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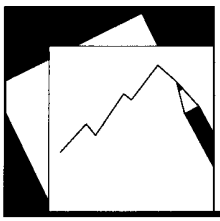

IMF Working Paper

Creditless Recoveries

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Creditless Recoveries[1]

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Abstract

Recoveries that occur in the absence of credit growth are often dubbed miracles and named after mythical creatures. Yet these are not rare animals, and are not always miracles. About one out of five recoveries is "creditless," and average growth during these episodes is about a third lower than during "normal" recoveries. Aggregate and sectoral data suggest that impaired financial intermediation is the culprit. Creditless recoveries are more common after banking crises and credit booms. Furthermore, sectors more dependent on external finance grow relatively less and more financially dependent activities (such as investment) are curtailed more during creditless recoveries.

JEL Classification Numbers: E32, E44, G21.

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I. INTRODUCTION

The importance of bank credit in facilitating economic activity is well-established. Bank credit finances investment, working capital, and important components of consumption. At the business-cycle frequency, disruptions in credit supply often result in sharp output contractions, as we are sorely reminded by the current crisis. And, from a longer-term structural perspective, financial development—often measured by the credit-to-GDP ratio—is an important determinant of long-term economic growth. It should not come as a surprise, then, that episodes in which output recovers without credit growth are dubbed miracles and named after mythical creatures.[2] But as we document below, these "creditless recoveries," while not the norm, are not rare animals, and fall short of the performance of recoveries with credit.

This paper aims at deepening our understanding of creditless recoveries. How common are they, and under what conditions do they tend to occur? How do they differ from "normal" recoveries? Do they reflect impaired financial intermediation? And finally, can and should policymakers respond to them? This paper focuses on the first three questions, but will also try to shed some light on the last.

A recovery can be creditless because credit is not available or because it is not needed. The first case implies some inefficiency. The second does not. At the micro level, tighter credit constraints may lead firms and households to delay, curtail, or cancel their more credit-dependent investment and expenditure decisions, or force them to tap alternative (and possibly more expensive) sources of funds such as retained earnings or bond and equity markets. At the aggregate level, the lack of credit may favor sectors that are less dependent on external finance, resulting in a suboptimal composition of output growth. In contrast, negative credit growth can be optimal when it results from low demand, churning, or a statistical artifact due to the lack of data on gross credit flows. Banks may be cutting credit to certain sectors (or firms) but extending it to others. In this case, as long as it is the most productive sectors that receive credit, output may expand even in the absence of growth in aggregate credit.

To study these issues we proceed in two steps. First, we use macro data to identify and examine creditless recoveries in a broad set of countries. This analysis focuses on correlations and studies the frequency, duration, shape, and composition of the recoveries. It investigates which types of downturns are more prone to be followed by creditless recoveries. And it asks whether creditless recoveries are associated with worse growth performance, and if so, which components of growth are most affected. Second, we turn to sectoral data to investigate the mechanism behind creditless recoveries. In particular, we use a difference-in-difference approach to identify causal links between credit growth and output performance. If disruptions of financial intermediation are at the roots of creditless recoveries, their effect should be felt disproportionately more by those sectors that rely more heavily on external finance.

[2] Calvo et al. (2006) and Huntley (2008).

We find that creditless recoveries—defined as episodes where real credit growth is negative in the first three years following a recession—are not rare. They follow about one in five recessions in a wide set of countries. And while they seem to be more common in developing countries and emerging markets, they also occur in advanced economies.

Creditless recoveries are only incomplete "miracles." True, there are a few exceptional cases (such as Argentina 2003 and Mexico 1996) of sharp recoveries without credit growth, generally in the aftermath of especially deep recessions. But on average, activity recovers by substantially less than in recoveries with credit: output growth is on average a third lower. Put differently, creditless recoveries tend to be weaker and more protracted (i.e., it takes longer for output to return to trend). This result remains when controlling for the characteristics of the preceding recession. And these averages mask wide variations—many creditless "recoveries" are followed by stagnant growth.

When we look at what pre-conditions tend to precede creditless recoveries, we find that the frequency of creditless recoveries doubles when the downturn was preceded by a credit boom, and more than doubles when the downturn was preceded by or coincided with a banking crisis. If the downturn was preceded by both a banking crisis *and* a credit boom, the subsequent recovery would almost certainly be creditless. Currency and sovereign debt crises have a smaller effect, and in the presence of a banking crisis they do not significantly increase the likelihood of a creditless recovery. These findings suggest that the relatively weak macroeconomic performance during creditless recoveries is the result of constrained growth due to impaired financial intermediation. This is consistent with Calvo et al. (2006) who argue that the lack of credit growth during these recoveries can be rationalized with financial frictions preventing firms from obtaining funding for new investment.

Output decompositions buttress this perspective. Investment—which is likely to depend more on credit than consumption—has a disproportionately smaller contribution to growth in creditless recoveries relative to other recoveries, although consumption takes a hit as well. Interestingly, creditless recoveries are not jobless recoveries—employment dynamics are no different on average from those in normal recoveries. Instead, it is productivity and capital deepening which are adversely affected.

In the second part of the paper, we use sectoral data to test more formally the hypothesis that the weaker macroeconomic performance during creditless recoveries stems from disruptions of financial intermediation. We use industry-level data covering 28 manufacturing industries in 48 countries, from 1964 to 2004, and follow Braun and Larrain (2005) (who focus on recessions rather than recoveries) who proxy an industry's performance with the growth rate of industrial production. This measure is then regressed on an array of controls, including multiple sets of fixed effects (to take care of industry-year, and industry-country specific omitted factors), and our variable of interest, the interaction of a measure of the industry's financial dependence and the creditless recovery dummy.

Braun and Larrain (2005) find that more financially dependent industries perform relatively worse during recessions. Consistent with their result, we find that these industries perform

relatively better than less financially dependent industries during typical recoveries (although, similar to their analysis of "booms", the result is generally weak and not always significant). During creditless recoveries, however, industries that are more dependent on external finance tend to grow disproportionately less than those that are more self-financed. This result appears economically meaningful. During creditless recoveries, the growth rate of industries that are highly dependent on external finance (at the 85th percentile of the index distribution) is over 1.5 percentage points lower than in "normal" recoveries. The same difference drops to 0.4 percentage points for low-dependence industries (those at the 15th percentile). This differential effect appears robust. It is present in both advanced economies and emerging markets. It survives when controlling for capital inflows. And it does not seem to depend on measurement issues that may stem from large fluctuations in credit aggregates due to exchange rate movements (in the presence of foreign denominated loans).

The finding that creditless recoveries are suboptimal outcomes associated with impaired financial intermediation is relevant from a policy standpoint. Had causality gone the other way—that is, had creditless recoveries resulted instead from an exogenous decline in the demand for credit, due for example to weak growth prospects—there would have been little room for policy action beyond countercyclical macro measures typically adopted in "normal" recoveries. Given the evidence, however, policies aimed at restoring credit supply should lead to fewer credit constraints and higher growth. The findings are also relevant for the recent global financial crisis. Given the widespread financial sector distress, the retrenchment in cross-border capital flows, and the occurrence of credit and property booms in several countries, the recovery from the crisis is likely to be creditless in a number of economies, and thus slower than average. To contain this effect, continued policy action is required to restore the supply of credit, cushion the effects of deleveraging, and address the undercapitalization of several financial institutions.

The rest of the paper is organized as follows: Section II provides a brief overview of related studies. Section III examines creditless recoveries from a macro perspective. Section IV presents the results of the sectoral analysis. Section V concludes.

II. Related Literature

Calvo, Izquierdo, and Talvi (2006) were the first to document the phenomenon of creditless recoveries. Their seminal paper focuses on what happens to output and credit after global or "systemic" sudden stop episodes and finds that, on average, output returns quickly to pre-crisis levels, but with weak investment (remaining below pre-crisis levels) and virtually no recovery in domestic or external credit (so-called "Phoenix miracles"). Huntley (2008) investigates these episodes further and finds that economic performance in the aftermath of a systemic sudden stop follows a bimodal distribution. Some economies have quick recoveries with credit; others do not recover at all and experience zero or negative credit growth. He argues that the averaging of growth and credit behavior across these two very different groups leads to the wrong perception: creditless recoveries. In a contemporaneous paper, Kannan (2009) focuses on recessions following financial crises in advanced economies. He finds that industries more heavily dependent on external finance tend to perform relatively worse during recoveries following banking crises.

Our work builds on these papers but asks different questions. By focusing on recoveries following all downturns, rather than just those that follow specific types of crises, and by classifying recoveries precisely based on the behavior of credit, we are able to shed new light on this debate. A practical advantage of our analysis is that by covering both advanced economies and emerging markets and including "normal" business cycles as well as full-fledged crises, we can work with a much larger set of observations.

Our paper is also related to and borrows some methodologies from a growing literature on the effects of financial development and banking crises on aggregate volatility and output (see for example, Kaminsky and Reinhart, 1999, Demirgüç-Kunt et al., 2006, and Raddatz, 2006). A few recent papers use sectoral data to establish a causal relationship between banking crises and the drop in output (Dell'Ariccia et. al, 2008, and Krozner et al., 2007). Their identifying assumption follows Rajan and Zingales (1998). If banking crises are detrimental to economic growth they should have a disproportionate impact on sectors that are more dependent on external credit. Braun and Larrain (2005) follows a similar methodology to ask whether sectors characterized by a greater degree of financial dependence experience a sharper output contraction than other industries during recessions, and finds a large positive differential effect. In this paper, we further test these views. If creditless recoveries are the result of financial frictions and impaired financial intermediation, sectors more dependent on external credit should perform worse than in regular recoveries. From Braun and Larrain (2005) we also borrow the methodology to identify recessions and recoveries.

From a theoretical perspective, creditless recoveries are somewhat puzzling. Indeed, there are theoretical arguments behind the correlation of economic and credit growth. Research on "financial accelerators," including Bernanke and Gertler (1989, 1990), Bernanke, Gertler, and Gilchrist (1999), Holmstrom and Tirole (1997) and Kiyotaki and Moore (1997), has focused on how financial intermediation can amplify and prolong the effects of real shocks. In these models, asymmetric information is central. The critical assumption is that moral hazard and agency costs are a decreasing function of firms' liquidity and collateralized assets. The models then predict that these variables are highly procyclical when endogenized in a general equilibrium framework. Hence, moral hazard and agency costs are more important in recessions than in booms. By contrast, Biggs et al. (2009) challenge the notion that there is anything surprising with Phoenix miracles. They show that in a model where credit is used to finance investment, depending on the value of certain parameters (primarily interest rates and the maturity of prevailing debt contracts), what matters for GDP growth may be the change in credit growth rather than credit growth itself. In light of this prediction, they argue that Phoenix miracles are not particularly surprising as they occur when credit growth stops dropping (although it remains in below zero). While their insights help explain the existence of Phoenix miracles (GDP growth without credit growth), they are also consistent with our findings that growth is lower during creditless recoveries.

III. PRELIMINARY ANALYSIS

In this section, we provide a framework to identify creditless recoveries. We examine how creditless recoveries differ from "normal" recoveries, and analyze and compare the duration,

shape, and frequency of these recoveries. We also examine whether creditless recoveries are peculiar to certain sets of countries or follow particular events such as banking crises, currency crises, debt crises, sudden stops, or credit booms. For now, we focus on associations and do not attempt to establish causal links between the variables, leaving that for the sectoral analysis in Section IV.

A. Identifying Recoveries

Before we can define creditless recoveries we first need to define what countries are recovering from. We identify economic downturns following the methodology in Braun and Larrain (2005). Recessions are identified based on fluctuations of real annual GDP.[3] Specifically, a Hodrick-Prescot filter is used to extract the trend in the logarithm of real GDP. The smoothing parameter is set at 6.25 as recommended for annual data by Ravn and Uhlig (2002). Recessions are identified whenever the cyclical component of GDP (detrended real output) exceeds one country-specific standard deviation below zero. The recession is then dated as starting the year following the previous peak in (detrended) real output, and continuing until the year of the trough (when the cyclical component is at its lowest point). We then define the "recovery period" as the first three years following the trough of a recession. This simplifies the distinction between creditless and normal recoveries and limits problems associated with "double dip" recessions. This methodology identifies 388 recoveries, roughly equally divided between advanced OECD countries, emerging markets, and low-income countries.[4]

We focus on bank credit to the private sector, as measured in line 22d of the *IFS*. This is a choice of necessity. The series is the only one available with broad cross-country and time-series coverage. One shortcoming is that it does not include credit extended by non-bank financial intermediaries. For most countries this is not a major issue. But for a couple of cases, such as the U.S., a critical portion of the financial sector is not covered by the data. A *creditless recovery* is then defined as one in which the growth rate of real bank credit (deflated by the GDP deflator) is zero or negative in the first three years of recovery.

B. How Common Are Creditless Recoveries?

Creditless recoveries are not rare. They represent about one-fifth of all recoveries. But there are more than slight differences in their distribution across country groups. In particular, creditless recoveries are more common in low income countries and emerging markets than in advance economies, where they represent only about 10 percent of all recoveries. Indeed, a Pearson chi-square test rejects at the 10 percent level the null hypothesis that the relative frequency of creditless recoveries is the same across country groups. This suggests that these

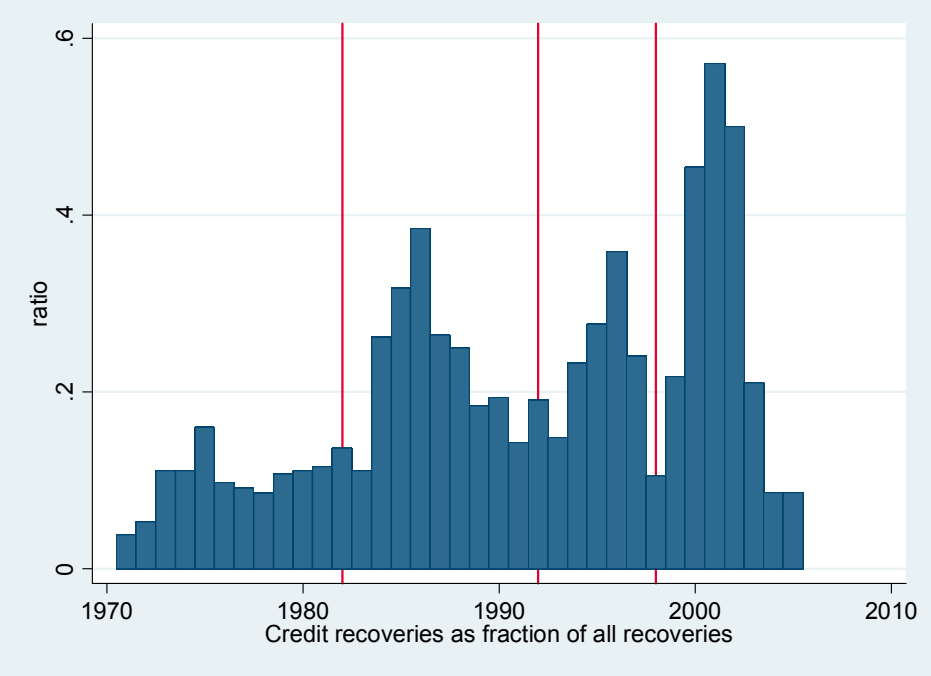
[3] We use real GDP data from WDI, extended using WEO data to 2008-09 where available. This data covers 172 countries, from 1960-2009 (unbalanced).

[4] The country groups are defined in the Data Appendix. Emerging markets are the 26 countries covered in the MSCI EM index, advanced OECD refers to the 23 OECD members not in the emerging markets group, and LIC refers to low-income countries according to the World Bank's income classification.

events tend to be more common in countries with less developed financial markets. Indeed, the cross-country correlation between financial development (measured by the average credit-to-GDP ratio over the sample period) and the frequency of creditless recoveries is about -0.2.

There is also substantial time-series variation in the relative frequency of creditless recoveries. In particular, creditless recoveries tend to be clustered geographically and around three peak periods (Figure 1). These clusters follow the Latin American debt crisis of the early 1980s, the ERM crisis and Scandinavian banking crises of the early 1990s, and the Asian crisis of the late 1990s.

Figure 1. Creditless Recoveries over Time



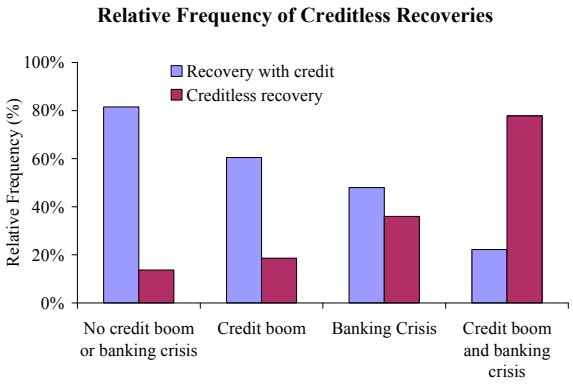
The question then arises: to what extent are creditless recoveries associated with the nature of the preceding recession? In particular, we are interested in the predictive power of specific events such as credit booms, banking and currency crises, and real-estate booms and busts. If creditless recoveries are the result of an impaired financial intermediation, they should be more likely in the aftermath of events associated with disruptions in the credit supply.

We first focus on downturns associated with a systemic banking crisis, as defined by Laeven and Valencia (2008). If a systemic banking crisis occurred in the two years prior to or the year coinciding with a downturn, the frequency of creditless recoveries is three times as high as when there is no banking crisis (Table 1). Nevertheless, only about half of banking crises are followed by a creditless recovery.

Both currency and sovereign debt crises seem to have some influence independent of the effect of banking crises (Tables 2). In the absence of a banking crisis, a currency crisis preceding a recession doubles the frequency of creditless recoveries, and a sovereign debt

Which Countries are Likely to Experience Creditless Recoveries?

How is credit likely to evolve as countries recover from the present downturn? What factors are associated with creditless recoveries? The descriptive statistics presented in the text suggest that creditless recoveries are more likely when the downturn was preceded by a credit boom or a banking crisis.



The severity of the downturn also plays an important role in the evolution of credit during the recovery. Financial accelerator mechanisms suggest that the more severe the downturn, the greater the likelihood that subsequent credit growth will be weak. This can be seen in the probit regressions below, run on a sample of 357 downturns in advanced, emerging, and developing economies. The dependent variable is a dummy variable indicating whether the recovery from the downturn was creditless. The regressors include two dummies indicating whether the downturn was preceded by a banking crisis and/or a credit boom, and a measure of the severity of the downturn, the peak-to-trough percent change in real GDP. All three variables are correctly signed and statistically significant.

Creditless Recoveries: Probit Regressions

Dependent variable: creditless recovery dummy					
Banking crisis	1.112***			1.035***	0.931***
	[4.557]			[4.219]	[3.795]
Credit boom		0.602***		0.458**	0.440*
		[2.815]		[2.100]	[1.682]
Peak-to-trough %ΔGDP			-0.0481***		-0.0453***
			[-4.204]		[-3.988]
Constant	-1.029***	-0.990***	-1.023***	-1.084***	-1.187***
	[-12.33]	[-11.82]	[-12.03]	[-12.14]	[-12.66]
Pseudo-R^2	0.06	0.02	0.12	0.07	0.17
Observations	366	366	366	366	366

Robust z-statistics in brackets
*** p<0.01, ** p<0.05, * p<0.1

The probit regression can be used to predict which countries are likely to have creditless recoveries as they emerge from the current downturn. Seven countries covered in our sample had systemic banking crises prior to the downturn and 19 had credit booms prior to the downturn. Based on this about a fifth of our sample has probability greater than 40 percent to have a creditless recovery after the recent crisis.

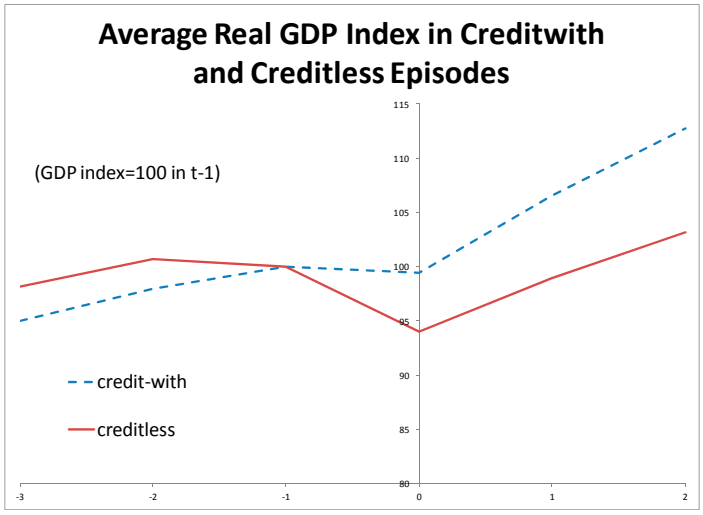
crisis more than doubles it. But conditional on a banking crisis, the occurrence of either a currency crisis or a sovereign debt crisis does not seem to be associated with a significantly higher frequency of creditless recoveries.

Finally, we look at downturns preceded by a credit boom, using the methodology developed in Mendoza and Terrones (2008). The occurrence of a credit boom prior to the downturn doubles the relative frequency of creditless recoveries (Table 2). But the effects of a credit boom are weak when there is no banking crisis; instead, it is when downturns are preceded by both a credit boom *and* a banking crisis that creditless recoveries become most likely.

If creditless recoveries tend to follow a credit boom-bust cycle, do they also tend to follow boom-bust cycles in the property market? In the absence of reliable cross-country housing price data, we rely on construction investment data as a proxy, and we do find that creditless recoveries are associated with construction boom-bust cycles. In particular, we find that, on average, creditless recoveries are preceded by a collapse in construction investment (with an average decline of about 17 percent). In contrast, construction investment growth is essentially zero before recoveries with credit. To the extent that a collapse in construction investment signals a housing bust, we interpret this result as evidence that creditless recoveries are associated with the destruction of collateral value (and the consequent increase in agency problems) stemming from sharp declines in real estate prices.

C. How are Creditless Recoveries Different?

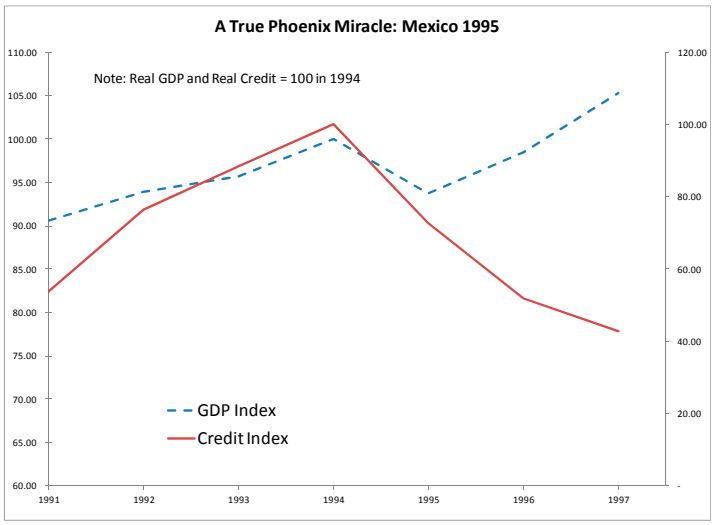
Creditless recoveries are less desirable than "normal" ones from a growth performance standpoint. For our broader sample of recessions, average output growth in creditless recoveries is 4.5 percent per year, compared to about 6.3 percent in recoveries with credit (Table 3). As a consequence, output is also slower to return to trend. Output returns to trend within three years from the end of the recession in less than half of creditless recoveries, compared to over two thirds of recoveries with credit. In part, this reflects the fact that creditless recoveries tend to be preceded by deeper recession. But it is also the result of the differential in growth rates. This is consistent with financial accelerator models. Greater destruction of collateral value associated with a deeper recession will translate in a more sluggish credit growth in the recovery.



Calvo et al. (2006) document the characteristics of recoveries after systemic sudden stop (3S) episodes. They find that after these episodes economies on average experience a quick, but creditless, recovery and dubbed the phenomenon a "Phoenix miracle". We find that over half

of 3S episodes in our sample are indeed creditless (Table 2), and average growth during 3S creditless recoveries is indeed quite high—3.9 percent, compared to 4.3 percent during 3S recoveries with credit—which is consistent with Calvo et al.'s (2006) findings.

A closer inspection, however, reveals a bimodal distribution, similar to what Huntley (2008) describes. But going beyond Huntley, we identify the cause of the bimodality: what matters is whether the 3S episode is associated with a banking crisis or not. For 3S episodes that did not result in a banking crisis, the recovery has always been one with positive real credit growth, and output returns to trend within three years in most (5 out of 6) cases. In contrast, during 3S episodes associated with a banking crisis, 80 percent of the recoveries are creditless, and in two-thirds of these episodes output does not return to trend within three years.



That said, we do find a few "true miracles"; exceptional cases in which output recovers sharply in the absence of credit growth. In our sample, Chile and Uruguay in 1984-86, Mexico 1995-98, Argentina 2003-05, fit this description. These events follow exceptionally deep recessions. Mexico, the possible exception, experienced a drop in output in excess of 6 percent in 1996, and the other three countries all witness double-digit falls during their recessions. It is, then, possible that these "miracles" are in part due to a rebound effect.

D. Slicing the Miracles

To shed some light on the difference in macroeconomic performance between creditless and "normal" recoveries, we decompose aggregate growth in its demand components. During creditless recoveries, the contributions of consumption and investment to output growth are roughly one percentage point lower than during normal recoveries, fully accounting for the two percentage point difference in output growth between creditless and with-credit recoveries (Table 4). In relative terms, however, the contribution of investment falls by roughly half against a fall by a third in that of consumption. This suggests that the components of aggregate demand more dependent on credit contribute the most to the difference in growth rates relative to with-credit recoveries. Net exports do not, on average, contribute to output growth during recoveries, regardless of credit dynamics. To be clear, the external sector does contribute positively to growth during the recession as the current account improves (often swinging from negative to positive). But during the recovery, both exports and imports increase, resulting on average in a roughly null contribution to growth.

Growth accounting points in the same direction (Table 4). Lower growth during creditless recoveries can be ascribed to lower capital accumulation and lower TFP growth. These results are consistent with what Calvo et al. (2006) find for 3S episodes. Lower capital accumulation is consistent with the results for demand decomposition. Lower TFP growth may indicate that younger and start-up firms, which typically have higher productivity growth, find it more difficult than others to obtain credit during these episodes. It is also consistent with the notion that an impaired financial system is less efficient in reallocating capital across sectors as needed to absorb asymmetric shocks.

In contrast, employment growth (or alternatively, the decline in the unemployment rate) seems independent from the evolution of credit during the recovery. We interpret these results as suggesting that it is, again, the more credit dependent components that suffer during creditless recoveries. As pointed out by Calvo et al. (2006), these results are consistent with a situation where, because of financial frictions, firms can obtain short-term credit for working capital but cannot obtain long-term financing for physical capital.

IV. Evidence from Sectoral Data

In this section, we test empirically the hypothesis that creditless recoveries (and the associated lower output performance) are the result of impaired financial intermediation. Our identification strategy relies on the notion that, in the presence of market imperfections, different sources of funds (bank credit, the issuance of tradable bonds, and equity) are not perfect substitutes. Then, if creditless recoveries stem from disruptions in the supply of bank credit, firms and industries that are more reliant on credit should perform relatively worse. By contrast, if the creditless nature of the recovery were demand driven, sector's performances should not differ in a systematic way.

A. Methodology

We follow the difference-in-difference approach employed by several studies focusing on the real effects of banking crises and financial development. We use industry-level data from manufacturing sectors in both advanced economies and emerging countries during 1970—2004 (the data are described in more detail in the appendix). Industries are ranked according to the Rajan and Zingales index of external financial dependence, defined as capital expenditures minus cash flow from operations divided by capital expenditures. The differential performance of growth in real value-added and industrial production during recoveries across these industries within a particular country is the main channel through which the real impact of credit is identified.

We adopt the same working assumption as in Rajan and Zingales (1998), later employed among others by Braun and Larrain (2005), Krozner et al. (2007), and Dell'Ariccia et al. (2008): External dependence is determined by technological factors, such as production time, capital intensity, and the importance of R&D investment. And while the absolute value of the index may vary across countries and time, for the methodology to work it is sufficient that

the industry ranking remains broadly the same. Rajan and Zingales (1998) support this assumption with data from Canada.

To provide a benchmark we start by looking at the relative performance of credit-dependent sectors during all recoveries (irrespective of credit conditions). Braun and Larrain (2005) find that more credit-dependent sectors suffer disproportionately during recessions (when agency problems become more severe). Hence, one would expect them to perform relatively better during recoveries, as agency problems diminish.

In this benchmark specification, the dependent variable is the growth rate of industrial production in industry *i* at time *t* in country *c*. Regressors include two sets of fixed effects (industry-year and industry-country) and the variable of interest, an interaction term equal to the product of the financial dependence measure for industry *i* and the recovery dummy for year *t* and country *c*. Following Rajan and Zingales (1998), we also include the lagged share of industry *i* in country *c* to account for "convergence" effects, i.e., the tendency of larger industries to experience slower growth.

First, we replicate the specification in Braun and Larrain (2005):

$$\begin{aligned} Growth_{i,c,t} &= \alpha_1 Share_{i,c,t-1} + a_2 Recession_{c,t} \\ &+ a_3 (Recession_{c,t} \times Dependence_i) \\ &+ \sum_{i,c} \beta_{i,c} \times d_{i,c} + \sum_{i,t} \beta_{i,t} \times d_{i,t} + \varepsilon_{i,c,t} \end{aligned} \tag{1}$$

where the *d*'s denote dummy variables. The variable $d_{i,t}$ denotes the industry-year dummy, and $d_{i,c}$ is the industry-country dummy. $Share_{i,c,t-1}$ is the size of the industry in the country at the time t-1. $\text{Recession}_{c,t}$ is a dummy which equals one when the country has a recession at time t. $Dependence_i$ is the industry-level financial dependence, which follows the Rajan and Zingales (1998) methodology, and is assumed to be constant across years. A negative α_3 would confirm the finding of Braun and Larrain (2005) that during recessions industries that depend more heavily on external finance perform relatively worse.

Then, we run a symmetric specification to extend the analysis to recoveries:

$$\begin{aligned} Growth_{i,c,t} &= \alpha_1 Share_{i,c,t-1} + \alpha_2 Recovery_{c,t} \\ &+ \alpha_3 (Recovery_{c,t} \times Dependence_i) \\ &+ \sum_{i,c} \beta_{i,c} \times d_{i,c} + \sum_{i,t} \beta_{i,t} \times d_{i,t} + \varepsilon_{i,c,t} \end{aligned} \tag{2}$$

where $Recovery_{c,t}$ is a dummy taking value 1 in the three years following the trough of a recession. The coefficient α_2 should be positive as it captures the across-the-board level effect of the recovery on industry growth. We also expect a positive α_3, indicating that during recoveries industries that depend more heavily on external finance perform relatively better than less dependent industries.

In our baseline specification, we add a creditless-recovery dummy and its interaction with the financial-dependence variable:

$$Growth_{i,c,t} = a_1 Share_{i,c,t-1} + a_2 Recovery_{c,t} + a_3 CreditlessRecovery_{c,t} + a_4 (Recovery_{c,t} \times Dependence_i) + a_5 (CreditlessRecovery_{c,t} \times Dependence_i) + \sum_{i,c} \beta_{i,c} \times d_{i,c} + \sum_{i,t} \beta_{i,t} \times d_{i,t} + \varepsilon_{i,c,t} \quad (3)$$

where $CreditlessRecovery_{c,t}$ is a dummy equal to one when real credit growth is negative during a recovery. We expect the sum of α_2 and α_3, reflecting the level effect of creditless recoveries, to be positive. But based on the results from the macro section, we expect α_3 to be negative; the macroeconomic performance during creditless recoveries is weaker than during standard ones. Furthermore, the coefficient α_5 allows us to have a comparison between the sectoral growth and the type of the recovery. In particular, a negative α_5 would indicate that sectors more reliant on external finance perform relatively worse during creditless recoveries. This would in turn lend support to our claim that creditless recoveries are the result of disruptions in the credit supply.

We perform several robustness tests. First, to allow for heterogeneous coefficients across countries with different levels of financial development, we run separate specifications for advanced economies and emerging markets. A second concern is about the measurement of credit growth in the presence of foreign denominated loans and large exchange rate movements. When a country with a sizeable amount of foreign loans experiences a large depreciation, its stock of outstanding credit (measured in domestic currency) will rise, even though no new credit has been extended. The lack of reliable and extensive information about the stock of foreign denominated credit implies that we may be classifying as "recoveries with credit" episodes that are actually creditless recoveries. This would bias the coefficient against our hypothesis, since it would reduce the difference between creditless and normal recoveries. Yet, for robustness, we run our baseline specification on a subsample excluding episodes with depreciations in excess of 20 percent. A third concern is for the role of capital inflows. What appears as a creditless recovery could actually be financed by foreign credit. Again, this would bias the results against our assumption (this time with-credit recoveries would be mistakenly classified as creditless). But, for completeness, we run an augmented specification where we control for the effect of net capital inflows (measured as net capital flows over GDP) both directly and interacted with financial dependence.

Finally, there may be several country-time specific factors other than recessions and recoveries influencing industry growth. To control for these potentially omitted factors, we run a specification with three cross-dummies:

$$Growth_{i,c,t} = a_1 Share_{i,c,t-1} + a_2(Recovery_{c,t} \times Dependence_i) + a_3(CreditlessRecovery_{c,t} \times Dependence_i) + \sum_{i,c} b_{i,c} \times d_{i,c} + \sum_{i,t} b_{i,t} \times d_{i,t} + \sum_{c,t} b_{c,t} \times d_{c,t} + e_{i,c,t} \quad (4)$$

The three sets of fixed effects control for any variable that does not vary along all three dimension (countries, industrial sectors, and time) of our panel. This should take into account most shocks affecting firm performance, including—for instance—the severity of the recessions, the level of financial development, global shocks to the industry, and aggregate country-specific shocks. As robustness tests, we also use value added growth, gross capital formation, employment, and number of establishments as alternative dependent variables.

B. Regression Results

The evidence from sectoral data suggests that creditless recoveries are indeed the result of impaired financial intermediation. During these episodes, sectors more dependent on external finance perform relatively worse. These results are statistically and economically significant and survive several robustness tests. All estimates in this section are obtained from winsorized data (for robustness we also dropped outliers altogether and obtained similar results). In all regressions, standard errors are clustered by industry and country.

Table 5 (Column 1) replicates the Braun and Larrain (2005) result that more credit-dependent sectors perform relatively worse during recessions. Recessions are bad for all sectors (the level coefficient comes in negative and very significant). But they are disproportionately worse for industries that are more reliant on external finance. More precisely, during recessions the growth rate in value added of theoretical industry at the 85th percentile of the external dependence distribution is 0.5 percentage points lower than that of an industry at the 15th percentile of the same distribution. The magnitude of this effect is economically meaningful and comparable to what found by Braun and Larrain (2005).

Table 5 (Colum 2) also shows that the sectors that suffer more during recessions tend to benefit more from recoveries, consistent with the notion that the severity of agency problems is countercyclical. These results are robust to changes in the recovery period. The magnitude of the differential effect in recessions is twice as large as that in recoveries. As pointed out in Braun and Larrain (who compare recessions and booms, where the latter are defined as periods leading up to a peak that is more than one country-specific standard deviation away from trend), this asymmetry is consistent with theory. The drag from credit constraints for financially dependent industries during recessions does not find a full counterpart in a boost during recoveries. That said, the different size of the coefficient may also be due to heterogeneous behavior during creditless and with-credit recoveries. Put differently, from the perspective of a financial dependent firm, the availability of funding during a creditless recovery may feel very much like that in a recession.

To investigate this issue, we turn to our baseline regression and looking more directly at the effect of credit growth. In Table 6, we allow the coefficients for creditless recoveries and recoveries with credit to differ. The level coefficient for creditless recoveries is negative as

expected, but is not significant, suggesting that the gap in performance between creditless and with-credit recoveries identified in the macro analysis depends in large part on sectoral effects. Indeed, the coefficient of the interaction term of creditless recoveries and credit dependence is consistently negative across all specifications. This indicates that industries more dependent on external finance perform relatively worse when the recovery is not accompanied by credit growth. The result loses some significance but remains stable when we split the sample in advanced countries and emerging markets. The difference in performance is economically meaningful. During creditless recoveries, the growth rate of industries that are highly dependent on external finance (at the 85th percentile of the index distribution) is over 1.5 percentage points lower than in "normal" recoveries. The same difference drops to 0.4 percentage points for low dependence industries (those at the 15th percentile). This across-industry difference in performance is even more pronounced in emerging markets (the cross-sector differential is 1.5 percentage points versus 1.2 percentage points for advanced economies), likely reflecting the scarcity of alternative sources of funding and/or more pervasive agency problems.

Table 7 reports the results of several robustness tests. First, we exclude all episodes with exchange rate depreciations in excess of 20 percent. The concern here is that sharp exchange rate falls may lead us to misclassify creditless recoveries as with-credit recoveries, through their effect on the stock of foreign credit measured in domestic currency. Our main coefficient of interest maintains sign and significance. Further, consistent with our concern of depreciation blurring the line between creditless and with-credit recoveries, it is larger than in our baseline specification. Second, we control for the effect of capital inflows. Again, the coefficient of interest maintains sign and significance, and remains broadly stable in size. The coefficient of the capital-flows-to-GDP variable is positive and significant as expected. In addition, capital flows seem to favor sectors that are more heavily dependent on external finance.

Finally, to control for omitted country-time specific variables, we include a third set of fixed effects in the regression. As discussed above, these will take care of any omitted variable that does not vary simultaneously across all three dimensions of our data. Table 8 reports the results of this exercise for the entire sample, OECD countries, and emerging markets, which corresponds to regression (4). All coefficients maintain the same sign and significance as in the previous regressions. In addition, the coefficient of our main variable of interest remains of roughly the same magnitude as in the baseline regressions. The differential effect between sectors at the 85th percentile and the 15th percentile of the distribution of the external dependence index continue to range between about 1 percentage points and 1.5 percentage points.

V. CONCLUSIONS

This paper sheds new light on the puzzling phenomenon of creditless recoveries: economic growth without credit growth. Its main findings are the following: (1) Creditless recoveries, while not the norm, are far from rare. They follow about one in five recessions. (2) They are somewhat less desirable than "normal" recoveries. Output growth is on average a third lower. (3) They are preceded by events likely to disrupt the supply of credit, such as banking crises, credit booms, and real-estate boom-bust cycles. (4) Investment has a disproportionately

lower contribution to growth than in "normal" recoveries and productivity and capital deepening are adversely affected. (5) Industries more reliant on external finance seem to grow disproportionately less during creditless recoveries.

Overall, the evidence supports the hypothesis that creditless recoveries are the result of impaired financial intermediation: their lower growth performance likely the outcome of a constrained allocation of resources. The results are consistent with agents delaying or downsizing their more credit dependent investment and expenditure decisions and firms more dependent on external finance being forced to curtail their activities.

This finding is relevant from a policy standpoint. During creditless recoveries, policy measures aimed at restoring financial intermediation are likely to lead to higher growth. Of course, the obstacles to efficient financial intermediation will vary from case to case and policies should be adapted accordingly. For instance, the lack of credit growth may be caused by stress on banks' balance sheets (as typically happens in the wake of a banking crisis) that could be addressed by recapitalizing banks (possibly with public intervention). Alternatively, the lack of credit growth could result from an over-indebted private non-financial sector. Even in the presence of relatively healthy banks, debt overhang would exacerbate agency problems and prevent an efficient allocation of capital. In this case, the response would be much more complex and would have to entail policies to facilitate deleveraging or possibly debt restructuring. Finally, given the association of creditless recoveries with banking crises, credit booms, and real-estate boom-bust cycles and their lower growth performance, supportive measures (including a more expansionary macroeconomic stance) could be taken in anticipation of a less buoyant recovery phase when the recession is associated with these events.

Table 1: Banking Crises and Relative Frequency of Creditless Recoveries (in percent)

	Banking Crisis?	
Creditless Recovery?	No	Yes
No	84.6	46.7
Yes	15.4	53.3

Pearson chi-sq. (1):	26.30
P-value:	0.00

Table 2: Crises and the Relative Frequency of Creditless Recoveries (in percent)

			In the absence of a banking crisis:		Concurrent with a banking crisis:	
Creditless Recovery?	Currency Crisis?		Currency Crisis?		Currency Crisis?	
	No	Yes	No	Yes	No	Yes
No	85.4	62.3	86.3	73.2	60.0	40.0
Yes	14.6	37.7	13.8	26.8	40.0	60.0
Pearson chi-sq. (1):	17.92		4.73		1.07	
P-value:	0.00		0.03		0.30	

			In the absence of a banking crisis:		Concurrent with a banking crisis:	
Creditless Recovery?	Debt Crisis?		Debt Crisis?		Debt Crisis?	
	No	Yes	No	Yes	No	Yes
No	82.8	57.9	85.8	61.5	45.8	50.0
Yes	17.2	42.1	14.4	38.5	54.2	50.0
Pearson chi-sq. (1):	7.40		5.55		0.03	
P-value:	0.01		0.02		0.86	

			In the absence of a banking crisis:		Concurrent with a banking crisis:	
Creditless Recovery?	Credit Boom-Bust?		Credit Boom-Bust?		Credit Boom-Bust?	
	No	Yes	No	Yes	No	Yes
No	83.7	65.1	85.6	76.5	57.1	22.2
Yes	16.3	34.9	14.4	23.5	42.9	77.8
Pearson chi-sq. (1):	8.68		1.94		3.09	
P-value:	0.00		0.16		0.08	

			In the absence of a banking crisis:		Concurrent with a banking crisis:	
Creditless Recovery?	Sudden Stop?		Sudden Stop?		Sudden Stop?	
	No	Yes	No	Yes	No	Yes
No	83.19	47.1	84.4	100.0	63.2	18.2
Yes	16.81	52.9	15.6	0.0	36.8	81.8
Pearson chi-sq. (1):	14.02		1.11		5.66	
P-value:	0.00		0.29		0.02	

Table 3: Creditless Recoveries and Growth Performance

Average Annual Output Growth, First Three Years of Recovery

Creditless Recoveries	Observations	Mean	Std. Dev.
No	295	6.3	3.8
Yes	67	4.5	3.4

When preceded by 3S recession:

Creditless Recoveries	Observations	Mean	Std. Dev.
No	8	4.3	2.2
Yes	9	3.9	1.8

Output recovers to trend within three years?	Creditless Recovery? No	Yes
No	34.24	55.2
Yes	65.76	44.8
Pearson chi-sq. (1):	10.19	
P-value:	0.00	

Table 4: Demand and Factor Input Contributions During Creditless Recoveries

	Output growth	Contributions of:		
		Consumption	Investment	Net Exports
Recoveries with credit	5.7	3.7	2.1	0.0
Creditless recoveries	3.8	2.6	1.2	0.0

Based on 223 episodes where all demand components and credit data are available.

Output is the sum of demand components, which can differ from real GDP.

	Output growth	Contributions of:		
		Employment	Capital	TFP
Recoveries with credit	5.1	1.5	1.4	2.3
Creditless recoveries	3.2	1.4	0.6	1.2

Based on 175 episodes where all factor inputs and credit data are available. Growth rates calculated using log-differences to ensure adding up.

Assumes Cobb-Douglas production and labor share of 0.65

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Table 5: Differential Effects of the Cycle on Sectoral Growth

VARIABLES	(1) Recessions Full sample	(2) Recoveries Full sample
size (lagged)	0.0019	-0.0052
	[0.055]	[-0.153]
recession	-0.0394***	
	[-22.807]	
recession x dependence	-0.0088**	
	[-2.031]	
recovery		0.0267***
		[18.066]
recovery x dependence		0.0061*
		[1.647]
Observations	35,796	35,796
R-squared	0.22	0.21
Change in growth rate for high dependence industry	-4.5%	3.0%
Change in growth rate for low dependence industry	-3.9%	2.7%
Implied differential effect	-0.5%	0.4%

Heteroskedasticity and time-correlated robust t-statastics are presented below the coefficients. Significance (p-value): *** p<0.01, ** p<0.05, * p<0.1.
This table presents the results from Regressions (1) and (2) in the text.

The dependent variable is the yearly growth rate in the production index of each ISIC-3 industry in each country computed from the UNIDO Indstat-3 (2006) data set. Lagged size is the share of a country's total manufacturing value added that corresponds to the industry in the previous year. Recession is a dummy variable that takes a value of 1 when the year and country observation has been identified as recession as explained in the text, and is 0 otherwise. External finance dependence is the average figure for each industry in the Rajan and Zingales (1998) index. The set of dummies includes industry-year and country-industry fixed effects (coefficients not reported).

Table 6: The Effect of Creditless Recoveries on Sectoral Growth

VARIABLES	OECD+EM	OECD	EM
size (lagged)	-0.0064	0.0703*	-0.0654
	[-0.187]	[1.873]	[-1.249]
recovery	0.0273***	0.0230***	0.0328***
	[17.645]	[14.366]	[11.473]
creditless recovery	-0.004	-0.0048	-0.004
	[-1.147]	[-1.291]	[-0.639]
recovery x dependence	0.0091**	0.0049	0.0147**
	[2.380]	[1.193]	[2.105]
creditless recovery x dependence	-0.0190**	-0.0200**	-0.0265*
	[-2.169]	[-2.033]	[-1.730]
Observations	35,796	20,006	15,790
R-squared	0.207	0.347	0.186
Creditless Recovery			
Change in growth rate for high depedence industry	-1.5%	-1.6%	-2.0%
Change in growth rate for low depedence industry	-0.4%	-0.4%	-0.4%
Implied differential effect	-1.1%	-1.2%	-1.5%

Robust t-statistics in brackets
*** p<0.01, ** p<0.05, * p<0.1

This table presents the results from Regression (3) in the text.

The dependent variable is the yearly growth rate in the production index of each ISIC-3 industry in each country computed from the UNIDO Indstat-3 (2006) data set. Lagged size is the share of a country's total manufacturing value added that corresponds to the industry in the previous year. Recovery is a dummy variable that takes a value of 1 when the year and country observation has been identified as recovery as explained in the text, and is 0 otherwise. Creditless recovery is a dummy variable that takes a value of 1 when the year and country observation has been identified as creditless recovery as explained in the text, and is 0 otherwise. External finance dependence is the average figure for each industry in the Rajan and Zingales (1998) index. The set of dummies includes industry-year and country-industry (two sets of cross dummies) fixed effects (coefficients not reported).

Table 7: Robustness Tests--The Effect of Exchange Rate Fluctuations and Capital Flows

	Two sets of cross dummies		
	Subsample: Less than 20% Depreciation	Full Sample: Controlling Net Private Capital Flow	
size (lagged)	0.0134	-0.0407	-0.0368
	[0.389]	[-0.904]	[-0.820]
recovery	0.0241***	0.0266***	0.0267***
	[14.810]	[14.197]	[14.206]
creditless recovery	0	0.0028	0.0021
	[0.002]	[0.734]	[0.546]
recovery x dependence	0.0065	0.0098**	0.0098**
	[1.634]	[2.164]	[2.163]
creditless recovery x dependence	-0.0272***	-0.0201**	-0.0174*
	[-2.681]	[-2.097]	[-1.818]
net private capital flows		0.0015***	0.0012***
		[7.843]	[5.083]
capital flows*dependence			0.0011*
			[1.925]
two sets of cross dummies	x	x	x
Observations	30,077	25,894	25,894
R-squared	0.246	0.23	0.23
Creditless Recovery			
Change in growth rate for high depedence industry	-1.6%	-0.9%	-0.8%
Change in growth rate for low depedence industry	0.0%	0.3%	0.2%
Implied differential effect	-1.6%	-1.2%	-1.0%

Robust t-statistics in brackets
*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the yearly growth rate in the production index of each ISIC-3 industry in each country computed from the UNIDO Indstat-3 (2006) data set. Lagged size is the share of a country's total manufacturing value added that corresponds to the industry in the previous year. Recovery is a dummy variable that takes a value of 1 when the year and country observation has been identified as recovery as explained in the text, and is 0 otherwise. Creditless recovery is a dummy variable that takes a value of 1 when the year and country observation has been identified as creditless recovery as explained in the text, and is 0 otherwise. External finance dependence is the average figure for each industry in the Rajan and Zingales (1998) index. The two sets of dummies includes industry-year and country-industry (coefficients not reported).

Table 8: Robustness Tests--Three sets of cross dummies

	Full Sample	OECD	EM
size (lagged)	-0.0138	0.0463	-0.0576
	[-0.467]	[1.333]	[-1.157]
recovery x dependence	0.0096***	0.0053	0.0141**
	[2.908]	[1.538]	[2.262]
creditless recovery x dependence	-0.0189***	-0.0200**	-0.0274**
	[-2.628]	[-2.475]	[-2.085]
Other controls			
Three sets of cross dummies	x	x	x
Observations	35,796	20,006	15,790
R-squared	0.392	0.46	0.39
Creditless Recovery			
Change in growth rate for high depedence industry	-1.1%	-1.2%	-1.6%
Change in growth rate for low depedence industry	0.0%	0.0%	0.0%
Implied differential effect	-1.1%	-1.2%	-1.6%

Robust t-statistics in brackets
*** p<0.01, ** p<0.05, * p<0.1

The dependent variable is the yearly growth rate in the production index of each ISIC-3 industry in each country computed from the UNIDO Indstat-3 (2006) data set. Lagged size is the share of a country's total manufacturing value added that corresponds to the industry in the previous year. Recovery is a dummy variable that takes a value of 1 when the year and country observation has been identified as recovery as explained in the text, and is 0 otherwise. Creditless recovery is a dummy variable that takes a value of 1 when the year and country observation has been identified as creditless recovery as explained in the text, and is 0 otherwise. External finance dependence is the average figure for each industry in the Rajan and Zingales (1998) index. The three sets of dummies include all industry-year, country-industry, and country-year fixed effects.

DATA APPENDIX

For the macro-level analysis, we use annual data from the IMF's World Economic Outlook database. Our sample consists of the 48 countries listed in Table A1, for which both macroeconomic and credit data are available. Real GDP and bank credit to the private sector are from the IFS database. The banking crisis variable is based on Laeven and Valencia (2008). Systemic sudden stop (3S) episodes are taken from Calvo, Izquierdo, and Talvi (2006).

Industry-level data are from the UNIDO, Industrial Statistics dataset. The dataset provides yearly observations for 28 ISIC-3 manufacturing industrial segments in a large number of countries from 1964 to 2004. The basic sample consists of 35,796 observations for 23 OECD countries and 25 emerging economies, during 41 years. The panel is unbalanced due to data availability. The sample size varies, as country-level data are not always available for all economies. Value added is deflated using consumer price indexes from the International Financial Statistics.[5]

External dependence is defined as the share of capital expenditure not financed with cash-flow from operations. The data come from Rajan and Zingales (1998), who compute them by using the U.S. firm-level statistics from Compustat. Following Krozner et al. (2007), and in contrast with Rajan and Zingales, to preserve sample size we include only 3-digit ISIC level sector rather than a mixture of 3 and 4-digit level sectors. The figures are for U.S. manufacturing firms and reflect industry medians during the 1980s (Table A2). An important assumption underlying our approach is that external dependence reflects technological characteristics of the industry that are relatively stable across space and time (see Rajan and Zingales, 1998 for a discussion of this assumption).

[5] The producer price index would be a more appropriate measure of prices in manufacturing, but it was not available for a number of countries in our sample. In any case, the price index does not affect differences in growth rates across sectors, which is what matters to our tests.

Table A1. Countries in the Sample, by Country Group

OECD	Australia	**EM**	Argentina
	Austria		Brazil
	Belgium		Chile
	Canada		China,P.R.: Mainland
	Denmark		Colombia
	Finland		Czech Republic
	France		Egypt
	Germany		Hungary
	Greece		India
	Iceland		Indonesia
	Ireland		Israel
	Italy		Jordan
	Japan		Korea
	Luxembourg		Malaysia
	Netherlands		Mexico
	New Zealand		Morocco
	Norway		Pakistan
	Portugal		Peru
	Spain		Philippines
	Sweden		Poland
	Switzerland		Russia
	United Kingdom		Slovak Republic
	United States		South Africa
			Thailand
			Turkey

Table A2. External Dependence Index

Industrial sector	External Dependence
Tobacco	−0.45
Pottery	−0.15
Leather	−0.14
Footwear	−0.08
Non-ferrous metal	0.01
Apparel	0.03
Petroleum refineries	0.04
Non-metal products	0.06
Beverages	0.08
Iron and steel	0.09
Food products	0.14
Paper and products	0.17
Textile	0.19
Printing and publishing	0.20
Rubber products	0.23
Furniture	0.24
Metal products	0.24
Industrial chemicals	0.25
Wood products	0.28
Petroleum and coal products	0.33
Transportation equipment	0.36
Other industries	0.47
Glass	0.53
Machinery	0.60
Other chemicals	0.75
Electric machinery	0.95
Professional goods	0.96
Plastic products	1.14

Source: Rajan and Zingales (1998) and Krozner et al. (2007).

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