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THE LABOR MARKET CONSEQUENCES OF FINANCIAL CRISES WITH OR WITHOUT INFLATION: JOBLESS AND WAGELESS RECOVERIES

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ABSTRACT

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

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This Draft: October 11th, 2012

Abstract

This paper offers empirical evidence showing that, relative to "normal" recessions, financial crises hit the labor market by either enhancing the degree of joblessness and/or by further depressing the real wage – a situation that the paper labels "wageless recovery." This holds for a sample of both advanced and emerging-market economies recession episodes, using credit market data prior to the recession episode as instrumental variable for financial crises. Results also indicate that inflation determines the type of recovery: low inflation is associated with jobless recovery, while high inflation is associated with wageless recovery. The paper shows that these outcomes are consistent with a simple model in which collateral requirements are higher (lower), the larger is the share of labor costs (physical capital expenditure) involved in a loan contract. This is motivated by the conjecture that if a loan becomes delinquent, physical capital is easier to confiscate than human capital. Evidence from advanced economies supports the model. An implication of these findings is that a spike of inflation during financial crisis may help to reduce jobless recoveries, but at the expense of sharply lower real wages. Only relaxing credit constraint might help both unemployment and wages.

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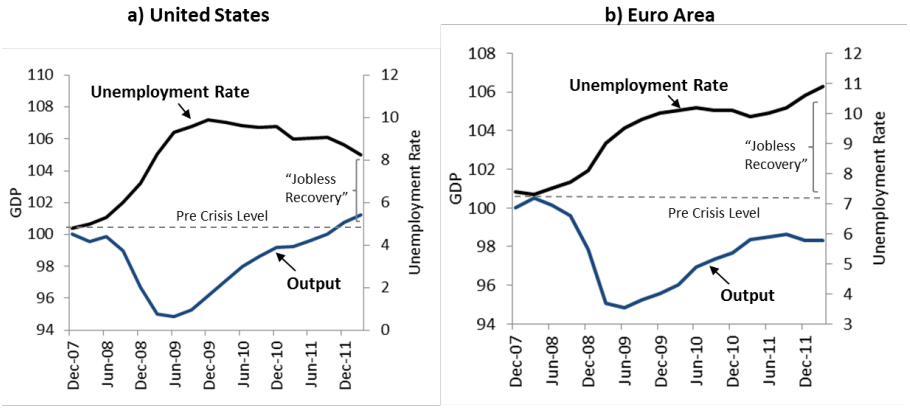
I. Introduction

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 also been observed 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 recessions' "cleansing effects" (Schreft et al (2005), Groshen and Potter (2003), Berger (2011)).[2]

The Great Recession, with its high and persistent unemployment in advanced economies, has again brought the jobless recovery issue 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.

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.

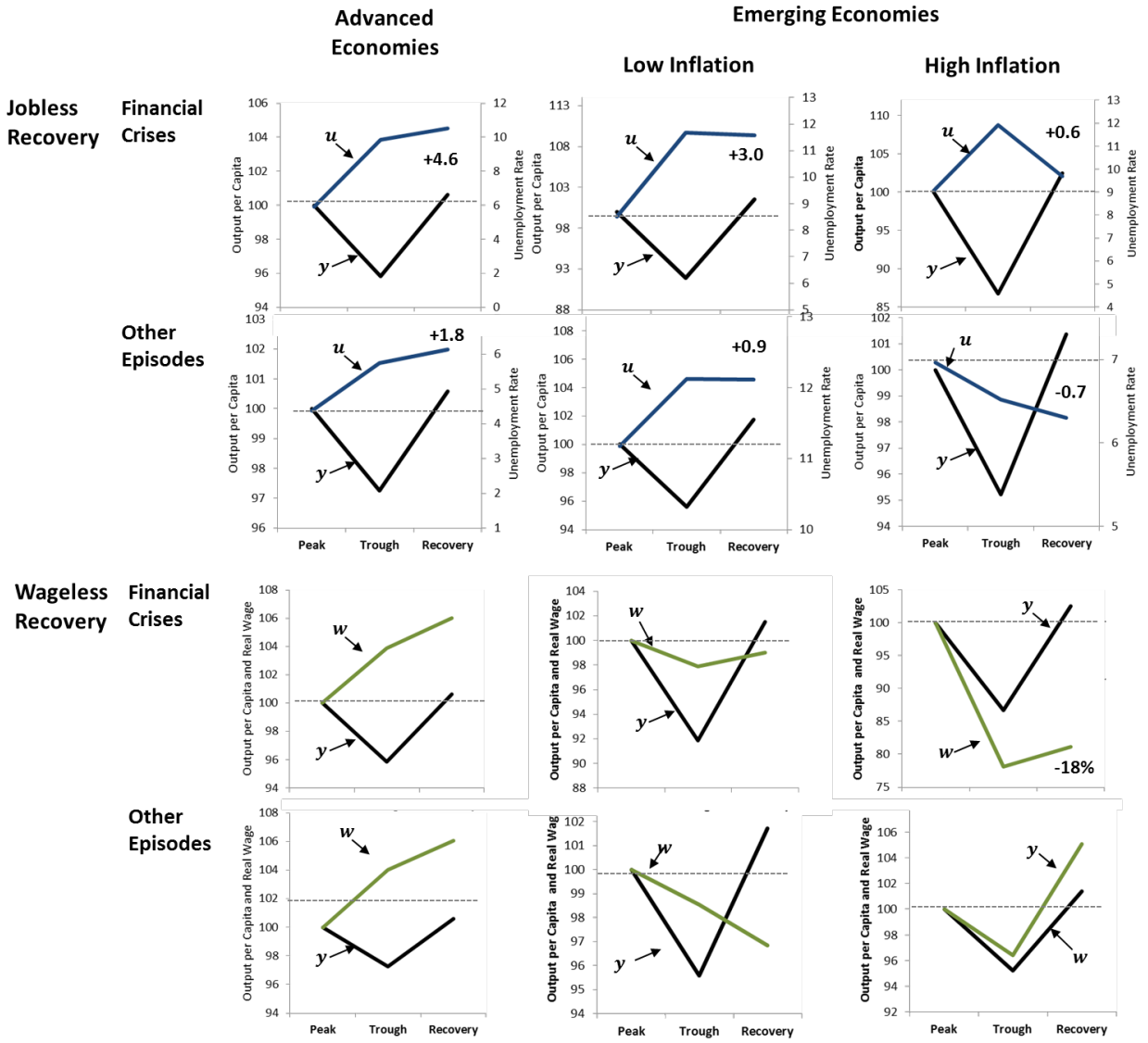
[1] Blanchard and Summers (1986) depicted the European experience as reflecting hysteresis in unemployment, a situation in which the natural rate of unemployment depends on the actual rate of unemployment. See also Ball (2009).

[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 has been much larger during the Great Recession than in previous post-war recession episodes (Farber (2011)).

In this paper, we explore the hypothesis that the joblessness nature of the recovery from a recession episode is related to the *financial* nature of the recession episode. We document for a sample of post-war recession episodes in advanced and emerging market economies (EMs), that financial crises tend to be followed by jobless recoveries in the presence of low inflation and by "wageless," e.g. significantly lower real wage, recoveries in the presence of high inflation. These findings are summarized in Figure 2, comparing the behavior of labor market during financial crises relative to other episodes, for advanced and emerging economies.

Figure 2. Financial Crises, Jobless and Wageless Recoveries



In advanced economies, where inflation in the post-war era has been relatively low, financial crises have been followed by recoveries in which joblessness was significantly higher than in "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 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 with jobless recoveries but with 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 contrast, low inflation EMs display a pattern similar to the one observed in advanced economies, with financial crises associated to more intense jobless recoveries.[4]

To establish whether the stylized facts summarized in Figure 2 truly reflect the central role of credit markets, we conduct an econometric analysis controlling 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. Since financial crises and credit conditions may be partially *caused* by 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.

[4] 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)).

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.[5] However, the above mechanism should operate in *any* recession and thus cannot explain the more intense joblessness of recoveries from financial crises.

We develop a simple theory that allows us to interpret the above empirical results. The central assumption is that financial crises are associated with a fall in collateral values, and that collateral requirements are lower for projects and firms possessing easily recognizable collateral, e.g., associated with tangible assets, which we define as "intrinsic collateral" (Calvo (2011)). 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 low real wages when real wages are flexible (a "wageless recovery").[6]

We test the role of collateral for the sample of advanced economies and we find that collateral variables have a significant impact on unemployment during the recovery phase. Using macroeconomic data does not permit to test the role of intrinsic collateral and thus in our empirical analysis we follow Kiyotaki and Moore (1997) and Bernanke and Gertler (1989), and use data on asset prices, in particular stock market prices and house prices, as proxy for collateral values.

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 putting under the same roof both advanced and emerging economies. The paper is thus radically different from the existing literature on jobless

[5] 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)).

[6] This form of collateral constraint is related to the literature on *inalienability of human capital* (Hart and Moore (1994)) and to the one on *asset tangibility* (see, for example, Almeida and Campello (2007)).

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

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 supporting continuation of stimulus packages, even after the level of output has returned to its pre-crisis peak.

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.

[7] There are a few studies that analyze 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 recession episodes.

II. The Effect of Financial Crises on Unemployment and Wages Recovery: Empirical Evidence on Post-War Recession Episodes

The main objective of our analysis is to test whether the recovery of unemployment and real wages during recessions is related to financial crises. To this end, we built up 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, which would hold if 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.

The empirical section is organized as follows. First, we describe the sample and associated data, and define financial crisis episodes and the variables that will be utilized to measure joblessness and wagelessness during recoveries from recession. Second, we outline the empirical strategy, which is 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.

II.1 Data

II.1.1 Sample Construction

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 (EMs).

We perform the analysis of developed and emerging economies separately. The reason is twofold. First, advanced and emerging economies typically have a remarkably different behavior in the business cycle (see, for example, Uribe (2012)). Dividing the sample reduces the problem of excess heterogeneity that typically arises in cross-country regressions. Second, datasets are different for advanced and emerging economies along several dimensions. The time period for advanced economies tend to be

larger; long time series are available at the quarterly frequency for advanced economies and at the annual frequency for EMs; and datasets on labor market controls (analyzed in the next section) are also different.

Recession Episodes

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, 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 output 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 helps us to identify 45 recession episodes in developed economies and 50 recession episodes in emerging economies, listed in Table A.1 of the appendix.

[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.

[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).

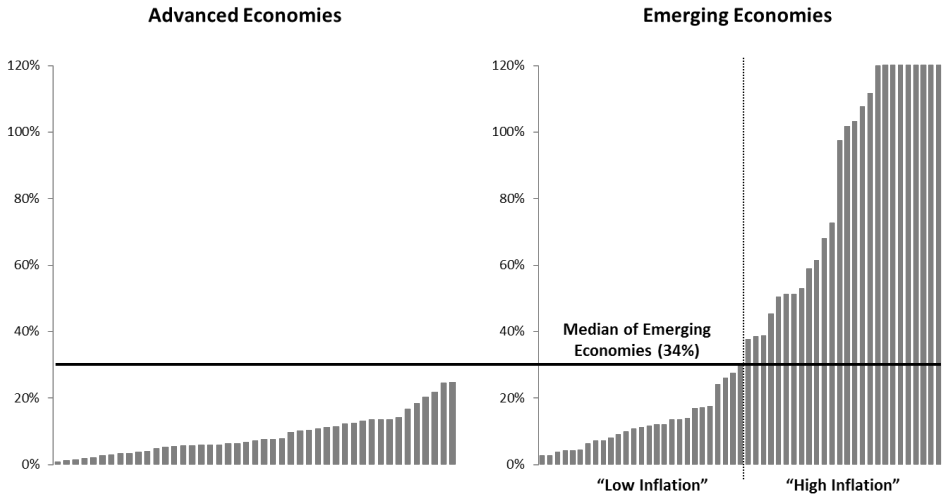
Next we classify recession episodes according to the inflation rate exhibited during the full recession episode.

Low and High Inflation Episodes

A major difference between developed and emerging economies is that recession episodes in the latter tend to display much higher inflation, as shown 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 compute the maximum level of inflation observed in each recession episode and divide the sample of EMs into "low inflation" episodes (below the median) and "high inflation" episodes (above the median); see Figure 3. Low-inflation EMs have an average inflation of 12.6%, not statistically different from the average inflation of advanced economies. The standard deviation is also very similar: 5,4% for low-inflation EMs and 6,6% for developed economies. Thus, the distribution of low-inflation EMs is comparable, in terms of inflation during recession episodes, to that of developed economies.

Figure 3. Inflation in Recession Episodes



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

II.1.2 Definition of variables

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 compute, for each episode, the change in the unemployment rate between output peak and output-recovery point ($\Delta_{PR}u$). Looking at the change in the unemployment rate permits to control for country specific effects that remain 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. Similarly, to measure wageless recovery, we computed, for each episode, the change in the real wage between output peak and output-recovery point ($\Delta_{PR}w$).

The data on unemployment and wages were obtained from WEO, ILO and ECLA 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 A.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. 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 labor market regulations. For advanced economies, we use a set of indicators constructed by the OECD that have been used in the empirical literature as determinants of unemployment rates across countries (see, for example, Scarpetta (1996)). In particular, we use the employment protection indicator (*epl*), unemployment benefits (*ub*), the coverage of collective bargaining (*colcov*), and the degree of unionization of the labor force (*union*).[10]
For EMs, we use a recent dataset on labor market regulations constructed by Campos and Nugent (2012). 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 report the natural rate of unemployment for EMs.

[10] The employment protection indicator (*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.

II.2 Econometric Analysis

II.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 (see, for example Mendoza and Terrones (2012), Schularick and Taylor (2009), Gourinchas et al (2001)). Specifically, we use the cyclical component of real per capita credit at the output peak ($credit_P$).[11]

Tables 1 and 2 show the first stage relationship for advanced and emerging economies respectively.

[11] The cyclical component of credit is obtained using HP filter. In the robustness section (Appendix) we show that using a log quadratic trend to compute the cyclical component of credit, results do not change.

Table 1: Advanced Economies -Credit Cycle at the Peak and Financial Crises (First Stage)

Dependent variable:		fin_crisis			Δ_{PR}credit		
		1	2	3	5	6	7
Estimation Method		OLS	OLS	OLS	OLS	OLS	OLS
Intrument	$credit_P$	6.471 ***	6.335 ***	6.125 ***	-1.197 ***	-1.189 ***	-1.124 ***
		1.666	1.663	1.969	-0.010	0.108	0.127
Labor	natural_u		1.73			-0.095	
Market			1.47			0.096	
	epl			0.005			0.002
				0.071			0.005
	ub			0.006			-0.0002
				0.007			0.000
	colcov			-0.003			0.0001
				0.004			0.000
	union			-0.0002			-0.0003
				0.0039			0.0003
Sample Size		45	45	45	45	45	45

Table 2a: Low Inflation Emerging Economies -Credit Cycle at the Peak and Financial Crises (First Stage)

Dependent variable:		fin_crisis			Δ_{PR}credit		
		1	2	3	5	6	7
Estimation Method		OLS	OLS	OLS	OLS	OLS	OLS
Intrument	$credit_P$	1.450 **	1.589 ***	1.546 **	-1.217 ***	-1.247 ***	-1.228 ***
		0.525	0.521	0.555	0.116	0.116	0.123
Labor	natural_u		-0.02			0.004	
Market			0.02			0.005	
	lamrig			0.142			-0.016
				0.231			0.051
Sample Size		25	24	25	25	24	25

Table 2b: High Inflation Emerging Economies - Credit Cycle at the Peak and Financial Crises (First Stage)

Dependent variable:		fin_crisis			Δ_{PR}credit		
		1	2	3	5	6	7
Estimation Method		OLS	OLS	OLS	OLS	OLS	OLS
Intrument	$credit_P$	0.839 **	0.832 *	0.856 **	-0.991 ***	-1.000 ***	-1.033 ***
		0.382	0.401	0.392	0.170	0.170	0.158
Labor	natural_u		0.01			-0.018	
Market			0.03			0.011	
	lamrig			-0.067			0.167 **
				0.187			0.075
Sample Size		25	24	25	25	24	25

Notes:

***Significant at the 1% level

**Significant at the 5% level

*Significant at the 10% level

The first stage coefficients are statistically significant, showing that credit booms prior to the recession episodes are associated with a higher probability of a the recession being financial and of a higher contraction of credit from output peak to recovery point.

II.2.2 Empirical Results

Estimation results of model 1, linking financial crises to jobless and wageless recoveries are reported in Tables 3 and 4. Results for advanced economies are reported in Table 3. 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 to those observed in the US and in Europe during the Global Financial Crisis that started in 2008 (see Figure 1). Appendix V.2 shows that the jobless recovery result is robust to the use of employment rather than unemployment as dependent variable.

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. Therefore, in advanced economies, 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 3: 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 ***	0.005	0.004	-0.003	0.032
Market		0.006	0.007	0.014	0.018	0.049	0.046	0.098	0.091
Labor	natural_u	0.192 ***		0.152		-0.208		-0.185	
Market		0.070				0.498		0.547	
	epl		0.007 **		0.008 *		-0.043 *		-0.043 *
			0.003		0.004		0.021		0.022
	ub		0.001 *		0.000		-0.002		-0.002
			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

These conclusions for advanced economies are robust to the inclusion of additional controls. In particular, results do not change when we control for the depth of the recession episode, measured by the fall of GDP from peak to trough, and for country fixed effects (see Appendix V.2).

Results for low inflation EMs are reported in Table 4a. 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.

Results for high inflation EMs are reported in Table 4b. In sharp contrast with advanced economies and low inflation EMs, financial crises in high inflation EMs are now 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.

Results for emerging economies are also robust to controlling for the depth of the recession episode, measured by the fall of GDP from peak to trough[12].

Table 4a: 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 **	0.026	0.023	0.149	0.149
Market		0.009	0.010	0.012	0.016	0.084	0.083	0.162	0.157
Labor	natural_u	0.002 *		0.002 *		0.003		0.007	
Market		0.001		0.001		0.012		0.014	
	lamrig		-0.006		-0.005		0.030		0.038
			0.011		0.012		0.094		0.101
Sample Size		18	18	18	18	19	19	19	19

Table 4b: 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		0.0005	-0.01	-0.003		-0.001	
Market		0.002		0.0026	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

[12] 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.

Estimation results of model 2, relating credit recovery to jobless and wageless recoveries, are reported in Tables 5 and 6 and confirm the findings of model 1.

Table 5 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 5: Advanced 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	-0.159 **	-0.198 **	-0.237 ***	-0.284 ***	0.240	0.171	0.015	-0.186
Market		0.062	0.073	0.073	0.091	0.409	0.441	0.474	0.539
Labor	natural_u	0.220 ***		0.206		-0.142		-0.190	
Market		0.076		0.08		0.486		0.491	
	epl		0.008 **		0.008 **		-0.044 *		-0.041
			0.004		0.004		0.022		0.022
	ub		0.001 *		0.0005		-0.002		-0.002
			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 6a 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 6b 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 6a: 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 **	-0.118	-0.105	-0.272	-0.274
Market		0.019	0.020	0.020	0.022	0.234	0.225	0.280	0.274
Labor	natural_u	0.0013		0.0013		0.0041		0.006	
Market		0.0011		0.0011		0.012		0.013	
	lamrig		-0.0005		0.0004		0.034		0.042
			0.011		0.011		0.094		0.096
Sample Size		18	18	18	18	19	19	19	19

Table 6b: 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	0.0007		0.001		0.001		0.003	
Market		0.0020		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 clearly 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 function model and delivers results compatible with empirical evidence for the case of rigid or flexible wages. Different assumptions on wage rigidity lead to a different distribution of the burden of adjustment in the labor market between employment and real wages.

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

In this section, we present a simple theoretical framework that illustrates how collateral constraints can account for the inability of output recovery to generate employment recovery. We introduce a collateral constraint that captures the idea that capital might be easier to finance than labor. With this form of collateral constraint, tighter lending conditions might imply that credit is directed more towards projects that involve physical capital at the expense of projects involving job creation, thus reducing the labor intensity of aggregate output.

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.

III.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 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,

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

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

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 $Z > 0$ 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)).

This form of collateral constraint is related to the literature on *inalienability of human capital* (Hart and Moore (1994)). In this framework, entrepreneurs cannot costlessly be replaced and can repudiate contracts by withdrawing their human capital. It is also related to the literature on *asset tangibility.* For example, Almeida and Campello (2007) show that pledgeable assets support more borrowing because such assets mitigate contractibility problems: tangibility increases the value that can be captured by

creditors in default states. Tangibility as a characteristic of assets used as collateral in debt contracts plays a central role in the corporate finance literature (Tirole (2005)) [13].

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, recalling linear homogeneity, one can show that the iso-profit lines in the (*K,L*) plane are strictly convex, and have the same slope along constant-*K/L* rays from the origin. Moreover, by expression (3), on a given iso-profit line

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

The slope of the credit line is $-\frac{\theta}{W}$, which, at an interior equilibrium must be equal to the right-hand-side 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:

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

[13] Recently, Eden (2012) has also used this form of collateral constraint to analyze welfare implications of international liquidity flows. The collateral constraint emerges in a setup in which labor must be paid in advance with liquid claims issued at the beginning of the period that can be collateral backed with capital.

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,

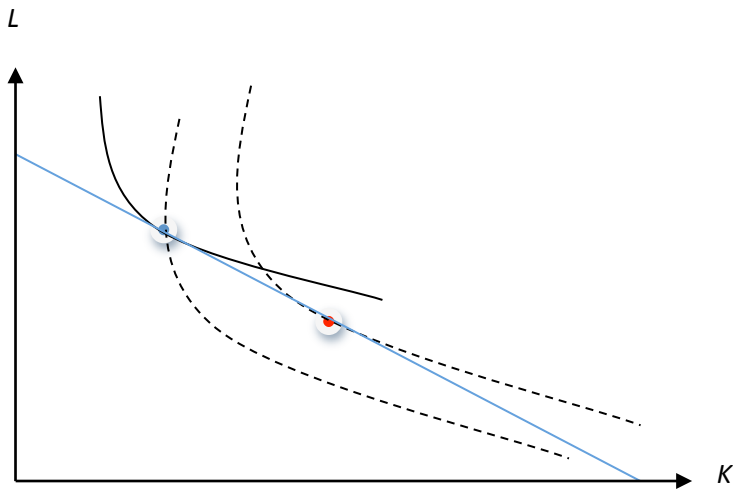
$$AF_K = 1 + \lambda\theta, and\ AF_L = W(1 + \lambda). \tag{10}$$

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 wage 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. This implies that credit constraints are tighter (looser) when TFP declines (increases).

III.2 A Quantitative Exercise

In this section we calibrate the model to match the salient features of the US Great Recession, to show that the model has the potential of rationalizing actual jobless recovery episodes. We analyze the dynamics of output and employment in response to two types of shocks. First, a shock to TFP, the

benchmark case. Second, a shock to the credit constraint, aimed at capturing the effects of collateral constraints.

We begin by assuming 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 with 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,

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

Hence, assuming discrete time, 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 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).

To focus on the consequences of these experiments on employment, we assume that real wages are constant ($\Delta w_t = 0$ for every t). This assumption is consistent with US data for the Great Recession, which show that the real wage was roughly constant throughout the Great Recession (Shimer (2012)).

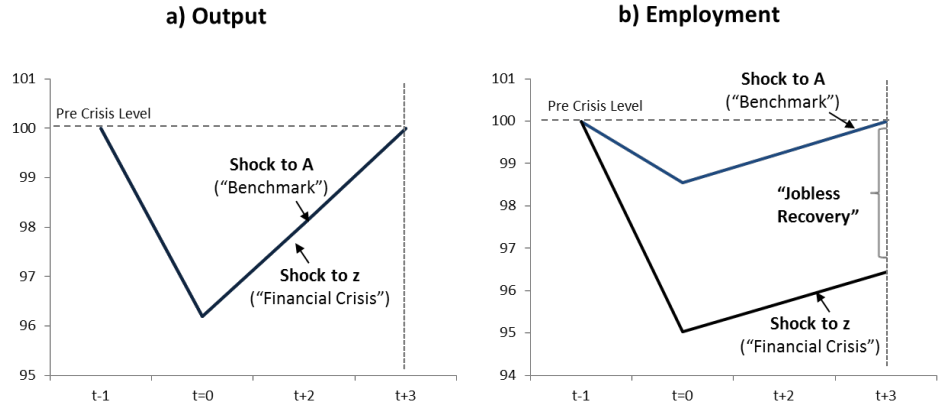
We calibrate the model as follows. The time unit is set equal to one year. The initial shocks Δa_0 and Δz_0 are set to match the peak-to-trough output contraction during the US Great Recession (- 3.8%) in

both "benchmark" and "financial crisis" experiments. We set $\Delta\bar{a} = 0.7\%$ to get a 2 year output recovery in both experiments (which in line with the US Great Recession; see Figure 1). 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.[14] It is important to stress that the calibration is such that the output path is identical in both experiments. Hence, differences in the employment path can be traced to the *nature* of the shock. Results are depicted in Figure 5. Panel a) displays output dynamics which, as noted, is identical for both shocks. Output contracts 3.8% in the first year and recovers two years after the shock. Panel b) shows that 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 jobless recovery: when output recovers, unemployment is still 3.3% below its pre-crisis level. The recovery of employment in the "benchmark" arises from the fact that wages in efficiency units decline during the recovery, and in spite of constant real wages.

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. The rate of unemployment in the US at the output- recovery point was above 9%. The difference may be accounted for by other factors that delay employment recovery even in non-financial crisis episodes. Actually, Elsby et al (2011) show for the US that structural factors such as skill and geographical mismatches and the effects of increased unemployment benefits may account for about 2 percentage points of higher unemployment rate during the Great recession, a number very close to the gap between our simulated and the actual unemployment.

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

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



III.3 Some Evidence on the Effects of Collateral on Labor Market Variables

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 7: Advanced Economies -Collateral and Jobless Recoveries

Dependent variable:		Δ_{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

IV. Conclusions

Financial crises are bad for the labor market. They exacerbate the negative impact on the labor market that recessions bring about. This is a central piece of evidence, which this paper shows for both advanced and emerging economies (EMs). An equally important piece of evidence is that the impact on the labor market depends on inflation during the crisis episode. In low-inflation cases (comprised by all advanced economy cases and EMs that exhibit inflation below the median), real-wages appear to be downward-inflexible, and the brunt of the adjustment is borne by high unemployment, measured at the point of output recovery, i.e., the time at which per-capita output recovers its pre-crisis level. In contrast, under high inflation (comprising EMs that exhibit inflation above the median), unemployment goes back to pre-crisis levels at the output-recovery point, but real wages are significantly lower.

This suggests that financial crises have negative effects on the labor market that cannot be undone by standard monetary expansionary policy. For instance, the evidence suggests that a sharp rise in the price level can help to restore full employment, but at the expense of sharply lower real wages (close to -20% according to the average in high-inflation EMs; see Figure 1). This indicates that the use of monetary expansion to palliate high unemployment may encounter severe political opposition. Moreover, the EM experience is not helpful to assess its political feasibility in advanced economies, because high inflation was an inevitable consequence of capital flight and resultant maxi-devaluations, not a calculated policy outcome. It is worth noting, incidentally, that there is no evidence in our sample that *persistent inflation* helps to lower the rate of unemployment. In the majority of high-inflation episodes, they occurred mostly within the crisis window and were followed by a return to previous inflation rates. Therefore, the evidence in no way contradicts the vertical Phillips curve conjecture.

Financial crisis episodes are dramatic events that involve the central nervous system of capitalist economies. Hence, there are strong a priori intuitive considerations that make one expect that those crises may be deeper and longer than most of the others. But it is much less obvious why the labor market should suffer a significantly more powerful blow. To address this issue, the paper presents a simple model in which the financial shock takes the form of a drop in loan collateral values, and firms are assumed to be subject to a binding collateral constraint. This is a standard assumption in the macroeconomic literature (see, for example, Brunnermeier, Eisenbach and Sannikov (2012)). The relatively new twist in the model is that it assumes that labor costs are harder to collateralize than

physical capital; the reason being that, as a general rule, a share of physical capital can be attached by the creditor in case of default, while hiring costs, for example, are more like "autumn leaves," hard to grab and put a price on. This slants credit in favor of capital-intensive projects and gives rise to an exacerbation of jobless or wageless recovery. Preliminary tests of this conjecture for advanced economies are encouraging.

The additional evidence about the role of loan collaterals give further support to the view that standard fiscal and monetary policies may be ineffective in speeding up full recovery, and that policies that address the weaknesses of the credit market should take center stage. Examples are debt restructuring and labor subsidies. Searching for policies of this kind that are both effective and politically viable should be at the top of the policy research agenda, especially under present circumstances.

References

Acemoglu, D. ,2001, "Credit Market Imperfections and Persistent Unemployment", *European Economic Review*, 45 (4-6), 665-679.

Agenor, P.R. and P. Montiel, 2008, *Development Macroeconomics*, 3rd edition, Princeton University Press.

Akerlof, G.A., W.T. Dickens and G.L. Perry, 1996, "The Macroeconomics of Low Inflation", *Brookings papers on Economic Activity*, 63, 4: 581-593.

Almeida, H. and M. Campello, 2007, Financial constraints, asset tangibility, and corporate investment, *Review of Financial Studies,* 20, 1429-1460.

Ball, L. ,2009, "Hysteresis in Unemployment: Old and New Evidence", NBER Working Paper Series, No. 14818, March.

Bassanini, A. and R. Duval, 2006, "Employment Patterns in OECD Countries: Reassessing the Role of Policies and Institutions", OECD Economics Department Working Paper No. 486, Paris.

Berger, D., 2011, "Countercyclical Restructuring and Jobless Recoveries", mimeograph, Yale University.

Bertola, G., Dabusinskas, A., Hoeberichts, M., Izquierdo, M., Kwapil, C., Montornès, J. and D. Radowski, 2009, "Price, Wage and Employment Response to Shocks: Evidence from the WDN Survey", *ECB Working Paper* No. 1164.

Bertola, G., F. Blau and L. Kahn, 2002, "Labour Market Institutions and Demographic Employment Patterns, NBER Working Paper No. 9043, July.

Bewley, T. F., 1999, Why Wages Do Not Fall During a Recession, Harvard University Press, Boston.

Blanchard, O. and L. Summer, 1986, "Hysterisis and and The Euroepan Unemployment Problem", NBER *Macro Annual*.

Blanchard, O., 2006, "European Unemployment: the Evolution of Facts and Ideas", *Economic policy* 21:45, pp. 5-59.

Blanchard, O., and J. Wolfers, 2000, "The Role of Shocks and Institutions in the Risk of European Unemployment: the Agregate Evidence", *Economic Journal*, No. 110.

Botero, J., S. Djankov, R. La Porta, F. Lopez-de-Silanes, and A. Shleifer, 2004, "The Regulation of Labor," *Quarterly Journal of Economics* 119: 1339-1382

Brunnermeier, M., T. Eisenbach and Y. Sannikov, 2012, "Macroeconomics with Financial Frictions: A Survey", forthcoming in *Advances in Economics and Econometric*s, Tenth World Congress of the Econometric Society, edited by D. Acemoglu, M. Arellano and E. Dekel, Cambridge University Press.

Calvo, G., A. Izquierdo and E. Talvi, 2006, "Phoenix Miracles in Emerging Markets: Recovering without

Credit from Systemic Financial Crisis," NBER Working Paper No. 1201, March.

Calvo, G., 2011, The Liquidity Approach to Bubbles, Crises, Jobless Recoveries, and Involuntary Unemployment", mimeograph, Columbia University.

Campos, N. and J. Nugent, 2012, "The Dynamics of the Regulation of Labor in Developing and Developed Countries since 1960", mimeograph, University of Southern California.

Demirguc-Kunt and E. Detragiache, 1998, "The Determinants of Banking Crises in Developing and Developed Countries," *IMF Staff Papers*, 45(1): 81-109.

Dromel, N., E. Kolakez and E. Lehmann, 2009, "Credit Constraints and Unemployment Persistence", IZA DP n. 4501.

Elsby, M., Hobijn, B., Sahin, A. and R. Valletta, 2011, " The Labor Market in the Great Recession: an Update", Federal Reserve Bank of San Francisco, WP. 2011-29.

Elsby, M., 2009, "Evaluating the Economic Significance of Downward Nominal Rigidity", *Journal of Monetary Economics*, 56 (2): 154-169.

Farber, Henry S., 2011, "Job Loss in the Great Recession: Historical Perspective from the Displaced Workers Survey, 1984-2010" NBER Working Paper 17040.

Furceri, D. and A. Mourougane, 2009, "The Effects of Financial Crises on Potential Output: New Empirical Evidence from OECD Countries", OECD Economic Department Working Papers, No. 669.

Gourinchas, P.O., R. Valdes and O. Landerretche, 2001, "Lending Booms: Latin America and the World," *Journal of LACEA Economia*, Latin American and Caribbean Economic Association.

Hart, O., and J. Moore, 1994, "A theory of Debt Based on the Inalienability of Human Capital," *Quarterly Journal of Economics*, 109 (4), 841-879.

Keynes, J.M., 1936, *The General Theory of Employment, Interest, and Money,* Harvest Brace Jovanovich, New York and London (reprinted in 1964 from the 1936 edition).

Kiyotaki, N. and J. Moore, 1997, "Credit Cycles", Journal of Political Economy, 1997, vol. 105, no. 2, 211-248.

Knotek, E.S. and S. Terry, 2009, "How Will Unemployment Fare Following the Recession?," Economic Review, Federal Reserve Bank of Kansas City.

Mendoza and Terrones, 2012, "An Anatomy of Credit Boom and Their Demise", NBER Working paper 18379.

Ohanian, Lee E., 2009, "What - or who - started the great depression?," *Journal of Economic Theory*, Elsevier, vol. 144(6), pages 2310-2335, November.

Rajan, R.G., 2010, *Fault Lines: How Hidden Fractures Still Threaten the World Economy*, Princeton University Press.

Reinhart, C. and V. Reinhart, 2010, "After the Fall", NBER Working Paper No. 16334.

Scarpetta, S., 1996, 'Assessing the Role of Labour Market Policies and Institutional Settings on Unemployment: A Cross Country Study', *OECD Economic Studies*, No. 26 1996/1, pp. 43-97.

Shimer, R., 2012 "Wage Rigidities and Jobless Recoveries", mimeograph, University of Chicago.

Schmitt-Grohé S. and M. Uribe, 2011, "Pegs and Pain", mimeograph, Columbia University.

Schularick M. and A. Taylor, 2009, "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises, 1870-2008", NBER Working Paper No. 15512.

Tirole, J. (2005). *The Theory of Corporate Finance*. Princeton University Press.

Uribe, M., 2011, *Open Economy Macroeconomics*, Columbia University, http://www.columbia.edu/~mu2166/GIM/lecture_notes.pdf

V. Appendices

V.1 List of Recession Episodes

Table A.1 lists the recession episodes included in the empirical analysis. The identification of recession episodes and classification of EMs episodes into "low inflation" and "high inflation" is detailed in Section I.1.1. The classification of episodes into "financial crises" and "other episodes" follows Reinhart and Rogoff (2009) and is detailed in Section I.1.2.

Table A1: Recession Episodes

		Financial Crises						Other Episodes					
Developed Economies		USA	1981					USA	1953	AUT	1992	ITA	1974
		AUS	1990					USA	1957	AUT	2001	ITA	1980
		CAN	1981					USA	1960	CAN	1990	ITA	1992
		FRA	1992					USA	1969	FRA	1974	ESP	1992
		ESP	1980					USA	1973	FRA	1980	SWE	1970
		SWE	1990					USA	1980	FRA	1982	SWE	1975
		GBR	1974					USA	1990	FRA	2002	SWE	1980
		GBR	1979					USA	2001	DEU	1974	CHE	1974
		GBR	1990					AUS	1974	DEU	1980	CHE	1981
								AUS	1981	DEU	1991	CHE	1990
								AUT	1974	DEU	2001	CHE	2001
								AUT	1980	ITA	1970	DEU	1966
Emerging Economies	Low Inflation	ARG	1994	MAR	1986	PHL	1997	BRA	2002	MAR	1994	MEX	2000
		COL	1997	MYS	1984	SLV	1980	CHL	1998	MAR	1980	PHL	1990
		DZA	1992	MYS	1997	THA	1996	CIV	1991	MAR	1991	TUN	1981
		KOR	1997	PAN	1986	TUN	1985	LBN	1998	MAR	1996		
		MAR	1982	PER	1997								
	High Inflation	ARG	1987	ECU	1998	URY	1981	TUR	1998	BRA	1987	MEX	1985
		ARG	1998	IDN	1997	URY	1998	DOM	1989	ECU	1986	URY	1994
		BGR	1995	LBN	1988	VEN	1988						
		BRA	1980	MEX	1994	VEN	2001						
		BRA	1991	RUS	1997	VEN	1995						
		CHL	1981	TUR	1993								
		DOM	2002	TUR	2000								

V.2 Robustness

In this section we investigate the robustness of the results contained in Section 2. In particular, we explore the robustness of the conclusions when (1) we consider employment rather than unemployment as the dependent variable; (2) we include additional controls and (3) we use different alternative instruments in the IV estimation.

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 for advanced economies are presented in Tables A.2 and A3 and confirm the findings that emerged from the analysis of unemployment rate as a measure of jobless recovery.

Due to data availability results for emerging economies are still work in progress.

Table A2: Advanced Economies - Financial Crises and Jobless Recoveries
Employment as Dependent Variable

Dependent variable:		Δ_{PR}l			
		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

Table A3: Advanced Economies -Credit Recovery and Jobless Recoveries
Employment as Dependent Variable

Dependent variable:		Δ_{PR}l			
		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

Additional Controls

This section studies the robustness of results to the inclusion of two additional controls: depth of the recession and country fixed affects.

First, we want to investigate whether results are influenced by the fact that financial crises are associated with larger output contractions. Jobless recoveries could result from deeper recession episodes if for example i) larger output contractions lead to higher increases in unemployment and ii) there is hysteresis in unemployment and the higher is the increase in unemployment, the longer it takes to be restored.

To control for the depth of the recession episode we include a variable measuring the contraction in GDP from output peak to trough. Results are presented in Tables A.4 and A.5, showing that conclusions on jobless and wageless recoveries for advanced and emerging economies do not change. [15]

Table A.4: Advanced Economies - Financial Crises, Jobless and Wageless Recoveries Controlling for the Depth of the Recession Episode

Dependent variable:		$\Delta_{PR}u$		$\Delta_{PR}w$	
		1	2	3	4
Estimation Method		OLS	IV	OLS	IV
Financial	fin_crisis	0.028 ***	0.048 ***	-0.018	-0.098
Market		0.007	0.017	0.047	0.103
Controls	$\Delta_{PT}y$	-0.06	0.04	-1.397 *	-1.681 *
		0.12	0.15	0.781	0.876
Sample Size		45	45		

[15] In these tables, due to the sample size we do not include labor market controls. Most of the results remain unchanged when we also include labor market controls. Results are also robust using the recovery of credit, the continuous measure of financial crisis ($\Delta_{PR}credit\_c$).

Table A.5a: Low Inflation EMs - Financial Crises, Jobless and Wageless Recoveries Controlling for the Depth of the Recession Episode

Dependent variable:		$\Delta_{PR}u$		$\Delta_{PR}w$	
		1	2	3	4
Estimation Method		OLS	IV	OLS	IV
Financial	fin_crisis	0.026 **	0.042 **	0.019	0.141
Market		0.010	0.017	0.088	0.158
Controls	$\Delta_{PT}y$	0.01	0.21	-0.073	0.287
		0.10	0.12	0.764	0.892
Sample Size		18	18	19	

Table A.5b: High Inflation EMs - Financial Crises, Jobless and Wageless Recoveries Controlling for the Depth of the Recession Episode

Dependent variable:		**$\Delta_{PR}u$**		**$\Delta_{PR}w$**	
		1	2	3	4
Estimation Method		OLS	IV	OLS	IV
Financial	fin_crisis	0.023	0.032	-0.246 *	-0.647 *
Market		0.016	0.036	0.135	0.361
Controls	$\Delta_{PT}y$	0.13	0.15	0.185	-0.893
		0.09	0.12	0.839	1.324
Sample Size		23	23	24	24

Notes:

***Significant at the 1% level

**Significant at the 5% level

*Significant at the 10% level

Second, we control for country fixed effects. This analysis can only be carried out for advanced economies. For EMs, the use of fixed effects is problematic as the number of countries in the sample is too large in relation to the overall sample, given by the number of recession episodes. Results are presented in Table A.6 and show that controlling for country fixed effects results do not change.

Table A.6: Advanced Economies - Financial Crises, Jobless and Wageless Recoveries
Country Fixed Effects

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	0.022 ***	0.023 ***	0.051 **	0.050 *	-0.007	-0.007	-0.103	-0.134
Market		0.006	0.006	0.024	0.026	0.053	0.052	0.156	0.168
Labor	natural_u	-0.037		-0.073		-1.324		-1.144	
Market		0.109		0.15		1.109		1.215	
	epl		0.001		-0.004		0.258		0.282
			0.02		0.02		0.162		0.187
	ub		0.0004		0.0001		-0.006 *		-0.005
			0.0003		0.0005		0.003		0.004
	colcov		0.00002		0.0001		-0.016		-0.017
			0.001		0.001		0.012		0.014
	union		0.0007 **		0.0009 *		-0.005		-0.005
			0.0004		0.0005		0.004		0.004
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

Robustness of the Instrument

In the IV strategy of Section 2, we use as instrument the cyclical component of real per capita credit at the output peak ($credit_P$), using as detrending method the HP filter.

This section shows that when we use a log quadratic trend to compute the cyclical component of credit results do not change. Results of the first stage regressions are presented in Tables A.7-A.8, while IV estimates of equations (1) and (2) are presented in Tables A.9 and A.9.

Table A.7: Advanced Economies -Credit Cycle at the Peak and Financial Crises (First Stage)
Log Quadratic Detrending for the Instrument

Dependent variable:		fin_crisis			Δ_{PR}credit		
		1	2	3	5	6	7
Estimation Method		OLS	OLS	OLS	OLS	OLS	OLS
Instument	$credit_P$	1.578 ***	1.545 ***	6.125 ***	-0.194 ***	-0.191 ***	-0.171 ***
					0.045	0.045	0.041
Labor	natural_u		1.77			-0.125	
Market			1.49			0.157	
	epl			0.005			0.007
				0.071			0.007
	ub			0.006			-0.0011
				0.007			0.001
	colcov			-0.003			0.0003
				0.004			0.000
	union			-0.0002			-0.0010
				0.0039			0.0003
Sample Size		45	45	45	45	45	45

Table A8a: Low Inflation Emerging Economies -Credit Cycle at the Peak and Financial Crises (First Stage)
Log Quadratic Detrending for the Instrument

Dependent variable:		fin_crisis			Δ_{PR}credit		
		1	2	3	5	6	7
Estimation Method		OLS	OLS	OLS	OLS	OLS	OLS
Intrument	$credit_P$	0.789 **	0.902 **	0.846 **	-0.741 ***	-0.773 ***	-0.752 ***
		0.321	0.321	0.341	0.061	0.056	0.065
Labor	natural_u		-0.02			0.007 *	
Market			0.02			0.004	
	lamrig			0.135			-0.028
				0.238			0.045
Sample Size		25	24	25	25	24	25

Table A8b: High Inflation Emerging Economies - Credit Cycle at the Peak and Financial Crises (First Stage)
Log Quadratic Detrending for the Instrument

Dependent variable:		fin_crisis			Δ_{PR}credit		
		1	2	3	5	6	7
Estimation Method		OLS	OLS	OLS	OLS	OLS	OLS
Intrument	$credit_P$	0.644 **	0.640 **	0.652 **	-0.406 **	-0.409 **	-0.425 **
		0.279	0.293	0.286	0.178	0.183	0.177
Labor	natural_u		0.01			-0.016	
Market			0.03			0.017	
	lamrig			-0.057			0.133
				0.185			0.115
Sample Size		25	24	25	25	24	25

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

Table A.9: Advanced Economies - Financial Crises, Jobless and Wageless Recoveries
Log Quadratic Detrending for the Instrument

Dependent variable:		Δ_{PR}u				Δ_{PR}w			
		1	2	3	4	5	6	7	8
Estimation Method		IV	IV	IV	IV	IV	IV	IV	IV
Financial	fin_crisis	0.046 ***	0.047 ***			-0.029	-0.006		
Market		0.014				0.086	0.078		
	Δ_{PR}credit			-0.37 ***	-0.407 ***			0.268	0.060
				0.13	0.145			0.788	0.830
Labor	natural_u	0.149 *		0.184 **		-0.117		-0.136	
Market		0.083		0.09		0.535		0.507	
	epl		0.008 **		0.009 **		-0.043 *		-0.043 *
			0.008		0.004		0.021		0.023
	ub		0.0003		0.0003		-0.002		-0.002
			0.0004		0.000		0.002		0.002
	colcov		-0.0003		-0.0004		0.002		0.002
			0.0002		0.000		0.001		0.001
	union		-0.00005		-0.0003		-0.002		-0.002
			0.0002		0.0003		0.001		0.002
Sample Size		45	45	45	45	36	36	36	36

Table A.10a: Low Inflation EMs - Financial Crises, Jobless and Wageless Recoveries
Log Quadratic Detrending for the Instrument

Dependent variable:		Δ_{PR}u				Δ_{PR}w			
		1	2	3	4	5	6	7	8
Estimation Method		IV	IV	IV	IV	IV	IV	IV	IV
Financial	fin_crisis	0.032 **	0.042 *			0.015	0.018		
Market		0.014	0.02			0.164	0.157		
	Δ_{PR}credit			-0.043 **	-0.05 **			-0.02	-0.030
				0.019	0.021			0.265	0.256
Labor	natural_u	0.002		0.001		0.003		0.003	
Market		0.001		0.001		0.013		0.013	
	lamrig		-0.004		6E-04		0.030		0.030
			0.013		0.011		0.094		0.094
Sample Size		18	18	18	18	19	19	19	19

Table A.10b: High Inflation EMs - Financial Crises, Jobless and Wageless Recoveries
Log Quadratic Detrending for the Instrument

Dependent variable:		Δ_{PR}u				Δ_{PR}w			
		1	2	3	4	5	6	7	8
Estimation Method		IV	IV	IV	IV	IV	IV	IV	IV
Financial	fin_crisis	-0.020	-0.017			-0.606 *	-0.602 *		
Market		0.039	0.038			0.334	0.335		
	Δ_{PR}credit			0.030	0.025			0.950 *	0.919 *
				0.061	0.056			0.521	0.499
Labor	natural_u	0.0023		0.0022		-0.001		0.008	
Market		0.0027		0.0028		0.020		0.021	
	lamrig		-0.01		-0.02		-0.008		-0.099
			0.02		0.017		0.143		0.146
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