The Labor Market Consequences of Financial Crises With or Without Inflation: Jobless and Wageless Recoveries

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Abstract

The paper provides empirical evidence and a simple theory on the central role played by credit market shocks in the sluggish adjustment of labor markets during the recovery from recessions. Such adjustment is remarkably more sluggish in recessions induced by disruptions in credit markets than in the case of "normal" recessions, and it takes the form of either a jobless recovery or persistently low real wages ("wageless" recovery). Whether the recovery from financial crises is of a jobless or of a wageless nature depends on the pattern of inflation during the recession episodes. When inflation is high, at the output recovery point, real wages remain well below their pre-crisis levels and employment recovers in line with output. This phenomenon characterized several recession episodes in emerging economies. In contrast, when inflation is low, the dominant pattern of adjustment to financial crises is one with jobless recoveries, with no differences between emerging and advanced economies.

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1. Introduction

The persistence of unemployment following recessions has preoccupied economists and policy makers at least since the Great Depression. Until the 1990s, jobless recoveries were considered a European phenomenon, associated to the labor market inflexibility typical of European economies.[1] Starting with the recession of 1990-91, and even more in connection with the recession of 2001, jobless recoveries have been observed as well in the US. Interestingly, and in contrast with the prevailing explanations of the jobless recoveries in Europe, the US jobless recoveries were interpreted as a sign of highly flexible labor markets, structural change, firm restructuring, or of the workings of "cleansing effects" of recessions (Schreft et al (2005), Groshen and Potter (2003), Berger (2011)).[2]

The Great Recession, with its high and persistent unemployment in the advanced economies, has again brought the issue of jobless recovery to the fore.[3] As depicted in Figure 1, by the first semester of 2012, although output recovered its pre-crisis level in the US and is recovering its pre-crisis levels in Europe, the unemployment rate is still significantly above its pre-crisis level.

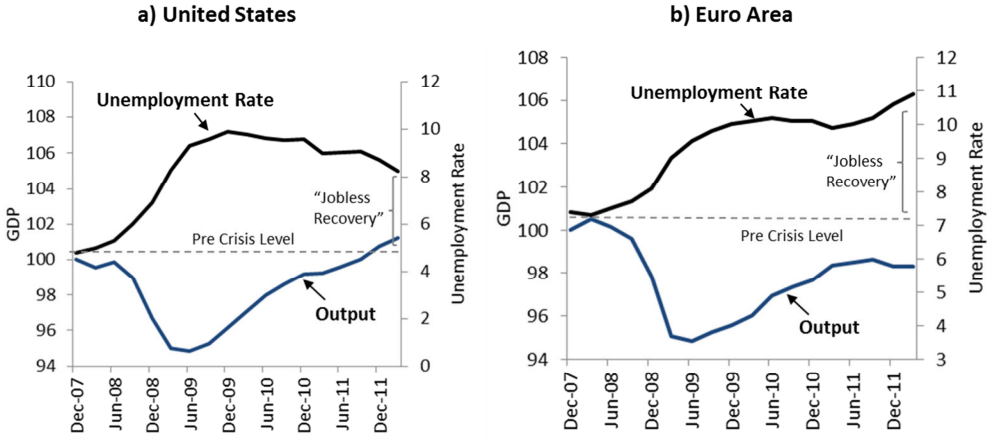
Assessing the nature and the determinants of the rate of unemployment during the recovery phase is of great policy relevance. For instance, the high persistence of unemployment well beyond the output recovery point may lead to interpret the actual unemployment rate as the new natural rate of unemployment and thus call for policy inaction. By contrast, persistently high unemployment rates provide ammunitions for those support continuation of stimulus packages, even after the level of output has returned to its pre-crisis peak. According to Rajan (2010), the jobless nature of the recovery following the US recession in 2001 explains the excessively loose monetary policy implemented by the FED, which mistakenly tried to boost job creation well beyond the point of output recovery.

[1] Blanchard and Summers (1986) depicted the European experience as reflecting a phenomenon of so-called hysteresis in unemployment, a situation in which the natural rate of unemployment depends on the actual rate of unemployment. See also Ball (2009).

[2] An example of such flexibility is the "just-in-time" hiring, which allows firms to use temporary workers to fill jobs during the recovery and thus wait to hire permanent workers.

[3] In the US, the increase in unemployment from the output peak prior to the recession and the recovery point has been much larger during the Great Recession than in previous recessions in the post-war period (Farber (2011)).

Figure 1. Jobless recovery during the Great Recession



Notes:
Euro Area includes EA-17, Eurostat definition
GDP in real terms, peak =100; unemployment rate in percent. Seasonally adjusted figures.

In this paper we explore the hypothesis that the joblessness nature of recoveries is more severe during financial crises than in "normal" recessions. The role of financial shocks has not been central to the traditional explanations of jobless recoveries, which have been generally based on labor market rigidities. For instance, the role of wage rigidities in jobless recoveries has been recently emphasized in connection with the Great Recession by Shimer (2012) who, within the standard framework of neoclassical growth, shows that in the presence of wage rigidities, recessions can lead to jobless recoveries, independently of the nature of the shock[4]. However, the above mechanism should operate in *any* recession and thus cannot explain the more intense jobless nature of recoveries from financial crises.

This paper documents that, for a sample of post-war recession episodes in advanced and emerging market economies (EMs), financial crises tend to be followed by jobless recoveries in the presence of low inflation and by "wageless" recoveries in the presence of high inflation. As shown in Figure 2, the behavior of labor market variables is clearly different in the episodes associated to financial crises, relative to "normal" recessions.

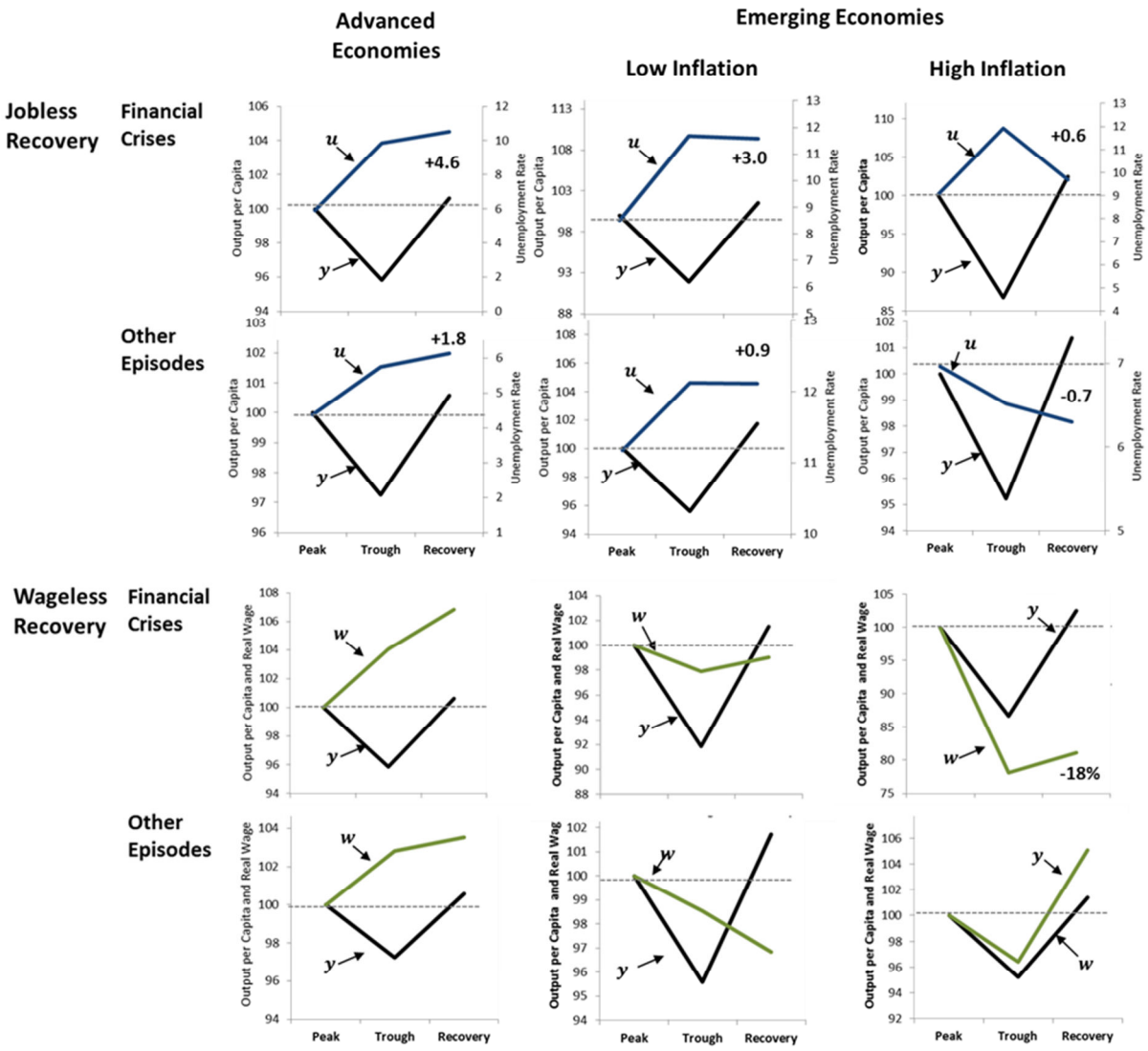
[4] The shock to the economy in Shimer (2012) is given by an exogenous destruction of physical capital. Furthermore, the presence of real wage rigidity played a relevant role in the explanations of the Great Depression and the persistence in unemployment associated to it (Ohanian (2009)).

In advanced economies, where inflation in the post-war era has been relatively low, financial crises have been followed by jobless recoveries of intensity significantly stronger than "normal" recessions. This is in line with Reinhart and Reinhart (2010), who report that during the ten years following financial crises unemployment rates remain on average five percentage points above the average rate characterizing the ten years prior to the crises. Similar evidence is provided by Knotek and Terry (2009), who show that for the "big five" banking crises (Spain 1977, Norway 1987, Finland 1991, Sweden 1991, Japan 1992) unemployment rates have been higher and more persistent than in recessions not associated with banking crises.

In EMs, heterogeneity in inflation allows us to divide the sample in "high" and "low" inflation episodes. We find again a sluggish adjustment of labor markets during the recovery from financial crises, but the nature of such adjustment depends on inflation. "High inflation" recession episodes are not associated jobless recoveries but wageless recoveries. This is consistent, empirically, with the findings in Calvo et al (2006), in which EMs that suffer a systemic sudden stop experience wageless recoveries, and, theoretically, with the model by Schmitt-Grohé and Uribe (2011), whereby in the presence of nominal wage rigidities, economies that generate inflation (for instance through a nominal exchange rate depreciation) are able to restore full employment in the labor market. In contrast, low inflation EMs display a pattern similar to the one observed in advanced economies, with financial crises associated to more intense jobless recoveries.[5]

[5] One difference between advanced and emerging economies that emerges from Figure 2 is that in advanced economies real wages increase during all recession episodes, while real wages decline in emerging countries in both financial crises and "normal" recessions. This might be consistent with views that attribute higher wage flexibility to emerging economies than in advanced economies, resulting from structural or institutional reasons (Agenor and Montiel (2008)).

Figure 2. Financial Crises, Jobless and Wageless Recoveries



The stylized facts suggested by Figure 2 seem to confirm the view that nominal, rather than real, wages are generally rigid, a view that dates back to Keynes (1936) and that has received wide empirical support (Bewley (1999), Elsby (2009)). Following large shocks originating in the financial sector, in advanced economies inflation remains subdued and often the main concern is the risk of a deflationary spiral. Our evidence suggests that when recessions are driven by disruptions in credit markets jobless recoveries are hardly avoidable without a spike in inflation. Even if there is a prima facie resemblance between our results and a Phillips curve type trade-off between inflation and unemployment (Akerlof et al (1996)),

our results do not imply the presence of a long run trade-off. Indeed, in EM crises inflation spiked initially but later subsided and thus did not result in permanently higher inflation. Therefore, our evidence does not contradict the existence of a vertical long run Phillips curve.

To establish whether the stylized facts summarized in Figure 2 truly reflect the central role of credit markets, we need to control for the effect that other variables, *in primis* labor market institutions, can have on the dynamics of unemployment and real wages during the recovery episodes. This is done in the econometric analyses carried out in section 2 of the paper. Since financial crises and credit conditions may be endogenous to unemployment, we carried out as well instrumental variable (IV) estimations to identify the exogenous effect of financial crises on jobless recoveries. The IV analysis confirms the results of the OLS estimations.

We develop a simple theory that allows us to interpret the above empirical results. The main channel that may generate equilibria in which shocks to the functioning of credit markets lead to jobless or wageless recoveries is based on the role of collateral in credit markets. Following a disruption in credit markets, collateral requirements drastically change and loans are biased towards projects and firms possessing easily recognizable collateral, associated with tangible assets, which we define as "intrinsic collateral" (Calvo (2011)).[6] As a large component of such intrinsic collateral is given by physical capital, credit supports more capital intensive activities, leading to a reduction in the employment content of a unit of output when real wages are rigid (a "jobless recovery"), or to persistent low real wages when real wages are flexible (a "wageless recovery"). Due to data availability, we present some partial evidence only for the sample of advanced economies on the relevance of the collateral channel emphasized in the theoretical model. Following Kiyotaki and Moore (1997) and Bernanke and Gertler (1989), we use data on asset prices, in particular stock market prices and house prices, as proxy for collateral values, and we find that collateral variables have a significant impact on unemployment during the recovery phase.

In sum, both the empirical evidence and the simple theory suggest that financial factors help to explain the peculiar adjustment of labor markets following financial crises. Indeed, the main contributions of the paper are the central role given to financial factors and the analysis of both advanced and emerging economies. As a consequence, the paper substantially differs from the existing literature on jobless

[6] The assumption that capital, but not labor, can serve as collateral is present among others in Eden (2012).

recoveries, which has emphasized rigidities in the labor market and has restricted its analysis to advanced countries. [7]

The paper is organized as follows. Section 2 contains the empirical analysis based on recession episodes for a sample of eleven advanced economies and a sample of thirty-five emerging economies during the post-war II era. Section 3 presents a simple theory of a sluggish labor market adjustment during the recovery phase following a recession induced by a shock to the credit market, in the form of a tightening of collateral constraints. The behavior of the model during a credit-led recession is contrasted with the case in which the recession is induced by a productivity shock. The predictions of the model are fully consistent with the empirical evidence. For the case of rigid real wages, the credit-led recession, but not the productivity-led recession, is followed by jobless recovery. When real wages are flexible, the credit-led recession is followed by persistent decline in real wages and full employment. Section 4 concludes, and discusses some policy implications of the credit view of jobless and wageless recoveries.

2. The Effect of Financial Crises on Jobless and Wageless Recoveries: Empirical Evidence on Post-War Recession Episodes

The main objective of our analysis is to verify whether the recovery of unemployment and real wages during recessions is related to financial crises. To this end, we construct a sample of recession episodes for advanced and emerging economies and performed cross-country regressions relating labor market outcomes (jobless and wageless recoveries) to financial crises.

To identify the exogenous effect of financial crises on jobless and wageless recoveries, and control for potential endogeneity and reverse causality, according to which the disruption in credit markets is due to the rise in unemployment, we perform an instrumental variable strategy, using credit market outcomes prior to the crisis as instruments for credit behavior during the recession episodes.

[7] There are a few studies that analyzed the role of credit constraints for the dynamics of unemployment. Acemoglu (2001) focused on the role of credit constraints in determining the long run rate of unemployment, while Dromel et al (2009) analyzed the role of credit constraints on the speed of adjustment of unemployment to its steady state. However, the focus of this literature differs from ours, as we analyze the role of credit markets for the behavior of labor markets during episodes of recessions.

The empirical section is organized as follows. First, we describe the data, how we construct the sample and define the variables to measure jobless and wageless recoveries and financial crises. Second, we describe the empirical strategy, based on ordinary least squares and on instrumental variables estimations. Finally we present and discuss the results of the econometric analysis for advanced and emerging economies.

2.1 Data

2.1.1 Sample Construction

The construction of our sample is based first on the identification of the recession episodes.

Recession Episodes

To analyze the relationship between credit and jobless recoveries in a historical perspective, we construct two samples of recession episodes: a sample for advanced economies and a sample for emerging economies. Due to data availability, and to reduce the problem of excess heterogeneity that typically arises in cross country regressions, we perform the analysis of developed and emerging economies separately.

For developed economies, using quarterly data, we construct a sample of recession episodes during the post-WWII period for eleven economies. Countries included in the sample are Austria, Australia, Canada, France, Germany, Italy, Spain, Sweden, Switzerland, United Kingdom and United States. We use the NBER (for the US) and the ECRI (for the rest of the economies) recession dates to identify the occurrence of a recession episode.[8]

For emerging economies, we use the sample of recession episodes since 1980 identified in Calvo et al (2006) for financially integrated emerging economies. Countries included in the sample are Argentina, Brazil, Bulgaria, Chile, Colombia, Croatia, Czech Republic, the Dominican Republic, Ecuador, El Salvador,

[8] Countries were selected on the basis of data and recession dates availability. Japan was not considered due to its strong idiosyncratic differences during this period. NBER and ECRI follow similar methodologies to define and date recessions. We did not include in the sample the episode of Austria in 1995, defined by the ECRI as recession, because there was no contraction of output

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.[9] In this sample, using annual data, the occurrence of a recession episode is simply identified as a period of negative change in GDP.

Given a recession episode, we define a pre-crisis output peak as the period displaying the maximum level of output per capita preceding the first output contraction in the recession episode. The full recovery point is that period in which the pre-crisis peak of the level of per capita output is fully restored. The data on output and population are obtained from OECD, WEO and WDI datasets. This methodology leads us to the identification of 45 recession episodes in developed economies and 50 recession episodes in emerging economies, listed in Table A.2 of the appendix.

We then distinguish the recession episodes in relation to the inflation rate experienced during the full recession episode.

Low and High Inflation Episodes

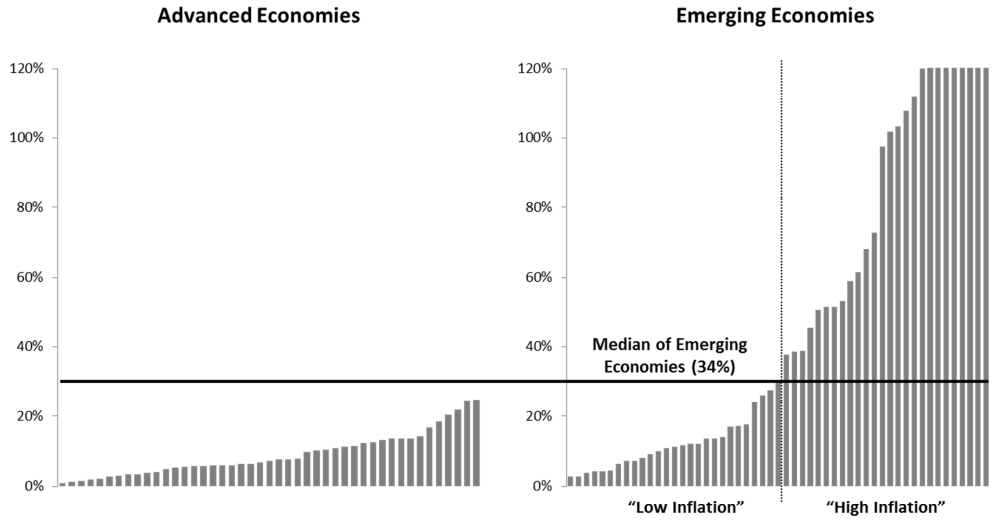
A major difference between developed and emerging economies is that recession episodes in EMs tend to display much higher inflation, as depicted in Figure 3. In the presence of nominal wage rigidities, inflation is a potential mechanism to induce a contraction of real wages and thus restore full employment. Schmitt-Grohé and Uribe (2011) show that this mechanism is especially relevant in those crises in EMs in which there is a sharp nominal depreciation of the exchange rates, accompanied by a fall in real wages that helps to avoid involuntary unemployment. This suggests that in EMs financial crises may be associated with "wageless" rather than jobless recoveries, as found in Calvo et al (2006).

To explore this hypothesis, we first computed the maximum level of inflation observed in each recession episode and then divided the sample of EMs into "low inflation" episodes (below the median) and "high inflation" episodes (above the median). Note that the median of the annual inflation observed in EMs

[9] Since we are interested in analyzing the recovery of unemployment during the crisis, we excluded from this sample two types of episodes. First, those associated to the collapse of the Soviet Union. Second, episodes in which output per capita did not fully recover its pre-crisis level before the occurrence of another recession episode. Finally, to separate recessions from long run phenomena, we also excluded from the sample episodes that are outliers in their duration (more than 2 standard deviation from the mean, 15 years).

(34%) is comparable to the maximum level of inflation in the sample of developed economies (25%). Therefore, low inflation EMs episodes are comparable to developed economies.

Figure 3. Inflation in Recession Episodes



Notes:
Inflation refers to maximum level of annual inflation observed during the episode

2.1.2 Definition of variables

The main focus of this paper is to relate jobless and wageless recoveries during recession episodes to financial crises. In this section we describe the construction of the variables used in the empirical analysis and data sources.

Measures of Jobless and Wageless Recoveries

To measure jobless recoveries, we computed, for each episode, the change in the unemployment rate between output peak and full-recovery point ($\Delta_{PR}u$). Looking at the change in the unemployment rate permits to control for country specific effects that remained stable during the whole sample. Furthermore, our aim is to focus on jobless recoveries from recession episodes, not to explain the historical differences in the average unemployment rate in these economies, which is likely to be determined by structural characteristics of labor markets and labor market institutions in the different

countries. Similarly, to measure wageless recovery, we computed, for each episode, the change in the real wage between output peak and full-recovery point ($\Delta_{PR}w$). The data on unemployment and wages were obtained from WEO, ILO and CEPAL datasets and from national sources. Nominal wages were deflated by wholesale price index or producer price index, obtained from OECD and IFS datasets and national sources.

Measures of Financial Crises

We construct two measures of financial crises. First, a dummy variable (fin_crisis) that takes the value of one for the episodes in which there is a banking crisis event or a debt default or rescheduling event, as defined in Reinhart and Rogoff (2009), in a window of 1 year before the output per capita peak and 1 year after the output per capita recovery point. This yields 9 episodes classified as financial crises in developed economies (20% of the sample) and 33 episodes in emerging economies (66% of the sample) detailed in Table 1 of the Appendix.

Second, to explore continuous measures of financial crises, we construct a variable to measure credit recovery during a recession episode (denoted $\Delta_{PR}credit$). Based on the approach of Calvo et al (2006), we use the change in the cyclical component of real credit per capita from output peak to full recovery point ($\Delta_{PR}credit\_c$). The cyclical component of credit was computed using the HP filter. In the robustness section, we use other methods to construct the cyclical component of credit. Also, based on the approach of Biggs et al (2010), who emphasize the role of credit flows rather than credit stocks, we use the change in the annual (log) increase of real credit from output peak to full recovery point ($\Delta_{PR}dcredit$). Data on credit were obtained from IFS dataset and from national sources.

Labor Market Controls

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 (Blanchard (2006), Bertola et al (2002), Furceri and Mourougane (2009) among others). To control for the impact of these factors, we use a set of labor market rigidities indicators (denoted $labor\_mkt_P$), computed at the output peak.

First, we use *de jure* indicators, directly linked to policy and legislative actions. For advanced economies we use the employment protection indicator (*epl*) constructed by the OECD. Several empirical analyses have used *epl* as determinant of unemployment rates across countries (Scarpetta (1996)). *Epl* is based

on three main sub-indicators: protection of permanent workers from individual dismissals, regulation of temporary forms of employment and specific requirements for collective dismissals. It is therefore an indicator of rigidities in labor markets resulting from government regulations. *Epl* has been used to study the impact of labor market rigidities both on average unemployment rates and on the change of unemployment rates following downturns. In addition, *epl* has been used to analyze the impact of labor market regulations on long term unemployment. Empirical results on the relevance of *epl* for labor market performance have been mixed (Bassanini and Duval, 2006). For this reason, we consider additional measures of labor market rigidity such as unemployment benefits (*ub*), the coverage of collective bargaining (*colcov*) and the degree of unionization of the labor force, such as union density (*union*), thus indicators that may affect the rigidity in wages.

For EMs, we use a recent dataset on labor market regulations constructed by Campos and Nugent (2012), a dataset that covers a sample of 140 countries, thus including EMs. Campos and Nugent extend both in terms of country coverage and of time span the widely used dataset on employment protection legislation constructed by Botero et al (2004). On the basis of a careful review of labor legislations Campos and Nugent build their variable of *de jure* labor market rigidity (LAMRIG), which we use in our estimates for EMs.

We also use a *de facto* measure of labor market rigidities, namely the natural rate of unemployment ($natural\_u_P$), which is likely to be affected by labor market institutions. For advanced economies, we use the natural rate of unemployment contained in the IMF-WEO dataset. For EMs, we compute the average rate of unemployment in the whole sample period as a proxy for the natural rate of unemployment, as the WEO dataset does not include the natural rate of unemployment EMs.

2.2 Econometric Analysis

2.2.1 Methodology

The first model relates jobless and wageless recoveries to financial crises, controlling for labor market characteristics. The estimated equation is as follows:

$$\Delta_{PR} y_i = \beta_0 + \beta_1 fin\_crisis_i + \beta_2 labor\_mkt_{P,i} + \epsilon_i \quad (1)$$

where the subscript *i* refers to each recession episode. $\Delta_{PR} y_i$ denotes $\Delta_{PR} u_i$ or $\Delta_{PR} w_i$ and ϵ_i is a random error term.

The second model relates the continuous measure of financial crisis, namely the recovery of credit during the recession episode, to jobless and wageless recoveries, controlling again for labor market indicators:

$$\Delta_{PR} y_i = \beta_0 + \beta_1 \Delta_{PR} credit_i + \beta_2 labor\_mkt_{P,i} + \epsilon_i \quad (2)$$

For each of these two models we begin by estimating an ordinary least squares (OLS) regression. A major concern associated with the OLS estimates is the possibility that financial crises or the recovery of credit are endogenous to jobless recoveries. For example, an increase in the unemployment rate driven by technological factors could induce a fall in house prices, a decrease in collateral values and thus lead to a decrease in credit or even trigger a financial crisis.

To address this issue, we use an instrumental variables (IV) estimation strategy to identify the exogenous effect of financial crisis and credit on jobless and wageless recoveries. The 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. Specifically, we use the cyclical component of real per capita credit at the output peak ($credit_P$).[10] Gourinchas et al (2001) used a similar variable to define lending boom episodes and to study their incidence on the probability of a banking crisis (see also Demirguc-Kunt and Detragiache (1998)). In the robustness section, we use real credit growth prior to the recession episode as in Schularick and Taylor (2009) as an alternative instrument.

[10] The cyclical component of credit is obtained using HP filter. In the robustness section (Appendix) we use other de-trending methods to compute the cyclical component of credit.

2.2.2 Empirical Results

Estimation results of model 1, relating financial crises to jobless and wageless recoveries are reported in Tables 1 and 2. Results for advanced economies are reported in Table 1. Columns 1-4 show the association between jobless recoveries and financial crises. The OLS estimates, reported in Columns 1 and 2, indicate that there is a positive and statistically significant association between financial crises and jobless recoveries. Columns 3-4 show that the IV estimates are also positive and significant at the 1 percent level, providing evidence that the exogenous component of financial crises play a relevant role in explaining jobless recoveries. Note that the IV coefficients are larger than in the OLS model, suggesting that the potential endogeneity of unemployment and financial crises could underestimate the effects. The magnitude of the coefficients indicate that the effect of financial crises on jobless recoveries is large: in a financial crisis, when output per capita recovers its pre-crisis level, the difference with the unemployment rate at its pre-crisis level tends to be between 2.5 and 4.5 percentage points higher than in a regular recession. Note that these figures are similar those observed in the US and in Europe during the Global Financial Crisis that started in 2008 (see Figure 1).

Columns 5-8 show the association between wageless recoveries and financial crises. None of the coefficients of the OLS or IV regressions are statistically significant at the 10 percent level. Therefore, in advanced economies, the evidence suggests that financial crises lead to jobless recoveries but do not have any significant effect on the dynamics of real wages. In particular, there is no sign of wageless recoveries.

Table 1: Advanced Economies - Financial Crises, Jobless and Wageless Recoveries

Dependent variable:		$\Delta_{PR}u$				$\Delta_{PR}w$			
		1	2	3	4	5	6	7	8
Estimation Method		OLS	OLS	IV	IV	OLS	OLS	IV	IV
Financial	fin_crisis	0.025 ***	0.027 ***	0.045 ***	0.052 ***	0.028	0.044	-0.041	0.036
Market		0.006	0.007	0.014	0.018	0.046	0.043	0.094	0.084
Labor	natural_u	0.192 ***		0.152		0.112		0.296	
Market		0.070				0.461		0.523	
	epl		0.007 **		0.008 *		-0.026		-0.026
			0.003		0.004		0.020		0.020
	ub		0.001 *		0.000		-0.003		-0.003
			0.000		0.000		0.002		0.002
	colcov		-0.0004 **		-0.0003		0.002 *		0.002 *
			0.000		0.000		0.001		0.001
	union		0.0001		-0.0001		-0.002 **		-0.002 **
			0.0002		0.0002		0.001		0.001
Sample Size		45	45	45	45	36	36	36	36

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

One could object that the adjustment in the labor market in different episodes derives from different depth of the recession associated to different types of recessions. When we control for the magnitude of the recession, measured by the fall of GDP from peak to trough, results do not change, indicating that the differential effect of financial crises on the labor market do not reflect different depths of the output contraction (see Appendix).[11] Furthermore, results are also robust to the use of employment rather than unemployment as dependent variable (Appendix).

Results for low inflation EMs are reported in Table 2a. As in advanced economies, evidence from OLS and IV estimates suggests that financial crises lead to jobless recoveries (Columns 1-4) but not to wageless recoveries (Columns 5-8). Note that the magnitude of the effect of financial crises on jobless recoveries is also similar to the one found for advanced economies.

[11] Results are also robust when we use fixed effect estimates. However, the use of fixed effects is problematic for EMs, as the number of countries in the sample is too large in relation to the overall sample given by the number of recession episodes, leaving an insufficient number of degrees of freedom. Therefore, the appendix only reports FE results for advanced economies.

Results for high inflation EMs are reported in Table 2b. In sharp contrast with advanced economies and low inflation EMs, financial crises in high inflation EMs are not associated with wageless rather than jobless recoveries. Columns 1-4 show that financial crises do not have a statistically significant association with the recovery of unemployment, both in the OLS and IV estimates. On the other hand, the association between financial crises and the recovery of real wages is negative and statistically significant, as shown by the OLS estimates in Columns 5 and 6. Moreover, Columns 7 and 8 show that the IV estimates are also statistically significant, providing evidence that the exogenous component of financial crises plays a relevant role in explaining wageless recoveries. The IV estimates are again larger than in the OLS model, suggesting that the potential endogeneity could lead to underestimating the effects.

Table 2a: Low Inflation Emerging Economies - Financial Crises, Jobless and Wageless Recoveries

Dependent variable:		$\Delta_{PR}u$				$\Delta_{PR}w$			
		1	2	3	4	5	6	7	8
Estimation Method		OLS	OLS	IV	IV	OLS	OLS	IV	IV
Financial	fin_crisis	0.023 **	0.021 *	0.027 **	0.035 **	0.028	0.027	0.159	0.157
Market		0.009	0.010	0.012	0.016	0.085	0.084	0.165	0.160
Labor	natural_u	0.002 *		0.002 *		0.002		0.006	
Market		0.001		0.001		0.012		0.014	
	lamrig		-0.006		-0.005		0.022		0.030
			0.011		0.012		-0.067		0.102
Sample Size		18	18	18	18	19	19	19	19

Table 2b: High Inflation Emerging Economies - Financial Crises, Jobless and Wageless Recoveries

Dependent variable:		$\Delta_{PR}u$				$\Delta_{PR}w$			
		1	2	3	4	5	6	7	8
Estimation Method		OLS	OLS	IV	IV	OLS	OLS	IV	IV
Financial	fin_crisis	0.010	0.012	0.031	0.035	-0.258 **	-0.259 **	-0.643 *	-0.638 *
Market		0.015	0.015	0.037	0.037	0.122	0.122	0.359	0.358
Labor	natural_u	0.001		0.00	-0.01	-0.003		-0.001	
Market		0.002		0.00	0.01	0.017		0.020	
	lamrig		-0.013				-0.013		-0.008
			0.014				0.122		0.147
Sample Size		23	23	23	23	24	24	24	24

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

Estimation results of model 2, relating credit recovery to jobless and wageless recoveries, are reported in Tables 3 and 4 and confirm the findings of model 1.

Table 3 shows that in advanced economies the recovery of credit is positively related to the recovery of unemployment. IV estimates indicate that the exogenous component of creditless recoveries is associated to jobless recoveries. On the other hand, creditless recoveries do not seem to be related to the recovery of real wages, as shown in Columns 5-8 by the OLS and IV estimates.

Table 3: Advanced Economies -Credit Recovery, Jobless and Wageless Recoveries

Dependent variable:		Δ_{PR}u				Δ_{PR}w			
		1	2	3	4	5	6	7	8
Estimation Method		OLS	OLS	IV	IV	OLS	OLS	IV	IV
Financial Market	Δ_{PR}credit	-0.159 **	-0.198 **	-0.237 ***	-0.284 ***	0.410	0.107	0.197	-0.212
		0.062	0.073	0.073	0.091	0.376	0.417	0.436	0.509
Labor Market	natural_u	0.220 ***		0.206		0.276		0.230	
		0.076		0.08		0.447		0.452	
	epl		0.008 **		0.008 **		-0.026		-0.024
			0.004		0.004		0.021		0.021
	ub		0.001 *		0.0005		-0.002		-0.003
			0.000		0.0004		0.002		0.002
	colcov		-0.0005 **		-0.0004 *		0.002		0.002 *
			0.000		0.0002		0.001		0.001
	union		-0.0001		-0.0002		-0.002 *		-0.003 **
			0.0002		0.0002		0.001		0.001
Sample Size		45	45	45	45	36	36	36	36

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

Table 4a shows that the same pattern is observed in low inflation EMs: creditless recoveries are associated to jobless recoveries and not to wageless recoveries.

Finally, Table 4b reports results for high inflation EMs. OLS estimates indicate a statistically significant association of credit recovery both with jobless and wageless recoveries. However, IV estimates indicate that the exogenous component of creditless recoveries in high inflation economies lead to wageless

recoveries but not to jobless recoveries. In summary, focusing on continuous indicators of credit conditions, rather than dummy variables identifying financial crises, broadly confirms the results obtained in the analyses of financial crises.

Table 4a: Low Inflation Emerging Economies - Credit Recovery, Jobless and Wageless Recoveries

Dependent variable:		$\Delta_{PR}u$				$\Delta_{PR}w$			
		1	2	3	4	5	6	7	8
Estimation Method		OLS	OLS	IV	IV	OLS	OLS	IV	IV
Financial	Δ_{PR}credit	-0.041 **	-0.046 **	-0.043 **	-0.052 **	-0.133	-0.121	-0.290	-0.290
Market		0.019	0.020	0.020	0.022	0.237	0.228	0.284	0.277
Labor	natural_u	0.001		0.001		0.003		0.006	
Market		0.001		0.001		0.013		0.013	
	lamrig		-0.001		0.0004		0.026		0.034
			0.011		0.011		0.095		0.097
Sample Size		18	18	18	18	19	19	19	19

Table 4b: High Inflation Emerging Economies - Credit Recovery, Jobless and Wageless Recoveries

Dependent variable:		$\Delta_{PR}u$				$\Delta_{PR}w$			
		1	2	3	4	5	6	7	8
Estimation Method		OLS	OLS	IV	IV	OLS	OLS	IV	IV
Financial	Δ_{PR}credit	-0.042 *	-0.041 *	-0.024	-0.027	0.407 **	0.417 **	0.535 **	0.516 **
Market		0.020	0.020	0.026	0.025	0.195	0.194	0.250	0.241
Labor	natural_u	0.001		0.001		0.001		0.003	
Market		0.002		0.002		0.017		0.017	
	lamrig		-0.01		-0.011		-0.054		-0.063
			0.01		0.013		0.122		0.124
Sample Size		23	23	23	23	24	24	24	24

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

The main results of the above empirical analysis highlight a clear different pattern of adjustment of labor market variables during financial crises, relative to "normal" recessions. Such differential effects are not explained by different dynamics of output or by institutional characteristics of the labor market.

In the next section, we present a simple model that can capture the main empirical findings as resulting from tightening of credit markets. The model is based on a collateral channel, although it is conceivable that other specifications of the credit market could lead to similar conclusions. The attractiveness of the

collateral channel that we present is that it delivers sharp results from a standard production model and it does not require specific assumptions on wage rigidity. The differential behavior of labor markets associated to shocks to credit markets occurs irrespectively of assumptions on wage rigidity. Different assumptions on wage rigidity lead to a different distribution of the burden of adjustment in the labor market between employment and real wages.

3. Credit Constraints, Jobless and Wageless Recoveries: A Simple Theory

A salient characteristic of the current global financial crisis is that the recovery of output is accompanied by a weak recovery of credit (see for example, Calvo and Loo-Kung (2010)). There are several channels through which credit constraints can affect employment dynamics during a recovery from recession (Calvo (2011)). Here we focus on the collateral channel. Tighter lending conditions imply that credit is directed more towards projects that involve "intrinsic collateral", such as physical capital investment projects, at the expense of projects involving job creation. This channel modifies the Okun's law, by reducing the labor intensity of aggregate output.

In this section, we sketch a simple framework that illustrates how credit constraints can account for the inability of output recovery to generate employment recovery. To emphasize the independent role of credit constraints, we present a model that abstracts from labor market imperfections leading to wage rigidities. We do not argue that wage rigidities do not play a role in explaining jobless recoveries and unemployment persistence. On the contrary, credit constraints and wage rigidities interact to generate unemployment persistence. When real wages are downward flexible, the higher degree of sluggishness in the adjustment of the labor market in the recovery from recessions induced by the tightening of credit constraints manifests itself in the persistence of low real wages rather than in the persistence of low employment.

3.1. The Model

Consider a firm that produces homogeneous output by means of capital (K) and labor (L). The production function is denoted by $AF(K, L)$, where *A* stands for neutral technical progress, and function F displays positive marginal productivities and strictly convex isoquants; 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 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,

$$AF(K,L) - (K + WL), \tag{3}$$

where *W* stands for the wage rate plus search and other costs associated with labor hiring.

Profit maximization without additional constraints implies that the firm will equate marginal productivities to factor costs (assuming interior solutions, of course).

We now introduce a credit constraint as follows:

$$\theta K + WL \leq Z, \ 0 \leq \theta \leq 1, \tag{4}$$

where *Z* stands for the exogenous credit constraint. Labor costs have full weight in the credit constraint, but not so capital (unless $\theta = 1$). This helps to capture a situation in which, under credit constraints, capital may be easier to finance than labor because *K* contains what could be called "intrinsic collateral." If loans are not repaid, for instance, some part of *K* can still be recovered by the creditors. In contrast, funds spent hiring labor cannot be recovered from the workers (unless somebody more skillful than Shylock is involved in the deal!). Conceivably, *Z* is determined by the amount of collateral that the firm can credibly post, in addition to the factors of production, e.g., land owned by the firm. This type of collateral could be called "extrinsic collateral". Under this interpretation, we could write inequality (4) in the following equivalent form:

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

The left-hand side of expression (5) corresponds to credit needs, while the right-hand side stands for total collateral = extrinsic collateral, *Z*, plus intrinsic collateral, $(1 - \theta)K$. If *K* is its own collateral, for example, i.e., $\theta = 0$, then constraints (4) or (5) boil down to $wL \leq Z$: labor would be the only input subject to a credit constraint, and capital could be accumulated in the standard manner, i.e., until the marginal productivity of capital equals 1 (recall equation (3)).

In what follows, we will focus on the case in which the credit constraint is strictly binding (i.e., it is not borderline) for both inputs. In this case, it clearly follows that

$$AF_K - 1 > 0, and\ AF_L > W, \tag{6}$$

where, as usual, the sub-indexes *K* and *L* indicate partial derivatives of function *F* with respect to *K* and *L*, respectively. Under these conditions, one can show that the iso-profit lines in the (*K,L*) plane are strictly convex and, recalling linear homogeneity, have the same slope along constant-*K/L* rays from the origin. Moreover, by expression (3), on a given iso-profit line

$$\frac{\partial L}{\partial K} = -\frac{AF_K(K,L)-1}{AF_L - W} < 0. \tag{7}$$

Moreover, the slope of the credit line is $-\frac{\theta}{W}$, which, at an interior equilibrium must be equal to the expression in (7). In Figure 4, the straight line in blue stands for the credit constraint (4). The convex curves are iso-profit lines. Solid and dashed lines correspond to two different families. The dashed lines are steeper than the solid lines. Equilibrium under the solid lines holds at the blue tangent point, while that under the dashed lines holds at the red point. We will now show that an increase in the neutral technical progress parameter *A* is equivalent to a shift from the solid to the dashed iso-profit lines.

Differentiating (7) with respect to *A* and focusing on the sign of the resulting expression, we get

$$sgn\frac{\partial^2 L}{\partial K^2} = sgn[F_L(AF_K - 1) - F_K(AF_L - W)] = sgn\left[F_L\frac{AF_K-1}{AF_L-W} - F_K\right] = sgn\left[F_L\frac{\theta}{W} - F_K\right]. \tag{8}$$

The rightmost expression is obtained recalling the tangency condition for optimality (depicted in Figure 4), which requires that expression (7) equals the slope of the credit-constraint line, i.e., $-\frac{\theta}{W}$.

The Lagrangean expression associated with the problem of maximizing profits (3) subject to the credit constraint (4), with respect to *K* and *L,* is as follows:

$$AF(K,L) - (K + WL) - \lambda(\theta K + WL), \tag{9}$$

where λ is the lagrange multiplier, which is positive because we assume that the credit constraint is strictly binding. Hence, the first-order conditions with respect to *K* and *L* are, respectively,

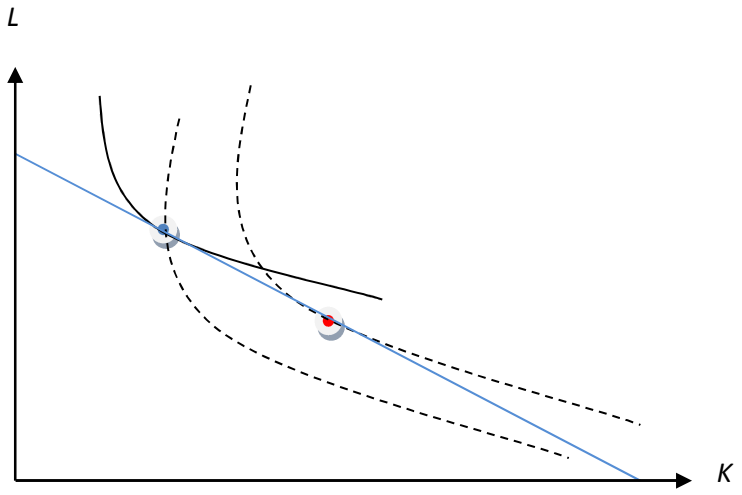
$$AF_K = 1 + \lambda\theta, and\ AF_L = W(1 + \lambda). \tag{10}$$

Therefore, by conditions in (10), we get

$$F_L\frac{\theta}{W} = \frac{1+\lambda}{\frac{1}{\theta}+\lambda}F_K < F_K \Leftrightarrow\ \theta < 1. \tag{11}$$

Hence, by (8) and (11), if $\theta < 1$, then the iso-profit lines in Figure 4 become steeper as *A* increases. Thus, the profit-maximizing technology becomes more capital intensive. This means that output and capital will grow faster than employment. Employment will lag behind output, which is the defining characteristic of *jobless recovery*. Notice that the bias against employment takes place even though the output shock is *neutral*, i.e., it does not favor either capital or labor.

Figure 4. Optimal Input Vector under Credit Constraint



The above result assumes that the wage rate *W* stays constant, which is a simple way to capture real wage rigidity. However, as the above empirical analysis suggested, wage rigidity is a salient feature of low-inflation episodes, but it is much more questionable under high inflation. In high-inflation episodes, while employment recovers with output, the real wage considerably lags behind the output recovery. To capture this case in a simple manner, we will now examine the case in which *W* adjusts in order to ensure full employment.

Assuming that credit constraint (4) is binding and using it in profit expression (3) to substitute for *L*, we get

$$AF\left(K, \frac{Z-\theta K}{W}\right) - (K + Z - \theta K). \tag{12}$$

Assuming interior solutions, profit maximization implies

$$A\left(F_K - F_L\frac{\theta}{W}\right) = 1 + \theta. \tag{13}$$

Assuming labor is inelastically supplied and normalizing it to 1, it follows from credit constraint (4) that, at full employment equilibrium,

$$W = Z - \theta K. \tag{14}$$

Hence, by (13) and (14), we have

$$AF_K(K,1) - F_L(K,1)\frac{\theta}{Z-\theta K} = 1 - \theta. \tag{15}$$

Therefore, by (15) and noticing that the linear-homogeneity implies $F_{K,L} > 0$, it follows that

$$\frac{dK}{dA} > 0, \tag{16}$$

which implies that output goes up with technical progress *A* (not a surprising result) and, by (14) that the real wages goes *down* with technical progress, dramatizing the possibility of wageless recovery under full employment. In the next section we use a version of the model with Cobb-Douglas production function to derive the quantitative implications of the model and relate them to the actual dynamics of unemployment in the US during the Great Recession. For the sake of realism, we modify slightly the credit constraint by assuming that it is a function of TFP. This implies that credit constraints are tighter (looser) when TFP declines (increases).

3.2. Quantitative implications of the Model

In this section we design a simple quantitative analysis to illustrate how jobless recoveries emerge in the context of this model. We analyze the dynamics of output and employment as a response to two types of shocks. First, a shock to TFP, constructed as benchmark. Second a shock to the credit constraint, aimed to capture a financial crisis. Even assuming an identical output contraction and recovery for both types of shocks, we find that the shock to the credit constraint results in a lower recovery of employment than the shock to TFP, showing that tighter credit constraints can trigger jobless recoveries.

3.2.1. Model Setup and Solution

Assume the technology is Cobb-Douglas:

$$F(K, L) = K^{\alpha} L^{1-\alpha} \tag{17}$$

We scale the credit constraint by TFP and assume for simplicity that $\theta = 0$, corresponding to the case in which *K* is its own collateral. Then the credit constraint becomes:

$$WL \leq ZA \tag{18}$$

We now solve the model for the case in which the credit constraint is binding and thus equation (18) holds as an equality. Thus, by equation (17), profits can be expressed as:

$$A^{2-\alpha} \left(\frac{Z}{W}\right)^{1-\alpha} K^{\alpha} - (K + ZA) \tag{19}$$

The first order condition with respect to capital implies,

$$K = \alpha^{\frac{1}{1-\alpha}} W^{-1} Z A^{\frac{2-\alpha}{1-\alpha}} \tag{20}$$

Assume time is discrete. Denoting for any variable X, $\Delta x_t = logX_t - logX_{t-1}$, we get

$$\Delta l_t = \Delta a_t + \Delta z_t - \Delta w_t \tag{21}$$

$$\Delta k_t = \frac{2-\alpha}{1-\alpha} \Delta a_t + \Delta z_t - \Delta w_t \tag{22}$$

We perform two experiments at $t = 0$. In the first experiment, that we denote "benchmark", TFP falls one period ($\Delta a_0 < 0$), then grows at a constant rate ($\Delta a_t = \Delta \bar{a}$ for $t > 0$), while the exogenous credit constraint (z) remains constant ($\Delta z_t = 0$ for every t). In the second experiment, labeled "financial crisis", the collateral constraint becomes temporarily tighter: z falls one period ($\Delta z_0 < 0$), then remains constant ($\Delta z_t = 0$ for $t > 0$), while TFP growth remains constant ($\Delta a_t = \Delta \bar{a}$ for every t).

3.2.2. Simulation under Constant Wages

To focus on the consequences of these experiments on employment, we start by assuming that real wages are constant $(\Delta w_t = 0 \text{ for every } t)$. Moreover, US data shows that the real wage was roughly constant throughout the Great Recession (Shimer (2012)), which makes these numerical experiments comparable to the current financial crisis.

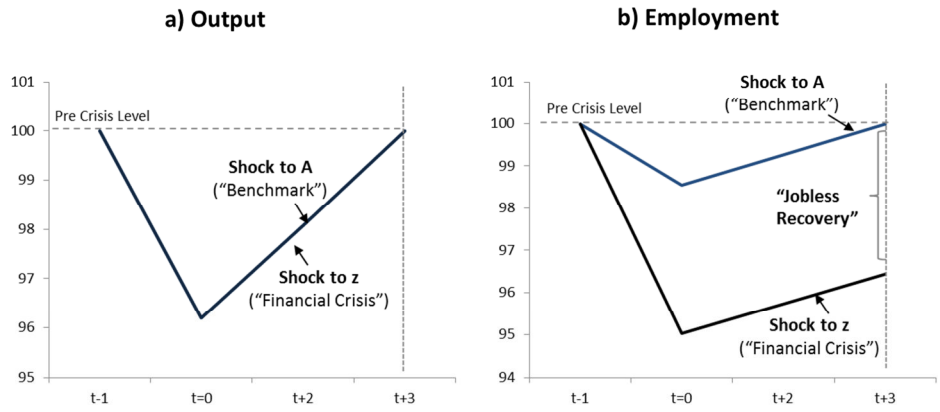
We calibrate the model as follows. The time unit is set to a year. The initial shocks Δa_0 and Δz_0 are set to match the peak-to-trough output contraction during the US 'Great Recession' (- 3.8%) in both "benchmark" and "financial crisis" experiments. We set $\Delta\bar{a} = 0.7\%$ to match a 2 year output recovery in both experiments. This value is similar to average TFP growth rate for the US since 1970s. Finally, α is set equal to 0.4, a standard parameter value for the US economy[12] . It is important to stress that the calibration is made so the behavior of output is identical in both experiments. As a consequence, the results of our analysis for the employment adjustment relate only to the difference in the *nature* of the shock. Results are depicted in Figure 5. Panel a) displays output dynamics, which is identical for both shocks. Output contracts 3.8% in the first year and recovers two years after the shock. Panel b) shows that for the employment displays a greater contraction in the "financial crisis" than in the "benchmark". In the "benchmark" employment recovers together with output, whereas "financial crisis" displays a jobless recovery: when output recovers, unemployment is still 3.3% below its pre-crisis level. The recovery of employment in the "benchmark" in spite of constant real wages arises from the fact that wages in efficiency units decline during the recovery.

The above results are quantitatively significant. Even assuming no population growth, an economy like the US that starts the "financial crisis" with a rate of unemployment of around 4%, would display a rate of unemployment larger than 7% at output recovery. In fact, the actual rate of unemployment in the US at the recovery point for output was above 9%. Our numerical simulation indicates that credit factors may account for a large proportion of the increased unemployment, 3 out of 5 percentage points. However, we do not claim that credit factors are the only determinants of unemployment persistence. Indeed, structural factors may also play a role, as documented by Elsby et al (2011) and the literature they review. According to Elsby et al, structural factors such as skill and geographical mismatches and the effects of increased unemployment benefits may account for about 2 percentage points of higher

[12] For instance, using the EUKlems dataset, the capital share in the US in the most recent observation available, 2007, is 0.38.

unemployment rate, a number very close to the gap between our simulated and the actual unemployment for the US.

Figure 5. Model Simulation under Constant Wages: Shock to TFP vs. Shock to Credit Constraint



In summary, the model's predictions are in line with our empirical results, which indicated that under rigid wages output contractions determined by shocks to credit constraints lead to a less favorable recovery of employment, for a given recovery of output, than recessions driven by a fall in TFP.

3.2.3. Simulation under Flexible Wages

We now perform the same exercise as above but under the assumption of flexible wages and full employment (that is, we assume that $\Delta l_t = 0$ for all *t*). We can use equations (23) and (24) to solve for the dynamics of wages and capital

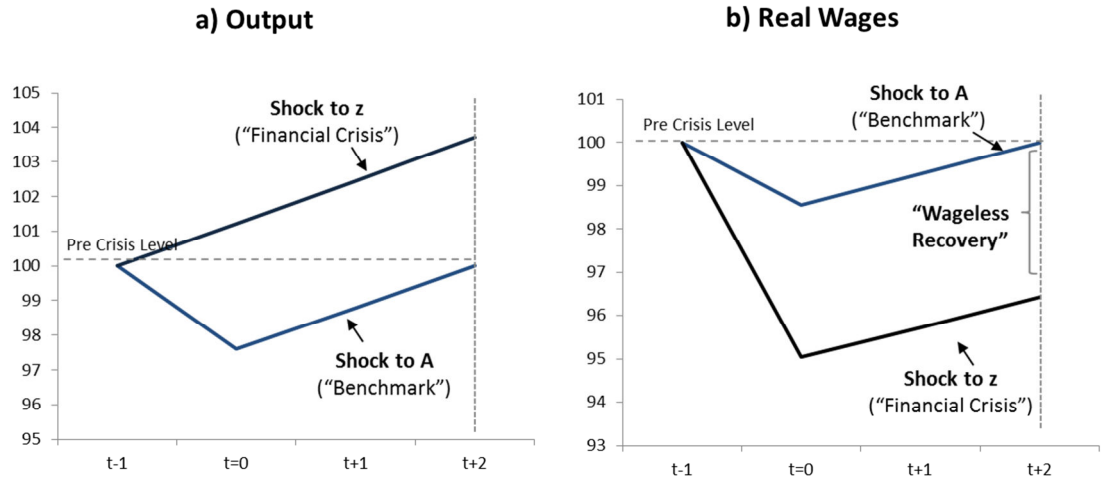
$$\Delta w_t = \Delta a_t + \Delta z_t \tag{23}$$

$$\Delta k_t = \frac{1}{1-\alpha}\Delta a_t \tag{24}$$

We use exactly the same calibration used for the case of constant wages. Results are depicted in Figure 6, which shows that the output dynamics is not anymore identical for both shocks. In particular, output does not contract under the shock to z. This result follows from equation (17) and is specific to the assumption that *K* is its own collateral ($\theta = 0$). Panel b) shows that the "financial crisis" displays a

"wageless recovery", as in period 2 wages are still below their "pre-crisis" levels. By contrast, following a productivity shock, wages mimic the behavior of output. This result is remarkable if one considers that credit tightening is associated to an increase in output, whereas output falls in response to a fall in TFP.

Figure 6. Model Simulation under Flexible Wages: Shock to TFP vs. Shock to Credit Constraint



Therefore, under flexible wages the model predicts that shocks to credit constraints lead to wageless recoveries, which provides support for the findings in our empirical analysis of the recoveries in emerging economies characterized by high inflation.

3.3. Some Evidence on the Effects of Collateral on Labor Market Variables

Finally, to explore the transmission mechanism of the theoretical model of Section 3.1, we relate jobless recoveries to the contraction in the collateral from output peak to trough (generically denoted $\Delta_{PT}collat$). Following Kiyotaki and Moore (1997) and Bernanke and Gertler (1989), we use data on asset prices, in particular stock market prices ($\Delta_{PT}stock\_mkt\_price$) and house prices $\left(\Delta_{PT}housing_{price}\right)$ in real terms, as proxies for collateral values. We estimate the following equation:

$$\Delta_{PR}u_i = \beta_0 + \beta_1 \Delta_{PT} collat_i + \beta_5 labor\_mkt_{P,i} + \epsilon_i \qquad (25)$$

Due to data availability, we present some partial evidence only for the sample of advanced economies. Table 5 presents results. Using the stock market as a measure of collateral, the estimated coefficients have the expected negative sign and are statistically significant at the 1 level in every specification. Due to data availability, when we use housing prices as a measure of collateral the number of observations is reduced considerably. However we can still observe statistically significant results when we include only one labor market control.

Table 5: Advanced Economies -Collateral and Jobless Recoveries

Dependent variable:		$\Delta_{PR}u$			
		1	2	3	4
		OLS	OLS	OLS	OLS
Collateral	Δ_{PT}stock_mkt_price	-0.04 ***	-0.04 ***		
		0.01	0.01		
	Δ_{PT}housing_price			-0.07 *	-0.025
				0.04	0.03
Labor Market	natural_u	0.22 ***		0.15	
		0.07		0.12	
	epl		0.005		0.001
			0.004		0.005
	ub		0.0006 *		0.001 **
			0.0003		0.0004
	colcov		-0.0004 **		0.000 *
			0.0002		0.000
	union		0.0002		0.001 ***
			0.0002		0.000
Sample Size		45	45	23	23

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

4. Conclusions

The paper tries to empirically verify the hypothesis that recessions associated with disruption in credit markets display, for the same output path, a worse outcome in terms of unemployment or real wages if compared with other types of recessions. Recessions associated with financial crises are a clear example of disruptions in credit markets. Our empirical analysis strongly supports our hypothesis that tightening of credit constraints produces jobless or wageless recoveries.

The main contributions of the paper are, first, the emphasis on credit markets as the main channel explaining the sluggish adjustment in labor markets and, second, the joint analysis of the experience of advanced and emerging economies. Such joint analysis allowed us to uncover the interesting result that, empirically, high inflation is a way to avoid high and persistent unemployment in the aftermath of a financial crisis.

The paper presents as well a simple model that help to interpret the empirical findings. The model is based on the different role played by labor versus other factors of production in the determination of collateral. Specifically, we assumed that capital, but not labor, has the feature of "intrinsic" collateral, as it can be pledged against borrowing. The paper provides some preliminary evidence on such collateral channel. However, a more direct test of the model would require looking at micro or sectoral data, in order to determine whether firms or sectors characterized by a larger share of intrinsic collateral display a less sluggish adjustment of employment and/or wages during the recovery from financial crises. This is an important item in our agenda for further empirical research.

The credit view of jobless and wageless recoveries has relevant policy implications. Neither expansionary aggregate demand policies, nor institutional reforms in the labor market are sufficient to significantly reduce unemployment persistence or to push the economy out of the low real wage equilibrium until pre-crisis conditions on credit markets have been restored.

The evidence reported in the paper suggests that a sharp dosage of price inflation for a *limited period of time* may go a long way to restoring full employment after financial crises, albeit at the cost of lower real wages. One should note, however, that in the average high-inflation EM episode covered by our sample, inflation spiked up at the beginning of those episodes but later subsided, and did not result in

permanently higher inflation. Therefore, the evidence does not support the view that *permanently higher* inflation can *permanently* lower the rate of unemployment. In other words, the empirical evidence does not contradict the existence of a long-run vertical Phillip curve.

Policies that do not tackle directly the credit constraints on job creation are likely to be ineffective in pushing the economy out of a jobless or wageless recovery. In particular, attention should be placed on policies aimed at overcoming the lack of access to credit for projects with little "intrinsic collateral". Of course, implementation of such policies may be complicated, as it implies information on firm characteristics.

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5. Appendices

5.1. Robustness

In this section we investigate the robustness of the results contained in Section 2. Robustness is conducted for advanced economies, while the extension of such robustness checks for emerging economies is still work in progress, mainly due to lack of data. We verify whether results survive when (1) we consider employment rather than unemployment as dependent variable; (2) when we consider alternative measures to identify financial crises, and (3) when we use different instruments in the IV estimations.

Alternative Measures of Jobless Recoveries

We begin by considering a different measure of jobless recovery, using the employment rate instead of the rate of unemployment. In particular, to measure jobless recoveries, we computed, for each episode, the change in the employment rate between output peak and full-recovery point ($\Delta_{PR} l$). This robustness check is aimed to confirm that jobless recoveries, consistent with the theory, are determined mainly by the dynamics of employment and not by changes in participation rates.

We estimate the two empirical models of section 2 relating jobless recoveries to financial crises. In particular, the estimated equations are as follows:

$$\Delta_{PR} l_i = \beta_0 + \beta_1 fin\_crisis_i + \beta_2 labor\_mkt_{P,i} + \epsilon_i \quad (1')$$

$$\Delta_{PR} l_i = \beta_0 + \beta_1 \Delta_{PR} credit_i + \beta_2 labor\_mkt_{P,i} + \epsilon_i \quad (2')$$

Results are presented in Tables R.1 and R2 and confirm the findings that emerged from the analysis of unemployment rate as a measure of jobless recovery.

Table R1: Advanced Economies - Financial Crises, Jobless and Wageless Recoveries

Dependent variable:		Δ_{PR}I			
		1	2	3	4
Estimation Method		OLS	OLS	IV	IV
Financial Market	fin_crisis	-0.020 ***	-0.021 ***	-0.040 ***	-0.046 ***
		0.005	0.005	0.012	0.015
Labor Market	natural_u	-0.102		-0.066	
		0.056		0.07	
	epl		0.005 **		-0.006 *
			0.002		0.003
	ub		-0.0004		-0.0001
			0.0002		0.0003
	colcov		0.0003 *		0.0001
			0.000		0.000
	union		-0.0001		0.0001
			0.0001		0.0002
Sample Size		39	39	39	39

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

Table R2: Advanced Economies -Credit Recovery and Jobless Recoveries

Dependent variable:		Δ_{PR}I			
		1	2	3	4
Estimation Method		OLS	OLS	IV	IV
Financial Market	Δ_{PR}credit	0.181 ***	0.212 ***	0.218 ***	0.252 ***
		0.045		0.053	
Labor Market	natural_u	-0.098		-0.091	
		0.056		0.06	
	epl		-0.007 ***		-0.007 ***
			0.002		0.002
	ub		-0.0003		-0.0002
			0.0002		0.0002
	colcov		0.0003 *		0.0003
			0.0001		0.0002
	union		0.000004		0.000
			0.00014		0.0002
Sample Size		39	39	39	39

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

Alternative Measures of Financial Crises

In section 2 we used the change in the cyclical component of real per capita credit from output peak to full recovery point ($\Delta_{PR}credit\_c$) as a continuous variable to measure financial crisis. Based on the approach of Biggs et al (2010), who emphasize the role of credit flows, we use as a robustness check the change in the annual (log) increase of real credit from output peak to full recovery point ($\Delta_{PR}dcredit$).

Table R3: Advanced Economies -Credit Flow Recovery, Jobless and Wageless Recoveries

Dependent variable:		Δ_{PR}u				Δ_{PR}w			
		1	2	3	4	5	6	7	8
Estimation Method		OLS	OLS	IV	IV	OLS	OLS	IV	IV
Financial Market	Δ_{PR}dcredit	-0.079 *	-0.109 **	-0.154 ***	-0.184 ***	0.252	0.090	0.139	-0.133
		0.041			0.063	0.246	0.251	0.307	0.320
Labor Market	natural_u	0.229 ***		0.211 **		0.266		0.230	
		0.077		0.08		0.447		0.452	
	epl		0.008 **		0.008 **		-0.026		-0.025
			0.004		0.004		0.020		0.021
	ub		0.001 *		0.0006		-0.002		-0.002
			0.000		0.0004		0.002		0.002
	colcov		-0.0005 **		-0.0005 **		0.002		0.002
			0.000		0.0002		0.001		0.001
	union		-0.00001		-0.0001		-0.002		-0.003 **
			0.0002		0.0002		0.001		0.001
Sample Size		44	44	44	44	36	36	36	36

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

Results confirm the findings obtained in the main body of the paper, where we used the cyclical component of credit stocks.

Alternative Instruments

In the instrumental variables strategy described in Section 2, we used the cyclical component of real per capita credit at the output peak ($credit_P$). Following Schularick and Taylor (2009) in this appendix we

use real credit growth prior to the recession episode as an alternative instrument instead of the cyclical component of credit.

Results are presented in Tables R.4 and R.5 and confirm the findings of Section 2.

Table R.4: Advanced Economies - Financial Crises, Jobless and Wageless Recoveries

Dependent variable:		$\Delta_{PR}u$		$\Delta_{PR}w$	
		1	2	3	4
Estimation Method		IV	IV	IV	IV
Financial	fin_crisis	0.037 **	0.049 **	0.016	0.089
Market		0.016	0.024	0.119	0.111
Labor	natural_u	0.172 *		0.172	
Market		0.08		0.555	
	epl		0.008 **		-0.029
			0.004		0.021
	ub		0.0001		-0.003
			0.001		0.002
	colcov		-0.0003		0.003 *
			0.0003		0.001
	union		-0.0001		-0.003 **
			0.0002		0.001
Sample Size		42	42	35	35

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level

Table R.5: Advanced Economies -Credit Recovery, Jobless and Wageless Recoveries

Dependent variable:		Δ_{PR}u		Δ_{PR}w	
		3	4	7	8
Estimation Method		IV	IV	IV	IV
Financial	Δ_{PR}credit	-0.203 **	-0.281 **	-0.076	-0.545
Market		0.095	0.131	0.560	0.707
Labor	natural_u	0.215 **		0.199	
Market		0.08		0.480	
	epl		0.009 **		-0.024
			0.004		0.022
	ub		0.0005		-0.003
			0.0004		0.002
	colcov		-0.0004 *		0.002 *
			0.0002		0.001
	union		-0.0002		-0.003 **
			0.0003		0.001
Sample Size		42	42	35	35

Notes:
***Significant at the 1% level
**Significant at the 5% level
*Significant at the 10% level