Jobless Recoveries during Financial Crises: Is Inflation the Way Out?

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The slow rate of employment growth relative to that of output is a sticking point in the recovery from the financial crisis episode that started in 2008 in the U.S. and Europe (a phenomenon labeled "jobless recovery"). The issue is a particularly burning one in Europe where some observers claim that problem economies (like Greece, Italy, Ireland, Spain, and Portugal) would be better off abandoning the euro and gaining competitiveness through steep devaluation. This would be a momentous decision for Europe and the rest of the world because, among other things, it may set off an era of competitive devaluation and tariff war. Thus, these topics require prompt attention.

In Calvo, Coricelli, and Ottonello (2012), we show that jobless recoveries have been a salient feature of financial crises in advanced economies since World War II. Once output per capita recovers its trend, the increase in unemployment from output peak to recovery tends to be higher during financial crises than in other recession episodes. This is consistent with findings in previous empirical literature that have documented the effect of financial crises on

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unemployment (see, for example, Knotek and Terry, 2009; Reinhart and Reinhart, 2010; Bernal-Verdugo, Furceri, and Guillaume, 2012; and Chodorow-Reich, 2013). However, jobless recoveries are not, in general, observed in high-inflation episodes. In particular, in Calvo, Coricelli, and Ottonello (2012), we show that in Emerging Market (EM) financial crisis episodes in which the annual rate of inflation exceeds 30 percent, when output recovers its trend level, the rate of unemployment returns to its pre-crisis level, but real wages are 13 percent below their pre-crisis level—a phenomenon that we label "wageless recovery." Thus, inflation is no panacea for the labor market, and evidence supports the view that the labor market is highly vulnerable to financial crisis through high unemployment and/or low wages. Moreover, the fact that inflation helps to reduce the rate of unemployment suggests that the two sets of cases identified in our previous study are partly a result of *nominal wage rigidity* (see Schmitt-Grohé and Uribe, 2011; 2013b). If this is the case, currency devaluation, insofar as it generates inflation, may help to speed up the return to full employment in Europe (as argued in Friedman, 1953), but wage earners are likely to bear the brunt of the adjustment.

The objective of this paper is twofold: (1) to exhibit case studies for individual countries that illustrate econometric results in Calvo, Coricelli, and Ottonello (2012), and (2) to discuss policies related to jobless recovery in the current financial crisis in the U.S. and Europe: inflation, real currency depreciation, and credit-recovery policies.

First, case studies are developed for Sweden and Argentina. We look at two crisis episodes for each country. In the case of Sweden, we examine the 1990-1993 and the 2008-2009 recessions. Identifying the financial component of each crisis with a methodology similar to that developed in Calvo, Izquierdo, and Mejia (2008), we show that only the crisis of 1990-1993—one of the widely studied "Big Five" banking crises—experienced a *domestic credit sudden stop* (i.e. a sudden and large contraction in domestic bank credit flows). Although the 2008-2009 recession happened during a worldwide financial crisis, evidence suggests that recession came through a contraction in exports due to a fall in demand from the E.U. rather than a shock stemming from the financial market. Inflation was relatively low in both episodes (below 10 percent annual rate) and, thus, putting them side-by-side allows us to compare a financial with a non-financial crisis for the same economy under low inflation. Results illustrate the econometric evidence in Calvo, Coricelli, and Ottonello (2012): joblessness is substantially larger during the financial crisis (i.e., the 1990-93 episode).

For Argentina, we select the 1995 and the 1998-2002 crises. Both episodes can be classified as financial crises. However, the 1998-2002 episode exhibits a much higher rate of inflation than the threshold considered in our previous study (30 percent), while in the 1995 crisis, inflation remained well below the threshold. In line with Calvo, Coricelli, and Ottonello (2012), the 1995 episode displays a sharp and persistent increase in the rate of unemployment in contrast with the 1998-2002 episode in which unemployment recovers *pari passu* with output (despite the record-setting output contraction from peak to trough, comparable to that in the U.S. Great Depression). However, when output recovers its pre-crisis level, wages remain 16 percent below their pre-crisis level.

Second, we discuss three policy tools to speed up employment recovery during financial crises: inflation, real currency depreciation, and credit-recovery policies. Being relatively rare phenomena in advanced economies, the resulting dearth of data makes policies in financial crises difficult to characterize. An option is to use the experience of (not so rare) EM financial crisis events as a laboratory to discuss policy options. This is the methodology we follow in this paper. Thus, the discussion of policies will be based on an empirical analysis that extends the one in Calvo, Coricelli, and Ottonello (2012), focusing on 55 financial crisis episodes in EMs.

We begin by digging more deeply into the relationship between inflation and jobless recovery, also considering the possible role of real currency depreciation and resource reallocation (between tradables and non-tradables). This discussion is particularly relevant for countries that, being in the Eurozone, cannot follow a nominal currency depreciation policy to mitigate high unemployment rates (e.g. Greece, Italy, Ireland, Spain, and Portugal). We show some evidence suggesting that large inflationary spikes (not a higher inflation plateau) help employment recovery. Even in high-inflation episodes, inflation typically returns to its pre-crisis levels, which is consistent with a vertical Phillips curve. Another finding is that (independent of inflation) financial crises are associated with real currency depreciation (i.e., the rise in the real exchange rate) from output peak to recovery. This shows that the relative price of non-tradables fails to recover along with output even if the real wage does not fall, as is the case in low-inflation financial crisis episodes. This implies that, contrary to widespread views, nominal currency depreciation may eliminate joblessness only if it generates enough inflation to create a contraction in real wages; real currency depreciation or sector reallocation might not be sufficient to avoid jobless recovery if all sectors are subject to binding credit constraints that put labor at a disadvantage with respect to capital. Similarly, for countries with fixed exchange rates, "internal" or fiscal devaluations during financial crises are likely to work more through reductions in labor costs than changes in relative prices and sectoral reallocation obtained through taxes and subsidies affecting differentially tradable and non-tradable sectors.[1]

However, neither nominal nor real wage flexibility can avoid the adverse effects of financial crises on labor markets, as wage flexibility determines the distribution of the burden of the adjustment between employment and real wages, but does not relieve the burden from wage earners. Our findings highlight the difficulty in simultaneously preventing jobless and wageless recoveries, and suggest that the first line of action should be an attempt to relax credit constraints. We discuss both a theoretical framework and empirical evidence that help to make this case.

Finally, we argue that an effective way to prevent jobless recoveries in EMs may be to accumulate international reserves during booms, which can be used to provide credit to firms during financial crises.

1. Two Case Studies: Sweden and Argentina

1.1 Sweden: Financial Crises and Jobless Recovery

In the early 1990s, Sweden experienced one of the largest "Big Five" banking crises in the post-war history of developed economies. The Swedish banking crisis has been extensively studied (see, for example, Englund, 1999; Reinhart and Rogoff, 2008). Moreover, this episode has been frequently cited in literature to illustrate the effect of banking crises on unemployment (see, for example, Knotek and Terry, 2009; Talvi, Munyo, and Perez, 2012).

Our aim is to identify the effect of the financial component of the crisis on the labor market by comparing the outcomes of the Swedish banking crisis of the early 1990s with those of another recession episode in Sweden, similarly deep, but whose nature has not been financial: the recession that started in 2008 in the context of the European economic crisis.

1. Fahri, Gopinath, and Itskhoki (2012) and Schmitt-Grohé and Uribe (2011) show that fiscal instruments can replicate the real effects of nominal devaluations and discuss this route for European countries as a way to exit their recession ensuing from the recent global financial crisis.

Figure 1 (panel A) depicts the behavior of output per capita in the two recession episodes. Both episodes displayed a large and similar contraction of economic activity: during the banking crisis of the early 1990s, output per capita from peak to trough dropped by 7.7 percent, while in the crisis that started in 2008, output per capita contracted from peak to trough by 8.6 percent. The duration of both episodes is also comparable: 25 quarters from peak to output recovery point in the banking crisis of the early 1990s, and 19 quarters in the 2008 recession. Measured by the year-on-year change in producer price index, inflation in both episodes was relatively low: the maximum level of inflation during the crisis of 1991-1993 and the crisis of 2008-2009 was 8.6 percent and 6.9 percent, respectively.

While both crises are comparable in terms of economic activity and inflation, the financial aspect of these recession episodes is remarkably different. In the early 1990s, Sweden went through a severe real estate crisis. Real estate prices dropped by more than 50 percent in 1991-1992, affecting major banks heavily exposed to the real estate market. A systemic banking crisis followed. During the recession of 2008-2009, in turn, the picture looks significantly different. In spite of the sharp drop in output, the financial sector was resilient, and credit conditions remained relatively favorable for firms and households. Short-term interest rates were markedly reduced after 2008, and the spread between Swedish and German long-term interest rates remained stable and close to zero throughout the recession episode.

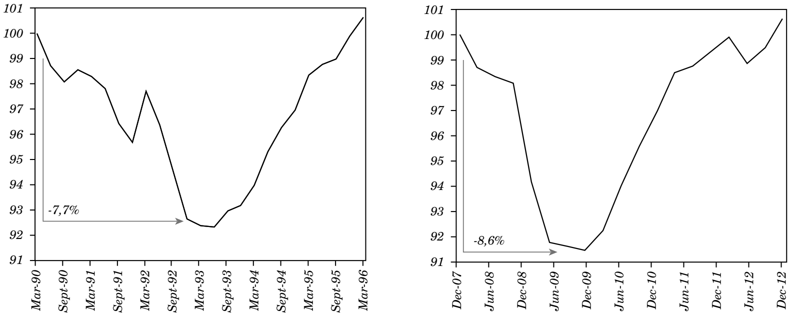
To more formally identify the financial nature of the two recession episodes, we determine whether, in each episode, the economy experienced a sudden and large contraction in domestic bank credit flows (i.e. a *Domestic Credit Sudden Stop*)[2] using an empirical methodology similar to that developed in Calvo, Izquierdo, and Mejia (2008), detailed in appendix A. Results are portrayed in figure 2 (panel A). We can see that, in the last 30 years, Sweden experienced two domestic sudden stops, both during the banking crisis of the early 1990s. During the 2008 recession episode, Sweden experienced a deceleration in bank credit growth but not a domestic sudden stop. This empirical evidence supports the view that, of the two recession episodes we are studying for Sweden, only the banking crisis of the early 1990s constitutes a financial crisis episode. Finally, figure 1 (panel B) displays the behavior of real credit stock to the private

2. The concept of a (External) Sudden Stop was originally developed to describe a sudden and large contraction in *external* credit flows (see Calvo, 1998).

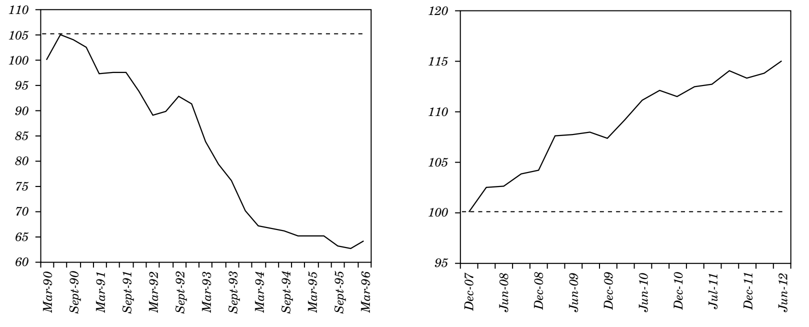
Figure 1. Sweden: Financial Crisis and Jobless Recovery

Crisis of 1991-1993 *Crisis of 2008-2009*

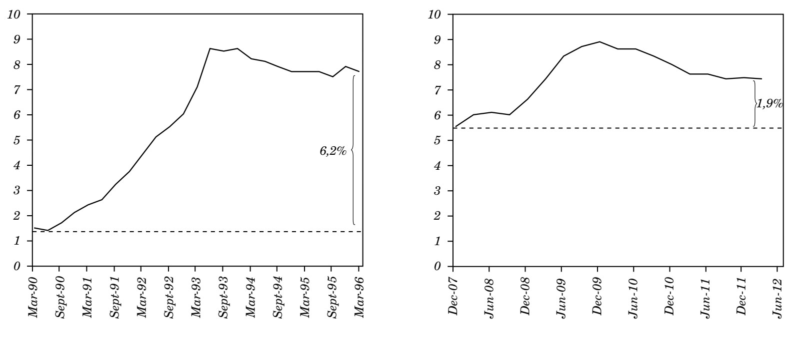
A. Output
(GDP per capita, in real terms)



B. Bank credit
(Bank credit to de private sector, per capita stock, in real terms)



C. Unemployment
(Rate, percent)



Source: Author's elaboration.
Data for GDP and unemployment rate was obtained from OECD; data for population was obtained from WDI; data for bank credit to the private sector and the CPI was obtained from the IMF. Real bank credit data was constructed using the CPI.

sector during both episodes. We can see that, during the banking crisis of the early 1990s, real bank credit stock contracted by 35 percent while it continued increasing throughout the 2008 episode.

The behavior of unemployment is depicted in figure 1 (panel C). It can be seen that the financial crisis of the early 1990s was associated with a much larger jobless recovery than the 2008 recession. In particular, during the financial crisis of the early 1990s, when output per capita recovers its pre-crisis level, unemployment is still 6 percentage points above its pre-crisis level, compared to only 1.9 percentage points during the 2008 recession. This illustrates the finding in Calvo, Coricelli, and Ottonello (2012) that financial crisis episodes are associated with a larger jobless recovery than non-financial recession episodes.

1.2 Argentina: High Inflation and Wageless Recovery

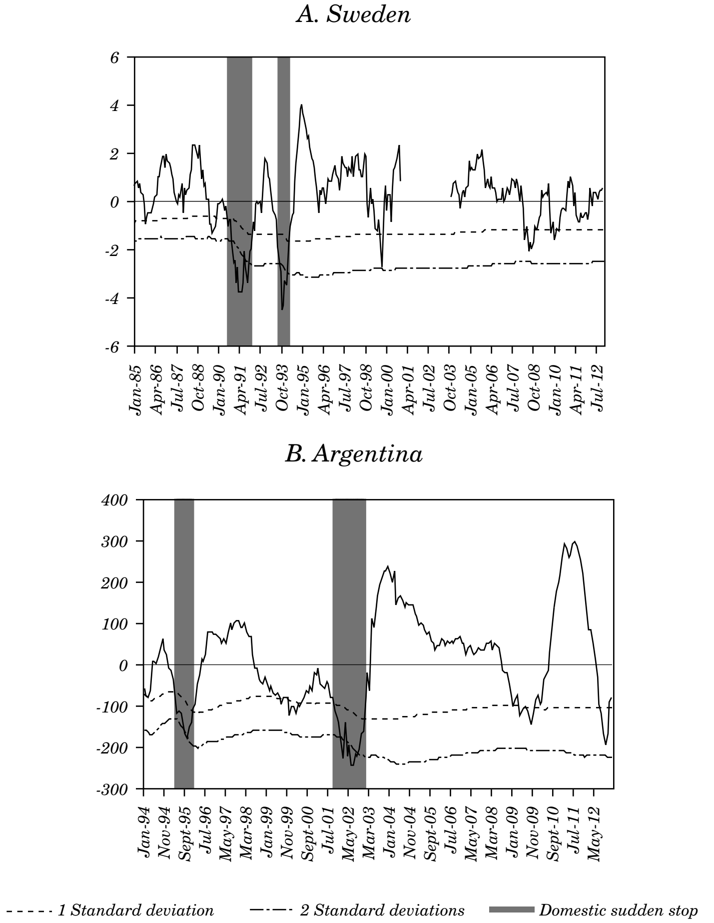
During the 1990s Argentina experienced two recession episodes. The first started in 1994 and was triggered by the "Tequila crisis"; the second started in 1998 and was initially associated with the East Asian and Russian crises. As shown in figure 2 (panel B), Argentina experienced a domestic sudden stop during both episodes (see appendix A for details). Thus, using this methodology, both recession episodes could be classified as financial crises. Other methodologies such as Calvo, Izquierdo, and Talvi (2006) and Reinhart and Rogoff (2009) reach the same conclusion.

The crisis of 1998-2002 was the most severe in terms of both financial and real outcomes. Between 1998 and 2002, output per capita fell 23.7 percent from peak to trough, a much larger fall than the 6.5 percent peak-to-trough output per capita contraction between 1994 and 1995 (figure 3, panel A). However, analyzing the behavior of unemployment, a striking fact emerges: while the 1994-1995 crisis shows a significant jobless recovery (when output per capita recovers its pre-crisis level, unemployment is still 4 percentage points above its pre-crisis level), the 1998-2002 crisis displays no trace of jobless recovery at all (when output per capita recovers its pre-crisis level, unemployment also recovers its pre-crisis level, as seen in figure 3, panel B).

A key difference between these episodes is inflation (figure 3, panel C).[3] During the crisis of 1994-1995 Argentina was in a currency peg, and the maximum level of inflation was 5.5 percent per annum.

3. We measure inflation in each quarter with the year-on-year change of the producer price index.

Figure 2. Domestic Sudden Stops in Sweden and Argentina
(Bank credit flows to the private sector, real year-on-year change)



Source: Author's elaboration.
Real bank credit data was constructed using the CPI. Data for bank credit to the private sector and the CPI was obtained from the IMF.

During the 1998-2002 crisis, Argentina abandoned the currency peg, and inflation reached 123 percent per annum.[4]

4. Schmitt-Grohé and Uribe (2011) also provide evidence for the role of devaluation on unemployment and real wages in the Argentinean 2001-2002 episode.

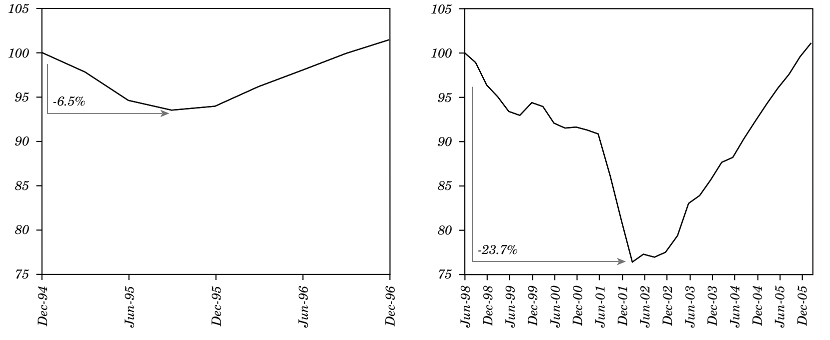
Inflation, however, cannot fully erase the trace of financial crises on the labor market. Figure 3 (panel D) shows the behavior of real wages. It can be seen that the crisis of 1998-2002 displays a significant "wageless" recovery: when output per capita recovers its pre-crisis level, real wages are still 16.4 percent below their pre-crisis level.

The case of Argentina illustrates the second lesson from our case studies: during financial crises, inflation seems to be able to eliminate jobless recoveries but at the expense of a substantially lower real wage, as shown in Calvo, Coricelli, and Ottonello (2012).

Figure 3. Argentina: Financial Crises, Inflation, Jobless and Wageless Recovery[a]

Crisis of 1994-1995 *Crisis of 19988-2001*

A. Output
(GDP per capita, in real terms)



B. Unenployment
(Rate, percent)

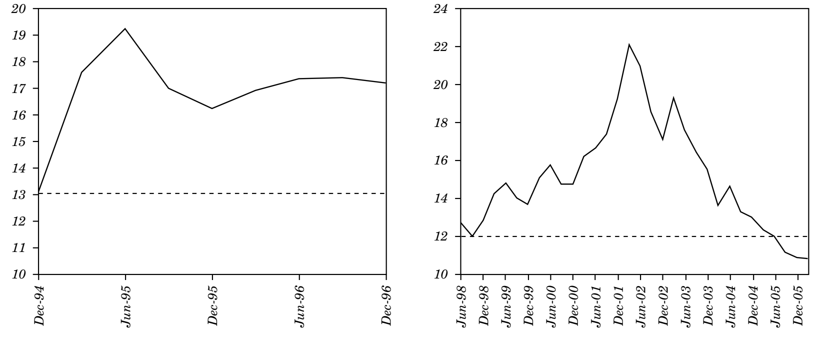
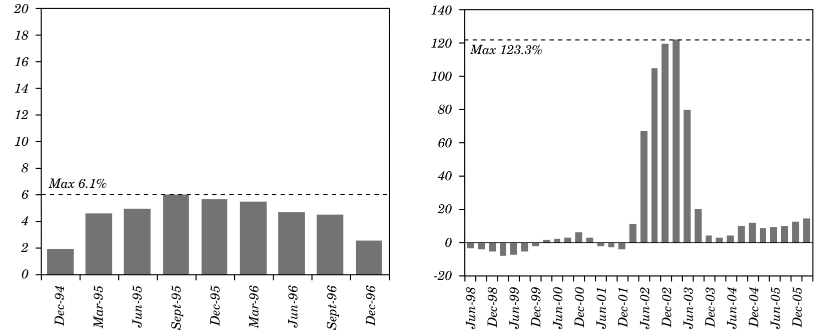


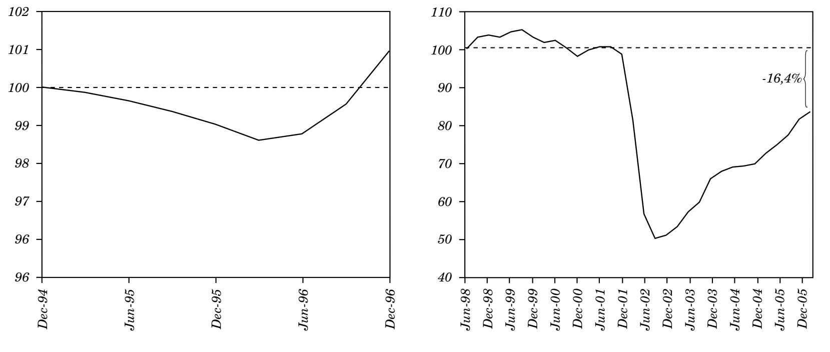
Figure 3. (continued)

Crisis of 1994-1995 *Crisis of 19988-2001*

C. Inflation
(PPI, percentage change)



D. Real wage
(Peak=100)



Source: Author's elaboration.
Data for GDP, PPI, and unemployment rate was obtained from INDEC (Instituto Nacional de Estadística y Censos, Argentina); data for nominal wages was obtained from ECLAC; data for population was obtained from WDI. In periods in which data for unemployment, wages, and population were not available at quarterly frequency, interpolation methods based on semi-annual or annual data were used to illustrate the quarterly behavior of the series.

2. Policy Discussion

This section discusses policies to mitigate jobless recoveries during financial crises. We conduct an empirical study to investigate the role of inflation, real currency depreciation, and credit policies on jobless recoveries during financial crises. We begin this section by describing the data that we use in the empirical analysis.

2.1 Data

2.1.1 Sample construction

The main objective of the empirical analysis is to test how inflation, real exchange rate, sector allocation, and credit are related to unemployment and wage recovery during financial crises. To this end, we build a sample of financial crises in EMs and define an output peak and a recovery point for each recession episode.

We use the sample of recession episodes since 1980 identified in Calvo, Izquierdo, and Talvi (2006) using annual data for financially integrated EMs.[5] In this sample, the occurrence of a recession episode is identified as a period of negative change in GDP.

As in Calvo, Coricelli, and Ottonello (2012), we define the output peak and recovery point using the cyclical component of output per capita for each recession episode.[6] In particular, given a recession episode, we define a pre-crisis peak as the period displaying the maximum cyclical component of output per capita in the window with a positive cyclical component of output per capita preceding the recession episode. The recovery point is defined as the period after the output trough in which output per capita recovers its trend level. The output trough is defined as the period between output peak and recovery point displaying the minimum level of cyclical component of output per capita. The cyclical component of output was computed using the HP filter. Data on output and population are obtained from OECD, WEO, and WDI datasets. With this methodology, we identify 71 recession episodes in EMs.

5. Countries included in the sample are Argentina, Brazil, Bulgaria, Chile, Colombia, Croatia, Czech Republic, Dominican Republic, Ecuador, El Salvador, Hungary, Indonesia, Ivory Coast, Lebanon, Malaysia, Mexico, Morocco, Nigeria, Panama, Peru, Philippines, Poland, Russia, South Africa, South Korea, Thailand, Tunisia, Turkey, Ukraine, Uruguay, and Venezuela. Since we are interested in analyzing unemployment recovery in market economies during the crisis, we excluded two types of episodes from this sample. First, those associated with the collapse of the Soviet Union (in particular, the recession episodes that started prior to 1991 in Bulgaria, Czech Republic, Croatia, Hungary, Poland, Russia and Ukraine). Second, episodes in which output per capita did not fully recover its trend level before the occurrence of another recession episode.

6. As discussed in Calvo, Coricelli, and Ottonello (2012), defining the recovery point of output per capita in terms of its trend level is relevant to ensure that differences among episodes are not driven by different recoveries to trend as argued in Ball, Leigh, and Loungani (2013). Dating recession episodes with the *level* of output per capita (i.e. defining the recovery point as the point in which output recovers its pre-crisis level), similar results are obtained.

From this set of recession episodes, we focus on financial crises. As in Calvo, Coricelli, and Ottonello (2012), we define a *financial crisis* as a recession episode in which a banking crisis event or a debt default or rescheduling event occurs in a window of one year before the output per capita peak, and one year after the output per capita recovery point. Data on banking crises, debt default and rescheduling events are obtained from Reinhart and Rogoff (2009). This methodology yields a sample of 55 episodes of financial crises in EMs, detailed in appendix B (table B.1).

2.1.2 Definition of variables

All variables are defined using annual data. We measure jobless and wageless recovery as in Calvo, Coricelli, and Ottonello (2012) and compute, for each episode, the change in the unemployment rate and the log change in real wages between output peak and output recovery points (denoted $\Delta_{PR}u$ and $\Delta_{PR}w$, respectively). The data on unemployment and wages are obtained from WEO, ILO, ECLA, Trading Economics datasets, and national sources. Nominal wages are deflated by the producer price index obtained from the IMF dataset and national sources.[7]

With these two variables we construct a proxy for the change of the real wage bill per capita, denoted by $\Delta_{PR}wl$. With $\Delta_{PR}l$ denoting the log change of employment rate, the change of the wage bill per capita is defined as $\Delta_{PR}wl = \Delta_{PR}w + \Delta_{PR}l$.[8]

We follow a similar strategy to measure real exchange rate depreciation and resource reallocation. For each episode, we compute the log change of the real exchange rate, the log change in the share of tradables in production, and the log change in the share of exports in production between output peak and output recovery point (denoted by $\Delta_{PR}rxr$, $\Delta_{PR}ty$ and $\Delta_{PR}xy$ respectively). The real exchange rate (RXR) is defined as the ratio of U.S. and domestic prices, both expressed in domestic currency (i.e. $RXR = (EP^*/P)$, where E denotes the nominal exchange rate, P^* denotes U.S. CPI, and P denotes domestic CPI). We define the tradable output as the sum of value added in agriculture and manufacturing, as is typically done

7. For countries in which producer price index is not available we use the wholesale price index or the consumer price index.

8. Due to data availability, we proxy the log change of employment rate using unemployment data, i.e.

$\Delta_{PR}l = log\ (1-u_R/1-u_P)$

in the literature. We compute the share of tradables in production as the ratio between tradable output and GDP, and the share of exports in production as the ratio between exports of goods and services and GDP, based on national account statistics. Both ratios are computed with data at constant prices. Data for the real exchange rate and the share of tradables and exports in production are obtained from WEO and WDI datasets.

For each episode, we compute the year-on-year inflation rate at the output peak (π_P), at the output trough (π_T) and at the output recovery point (π_R); and the maximum level of inflation for the entire episode ($\pi_{\max}$). Following Calvo, Coricelli, and Ottonello (2012), we define a high (low) inflation episode as one in which the maximum level of inflation is above (below) the 30 percent annual rate. This threshold is the upper bound considered in Dornbusch and Fischer (1993) to define moderate inflations, and the cutoff above which Calvo and Reinhart (2002) define high inflations. With this classification, we construct a dummy variable that takes the value of 1 if the episode displays high inflation and zero otherwise (denoted $high\_\pi_{\max,i}$). It is also useful to distinguish episodes of hyperinflation. We consider a hyperinflation episode as one in which the annual inflation rate is above 200 percent. This classification leads us to identify eight hyperinflation episodes in line with those studied in the literature (see for example, Hanke and Krus, 2013; Sargent, Williams, and Zha, 2009).[9] We compute inflation using the producer price index (wholesale price index or the consumer price index when not available) obtained from the IMF dataset and national sources.

We construct a variable to measure credit recovery during a recession episode (denoted by $\Delta_{PR}credit$). Based on the findings in Calvo, Izquierdo, and Talvi (2006), we use the change in the cyclical component of real credit per capita from output peak to full recovery point ($\Delta_{PR}credit\_c$).[10] The cyclical component of credit was computed using the HP filter. Data on credit was obtained from IFS dataset and from national sources.

9. In particular the hyperinflation episodes are Argentina 1980, 1984, and 1987; Bulgaria 1995; Brazil 1980, 1987 and 1991; and Peru 1987 (dates refer to output peak of the episode).

10. In the recession episodes in which a financial crisis episode occurs prior to or at the output peak, we consider the maximum level in the cyclical component of real credit per capita between the beginning of the financial crisis and the output peak instead of the cyclical component of real credit per capita at the output peak. Otherwise, when a financial crisis starts before the recession episode, considering the level of credit at the output peak is considering a level of credit already affected by the financial crisis episode.

Finally, the empirical analysis includes two sets of controls. The first are labor market controls (denoted by $labor\_mkt_P$, computed at the output peak. As emphasized in the labor market literature, labor market institutions are likely to affect the response of unemployment to shocks, including the recovery of unemployment following recession episodes (see Blanchard, 2006; Bertola, Blau, and Kahn, 2007; Furceri and Mourougane, 2009; Bernal-Verdugo, Furceri, and Guillaume, 2012). In particular, we use two variables: an indicator of labor market legislation ($lamrig_P$) from the recent dataset on labor market regulations constructed by Campos and Nugent (2012); and the natural rate of unemployment ($natural\_u_P$), computed as the average rate of unemployment in the whole sample period. Second, we control for the secular growth experienced throughout the recession episode, denoted by gd. With g denoting the annual secular growth rate of a given country and d the duration of a recession episode, the secular growth experienced throughout the recession episode is defined as $gd = g \times d$. The secular growth rate for a given country is computed as the average per capita growth rate between 1980 and 2007. The duration of the recession episode is defined as the number of years from output peak to recovery point. Controlling for this variable is relevant since countries can have different long-run growth rates, and recession episodes might differ in their duration, which can affect jobless and wageless recoveries. For instance, in a neoclassical growth model, higher technological progress would lead to a higher growth of real wages.

2.2 Inflation and Labor Market Recovery from Financial Crises

Empirical evidence in Calvo, Coricelli, and Ottonello (2012) suggests that high inflation (defined as annual inflation above 30 percent) may help to lower the rate of unemployment in the context of financial crises. This is illustrated in our sample of EM financial crises in figure 4 (panels A and B): low-inflation episodes display jobless recovery, with real wages similar to pre-crisis levels; high-inflation episodes display no jobless recovery, but a significant wageless recovery.

To formally test this stylized fact, we estimate a model relating jobless and wageless recoveries to high inflation, controlling for labor market characteristics and secular growth:

$$\Delta_{PR} z_i = \alpha + \beta\, high\_\pi_{\max,i} + X'_i \gamma_i + \in_i, \tag{1}$$

where $\Delta_{PR}z_i$ denotes the jobless recovery measure ($\Delta_{PR}u_i$) or wageless recovery measure ($\Delta_{PR}w_i$) in financial crisis episode i, X_i is a vector of controls including labor market controls ($labor\_mkt_{P,i}$) and secular growth (gd_i), and $\in_i$ is a random error term (variables are defined in section 2.1). The coefficient of interest is β the difference in jobless recovery or wageless recovery displayed by high-inflation episodes relative to low-inflation episodes.

Results from OLS estimates are presented in table A1 and confirm the findings in Calvo, Coricelli, and Ottonello (2012): high-inflation episodes tend to display less unemployment and lower real wages at output recovery point than low-inflation episodes. Estimated coefficients are statistically significant at the five or ten percent level, and economically relevant: high-inflation episodes tend to display 2 percent less increase in the unemployment rate from output peak to recovery than low-inflation episodes; and from output peak to recovery point real wages in high-inflation episodes tend to decrease 15 percent more than low-inflation episodes. Appendix C (table C.2) shows that these results are robust to the inclusion of additional recession and country controls.

The threshold we have considered so far to define a high-inflation episode (above 30 percent) is similar to that used in previous literature (Dornbusch and Fischer, 1993; Calvo and Reinhart, 2002). To study this threshold more formally, we conduct threshold estimation, following Hansen (2000), to identify a level of inflation from which financial crisis episodes have a different degree of jobless recovery. Results confirm the presence of a threshold around 30 percent (point estimate of 31.7 percent). The estimation procedure and results are detailed in appendix D.

Having established a link between high inflation and unemployment recovery, we now use the sample of EM financial crises to study the dynamic pattern displayed by inflation, which is especially relevant from a policy perspective. As shown in figure 4 (panel C) in the typical financial crisis episode, inflation spikes up between output peak and trough, and returns to its pre-crisis level once output recovers its trend level, not resulting in permanently higher inflation. Since inflation returns to its pre-crisis level even in high-inflation episodes (excluding hyperinflation episodes, section 2.1), seems to suggest that a *transitory* hike in the rate of inflation can have an effect on unemployment recovery.

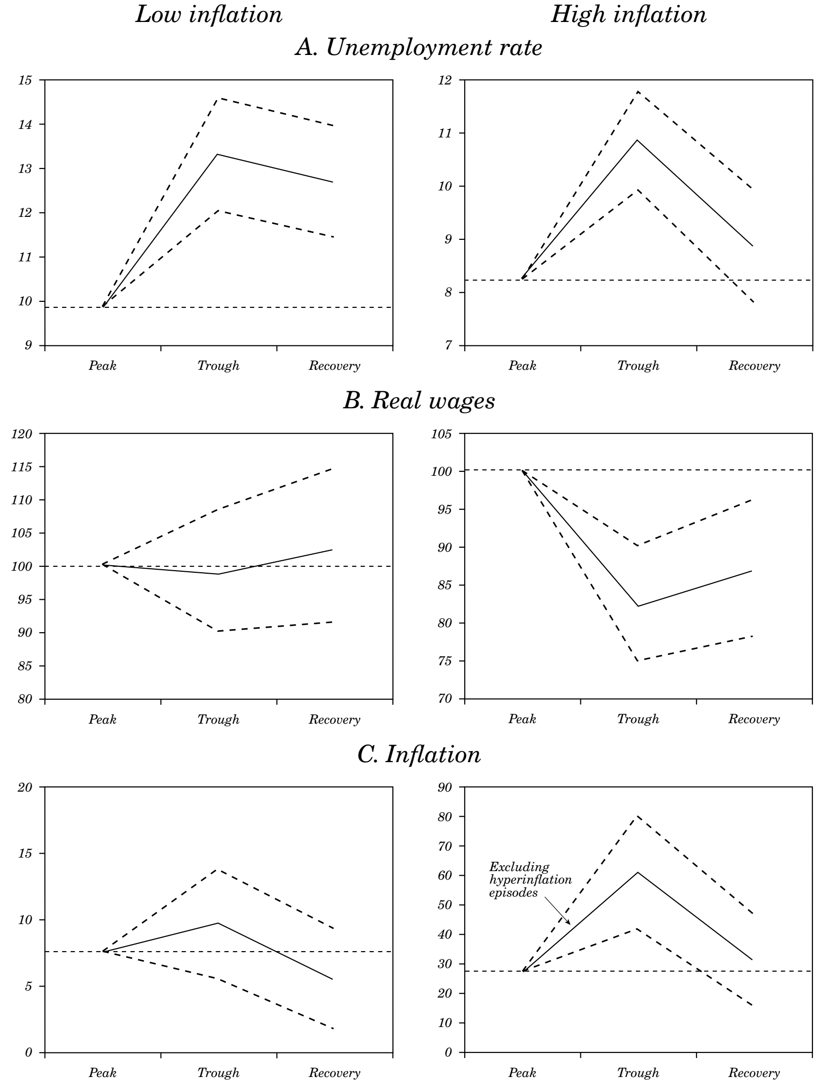
To provide further evidence on this issue we estimate model (1) —relating high inflation to jobless and wageless recovery—but instead of classifying high-inflation episodes based on the maximum level of inflation experienced during the episode, we classify high-inflation episodes based on inflation experienced at the output peak and at the output recovery point. In particular, we construct a dummy variable that takes the value of 1 if the episode displays high inflation (above 30 percent) at the output peak, and zero otherwise (denoted $high\_\pi_{P,i}$); and a dummy variable that takes the value of 1 if the episode displays high inflation (above 30 percent) at the output trough, and zero otherwise (denoted $high\_\pi_{R,i}$).

Results from OLS estimates are presented in table A.2. Neither high inflation at the output peak nor high inflation at the recovery point displays a statistically significant relationship with jobless or wageless recovery, suggesting that having high inflation when the financial crisis episode starts, or maintaining high inflation levels once output has recovered its trend, might not be necessary to fight jobless recovery. Thus, what seems to be needed to speed up employment during the recovery of financial crises is more a relative price adjustment (a fall in the real wage) than a permanent increase in the inflation rate.

To sum up, the good news for central banks is, first, that having inflation levels at the output peak or recovery points does not seem to impinge on jobless recoveries; and, second, that in the typical high-inflation episode, inflation does return to its pre-crisis low-inflation level (figure 4, panel C). The bad news is that the level of inflation that seems to be needed to mitigate a jobless recovery is not trivial (above 30 percent), and is above what most central banks would be willing to accept.

Since the threshold identified (30 percent) is relatively high, a relevant question for policy design is whether or not there is any *linear* type of relationship that can also be established empirically between the inflation experienced in the episode (level or change) and unemployment recovery. If this is the case, countries could choose only a moderate increase in inflation and still expect to have an effect on jobless recovery. Appendix E shows that there does not seem to be strong evidence supporting the statistical significance of a relationship of this type. Evidence suggests that, on one hand, a small increase in inflation might not be of any help to fight jobless recoveries. On the other hand, a very large increase in inflation appears to be overkill, which is consistent with the existence of a long-run vertical Phillips curve around the pre-crisis rate of unemployment. Thus, the relationship between jobless recovery and inflation is far from simple. Part of this complexity is probably associated with wage setting. We leave this issue for future research.

Figure 4. Inflation and Labor Market Recovery from Financial Crises in EMs



Source: Author's elaboration.

Slashed lines depict 95 percent confidence intervals for the change in unemployment and inflation, and for the log change in real wages (sample and variables defined in section 2.1). Peak, trough, and recovery point are defined using the cyclical component of output per capita, as defined in section 2.1. Low-inflation (high-inflation) episodes are episodes in which the maximum level of annual inflation rate is below (above) 30 percent. Hyperinflation episodes are eight episodes of the sample that display a maximum level of annual inflation greater than 200 percent (Argentina, 1980, 1984, and 1987; Bulgaria, 1995; Brazil, 1980, 1987 and 1991; Peru, 1987 (see section 2.1)).

2.3 Real Exchange Rates, Inflation and Labor Market Recovery from Financial Crises

During financial crises, it is common for EMs to achieve high levels of inflation by depreciating the nominal currency, as illustrated by the case of Argentina in section 1. From a policy perspective, a key issue to study is whether the relationship between high inflation and jobless recovery is driven by currency depreciation. In other words, to what extent does the transmission mechanism from inflation to higher employment rely on real currency depreciation and resource reallocation from non-tradable to tradable sectors?

To shed light on this question, we begin by analyzing the behavior of the real exchange rate and sector reallocation in our sample of EM financial crises, comparing low-inflation episodes and high-inflation episodes (for definition of sample variables see section 2.1). Figure 5 (panel A) shows that from *output peak to trough,* high-inflation episodes display larger real currency depreciation and sector reallocation than low-inflation episodes. This is easy to understand given the fact that, during an inflationary spike, the nominal exchange rate typically adjusts faster than goods prices due to price stickiness.

However, if real depreciation were the main factor behind the negative relationship between inflation and unemployment, one would expect that high-inflation episodes display higher real currency depreciation and resource reallocation, from *output peak to recovery*, than low-inflation episodes. As depicted in figure 5, this is shown not to be the case: both low-inflation episodes and high-inflation episodes display similar levels of real currency depreciation from output peak to recovery point; consistent with this, from output peak to recovery, both high-inflation episodes and low-inflation episodes display a similar change in the share of exports in production and the share of tradables in production.

To formally test these hypotheses, we estimate a model relating changes in the real exchange rate and resource reallocation to high inflation, controlling for labor market characteristics and secular growth:

$$\Delta_{P_T} q_i = \alpha + \beta \, high\_\pi_{\max,i} + X'_i \gamma_i + \epsilon_i, \tag{2}$$

where $\Delta_{P_T} q_i$ denotes the log change in the real exchange rate ($\Delta_{P_T} rxr_i$) or the measures of resource reallocation ($\Delta_{P_T} rxr_i$ or $\Delta_{P_T} xy_i$)

in financial crisis episode i, τ denotes output trough ($\tau = T$) or output recovery point ($\tau = R$), X_i is a vector of controls including labor market controls ($labor\_mkt_{P,i}$) and secular growth ($gd_{\ i}$), and $\in_i$ is a random error term (variables are defined in section 2.1). This model is similar to the one in equation (1) but uses real exchange rate depreciation and resource reallocation instead of labor market outcomes as dependent variables.

Results from OLS estimates are presented in tables 3A and 3B and confirm the above conclusions from the graphical analysis. Columns 1-3 of table 3A show that from output peak to trough, the increase in the real exchange rate is larger in high-inflation episodes than in low-inflation episodes. However, if one considers the whole crisis interval, from output peak to recovery, there is no statistically significant difference between the real exchange rate depreciation of high-inflation episodes and low-inflation episodes, as shown in columns 4-6 of table 3A. As shown in table 3B, similar conclusions are obtained for sector reallocation: sector reallocation is not larger in high-inflation episodes than in low-inflation episodes. Appendix C (table C.3) shows that high inflation is not related to changes in the real exchange rate, or sector allocation, from output peak to recovery once additional recession and country controls are included.

Having established that from output peak to recovery point there is no significant relationship between real exchange rate changes and inflation, we investigate whether, independent from inflation, real currency depreciation and sector reallocation from output peak to recovery point might have any relationship with jobless recovery. To study this question, we directly estimate the relationship between jobless recovery, real exchange rate, and resource reallocation from output peak to recovery point, controlling for labor market characteristics and secular growth:

$$\Delta_{PR}u_i = \alpha + \beta\,\Delta_{PR}q_i + X'_i\gamma_i + \in_i, \tag{3}$$

where the subscript i refers to each financial crisis episode, $\Delta_{PR}q_i$ denotes $\Delta_{PR}rxr_i$, $\Delta_{PR}ty_i$ or $\Delta_{PR}xy_i$ and $\in_i$ is a random error term (variables are defined in section 2.1).

Results are presented in tables 4A and 4B. OLS estimates indicate that there is no statistically significant association between peak-to-recovery change in unemployment and real exchange rate changes or sector allocation. Appendix C (table C.4) shows that these finding are robust to the inclusion of additional recession and country controls.

We conclude that during financial crises, real currency depreciation and sector reallocation from output peak to recovery seem to be independent of whether the recovery is jobless or wageless. Accordingly, real exchange rate depreciation and sector reallocation might not be sufficient to mitigate jobless recoveries if they take place without the adjustment in real wages. As we will discuss in section 2.4, a key reason why financial crises impact the labor market may be the presence of credit constraints that differentially affect employment from other factors of production, determining a lower equilibrium real wage rate. If credit constraints were present in both tradable and non-tradable sectors, a sector reallocation would not necessarily avoid a jobless recovery.[11]

Furthermore, evidence suggests that a full recovery of employment might be achieved without a significant change in the real exchange rate and resource reallocation, given the economy manages to achieve an adjustment in the real wage. In our sample, an extreme but illustrative example of this situation can be found in some hyperinflation episodes.

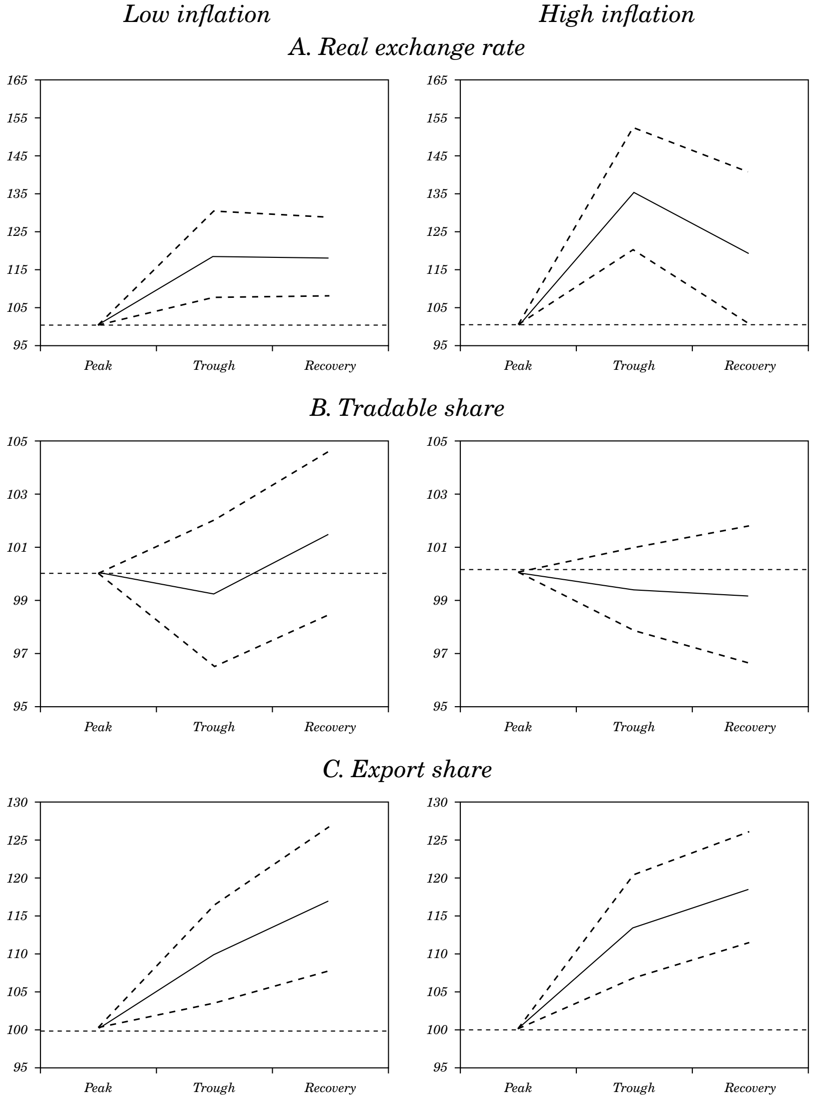
These results suggest two policy implications for countries with fixed exchange rates, such as those in the Eurozone. Firstly, fiscal devaluations, based on reduction of labor costs, might work better than those based on changes in relative prices between tradable and non-tradable goods and sectoral reallocation (provoked by, e.g., import tariff and export subsidy).

Secondly, if the Eurozone as a whole increases inflation and as a result, there is an adjustment in real wages in peripheral economies (e.g. Greece, Ireland, Portugal and Spain), there could be positive effects on unemployment even if this does not necessarily imply a real currency depreciation for the peripheral economies relative to the core economies (Germany in particular).[12]

11. Tornell and Westermann (2003) argue that credit constraints are more stringent in the non-tradable sector, and this is one reason for the dynamics of the real exchange rate and sectoral reallocation associated with twin crises (currency and banking crises). They also find that real exchange rate changes and sectoral reallocation are independent of the exchange rate regime. However, they do not discuss implications of credit constraints for the adjustment of labor markets.

12. For an analysis of adjustment in real wages as a result of inflation in the Eurozone, see Schmitt-Grohé and Uribe (2013a).

Figure 5. Inflation, Real Exchange Rates and Sector Allocation during Financial Crises in EMs



Source: Author's elaboration.
Slashed lines depict 95 percent confidence intervals for log changes in the real exchange rate, tradable share (tradable-to-GDP ratio) and exports share (exports-to-GDP ratio), sample and variables defined in section 2.1. Low-inflation (high-inflation) episodes are episodes in which the maximum level of annual inflation rate is below (above) 30 percent. Peak, trough, and recovery point are defined using the cyclical component of output per capita, as defined in section 2.1.

2.4 Beyond Inflation: Relaxing Credit Constraints

This section focuses on policies that go to the heart of the workings of financial crises and, if adequately managed, could help the recovery of both employment and real wages, namely, relaxing credit constraints. We begin by presenting a theoretical framework that explains the mechanism by which financial crises can induce a jobless recovery.

2.4.1 A Simple theoretical framework

Financial crises typically impact collateral values (e.g. fall in housing prices), tightening the availability of credit for firms. But not all firms' projects require the same collateral per unit cost. Collateral requirements are lower for projects and firms possessing easily recognizable collateral (e.g., tangible assets) or "intrinsic collateral" (Calvo, 2011). As a large component of such intrinsic collateral is given by physical capital, a relaxation of credit conditions might support more capital-intensive activities. This hypothesis is related to the literature on inalienability of human capital (Hart and Moore, 1994) and to the literature on asset tangibility. Pledgeable assets support more borrowing because such assets mitigate contractibility problems: tangibility increases the value that can be captured by creditors in default states (Almeida and Campello, 2007; Tirole, 2005).

In Calvo, Coricelli, and Ottonello (2012) we develop a simple theoretical framework to formalize this hypothesis. In particular, the model considers the case of a firm that produces homogeneous output by means of capital (K) and labor (L), using a production technology given by $AF(K, L)$, where A stands for neutral technical progress, and function F is linear homogenous, and twice-continuously differentiable. Factors of production have to be hired a period in advance, for which credit is required. Therefore, assuming that capital is fully depreciated at the end of the period, and the relevant rate of interest is zero (assumptions that can be relaxed without affecting the central results), profits are given by the following expression,

$$AF(K, L) - (K + WL), \tag{4}$$

where W stands for the wage rate plus search and other costs associated with labor hiring (measured in terms of output).

The central element of the model is the assumption that credit is subject to a constraint that takes the following form:

$$K + WL \leq Z + (1 - \theta) \tag{5}$$

where $Z > 0$ is a parameter measuring extrinsic collateral constraint (see below), and the parameter $\theta \in [0\ ,1)$.

The left-hand side of expression (5) corresponds to credit needs which, for simplicity, are assumed equal to factor cost. The right-hand side stands for total collateral, which equals the sum of the "extrinsic collateral", Z, (amount of collateral that the firm can post in addition to the factors of production, an exogenous parameter), and the intrinsic collateral, $(1 - \theta)K$. For instance, if K is its own collateral (i.e., $\theta = 0$), then the credit constraint boils down to $WL \leq Z$ and labor would be the only input subject to a credit constraint. Moreover, the wage bill is proportional to the credit constraint.

This constraint captures the asymmetry that might exist between capital and labor in providing collateral. If loans are not repaid, for instance, the creditors can still recover some part of K. In contrast, funds spent on hiring labor cannot be recovered from the workers. In Calvo, Coricelli, and Ottonello (2012), we provide empirical evidence showing that, in advanced economies, the contraction of collateral values (measured with stock market and housing prices) tends to be associated with jobless recovery.

One can show that if firms are subject to a credit constraint of this form, then, after a contraction in the binding extrinsic collateral (Z), profit-maximizing technology becomes more capital-intensive as technology grows. This implies jobless recovery, if the real wage is constant; or a fall in the equilibrium real wage at the point of output recovery, if wages are flexible (Calvo, Coricelli, and Ottonello, 2012).

2.4.2. Credit and jobless recovery during financial crises

From the theoretical framework discussed above, it follows that policies aimed to relax credit constraints should help to mitigate the labor market consequences of financial crises (jobless or wageless recovery).

We explore this hypothesis empirically for our sample of financial crises in EMs. In particular, conditional on a financial crisis event, we analyze whether credit recovery is related to the recovery of the wage bill, wl.[13] Since, depending on the levels of inflation, financial crises can impact the labor market in the form of jobless or wageless recovery, the wage bill is a plausible summary measure of conditions in the labor market. We estimate the following model:

$$\Delta_{PR} wl_i = \alpha + \beta_1 \Delta_{PR} credit_i + \beta_2 high\_\pi_{\max,i} + X'_i \gamma + \in_i, \tag{6}$$

where, as before, X_i is a vector of controls including labor market controls ($labor\_mkt_{P,i}$) and secular growth (gd_i), and $\in_i$ is a random error term (variables are defined in section 2.1). In this model, we also control for the presence of high inflation (which was identified in section 2.2 as having a negative relationship with jobless recovery). The coefficient of interest is β_1, interpreted as the effect of credit recovery on the recovery of the wage bill during financial crisis episodes.

A major concern associated with the OLS estimates of model (6) is the possibility that the recovery of bank credit is endogenous to labor market recovery, as, for example, unemployed workers might have restricted access to the credit market. To address this issue, we use an instrumental variable (IV) estimation strategy to identify the exogenous effect of credit recovery on the labor market recovery. We use the instrument employed in Calvo, Coricelli, and Ottonello (2012), namely the cyclical component of real per capita credit at the output peak ($credit_P$).[14] This instrument is a variable that captures credit market outcomes *prior* to the recession episode, as is typically done in the literature to predict financial crises (see, for example, Gourinchas, Valdes, and Landerretche, 2001; Schularick and Taylor, 2009; Mendoza and Terrones, 2012). Table 5A shows that the first stage coefficients are negative and statistically significant at the one percent level, showing that credit booms prior to the recession episodes are associated with a higher contraction of credit from output peak to recovery point.

Results are presented in table 5B. The OLS estimates, reported in columns 1, 3, and 5, indicate that there is a positive association

13. Calvo, Coricelli, and Ottonello (2012) analyze the relationship between credit recovery, and jobless and wageless recoveries for all recession episodes to understand the difference between financial crises and other recession episodes. Here the objective is the analysis of credit policies during financial crises, and for that reason we restrict the analysis only to these episodes.

14. The cyclical component of credit is computed using the HP filter. Recall that the output peak occurs prior to the crisis.

between credit recovery and wage bill recovery, statistically significant at the five percent level. Columns 2, 4, and 6 of table 5 show that the IV estimates are also positive and significant at the five percent level, suggesting that the exogenous component of credit plays a role in the labor market recovery. Appendix C (table C.5) shows that these findings are robust to the inclusion of additional recession controls and country controls.

This empirical evidence is complementary to the view that credit policies can be an effective instrument to mitigate the effect of financial crises on real economic activity (see, for example, Gertler and Kiyotaki, 2010).[15] In particular, this evidence suggests that credit policies can improve employment and wages simultaneously at the recovery of financial crises.

3. Final Words

In this paper we discuss the role of inflation, real currency depreciation, and credit-recovery policies in helping unemployment recovery during financial crises, based on an empirical analysis of a sample of EM financial crisis episodes.

Higher unemployment, once output has recovered its trend, seems to stem from the interaction between credit constraints that differentially affect labor, and nominal wage rigidities. Our evidence indicates that high inflation can help to overcome nominal wage rigidities—in high-inflation episodes, unemployment recovers its pre-crisis level once output has recovered its trend—but not the labor market consequences of credit constraints—in these episodes real wages are significantly below their pre-crisis level once output recovers its trend. At the same time, real exchange rate depreciation seems to be able to help unemployment only insofar as it generates inflation at levels far above current convention.

Only direct credit policies that tackle the root of the problem seem to be able to help unemployment and wages simultaneously. Even if our evidence points to the relevance of policies that relax credit constraints, achieving this objective is an important open issue for future research. However, common sense suggests the following conjectures.

15. Gertler and Kiyotaki (2010) analyze credit policies employed by the Federal Reserve during the financial crisis that started in 2008: i) expansion of discount window operations ii) lending directly in high grade credit markets.

In advanced economies, quantitative easing operations, especially if they involve the purchase of "toxic" assets, can have an effect on increasing firms' collateral and relaxing credit constraints that affect employment recovery.

In EMs, credit policies can be harder to implement because the government tends to be part of the problem. For this reason, a relevant instrument to mitigate jobless recovery might be the accumulation of international reserves, *prior* to financial crises. International reserve accumulation might not only reduce the probability of experiencing a *credit* event (Calvo, Izquierdo, and Loo-Kung, 2012), but might also facilitate credit policies during financial crises. Brazil offers a good example of this type of policy. It consists of using international reserves for extending credit lines to the export sector.[16]

Finally this discussion stresses the potential role of multilaterals in providing liquidity during financial crises in EMs. The new credit lines created by the IMF during the recent crisis (flexible credit lines and the precautionary and liquid lines) go in that direction, although the overall magnitude of the resources that can be quickly mobilized remains an issue. Partnership and coordination between multilaterals and the private sector can also be effective. For some emerging European countries, the so-called "Vienna initiative"—whereby the main foreign lenders committed to maintain the pre-crisis stock of credit in those countries that agreed to subscribe an IMF/EU program—helped to avoid a sudden withdrawal of foreign investors. However, in principle, the "Vienna initiative" did not fully shelter receiving countries from a sudden stop in credit flows.

16. See, for example, Martins and Salles (2010), Barbosa (2010), and Aisen and Franken (2010).

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Appendix A
Tables

Table A1. Inflation and Labor Market Recovery from Financial Crises in EMs

Dependent variable	$\Delta_{PR}u$			$\Delta_{PR}w$		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$high\_\pi_{\max}$	-0.021** (0.008)	-0.024*** (0.009)	-0.023** (0.009)	-0.165* (0.084)	-0.157* (0.078)	-0.165* (0.087)
$natural\_u_P$	0.088 (0.086)		0.121 (0.095)	0.752 (0.963)		0.758 (1.017)
$lamrig_P$		0.002 (0.008)	0.007 (0.009)		-0.005 (0.079)	0.002 (0.087)
gd	-0.037 (0.042)	-0.052 (0.040)	-0.026 (0.044)	0.873** (0.402)	0.768** (0.367)	0.876** (0.429)
No. observations	45	45	45	41	45	41

Source: Author's calculations.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table A2. Inflation and Labor Market Recovery from Financial Crises in EMs

Dependent variable	$\Delta_{PR}u$						$\Delta_{PR}w$					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
$high\_\pi_P$	-0.010 (0.009)	-0.012 (0.009)	-0.010 (0.009)				0.036 (0.090)	0.020 (0.085)	0.038 (0.091)			
$high\_\pi_R$				-0.009 (0.010)	-0.012 (0.010)	-0.010 (0.010)				-0.063 (0.104)	-0.085 (0.096)	-0.061 (0.105)
$natural\_u_P$	0.128 (0.089)		0.139 (0.101)	0.121 (0.091)		0.135 (0.103)	1.161 (1.012)		1.056 (1.071)	0.894 (1.039)		0.811 (1.095)
$lamrig_P$		-0.004 (0.008)	0.002 (0.009)		-0.003 (0.008)	0.003 (0.009)		-0.058 (0.080)	-0.030 (0.090)		-0.040 (0.080)	-0.024 (0.090)
gd	-0.022 (0.043)	-0.047 (0.042)	-0.018 (0.047)	-0.033 (0.047)	-0.060 (0.044)	-0.028 (0.050)	1.038** (0.418)	0.754* (0.384)	0.987** (0.449)	0.917** (0.444)	0.683* (0.389)	0.878* (0.472)
No. obs.	45	45	45	45	45	45	41	45	41	41	45	41

Source: Author's calculations.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table A3a. Inflation and Real Exchange Rate during Financial Crises in EMs

Dependent variable	$\Delta_{PT}rxr$			$\Delta_{PR}rxr$		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$high\_\pi_{\max}$	0.111 (0.093)	0.143* (0.084)	0.135 (0.095)	-0.058 (0.114)	0.052 (0.107)	-0.020 (0.114)
$natural\_u_P$	-0.476 (0.945)		-1.044 (1.038)	-0.005 (1.155)		-0.873 (1.254)
$lamrig_P$		-0.050 (0.082)	-0.121 (0.095)		-0.154 (0.105)	-0.185 (0.114)
gd	0.216 (0.460)	0.357 (0.381)	0.014 (0.483)	0.088 (0.562)	0.315 (0.487)	-0.221 (0.583)
No. observations	45	55	45	45	55	45

Source: Author's calculations.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table A3b. Inflation and Sector Allocation during Financial Crises in EMs

Dependent variable	$\Delta_{PT}ty$			$\Delta_{PR}ty$			$\Delta_{PT}ty$			$\Delta_{PR}ty$		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
$high\_\pi_{\max}$	0.003 (0.016)	-0.006 (0.017)	0.000 (0.016)	-0.019 (0.022)	-0.029 (0.021)	-0.019 (0.023)	-0.008 (0.050)	0.019 (0.045)	-0.004 (0.052)	-0.048 (0.050)	-0.007 (0.050)	-0.038 (0.051)
$natural\_u_P$	-0.002 (0.159)		0.117 (0.178)	-0.355 (0.225)		-0.338 (0.259)	-0.989* (0.508)		-1.083* (0.568)	-1.537*** (0.507)		-1.766*** (0.562)
$lamrig_P$		0.022 (0.017)	0.023 (0.016)		0.015 (0.021)	0.003 (0.024)		0.023 (0.045)	-0.020 (0.052)		0.023 (0.049)	-0.049 (0.051)
gd	0.126 (0.090)	0.072 (0.081)	0.185* (0.098)	0.112 (0.127)	0.136 (0.101)	0.120 (0.142)	-0.044 (0.247)	0.224 (0.200)	-0.077 (0.264)	0.327 (0.247)	0.660*** (0.219)	0.246 (0.262)
No. obs.	40	48	40	40	48	40	45	53	45	45	53	45

Source: Author's calculations.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table A4a. Real Exchange Rate and Jobless Recovery During Financial Crises in EMs

Dependent variable	$\Delta_{PR}u$					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$\Delta_{PT}rxr$	-0.003 (0.015)	-0.006 (0.015)	-0.002 (0.015)			
$\Delta_{PR}rxr$				0.005 (0.012)	0.004 (0.013)	0.006 (0.013)
$natural\_u_P$	0.140 (0.090)		0.151 (0.104)	0.142 (0.089)		0.159 (0.102)
$lamrig_P$		-0.005 (0.008)	0.002 (0.009)		-0.004 (0.008)	0.003 (0.009)
gd	-0.017 (0.044)	-0.044 (0.043)	-0.013 (0.048)	-0.018 (0.044)	-0.045 (0.043)	-0.011 (0.048)
No. observations	45	45	45	45	45	45

Source: Author's elaboration.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table A4b. Sector Allocation and Jobless Recovery During Financial Crises in EMs

Dependent	$\Delta_{PR}u$											
variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
$\Delta_{PT}ty$	0.019 (0.103)	0.013 (0.108)	-0.009 (0.106)									
$\Delta_{PR}ty$				-0.027 (0.072)	-0.050 (0.072)	-0.027 (0.072)						
$\Delta_{PT}xy$							-0.009 (0.028)	-0.019 (0.028)	-0.008 (0.029)			
$\Delta_{PR}xy$										0.017 (0.028)	-0.001 (0.026)	0.019 (0.029)
$natural\_u_P$	0.132 (0.094)		0.194* (0.109)	0.123 (0.096)		0.185 (0.111)	0.134 (0.093)		0.145 (0.106)	0.167* (0.097)		0.187 (0.113)
$lamrig_P$		0.002 (0.009)	0.011 (0.010)		0.003 (0.009)	0.011 (0.010)		-0.004 (0.008)	0.002 (0.009)		-0.004 (0.008)	0.003 (0.009)
gd	0.003 (0.054)	-0.024 (0.053)	0.037 (0.062)	0.009 (0.053)	-0.011 (0.053)	0.040 (0.060)	-0.017 (0.044)	-0.042 (0.043)	-0.013 (0.048)	-0.023 (0.045)	-0.045 (0.046)	-0.018 (0.048)
No. obs.	40	40	40	40	40	40	45	45	45	45	45	45

Source: Author's elaboration.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table A5a. Credit Cycle at the Peak and Credit Recovery (First Stage)

	$\Delta_{PR}credit$		
Dependent variable	*(1)*	*(2)*	*(3)*
$credit_P$	-1.285*** (0.143)	-1.105*** (0.124)	-1.256*** (0.150)
$high\_\pi_{\max}$	-0.086 (0.063)	-0.107* (0.055)	-0.096 (0.066)
$natural\_u_P$	-0.900 (0.636)		-0.706 (0.707)
$lamrig_P$		0.122** (0.053)	0.044 (0.067)
gd	-0.134 (0.310)	0.180 (0.247)	-0.066 (0.329)
No. observations	45	55	45

Source: Author's elaboration.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table A5b. Credit Recovery and Labor Market Recovery during Financial Crises in EMs

Dependent variable	$\Delta_{PR}wl$					
Estimation method	*OLS* *(1)*	*IV* *(2)*	*OLS* *(3)*	*IV* *(4)*	*OLS* *(5)*	*IV* *(6)*
$\Delta_{PR}credit$	0.403** (0.159)	0.456** (0.197)	0.428** (0.162)	0.507** (0.205)	0.421** (0.165)	0.483** (0.206)
$high\_\pi_{\max}$	-0.096 (0.084)	-0.089 (0.085)	-0.087 (0.086)	-0.075 (0.089)	-0.084 (0.087)	-0.075 (0.090)
$natural\_u_P$	0.668 (0.920)	0.662 (0.921)			0.509 (0.975)	0.479 (0.979)
$lamrig_P$			-0.060 (0.081)	-0.068 (0.082)	-0.046 (0.086)	-0.053 (0.087)
gd	1.042** (0.386)	1.057** (0.389)	0.891** (0.376)	0.906** (0.378)	0.973** (0.411)	0.979** (0.412)
No. observations	39	39	39	39	39	39

Source: Author's elaboration.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Appendix B
Methodology for Domestic Sudden Stops

Following Calvo, Izquierdo, and Mejia (2008) a *Domestic Sudden Stop* is defined as a phase that meets the following conditions:

— It contains at least one observation where the year-on-year fall in real bank credit flows lie at least two standard deviations below its sample mean (this addresses the “unexpected” requirement of a sudden stop).

— The sudden stop phase starts the first time the annual change in real bank credit flows fall one standard deviation below the mean and ends once the annual change in capital flows exceed one standard deviation below its sample mean (this captures the persistence of the sudden stop).

Calvo, Izquierdo, and Mejia (2008) use this methodology to define *External Sudden Stops*, using (external) capital flows instead of bank credit flows. Data on bank credit flows includes claims on the private sector by depositary institutions. CPI deflates credit data. Data source: IFS.

Appendix C
List of Financial Crisis Episodes

Table C.1 lists the 55 financial crisis episodes included in the empirical analysis. As detailed in section 2.1, low-inflation (high-inflation) episodes are episodes in which the maximum level of annual inflation rate is below (above) 30 percent.

Table C1. Sample of Financial Crisis Episodes

Low inflation		*High inflation*	
Country	*Peak*	*Country*	*Peak*
Algeria	1985	Algeria	1989
Algeria	1992	Argentina	1980
Argentina	1994	Argentina	1987
Brazil	1997	Argentina	1998
Colombia	1995	Brazil	1980
Côte d'Ivoire	1982	Brazil	1987
Côte d'Ivoire	1986	Brazil	1991
Côte d'Ivoire	1991	Bulgaria	1995
Côte d'Ivoire	1998	Chile	1981
Côte d'Ivoire	2001	Dominican Republic	2000
Korea	1996	Ecuador	1981
Malaysia	1984	Ecuador	1998
Malaysia	1997	El Salvador	1980
Morocco	1980	Indonesia	1997
Morocco	1982	Lebanon	1988
Morocco	1986	Mexico	1981
Panama	1982	Mexico	1994
Panama	1986	Nigeria	1980
Peru	1997	Peru	1981
Phillipines	1997	Phillipines	1983
South Africa	1981	Russia	1997
South Africa	1984	Turkey	1993
South Africa	1989	Turkey	1997
Thailand	1996	Turkey	2000
		Uruguay	1981
		Uruguay	1998
		Venezuela	1980
		Venezuela	1988
		Venezuela	1992
		Venezuela	1995
		Venezuela	2001

Appendix D
Robustness

In this section, we explore how robust our results are to the inclusion of additional controls that could be associated with the dependent variables in the above estimated equations. We explore controls related to the characteristics of the recession episode, and linked to country-specific characteristics. The following list describes each of these controls:

— Depth of the recession episode ($\Delta_{PT}y$). Defined as the log change in GDP per capita from output peak to trough. Jobless recoveries could result from deeper recession episodes if, for example, larger output contractions lead to higher increases in unemployment and there is hysteresis in unemployment. Data source: WEO and WDI.

— Country's historical inflation ($hist\_\pi$): Defined as the country's historical median (1980-2007) rate of inflation. We compute inflation using the producer price index (wholesale price index or the consumer price index when not available). Data source: IMF and national sources.

— Country's *openness*, defined as the country's historical average (1980-2007) of the share of tradables in GDP. The tradables sector includes agriculture and manufacturing. An economy that is more open could, for instance, require smaller real currency depreciation for a given shock (Calvo, Izquierdo, and Mejia, 2008). Data source: WDI.

— Country's financial development (*fin_development*). Defined as the country's historical median (1980-2007) of domestic credit provided by the banking sector in terms of GDP. Data source: WDI.

— Country size (*small_country*, *medium_country*, and *large_country*). Defined as three dummy variables measuring the size of the population of a given country: *small_country* takes the value of one when the country's population is below 20 million and zero otherwise; *medium_country* takes the value of one when the country's population is between 20 and 80 million and zero otherwise; *large_country* takes the value of one when the country's population is above 80 million and zero otherwise. Definition of thresholds and data source, Uribe (2012).

Results are presented in tables D.1-D.4. Table D.1 shows that the result—high-inflation episodes tend to display less unemployment and lower real wages at the output recovery point than low-inflation episodes (table A.1, section 2.2)—is robust to the inclusion of the additional recession and country controls. Only when we control for financial development or country size does the relationship between real wages and high inflation lose its statistical significance, although the estimated coefficient remains negative and has a similar size to that of the other regressions.

Table D.2 shows that, in line with section 2.3, high inflation is not related to changes in the real exchange rate or sector allocation from output peak to recovery once additional recession controls and country controls are included.

Table D.3 shows that the finding of no statistically significant association between jobless recovery and peak-to-recovery change in real exchange rate/sector allocation (section 2.3) is robust to the inclusion of the additional controls of this section.

Finally, table D.4 shows that the finding of a positive and statistically significant relationship between credit recovery and wage bill recovery (section 2.4) is robust to the inclusion of the additional controls of this section. In particular, both OLS and IV estimates are positive and statistically significant for all specifications.

Table D.1. Inflation and Labor Market Recovery from Financial Crises in EMs

Dependent variable	$\Delta_{PR}u$					$\Delta_{PR}w$				
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
$high\_\pi_{\max}$	-0.020** (0.009)	-0.022** (0.009)	-0.023** (0.008)	-0.031*** (0.010)	-0.022** (0.009)	-0.160* (0.094)	-0.158* (0.089)	-0.167* (0.087)	-0.134 (0.105)	-0.133 (0.092)
$\Delta_{PT}y$	0.061 (0.059)					0.083 (0.603)				
$high\_\pi$		-0.010 (0.017)					-0.078 (0.167)			
$openness$			0.121 (0.072)					-0.779 (0.730)		
$fin\_development$				-0.000 (0.000)					0.001 (0.002)	
$small\_country$					-0.016 (0.013)					-0.149 (0.131)
$medium\_country$					-0.012 (0.011)					-0.012 (0.110)
$natural\_u_P$	0.118 (0.095)	0.109 (0.098)	0.251** (0.121)	0.120 (0.093)	0.164 (0.103)	0.760 (1.031)	0.661 (1.049)	0.021 (1.228)	0.670 (1.041)	1.371 (1.138)
$lamrig_P$	0.005 (0.009)	0.008 (0.009)	0.015 (0.010)	0.003 (0.009)	0.005 (0.009)	-0.001 (0.091)	0.014 (0.092)	-0.056 (0.103)	0.018 (0.094)	0.004 (0.091)
gd	-0.025 (0.044)	-0.031 (0.046)	-0.023 (0.043)	-0.018 (0.044)	-0.019 (0.048)	0.878* (0.436)	0.834* (0.443)	0.846* (0.429)	0.857* (0.435)	1.083** (0.462)
No. observations	45	45	45	45	45	41	41	41	41	41

Source: Author's elaboration.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table D.2. Inflation, Real Exchange Rate and Sector Allocation during Financial Crises in EMs

Dependent variable	$\Delta_{PR}rxr$					$\Delta_{PR}ty$					$\Delta_{PR}xy$				
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*
$high\_\pi_{\max}$	-0.087 (0.119)	-0.004 (0.116)	-0.022 (0.114)	-0.081 (0.132)	-0.022 (0.122)	-0.028 (0.024)	-0.018 (0.023)	-0.015 (0.023)	-0.008 (0.027)	-0.012 (0.024)	-0.030 (0.055)	-0.050 (0.051)	-0.040 (0.049)	-0.009 (0.059)	-0.020 (0.053)
$\Delta_{PT}y$	-1.269 (0.766)					-0.175 (0.159)					0.163 (0.354)				
$high\_\pi$		-0.213 (0.223)					-0.030 (0.053)					0.150 (0.098)			
openness			-1.093 (0.973)					-0.310 (0.194)					-0.874** (0.421)		
$fin\_development$				-0.002 (0.002)					0.000 (0.000)					0.001 (0.001)	
$small\_country$					0.042 (0.176)					-0.030 (0.038)					-0.121 (0.076)
$medium\_country$					0.029 (0.151)					0.003 (0.031)					-0.035 (0.065)
$natural\_u_P$	-0.819 (1.228)	-1.119 (1.281)	-2.050 (1.631)	-0.876 (1.256)	-0.990 (1.379)	-0.348 (0.258)	-0.361 (0.264)	-0.618* (0.308)	-0.348 (0.261)	-0.234 (0.290)	-1.773*** (0.568)	-1.593*** (0.565)	-2.707*** (0.705)	-1.764*** (0.562)	-1.414** (0.597)
$lamrig_P$	-0.154 (0.113)	-0.156 (0.118)	-0.260* (0.132)	-0.212* (0.118)	-0.181 (0.121)	0.004 (0.024)	0.007 (0.025)	-0.014 (0.026)	0.009 (0.025)	0.010 (0.025)	-0.053 (0.053)	-0.069 (0.052)	-0.109* (0.057)	-0.036 (0.053)	-0.048 (0.052)
gd	-0.235 (0.571)	-0.334 (0.596)	-0.249 (0.582)	-0.161 (0.588)	-0.244 (0.644)	0.104 (0.142)	0.110 (0.145)	0.163 (0.142)	0.103 (0.145)	0.190 (0.157)	0.247 (0.264)	0.325 (0.263)	0.224 (0.252)	0.216 (0.263)	0.388 (0.279)
No. observations	45	45	45	45	45	40	40	40	40	40	45	45	45	45	45

Source: Author's elaboration.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table D.3. Jobless Recovery, Real Exchange Rate and Sector Allocation during Financial Crises in EMs

Dependent variable	$\Delta_{PR}u$														
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*
$\Delta_{PR}rxr$	0.012 (0.013)	0.004 (0.013)	0.010 (0.013)	0.006 (0.013)	0.007 (0.013)										
$\Delta_{PR}ty$						-0.008 (0.069)	-0.029 (0.073)	-0.006 (0.074)	-0.028 (0.074)	-0.061 (0.065)					
$\Delta_{PR}xy$											0.014 (0.028)	0.026 (0.029)	0.037 (0.029)	0.021 (0.030)	0.009 (0.030)
$\Delta_{PT}y$	0.116* (0.060)					0.135** (0.061)					0.100* (0.059)				
$hist\_\pi$		-0.015 (0.018)					-0.004 (0.023)					-0.020 (0.018)			
$openness$			0.134 (0.079)					0.092 (0.088)					0.155* (0.081)		
$fin\_development$				-0.000 (0.000)					0.000 (0.000)					-0.000 (0.000)	
$small\_country$					-0.020 (0.014)					-0.049*** (0.014)					-0.019 (0.014)
$medium\_country$					-0.008 (0.012)					-0.025** (0.012)					-0.008 (0.012)
$natural\_u_P$	0.150 (0.099)	0.138 (0.106)	0.306** (0.133)	0.159 (0.104)	0.214* (0.109)	0.182* (0.105)	0.181 (0.114)	0.277* (0.141)	0.184 (0.114)	0.321*** (0.106)	0.166 (0.111)	0.173 (0.113)	0.383** (0.150)	0.191 (0.115)	0.219* (0.116)
$lamrig_P$	0.003 (0.009)	0.005 (0.010)	0.013 (0.011)	0.003 (0.010)	0.003 (0.010)	0.012 (0.010)	0.012 (0.011)	0.016 (0.011)	0.012 (0.011)	0.016 (0.009)	0.002 (0.009)	0.007 (0.010)	0.015 (0.011)	0.003 (0.010)	0.003 (0.010)
gd	-0.013 (0.046)	-0.021 (0.049)	-0.007 (0.047)	-0.011 (0.049)	0.007 (0.050)	0.039 (0.057)	0.038 (0.061)	0.025 (0.062)	0.039 (0.063)	0.102* (0.058)	-0.018 (0.047)	-0.031 (0.049)	-0.019 (0.046)	-0.016 (0.049)	0.002 (0.052)
No. observations	45	45	45	45	45	40	40	40	40	40	45	45	45	45	45

Source: Author's elaboration.
Standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

Table D.4. Credit Recovery and Labor Market Recovery during Financial Crises in EMs

Dependent variable	$\Delta_{PR}wl$									
Estimation method	*OLS*	*IV*	*OLS*	*IV*	*OLS*	*IV*	*OLS*	*IV*	*OLS*	*IV*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
$\Delta_{PR}credit$	0.427** (0.169)	0.485** (0.210)	0.516*** (0.175)	0.624** (0.229)	0.423** (0.158)	0.535** (0.197)	0.416** (0.170)	0.475** (0.214)	0.401** (0.181)	0.470* (0.233)
$high\_\pi_{\max}$	-0.090 (0.092)	-0.083 (0.094)	-0.043 (0.091)	-0.022 (0.095)	-0.099 (0.084)	-0.082 (0.087)	-0.075 (0.102)	-0.070 (0.103)	-0.079 (0.092)	-0.072 (0.093)
$\Delta_{PT}y$	-0.139 (0.607)	-0.170 (0.612)								
$hist\_\pi$			-0.245 (0.170)	-0.285 (0.180)						
$openness$					-1.420* (0.735)	-1.423* (0.741)				
$fin\_development$							0.000 (0.002)	0.000 (0.002)		
$small\_country$									-0.027 (0.141)	-0.016 (0.143)
$medium\_country$									0.011 (0.114)	0.007 (0.114)
$natural\_u_P$	0.495 (0.991)	0.465 (0.995)	0.122 (0.997)	0.014 (1.013)	-0.745 (1.139)	-0.801 (1.150)	0.484 (1.001)	0.467 (1.003)	0.650 (1.157)	0.562 (1.175)
$lamrig_P$	-0.043 (0.088)	-0.049 (0.089)	-0.023 (0.086)	-0.030 (0.087)	-0.141 (0.096)	-0.153 (0.098)	-0.041 (0.094)	-0.049 (0.096)	-0.039 (0.095)	-0.049 (0.097)
gd	0.967** (0.418)	0.972** (0.419)	0.835* (0.416)	0.822* (0.419)	0.962** (0.395)	0.974** (0.398)	0.966** (0.419)	0.975** (0.420)	1.033** (0.463)	1.014** (0.465)
No. observations	39	39	39	39	39	39	39	39	39	39

Source: Author's elaboration.
Notes: standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.

APPENDIX E

Threshold Effects in the Inflation-Unemployment Relationship[17]

We follow Hansen (2000) in order to assess whether there is indeed robust evidence of a non-linear relationship between inflation and unemployment during financial crises in EMs. In particular, we wish to verify the presence of two different regimes for unemployment behavior distinguished by their level of inflation during the crisis episodes, as assumed in model (1) in the main text of the paper. Our conjecture is that low-inflation episodes are associated with more jobless recovery than high-inflation episodes.

The general form for the estimated model for a single threshold is as follows.[18]

$$\begin{aligned} \Delta_{PR}u_i &= \alpha_1 + X'_i\gamma_1 + \in_i \quad \text{for} \quad \pi_{\max,i} \le q, \\ \Delta_{PR}u_i &= \alpha_2 + X'_i\gamma_2 + \in_i \quad \text{for} \quad \pi_{\max,i} > q. \end{aligned} \tag{E1}$$

where q is the threshold, $\Delta_{PR}u_i$ denotes the jobless recovery measure in financial crisis episode i, X_i is a vector of controls including labor market controls ($labor\_mkt_{P,i}$) and secular growth (gd_i), $\in_i$ is a random error term (variables are defined in section 2.1). The threshold variable is defined with respect to the maximum rate of inflation experienced during the episode ($\pi_{\max,i}$).

The equation estimated in model (1) of the main text is a single equation version of the above model, in which the threshold q is used to create a dummy, with value 1 for the high-inflation regime and 0 for the low-inflation regime.

Hansen's approach allows us to consider either all parameters as regime-dependent or just a subset of them. In the model estimated in

17. We thank Zorobabel Bicaba and Farshad Ravasan for excellent research assistance.

18. The specification in (E.1) is consistent with the one in model (1), studied in section 3.1, in which the level of inflation does not enter as a regressor. An alternative specification of the model for a single threshold would be to include the inflation variable that defines the threshold as a regressor:

$$\begin{aligned} \Delta_{PR}u_i &= \alpha_1 + \beta_1\pi_{\max,i} + X'_i\gamma_1 + \in_i \quad \text{for} \quad \pi_{\max,i} \le q, \\ \Delta_{PR}u_i &= \alpha_2 + \beta_2\pi_{\max,i} + X'_i\gamma_2 + \in_i \quad \text{for} \quad \pi_{\max,i} > q. \end{aligned} \tag{E2}$$

A relationship of this type is studied in appendix E, where we relate continuous measures of inflation to unemployment recovery. The estimated threshold under this alternative specification is similar to that estimated under (A.1).

the main text, we consider as regime-dependent only the intercept, which is the variable subject to the shift caused by the threshold-related dummy. This amounts to assuming that $\gamma_1 = \gamma_2$. The least squares point estimate for the threshold is derived from the minimum of the graph of the normalized likelihood ratio sequence as a function of the threshold in inflation depicted in figure E.1 (Hansen, 2000). Said estimated value is 0.317. There are 17 episodes with $\pi_{\max,i} \leq 0{,}317$ and 26 episodes with $\pi_{\max,i} > 0{,}317$. The confidence interval around said point estimate is rather large, at 90 percent the interval is from 0.19 to 1.74 (table A.6). Roughly speaking, this interval can be seen in the graph from the intersections of the LR with the lowest critical line (associate to 90 percent confidence). The wide confidence interval indicates a difficulty in pinning down the exact location of the relevant threshold and, possibly, suggests the presence of additional thresholds. Due to the small size of our sample, we cannot perform robust tests for the presence of an additional threshold. The estimated threshold is robust to different sets of controls, including the case in which $\pi_{\max,i}$ enters the set of regressors. Table E.1 reports the results of the OLS regression for the split sample for model (1). The intercept switches in sign in the two

Table E.1. Regression on Split Sample

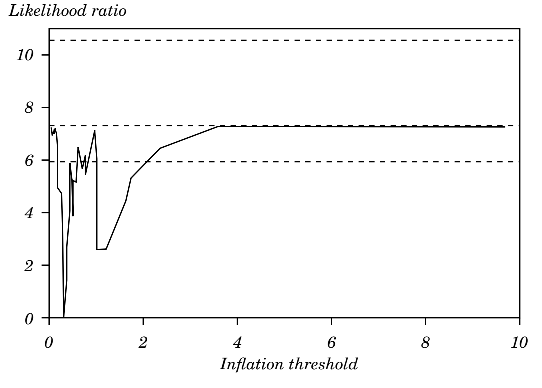
	$\Delta_{PR}u(\pi \leq 0{,}317)$	$\Delta_{PR}u(\pi > 0{,}317)$
Dependent variable	*1*	*2*
Regime independent variables		
$natural\_u_P$	0.105 (0.099)	0.105 (0.099)
$lamrig_P$	0.005 (0.009)	0.005 (0.009)
gd	-0.019 (0.04)	-0.019 (0.04)
Regime dependent variable		
Intercept	0.012 (0.025)	-0.011 (0.025)
No. observations	17	26

Source: Author's elaboration.
Sample and variables definition are detailed in section 3.1.
Standard errors shown below the coefficient.

regimes, and the difference between high and low inflation implies a decline in the rate of unemployment of about 2 percent when we move from low to high inflation.

In summary, Hansen's approach indicates that there is evidence of a threshold on inflation, dividing the sample in two different regimes. As documented in the OLS regression that uses the estimated threshold to identify a switch in regime, evidence suggests that moving from below to above a threshold around 30 percent for inflation helps explain a switch from jobless to job-intensive recovery.

Figure E.1. Likelihood Ratio and Threshold Variable (Inflation)



Source: Author's calculations.
The three dashed lines starting from below indicate the confidence interval at 90 percent, 95 percent, and 99 percent.

Appendix F
A Linear Relationship between Inflation and Unemployment

The threshold identified in this paper, in terms of a level of inflation up to which financial crisis episodes do not display a jobless recovery, is relatively high (30 percent). A relevant question for policy design is whether there is any *linear* type of relationship that can also be established empirically between the inflation experienced in the episode (the level of inflation or the change in inflation) and unemployment recovery. If this is the case, countries could choose only a moderate increase in inflation and still expect to have an effect on jobless recoveries.

The pattern we identify in the data is illustrated in figure F.1, displaying our measure of jobless recovery for different ranges of inflation rate achieved during the episode and suggesting the non-linear type of relationship between inflation and unemployment recovery we have discussed in section 2.2. However, aside from this pattern, data does not suggest a (strictly) decreasing relationship between the level of inflation and jobless recovery.

To further explore this pattern, we estimate a linear model relating jobless recovery to different continuous measures of inflation experienced during the episode. In particular, we estimate the model

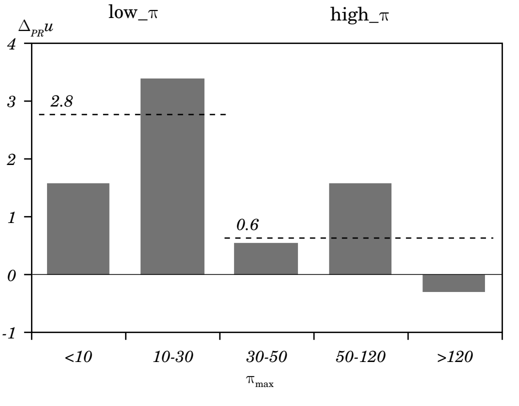
$$\Delta_{PR}u_i = \alpha + \beta\pi_i + X'_i\gamma + \in_i, \tag{F.1}$$

where π_i denotes a measure of the inflation experienced during the financial crisis episode i. The four measures of inflation experienced during the episode considered are the maximum level of inflation ($\pi_{\max}$), the level of inflation at the output trough (π_T), the difference between the maximum level of inflation and inflation at the output peak ($\Delta_{P\max}\pi$), and the change in inflation from peak to trough ($\Delta_{PT}\pi$) (variables are defined in section 2.1).

This model is similar to model (1), but the regressor—instead of being a dummy variable—is a continuous measure of the inflation experienced during the episode. Results are presented in table F.1. Columns 1-4 show that, for the whole sample, there is no statistically significant relationship between any of the continuous measures of inflation and unemployment. A possible explanation of this result could be that, as explained in section 2.1, eight episodes in our sample could be considered hyperinflations. However, columns 5 - 8 show that, if we include a dummy for hyperinflation episodes, the relationship between jobless recovery and inflation is still not statistically significant. Moreover, the negative estimated relationship is mostly driven by the difference between low-inflation episodes and high-inflation episodes: if we include a dummy variable for low-inflation episodes, it is not even clear that there is a negative relationship between inflation and unemployment recovery for low-inflation episodes (columns 9-12).[19]

The estimated results from this section show that there does not seem to be strong evidence supporting the statistical significance of a linear relationship between a continuous measure of inflation and unemployment recovery. Although the sample size is small, this suggests that, on one hand, a small increase in inflation might not be of any help to fight jobless recoveries; and on the other hand, a very large increase in inflation, beyond the identified threshold, might be an overkill to avoid jobless recovery.

Figure F.1. Inflation and Jobless Recovery (Percent)



Source: Author's calculations.
Sample and variables definition are detailed in section 2.1.

19. The results shown in table A.7 (columns 9-12) include a dummy variable for low-inflation episodes that experience a maximum annual rate of inflation below 30 percent, as in section 3.2. If we estimate this threshold using the method in Hansen (2000), as in appendix D, model (A.2), we obtain similar results: there does not seem to be evidence of a negative and significant relationship between inflation and unemployment recovery for low-inflation episodes.

Table F.1. Inflation and Labor Market Recovery from Financial Crises in EMs

	$\Delta_{PR}u$											
Dependent variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
$\pi_{\max}$	-0.000 (0.001)				0.000 (0.001)				0.000 (0.001)			
π_T		-0.001 (0.001)				0.001 (0.002)				0.001 (0.002)		
$\Delta_{P\max}\pi$			-0.000 (0.001)				0.000 (0.001)				0.000 (0.001)	
$\Delta_{PT}\pi$				-0.001 (0.002)				0.002 (0.002)				0.002 (0.002)
$\pi_{\max} \times (1-hyper)$					-0.014 (0.011)				-0.001 (0.014)			
$\pi_T \times (1-hyper)$						-0.015 (0.011)				-0.002 (0.015)		
$\Delta_{P\max}\pi \times (1-hyper)$							-0.010 (0.013)				0.013 (0.015)	
$\Delta_{PT}\pi \times (1-hyper)$								-0.014 (0.014)				0.000 (0.015)
$\pi_{\max} \times (1-high\_\pi_{\max})$									0.192** (0.090)			
$\pi_T \times (1-high\_\pi_{\max})$										0.193** (0.090)		
$\Delta_{P\max}\pi \times (1-high\_\pi_{\max})$											-0.006 (0.100)	
$\Delta_{PT}\pi \times (1-high\_\pi_{\max})$												-0.023 (0.085)

Table F.1. (continued)

	$\Delta_{PR}u$											
Dependent variable	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
$(1-hyper)$					0.027	0.030	0.023	0.027	0.013	0.017	0.003	0.016
					(0.020)	(0.023)	(0.020)	(0.021)	(0.021)	(0.024)	(0.020)	(0.021)
$(1-high\_\pi_{\max})$									-0.003	-0.003	0.028**	0.024**
									(0.018)	(0.018)	(0.013)	(0.011)
$natural\_u_P$	0.151	0.154	0.144	0.147	0.129	0.125	0.126	0.113	0.097	0.093	0.091	0.093
	(0.102)	(0.101)	(0.105)	(0.105)	(0.103)	(0.103)	(0.109)	(0.109)	(0.096)	(0.096)	(0.095)	(0.107)
$lamrig_P$	0.003	0.003	0.002	0.002	0.006	0.006	0.004	0.004	0.010	0.010		0.006
	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)		(0.010)
gd	-0.015	-0.013	-0.012	-0.009	-0.022	-0.024	-0.013	-0.026	-0.021	-0.023	-0.024	-0.020
	(0.047)	(0.047)	(0.049)	(0.049)	(0.048)	(0.048)	(0.049)	(0.051)	(0.044)	(0.044)	(0.045)	(0.050)
No. observations	45	45	44	44	45	45	44	44	45	45	44	44

Source: Author's calculations
Notes: standard errors in parentheses.
* indicates significance at 10 percent level; ** at 5 percent level; *** at 1 percent level.
Sample and variables definition are detailed in section 3.1.