The Fall of Wage Flexibility: Labor Markets and Business Cycles in Latin America and the Caribbean since the 1990s

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Introduction and Summary

The Global Financial Crisis of 2008-09 affected Latin American and Caribbean (LAC) labor markets. Approximately 2.2 million workers joined the ranks of the unemployed (ILO, 2010), although the initial forecasts of international agencies were more pessimistic. The same organization had forecasted that 3.5 million workers would enter unemployment by the end of 2009 (ILO, 2009). In spite of the magnitude of the global crisis and the strong GDP contractions observed in the region, this temporary setback was characterized by the World Bank as being less severe than previous crises, especially when compared to recessions rooted in domestic macroeconomic factors such as Argentina during 1998-2002 and Mexico during 1995 (LCRCE Spring Meetings Report, 2010). Still, there is no doubt that business cycles can still inflict much pain on workers. And understanding how labor markets adjust with respect to temporary economic fluctuations remains important for designing appropriate short-term (e.g., social protection and safety nets) and long-term policies (e.g., education and skills).

This study explores how labor markets have adjusted to temporary business cycle fluctuations since (at least) the 1990s. It focuses on how changes in macroeconomic conditions affect the evolving nature of labor-market adjustments on the other hand. Labor-market adjustments are evaluated in terms of long-standing concerns about employment security, average wages, informality, and the dispersion of wages between skilled and unskilled workers. While employment and wages are traditional concerns for almost any economy, the latter two have played central roles in the policy debates of LAC.

A determining factor in the business cycle adjustment of labor markets is the behavior of wages. Wages in Latin America and the Caribbean showed great flexibility under duress, at least since the 1970s until the early 1990s. While this flexibility implied significant income risk for workers, it allowed economies to maintain relatively low levels of unemployment, even when battered by severe economic fluctuations. This report documents, among other things, the fall of real wage flexibility and discusses implications of the emergence of downward wage rigidities, both in real and nominal wages.

There are few changes in macroeconomic performance in LAC since the early 1990s that are more dramatic than the reduction in domestic inflation rates and the rise of international trade. Since 1985-1990 the median inflation rate declined from over 33 to 6 percent in 2005-2010. Similarly, the median incidence of trade over GDP rose from 46 to almost 64 percent during the same period. Hence this study pays particular attention to the role of low inflation and international trade in shaping labor-market adjustment. The fall of inflation and rise of real wage rigidity are intimately related via two mechanisms: First, downward nominal wage frictions become more binding in a low inflation environment, hence obstructing real wage adjustments during downturns, and second, low and stable

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1 The median inflation and trade numbers were computed for a sample of seventeen LCR countries. They correspond to the median of average inflation rates and trade ratios by country calculated with six years of data from 1985-1990 and 2005-2010.
inflation helps stabilize inflation expectations. While the benefits of macroeconomic stabilization are well known, and go well beyond the labor market, one possible consequence of more predictable inflation is that wage setters coordinate their efforts in bargaining wage growth in accordance with predicted inflation, bringing about rigidity in real wages.

At the same time, external shocks have been perhaps no less dramatic than those experienced by LAC in 1990s; it is now cliché to state that the crisis of 2008-09 was the deepest downturn in global GDP and international trade since the Great Depression. From the viewpoint of LAC, the nature of the recession was different in the sense that most of the impact was felt through the collapse of world trade, which proved to be transitory. The historically feared financial contagion did not materialize. Explaining the apparent resilience of the Region since 2009 is not the subject of this study, but the report illustrates key characteristics in the recent evolution of labor market adjustment in the region that might help our understanding of some of the patterns of adjustment observed during the global recession.²

The main focus of the report is on employment, wages and informality. The report analyzes how they are affected by business cycles, and on how low inflation and the nature of external shocks affects labor market dynamics. The main findings can be summarized as follows:

- LAC labor markets can be surprisingly characterized as having been quite flexible when compared to those of other regions, in spite of the much maligned regulatory rigidities. Wages were, on average, substantially pro-cyclical when compared to most OECD countries during the last three decades. Flows of workers in and out of the labor market and between sectors were very high too.
- As inflation fell since the early 1990s, however, the cyclicality of wages declined. This is consistent with the emergence of a new phenomenon that has accompanied the disinflation process: the rise of downward rigidities in wages. The reduction of inflation introduced downward adjustment frictions in both real and nominal wages.
- Wage setting in LAC labor markets appears intimately related to macroeconomic and institutional frameworks. For example, changes in the minimum wage in Brazil used to have a powerful impact on wage indexation, serving as a coordinating device in wage negotiations. Similar impacts of the minimum wage are evident in other countries where minimum wages are binding (i.e., close to the median wage). Interestingly, the introduction of inflation targeting in Brazil reduced the impact of the minimum wage as a coordination device and was replaced by inflation expectations.
- Recessions in LAC are characterized by sudden declines in hiring rates of the formal sector, rather than by an increase of the layoff rate of either formal or informal workers. Consistent with the decline of hires in the formal sector, formal sector wages appear to respond much less to the business cycle than wages in the informal sector. This decline in formal sector hiring hence might be due to wage rigidity in the formal sector.
- This set of facts is well illustrated in the labor market adjustment of the export-processing economy of northern Mexico during the global crisis of 2008-09. The massive reduction in formal employment was achieved by a complete freeze of formal hiring and an important

increase in layoffs. Importantly, most of the adjustment occurred via quantities, with tiny effects on the wages of incumbent workers (who did not lose their jobs). However, changes in average wages within industries were more notable than the small changes in the wages individual workers who retained their jobs. These changes in average wages were due to changes in the composition of the employed labor force.

- During recoveries, the formal sector starts hiring again, feeding mostly of workers moving from the informal sector. The vast majority of these hires are related to workers moving from small informal firms to large firms with a high degree of formalization.
- When considering the distributional impacts of the business cycle, external shocks driven by foreign demand that affect exports tend to affect the wages of skilled workers to a larger extent that those of unskilled workers, even after considering the protective effect of education in terms of reducing the probability of unemployment. As expected, labor market institutions such as the degree of employment protection mitigate this impact.

The rest of this report summarizes research from background papers commissioned for this study, complemented with additional quantitative analyses. It is organized as follows. Chapter 1 provides an overview of the cyclical macroeconomic behavior of wages in four LAC countries. Importantly, rather than examining the average cyclical pattern of wages, it focuses on the time varying patterns in the relationship between wages, employment and output.

After the presentation of the basic patterns of wage adjustments at the macro level, Chapter 2 takes a deeper look at the nature of wage adjustments drawing from two distinct sources of data. First, it goes to the most micro level of analysis and studies individual-worker wage adjustments in two prototypical middle-income economies, one large (Brazil) and one small (Uruguay), which experienced notable reductions in domestic inflation since the early 1990s. The objective is to determine the degree of downward wage rigidities (DWR) in these two economies, and to establish the links between the degree of rigidity observed in macro data and fundamental determining factors: changes in macroeconomic conditions and the business cycle phase in which the labor market operates, and changes in the institutions and policies that are likely to affect wage setting. The wage setting process can be analyzed precisely with micro data. However, wage rigidities measured at the individual level might wash out at the macro level, as firms have other margins for adjusting the wage bill including turnover and flexible forms of compensation. Therefore the second part of Chapter 2 studies downward wage rigidities with sectoral data. If the wage rigidities measured at the individual level are still observed in sectoral wages, it is very likely that they will matter for the determination of employment and unemployment. An additional advantage of looking at sectoral data is its international availability, which helps to compare Latin America with other regions, including both developed and developing countries.

Chapter 3 moves from wages to quantitative labor-market adjustments and attempts to the answer what limits the expansion of formal employment in LAC? The chapter studies differences, similarities and linkages between formal and informal employment over the business cycle to understand the frustrating persistence of informal employment in the region. Some of the findings might have, perhaps surprisingly, important implications for the region’s long-term growth agenda.
Chapter 4 takes a close look at the adjustment of formal labor markets in Northern Mexico during the United States recession of 2008-09. This case study offers an unfortunate but analytically clean setting to study labor market dynamics in an open economy characterized by a particular form of integration – vertical – that is also of interest for much of Central America and the Caribbean.

Chapter 5 turns our attention to the distributional costs of recessions by examining how returns to schooling fluctuate with the business cycle, and how they respond to different types of economic shocks. As such, it is also a study of how international trade affects the volatility of the returns to schooling, with potentially important implications for development policies. Chapter 6 concludes with a brief summary of the findings and some thoughts about policy implications.
Chapter 1. Real Wage Cyclicality in Four Latin American Economies

Summary: This chapter describes the cyclicality of wages and employment in the manufacturing sector in four countries where sufficiently long quarterly time series are available: Brazil, Chile, Colombia and Mexico. The focus is on the time-varying patterns of co-movement between employment and wages on the one hand, and industrial output on the other. Three findings stand out. First, compared to the available evidence for developed countries, wages are highly pro-cyclical in Brazil, Colombia and Mexico throughout the sample period. In contrast, they appear to be a-cyclical in the case of Chile. However, the same three countries that exhibit strong pro-cyclicality also show signs of decreasing cyclicality over the sample period, with the responses of wages to output starting to decline in the mid 1990s. The decline in the cyclicality of wages during this period coincides with an unprecedented disinflation in the region, perhaps suggesting the emergence of downward wage rigidities associated with the new low inflation environment. Thirdly, the reduction in the cyclicality of wages is not accompanied in all cases by a corresponding increase in the co-movement between employment and output. Indeed, the pro-cyclicality of employment declines together with the reduction in the cyclical responses of wages in the case of Brazil, while it increases in the cases of Colombia and, especially during the 2008-2009 crisis, in the case of Mexico. This suggests that changes in the composition in the labor force and working hours are likely to be different in the LAC countries. Some of these issues are discussed in other chapters of the report.

1.1. Introduction
Starting in the second half of the 1990s, Latin American countries successfully brought down inflation. The inflation rate declined from an average of 25 percent in the first half of the 1990s to 5 percent in 2005-2009. This process of macroeconomic stabilization is likely to have a significant impact on the dynamics of wages and employment in the region. One reason is the “natural” resistance of workers to accept nominal wage cuts. If workers resist nominal wage cuts, firms operating in this low inflation environment are most likely hampered to adjust real wages during downturns. As a result, the

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3 Aggregate inflation for LAC is obtained as a weighted average of CPI inflation in the region from the World Bank’s World Development Indicators database.

4 There are several theoretical reasons suggesting why wages might be downwardly rigid. Efficiency wage considerations suggest that wage rigidities arise as a detractor of worker shirking behavior (Shapiro and Stiglitz, 1984), as a firm effort to avoid costly labor turnover (Stiglitz, 1974), or as a result of a firm gift in exchange for higher effort (Akerlof, 1992). In the fair wage effort model, Akerlof (1990) argues that a lower wage would be perceived by the workers as unfair, reducing worker’s morale and effort. Hence, firms are reluctant to cut nominal wages. The latter rationale has received substantial support in empirical studies in the US, as suggested by manager interviews (Bewley, 1999) and surveys of wage setters (Cambell and Kammlani, 1997). In Europe efficiency wage considerations are important, but institutional constraints, most notably unions and employment protection, play a fundamental role in understanding the resistance of workers to nominal (Holden and Wulfisberg, 2008) and real (Dickens et al. 2007) wage cuts.
adjustment in the recessions falls disproportionately on the side of jobs. However, workers in the LAC region might be well aware of the consequences of inflation, and resist real rather than nominal wage cuts. If this is the case, the consequences of operating in a low inflation environment become less clear. On the one hand, indexation mechanisms might be easier to implement when inflation is low, considering that in a low inflation environment the predictability of inflation is higher. On the other, indexation rules might become less necessary when inflation is under control, shifting the bargain in the labor market towards other aspects of employment relations.

In the context of high inflation of the 1980s and early 1990s, the traditional adjustment mechanism was characterized by what may be termed “competitive depreciations.” Economic downturns were typically coupled with a progressive loss of competitiveness, which triggered nominal exchange rate depreciations. The fall of the nominal exchange rate resulted in domestic inflation, which nonetheless was not enough to avoid real exchange rate depreciations, at least temporarily. The depreciation of the real exchange rate, in turn, played a key role in restoring external balance, by shifting resources towards tradable sectors. The adjustment of labor markets was arguably a key factor in facilitating real exchange rate depreciations. Even if indexation of wages to prices was widespread in the region, sudden inflation spikes at the time of the depreciation of the nominal rates translated into real wage reductions, as nominal wages were not perfectly indexed to inflation.

We can illustrate the traditional adjustment mechanism in LAC by looking at important depreciation episodes in selected countries of the region. The left panels of Figure 1.1 illustrate the rapid fall of real wages that was associated to the exchange depreciations that followed Tequila crisis in Mexico, the end of convertibility plan in Argentina, and the contagion after the Asian crisis in Brazil. Hence, one may argue that labor markets probably tended to adjust to output shocks predominantly through real wages, rather than unemployment. The wage adjustment during the crisis of the late 1990s contrasts sharply with the adjustment of real wages during the great recession, as illustrated in the right hand panels of Figure 1.1. First, the inflation rate was virtually unaffected by the global crisis, and the flexibility in the exchange rates prevented from abrupt changes in the terms of trade. Consequently, in spite of a sharp reduction in the growth rates of GDP, real wages suffered a mild deceleration in Brazil and Mexico, and even continued growing in Argentina. This is suggestive of a reduction in the responsiveness of real wages to the fluctuations in output during the last decade. Before turning to the analysis, it is important to bear in mind that, as discussed later in this report, changes in average real wages discussed in this chapter could reflect changes in the composition of employed workers, rather than responsiveness of wages of individual workers who remain employed over the cycle.

In the presence of downward nominal wage rigidities real wages become more rigid, especially during a recession, as the necessary downward wage adjustments are not allowed by the nominal wage change floor at zero. Naturally, in the absence of changes in the deep structure of rigidities, this mechanism

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5 The real wage growth in Argentina is subject to the caveat that the official CPI inflation rate is most likely underestimated. As there is a wide range in the un-official statistics of inflation, we show in the graph the official statistics.
becomes more binding in a low inflation environment. Figure 1.2 illustrates this claim using sectoral data for LAC. The figure shows the histograms of nominal wage changes in 15 LAC countries. The unit of observation is the industrial sector. The right hand panel includes all country-year observations in high inflation years (we exclude hyper-inflations). The histogram shows fairly high variation in wage changes. There are a few nominal wage cuts, and no apparent distortions at 0 nominal wage changes. The left hand panel instead focuses on moderate inflation country-years (between 0 and 20%). In this case, we observe that the distribution is less spread. More importantly, there is a clear distortion at zero wage changes, and an asymmetry in the distribution around zero, with substantially more small positive wage changes than negative wage changes. This is the sign of downward nominal wage rigidity that will be discussed at length in the next chapter.

What about employment adjustments? On the one hand, one may argue that if there is wage flexibility, employment is likely to fluctuate less with the ups and downs of economic activity. On the other hand, it is well known than in the presence of considerable wage flexibility, labor market rigidities, if present in the form of employment protection or other forms of firing restrictions, are likely to be less binding (Bertola and Rogerson, 1997). Hence, the interplay of employment and wage adjustments need to be further investigated. Ultimately, the relationship between wage and employment cyclicality in different macro frameworks is an empirical question.

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6 The number of sectors varies by country and year. On average, there are 22 sectors.
Figure 1.1. Evolution of Real Wages and the CPI

Note: the graphs depict the evolution of quarterly average male real wages for the whole economy (all sectors) and the CPI index around recession periods for Argentina, Brazil and Mexico.

Sources: Own calculations for Argentina based on Encuesta Permanente de Hogares (EPH) and Encuesta Permanente Continua de Hogares (EPHC) and for Brazil based on Pesquisa Mensal de Emprego (PME). For Mexico, based on Encuesta Nacional de ocupacion y Empleo (ENOE) and Encuesta Nacional de Empleo Urbano (ENEU).
The rest of this chapter provides an assessment of the cyclical behavior of employment and wages in LAC. We study the dynamic properties of wages and employment and the relation with output. Our focus is on the time-varying correlation of the aforementioned variables, since we want to assess differences in the cyclical behavior between the low inflation environments of the 2000s and the high inflation regimes of the previous decades. Moreover, we will also assess business cycle asymmetries in the responses of both, wages and employment, with respect to output fluctuations.

1.2. The Evolution of Real-Wage and Employment Cyclicality
The first papers in the literature that measured the co-movement between real wages and the cycle used simple static approaches.\(^7\) However, a number of authors starting with Neftçi (1978) stressed that

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\(^7\) The chosen cyclical measure has been either the unconditional correlation coefficient between the cyclical component of real wages and an indicator of the cycle or the coefficient of OLS regressions of a (de-trended) real wage series on a (de-trended) business cycle series. In both cases, only the contemporaneous values of real wages and the cycle have been taken into account. Abraham and Haltiwanger (1995) discuss at length the different approaches taken up in the literature to measure the cyclical behavior of wages. An application using the
accounting for the dynamic properties of the data series, such as persistence over time, may matter for correctly understanding real wage and employment cyclicity. The dynamic properties of the data can indeed vary substantially across data series and countries, and as shown in Den Haan (2000), evidence the cyclicity based on simple static measures can be misleading. Hence, we propose a dynamic approach that has the additional advantage of allowing the cyclicity of wages and employment to change over time. This should help identification if, hand in hand with the disinflation process, real wages have become less responsive to the cycle, a feature that may be related to the emergence of wage rigidities.

Our model is a time-varying coefficients vector autoregression with stochastic volatility in the residuals. This model has become a popular tool in macroeconomics, and has been applied to address questions related to the evolution of the structure of the economy and the volatility of the shocks in developed countries (see Primiceri, 2005, Canova and Gambetti, 2009 and Gali and Gambetti, 2009). The model is estimated using Bayesian methods, as described in the Appendix at the end of the report.

The indicator of real wage is the average hourly wage in the manufacturing sector deflated by the consumer price index (CPI). As Abraham and Haltiwanger (1995) and Messina, Strozzi and Turunen (2009) have shown, the choice of the deflator is not innocuous. Consumer wages (those deflated with the CPI) tend to be more pro-cyclical than producer wages (those deflated with producer price indices). We focus on consumer wages since this is the best measure to approximate worker’s welfare. Naturally, the employment measure we use is the number of employees in the manufacturing sector. The focus on employment rather than hours leaves out from the analysis the intensive margin of labor market adjustment, since long series of hours worked for LAC countries are not available. The analysis focuses on four LAC countries, Brazil, Chile, Colombia and Mexico, which are the only countries with sufficiently long quarterly series for the four variables we are considering in the analysis: CPI, hourly wages, employment and industrial production.

correlation between de-trended compensation per employee and GDP in a large number of LAC countries is Aguilera et al. (2009).
Figure 1.2. Variances of Real Wages, Employment and Industrial Production
Before turning to the main results, Figure 1.3 shows the time-varying evolution of the variance of wages, employment and industrial production (IP) in the four countries. The devastating impact of inflation on the efficiency of labor market functioning in the cases of Brazil and Mexico is apparent; both countries had three-digit inflation rates during the 1980s. The volatility of employment and wages is about three to four orders of magnitude larger in this period compared to the other two countries, and to their experiences during the 2000s. In contrast, the variance of wages in Chile and Colombia remains low and fairly stable throughout the sample period. We only observe a spike in the variances of employment in these two countries at the end of the 1990s. How about the response of these three macro aggregates during the great recession? Nothing much happened in Brazil, Chile and Colombia, perhaps with the exception of an increase in the variance of IP in Chile associated with the great recession. In contrast, and consistently with the sharp economic downturn suffered by Mexico due to the collapse of trade with the US, the variance of wages, employment and output in this country increases rapidly during the last two years of the sample. This feature will be studied in depth in Chapter 4, which characterizes the response of the Maquilas sector during the great recession.
Figure presents the main results of this chapter. Each row presents a country and each column an estimated pair-wise measure of co-movement: wages and output (column 1) and employment and output (column 3). The first aspect worth stressing is that, with the exception of Chile, wages appear to be exceptionally pro-cyclical. Concentrating on the co-movement between wages and output, the average of the median posterior cyclicality in Brazil is 0.58, 0.40 in Colombia and 0.32 in Mexico. This contrasts with the mild pro-cyclical behavior of wages found in most OECD countries. Using two dynamic approaches for 18 OECD countries, Messina et al. (2009) found that the correlation between consumer wages in the manufacturing sector and industrial production ranges from -0.38 in New Zealand to 0.41 in Japan. In the United States, wages are mildly pro-cyclical, at 0.28. The high pro-cyclicality of wages is suggestive of a great deal of wage flexibility in LAC.

There are signs of decreasing cyclicality over time in Colombia and Brazil, and to a lesser extent in Mexico. In the case of Colombia, we can accept at the 95% level that the correlation between real wages and output in the first date of the sample is larger than the correlation of the same variables at the last date of the sample. In Brazil the probability of a larger cyclicality of real wages at the beginning of the sample is higher than in the last date of the sample is 87%. Interestingly, the decline in the cyclicality of wages in this country is observed during the 1990s, coinciding with the Real stabilization plan (introduced in 1994). The corresponding probability in Mexico is 70%. In sharp contrast, wages appear to be relatively a-cyclical in Chile, with no clear pattern over the short period of time for which data is available (1995-2010).

As argued earlier, there is not necessarily a one-to-one correspondence between the time evolution of the cyclicality of wages and employment. The different paths in Brazil and Colombia illustrate this with clarity. The employment cyclicality in Brazil declined throughout the sample period, hand in hand with the reduction in the cyclicality of wages. The probability of a higher cyclicality at the beginning of the sample with respect to the last observation is 96%. In contrast, the reduction of the cyclicality of wages in Colombia is associated with an increase in the co-movement between employment and output, although in this case the estimated probability of an increase is 88%.

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<th>16th</th>
<th>50th</th>
<th>84th</th>
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<tbody>
<tr>
<td><strong>Brazil</strong></td>
<td></td>
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</tr>
<tr>
<td>W-Y</td>
<td>0.1261</td>
<td>0.1603</td>
<td>0.1925</td>
</tr>
<tr>
<td>E-Y</td>
<td>0.1666</td>
<td>0.1913</td>
<td>0.2187</td>
</tr>
<tr>
<td><strong>Chile</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W-Y</td>
<td>-0.1597</td>
<td>-0.0612</td>
<td>0.0403</td>
</tr>
<tr>
<td>E-Y</td>
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<td>0.1117</td>
<td>0.2108</td>
</tr>
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<td><strong>Colombia</strong></td>
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<tr>
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<tr>
<td>E-Y</td>
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<td>0.3291</td>
<td>0.3794</td>
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<tr>
<td><strong>Mexico</strong></td>
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</tbody>
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Table 1.1 The Cyclicality of Employment and Output: Differences between Booms and Recessions

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8 One has to bear in mind that the density function of the posterior distributions are estimated with substantial uncertainty, as suggested by the wide confidence bands of the estimates of comovement. This is somewhat common in this literature, and it is exacerbated by the short time series available in LAC countries.
Table 1.1 Note: The table displays the median and the 68% confidence interval for the difference between the average correlation coefficient in booms and recessions. W-Y: real wage and industrial production; E-Y: employment and industrial production.

<table>
<thead>
<tr>
<th></th>
<th>W-Y</th>
<th>E-Y</th>
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<tbody>
<tr>
<td>Median</td>
<td>0.0414</td>
<td>0.2613</td>
</tr>
<tr>
<td>CI</td>
<td>0.0881</td>
<td>0.2819</td>
</tr>
</tbody>
</table>

To shed further light on the importance of wage rigidities in the four countries, we have calculated the difference in the average correlations between expansions and recessions. These summary statistics are displayed in Table 1.1. Perhaps not surprisingly, wages tend to be more responsive to output during expansions in the three countries that exhibit highly pro-cyclical wages. The excess pro-cyclicality of wages (difference in the cyclicality between expansions and recessions) is 0.16 in Brazil, 0.09 in Mexico, and 0.27 in Colombia. In all three cases the differences are significant at the 95% confidence level. This is indicative of asymmetries in wage setting, whereby upward mobility in wages during expansions is more easily obtained than real wage cuts during recessions.

The following chapter assesses downward wage rigidities in LAC by looking at individual pay records, in an attempt to shed further light on the determinants of wage dynamics in two countries that experienced notable reductions in inflation, namely Brazil and Uruguay. In addition, the following chapter benchmarks wage rigidities in LAC by comparing it with other regions since the 1970s, but by focusing on average wages at the industry level. As will become apparent, the industry-level evidence suggests that LAC historically exhibited relatively high flexibility of average nominal wages measured at the industry level, but rigidities rose in the 1990s and especially in the 2000s. It is worth noting, however, that changes in average wages at the aggregate (industry) level might be detected even when rigidities are binding at the individual level. This latter point will become even more apparent in subsequent chapters, which discuss how changes in average wages at the industry level can reflect quantity adjustments through the composition of employed workers over the business cycle. That is, average industry wages might appear to be less or more flexible than the wages of individual workers who remain employed, because changes in the composition of workers results in changes in observed average wages, although there might be nominal wage rigidity at the level of individual workers.

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9 The turning points to date expansions and recessions are obtained from the series of industrial production with the Bry–Boschan Quarterly (BBQ) algorithm (Hardin and Pagan, 2002).
Chapter 2. Downward Wage Rigidities in LAC

Summary: The chapter has two objectives. First, it characterizes the existence and evolution of downward wage rigidities in the context of disinflation since the 1990s by looking at individual wages. For this purpose, it focuses on two countries, Brazil and Uruguay, which experienced substantial inflation stabilization. The analyses not only assess the extent of nominal wage rigidity, but also how the nature of price-indexation of wages changed after macroeconomic stabilization. Although a non-trivial fraction of workers experiences wage cuts Brazil and Uruguay, downward wage rigidities are commonplace in the two countries during the low inflation period. Important differences between the two case studies related to the indexation of wages are also discussed. The second section turns to sectoral data to search for evidence on nominal and real wage rigidity across a larger group of countries and longer time periods. This evidence suggests that nominal wage rigidity fell as inflation declined, and nominal wage cuts increased with disinflation. These two facts are observed in all regions. In contrast with other regions, the disinflation process in LCR appears to have brought also an increase in downward real wage rigidities, suggesting that in a low inflation environment LCR workers are more likely to resist not only nominal wage cuts, but also wage increases below the rate of inflation.

2.1. Introduction

This chapter assesses the extent of nominal wage rigidities in LAC with two different types of data. The first section explores labor market adjustments in two examples of middle-income LAC economies, Brazil and Uruguay, which experienced substantial inflation stabilization, with individual-worker data. The analyses not only assess the extent of nominal wage rigidity, but also how the nature of price-indexation of wages changed after the macroeconomic stabilizations. The second section turns to evidence on nominal wage rigidity across industries, countries and over time.

2.2. The Micro Evidence: Downward Wage Rigidities in Brazil and Uruguay

Comparing Brazil and Uruguay is interesting as both countries share a similar inflation history but differ in important aspects of their labor market institutions. Our periods of analysis, 1996-2004 in Uruguay and 1995-2002 in Brazil, include the first years of relatively low inflation in both countries. Inflation fell sharply in the two countries during the 1990s, from three (even four, in Brazil) digit levels in the first years to single digits by the end of the decade. Another relevant similarity is that both countries suffered a recession during the sample periods. Brazil goes through two mild recessions in 1998 and 2001, while the recession in Uruguay was severe, extending through 1998 to 2002, with a brief recovery during 2000. There is some evidence that nominal wage cuts can occur during severe downturns, when a large number of jobs is at risk (Fabiani et al. 2010). Since wages appear to be more flexible in LAC countries than in the developed world, one may expect downward nominal wage rigidity (DNWR) to be less binding during these recessionary periods. Regarding labor market institutions, this section emphasizes one aspect that differentiates these countries: minimum wages in Uruguay were hardly binding, but workers earning a minimum wage in Brazil represent 6.9 percent of the formal labor force in the sample.
This is an important distinction because changes in the minimum wage tend to be used as a signal for wage bargaining across sectors in many Latin American countries (Maloney and Nuñez, 2004).

While there is a well established literature for OECD countries measuring and assessing the determinants of downward rigidities, it is thin for LAC. Using aggregate data for 13 LAC countries, a previous LCRCE regional study (González-Anaya, 1999) found that the elasticity of wages with respect to output declined in the 1990s with respect to the 1980s and 1970s, especially in 5 of the 6 countries in the sample that carried out a price stabilization programs. This finding is consistent with the notion that downward nominal wage rigidity might obstruct the adjustment of wages in low inflation environments. Castellanos et al. (2004) is one of the few studies measuring downward nominal wage rigidity (DNWR) with micro data in a middle income country, Mexico. Following the methodology first proposed by Kahn (1997), they found lower levels of DNWR in Mexico than those found in advanced economies. Cobb and Opazo (2010) studied the frequency of wage changes in Chile during 2001-2007. In contrast with the Mexican case, these authors found substantial nominal wage rigidity. On average, wages adjusted every 9 quarters. This amounts to almost double the duration of wage contracts found in the United States as reported by Barattieri et al (2010).

The analysis is based on a model of wage setting detailed in Messina and Sanz de Galdeano (2011). The main objective is to estimate downward wage rigidity from individual pay records. Following the literature, we focus on workers who remain on the job for two consecutive years. Hence, we abstract from the flexibility of wages associated with worker mobility. This is an important issue to be kept in mind when interpreting the results. As we will see in the next chapter, there is substantial evidence suggesting that the wages of movers are much more volatile than the wages of stayers.

We focus on two indicators of wage rigidity: the extent to which employed workers resist nominal wage cuts and the extent to which they resist real wage cuts. Downward real wage rigidity (DRWR) is defined in a broad sense, as a worker’s resistance against growth of nominal wages below a positive threshold, which needs to be determined. This threshold may differ across individuals, because inflation expectations are heterogeneous and may be affected by policies, such as the growth rate of the minimum wage if this rate is used to index nominal wages.

The intuition underpinning the methodology can be illustrated by histograms of wage changes in the two countries. Figures 2.1 and 2.2 show histograms of yearly log wage change distributions of private sector workers staying in the same job for two consecutive years. Each bin contains a 1% variation in wages except for the bin that contains zero wage changes, which has been explicitly distorted in order to contain just observations with exact zeroes. Two vertical lines are also shown in the graph. The dashed line is the year on year inflation rate, and the solid line shows the yearly growth rate of the minimum wage.

Figure 2.1 presents the first few years of the sample in Uruguay. Let us first look at 1999, which was a year of moderate (5.6%) inflation. The first aspect worth noticing is a concentration of observations at cero wage changes (around 8%), and relatively little mass below it, in what seems to be a sign of
downward nominal wage rigidities. There is another important asymmetry in the distribution this year. About 10% of workers received a wage increase similar to the inflation rate, while the percentage of workers with a wage change just below the 5% bin is clearly lower than the percentage of wage changes above it. This asymmetric agglomeration of observations around the expected inflation can be interpreted as evidence of downward real wage rigidities.

Histograms for other years present a similar picture, but also show an important difference. The asymmetry associated with DRWR does not always coincide with the realized inflation rate. In some years it does (1998) but in others it seems to be related to the increase in the minimum wage (1996 and 1999). We will come back to the issue of the minimum wage when we discuss the Brazilian data, but these differences highlight that not all agents have the same expectations about inflation or the same focal point in wage negotiations. This renders the measurement of DRWR more challenging than the measurement of DNWR, because the focal point of rigidity might vary across individuals. It is noteworthy that the spike at zero increases as inflation declines throughout the sample period. However, the relationship between wage rigidities and inflation is a complex one. The recession years are characterized by a high incidence of wage freezes, with the concentration of observations at zero above 20%. This is the case in spite of inflation rates around 10%, suggesting that the severity of the downturn affected wage bargaining between firms and workers.

In contrast with Uruguay, in Brazil (Figure 2.2) we find clear signs of DRWR but little signs of DNWR. Our first year of analysis is 1996, the first moderate inflation year (15%) after several years of hyperinflation. Three features are worth noticing from the histogram. First, there is a large spike in the positive inflation range, and missing mass below it, suggesting the presence of DRWR. Second, the spike is not at the realized inflation rate, but rather at the rate of change of the minimum wage (12%). Finally, there are virtually no wage freezes, but the bins just above and below 0 nominal wage changes present a concentration of observations with respect to adjacent bins. This is suggestive of the presence of measurement errors in the data, which result in a large number of tiny wage changes. The methodology presented in this chapter arguably controls for measurement error, as discussed in Messina and Sanz de Galdeano (2011).

One complication of moving from the description of the histograms to the measurement of downward wage rigidities is that the wage change distribution in the absence of distortions that prevent wages from falling below 0 or at some positive threshold is unobserved. A distortion-free counter-factual distribution needs to be constructed. The model we use estimates a distribution of desired wage changes, which is called the notional wage change distribution, as a function of observable characteristics of individuals (e.g., gender, age, and education) and their employers (e.g., sectors and firm size). It also jointly estimates the relevant parameters that distort the distribution due to downward wage rigidities. In particular, we allow for two distortions. For a fraction of workers who are subject to downward nominal wage rigidity (DNWR) their nominal wage changes coincide with the notional or desired wage change only if they are positive; i.e., in the case that their employer wanted to reduce their nominal wages, downward nominal wage rigidities would be binding, and their actual wage change would be zero. A second group of workers is subject to downward real wage rigidity (DRWR). These
workers receive their notional nominal wage change only if this desired wage change falls above a given threshold. If instead their employer wanted to reduce their wage below this threshold, DRWR would be binding and the employee will receive a nominal wage change equal to the threshold. The estimator determines this threshold endogenously by looking at all the possible asymmetric distortions in the positive range of the wage change distribution.\(^{10}\) There is a third type of workers in the model, those who have flexible wages, whose wage always coincides with the notional wage change. The results presenting the fraction of workers subject to DNWR and DRWR are shown in Figures 2.3 and 2.4.

\(^{10}\) See Messina and Sanz de Galdeano (2011) for further details.
Figure 2.2. Wage Changes in Brazil, 1996-1999

Figure 2.3 presents the fraction of workers subject to both types of rigidities and the rate of inflation for the case of Uruguay. Perhaps due to the history of high inflation and widespread indexation in labor contracts that preceded the sample period, the incidence of DRWR is very important in the first years. The fraction of workers subject to real rigidity is 72% in 1996-1997 and 88% in 1997-1998. As inflation declined, real rigidity rapidly declined as well. In 1998-1999, the share of workers subject to the real rigidity regime was 65%, plummeted to 12% the next year, and remained relatively stable thereafter (below 8%). The decline of DRWR was accompanied by an increase in DNWR. During the first two years, DNWR was virtually inexistent at about 12%. After a mild increase in 1998-1999, DNWR jumps to a new equilibrium in 1999, when the share of workers subject to DNWR stabilized at around 65%. However, as mentioned, the relationship between the two types of rigidities and inflation is complex. When inflation picks up again in 2002 and 2003, the share of workers subject to DRWR remains low, while DNWR is still binding for a majority of the labor force (62% in 2002 and 70% in 2003). The explanation for this behavior must be the severity of the recession that afflicted the Uruguayan economy during those years. The recession began in 1999, reached its trough in 2002, and the accumulated contraction of GDP was 11%. Hence, even in the presence of high inflation during 2002 and 2003, firms required downward real wage adjustments, which were only obtainable via wage freezes because of DNWR.

In contrast with Uruguay, DWNR was less important in Brazil, as illustrated in Figure 2.4. The incidence of DRWR was higher, and it remained relatively stable throughout the period. On average, 43% of the formal workforce in Brazil was subject to DRWR. The share of workers subject to DNWR was on average 10%, but it increased somewhat over the period. The reasons behind the persistence of DRWR in Brazil and the emergence of DNWR in exchange of weaker DRWR in Uruguay remain to be understood. A
possible explanatory factor is unionization. Unions remained relatively strong during this period in Brazil, while in Uruguay there was a strong reduction in affiliation rates and a rapid movement towards decentralization. To the extent that real wage rigidities are related to union behavior, as the international evidence suggests (Dickens et al. 2007) this factor can help understand the differential behavior in the two countries during the disinflation process.

There was an important regime shift in Brazil, in spite of the relative stability of the incidence of DNWR and DRWR. Figure 2.5 shows the evolution of the estimated focal point of DRWR and its variance, together with the CPI inflation rate and the change in the minimum wage. In the first years of the sample the focal point that serves as a threshold for real wage adjustments traces the increase in the minimum wage almost perfectly. The importance of the minimum wage as a focal point of wage negotiations is such that the estimated bound around it, as measured by its variance, is virtually zero. Only after several years of low inflation and a change in the monetary policy regime with the introduction of inflation targeting in 1999q2 the focal point in wage negotiations began to follow the rate of inflation rather than the growth of the minimum wage. Interestingly, the confidence bands around the focal point widen during this transition, reflecting heterogeneity in inflation expectations (i.e., different focal points across agents in wage negotiations). While some workers might have used expected inflation as the central goal in wage bargains, others might have continued to focus on the minimum wage. Indeed, the growth of the minimum wage falls outside the estimated range of focal points only in 2000-01, a year in which wage rigidities are narrowly pinned down by the rate of inflation.

**Figure 2.3. Downward Wage Rigidities and the Rate of Inflation: Uruguay**
Figure 2.4. Downward Wage Rigidities and the Rate of Inflation: Brazil
The analysis of wage rigidities in Uruguay and Brazil provides potentially important lessons for policy. From the viewpoint of monetary policy, it is clear that there is an interaction between the monetary policy regime and wage setting. The introduction of inflation targeting in Brazil eventually broke the link between minimum wage growth and wage negotiations. As expected, the introduction of an inflation target (of 4.5% +/- 2%) helped anchor inflation expectations, as agents began to negotiate wage increases around the target inflation. Other countries in the region have recently introduced inflation targeting, including Chile and Colombia (1999), Mexico (2001) and Peru (2002), while other economies, such as Costa Rica, are considering adopting similar regimes. As new datasets become available, it would be interesting to see if similar changes in wage setting are taking place in the inflation-targeting regimes.

The stabilization plan and subsequent reduction of inflation in Uruguay also triggered fundamental changes in wage setting. During the late 1990s, wage setting in Uruguay was characterized by a considerable degree of downward real wage rigidities associated with the expected rate of inflation. As inflation came down, downward real wage rigidities virtually disappeared, and workers resistance to nominal wage cuts became the central friction in wage setting.

Whether the emergence of DNWR should be a matter of concern depends on the reaction of firms to the worker’s resistance against nominal wage cuts. Akerlof, Dickens and Perry (1996) showed that in the presence of downward nominal wage rigidities, a monetary authority that aims at an inflation that is too low might end up obstructing real wage adjustments, with negative consequences in terms of unemployment. However, firms are likely to react to worker resistance to nominal wage cuts, in
attempts to enhance the badly needed flexibility of unit labor costs. Babecky et al. (2009) showed for a sample of OECD countries that in light of workers’ resistance to nominal wage cuts, firms react by using more heavily a variety of cost-cutting margins, including changes in shift assignments, the replacement of high-tenure high-wage workers by younger workers at lower wages, adjustment of bonuses and fringe benefits, and the like. In the LAC context, firms could replace formal workers with rigid wages with informal workers, who are potentially more likely to accept cuts in nominal wages.

Regarding the informality margin, Figure 2.6 shows the correlation between the incidence of wage rigidity of formal workers in a sector and the incidence of informality.11 Interestingly, there is a strong positive association between the degree of wage rigidity of formal workers and the incidence of informality in Brazil, but no association in Uruguay. The positive correlation in Brazil suggests that firms may be able to circumvent some of the negative consequences of rigid wages in the formal sector by hiring informal workers. Whether this association occurs within firms, or through Malthusian effects whereby firms with formal workers and rigid wages are substituted by more competitive firms hiring informal workers with more flexible wages remains to be studied.

The lack of correlation in Uruguay deserves further exploration, but might be related to two factors. First, the matched data in the case of Uruguay is at a relatively high level of aggregation. Compositional changes within sectors might blur the relationship between wage rigidity of formal workers and informality. The second factor has to do with the nature of informality in Uruguay, and the degree of substitutability between formal and informal workers. Uruguay is the country with the lowest level of informality in LAC. This may imply that formal and informal workers are not employed for the same jobs. That is, firms may not be able to substitute formal employees with downward rigid wages with informal workers.

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11 We follow the legal definition of informality, which relates worker status to access to certain benefits. In the case of Brazil, we follow the definition of informal status used in Chapter 3, and link it to the lack of “carteira de trabalho,” a document that certifies social protection entitlements through employee status. The data comes from the Brazilian PME (a monthly employment survey), which is a representative household survey of Urban areas. Hence, the comparison with wage rigidities is done for Belo Horizonte, the capital of Mina Gerais. We are able to match the two datasets at a 3 digit industry level for selected industries. In Uruguay, informal workers are defined as those who do not have access to pension benefits through their job. The data come from the “Encuesta Continua de Hogares,” which is representative at the country level. The matching of sectors between the two datasets is done at a two digit level. Note that information on eligibility of pension benefits through the job is only available after the revision of the survey in 2001. Hence, we limit the comparison to the years 2001-2004. The results from a year-on-year analysis are very similar.
In general, Latin American labor markets are characterized by a high degree of worker turnover, an issue that will be emphasized in Chapter 3 of this report. Hence, it becomes a relevant question whether the rigidities that we observe at the micro level translate into rigidities at the macro level, since changes in the composition of the labor force at the sector or macro level can bring about substantial flexibility of wages. To shed further light on this question, the next subsection assesses downward wage rigidity in sectoral data.

### 2.3. Downward Wage Rigidities around the World: Sectoral Evidence

The incidence of downward wage rigidities across different types of workers is certainly important from the point of view of welfare, independently of its macroeconomic consequences. For instance, if workers are risk averse and alternative insurance mechanisms to labor income shocks are not available, wage rigidities may be welfare improving (Azariadis, 1975). However, the macroeconomic impact of downward wage rigidities at the individual level is likely to be limited if these rigidities are washed out at the macro level. There are two reasons to think this might be the case. First, as discussed in Chapter 3, labor turnover rates in LAC are high. With high labor turnover, rigid nominal wages for a large fraction of individual job stayers need not imply significant rigidity of average wages. Second, Chapter 3 also reviews international evidence and stylized facts for Brazil showing that wages of new entrants tend to be more flexible than the wages of incumbent workers. If the bulk of wage adjustments occur at the entry margin, downward wage rigidities for job stayers may not translate into rigid unit labor costs at the firm level, with limited effects on employment or unemployment.

An additional advantage of moving to sectoral data is that we can benchmark LAC with respect to the rest of the world. In total, we were able to collect data for 86 countries, including 15 LAC economies. The time coverage varies by country, but in most cases includes the period 1980-2010, and for some countries extends back to the 1970s.
Instead of looking at wage changes in two consecutive years for workers who remained employed in the same firm, which amounts in some years to hundreds of thousands of wage changes, we look at wage changes within sectors, with a maximum of 43 observations in a country-year cell. This implies that estimates of wage rigidities for individual countries are unlikely to be statistically significant. Therefore, the results for groups of countries and decades are more meaningful. The small number of sectors also requires different methods to construct the counter-factual distortion-free wage change distribution. The methodology we apply is discussed at length in Holden and Messina (2011), builds on Holden and Wulfsberg (2009), and it is described in the Appendix.

Figure 2.7 shows the incidence of DNWR in five regions of the world: LAC, OECD, ECA, East and South Asia and Africa and the Middle East. We concentrate on the fraction of wage changes prevented by the nominal wage floor (FWCP), which is the share of wage cuts that would have occurred if wage rigidities were not present in a country-year. Each bar contains the FWCP in a decade.

Wage rigidity is not only present in individual worker data; it can also be observed in industry data in all regions of the world. However, there was a movement towards greater flexibility in the world over time. This is especially noticeable in the OECD, where the incidence of DNWR declined from 30% in the 1970s and 1980s to insignificant in the 2000s. In LAC, DNWR also declined over time, but the reduction was moderate. The incidence of DNWR was slightly below the OECD in the first two decades, but during the 1990s and 2000s it remained statistically significant and close to 15%. When compared with other developing countries, LAC started with slightly more wage rigidity, but in the 2000s the incidence of prevented nominal wage cuts was lower in LAC than in the other three developing regions.

The evolution of DRWR shows that LAC has followed a different path than other regions. Figure 2.8 shows the evolution of DRWR, or the FWCP below 0 real wage changes. The OECD and ECA experienced downward trends. The former started with DRWR above 20% in the 1970s and became insignificant in the last two decades. We do not have sufficient data for ECA for first two decades of the sample, but DRWR declined from 15% in the 1990s to insignificant in the 2000s. In contrast, LAC had no signs of DRWR until the 2000s, when the FWCP reached 13%. This finding suggests that if there was wage indexation during the 1970s-1990s, this indexation was very partial, and perhaps followed a price index different than expected inflation (e.g., the minimum wage growth, as we showed in the case of Brazil). However, during the 2000s, when inflation was lower and more predictable, the region experienced a significant increase in the resistance to real wage cuts.

---

12 We restrict the country-year cells to have a minimum of 10 sectors in two adjacent years to construct a meaningful histogram of wage changes.

13 The FWCP was obtained from a notional wage change distribution constructed with all observations in the dataset. We experimented with different notional wage changes across regions, periods and region-periods, and obtained very similar results to those discussed in the text.
Table 2.1 assesses the relationship between downward wage rigidities and inflation more formally. More specifically, the regression models estimate the correlation between DNWR observed in every country-year and lagged CPI inflation and its squared term. In addition, we included the lagged
unemployment rate as a control for the business cycle. Two specifications are shown in the first two columns of Table 2.1; one includes all countries except LAC and the other includes only LAC countries. As suggested by the previous graphs, there is a negative association between wage flexibility and the rate of inflation. Indeed, the number of observed nominal wage cuts increased with the disinflation process (Columns 3 and 4 in Table 2.1). These two facts are observed in all country groupings, but an important difference is apparent between LAC and the rest of the world. In the rest of the world, the incidence of downward nominal wage rigidity declines when unemployment is high, in an additional sign of wage flexibility. This does not seem to be the case in LAC, where the relationship between DNWR and unemployment is negative but not statistically different from zero. Table 1 confirms the above finding. It relates DRWR and the extent of empirical real wage cuts to inflation and unemployment. Although there is not a clear link between the rate of inflation and DRWR, in the rest of the world the frequency of empirical wage cuts increases, and the rigidity of real wages declines, with the unemployment rate. This is not the case in LAC. The interpretation of these findings demands further research. One may speculate that this is a sign of persistent wage rigidities in LAC, as wage cuts are less sensitive to the rate of unemployment. However, the results might also be driven by the large and dynamic nature of the informal sector in LAC, or other atypical forms of employment or underemployment, which act as a buffer in recessions.

Table 2.1. Inflation, Unemployment and DNWR

<table>
<thead>
<tr>
<th></th>
<th>FWCP</th>
<th>Percentage Empirical Wage cuts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>World</td>
<td>LAC</td>
</tr>
<tr>
<td>Inflation</td>
<td>2.226***</td>
<td>1.640***</td>
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<tr>
<td></td>
<td>(0.265)</td>
<td>(0.436)</td>
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<tr>
<td>Inflation squared/1000</td>
<td>-17.65***</td>
<td>-10.98***</td>
</tr>
<tr>
<td></td>
<td>(2.637)</td>
<td>(4.172)</td>
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<tr>
<td>Unemployment Rate</td>
<td>-2.508***</td>
<td>-0.0356</td>
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<tr>
<td></td>
<td>(0.428)</td>
<td>(0.937)</td>
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<tr>
<td>Constant</td>
<td>15.73</td>
<td>43.71***</td>
</tr>
<tr>
<td></td>
<td>(38.73)</td>
<td>(13.61)</td>
</tr>
</tbody>
</table>

| Country Effects | Yes | Yes | Yes | Yes |
| Observations    | 1,116 | 200 | 1,180 | 251 |
| R-squared       | 0.282 | 0.404 | 0.409 | 0.581 |

Note: Unemployment, inflation and inflation squared are lagged one year. Standard errors in parentheses. *** 0.01, ** p<0.05, * p<0.1
Table 1.2. Inflation, Unemployment and DRWR

<table>
<thead>
<tr>
<th></th>
<th>FWCP</th>
<th>Percentage Empirical Wage cuts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>World</td>
<td>LAC</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.423</td>
<td>0.551</td>
</tr>
<tr>
<td></td>
<td>(0.328)</td>
<td>(0.528)</td>
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<td>Inflation squared/1000</td>
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<td>-1.282</td>
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<td></td>
<td>(3.327)</td>
<td>(4.966)</td>
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<tr>
<td>Unemployment Rate</td>
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<td>(1.158)</td>
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<td>Constant</td>
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<td></td>
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<td>(15.93)</td>
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<tr>
<td>Country Effects</td>
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<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
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<td>95</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.154</td>
<td>0.303</td>
</tr>
</tbody>
</table>

Note: Unemployment, inflation and inflation squared are lagged one year. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

2.4. Conclusions

The first section of this chapter examined the extent of downward nominal and real wage rigidity in Brazil and Uruguay before and after macroeconomic stabilization. In contrast with Uruguay, DWNR was relatively unimportant in Brazil during 1995-2002. There was more DRWR, which remained relatively stable throughout the period of analysis. Furthermore, Brazil experienced an important regime shift: in the beginning, the focal point that served as a threshold for real wage adjustments closely tracked the minimum wage, but after several years of low inflation and the advent of inflation targeting in 1999q2, the focal point in wage negotiations shifted towards the rate of inflation.

The reasons behind the decline of wage indexation in Uruguay, and the persistence of the same phenomenon in Brazil remain an open issue for future research. As a point of departure, these patterns appear to be consistent with the different trends of unionization in the two countries taking place over the same period. While we observe a decline in union density and a strong movement towards decentralization in wage negotiations in Uruguay, union coverage remains fairly high and stable in Brazil.

The international industry-level evidence presented in the second section of this chapter suggested that there is a positive correlation between the degree of wage rigidity observed in industry data and the rate of inflation: nominal wage rigidity falls as inflation declines. Also, nominal wage cuts increased with disinflation. These two facts are observed in all country groupings. However, LAC might be different in
some important aspects. Perhaps the most important is that, in contrast with other regions, the disinflation process appears to have brought an increase in downward real wage rigidities. A second aspect to be highlighted is that in the rest of the world, the extent of downward wage rigidity declines when unemployment is high, but this might not be the case in LAC, where the relationship between DNWR and unemployment is negative but not statistically different from zero. The interpretation of this finding demands further research. One may speculate this to be a sign of persistence of wage rigidities in LAC, as wage cuts are less sensitive to the rate of unemployment. However, the result might also be driven by the large and dynamic nature of the informal sector in LAC, which is the object of study in the next Chapter.
Chapter 3. The Micro-dynamics of Cyclical Behavior and Informality

Summary: This chapter examines the micro dynamics of cyclical labor market behavior and how they relate to the cyclical patterns of aggregate wages and employment discussed in previous chapters. It focuses on how the interactions of gross flows between sectors determine the movements in employment aggregates. It confirms that Brazil and Mexico follow the pattern found in the United States; the formal sector shows greater volatility in hiring than firing across the cycle, and, in addition, hiring volatility is large relative to the informal sector. This difference in the relative response to productivity shocks importantly drives aggregate movements in relative formal and informal sector sizes across the cycle. It then examines whether these accessions into the formal sector are truly analogous to the advanced country literature—effectively hires into formal firms from unemployment or other sectors— or rather represent formalization of workers in existing firms. In finding the former to be largely the case in Mexico, it draws on the mainstream literature on the source of the excess responsiveness of hiring to productivity shocks. A leading theory is that wages are insufficiently flexible in response to shocks, thereby forcing a large quantity adjustment. Using data from Brazil, it shows that, in fact, the wages of both new hires and continuing workers are less responsive in the formal sector than those in the informal sector. As in the mainstream literature, this emerges as a partial explanation for the observed differences in hiring volatility.

3.1 Introduction
How are the micro dynamics of the quantity side of the labor market adjusting along the business cycle? How do they relate to the cyclical patterns of aggregate wages and employment described in Chapter 1? Recent regional work (See Informality: Exit and Exclusion, Bosch and Maloney 2009, 2010) stressed the importance of studying the gross labor flows underlying labor force reallocations to understand the mechanisms of adjustment of labor markets, particularly during crisis, to inform the design of safety net programs.

At any moment in time, changes in any labor market indicator, such as the unemployment rate, or the share of formal employment, are driven by changes in flows into and out of those employment states from and to other states. A change in the unemployment rate, for example, could be supported with a various combinations of flows. In the US literature, for example, Shimer (2007) and Hall (2005) among others have argued that most new unemployment is caused by employers ceasing hiring, rather than firing workers. Bosch and Maloney (2008) show that a decline in accessions to formal employment appears to be the case as well in Latin America: most of the decline in formal employment (and rise in informal employment) in downturns is due to a reduction in hiring in the formal sector as opposed to increases in separations.

This chapter focuses on confirming this finding of “excess volatility” in formal sector hiring, and then expanding our understanding of it in two dimensions. First, a large literature beginning with de Soto argues that the critical margin of formalization occurs with small firms attempting to become formal. That is, potentially what Bosch and Maloney identify as “formal hiring” could be firms formalizing their
existing workers. Loayza and Rigolini (forthcoming) modeled the cyclical behavior of “hiring in the formal sector” as exactly the decision of firms to become more formal. If this is true, then there is a significant disconnect between the mainstream, mostly US literature, on the hiring behavior of the “formal” sector and what is occurring in developing countries. Bosch and Maloney (2011) analyze to which extent this is true- that this is the relevant margin as opposed to the mainstream one that stresses hiring into firms from unemployment or, in the developing-country analogue, hiring into formal firms from small informal firms. Second, if, in fact, this small to large firm or “intrasectoral” margin is the relevant one, then the mainstream literature trying to understand the movements in hiring is also central to understanding the behavior of Latin labor markets. Perhaps the most popular hypothesis to explaining the “excess volatility” is that, while we would expect hiring to respond to shocks to productivity, the response will be exaggerated if wages do not reflect the change in productivity. Further, to the degree that informal firms are more able to adjust wages, we may expect their reaction to productivity shocks to be substantially more muted than those found in the formal sector. Goñi (2010), in a paper commissioned for this report, tests this hypothesis.

3.2. Update of Previous Findings

Following workers as they move across sectors during several economic downturns in Brazil and Mexico, Bosch and Maloney (2008) proposed several stylized facts about how Latin America’s labor markets adjust to macro economic shocks.

First, consistent with the literature on the U.S., the share of formal employment is procyclical with an elasticity of approximately 0.2-0.3. That is, while not always the case, formal employment generally falls during recessions. Bosch and Maloney (2008) showed that this occurs primarily because of a reduction in hiring and hence greater difficulty of finding formal jobs from inactivity, unemployment and informal jobs rather than because of increased separation from formal jobs (see Appendix at the end of this report).

Second, transitions between informality and formal employment, in fact, slow down during downturns. Conversely, in recoveries, flows increase in both directions suggesting increased matching across both the informal and formal sectors of the economy. The symmetry of flows, as opposed to workers transiting unidirectionally from unemployment to informality to formality to retirement suggests that job matches in the informal sector are not generally considered inferior. The queuing view of informality as disguised informality is true for some, but not the majority of those holding informal jobs.

More generally, the cyclical patterns can be more complex depending on the nature of the economic shock. From 1988-91 in Mexico, the informal sector expanded during the boom in non-tradables-construction, services, transport, a pattern also found in Brazil and Colombia at various times (Fiess et al 2008). However, the present shock is originating from the exterior largely through demand for exports which tend to be more formal sectors. The more straightforward interpretation as a negative shock to the formal sector is appropriate.
The unemployment rate is countercyclical, rising as output falls, with an elasticity with respect to output of roughly -4.5. It is driven primarily by increased job separations of informal workers. Shedding of workers from the formal sector, while important, has not been the dominant driver.

Informality tends also to be countercyclical, not primarily because of increased shedding from the formal sector, but because unemployed workers cannot find jobs in the formal sector. Fundamentally, informal job finding rates show much less cyclical volatility than formal ones and hence the sector winds up hiring a disproportionate number of job seekers in downturns.

Together, these stylized facts offer an updated mechanism of the informal sector as a safety net, although without the connotation of a general inferiority of informal employment. The sector absorbs the majority of the newly unemployed, and contributes most to changes in unemployment. However, it is not primarily a direct safety net for those losing formal sector jobs.

Running through these stylized facts is a central critical fact: transitions into the formal sector from the rest of the labor market are extremely volatile across the business cycle while those into informality are less so. Figures 3.1a and 3.1b extend Bosch and Maloney to the present and show cyclically adjusted rates of separation from the formal sector. What is clear in both Brazil and Mexico is that the most volatile sector in terms of separations into unemployment are the informal self employed, followed by the informal salaried. The least volatile are the formal.

Figures 3.2a and 3.2b extend the series for accessions into formality from unemployment, again, for Brazil and Mexico. Here, the most volatile series tends to be the formal sector. Again, as Bosch and Maloney 2008 and the Appendix show, it is the shutting down of formal hiring in downturns that drives the reduction in the size of the formal sector and the continued hiring in the informal sector that drives the relative patterns of sectoral allocation observed.

Tables 3.1a and 3.1b confirm this. For both countries, flows out of the labor force and out of unemployment into formal employment are much more responsive to either unemployment or output as a measure of the cycle, than flows to the other sectors. The reverse is the case for flows out of formality into OLF or unemployment.

**Figure 3.1a: Employment Separations by Initial Sector- Brazil**
Figure 3.1b: Employment Separations by Initial Sector - Mexico

Figure 3.2a: Brazil: Accessions to Employment from Unemployment
Figure 3.2b: Mexico: Accessions to Employment from Unemployment
### Table 3.1a: Brazil: Correlations of Sectoral Flows and Cyclical Variables (1982-2010)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>OLF_SE</th>
<th>OLF_INF</th>
<th>OLF_FOR</th>
<th>UNM_SE</th>
<th>UNM_INF</th>
<th>UNM_FOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT</td>
<td>-0.404**</td>
<td>0.511**</td>
<td>1.675***</td>
<td>-1.131***</td>
<td>1.113***</td>
<td>3.230***</td>
</tr>
<tr>
<td></td>
<td>(0.202)</td>
<td>(0.239)</td>
<td>(0.258)</td>
<td>(0.232)</td>
<td>(0.198)</td>
<td>(0.594)</td>
</tr>
<tr>
<td>%UNM</td>
<td>0.094**</td>
<td>-0.158***</td>
<td>-0.580***</td>
<td>0.336***</td>
<td>-0.305***</td>
<td>-1.011***</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.043)</td>
<td>(0.047)</td>
<td>(0.053)</td>
<td>(0.036)</td>
<td>(0.061)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>SE_OLF</th>
<th>INF_OLF</th>
<th>FOR_OLF</th>
<th>SE_UNM</th>
<th>INF_UNM</th>
<th>FOR_UNM</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT</td>
<td>-0.578***</td>
<td>0.239</td>
<td>0.208</td>
<td>-4.338***</td>
<td>-2.865***</td>
<td>-0.340</td>
</tr>
<tr>
<td></td>
<td>(0.134)</td>
<td>(0.182)</td>
<td>(0.256)</td>
<td>(0.469)</td>
<td>(0.227)</td>
<td>(0.318)</td>
</tr>
<tr>
<td>%UNM</td>
<td>0.158***</td>
<td>-0.095**</td>
<td>-0.228***</td>
<td>1.341***</td>
<td>0.769***</td>
<td>0.068</td>
</tr>
<tr>
<td></td>
<td>(0.033)</td>
<td>(0.038)</td>
<td>(0.057)</td>
<td>(0.066)</td>
<td>(0.037)</td>
<td>(0.073)</td>
</tr>
</tbody>
</table>

### Table 3.1b: Mexico: Correlations of Sectoral Flows and Cyclical Variables (1987-2006)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>OLF_SE</th>
<th>OLF_INF</th>
<th>OLF_FOR</th>
<th>UNM_SE</th>
<th>UNM_INF</th>
<th>UNM_FOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT</td>
<td>-0.049</td>
<td>0.215</td>
<td>1.353***</td>
<td>-1.773***</td>
<td>0.615**</td>
<td>3.563***</td>
</tr>
<tr>
<td></td>
<td>(0.221)</td>
<td>(0.157)</td>
<td>(0.323)</td>
<td>(0.317)</td>
<td>(0.236)</td>
<td>(0.460)</td>
</tr>
<tr>
<td>%UNM</td>
<td>-0.015</td>
<td>-0.112***</td>
<td>-0.491***</td>
<td>0.230***</td>
<td>-0.174***</td>
<td>-0.887***</td>
</tr>
</tbody>
</table>
The literature on informality is extremely noisy. In addition to the multiple and often conflicting definitions of the sector, there is no clarity on which margin of the decision to become formal (or informal in the case of a downturn) is the important one. In Argentina, the concern is with large firms that mix both workers with mandated benefits, and those without. On the other hand, De Soto’s seminal work, and much of the doing business literature it inspired, focuses on the difficulties of small firms becoming formal. Finally, the literature broadly descending from Harris and Todaro (1970) focuses on transitions between workers in small informal micro firms and larger formal firms.

The margins of flows out of informality are central for two reasons. First, we need to know which margin is central for formalization if we intend to support it. Second, from the point of view of understanding the cyclical behavior of the labor market, it matters if the transitions into formality described above really are analogous to flows from unemployment into employment in the US, or whether, perhaps, as Loayza and Rigolini (forthcoming) have argued, the relevant margin across the business cycle is whether firms themselves formalize. If the latter is the case, then the discussion about hiring and firing costs becomes somewhat moot.

To approach the issue, Bosch and Maloney (2011) break apart the observed transitions from informal to formal firms into types. More specifically, given a transition into formality, they ask what fraction is arguably within firm and what fraction is arguably moving from micro firms into larger firms. This requires a panel survey that permits definition of informality on the basis of participation in social protection schemes, and that allows breakdowns by reasonably disaggregated level of firm size.

Source: Bosch and Maloney (2011)
Mexico’s ENOE permits this. Regrettably Brazil, while introducing firm size into the new PME, does so at such a high level of aggregation as to be unhelpful for our purposes here. Hence, we focus on Mexico.

Table 3.2 documents shares of informal workers by firm size: in firms of 5 or below we find 77 percent of the informal defined as being uncovered by the Mexican social security system; 85 percent of informal workers are employed in firms of 10 or less. The Argentine concern about a large share of informal workers in large firms, while overstated in that case, seems inapplicable in the Mexican case.

Table 3.2. MEXICO: Distribution of Informal Workers by Firm Size (2001)

<table>
<thead>
<tr>
<th>Firm Size</th>
<th>Share of Firm Workers that are Informal</th>
<th>Distribution of Informal Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>97</td>
<td>35</td>
</tr>
<tr>
<td>2 to 5</td>
<td>90</td>
<td>42</td>
</tr>
<tr>
<td>6 to 10</td>
<td>50</td>
<td>7</td>
</tr>
<tr>
<td>11-15</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>16-50</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td>51-100</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>101-250</td>
<td>12%</td>
<td>1</td>
</tr>
<tr>
<td>+250</td>
<td>7%</td>
<td>6</td>
</tr>
<tr>
<td>Total All Sizes</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Bosch and Maloney (2011), based on the National Urban Employment Survey (ENEU). Note: Informal workers are both self employed and salaried who are not covered by labor benefits.

Based on this, the question can be phrased as “if I observe an informal worker becoming formalized, is it due to a small firm of, effectively under 5 workers, become larger and/or formalizing, or a worker in a small firm moving to a larger formal firm.”

Table 3.3 explores this question. For each of the two dominant size categories of firms, 1 and 2-5, we ask if the transition to formality was accompanied by a change to a much larger firm size, defined as jumping two size categories, or by staying, plausibly, within the same firm, defined as moving at most one firm size? This classification is admittedly very crude and likely understates the movement to larger firms. The probability that in one year, a firm of 1 worker will grow to 6-10, or a firm of 2-5 workers will grow to 11-15 is fairly low. Nonetheless, we can be fairly sure that we are not mistakenly classifying
growing/formalizing firms as transitions to big firms and hence are giving the De Soto margin the best odds.

The results are strikingly against the de Soto view, however. Of those self employed (of size 1) who became formal, only 13.7 percent stayed within firms with less than 5 workers. Of those that started in firms with 2-5 workers, only 34.9% stayed in firms with 2-20 workers. That is, a maximum of 25% of formalizing workers did so within the small firms and probably much less. Hence, despite de Soto’s emphasis on reducing registration costs, in the hopes of increasing formalization, the bulk of the action appears to be in getting informal workers into larger formal firms. It could be argued that we observe few within firm-size transitions precisely because the barriers are so high. However, as Bruhn (2008) has shown, the response to lowering registration costs in Mexico was largely to increase flows from salaried workers into small formal businesses, not the formalization of small businesses.

Table 3.3. The Change in Firm Size Associated with the Transition to Formal Employment

<table>
<thead>
<tr>
<th>Initial Firm Size</th>
<th>Destination Firm Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2.1</td>
</tr>
<tr>
<td>2 to 5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: Bosch and Maloney (2011), based on the ENEU panel.

Figures 3.3a and 3.3b plot these transitions over the cycle in a way that is consistent with figures 3.2a and 3.2b above. Figure 3a first asks, of those accessions observed of workers found in firms of five workers or less, what fraction occurred within the current or next size category, and what fraction were to firms of larger than one additional category (inter sectoral transitions)?

In 2001, roughly 70% made inter sectoral transitions. It is striking that they occurred within a steady rise over time. The share of accessions today occurring across the intra sectoral margin is perhaps 10 to 20 percentage points higher than it was in 1987. Understanding the source of this trend is beyond the purview of this report, but it does merit further attention.

In addition, we find relative pro-cyclicality in the share of accessions to large firms consistent with the findings of procyclical hiring into the formal sector. It is most clear in the Tequila crisis when the share of accessions into larger firms falls by just more than 5 percentage points. What is not clear, from this figure are the absolute magnitudes of these flows. Figure 3.3b plots the probability that an informal worker in a firm of under 5 workers would transit to formality, either in a larger or smaller firm. Two findings merit note. First, again looking at 2001, the absolute probabilities are roughly twice moving to large firms than to same size firms. Second, the observed cyclical occurs virtually entirely from inter sectoral (between firm) transitions, with within firms maintaining a downward trend with relatively little
cyclical pattern. This suggests that the relevant place to study the hiring and firing decisions is, as in the US, in the hiring decisions of larger firms.
**Figure 3.3a:** Share of transitions of informal workers in firms of less than 5 employees that occur within the firms, vs. moving to a larger firm.

**Figure 3.3b:** Transition probabilities of informal workers in firms of less than 5 employees that occur within the firms, vs. moving to a larger firm.
3.4 Wage Adjustments in the Informal and Formal Sectors

Hence, we are again back to understanding why “formal” firms’ hiring shuts down while informal hiring does not. Put differently, what accounts for the “excess volatility” in formal sector hiring beyond what would be dictated by productivity shocks alone. Given a pattern of shocks to firms that translate into shifts in the demand curve for labor, why does this manifest itself in such large fluctuations in hiring? Attention has focused on the inability of wages to adjust to reflect shifts in the productivity of labor, hence firms adjust through quantities (see Shimer etc). And in fact, a large US literature suggests poor empirical correlation between aggregate measures of wages and aggregate measures of productivity. Indeed, the traditional view that wages are sticky over the cycle was commonly derived from aggregate time-series. Since almost by definition, the informal sector is not subject to many labor market regulations, it presumably could adjust wages more easily and hence, continue hiring, albeit at lower wage, and explain the patterns discussed above.

Several concerns arise about this explanation, however. First, doubt has been cast on Shimer’s explanation of wage rigidities as the source of reduced hiring. In simulations the effect is not large enough to generate the documented variability in hiring. Second, the more recent literature (see especially Pissarides 2009)\(^{15}\) stresses that, from a conceptual point of view, hiring concerns the marginal worker and hence the relevant question is whether the wages of new hires are flexible. Haefke et al. (2008) has shown that in the US, wages of new hires are, in fact, very flexible with wages of new hires moving one for one with productivity shocks.

Second, it is not so clear that the informal sector is not bound at least in normative ways, to official regulations. Other regional studies (See Maloney and Nunez 2004, Cunningham 2007) have shown that wage distributions of informal workers tend to be even more affected by minimum wage regulation than formal workers. Hence, as an alternative hypothesis, it may still be that there is something in the nature of the micro firms that dominate the informal sector that is responsible.

To evaluate the first hypothesis, Goñi (2011) follows the recent literature on measuring the degree to which wages respond to changes in firm productivity, using the case of Brazil. Using detailed wage data from the PME and detailed productivity data from the firm enterprise surveys, it is possible to improve upon studies that look purely at aggregates across time. Using the PME panel, the wage behavior of three kinds of workers are studied: (1) “new hires” who were not working prior to the present job; (2) “movers” who moved directly to a new job from a previous job; and (3) “stayers” who, across the period, remain in the same job. The sample is further divided into formal and informal firms, the latter being defined as those firms with five workers or less.

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\(^{15}\) For instance, Pissarides (2009) shows that the job creation condition that drives the volatility of the job finding rate depends on the wage bargain in new jobs. Moreover, he claims that time-series or panel studies on the cyclical volatility of wages show considerable stickiness, but this evidence is dominated by wages in ongoing jobs and it is not relevant for job creation in the search and matching model. He also claims that an examination of panel data evidence on the volatility of wages in new jobs shows that volatility is about the same as in the Nash wage equation of the canonical search and matching model.
Figure 3.4 plots wages against productivity (in shaded area) for the different groups. It is clear from the formal sector that there is a loose tracking of wages and productivity, and, as expected, hires show the greatest volatility and stayers (workers already in the firm) the least. The informal sector shows somewhat distinct patterns. Overall, the variance of all series is higher than that of the formal sector and, in fact, stayers and new hires appear to be the most volatile.

Table 3.4 analyzes these patterns more formally. To begin, the results are consistent with the U.S. literature. In the formal sector, the wages that are least responsive to productivity shocks are those of stayers. In fact, their earnings show a high degree of persistence of almost .8, and no impact of
productivity changes and hence, no significant long run impact either. At the other extreme, new hires respond strongly almost 1 for 1 in the short run to productivity shocks although a somewhat counterintuitive autoregressive terms drops this to .74 for the long run coefficient. In between we find movers who presumably have somewhat more bargaining power over wages, or higher expectations when they leave an existing job. But even here, wages move roughly half of the changes in productivity. Together, movers and new hires show an elasticity of between 0.5 and 0.74, suggesting substantial room for over adjustment on the quantities side. If we believe that it is not just the marginal worker, but the response of all workers whose response is relevant, then the long run elasticity is only slightly above 0.32.

| Source: Goñi (2011) |

<table>
<thead>
<tr>
<th></th>
<th>Formal</th>
<th>Informal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lag</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>0.53</td>
<td>0.24</td>
</tr>
<tr>
<td>New hires</td>
<td>-0.371</td>
<td>-0.046</td>
</tr>
<tr>
<td>Movers</td>
<td>0.446</td>
<td>0.097</td>
</tr>
<tr>
<td>Stayers</td>
<td>0.778</td>
<td>-0.203</td>
</tr>
<tr>
<td><strong>SR elasticity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>0.151</td>
<td>0.656</td>
</tr>
<tr>
<td>New hires</td>
<td>1.007</td>
<td>0.846</td>
</tr>
<tr>
<td>Movers</td>
<td>0.279</td>
<td>0.759</td>
</tr>
<tr>
<td>Stayers</td>
<td>-0.012</td>
<td>0.564</td>
</tr>
<tr>
<td><strong>LR elasticity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>0.321</td>
<td>0.863</td>
</tr>
<tr>
<td>New hires</td>
<td>0.735</td>
<td>0.809</td>
</tr>
<tr>
<td>Movers</td>
<td>0.504</td>
<td>0.841</td>
</tr>
<tr>
<td>Stayers</td>
<td>-0.054</td>
<td>0.469</td>
</tr>
</tbody>
</table>

The view from the informal sector is very different, however. The overall elasticity of both incumbent and new workers approaches 0.9, suggesting that earnings of the entire work force responds greatly to productivity shocks. Again, this is largely driven by new hires and movers who both show values above 0.8, which is higher than the elasticity of stayers at 0.47. That said, all of these elasticities are significantly higher than those of the formal sector and suggest that the informal sector, in spite of what wage density plots tell us, are more flexible downward than is the case in the formal sector.

This does not, for a minute, rule out other characteristics of small vs. large firms as shaping their relative hiring volatilities across the business cycle. However, it does suggest that we cannot rule out relatively more rigid wage behavior in the formal sector as driving the differences.

### 3.5. Conclusions

Studying gross labor flows lifts the hood on the cyclical patterns of aggregate wages and employment discussed in previous chapters and allows us to understand underlying micro dynamics. The chapter updated and confirmed previous findings that Brazil and Mexico follow the pattern found in the United States, namely that the formal sector shows greater volatility in hiring than firing across the cycle. In addition, this hiring volatility is large relative to that found in the informal sector. This difference in the relative response to productivity shocks importantly drives the aggregate movements in relative formal and informal sector sizes across the cycle.

This shown, the chapter then finds that these accessions into formal-sector employment are more analogous to the advanced country literature -- effectively hires into formal firms from unemployment or other sectors -- than representing formalization of workers in existing firms a la de Soto. Hence, the
analytical work developed in the advanced countries to explain the high responsiveness of hiring to productivity shocks is potentially applicable in the developing world as well, at least in important Latin American economies. A leading theory is that wages are insufficiently flexible in response to shocks and hence force a large quantity adjustment. The data from Brazil suggest that in fact, the wages of both new hires and continuing workers are less responsive in the formal sector than those in the informal sector. As in the mainstream literature, this emerges as a partial explanation for the observed differences in hiring volatility.
Chapter 4. Trade and Labor Market Adjustments: The Case of the Maquila Economy in Northern Mexico during the Great Recession

Summary: This chapter studies the wage and employment responses of formal labor markets in Northern Mexico during the United States recession of 2007-09 by focusing on the correlations with Mexico-U.S. trade flows. The main finding is that most of the adjustment took place through employment rather than wages, in spite of the severity of the decline in trade. In addition, there were notable changes in the composition of the employed labor force during the crisis period. Overall the evidence from the study by Kaplan, Lederman and Robertson is consistent with existence of nominal wage rigidities in low inflation environments discussed in previous chapters.

4.1. Introduction

The essential question addressed in this chapter is: How do labor markets adjust in the short run when hit by a sudden trade shock? We seek answers from the experience of the Northern states of Mexico that lie on the border with the United States during 2007-2009. On the one hand, this case might appear to be unique and thus the findings could be thought to be irrelevant for most LCR economies. On the other hand, the setting, which covers the effects of the sudden collapse of bilateral trade between Mexico and the United States during late 2008, allows the analysis to trace how a truly exogenous shock through trade flows affected a labor market in a relatively straightforward empirical analysis. Furthermore, the results could be instructive for numerous other LCR economies, such as those of Central America and the Caribbean, which are also highly integrated with the U.S. economy through export-processing zones and other arrangements characterized by a high incidence of “vertical” trade. The latter refers to trade flows between trading partners where the manufacturing economy relies on imported inputs to assemble final goods for exporting to the U.S. Finally, the labor market of Northern Mexico examined in this chapter affected approximately four million workers, and thus it is large on its own.

Perhaps more importantly, we can treat the trade shock as a sort of natural experiment that allows us to trace its consequences throughout the labor market in a low inflation environment, thus allowing for an assessment of how employment and wages responded to the shock strictly in the short run (i.e., in a matter of quarters rather than years). More comprehensive analyses of the relationship between business cycles, employment and wages covering other economies of LCR and elsewhere were covered in the previous chapters, but few other analysis can so clearly focus on the effect of one type of shock (trade, in this case) on both employment and wages simultaneously.

It turns out that the experience of Northern Mexico during 2007-09 is consistent with the findings from the previous chapters. First, the evidence provided by Kaplan, Lederman and Robertson (2011) suggests that the adjustment of labor market was dominated by employment quantities rather than adjustments.

16 This chapter borrows heavily from Kaplan, Lederman and Robertson (2011).
in wages. Sure, there were notable reductions in wages, but they were comparatively small relative to the observed changes in employment and a portion of the change in average wages was importantly due to changes in the composition of employed workers rather, than changes in wages of workers who remained employed. In other words, the most important change in wages was due to changes in quantities and the quality of employment, rather than straightforward changes in employment. In this sense, the evidence discussed herein is entirely consistent with the previously discussed view that in low-inflation and open LCR economies most of the adjustments are coming through changes in quantities of employment rather than wages.

Second, and this might be a unique feature of vertically integrated economies, imports appear to be complements to workers. That is, when imports fell, employment also fell (after controlling for exports, industry characteristics, and time-period effects). Furthermore, the shock was associated with general equilibrium effects, whereby shocks to one industry affected employment in other industries. And the evidence suggests that these effects are consistent with the view that the labor market in Northern Mexico as a whole behaves like one big maquila operation. More specifically, the evidence compiled by Kaplan, Lederman and Robertson (2010) indicates that when an industry declines due to a negative trade shock (i.e., decline in exports to the U.S.) other “related” industries are also negatively affected. It is noteworthy that if industries were related by worker mobility across industries due to worker characteristics (such as occupations) the result would have been the opposite.

All of these results are not only relevant for the broader narrative of this study, which focuses on the role of employment versus wages as the margins for adjustment, but they are also relevant for policy discussions in the region. In particular, they are relevant for both long-term policies such as trade policies and short-run policies related to social protection.

The rest of this chapter is organized as follows. The next section 2 summarizes the main characteristics of the trade shock that affected Northern Mexico in late 2008 by focusing on how the trade shock itself was characterized by changes in quantities versus prices (unit values), as well as on how the relevant labor market responded in terms of employment and wages. Section 3 argues by relying on descriptive evidence that the trade shocks had inter-industry spillovers in the sense that a fall in trade in one industry very likely affected employment in other industries within Northern Mexico. Section 4 briefly discusses two econometric models estimated by Kaplan, Lederman and Robertson, which shed light on how variations in trade flows (both exports and imports) between Mexico and the United States affected labor markets in Northern Mexico. Section 5 concludes with a succinct summary of the main findings.

4.2. The Trade Collapse and the U.S. Recession of 2008-09

The Great Trade Collapse has received a great deal of attention both in the academic literature and popular press. The collection of essays published in Baldwin (2009) suggest the “Great Trade Collapse” between the third quarter of 2008 and the second quarter of 2009 was primarily a demand-side shock induced in large part by European Union and U.S. firms and consumers postponing purchases of consumer durables and investment goods. Eaton et al. (2009) estimate that changes in demand for
manufactured goods accounted for about 70 percent of the global decline in the incidence of international trade over Gross Domestic Product (GDP). These authors cite the World Trade Organization’s estimate that merchandise trade dropped by 23 percent in 2009 relative to the previous year—the largest drop in trade by a factor of four since World War II.

The impact of the trade collapse was especially acute in Mexico. The decline in Mexican trade was highly correlated with the decline in U.S. GDP (Robertson 2009). Mexico’s trade with the U.S. fell nearly 45 percent during the last quarter of 2008. Data from Mexico’s social security records used by Kaplan and coauthors show that formal employment in the trade-intensive Northern states fell more than 9 percent between September 2008 and March 2009. Real log wages of workers who did not lose their jobs (stayed with the same firm) fell on average by 0.001 log points between the end of September 2008 and the end of December 2008 and by 0.012 log points between December 2008 and March 2009. As exports and imports with the United States began to recover in the second quarter of 2009, employment and wages recovered as well. Since this shock originated outside of Mexico, and there have been few, if any, suggestions that factors within Mexico induced the crisis, we consider the shock to be reasonably exogenous from Mexico’s point of view.

Perhaps most relevant for this volume, it is notable that such a huge trade shock, which resulted in a large number of lost jobs, affected wages for individual workers only slightly in real terms. In nominal terms, the average wage of workers who stayed with their employers actually increased during the crisis quarters. In the fourth quarter of 2008 the average nominal wage of stayers increased by 1.7 percent, as consumer-price inflation (quarter-on-quarter) reached 2.5 percent. Consequently it is fair to conclude that nominal wages of individual employed workers were forcefully rigid downwards, and the slight uptick in inflation probably helped reduce the loss of jobs somewhat.

Furthermore, the data on bilateral trade between the U.S. and Mexico suggest that trade flows themselves adjusted mainly via quantities. A simple statistical calculation with data from U.S. customs transactions helps support this claim. The data provide information on quantities and values of Mexican exports to and imports from the U.S. at the product level, from which unit values can be computed at the product level. Utilizing monthly data at the 6-digit level of the Harmonized System (HS) of trade statistics, Kaplan and coauthors computed the variation coefficients for unit values and quantities within products. For exports they found that the variation coefficient of quantities was 0.49 and for unit values it was 0.22. On the import side, the corresponding variation coefficients were 0.59 and 0.26, respectively. And these number under-state the variation in quantities, because they ignore products with zero trade flows. If the zeroes were taken into account the variation coefficients of quantities would be greater than one, whereas the variation coefficients for unit values would remain the same.

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17 These inflation numbers are based on the Banco de Mexico’s national CPI index. In the Northern city of Monterrey, Nuevo Leon, inflation was a bit higher in the last quarter of 2008 and it was about 3 percent.
because they cannot be computed.\(^{18}\) Hence the variation of quantities in bilateral trade flows between Mexico and the United States was at least twice as large as the variance in unit values (a proxy for prices). Conceptually, this makes sense in the context of vertical integration arrangements where final goods distributors in the U.S. place orders in terms of quantities from the manufacturers in Mexico. Thus it is plausible that the observed huge drop in the number of jobs (especially large when compared to the small temporary fall in average real wages and the rise in average nominal wages of stayers) was in part a result of the type of contractual arrangements that are expected to predominate in such a trading environment.

### 4.3. Trade and Inter-industry Spillovers

Thus far we have argued that the variation in trade was dominated by the variation in quantities of goods traded and that the labor market in Northern Mexico responded mostly via adjustments in employment rather than wages. However, from the viewpoint of the literature on trade and labor, it is important to understand how the trade shock spread through the labor market across industries. For instance, Ebenstein et al. (2009) argued that econometric estimates of the effect of trade shocks on wages within industries can be attenuated by labor mobility across industries. That is, if we are interested in knowing exactly how the decline in trade between Mexico and the U.S. affected wages of workers initially employed in one industry, we also need to take into account that affected workers who lost their jobs could have found employment in other industries, thus driving down wages in those alternative industries as well. But standard empirical models linking variations in trade flows with wages within industries would not identify this effect. Consequently, Kaplan and his coauthors utilized the social security employment data to study how workers moved across industries during 2007-09 and take those inter-industry transitions into account. The following section will return to the econometric estimations, but three simple graphs presented in Kaplan, Lederman and Robertson (2011) illustrate the story about inter-sector spillovers.

The solid line in Figure 1, which also appears in Kaplan, Lederman and Robertson (2011), shows the evolution of employment in tradable industries in Northern Mexico during 2007-2009 on a quarterly basis.\(^{19}\) The dashed line in the graph shows the evolution of the value of Mexican exports to the U.S. The over-time correlation between these two variables is clearly high. Figure 2 plots employment in non-tradable industries, as well as Mexico’s exports. Surprisingly, it appears that the employment in non-traded industries was highly correlated with exports for most of the period, even more so than employment in traded-goods industries. Nonetheless, Figure 3 shows that the relative changes in the

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\(^{18}\) That is, zero divided by zero is not defined and therefore unit values cannot be computed for product-time periods with zero trade. In contrast, the variation coefficient for quantities can be computed with items with zero quantities traded.

\(^{19}\) Tradable industries are those for which Kaplan, Lederman and Robertson (2011) were able to find a correspondence between the IMSS industry of employment categories and the HS trade classification. Any industry for which the authors were unable to find a match were considered as “non-tradable” industries.
number of employed workers in non-traded industries did fall proportionately less during the crisis quarters. Still, it is clear that non-traded industries were not immune to the trade shock, thus suggesting that the shock got diffused through the labor market through inter-industry employment spillovers. Alternatively, the rise of unemployment brought a fall in demand for non-tradable goods and services.

Finally, as final piece of evidence suggesting that these dramatic changes in the number of employed workers was associated with changes in average wages due to changes in the composition of employed workers rather than due to changes in wages of stayers. Figure 4 plots the difference between the change in the average wage of stayers minus the change in the average wage of all employed workers within the same industry. It covers both tradeable and non-tradable industries. In the tradable industries, the change in the average wage of stayers relative to that of the average employed worker was negative in the fourth quarter of 2008. As demonstrated in Box 1, this difference can be attributed to changes in the composition of workers employed in each industry, with a decline reflecting an improvement in the average “quality” of employed workers. In other words, the trade shock produced not only dramatic variation in the number of jobs, but it also affected the types of workers who retained and found employment. Essentially, employers tended to upgrade the quality of their labor force during the downturn.

Box 1. Changes in the Average Wages of Stayers versus Changes in Average Wages of All Employed Workers Reflected Changes in the Average “Quality” of Workers

Consider the following wage-setting process:

\[ \ln(w_{w,s,t}) = \alpha_w + \gamma_{i,t} + \bar{\varepsilon}_{w,f,t}, \]

where \( \alpha_w \) is a fixed effect for each worker and \( \gamma_{i,t} \) is a time varying industry or sector effect.

The wage change of stayers reduces to \( (\gamma_{i,t} - \gamma_{i,t-1}) \) since the worker-specific fixed effects disappear. The change in the wages of all employed workers becomes

\[ (\gamma_{i,t} - \gamma_{i,t-1}) + (\bar{\alpha}_{i,t} - \bar{\alpha}_{i,t-1}), \]

where \( \bar{\alpha}_{i,t} \) is the average person effect in industry \( i \) in time \( t \). This formulation implies that the difference between the change in average log wages of stayers and the change in average log wages of all workers in industry \( i \) in time \( t \) can be expressed as

\[ \text{diff}_{i,t} = (\bar{\alpha}_{i,t-1} - \bar{\alpha}_{i}). \]

A positive value for \( \text{diff}_{i,t} \) can be interpreted as a downgrading of average skill or human capital in the industry, whereas a negative value can be interpreted as an upgrading of skill or human capital in the industry.

Source: Kaplan, Lederman and Robertson (2011).

4.4. Estimates of Labor-Market Responses to Trade Fluctuations
The standard approach to estimating the effects of variations in trade on employment and wages is to look for within-industry effects. For instance, it is common to focus on changes in wages of workers
employed in a given industry, often utilizing data from many industries (i.e., panel data). However, as mentioned above, this type of empirical model could yield misleading results when workers can find employment in other industries, thus reducing wages in that industry and attenuating the fall in wages in the original industry. It is also plausible that a positive shock to one industry can raise wages and employment in that industry, but also indirectly raise wages of workers in other industries who face similar shocks. This would be the case, for example, of a trade shock affecting an industry as well as the industries that supply inputs of production; a positive shock to one industry implies a positive shock to the whole supply chain.

In addition to considering inter-industry spillovers through the labor market, another novel feature of the estimations presented by Kaplan, Lederman and Robertson (2011) is related to their use of quarterly data, in contrast with most of the literature that uses annual data. Specifically, the authors experimented with leads and lags, implying that employment decisions today depend on orders for manufactured exports in the future. Hence we expect changes in employment within industries to precede exports, whereas imports of other inputs of production could be correlated with contemporaneous imports. Kaplan and coauthors call it the “time-to-build” specification, a term inspired by the seminal paper by Kydland and Prescott (1982).

Box 2 summarizes the main findings from Kaplan, Lederman and Robertson (2011). A few points are worth emphasizing in this volume. First, both trade variables, exports and imports, tend to have a positive effect on employment and wages when they are significant, suggesting that in Northern Mexico (and probably in several other economies from Central America and the Caribbean) imports are complements of labor rather than competing against domestic industries for domestic consumers. Second, the effects of related imports, meaning variations in imports in industries related via employment mobility with a given industry, affects both employment and the wages of stayers. Perhaps more interestingly, for every type of shock, employment was more responsive than wages, as evidenced by the higher employment elasticities. Finally, trade appears to be associated with changes in the composition of employment, which is reflected in the significant results concerning the difference between the changes in wages of stayers minus the changes in wages of all employed workers.

4.5. Concluding Remarks
This chapter began by noting that in low inflation environments, quantity adjustments in labor markets are likely to dominate over adjustments in wages. In addition, we noted that in economies characterized by vertical integration, whereby foreign buyers of final goods buy fixed numbers of products at global prices, trade itself is likely to affect economies through variations in quantities rather than prices. We further noted that the experience of Northern Mexico during the so-called Great Trade Collapse of 2008 provided an unfortunate but quasi-natural experiment that could shed light on quantity and wage adjustments in single labor market affected by clearly identified shock.

The work by Kaplan and coauthors provided just this type of quasi experimental evidence. And the results appear to support the broader argument of this volume: labor markets in LCR tend to adjust through quantities, that is, by affecting mostly the number of jobs available, rather than wages. This
does not mean that wages are totally fixed; in fact, average wages can be observed to change especially at the industry and national level, as noted in Chapter 2. However, this case study also suggests that such changes in wages can be at least partly due to changes in the composition of the employed labor force, but these compositional changes do not necessarily affect employment or unemployment rates.\(^{20}\)

The last statement also implies that average relative wages can also change, even when most of the adjustment comes via changes in the number of available jobs. The following Chapter 5 investigates the how the average wage of skilled workers relative to unskilled workers in several LCR countries vary in response to different types of shocks. This evidence reviewed in this chapter suggests that at least some types of economic shocks (or temporary economic fluctuations outside the control of workers) can have notable impacts on relative wages, thus perhaps temporarily affecting income inequality.

**Box 2. Labor Responses to Trade Shocks in Northern Mexico, 2007-09: Results from the “Time-to-Build” Model**

- Employment versus wages and vertical integration
  - Employment elasticity w.r.t. to one-period ahead exports: 0.03
  - Stayers’ wage elasticity w.r.t. to exports: 0.01
- Import competition versus imported inputs
  - Employment elasticity w.r.t. to imports ~ 0.01
  - Stayers’ wage elasticity w.r.t. to imports: ~ 0.006 (n.s.)
- Diffusion of shock through the labor market
  - Employment elasticity w.r.t. to “related” imports: 0.13
  - Stayers’ wage elasticity w.r.t. to “related” imports: 0.003 (n.s.)
- Skill upgrading: Relative wage changes of “stayers”
  - W.r.t. imports: 0.008; W.r.t. exports: 0.021
  - W.r.t. one-period ahead exports: 0.015
  - W.r.t. “related” imports: 0.065; W.r.t. “related” exports: 0.110

Notes: w.r.t. = “With respect to”; n.s. = “not significant”; ~ = approximately

Source: Kaplan, Lederman and Robertson (2011). Note: Results come from econometric models that control for time-period effects, industry-specific effects, and all explanatory variables included at the same time.

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\(^{20}\) In fact, it is plausible that more low “quality” workers are either laid off or are not hired per peso of savings for the firm.
Chapter 4 Figures

Figure 4.1. Employment in Tradable Industries in Northern Mexico and Exports to the U.S., 2007-2009

Source: Kaplan, Lederman and Robertson (2011) based on data from IMSS.

Figure 4.2. Employment in Non-Tradable Industries in Northern Mexico and Exports to the U.S., 2007-09

Source: Kaplan, Lederman and Robertson (2011) based on data from IMSS.
Figure 4.3. Net Percent Change in Employment in Northern Mexico, 2007-09
(tradable and non-tradable industries)

Source: Kaplan, Lederman and Robertson (2011) based on data from IMSS.

Figure 4.4. Average Change in Real Wages of Stayers minus Average Change in Real Wages of All Workers in Northern Mexico, 2007-09

Source: Kaplan, Lederman and Robertson (2011).
Chapter 5. Who Suffers the Burden of Adjustment? Returns to Schooling and Business Cycles in Latin America

Summary: This chapter studies the cyclical properties and determinants of the returns to schooling in twelve LCR countries. The cyclical components of returns to schooling tend to be significant in 8 out of the 12 countries, whereas long-term trends are significant in less than a handful, and the results are even stronger when unemployed workers are taken into account. The most robust determinant of cyclical fluctuations in the returns to schooling is temporary fluctuations in foreign demand for LAC exports, which tend to be positively correlated with returns to schooling. Finally, the effect of export fluctuations (driven by changes in foreign demand) seems to be attenuated by labor-market rigidities, such as constraints on employers to hire temporary workers on an hourly basis and minimum wages. From a policy perspective, it is tempting to conclude that such rigidities can stabilize the returns to schooling and thus income inequality (between skilled and unskilled workers). However, this effect needs to be weighed against their long-term costs for the economy as a whole, including the fact that rigidities are associated with quantitative impacts on labor markets.

5.1. Introduction

Thus far this report has focused on the behavior of individual and average wages and on the role of quantitative labor-market adjustments in determining average wages and the share of informal workers. This chapter turns to the dispersion of wages between skilled and unskilled workers. As such, it sheds light on the ever-lasting challenge of income inequality in the Region from a yet under-investigated prism, namely its cyclical properties. In addition, one implication of examining the cyclical properties and determinants of returns to schooling (RTS) is that the analysis can be interpreted not only as shedding light on short-term fluctuations of income inequality but also of the risk of investments in human capital, because short-term deviations from a long-term RTS imply volatility around the long-term trends in RTS.

Indeed, much work has been done to estimate the returns to schooling in LAC, including the recent study on skills gaps (Aedo and Walker, forthcoming), which tends to focus on the evolution of cross sectional estimates of the returns to schooling over time. A potential limitation of this approach is that it is hard to disentangle secular movements from business cycle fluctuations, which are the subject of this report. This chapter takes a different analytical approach, which is well suited for identifying both long-term trends and cyclical components of the returns to schooling, although not without flaws. In

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21 This chapter borrows heavily from ongoing research by Lederman and Rojas Alvarado (2011).
22 It is noteworthy that our pseudo-panel approach (see the technical Appendix at the end of the report) is probably not well suited for identifying long-term trends in RTS because it implies working with a sample of 50 or so cohorts per year, thus reducing significantly the degrees of freedom relative to the repeated Mincerian approach that utilizes thousands of observations of individual workers per year to estimate each year’s average RTS per country.
addition, with the cyclical components of the returns to schooling from a dozen LAC countries in hand, the chapter analyzes their empirical determinants.

The main findings can be summarized as follows. First, the cyclical components of returns to schooling tend to be significant in 8 out of the 12 countries, whereas long-term trends are significant in less than a handful, and the results are even stronger when unemployed workers are taken into account. Second, the most robust determinant of cyclical fluctuations in the returns to schooling is temporary fluctuations in foreign demand for LAC exports, which tend to be positively correlated with returns to schooling. Third, the effect of export fluctuations (driven by changes in foreign demand) seems to be attenuated by labor-market rigidities, such as constraints on employers to hire temporary workers on an hourly basis and minimum wages. From a policy perspective, it is tempting to conclude that such rigidities can stabilize the returns to schooling and thus income inequality (between skilled and unskilled workers). However, this effect needs to be weighed against their long-term costs for the economy as a whole, including the fact that rigidities are associated with quantitative impacts on labor markets. That is, rigidities should be evaluated by taking into account the potential reduction in hiring as well as the loss of jobs during downturns, rather than as a means to smooth out fluctuations in the skill-driven inequality.

The rest of this chapter is organized as follows. Section 2 provides a brief literature review on the cyclical properties of the returns to schooling, and highlights the literature’s lack of coverage of developing countries. Section 3 discusses methodological issues concerning estimates of the RTS (including transitory cyclical components) and presents stylized facts from repeated cross sections of employment surveys from LCR countries, which suggest that the real wages of skilled workers can, in some instances, be more volatile than those of unskilled workers, and the employment rates of these workers tend to vary over the business cycle (proxied by the aggregate unemployment rate for each country). However, there is notable heterogeneity across the twelve LAC countries in the correlation between national unemployment and employment rates within skill categories, which implies that average wages adjust differently across countries and skill categories. Section 4 studies the determinants of the cyclical fluctuations in the returns to schooling, and Section 5 concludes.

5.2. What Do We Know about Cyclical Fluctuations of the Returns to Schooling?
The relationship between returns to schooling (RTS) and the business cycle is theoretically and empirically ambiguous. As mentioned by King (1980), counter-cyclical returns to schooling are supported by theories proposed by Oi (1962) and Reder (1955). Oi (1962) and Mincer (1991) argued that if firms invest in job-specific capital for highly educated workers, they have an incentive to retain these workers and lay off less educated workers during recessions. In Reder (1955), this cyclical wage differential is explained by a quality adjustment of the workers over the business cycle. During booms, when job applicants become scarce, employers tend to lower standards for hiring, thus reducing the wage skill premium. During recessions when applicants for a given job become plentiful, skilled workers crowd out unskilled workers in recessions. Lederman and Rojas Alvarado (2011) provide an extensive review of the rather ambiguous empirical evidence from high-income economies.
The relationship between the RTS and the business cycle appears to be ambiguous in the scant literature that covers Latin American economies. For instance, Psacharopoulos et al. (1996) studied the behavior of the RTS for Mexico in 1984, 1989 and 1992, using the Encuesta Nacional de Ingresos y Gastos de los Hogares, and they found that the returns to investment in education fall during recessions and rise during expansions. In contrast, Fasih et al. (2010) found that the RTS in Mexico are countercyclical (for the period 1984-1992), and found the same behavior is found for the rates of return to education in Venezuela since the late 1990's. They also found that the earnings of educated workers were less affected by crises in Argentina than the earnings of less educated workers (in the period 1992-2002).

This literature on the relationship between the returns to schooling and economic activity does not take into account the drivers of business cycles, which might affect sectors in different ways. For instance, a rise in economic activity (above trend) might be caused by fluctuations in foreign demand for exports, which would have different effects than, say, changes in global interest rates that affect all firms’ access to credit. For instance, Brambilla et al. (2010) suggest that exports tend to be skilled-labor intensive, and thus a temporary rise in foreign demand could be associated with temporary increases in the RTS.

In brief, the existing literature has focused on high-income countries, with mixed results regarding the cyclicality of the relative wage of skilled workers. The literature on LAC economies is not deep, but it is equally ambiguous. Furthermore, neither has focused on the determinants of business cycles and their relationship with RTS. Finally, it is notable that the few studies that explicitly assess the cyclicality of LAC skill premiums or returns to schooling have relied on Mincerian estimates of the RTS using repeated cross sections of workers. The following section discusses our approach, which attempts to deal with analytical weaknesses of the standard approach and also focuses on the role of different types of transitory economic shocks.

5.3 Data, Methodologies and Stylized Facts about the Cyclicality of RTS in LCR

Although a few countries in the region have employment surveys and other data sources that follow workers over time (e.g., see previous chapters in this report), most countries do not. And in the few countries with panel data on workers, such as Brazil, Argentina, and Mexico, the resulting samples suffer from other problems, including attrition. Furthermore, panel data from social security records often does not include data on workers’ educational attainment, as is the case of the Mexican data utilized in Chapter 4.

Consequently, it seems practical to develop an approach to study the RTS for a relatively large sample of twelve LCR countries with repeated cross sections of workers. Fortunately, there is an econometrics literature precisely on how to use these data for estimating the RTS while at the same time eliminating the problem of “ability bias” that afflict the standard Mincerian estimates of RTS; the Appendix at the end of the report includes a detailed discussion of this “pseudo-panel” approach for estimating the permanent and cyclical components of RTS. It suffices to say that this approach has other analytical benefits, including the fact that it allows the researcher to control for cohort-specific effects (i.e., the year of birth of a group of workers), as well as for the potentially confounding effects of secular trends in the RTS. On the other hand, this approach brings its own challenges – it is not bulletproof. These include
the fact that for each year we work with a small number of observations (about fifty) imprecisely computed averages by cohort, and thus it should not be surprising if secular trends appear to be statistically insignificant. The important point, however, is that it allowed us to focus on the cyclical components of RTS and their determinants.

5.4. Stylized Facts about the Cyclicality of RTS in LAC
The main policy issue at hand is whether income inequality between skilled and unskilled workers fluctuates over the business cycle. As mentioned in the literature review, relative average wages can fluctuate due to variations in wages of employed workers and variations in unemployment. A corollary issue concerns the relative volatility of average wages across skills.

Figure 5.1 shows the relationship between the ratios of wages of skilled over unskilled workers (defined as workers with less than twelve years of schooling) and aggregate unemployment rates for the twelve countries in our sample.23 The blue triangles correspond to the relative wages for employed salaried (male) workers, and the red circles correspond to the relative wage for samples of workers that include the unemployed (with a wage set equal to zero). The relationship between the relative wage of skilled workers and each economy’s aggregate unemployment rate tends to be positive for most countries, except Brazil, Chile and Venezuela. In a few of them, the slopes of the two fitted lines are different. When both are positive and the red line is steeper, the data suggest that education protects workers by reducing the risk of unemployment. This is the case for Argentina, Colombia, Costa Rica and Uruguay. In contrast, in Ecuador and Honduras the blue line is steeper, thus suggesting that education protects the wages of employed workers (relative to employed unskilled workers) and less so by reducing the risk of unemployment. Hence it appears that education generally protects workers’ average wages in most of our countries but not in all, and there is also heterogeneity in terms of how education protects workers with respect to the risk of unemployment. Nonetheless, these pictures need to be interpreted with caution and should not lead to rash conclusions, because we know that the relative wages of skilled workers could be determined by other variables besides education, including innate ability and years of experience.

23 The aggregate unemployment rates come from the International Labor Organization (ILO), so that the definition of unemployment is consistent across countries.
Figure 5.1. Relative Wages of Skilled over Unskilled Workers and Aggregate Unemployment Rates in Twelve Latin American Economies (various years)

Figure 5.2 presents the relationships between our pseudo-panel estimates of the cyclical components of the RTS (which control for ability bias, age as a proxy of experience, as well as cohort fixed effects and pre-determined trends in wages and the RTS) and aggregate unemployment rates for the twelve LCR countries. The graphs show the correlations for two estimates of the cyclical components of RTS; one with a quadratic on age and the other using age dummy variables in the estimation. Both estimates rely on data of salaried male workers (excluding the unemployed) and were estimated with the cohort pseudo panels described above. The specification of the model in terms of the years of age does not appear to affect the results, as the fitted lines are almost identical for the two specifications. However, there is notable heterogeneity in the slopes: Argentina, Chile, Colombia, Mexico, and Uruguay appear with negative slopes; the other seven countries appear with flat or positive correlation coefficients. This mixed evidence thus suggests notable international heterogeneity, which could be due to cross-country differences in the types of temporary shocks driving the business cycles over various periods of time (which also vary across countries, depending on the availability of the employment survey data). The following section turns to the analysis of the determinants of the cyclical components of the RTS.
Figure 5.2. Cyclical RTS and Aggregate Unemployment Rates (various years)

5.4. Transitory Fluctuations and Cyclical Returns to Schooling

As a first pass, it is worth analyzing the statistical significance of our estimates of cyclical RTS. Table 5.1 contains the estimates for the specifications with a linear deterministic trend in wages and in the RTS. As shown in the last column of the table, in seven cases the cyclical components of the RTS are statistically jointly significant (at the 10 percent level); they are not in Colombia, Ecuador, Honduras, Peru and El Salvador. The linear trend in the RTS is significant in five countries, namely Argentina, Chile, Costa Rica, Peru and Venezuela. Readers can compute each country’s “permanent” RTS at the end of each country’s sample period by adding the coefficient on the “constant” plus the product of the number of survey years (see Table A5.1 in the Appendix) times the coefficient on the time trend. More importantly for our focus on the cyclical behavior of the RTS, the fact that not all deviations from trend are statistically significant implies that in our analysis of their determinants we need to take into account the lack of precision of the estimates. Consequently, the results reported further below come from Weighted Least Squares estimations with the inverse of the standard error of each deviation from trend RTS is used as the weight for each observation.

Table 5.1. Components of the Returns to Schooling (Linear Trend, Salaried Workers, various years)

<table>
<thead>
<tr>
<th>Country</th>
<th>Constant Coefficient</th>
<th>P-value</th>
<th>Trend Coefficient</th>
<th>P-value</th>
<th>Cyclical (Average) Coefficient (Mean)</th>
<th>P-value (F-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>0.087</td>
<td>0.000</td>
<td>-0.005</td>
<td>0.036</td>
<td>-0.001</td>
<td>0.0002</td>
</tr>
<tr>
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<td>-0.001</td>
<td>0.414</td>
<td>0.001</td>
<td>0.0023</td>
</tr>
<tr>
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<td>0.000</td>
<td>0.002</td>
<td>0.026</td>
<td>0.000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Colombia</td>
<td>0.062</td>
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<td>-0.003</td>
<td>0.398</td>
<td>0.000</td>
<td>0.1680</td>
</tr>
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<td>0.000</td>
<td>0.000</td>
<td>0.753</td>
<td>0.001</td>
<td>0.8377</td>
</tr>
<tr>
<td>Honduras</td>
<td>0.097</td>
<td>0.000</td>
<td>0.001</td>
<td>0.368</td>
<td>-0.001</td>
<td>0.4275</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.105</td>
<td>0.000</td>
<td>-0.001</td>
<td>0.175</td>
<td>0.000</td>
<td>0.0411</td>
</tr>
<tr>
<td>Peru</td>
<td>0.022</td>
<td>0.044</td>
<td>0.007</td>
<td>0.000</td>
<td>0.001</td>
<td>0.1409</td>
</tr>
<tr>
<td>EL Salvador</td>
<td>0.057</td>
<td>0.000</td>
<td>0.000</td>
<td>0.675</td>
<td>0.001</td>
<td>0.8374</td>
</tr>
<tr>
<td>Uruguay</td>
<td>0.097</td>
<td>0.000</td>
<td>0.000</td>
<td>0.868</td>
<td>-0.001</td>
<td>0.0248</td>
</tr>
</tbody>
</table>

24 However, it is noteworthy that Lederman and Rojas Alvarado (2011) report that when the RTS were estimated with salaried and unemployed workers, the cyclical components were insignificant only for the case of Costa Rica.
5.4.a. Transitory Economic Fluctuations and Other Determinants of RTS

As mentioned, transitory RTS could be affected by different types of shocks. In general, economies can face foreign or domestic shocks, and within these categories, the shocks can emanate from financial markets or from the real sector (i.e., fluctuations in demand for goods and services produced in each country). For the econometric study of the determinants of the cyclical components of the RTS, we therefore focus on the following four types of shocks:

- **External real-sector shocks.** To capture the effect of fluctuations in foreign demand for domestically produced goods we used the gravity model of trade for each country to estimate the effect of changes in trading partners’ GDP on each country’s exports of merchandise, after controlling for bilateral distance and the country’s own GDP. In turn, we computed the effect of deviations from trend (see below) in trading partners’ GDP on a country’s exports as the product of the estimated coefficient on the importers’ GDP times the average of the annual change in GDP of each country’s trading partners. The necessary data come from the International Monetary Fund, the World Bank, and the data on bilateral distances needed to estimate the gravity model of trade French Centre d’Etudes Prospectives et d’Informations Internationales (CEPII).

- **Domestic real-sector shocks.** We used the deviation from trend of each country’s consumer price index as a proxy for domestic shocks. When inflation rises, it is interpreted as domestic demand exceeding the rise in domestic output. The data come from the World Bank.

- **External financial shocks.** Such a shock was defined as the deviation from trend of the product of the United States lending interest rate times a country’s foreign debt over Gross National Income ratio in the previous year. The data come from the International Monetary Fund.

- **Domestic financial shocks.** These shocks were defined as the deviation from trend of the product of domestic lending rate times the lagged ratio of domestic credit to the private sector over GDP. Lederman and Rojas Alvarado present results with alternative domestic interest rates, such as deposit rates, and the results discussed below are robust. The data come from the International Monetary Fund.

---

25 Other variables included in the gravity model of bilateral trade flows are the following: import tariffs, (the log of) the distance between country $i$ and country $j$, a dummy variable that takes a value of 1 if the two countries are contiguous, a dummy variable that indicates if the two countries share their official language, a dummy variable that indicates if the two countries have a preferential trade agreement, a dummy variable if country $j$ is landlocked, and a set of year dummy variables. To construct the preferential trade agreement variable, we used data from the WTO-Regional Trade Agreements Information System. This database contains information on the regional trade agreements of the WTO members, but only covered those agreements that have been notified to the WTO and are in force.
All these explanatory variables were transformed into their transitory components by using the same trends we used to estimate the cyclical component of RTS. That is, when we assumed a linear trend for the RTS, we de-trended the explanatory variables using a linear trend; when root of the linear trend (or the natural logarithm of the linear trend, etc) was used for the RTS we used the same for the explanatory variables, and so on. The basic idea is to use a common de-trending approach for both sides of the model.

In addition to transitory economic fluctuations affecting demand for domestically produced goods and the finances of domestic firms and other economic agents, the analysis of the determinants of the cyclical components of the RTS also considers the effects of labor market characteristics and rigidities in each labor market. More specifically, we use data from the Doing Business database on constraints for employers to hire workers on an hourly basis, difficulty of using redundancy as a reason for firing, and constraints on using temporary workers (fixed term contracts). These indexes were average over 2004 to 2009 by country and range between 0 and 100, with higher values indicating more rigid regulation. In addition, we computed the ratio of the minimum wage in each country over the median wage in our sample, and the data come from national sources. Since the econometric models include country fixed effects, these variables were multiplied times the four types of transitory shocks, and the estimated coefficients can thus be interpreted as the effects of these labor-market features on the impact of the shocks on the transitory component of the RTS within countries.

5.4.b. Determinants of the cyclical components of RTS in Latin America
A summary of the results provided by Lederman and Rojas Alvarado (2011) appears in Table 5.2. The first column corresponds to the determinants of the RTS estimated with the pseudo-panel of employed salaried workers; the second column presents the results of the determinants of the same cyclical RTS but with the inclusion of the labor-market institutions variables interacted with each transitory economic fluctuation; and the last column presents the results for the model where the cyclical RTS were estimated with salaried and unemployed male workers. In the three reported models, the trend component was estimated with a linear trend, but Lederman and Rojas Alvarado present results for various alternative specifications of the pre-determined time trend (quadratic and cubic trends) and the results are robust across these alternative specifications of the model.

<table>
<thead>
<tr>
<th>Dependent variables:</th>
<th>Cyclical RTS: Salaried Workers</th>
<th>Cyclical RTS: Salaried Workers</th>
<th>Cyclical RTS: Salaried &amp; Unemployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>0.138**</td>
<td>0.181**</td>
<td>0.798**</td>
</tr>
<tr>
<td>External Fin.</td>
<td>-0.301***</td>
<td>-0.206**</td>
<td>-0.866</td>
</tr>
</tbody>
</table>

26 For details about these indexes see www.doingbusiness.org
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Fin.</td>
<td>-0.036</td>
<td>-0.016</td>
<td>-1.263***</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.009***</td>
<td>0.007**</td>
<td>0.029*</td>
</tr>
<tr>
<td>Exports*Hrs</td>
<td></td>
<td>-0.002**</td>
<td>-0.014***</td>
</tr>
<tr>
<td>Exports*Redun.</td>
<td></td>
<td>-0.002***</td>
<td>-0.009***</td>
</tr>
<tr>
<td>Exports*Min.W.</td>
<td></td>
<td>0.089</td>
<td>-0.702*</td>
</tr>
<tr>
<td>OBS</td>
<td>165</td>
<td>165</td>
<td>165</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.22</td>
<td>0.31</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Notes: Results are robust to alternative specifications of the time trend in the cohort-income models. Country fixed effects and year effects were included in all specifications. Not all coefficients are reported; only the statistically significant coefficients on the interactions between transitory shocks and labor-market institutions are reported. Source: Lederman and Rojas Alvarado (2011).

It is evident that the most significant and robust explanatory variable is the one reflecting transitory deviations from trend in the foreign demand for LCR exports. It consistently appears with a positive effect, but the interactions with labor-market institutions are also significant. Furthermore, it appears than when foreign demand is above trend, the RTS within countries tends to rise, but this effect is attenuated by labor-market rigidities. In addition, the effect of transitory increases in exports is much larger when the RTS were estimated for salaried and unemployed workers. This suggests that part of the effect works through unemployment in a manner that is consistent with the pioneering article by Reder (1955). That is, when export rise due to temporary increases in foreign demand, the wages of skilled workers rise more than proportionately relative to the average wage of the less skilled workers, but when export fall, the wages the RTS also fall implying that the wages of skilled labor fall more than those of less skilled workers.

The only other somewhat robustly significant variable is the (deviation from trend of the) consumer price index. When the price index is above trend, the RTS tend to rise. These results imply that when an economy is over-heating, the average wage of skilled labor temporarily rises more than those of unskilled workers. These results are thus also consistent with Reder (1955). However, the Lederman and Rojas Alvarado (2011) report that the interactions between deviations from trend in the price index and labor-market institutions were not statistically significant. Moreover, the magnitude of the effect of
temporary inflation on the cyclical component of the RTS is much smaller than that of the export demand variable.  

Broadly speaking, these results suggest that for the twelve LCR economies included in this analysis, the most important driver of cyclical fluctuations in the RTS within countries is temporary fluctuations in foreign demand for exports. The results are thus consistent with an important strand of the labor economics literature (e.g., Reder 1955) as well as with a more recent literature related to the role of exports in shaping the relative demand for skills (Veerhogend 2008; Brambilla et al. 2011, 2010). However, the results might seem to be inconsistent with the findings reported in Chapter 4 on the Northern Mexico during the recent global financial crisis. In that case, Kaplan, Lederman and Robertson (2011) found that during the trade-related downturn, the average “quality” of employed workers rose as reflected in a significant improvement in the average wage relative to the wages of stayers (although the effect was much smaller than the quantitative adjustment of over employment). The results are actually consistent. If RTS fall during a trade-driven downturn, the relative cost of hiring skilled workers falls, which allows firms to upgrade the average quality of their employed labor force.

5.5. Concluding Remarks

This chapter reviewed the extensive literature on the cyclical properties and determinants of skill premiums and the returns to schooling, which is evidently highly focused on high-income countries. The few studies of LCR economies that do exist appear to present contradictory evidence and rely exclusively on analyses of the evolution over time of standard Mincerian estimates of the returns to schooling.

The research underpinning this chapter provided by Lederman and Rojas Alvarado (2011) is somewhat unique in its use of a pseudo-panel approach to the estimation of the permanent, trend and cyclical components of RTS in twelve LCR economies. While not totally bullet-proof, this approach is appealing as it gets rid of ability biases in the estimates of the RTS, and it can be implemented for any developing country with repeated cross-sections of household employment surveys.

In addition, the analyses attempted to link four types of transitory economic fluctuations with the cyclical components of the RTS in models that controlled for time invariant country characteristics and time-period effects common to all observations from a given year. The evidence suggests that temporary fluctuations in foreign demand for LCR exports are perhaps the most important driver of cyclical movements of the RTS within countries.

27 In the Lederman and Rojas Alvarado (2011) dataset, the standard deviation of the price index is about 0.6 and that of the export variable is about 0.05. In table 5.2, the coefficients on the latter variable for both samples are more than 15 times larger than the corresponding coefficients for the price index. Since the standard deviation of the price index is only about 12 times larger, the implied normalized coefficients (i.e., the product of the standard deviation of each variable times their estimated coefficient) for exports are at least 27 percent larger than the normalized coefficient of the price index. The normalized coefficient of the export variable is much larger (more than twice as large) relative to the normalized coefficient of the price index for the case of the sample of salaried and unemployed workers.
Finally, it is worth recalling that changes in the average relative wage of skilled labor relative to unskilled labor can be due to changes in the number of jobs and the composition of workers that remain employed. Indeed, the results presented in this chapter are consistent with labor and trade models driven by compositional changes rather than changes in the wages of workers that remain employed throughout the cycle. Furthermore, trade and to a lesser extent inflation, appear to be the main drivers of transitory fluctuations in the returns to schooling.
Chapter 6. Summary and Policy Implications

Summary: The main policy implications of the findings discussed in previous chapters are divided into three policy areas: Social protection and labor, macroeconomic policies, and the long-term growth agenda.

6.1. Summary of Findings
This report has documented the fall of wage flexibility in Latin American labor markets. The main driving force of this fall is the reduction of inflation and, in some instances, the rise of international trade through input-output relationships. In addition, the rise of international trade was associated with transitory changes in the relative incomes of skilled and unskilled workers.

During the high inflation environment that ended in the late 1990s, wages appeared to be quite flexible in LAC. The correlation of aggregate wages and output was high in comparison with other regions, and the incidence of downward real wage rigidities was low. The high flexibility of wages was coupled with substantial volatility of employment. The region thus appeared to have fairly flexible labor markets. The picture changed after the mid-1990s. Most likely as a consequence of disinflation, this report has documented that real wages appear to be more rigid in the recent past. At the aggregate or sectoral level, the cyclicality of real wages fell in some countries, and downward real wage rigidities become apparent in the region as a whole. The emergence of downward rigidity of wages can be inferred also from labor market responses to the 2008 global crisis, where the bulk of the adjustment fell on employment and unemployment, with little apparent impact on wages.

These changes might have implications for the design of social protection programs, macroeconomic policies and for setting priorities in the longer-term growth agenda.

6.2. Implications for Social Protection and Labor Policies
When real wages are downward flexible, the effectiveness of employment protection as an insurance mechanism is put into question. Hence, the substantial flexibility of wages observed in past decades, especially during recessions, is likely to have limited the usefulness of this policy to mitigate the welfare losses associated with economic downturns. In a downwardly rigid wage environment, the effectiveness of employment protection as an insurance device is enhanced. This is good news for a region subject to substantial volatility and imperfect capital markets. However, all good things come at a cost. The implication of more effective firing restrictions is that the efficiency loss associated with this type of policies is likely to be exacerbated. That is, while such policies can protect employed workers, they are likely to come at the cost of increased misallocation of resources, and hence lower productivity. The optimal design of the level of protection depends on the relative strengths of these two forces, and the weights attached to each of them by policy makers, embodies the classic efficiency-equity trade off.

The authors gratefully acknowledge the insightful comments and critiques provided by Louise Cord, Margaret Grosh, Ian Walker, Francisco Ferreira and Augusto de la Torre on an earlier version of this chapter.
A note of caution is warranted for the large number of LAC countries with high minimum wages relative to the median wage. The report documented that increases in the minimum wage served as a powerful coordinating device for indexation in Brazil, inducing substantial real wage rigidity in the formal sector of the economy. Similar experiences might be observed in other countries where the minimum wage is relatively high. To the extent that wage indexation emanating from the formal sector induces wage rigidity wages in the informal sector, economies are likely to be badly suited for absorbing negative external shocks without substantial job losses. If the informal sector instead displays more flexible wages than the formal sector, as suggested by evidence from Brazil, indexation to the minimum wage is likely to become an obstacle for the formalization of the labor market.

Regarding international trade and its impact on labor markets, it is somewhat ironic that the increase in the incidence of exports can be associated with a rise in the relative volatility of the incomes of skilled workers relative to the unskilled. This is so because, as it became abundantly clear during the Great Trade Collapse associated with the Global Financial Crisis of 2008-09 and as suggested by the evidence presented in Chapter 5 more generally, export-driven business cycles are associated with temporary changes in the returns to schooling: When exports fall due to fluctuations in foreign markets, the returns to schooling fall, which implies that the wages of skilled workers fall proportionately more than those of unskilled workers. Consequently, it appears that a side-effect of the increased dependence of LAC on international trade has been a relative reduction of income risk for unskilled workers.

This said, if export-driven business cycles in LAC become more frequent with the rise of international trade, the priorities of social protection systems might also change. For instance, current debates in the Region about utilizing conditional cash transfers, which have been seemingly successful in reducing long-term poverty, to provide temporary assistance to poor families during downturns might not provide insurance to protect formal and skilled workers from a potential rise in the volatility of the returns to schooling. Hence the debates over social protection policies might need to pay new attention to protection schemes that do not exclude skilled workers, such as broad unemployment insurance schemes. As such, it could be argued that the funding needs of temporary social protection programs for less educated workers have declined with the rise of exports as a share of national income.

As in other policy domains, the policy tradeoffs in social protection systems are complex. Because education tends to be positively correlated with income, the capacity of skilled workers to save for a rainy day or to purchase some sort of private insurance, it is possible that more skilled workers might still need publicly provided social protection “less” than unskilled workers, despite the (possibility of) increases in their relative income volatility.

Furthermore, related to the point above, social protection -- like any other public expenditure -- has opportunity costs: the marginal value of public funds. In this context, what economists would call the “marginal utility” of income of different households or workers also matters for policy design. That is, an additional dollar of income might raise the welfare of a poor household on the verge of starvation to a much greater extent than it would raise the welfare of a rich household with plenty of savings to boot. Hence social protection schemes that target poor households (and probably unskilled and under-
educated workers) are still desirable, even if the income risk of educated workers has risen with globalization.

Finally, the results discussed in Chapter 5 are silent with respect to the risk of falling into poverty or of increasing the poverty gap. Hence social programs, such as CCTs, which target long-term poverty, as well as short-term income fluctuations of poor households should probably be maintained and strengthened if possible, but the policy priorities might be shifting as a consequence of the rise of trade-driven business cycles.

6.3. Implications for Macroeconomic Policies

Looking at the functioning of labor markets through a microscope by looking at individual-wage setting behavior in selected countries, the report uncovered an important fact, which may have implications for macro policies: Wage rigidities are not written in stone. Instead, they change with the policy framework operating in the economy, even with changes in policy areas which are not directly related to wage bargaining between workers and firms, such as macroeconomic policies and even trade policies.

The evidence from Brazil suggests that the monetary policy framework had an impact on the nature of wage rigidities. The introduction of inflation targeting in 1999, most likely by anchoring inflation expectations, shifted the focal point of wage negotiations from changes in the minimum wage to the rate of inflation (within certain bounds, at least initially). This may be seen as a move towards flexibility in wage setting. The old system of wage indexation to changes in the minimum wage was extremely rigid, since a large fraction of workers pegged their fortunes to just one price index. Instead, inflation expectations, even if anchored by the target, are heterogeneous across agents. More importantly, this illustrates that the interaction between monetary policy and the functioning of labor markets works in both directions. Central banks make monetary policy decisions considering, among other factors, the importance of second round effects, or the pass-through from goods' prices into wages. Our findings illustrate that wage setters also respond to the monetary policy framework, in adapting their focal point of wage negotiations depending on the credibility of the target rate.

The emergence of wage rigidity of incumbent workers in the formal sector in the second half of the 1990s and beginning of the 2000s was confirmed by the analysis of individual data in Brazil and Uruguay. However, wages of new hires show much greater flexibility than the wages of incumbents in Brazil. Their response to productivity shocks is much higher, both in the formal and informal sectors. However, wages of both incumbent and new hires in the informal sector are less rigid downwards than wages in the formal sector. This fact helps us understand another stylized fact of the business cycle adjustment of labor markets in LAC, which is the substantial freeze of formal sector hiring during recessions. If reducing informality is a priority in the policy agenda, focusing on the underlying forces of downward wage rigidity in the formal sector appears a fruitful avenue for further research.

Regarding macroeconomic policies per se, economies with inflation targeting monetary regimes should take into account the importance of nominal wage floors at the time of determining their targets. There is a tradeoff: inflation rates above zero allow the maintenance of internal balance in the sense of
stabilizing employment by allowing wage adjustments with respect to fluctuations in productivity, but increasing such targets might threaten the macroeconomic stability the region fought so hard to attain. The available international evidence suggests that there is little reason to think that the current inflation targets in LAC may be costly. The level of downward nominal wage rigidity in Uruguay documented here is fairly high, but not higher than in other OECD countries where the optimal inflation has been found to be no higher than 2% (Fagan and Messina, 2009). However, as Central Banks discuss possible reductions in their targets, the issue of wage rigidity may warrant some discussion.

The fall of wage flexibility might have short- and long-term policy implications. Regarding short-term fluctuations, income risk has been supplanted in part by unemployment risk. This might imply long-term losses in output caused by the cumulative effect of bouts of transitory unemployment. And in the short-run labor-market protections for workers and social protection programs focused purely on protecting wages might be less effective. Thus more attention might need to be given to social insurance, in the forms of safety nets for temporarily unemployed workers. The policy issues, however, are complex, because unemployment insurance policies should be designed so as to alleviate the welfare losses for temporarily unemployed workers and to shorten unemployment spells, instead of providing incentives for workers to remain out of the labor force. A detailed discussion about how to design such policies falls well beyond the scope of this report, but we need to refocus our attention on these tradeoffs.

6.4. The Long-Term Growth Agenda
Latin America and the Caribbean countries are experiencing a rebirth in terms of economic growth, but the debate reflects reasonable concerns about the sustainability of current growth rates, which might be due to relatively favorable external conditions such as commodity prices and low global interest rates. Hence the debate over policies needed to sustain high long-term productivity growth, such as innovation and diversification policies, are also re-emerging.

Perhaps surprisingly, this report on business cycles and labor markets made some modest contributions to the policy debate over long-term growth. As mentioned above, with the fall of wage flexibility, short-term unemployment spells might have cumulative effects on economic growth, as periods of less than full employment imply output losses.

Even the results on the volatility of returns to schooling have potential implications for long-run growth. To the extent that export-related business cycles are becoming more frequent, the consequent increased volatility of the returns to schooling might result in reduced incentives for households to invest in their children’s education. That is, investments in human capital accumulation might become riskier with international integration, and thus, for a given return, a rise in its volatility reduces incentives for investment.29

Finally, a word about informality and how it is related to the long-run growth and productivity policy agenda. It is undeniable that policymakers and analysts remain concerned about its persistence. However, by now it should be abundantly clear that the most important margin of informality is the

29 This would be true unless agents are risk lovers.
movement of informal workers into relatively large and formal firms. At a business cycle frequency, wage rigidity in the formal sector appears to be an important factor in explaining the freeze of formal sector hiring during recessions. But, what prevents formal employment from expanding in the long run? The great majority of informal employees in the region work in micro firms, which employ less than 5 workers. Analyzing the transitions of workers who succeed in moving from informal to formal jobs uncovers a clear fact: the bulk of this formalization process, when it occurs, takes place by changing jobs; that is, workers who become formal change employers, and move from informal micro firms to large firms. The policy implications of this stylized fact are not clear-cut, and deserve further exploration. One the one hand, this process may highlight barriers to the growth or formalization of micro firms. If this is the case, removing these barriers or increasing the benefits of formalization should be a priority for policy. The more realistic view is that the policy focus should be on creating the environment that strengthens medium and large sized firms, as these are the only ones that appear to have the capacity to create formal jobs. This implies that in the long run the most pressing policy issues are related to the productivity of the formal sector. Consequently our attention should shift back to the mainstream policy agenda on productivity and away from special programs to support the incomes of informal workers per se, which are unlikely to reduce informality or raise productivity of the formal sector in the long run.
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Appendix for Chapter 1. Estimation of Time Varying Cyclicality of Wages

The model we use is a vector autoregression with both time varying coefficients and residuals volatilities. This type of models have become quite a popular tool in macroeconomics over the last few years, generally addressing questions related to the evolution of the structure of the economy and the volatility of the shocks (see Primiceri, 2005, Canova and Gambetti 2009, Gali and Gambetti 2009). The idea behind the model is that the structure of the economy as well as the size of the shocks may evolve over time. These changes are modeled as permanent and smooth rather than abrupt regime shifts. In fact the parameters are assumed to evolve as driftless random walks.

The model is estimated using Bayesian methods, specifically using the Gibbs sampler. The Gibbs sampling algorithm is well suited in cases where the joint posterior distribution is not analytically available as here. The algorithm works in an iterative way. Each iteration is done in several steps and consists in drawing a subset of coefficients conditional on a particular realization of the remaining coefficients and then using such a realization in the conditional densities of the remaining coefficients. Under regularity conditions and after a burn-in period, iterations on these four steps produce draws from the joint density. The method allows us to characterize the posterior distribution of the model coefficients. The point estimate will simply correspond to the median of the distribution.

Note that once the distribution of the coefficients has been characterized, variances and correlations can be computed. Importantly, given that variances and correlations are functions of the model coefficients they also are time-varying. For a given draw from the joint posterior of the coefficients a corresponding draw for variances and correlations can be obtained. Again, the point estimate for variances and correlations will be represented by the median of resulting distributions. Confidence bands for the parameters of interest can be easily obtained as the percentiles of the distribution of such parameters.

The econometric model

Let \( y_t = (w_t, e_t, y_t)' \) where \( w_t \) is the real wage, \( e_t \) is employment and \( y_t \) is industrial production. We assume that \( y_t \) satisfies

\[
y_t = A_{0,t} + A_{1,t}y_{t-1} + ... + A_{p,t}y_{t-p} + \epsilon_t
\]

where \( A_{0,t} \) is a vector of time-varying intercepts, \( A_{i,t} \) are matrices of time-varying coefficients, \( i = 1, ..., p \) and \( \epsilon_t \) is a Gaussian white noise with zero mean and time-varying covariance matrix \( \Sigma_t \). Let \( A_t = [A_{0,t}, A_{1,t}, ..., A_{p,t}] \), and \( \theta_t = \text{vec}(A_t) \), where \( \text{vec}(\cdot) \) is the column stacking operator. Conditional on such an assumption, we postulate the following law of motion for \( \theta_t \):

\[
\theta_t = \theta_{t-1} + \omega_t
\]
where \( \omega_t \) is a Gaussian white noise with zero mean and covariance \( \Omega \). We let \( \Sigma_t = F_t D_t F_t' \), where \( F_t \) is lower triangular, with ones on the main diagonal, and \( D_t \) a diagonal matrix. Let \( \sigma_t \) be the vector of the diagonal elements of \( D_t^{1/2} \) and \( \phi_t, \psi_t, i = 1,..., n - 1 \) the column vector formed by the non-zero and non-one elements of the \((i+1)\)-th row of \( F_t^{-1} \). We assume that

\[
\log \sigma_t = \log \sigma_{t-1} + \xi_t \\
\phi_{t,i} = \phi_{t-1,i} + \psi_{t,i}
\]

where \( \xi_t \) and \( \psi_{t,i} \) are Gaussian white noises with zero mean and covariance matrix \( \Xi \) and \( \Psi_i \), respectively. Moreover, we assume that \( \psi_{t,i} \) is independent of \( \psi_{t,j}, \) for \( j \neq i \), and that \( \xi_t, \psi_{t,i}, \omega_t, \xi_t \) are mutually uncorrelated at all leads and lags.

**Estimation**

The first step in the estimation is the specification of the prior distributions. Following Primiceri (2005), we make the following assumptions for the priors densities. First, the coefficients of the covariances of the log volatilities and the hyperparameters are assumed to be independent of each other. The priors for the initial states \( \theta_0, \phi_0 \) and \( \log \sigma \) are assumed to be normally distributed. The priors for the hyperparameters, \( \Omega, \Xi \) and \( \Psi \) are assumed to be distributed as independent inverse-Wishart. More precisely, we have the following priors:

- Time varying coefficients: \( P(\theta_0) = N(\hat{\theta}, \hat{\Sigma}) \) and \( P(\Omega) = IW(\Omega^{-1}_0, \rho_\Omega) \)
- Diagonal elements: \( P(\log \sigma_0) = N(\log \hat{\sigma}, I_n) \) and \( P(\Psi_i) = IW(\Psi_i^{-1}, \rho_{3i}) \)
- Off-diagonal elements: \( P(\phi_{0i}) = N(\hat{\phi}, \hat{\Sigma}) \) and \( P(\Xi) = IW(\Xi^{-1}_0, \rho_\Xi) \)

where the scale matrices are parameterized as follows: \( \Omega^{-1}_0 = \lambda_4 \rho_{\theta} \hat{V}_\theta, \ \Psi_{0i} = \lambda_2 \rho_{\phi} \hat{V}_\phi \) and \( \Xi_0 = \lambda_2 \rho_{\phi} I_n \). The hyper-parameters are calibrated using a time invariant recursive VAR estimated using a sub-sample consisting of the first \( T_0 = 32 \) observations. For the initial states \( \theta_0 \) and the contemporaneous relations \( \phi_{0i} \), we set the means, \( \hat{\theta} \) and \( \hat{\phi} \), and the variances, \( \hat{V}_\theta \) and \( \hat{V}_\phi \), to be the maximum likelihood point estimates and four times its variance. For the initial states of the log volatilities, \( \log \sigma_0 \), the mean of the distribution is chosen to be the logarithm of the point estimates of the standard errors of the residuals of the estimated time invariant VAR. The degrees of freedom for the covariance matrix of the drifting coefficient’s innovations are set to be equal to \( T_0 \), the size of the initial-sample. The degrees of freedom for the priors on the covariance of the stochastic volatilities'
innovations are set to be equal to the minimum necessary to insure that the prior is proper. In particular, \( \rho_1 \) and \( \rho_2 \) are equal to the number of rows \( \Xi_0^{-1} \) and \( \Psi_0^{-1} \) plus one respectively.

The parameters \( \lambda_i \) are specified as follows:

- Brasil: \( \lambda_1 = 0.0002 \), \( \lambda_2 = 0.0005 \), \( \lambda_3 = 0.0005 \)
- Chile: \( \lambda_1 = 0.02 \), \( \lambda_2 = 0.02 \), \( \lambda_3 = 0.02 \)
- Colombia: \( \lambda_1 = 0.02 \), \( \lambda_2 = 0.02 \), \( \lambda_3 = 0.02 \)
- Mexico: \( \lambda_1 = 0.0002 \), \( \lambda_2 = 0.0005 \), \( \lambda_3 = 0.0005 \)

**Time-varying variances and correlations**

Variances and correlations, in general the dynamic of \( y_t \), can be studied using the instantaneous (local) MA representation:

\[
y_t = \mu_t + \sum_{k=1}^{\infty} C_{k,t} \varepsilon_{t-k}
\]

Where \( C_{0,t} = I \), \( \mu_t = \sum_{k=0}^{\infty} C_{k,t} A_{kt} \), \( C_{k,t} = S_{n,n}(A^t) \), \( A_t = \left( \begin{array}{ccc} A_{1} & & \\ \vdots & \ddots & \\ 0_{n(p-1),n} & \cdots & 0_{n(p-1),n} \end{array} \right) \), \( A_t = [A_{1}, ... A_{p}] \) and \( S_{n,n}(X) \) is a function selecting the first \( n \) rows and \( n \) columns of the matrix \( X \).

The variance of \( y_{it} \) is given by the \( i \)-th diagonal element of the variance covariance matrix of \( y_t \), i.e.,

\[
V_i(y_t) = \sum_{k=0}^{\infty} C_{k,t} \Sigma C^t_{k,t}
\]

Given that both the MA coefficients and the variances are changing over time so will be the covariance matrix. Correlations can be computed easily using the above covariance matrix. In fact the time-varying correlation between the first and second variable is given by

\[
Corr_{t,12} = \frac{V_t^{12}}{\sqrt{V_{t,11}V_{t,22}}}
\]

Once the estimates of the model parameters are available, we draw \( A_t \) and \( \Sigma_t \) and compute a draw for \( V_t \) and \( Corr_t \). By repeating the drawing a large number of times the distribution of variances and covariances can be characterized.
Differences between booms and recessions

Once the time-varying correlations are calculated, we can easily define the differences between booms and recessions. Let $\rho_j^k$ be the median correlation between variable $j$ and $k$. We can define the median differences between boom and recessions as:

$$\frac{1}{T_1} \sum_{t \in \text{boom}} \rho_{t}^{b} - \frac{1}{T_2} \sum_{t \in \text{recession}} \rho_{t}^{r}$$

where $T_1$ is the number of periods of expansion and $T_2$ the number of periods of recession. Expansions and recessions are determined following the Bry–Boschan Quarterly (BBQ) algorithm (Hardin and Pagan, 2002).
Appendix for Chapter 2. Estimation of a Notional Wage Change Distribution in Sectoral Data

In any analysis of wage rigidities the complication lies on the identification of the counter-factual notional wage change distribution; i.e., the distribution that would have prevailed in the absence of wage rigidities. In this section we assume, following the work of McLaughlin (1994), that the shape of the notional wage-change distribution is well approximated by the distribution of wage changes in country-year samples with high real and nominal wage growth, where downward rigidities are less likely to be binding. However, we do not want the notional wage change distribution to be distorted by hyperinflation years. Hence, we limit the set of observations entering the notional to have a mean yearly wage growth below a certain threshold.

We assume that absent any DWR, the notional real wage growth in industry \( \varphi \) in country \( i \) in year \( \tau \) is stochastic with an unknown distribution \( \Gamma \), which is parameterized by \( G \), which is parameterized by \( (\mu_{it}^N, \sigma_{it}) \), where \( \mu_{it}^N \) is the mean real wage growth, and \( \sigma_{it} \) is a measure of the dispersion of \( G \). Thus, we allow the location and dispersion of the notional industry wage growth to vary across countries and years, to capture variation across countries and time caused by differences in productivity growth, wage setting, inflation, industry structure, etc. However, we impose the same structural form (or shape) of \( G \) in all country-years. Imposing the same shape in all country-years gives us a larger data set to select high wage growth samples from, improving our possibility to derive the notional distribution from country-years that are not affected by downward wage rigidity.

Specifically, we first select the country years where the mean wage growth is below 20%. Then, we construct an underlying distribution based on a subset \( H \) of the remaining sample, with \( S^H = 4,720 \) observations from the 181 country-year samples, where both the median nominal and the median real wage growth are among their respective upper quartiles, implying that the median nominal wage growth is above 11 percent, and the median real wage growth is above 3.3 percent. Constructing the underlying distribution on this selection of 181 country-year samples is clearly somewhat arbitrary, but other sub-samples of country-years with high inflation yield similar results. To mitigate any effect of DWR and outliers, we follow Nickell and Quintini (2003) and measure the location by the median, and the dispersion by the range between the 35th and the 75th percentiles, rather than the mean and the standard deviation. More precisely, the underlying distribution of wage changes is constructed by using the 181 samples with high median nominal and real wage growth, by subtracting the corresponding country-year specific median \( \mu_{it}^N \), and dividing by the inter-percentile range \((P75_{it} - P35_{it})\):

\[
X_s = \frac{\Delta w_{ijt} - \mu_{it}}{P75_{it} - P35_{it}}
\]

where the subscript \( s \) runs over all \( j, i, \) and \( t \) in the 181 country-year samples. \( X_s \) should thus be thought of as an observation of the stochastic variable \( X \) from the underlying distribution \( G(0,1) \). There
are clearly stochastic disturbances in the normalization due to $\mu_{it}^N$ and $(P75_{it}-P35_{it})$ being stochastic. However, as the underlying distribution consists of $H_T = 4,720$ observations, it should nevertheless give a pretty accurate estimate of the shape of $G$. Figure A.1 compares the underlying notional distribution of wage changes (illustrated by the histogram and the kernel density in solid line) with the standard normal distribution (dotted line); we notice that the underlying distribution is slightly skewed to the right, with a coefficient of skewness of 0.070, and with higher peak and fatter tails than the normal.

Once the notional wage distribution has been constructed we compare the empirical number of wage cuts with the number of wage cuts predicted by the notional. If the latter is larger than the former, it is interpreted as a sign of downward wage rigidities. To parallel with the discussion in Section 1.2, we concentrate on two thresholds for wage cuts. We search for signs of DRWR by comparing wage cuts at cero real wage changes in the notional and the empirical distributions. Note the subtle but fundamental difference with respect to our previous methodology. While before the threshold of DRWR was estimated by the model, here we impose it to be equal to the inflation rate. Our second threshold is set at minus the inflation rate, and in this case parallels perfectly with our previous definition of DNWR.
Appendix for Chapter 3: Details on Adjustment Mechanisms

Fujita and Ramey (2007) offer a means of decomposing movements of labor market aggregates, such as the unemployment rate, or the share of formal employment into the principle contributions of flows to and from different sectors. Table A.3.1 reports this breakdown for Brazil and Mexico, across a long period, and during times of crisis. In general, between 85 and 80% of movements in the unemployment rate are driven by inflows from informality (I). Outflows reductions in outflows to formal jobs (F) contribute roughly 20%; to informal salaried work, relatively little, and to self employment (S), essentially zero.

Table A.3.1: Relative Contribution of Flows to Aggregate Movements in Unemployment and Formal Employment (In percent)

<table>
<thead>
<tr>
<th></th>
<th>Unemployment Rate</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I-Inflows</td>
<td>Outflows-F</td>
<td>Outflows-I</td>
<td>Outflows-S</td>
<td>Error</td>
</tr>
<tr>
<td>Whole Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>0.82</td>
<td>0.20</td>
<td>0.02</td>
<td>-0.03</td>
<td>-0.01</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.69</td>
<td>0.22</td>
<td>0.11</td>
<td>-0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Recession</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>0.76</td>
<td>0.24</td>
<td>0.04</td>
<td>-0.01</td>
<td>-0.02</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.65</td>
<td>0.26</td>
<td>0.09</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Formal Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-flows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>0.69</td>
<td>0.08</td>
<td>0.01</td>
<td>0.19</td>
<td>0.04</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.22</td>
<td>-0.21</td>
<td>-0.16</td>
<td>0.18</td>
<td>-0.02</td>
</tr>
<tr>
<td>Recession</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>0.84</td>
<td>-0.05</td>
<td>-0.01</td>
<td>0.17</td>
<td>0.05</td>
</tr>
<tr>
<td>Brazil</td>
<td>1.31</td>
<td>-0.15</td>
<td>-0.22</td>
<td>0.08</td>
<td>-0.02</td>
</tr>
</tbody>
</table>

Notes: The table presents the contribution of the cyclical component of each flow to cyclical volatility of the unemployment rate and the share of formal employment for Mexico and Brazil following Fujita and Ramey, 2007. We define recession as output below trend. O=Out of the Labor Force, U=Unemployment, E=Employment,

Underlying these results are differing responses of flows among particular sectors to downturns. Figure A.3.1 presents the raw and de-trended job finding probabilities across time in Brazil and Mexico. The former are somewhat clearer, however Brazil experienced a steady rise in informality across the sample period and this evolution muddies somewhat the cyclical patterns. What is clear is that flows from unemployment into formal employment show the greatest volatility across the cycle, decreasing more than any other sector of employment during downturns.

Figure A.3.2 shows the analogous series for job separations. In this case, transitions from formality to unemployment vary far less than either flows from informal salaried work or informal self employment. In the simulations underlying table A.3.1, the contribution of each possible flow to the evolution of unemployment and formal employment is undertaken by modeling how all flows interact to generate these aggregates, and then sequentially holding one flow or another fixed and measuring the resulting impact on the evolution of the aggregate.

Figure A.3.1: Job Finding Rates from Unemployment (Levels and Cycle): Mexico and Brazil

![Figure A.3.1: Job Finding Rates from Unemployment](image-url)
Figure A.3.2: Job separation Rates towards Unemployment (Levels and Cycle): Mexico and Brazil

Mexico

Brazil

Notes: Figure 1 shows the transition rates from unemployment (U=Unemployment) into the three employment sectors (S=Informal Self-employed, I=Informal Salaried, and F=Formal Sector). Figure 2 shows the transitions rates into unemployment (U) from all three sectors of employment. Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Bosch...
and Maloney (2009) Section III. Computations are based on 10,000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.
Appendix for Chapter 5: Data and Pseudo-Panel Methodology for Estimating Permanent and Cyclical Components of the Returns to Schooling in Twelve Latin American Economies

The data consists of repeated cross sections of household surveys from twelve Latin American countries (see Table A5.1). The pseudo-panel data sets by country are constructed by calculating worker-group averages by year of birth. This means that, in a particular year, a cohort is formed for those with the same age and their age varies over time.

Table A5.1. Household Employment Surveys and other Data from Twelve LCR Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Survey</th>
<th>Years</th>
<th>Number of Surveys</th>
<th>Age Range</th>
<th>Consumer Price Index</th>
<th>Source</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>EPH and EPHC</td>
<td>1995-2006</td>
<td>12</td>
<td>26 65</td>
<td>October</td>
<td>INDEC</td>
<td>Urban</td>
</tr>
<tr>
<td>Brazil</td>
<td>PNAD</td>
<td>1992-2007</td>
<td>14</td>
<td>28 65</td>
<td>September</td>
<td>IBGE</td>
<td>National</td>
</tr>
<tr>
<td>Chile</td>
<td>ESI</td>
<td>1990-2008</td>
<td>18</td>
<td>25 65</td>
<td>November</td>
<td>INE</td>
<td>National</td>
</tr>
<tr>
<td>Colombia</td>
<td>ENH and ECH</td>
<td>1984-2004</td>
<td>21</td>
<td>26 60</td>
<td>September</td>
<td>DANE</td>
<td>Urban</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>EHPM</td>
<td>1987-2009</td>
<td>23</td>
<td>24 65</td>
<td>July</td>
<td>INEC</td>
<td>National</td>
</tr>
<tr>
<td>Ecuador</td>
<td>EPED and ENEMDU</td>
<td>1989-2009</td>
<td>20</td>
<td>27 65</td>
<td>November</td>
<td>INEC</td>
<td>Urban</td>
</tr>
<tr>
<td>El Salvador</td>
<td>EHPM</td>
<td>1995-2007</td>
<td>13</td>
<td>29 60</td>
<td>December</td>
<td>DIGESTYC</td>
<td>National</td>
</tr>
<tr>
<td>Honduras</td>
<td>EHPM</td>
<td>1990-2007</td>
<td>17</td>
<td>25 65</td>
<td>May</td>
<td>INE</td>
<td>National</td>
</tr>
<tr>
<td>Mexico</td>
<td>ENEU</td>
<td>1987-2001</td>
<td>15</td>
<td>26 65</td>
<td>November</td>
<td>INEGI</td>
<td>Urban</td>
</tr>
<tr>
<td>Peru</td>
<td>ENAHO</td>
<td>1997-2009</td>
<td>13</td>
<td>15 65</td>
<td>November</td>
<td>INEI</td>
<td>National</td>
</tr>
</tbody>
</table>
As highlighted by Deaton (1997), pseudo-panels have several advantages over panel data. A pseudo-panel does not suffer from attrition because it is constructed from new samples every year, and “it is likely to be less susceptible to measurement error than panel data, because the quantity that is tracked is normally an average, and the averaging will nearly always reduce the effects of measurement error” (Deaton 1997, p. 120).

Furthermore, this pseudo-panel approach removes ability biases from the estimated RTS. The ability bias refers to the omission of unobserved worker ability in traditional Mincerian estimates of the RTS. Individual ability might be correlated with both the level of education and wages, and its omission might thus yield upwardly biased estimates of the RTS. By using cohort averages and under the rather strong assumption that ability does not vary systematically across cohorts, the pseudo-panel approach washes out any potential ability bias. Angrist (1991) showed that this pseudo-panel approach is equivalent to an IV regression that uses cohort dummies as an instrument for the level of education.

Moreover, when a cross-section is used to estimate a Mincerian equation, age might reflect not only the age effect but differences due to specific characteristics of each generation or cohort. Different generations might have different schooling opportunities, different initial wealth and other characteristics that might influence their overall earnings. The pseudo-panel approach allows us to account for these differences by including cohort-specific effects in the estimations of the determinants of earnings.

More formally, Lederman and Rojas Alvarado (2011) follow the Mincerian tradition and assume that income is (mainly) explained by education and experience. Consider the following wage equation:

\[ \ln(w_{it}) = \omega + f(s_{it})\rho + X_{it}\beta + \nu_i + \varepsilon_{it}, \]

where, \( f(\cdot) \) is linear, \( s_{it} \) refers to the educational level of individual \( i \) in the year \( t \), \( \nu_i \) represents characteristics of the individual \( i \) (such as innate ability), and \( X_{it} \) refers to other determinants of income. If \( \nu_i \) is correlated with \( s_i \) the least-squares estimation of (5.1) (without individual fixed effects, which cannot be included when the data come from repeated cross sections of workers instead of panel data) captures this correlation, and the estimate of \( \rho \) will be biased upwards.

Taking the means for each birth-year cohort in (1) allows for the estimation of the pseudo-panel model:

\[ \ln(w_{ct}) = \omega + f(s_{ct})\rho + X_{ct}\beta + \nu_c + \varepsilon_{ct} \]
In (5.2) the subscript $c$ represents a birth cohort. As noted by Kaymak (2008) and Warunsiri and McNown (2009), this averaging, eliminates the ability bias, and a cohort fixed effect, $\nu_c$, can be included in the model when working with data from repeated cross sections of workers.

Thus, for each country, we estimate the following model:

$$\ln(w_{ct}) = \omega + A\alpha + C\theta + Y\psi + f(s)\rho + \varepsilon_{ct},$$

where $A$ is a matrix of age dummies, $C$ is a matrix of cohort dummies, $f(s)$ is linear and $Y$ is a matrix that allow us to capture the cyclical component of wages by year. The latter was proposed by Deaton and Paxson (1994) to solve the problem of collinearity between the cohort, age and year effects.

As we mention above, the cohort is defined by the year of birth of the individual, then there is a linear relationship between the cohort ($c$), age ($a$) and the year ($t$): $c = t - a$. Given this (linear) relationship, it is impossible to estimate (5.3) using dummy variables for age, cohort and years. To solve this problem, Deaton and Paxson (1994) proposed attributing time trends to age and cohort effects, and to use the year effect to capture only cyclical fluctuations. Deaton (1997) suggested regress $\ln(w_{ct})$ on dummies for cohort (excluding the first), dummies for age (excluding the first), and a set of $\tau - 2$ year dummies defined as:

$$d^*_t = d_t - [(t-1)d_{t-1} - (t-2)d_{t-2}],$$

where $t = 3, \ldots, \tau$ and $d_t$ equals 1 if the year is $t$ and 0 otherwise. The matrix $Y$ is formed by the variables $d^*_t$, with the sum of its elements being equal to zero. That is, the decomposition ensures that the effects captured by $d^*_t$ are strictly transitory.

Hence, we include in our regressions the years of schooling (YOE); the interaction between the YOE and a trend $T$; and also the interaction between the YOE and the dummy variables $d^*_t$. The coefficient on this last interaction provides an estimate of the cyclical component of the RTS. The estimation model is thus:

$$\ln(w_{ct}) = \omega + A\alpha + C\theta + Y\psi + s_{ct}\rho_1 + Ts_{ct}\rho_2 + \sum_{t=3}^{\tau} s_{ct}d^*_t\rho_3 + \varepsilon_{ct}$$

This specification is quite flexible; it allows for cyclical and trend components in the RTS. As Goldberg and Pavcnik (2007) point out the literature on globalization and inequality has argued that all countries have experienced a rising skill premium over time, particularly in developing countries. This trend might reflect an increase in the demand for skilled workers caused by outsourcing of skill-intensive activities, rising capital flows that are complementary to skilled labor, or by skill-biased technological change, for example.
On the other hand, the relative supply of educated workers has also changed as the coverage of educational systems has improved in LCR. Thus, changes in either the relative supply or demand for skilled workers, which occur gradually, can account for a trend in the RTS. For example, Riveros (1990) found a declining time-trend in rates of return for Chile in the period 1960-1985. This trend is explained by the expansion of the educational system, the shift of labor demand from middle education to primary skills and to increasing real costs of education. Similarly, Patrinos and Sakellariou (2006) found that the RTS in Venezuela declined steadily from the 1970’s to the mid-1990s, followed by an increasing trend thereafter. The authors suggest that during the 1990s in Venezuela, the lack of opportunities in the formal sector resulted in an increasing number of workers moving to the informal sector, where the returns to education are low, therefore increasing the RTS. Psacharopoulos (1989) presents the behavior of the RTS for a large number of countries finding a declining trend over time. In part, this tendency is explained by expansions of the educational system that have been taken place. It is thus prudent to allow for deterministic trends in the estimation of the RTS and its cyclical components as in our preferred model (5.7).

For practical reasons, we limit our sample to male workers with information on income, hours worked and years of education in each survey. We also restricted our sample to those within a certain range of age, which varies from country to country. This age range was selected to avoid the inclusion of younger individuals who are working and acquiring more years of education, because estimates of RTS can be distorted by young workers who have not finished their education but report income from part time jobs, or jobs which do not reflect their RTS.

To select the minimum age, we calculated Deaton’s decomposition for the years of schooling. Then the minimum age was selected as the age at which the age effect flattens. The maximum age was fixed at 65 years old, except for those countries in which a pension can be obtained at a younger age.

Moreover, since education can impact the probability of being unemployed, as highlighted by the existing literature, we estimated RTS using two samples. The first one includes only salaried male workers and the second includes these workers as well as the unemployed. When we only include salaried workers, we use their hourly (real) income. When we include salaried workers and the unemployed we use the monthly wage, and we assume that the income of the unemployed is zero. In

30 The inclusion of female workers would complicate the estimation due to selectivity biases related to the decision to participate in the labor market.

31 While the pseudo –panel approach has many advantages described above, it also has some weaknesses. One concerns selectivity biases due to workers approaching retirement age. We thank John Gilles for pointing this out. Another weakness concerns measurement error in the cohort averages that might be due to sampling errors, as the surveys are not designed to be representative of workers by cohort. As explained further below, we follow Deaton (1985, 1997) and Deveraux (2007a,b) and use Weighted Least Squares with the number of workers in each cohort group and year of the survey as the weights. Thus we place more weight on observations with a larger number of (randomly) sampled workers by cohort-year.
both estimations, we used weighted least squares taking the size of the cohort as weights, which helps dilute biases due to sampling errors affecting the averages by cohort group.