low–average- wage groups down, thus moving the between-group index in the same direction as the whole.

[5] It is possible to construct a rough check of the quality of a partitioning scheme, such as an industrial classification, by computing a Herfindahl index of the concentration of employment in each of the groups. From this evidence we judge our sectorization for Brazil to be the rough equivalent of a division of the underlying worker population into income deciles; while in the case of Mexico the sectorization varies in quality from quintile-equivalence to percentile-equivalence, depending on the data set. In any case we believe the quality is adequate for our purposes.

[6] As Galbraith (1998) has shown, the measure of T′ for the United States from 1958 to 1992 is highly correlated with the movement of a Gini coefficient computed from Current Population Survey data for family incomes in the same years. The T′ and Gini series diverge mainly after 1985, when T′ stabilizes but the Gini continues to rise. Comparisons of T′ for Brazil with various broader measures are given in Figure A1, in the appendix, and Galbraith, Garza and Hibert (1998), show the high degree of consistency between alternative T′ measures for Mexico.

[7] We exclude only the so-called Cruzado II plan of November 1986, because it was merely a reindexation of prices and not a true stabilization plan.