Pontifícia Universidade Católica
do Rio de Janeiro

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The Labor Market in Brazil and the 2008 Financial Crisis: An Analysis Based on the Flow Approach

Dissertação de Mestrado

Dissertation presented to the Programa de Pós-Graduação em Economia of the Departamento de Economia, PUC-Rio as partial fulfillment of the requirements for the degree of Mestre em Economia.

Advisor : Prof. Juliano Assunção
Co–Advisor: Prof. Gustavo Gonzaga

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Resumo

Ravani Cecato, Bianca; Assunção, Juliano; Gonzaga, Gustavo. **O Mercado de Trabalho no Brasil e a Crise Financeira de 2008: Uma Análise de Fluxos**. Rio de Janeiro, 2015. 54p. Dissertação de Mestrado — Departamento de Economia, Pontifícia Universidade Católica do Rio de Janeiro.

Esse trabalho usa dados de empregador e empregado para investigar o canal de crédito como um canal de transmissão relevante da crise financeira em 2008 sobre o mercado de trabalho. Eu estudo o impacto entre setores da indústria das decisões das firmas em relação à força de trabalho. Eu uso medidas como taxas de contratação e demissão. Eu encontro que crédito foi um mecanismo de transmissão importante da crise sobre a economia real. Mais especificamente, eu encontro que as taxas de demissão são maiores para firmas mais dependentes de financiamento durante a crise. Trabalhadores mais jovens e menos qualificados foram mais afetados negativamente, através do canal de crédito. Eu também encontro evidências de realocação de trabalhadores entre setores; setores menos dependentes de financiamento 'roubaram' mais trabalhadores de outros setores, especialmente de firmas pequenas. Eu também encontro evidências de realocação de trabalhadores dentro dos setores e entre intervalos de tamanho de firma.

Palavras–chave

Canal de crédito; Fluxo de trabalhadores; Choque financeiro;

Abstract

Ravani Cecato, Bianca; Assunção, Juliano; Gonzaga, Gustavo. **The Labor Market in Brazil and the 2008 Financial Crisis: An Analysis Based on the Flow Approach**. Rio de Janeiro, 2015. 54p. Dissertação de Mestrado — Departamento de Economia, Pontifícia Universidade Católica do Rio de Janeiro.

This paper uses matched employer-employee data to investigate the credit channel as a relevant transmission channel of the 2008 financial crisis on the labor market in Brazil. I study the cross-sector impact on employment decisions of firms of the manufacturing industry. I use measures such as hiring and firing rates as outcomes. I find that the credit was an important transmission mechanism of the crises to the real economy. More specifically, I find that the firing rate is higher for more financially dependent industries during the crisis. Younger and less skilled workers were more adversely affected through the credit channel. I also find evience of reallocation of workers across sectors; less financially dependent sectors 'poached' more workers from other sectors, and particularly so from smaller firms. I also find some evidence of reallocation within sector and across firm size intervals.

Keywords

Credit Channel; Worker Flows; Financial Shock;

Contents

1
Introduction

The 2007–2009 financial crisis that begun in the United States shocked the global financial system and originated the worst global recession since the Great Depression. The crisis spread through a combination of demand and financial channels, affecting expectations of consumers and firms all over the world. Financial sector lending to nonfinancial firms contracted significantly during the crisis, while production and employment were negatively affected.

The financial shock is one of the leading factors driving the drop in economic activity during the "Great Recession" (Chistiano et al (2014), Jermann & Quadrini (2012)). Although there is an emerging literature that aims to evaluate the impact of financial crises and credit shocks over labor market outcomes (see Chodrow-reich (2014)), the link between credit crises and the labor market has not yet been fully understood, especially in developing countries. One of the reasons for that is the lack of data at the firm level, both on credit contracts with financial intermediaries and on matched employer-employee information.

In this paper, I investigate whether the credit channel was an important transmission mechanism of the 2008 financial crisis to the real economy. I study its effect on the labor market in a developing country: Brazil. Brazil has a very rich administrative database that has information on the full history of formal jobs for millions of Brazilian workers: the *Relação Anual de Informações Sociais* (RAIS), collected by the Labor Ministry. Each observation in the dataset consists of a contract-worker-establishment triplet in a given year. The use of RAIS provides an opportunity to investigate the flow of workers between different jobs, from which I can derive my main outcomes: the worker flow measures. This approach not only provides concise information about employers' decisions taken throughout a specific period of time; it is also a very appropriate way to measure potential changes in the pattern of reallocation of workers across employees with distinct characteristics given a credit shock, which is an innovation of this paper.

In order to exploit the role of the credit channel over the flow measures I use the Rajan & Zingales (1998) proxy for each industry's financial dependence, which measures to what extent each industry intrinsically depends on resources from financial intermediaries. The sectors with higher degrees of financial dependence before the crisis might have faced deeper financial constraints during

the crisis, since they intrinsically rely more on external resources to finance its activities. I investigate whether more financially dependent industries adjust their labor force when faced with a credit shock, as compared to less financially dependent industries. The crisis period is defined as the last quarter of 2008 and the first semester of 2009. This paper's methodology relies on the assumption that the 2008 financial crisis was an exogenous shock on the availability of financial resources to Brazilian firms. I investigate the role of credit on the determination of hiring rates and separation rates. I also investigate if credit availability induces a reallocation of workers across employers with different levels of exposure to credit shocks; I rely on the definition of "hiring from poaching" (Hyatt et al. (2014)) to study this reallocation.

My results strongly suggest that credit indeed played a role on the determination of the flow of workers. I find that the credit channel is relevant in the determination of separation rates due to firings during the 2008 financial crisis. The effects of the crisis were particularly perverse on those sectors with greater financial dependence (according to the Rajan & Zingales (1998) sector level proxy), i.e, those with larger financial constraints during the crisis. Within these sectors, younger and less skilled workers were mostly harmed through the credit channel, both in terms of hiring and firing rates. Moreover, I find that during the crisis, the hiring from poaching is larger for less financially dependent industries. This suggests that the financial crisis induced a reallocation of workers across sectors, as the less financially dependent industries we poaching more workers from other sectors. This reallocation of workers across sectors is even stronger for small firms; this is consistent with the prediction that among firms that depend heavily on outside financing, smaller firms may have particular difficulties raising funds from the financial intermediaries (Krosner et al. (2007)).

This works is closely related to two strands of the literature. The first one uses job and worker flow measures to investigate several aspects of the labor market, from job protection and labor market regulation to cyclical response of these flows. The second one studies real effects of financial crises through a micro econometric approach.

A large number of studies attempt to investigate the mechanisms of transmission of the 2008 financial crisis to the real economy using micro data (usually firm level or sector level data). Most of them are focused on the effects of the credit supply shock on firm level measures such as profit, sales and investments following the crisis. Claessens et al. (2012) and Fund (2011) use cross-country firm level data to investigate which transmission channels were important and quantify them; one of the channels they investigate is

the credit channel. In these papers the authors also use the Rajan & Zingales (1998) measure of financial dependence to quantify the credit channel[1]. I use a similar methodology, but I am interested on labor market responses to the crisis, instead of measures of firm performance.

A recent paper about the effects of the crisis on the labor market, Chodrow-reich(2014) compares the employment growth at firms that had borrowed before the crisis in the United States from relatively healthy financial institutions with firms with similar characteristics that had borrowed from lenders that were more adversely affected during the crisis. He uses a dataset with the borrowing history of both public and private firms, which overcomes the issue of lack of data on credit contracts. In this paper, I do not have information on banking relationships with firms (an issue that I overcome by using the Rajan & Zingales (1998) measure of financial dependence), but the detailed information on flows of workers provided by my dataset allows me to investigate labor reallocation induced by a credit shock.

Within the literature on the flow approach, we can relate this work to the papers that evaluate the cyclical responses of the flows, and the role of firm and sector characteristics on the determination of the flows. Haltiwanger et al. (2014) find that firm size effects and industry fixed effects are dominant factors that account for the variation of job reallocation across industries and size cells. Davis et al. (2006) find that employment adjustments are very lumpy; approximately two-thirds of job creation (destruction) occurs at establishments that grow (shrink) more than 10% within a quarter. Davis et al. (2006) and Lazear & Spletzer (2012) introduce a stylized fact that quits are procyclical and layoffs are countercyclical. This contradicts Bachman et al. (2013), that find that worker turnover is procyclical, i.e., both hires and layoffs drop during an economic downturn. I will show that during the 2008 financial crisis in Brazil, the hiring rate dropped and the firing rate increased, which is consistent with the findings of Davis et al. (2006) and Lazear & Spletzer (2012).

Most of these papers are interested in the evolution of job and worker flows along the business cycle, using standard business cycle indicators (like the difference of the unemployment rate from its H-P trend). In this paper I take one step further; instead of documenting the response of admissions and dismissals during the 2008 financial crisis in Brazil, I use the crisis as an exogenous shock to the credit supply to firms and I investigate the role of credit in the determination of these flows.

Still on the cyclical responses of labor market outcomes, one of the

[1]Another paper that uses this measure is Catao et al. (2009), which investigates the impacts on labor formalization of the credit expansion in Brazil during the early 2000's.

theoretical predictions of Moscarani & Postel Vinay (2008) model is that small firms engage in more intensive poaching of workers from larger firms in times of high unemployment, i.e., in times of economic downturns[2]. On the other hand, Fort et al. (2013) argues that firm size (and to a lesser extent, firm age) is often used as a proxy for access to the credit market[3], which could induce poaching of workers from small to large firms when credit availability drops. In order to see if this holds for Brazilian firms during the crisis, I also investigate the reallocation of workers across firms in different size intervals, within and across sectors with different degrees of financial dependence. I find that, during the crisis, the poaching of workers from small to large firms increases as we move from the less financially constrained sectors to the more financially constrained sectors, which reinforces the conclusion that credit induces a reallocation of workers.

Bell and Blanchflower (2011) and O'Higgins (2012) find that young workers were hit particularly hard by the "Great Recession". There are a few explanations for this phenomena in the literature; young workers lack skills and experience, and are generally employed in more precarious contracts (OECD (2009)). In this paper, I find that the credit channel affected the worker flows during the crisis, but particularly so for young and less skilled workers.

The remainder of this paper is organized as follows: section 2 provides a description of the data used in this paper; section 3 describes the crisis period in Brazil and provides some evidence of the shifts in the labor market during the crisis; section 4 discusses the specifications and identification strategies; section 5 provides the results of the regressions and its interpretations; and section 6 states the conclusions and the potential next steps of the research.

[2]Hyatt et al. (2014) show empirical evidence that this prediction is consistent using US data.

[3]See Gertler & Gilchrist (1994).

2
Data Description

2.1
Worker data

My main data source comes from RAIS (*Relação Anual de Informações Sociais*), a matched employer-employee dataset collected by the Brazilian Ministry of Employment and Labor (*Ministério do Trabalho e Emprego* - MTE). RAIS is a very rich longitudinal dataset that matches employer-employee data and contains characteristics of the employee - like age and schooling -, of the firm in which s/he is employed - like sector activity and size. It also includes the type of contract, wage, dates of admission and separation, reason of separation, and the geographic location of the firm (state and municipality). It covers by law the universe of formally employed workers in Brazil. All tax-registered firms have to report every worker formally employed at some point during the previous calendar year. The period of analysis is from 2005 to 2010.

In my analysis, I keep only workers with open-ended duration contracts (*CLT tempo indeterminado*). If a worker has simultaneous jobs I keep only his main job, which I define as the job in which s/he works more hours[1]. I also drop the public sector and firms with zero workers.

RAIS provides us with enough information to construct measures that capture the dynamics of hiring and separation rates, as well as the creation and destruction of jobs. From the yearly data set we can easily create higher frequency data for the labor market flow measures. For reasons I will expose below, my analysis is focused on the manufacturing industry sectors.

2.2
Flow Measures

In this paper, I use labor market flow measures to analyze credit as a transmission mechanism of the 2008 financial crisis to the Brazilian labor market.

[1]In case the hours worked per week is the same for a pair of simultaneous jobs, I keep the job in which the average monthly wage is higher

Labor force adjustment is one of the ways through which firms can allocate their resources more efficiently and respond to changes in the economic environment. This process often leads to labor force reallocation across firms and industries. The advantage of employing the flow approach instead of simply using stock variables as outcomes is that we can have a clearer picture of the patterns of this process of reallocation of workers.

I follow the standard measures as in the literature (see for instance Davis & Haltiwanger (1992), Davis et al. (2006) and Hyatt et al. (2014)). I use worker flow measures as outcomes. The worker flows are hiring and separation rates. These are the basic measures, from which many others are derived. I describe them below.

Worker flows:

$$HR_{i,t} = \frac{TotalHirings_{i,t}}{(Empl_{i,t-1} + Empl_{i,t}) * 0.5} \qquad SR_{i,t} = \frac{TotalSeparations_{i,t}}{(Empl_{i,t-1} + Empl_{i,t}) * 0.5}$$

where i is sector and t is quarter. The firing rate (the outcome of one of my main results) is calculated the same way as the separation rate, but $TotalSeparations_{i,t}$ includes dismissals only.

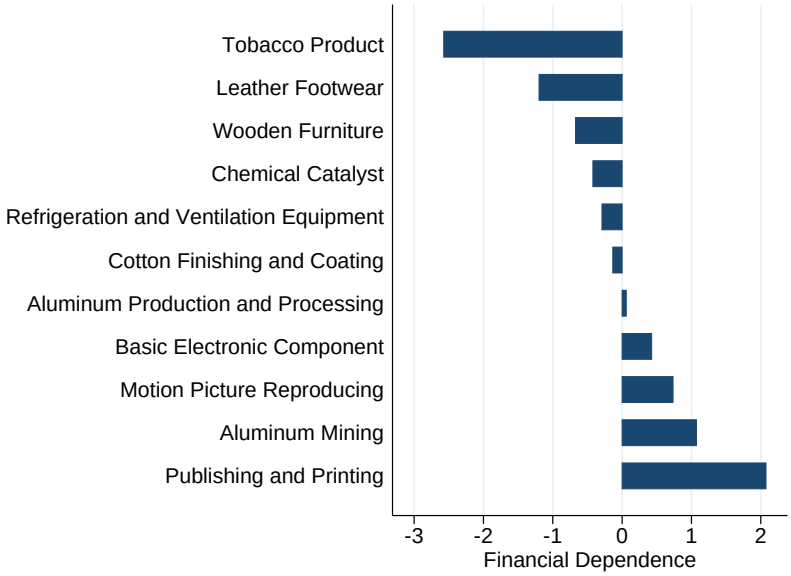
2.3 Financial Dependence Measure

I follow the methodology of Rajan & Zingales (1998) for the *ex ante* proxy for the intrinsic financial external dependence for each 4-digit manufacturing industry level using CNAE 1.0 (Classification of Economic Activities - *Classificação Nacional de Atividades Econômicas*). The data on financial dependence (here on, FD) is provided by Fund (2011), who extended the Rajan & Zingales (1998) methodology to 253 3-digit SIC (Standard Industrial Classification) level manufacturing sectors. They construct the measure as the median of external dependence across all firms at each SIC 3 digit sector, between 1990 and 2006 (therefore, the measure is *ex ante*, i.e., before the crisis) in the US. I merge the SIC codes and the CNAE 1.0 codes on its most disaggregate level (5-digit level) using a mapping provided by Marc Andreas Muendler; the unit of observation is the 4-digit CNAE 1.0 sector level[2].

This formula involves accounting identities and definitions, and its definition is: Capital Expenditures minus Cash Flow from Operations divided by Capital Expenditures. In accounting, Capital Expenditures is the amount of resources a firm uses to the acquisition or the upgrade of physical assets, like machinery and equipment, industrial and commercial buildings. The Cash Flow

[2]For more details, see Data Appendix.

Figure 2.1: Sectors by Degree of Financial Dependence



Note: The range of the values for financial dependence are the maximum value, minimum value and standard percentiles (p1, p5, p10, p25, p50, p75, p90, p95, p99).

from Operations measures to what extent the firm is capable of generating its own resources; it is the net revenues plus depreciation, decreases in inventory and decreases in net receivables.

The idea behind it is to capture the structural dependence that the sector has on external (i.e., external to the firm's own resources) funds. The degree of financial dependence is measured using United States data. What justifies the use of US data is that the financial market in the US is known as the most developed one in the world, and the sectorial financial dependence as ranked by the FD measure likely reflects the "true" financial dependence degree of the sector. It reflects the "ideal" amount foreign firms in the same industry would have liked to raise if the financial system in their country was more developed[3].

Figure 2.1 provides some examples of sectors in the standard percentiles of the FD measure (minimum and maximum value and the percentiles 1, 5, 10, 25, 50, 75, 90, 95, 99). The least financially dependent sector is the Tobacco Product Manufacturing and the Publishing and Printing Manufacturing is among the most financially dependent sectors.

2.4 Other Data and Additional Controls

[3]There is no paper that calculates this measure for any other country. All related works use the US measure for any other country. Catao et al. (2009) calculate the measure for the service sector, but using US data as well.

2.4.1 Occupation Categories

RAIS provides us with information on disaggregate level of occupations (5-digit level) according to CBO (Brazilian Classification of Occupations - *Classificação Brasileira de Ocupações*). To account for worker features that might influence the worker flows across sectors, in all regressions I control for the share of workers within each category/4-digit level sector cell. I also do a separate analysis of worker flows by occupation category.

I split the workers into a 5-broad occupation classification system proposed by Abowd et at (2001). The 5 categories are: professional and managerial, technician, other white-collar, skilled blue-collar and unskilled blue-collar. Table 2.1 describes some examples of occupations included in each one of these categories and the share of workers in our sample within each of these groups. The categories in the table are ordered by decreasing level of skills. The majority of the workers belong to the skilled blue-collar category, whereas the most skilled workers (professional and managerial category) represent only 7.05% of our sample.

Table 2.1: Worker by Occupation

Occupations	**Examples (5-digit CBO)**	**Share of Workers**
Professional and Managerial	Directors, engineers, designers, office supervisors, accountants, lawyers	7.05%
Technician	Tecnician (mechanical, electrical, textile, etc), administrative agents, sales supervisors	11.2%
Other White-Collar	Cashier operators, sales assistants, security guards, secretaries and receptionists (general)	9.41%
Skilled Blue-Collar	Drivers, fruit and vegetable processors, stone engravers, ceramists, wood carving operators	57.13%
Unskilled Blue-Collar	Maintenance and cleaning, fishery and related, door-to-door vendors	15.24%

2.4.2 International Trade Data

In order to control for demand shocks during the crisis, in my main regressions I include sector level data on exportations as additional controls. The data on exportations comes from the the Ministry of Development and International Trade (MIDC - *Ministério do Desenvolvimento e Comércio Exterior*). The ministry has a publicly available list of every Brazilian firm that exported a positive value in a specific year, and classifies them into 5

groups, according to the value exported: (1) Up to 1 million dollars; (2) From 1 to 10 million dollars; (3) From 10 to 50 million dollars; (4) From 50 to 100 million dollars; (5) More than 100 million dollars.

Table 2.2 reports the mean across the years of the share of firms within each of these exporting value thresholds. As can see, only about 6% of the manufacturing industry firms in Brazil exported a positive amount of goods between 2005 and 2010. The majority of exporting firms in this period exported less than 1 million dollars a year; the share of firms within each threshold decreases as we go from the lower to the higher values.

Table 2.2: Exporting firms

Exporting thresholds	**Share of firms**
Non exporting firms	93.63%
Up to 1 million dollars	4.52%
From 1 to 10 million dollars	1.35%
From 10 to 50 million dollars	0.43%
From 50 to 100 million dollars	0.09%
More than 100 million dollars	0.08%

2.5 Descriptive statistics

The sample is composed of 253 4-digit CNAE 1.0 sector level in each period, from 2005 to 2010. My main regressions use quarterly data. The descriptive statistics of our sample are shown in Table 2.3.

Our FD measure assumes a range of values from -2.572 to 2.075 and its distribution is shifted to the left, as shown by its mean and median. The second row presents the number of firms per sector per year; more specifically, it shows the mean across the years of number of firms per sector for each percentile across the years. Note that the "size" of the sector varies a lot, from 2 firms to 18,601 firms[4].

Two other variables at the firm level that I will be using in some of the specifications are the firm size (measured as the number of employees[5]) and the firm age. Brazilian firms are generally small and young as compared to other countries; as the descriptive statistics show, 50% of Brazilian firms employ 14 workers or less.

[4]This is a good reason to weight our sector level regressions by number of firms per sector, as I will explain in the next sections.

[5]Although my analysis is focused on open ended contract workers, the firm size includes all employees.

Table 2.3: Descriptive Statistics

VARIABLES	mean	sd	min	p10	p25	p50	p75	max
Financial Dependence	-0.089	0.454	-2.572	-0.529	-0.322	-0.133	0.0945	2.075
Number of firms per sector	580.37	1386.883	2	29	73	194.5	554	18,601
Firm Size	59.70	350.68	1	3	6	14	35	53,971
WORKER FLOWS (year)								
Hiring Rate	0.458	0.233	0.0469	0.226	0.320	0.428	0.545	3
Separation Rate	0.410	0.205	0	0.205	0.285	0.380	0.491	2.035
Firing Rate	0.280	0.130	0	0.145	0.202	0.264	0.332	1.690
WORKER FLOWS (quarter)								
Hiring Rate	0.109	0.0583	0.00436	0.0488	0.0733	0.103	0.133	1
Separation Rate	0.0986	0.0547	0	0.0469	0.0672	0.0916	0.118	1.418
Firing Rate	0.0675	0.0423	0	0.0325	0.0464	0.0623	0.0799	1.390

My main outcomes of interest are the worker flows, namely hiring and firing rates; the firing rate is defined the same way as the separation rate, but includes only dismissed workers. To calculate the firing rate, I include separations due to transitions between the estabilishments of the same firm, because a single firm can have estabilishments in different 4-digit sector level classification. I also report descriptive statistics for separation rates. In Table 2.3 I show some descriptive statistics of these measures at the 4-digit sector level of manufacturing industry only by year and quarter. The mean of hiring rate, separation rate and firing rate across the sectors and are 10.9%, 9.86% and 6.75%, respectively.

3
Crisis, Production and Employment Outcomes

From the implementation of the stabilization plan (the *Plano Real*) in 1994 until 2002, a remarkable feature of the Brazilian banks was that they placed a relatively high proportion of their investment portfolio on government bonds. From 2003 on this picture changed and Brazil experienced a great credit supply expansion; the reduced macroeconomic volatility and the expectations of lower interest rates in the future encouraged the banks to change their portfolio composition in favor of private borrowers.

In 2007, the Brazilian economy expanded rapidly. The manufacturing industry contributed significantly to this good performance, thanks to the better credit market conditions which made it more feasible for the private companies to invest in productive capacity[1].

In 2008 several firms which depended on the international credit markets in order to finance its working capital and investments turned to the national banks due to the deepening of the financial crisis around the world (with the bankruptcy of Lehman Brothers in September) and the subsequent worsening of international credit market conditions. At the same time, the rise of the interest rates on the Certificates of Deposit (CDB) pushed upwards the interest rates on debt instruments for the private companies, and also increased the cost of raising resources, particularly so for the medium size and small banks. The increased competition for domestic credit was particularly harmful for smaller firms which are generally deprecated by the financial intermediaries - and also by government policies- in favor of bigger and more solid companies (de Freitas (2009)).

The Central Bank adopted a series of measures to mitigate the liquidity problems of small banks, including one that allowed the banks to use up to 40% - and then up to 70% - of their mandatory deposits on the acquisition of interbank assets. As the returns on government bonds were still relatively high, this measure had little impact on the investment decisions of larger banks. In this scenario, and with relatively stable exchange rates, some banks started to link some loan contracts with dollar derivatives, underestimating the risk of it. After the Lehman Brothers bankruptcy the capital flight harmed the parts involved in these kind of contracts due to the subsequent depreciation of the

[1]Brazilian Central Bank Annual Report (2007).

Figure 3.1: Worker Flows and Credit Growth - Manufacturing Industry only

Note: The figure plots the annual credit growth by month from operations with free resources, and the monthly hiring and firing rates The monthly hiring and firing rates are deseasonalized using the X12-Arima method.

Brazilian Real[2].

3.1 Credit, Production and Labor Market Responses

Figure 3.1 plots the hiring and firing rates and the credit growth (free resources only) for the manufacturing industry only. The vertical line is September 2008. The graph depicts the annual credit volume growth (free resources) by month relative to the same month in the previous year. The growth rate of operations with free resources declined from November 2008 to January 2010, and then started to recover. It is worth noting that the growth rate of the operations with free resources directed to the legal persons declined more than the growth rate of operations with free resources for individuals; in 2008, it had grown by 39%, while in 2009 it grew by only 1.6%. The monthly credit growth to the manufacturing industry followed the growth path of the operations with free resources. When the expansion of credit started to recover, the recovery of the credit hiring to legal persons were slower than the one for private persons[3].

Although the GDP in the last quarter of 2008 declined by 3.6% it still

[2]It depreciated by 27.25% between September 15th and December 31st.

[3]As for the directed resources, its growth can be partially explained by the government interventions in the sense of amplifying the credit supply by the public banks, especially the BNDES (the Brazilian Development Bank).

grew by 5.1% in the year. The manufacturing industry grew by 3.6%, but it was lower than in the last year, reflecting the worsening of economic conditions in the last quarter of 2008. In contrast with the last year, the machinery industry production declined by 9%[4].

In 2009 the GDP declined by 0.2%. The economy started to recover by the end of the first semester pushed by the internal demand and by the government fiscal measures, such as the reduction of IPI (a tax over the manufacturing industry products). Still, the manufacturing industry production declined by 5.5%. Among the manufacturing activities the worst performing sectors were the Machinery and Electric Appliances (19.9%) and Machinery and Equipment (18.5%). On the other hand, the best performing ones were the Food Products, Beverages, Tobacco and Drugs[5].

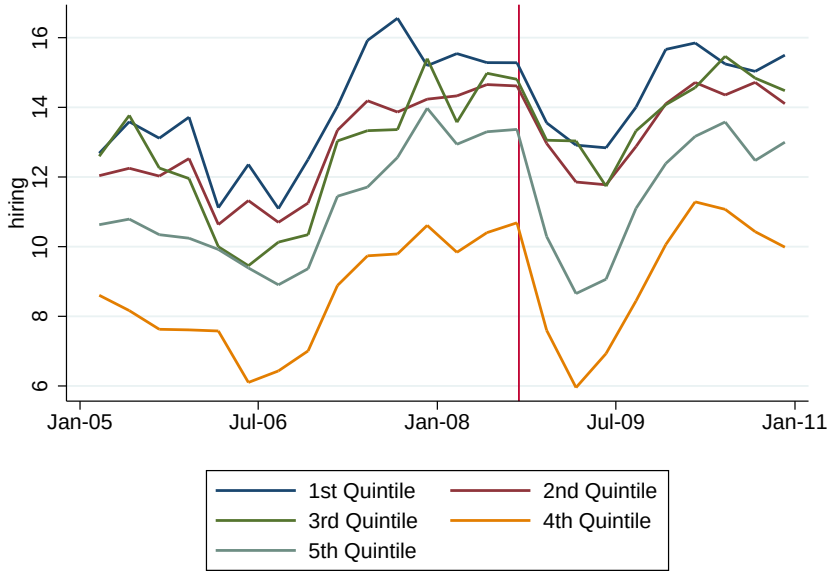
The manufacturing industry was the worst performing sector in terms of physical production, but the impacts of the crisis over this industry is not limited to its production. In 2009, the changes in the level of employment in the manufacturing industry basically followed the physical production, although the effects were lagged and smoother. The number of people employed in the manufacturing industry declined by 5.2% in 2009, and the production recovery which started already in the second quarter of that year affected the employment level only in the second semester.

The investigation of the effects of economic downturns on labor market outcomes is an important first step to the analysis of welfare consequences brought by periods of recession. If we go back to Figure 3.1, we see that the aggregate hiring rate started to drop sharply in September 2008, while the firing rate started to increase before that at a lower rate. Figure 3.1 shows that the firms in the manufacturing industry seem to be responding to the financial crisis by adjusting their labor force, while the credit expansion that had started in the early 2000's was starting to reverse its trend. The hiring rate dropped by almost 30%, and the increase in separations was approximately 17% from September 2008 to April 2009. This sharp decline in the hiring rate and the increase in the firing rate that we observe in the manufacturing industry were only mild in other sectors; the hiring rate dropped by 13.4% and 11% in the commercial and services sector, respectively, and the firing rate increased by only 2.25% and 2.82% in the commercial and services sector, respectively.

The response of firms in the manufacturing industry to the worsening in credit market conditions seems relevant. Does the financial channel really help determine the flow of workers during the crisis? If the link between credit and

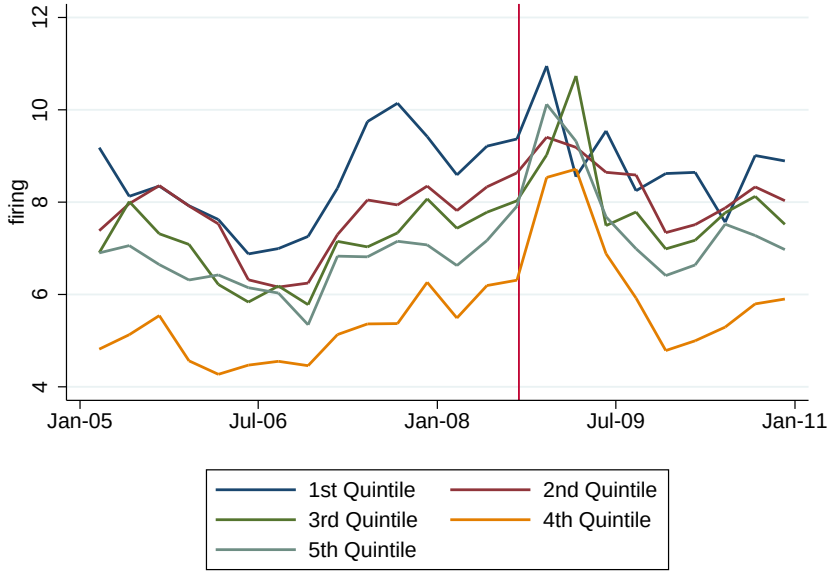
[4]Brazilian Central Bank Annual Report (2008)
[5]Brazilian Central Bank Annual Report (2009).

Figure 3.2: Hiring Rate by Quintile of Financial Dependency



Note: The figure plots the quartely hiring rate by quintiles of the FD measure, from 2005 to 2010. The quarterly hiring rate is deseasonalized using the X12-Arima method.

Figure 3.3: Separation Rate by Quintile of Financial Dependency - Firings only



Note: The figure plots the quartely firing rate by quintiles of the FD measure, from 2005 to 2010. The quarterly firing rate is deseasonalized using the X12-Arima method.

labor market is relevant, financially constrained firms would respond differently to the crisis if compared to non financially constrained firms. More specifically, they would have worse labor market outcomes.

We try to investigate if there is some initial evidence that workers in more financially dependent industries were particularly harmed by the crisis, using the Rajan & Zingales (1998) measure of financial dependence. Figures 3.2 and 3.3 plot the hiring and firing rate by quintiles of sector external dependence using the FD measure. From Figure 3.2 it is clear that as we go from the first (the least financially dependent industries) to the last quintile the drop in hirings becomes more intense after September 2008. As for the firing rate in Figure 3.3, we have a less clear pattern. Only for the 4th quintile can we see a higher separation rate increase as compared to the first and second quintiles.

Overall, it seems that more financially dependent sectors responded differently to the crisis. More specifically, the financial shock seem to impact industries differentially based on their exposure to credit shocks. This heterogeneous impact of the crisis on the labor market requires further investigation. In the next sections I try to isolate and quantify the impact of the credit shock over the worker flow measures.

4
Framework

My goal is to isolate and quantify the credit channel as an important transmission mechanism of the 2008 financial crises into the labor market using worker flow measures. The methodology relies on the assumption that the 2008 financial crisis is an exogenous shock on the availability of financial resources to Brazilian firms. To study the reflection of the crisis over the labor market, my baseline specification is the following:

$$Flow_{j,t} = \beta Crisis * FD_j + \alpha_j + \lambda_t + X_{j,t} + \varepsilon_{j,t} \quad (4\text{-}1)$$

where j stands for sector (4-digit level CNAE 1.0) and t for time (quarter). $Flow_{j,t}$ is one of the flow measures (hiring and firing rates), FD_j is our measure of financial dependence (Rajan & Zingales (1998)), α_j are industry fixed effects, λ_t are quarter dummies and $X_{j,t}$ are sector covariates. The variable $Crisis$ is a dummy variable that equals one during the crisis and zero otherwise. I consider the crisis period as the last quarter of 2008 (after the Lehman Brothers bankruptcy) and the first semester of 2009. In all the regressions I include as sector covariates the share of workers from each occupation category (as described in Section 2.4.1) within each sector.

The crisis is a variable (a shock) with different "treatment" intensity across industries. The idea behind it is that if credit is an important transmission mechanism of the financial crisis to the labor market, it should have a relatively larger impact on firms with greater *ex-ante* resource constraints. Our coefficient of interest is β. Once we control for time (quarter) dummies and industry fixed effects, β represents the average effect that captures the heterogeneous impact of the credit shock across sectors with different degrees of financial dependence; the higher it is, the more constrained the sector will be in terms of resources to finance its investments and working capital once hit by an exogenous credit shock (the crisis).

I estimate equation (1) by Weighted Least Squares. I weight each observation (sector) by the share of firms within the sector/year cell, weights designed to reflect population shares. The idea behind it is that labor force adjustment decisions in response to a change in the economic environment are decisions taken at the firm level. We are interested in investigating the cross group (i.e., cross sector) variation of worker flows, but these sector flows are based on widely varying within group (sector) sample sizes.

In Table 2.3 I had shown some summary statistics of the distribution of total number of firms per sector. The statistics show that there is a wide dispersion in the distribution of sector size at the 4-digit level. Small sectors like Sanitation Good and Polish Manufacturing and Railroad Rolling Stock Manufacturing are composed of less than 10 firms in 2009, while big sectors like Apparel Cut-and-Sew Manufacturing and Plastics Product Manufacturing have more than 5,000 firms. These larger sectors offer many more observations of the firm-level decisions of whether or not to hire or fire workers. Because the number of firms varies widely across groups, this WLS approach does consistently estimate the population linear projection of the dependent variable on the explanatory variables (Solon et al. (2013)).

5
Results

5.1
Worker Flows

Table 5.1 reports the results for my baseline specification. In columns (1) and (2) I run a fixed effects regression without controls for hiring and firing rates, respectively. In columns (3) and (4) I run the same regressions with time dummies (quarter) and industry covariates. As we can see, the crisis had a negative and significant impact on sector level hiring rates, and a positive and significant effect on sector firing rates. In our most saturated model in column (3) the direct effect of the crisis on hiring is not statistically significant.

Our coefficient of interest is the one from the interaction between our measure of financial dependence (FD) and the crisis dummy; the second column shows that it is positive and significant, suggesting that more financially dependent industries were relatively more affected during the crisis in terms of firings. This result is robust to the inclusion of industry covariates and quarter dummies, as shown in column (4). There is no evidence of statistically relevant effect on the hiring rate, although the sign of the coefficient of interest is negative, as expected. The coefficient in column (3) tell us that, during the crisis, an industry in the 90th percentile of the distribution of FD fires approximately 0.9 percentage points more than an industry in the 10th percentile of the distribution. This result suggests that disruptions to the supply of credit to the firms related to the global financial crisis led to an increase in firings.

To check if the results are not simply driven by our definition of crisis, in column (5) and (6) I slightly change it (I include the last two quarters of 2009). The magnitude of the coefficient is reduced, but it is still significantly different from zero. If we look at the coefficient of the dummy *Crisis* in the last column, the effect of the crisis on the lay off of workers is actually stronger. The heterogeneity across industries is weaken though, as shown by the coefficient of the interaction term. It seems that the crisis continued to lead to an increase in firings (although there is also an increase in the hiring rate), but the role of the credit channel is diminished[1].

[1]When I further include the first and the second quarter of 2010 the heterogeneity is weaken even more, but it is still relevant. The significant vanishes completely when I include

Table 5.1: Worker Flows during the crisis

	(1)	(2)	(3)	(4)	(5)	(6)
					Changing *Crisis* Def	
VARIABLES	Hiring	Firing	Hiring	Firing	Hiring	Firing
Mean of Dep Var	0.1086	0.0673	0.1086	0.0673	0.1086	0.0673
Crisis	-0.0159***	0.0185***	-0.0146***	0.0210***	-0.0205***	0.0160***
	(0.00191)	(0.00164)	(0.00345)	(0.00271)	(0.00333)	(0.00212)
Crisis x FD	-0.00240	0.00883***	-0.00295	0.00850***	-0.00169	0.00457**
	(0.00549)	(0.00260)	(0.00519)	(0.00272)	(0.00466)	(0.00202)
Industry FE	x	x	x	x	x	x
Time (quarter) dummies			x	x	x	x
Industry Covariates			x	x	x	x
Observations	5,844	5,844	5,816	5,816	5,816	5,816
R-squared	0.180	0.108	0.448	0.209	0.448	0.207

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The table report the results of the baseline specification having quarterly hiring and firing rate as dependent variables. In the first two columns I only include industry FE. In the remaining columns I include time (quarter) dummies and industry covariates (share of workers within each occupation category). The coefficient of interest is the one from the interaction term $CrisisxFD$. In columns (5) and (6) I slightly change the definition of $Crisis$, including the last two quarters of 2009.

Table 5.2 reports some robustness checks. In columns (1) and (2) I include the share of workers within the sector/year cell that are employed in exporting firms (i.e., firms that export at least 1 US dolar in each year), and the interaction between this variable and the crisis dummy. This variable works as a proxy for the demand shock exposure of each sector, and the idea behind it is to isolate a potential (negative) demand impact over the worker flows during the crisis; it might be that the most financially dependent industries are also more sensitive to demand shocks, and this works as a confounding effect. If this is true, the interaciton term $CrisisxFD$ would not be isolating the average partial effect of the credit shock. Note that in the first two columns the coefficient of $CrisisxFD$ doesn't change, and both the coefficients of $ShareWorkers$ and $CrisisxShareWorkers$ are statistically equal to zero.

Table 5.2 reports some robustness checks. In columns (1) and (2) I include the share of workers within the sector/year cell that are employed in exporting firms (i.e., firms that export at least 1 US dolar in each year), and the interaction between this variable and the crisis dummy. The great recession has been marked not only by contractions in credit volumes, but also by contractions in output and consumption; it might be that the most financially dependent industries are also more sensitive to demand shocks, and this might be working as a confounding effect. If this is true, the interaciton

the 4 quarters of 2010.

term $CrisisxFD$ would not be isolating the average partial effect of the credit shock. $ShareWorkers$ works as a proxy for the demand shock exposure of each sector, and the idea behind it is to isolate a potential (negative) demand impact over the worker flows during the crisis.

Note that in the first two columns the coefficient of $CrisisxFD$ doesn't change, and both the coefficients of $ShareWorkers$ and $CrisisxShareWorkers$ are statistically equal to zero. So far, there isn't enough evidence to reject the hypotesis that the impact of the demand shock over the worker flows during the crisis is equal to zero. However, it might be that the share of workers within the sector that are employed in exporting firms is not a good proxy for demand shock exposure. Therefore, in columns (3) and (4), I instead consider the share of exporting firms within the year/sector cell as a proxy for sector level demand shock exposure. I include it as a control, along with it's interaction with the crisis dummy. Note that now the coefficient of the interaction term is significant for both the hiring and firing rates. It means that, during the crisis, industries that were more exposed to demand shocks hired less and fired more, as compared to less exposed industries. In column (4) we can also note that the coefficient of $CrisisxFD$ diminishes, suggesting that it was indeed capturing some demand shock effect. However, it reamins statistically and economically significant, and the general conclusions do not change.

The sectors with higher degrees of financial dependence faced a deeper financial constraint during the crisis, since they intrinsically rely more on external resources to finance its activities. These results suggest that the workers employed in these industries were more adversely affected through the credit channel. Therefore, we have a strong evidence of a heterogeneous impact on the firing rate across sectors with different degrees of financial dependence.

5.2 Firm's Entry and Exit

The results reported in the last section suggest that the impacts of the credit shock on worker flows is limited to an increase in the firing rate; there was no evidence of differential impact on the hiring rate when we compare the sectors with different degrees of financial dependence. However, when looking at the worker flows from firms that are entering or exiting the market, we might reach very different conclusions. There are some theorectical predictions and empirical evidences in the literature that points to the conclusion that the extensive margin of the worker flows represents a viable mechanism for

Table 5.2: Worker Flows during the crisis

	(1)	(2)	(3)	(4)
VARIABLES	Hiring	Firing	Hiring	Firing
Mean of Dep Var	0.1086	0.0673	0.1086	0.0673
Crisis	-2.246***	1.219***	-2.298***	1.576***
	(0.332)	(0.319)	(0.304)	(0.282)
Crisis x FD	-0.162	0.738***	-0.0833	0.669***
	(0.461)	(0.244)	(0.501)	(0.240)
Share Workers	-4.552***	-1.396		
	(1.361)	(0.885)		
Crisis x Share Workers	-1.604**	1.982***		
	(0.732)	(0.619)		
Share Firms			-7.807*	4.325
			(4.447)	(2.810)
Crisis x Share Firms			-5.367***	5.446***
			(1.849)	(1.595)
Industry FE	x	x	x	x
Time (quarter) dummies	x	x	x	x
Industry Covariates	x	x	x	x
Observations	5,844	5,844	5,816	5,816
R-squared	0.454	0.214	0.451	0.214

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The table report the results of the baseline specification having quarterly hiring and firing rate as dependent variables. I include time (quarter) dummies and industry fixed effects. In the first two columns I include as additional controls the share of workers within the sector that are employed in exporting firms and the interaction between this variable and the crisis dummy. In the last two columns I include as additional controls the share of exporting firms within the sector and the interaction between this variable and the crisis dummy.

understanding the cyclical properties of the labor market fluctuations (see Aghion at al. (2007)). Besides that, since credit constraints might work as a potential barrier to entry of firms (See Garibaldi (2006)), the credit shock might have affected the hirings at the extensive margins, i.e., the hirings coming from the entrants.

In order to explore the potential impact of the credit shock over the extensive margin of the worker flows, Table 5.3 reports the results from the baseline specification, but with slightly different outcomes. Instead of hiring and firing rates, now the outcomes are hiring due to firm entry and firing due to firm exit. In other words, the total (quarterly) hiring of a specific firm includes only the hirings that occurred in the same year in which the firm entered the market, which we define as the first year in which the firm appears in RAIS. Similarly, the total (quarterly) firing of a specific firm includes only the firings that occurred in the same year in which the firm exit the market, which we define as the last year in which the firm appears in RAIS.

In columns (1) and (2) I report the results including time dummies and

industry covariates. In columns (3) and (4) I add the share of workers within the sector that are employed in exporting firms and the interaction between this variable and the crisis dummy as additional controls, and in columns (5) and (6) I include the share of exporting firms within the sector and the interaction between this variable and the crisis dummy.

Table 5.3: Worker Flows during the crisis

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Hiring	Firing	Hiring	Firing	Hiring	Firing
Mean of Dep Var	0.0016	0.0007	0.0016	0.0007	0.0016	0.00073
Crisis	0.00206	-0.00182*	0.000833	-0.00177	0.00175	-0.00172
	(0.00160)	(0.00107)	(0.00251)	(0.00115)	(0.00206)	(0.00109)
Crisis x FD	-0.00276**	-0.000505	-0.00309**	-0.000463	-0.00302**	-0.000376
	(0.00114)	(0.000487)	(0.00124)	(0.000508)	(0.00129)	(0.000507)
Share Workers			0.00690	-0.00123		
			(0.00476)	(0.00201)		
Crisis x Share Workers			0.00557	-0.000791		
			(0.00448)	(0.00111)		
Share Firm					0.00886	-0.00728
					(0.0118)	(0.0114)
Crisis x Share Firm					0.00774	-0.00394
					(0.00936)	(0.00269)
Observations	5,728	5,728	5,728	5,728	5,728	5,728
R-squared	0.059	0.044	0.062	0.045	0.059	0.045

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The table report the results of the baseline specification having quarterly hiring due to firm entry and firing rate due to firm exit as dependent variables. In the first two columns I include time (quarter) dummies and industry covariates (share of workers within each occupation category). In columns (3) and (4) I include as additional controls the share of workers within the sector that are employed in exporting firms and the interaction between this variable and the crisis dummy. In the last two columns I include as additional controls the share of exporting firms within the sector and the interaction between this variable and the crisis dummy.

In Table 5.3 we can see that the hirings (firings) react differently from the previous results, when we consider only hirings (firings) due to firm creation (destruction). The results suggest that the firings due to firm destruction are not affected by credit shock; in other words, there is no evidence of a stronger positive effect on firings on more financially dependent sectors during the crisis, as compared to less financially dependent sectors. On the other hand, we do have a significant effect on hirings, and the sign of the coefficient is as expected. If we take the most saturated model in column (5), the coefficient tell us that, during the crisis, an industry in the 90th percentile of the distribution of FD hires on the extensive margin approximately 0.304 percentage points less than an industry in the 10th percentile of the distribution.

The credit shock is working here as a barrier to growth of new firms.

Financial intermediaries find it much riskier to lend to younger firms (See Sharpe (1994)). It is common to assume that there is a heterogeneity and uncertainty among entrants, and this uncertainty creates constraints for these firms in the capital market. The results of this section are supported by these predictions; they suggest that entrant firms in more financially dependent sectors hire less during the crisis than entrant firms in less financially dependent sectors, which might be reflecting the decrease in hirings in the extensive margin due to a higher degree of exposure of entrant firms to credit shocks.

5.3 Who's Hit the Hardest?

There is a vast literature dedicated to investigate the vulnerability of workers to economic downturns. The adverse implications of a crisis over the labor market can be particularly harmful for the weakest segments of the labor market. O'Higgins (2012) and Bell & Blanchflower (2011) look at the effects of the 'Great Recession' on young people's employment. They both document that young people were hit particularly hard by the recession.

Youth labor markets are quite distinct from adult labor markets. Younger workers lack experience and skills, and are generally employed in more precarious contracts[2], which makes them relatively more vulnerable in case their employer needs to adjust its labor force in response to a worsening in economic conditions. Therefore, they are more likely to be laid off or to be unemployed for long periods of time; in case s/he is a new entrant to the labor market, it can also be particularly hard to find a job in periods of recessions if there is a freeze in hirings.

Given these differences, it is worth exploring if the credit shock that had arguably began in the third quarter of 2008 also distinctly affected workers depending on their age. Ultimately, the approach is the same, so the feature we want to explore is if younger workers were in fact more affected through the credit channel. I construct 5 age categories (15 to 24, 25 to 34, 35 to 44, 45 to 54, and 55 to 65 years old), and I calculate the flow variables within the age category/sector cell.

Table 5.4 reports the results of my main specification by age category; the dependent variable is the quarterly firing rate by age category/sector cell. I include as an extra control an interaction term between the dummy *Crisis* and the share of workers within the category that are employed in each 4-digit level sector. There might be that most of younger (older) workers are allocated in the

[2]Though we are not including temporary and fixed term contract workers.

Table 5.4: Firing Rate by age category

	(1)	(2)	(3)	(4)	(5)
VARIABLES	>=15 and <=24	>=25 and <=34	>=35 and <=44	>=45 and <=54	>55 and <=65
Mean of Dep Var	0.0810	0.0741	0.0583	0.0510	0.0572
Crisis	0.0210***	0.0179***	0.0152***	0.0150***	0.0144***
	(0.00283)	(0.00181)	(0.00132)	(0.00137)	(0.00215)
Crisis x FD	0.00732**	0.00580**	0.00535*	0.00433	0.00460
	(0.00335)	(0.00271)	(0.00324)	(0.00276)	(0.00382)
Industry FE	x	x	x	x	x
Time (quarter) dummies	x	x	x	x	x
Industry Covariates	x	x	x	x	x
Observations	5,848	5,848	5,844	5,848	5,836
R-squared	0.264	0.225	0.163	0.115	0.124

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The table report the results of the baseline specification having the quarterly firing rate as dependent variable, by worker age category. I include time (quarter) dummies and industry covariates (the share of workers within each occupation category). The coefficient of interest is the one from the interaction term $CrisisxFD$. I include as a control an interaction term between the dummy *Crisis* and the share of workers within the age category that are employed in each 4-digit level sector.

sectors that are more (less) exposed to credit shocks, so this interaction term account for this possibility. If we look again at the coefficient of the interaction term $CrisisxFD$ we can clearly see that it decreases monotonically as we move from the lowest age category (first column) to the highest one (last column). For the two last categories, the effect on firings through the credit channel disappears completely in terms of statistical significance. The workers who were mostly harmed are the ones that the literature classifies as "young" (15 to 24 years old). It seems then that most of the effect of credit on the firing rate we found on Table 5.1 comes from younger workers.

On Table 5.1 I had not found any evidence of heterogeneous reduction on the hiring rate across sectors, depending on their exposure to the credit shock. If we again run separate regressions by age category using the quarterly hiring rate within the age group/sector cell as a dependent variable, Table 5.5 shows that there actually was a heterogeneous effect on hiring for the first two age groups, although not as significant as the effect on firings; there is also a negative and significant effect on hiring for senior workers (55 to 65 years old). The effect over young workers (15 to 24 years old) was particularly strong; the coefficient means that as we move from the 10th percentile to the 90th percentile of the financial dependence distribution the drop on hirings increases by 1.3 percentage points.

Although younger workers are generally less skilled and lack experience, age is not a very good measure of human capital accumulation[3]. If one wants to focus more specifically on skills, one might want to look more directly

[3]Human capital is occupation specific (Kamborov (2009)).

Table 5.5: Hiring Rate by age category

	(1)	(2)	(3)	(4)	(5)
VARIABLES	>=15 and <=24	>=25 and <=34	>=35 and <=44	>=45 and <=54	>55 and <=65
Mean of Dep Var	0.1883	0.1112	0.0772	0.0559	0.0517
Crisis	-0.0359***	-0.0188***	-0.0137***	-0.00637***	-0.0143***
	(0.00504)	(0.00316)	(0.00209)	(0.00163)	(0.00187)
Crisis x FD	-0.0127*	-0.00751*	-0.00490	-0.00325	-0.00480*
	(0.00707)	(0.00453)	(0.00308)	(0.00257)	(0.00286)
Industry FE	x	x	x	x	x
Time (quarter) dummies	x	x	x	x	x
Industry Covariates	x	x	x	x	x
Observations	5,848	5,848	5,844	5,848	5,836
R-squared	0.462	0.414	0.324	0.231	0.169

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The table report the results of the baseline specification having the quarterly hiring rate as dependent variable, by worker age category. I include time (quarter) dummies and industry covariates (the share of workers within each occupation category). The coefficient of interest is the one from the interaction term $CrisisxFD$. I include as a control an interaction term between the dummy *Crisis* and the share of workers within the age category that are employed in each 4-digit level sector.

at occupations. Besides that, it is a well established stilyzed fact that low-qualified workers have consistently greater probability of separation than more qualified workers (OECD (2009)). We also have empirical evidence that the turnover (measured as the sum of hiring and separation rates) is higher for young and less skilled workers. The results by age category might be capturing the fact that younger workers are employed in occupations with a low degree of accumulation of human capital. So another way of investigating if the workers were distinctly affected by the financial crisis is to look at occupation categories, which captures the different level of skills and human capital accumulation. In other words, are the less skilled workers also more vulnerable to recessions? More importantly, can we find evidence that credit particularly affects less skilled workers? I realy on the occupation classification introduced by Abowd et al. (2001) (described in Section 2.4.1) to investigate that.

Table 5.6 report results separately by occupation category; the dependent variable is the quarterly firing rate within the occupation category/sector cell as a dependent variable. Our coefficient of interest increases monotonically as we go from the more skilled workers (first column) to the less skilled workers (last column). I also include the share of workers within the category/sector cell as a control. The heterogeneity of the credit shock across industries is particularly strong for the unskilled blue-collar workers; as we move from the 10th percentile to the 90th percentile of the financial dependence distribution the firing rate increases by 1.6 percentage points. The role of credit on the determination of workers flows during the crisis disappears (statistically) for

Table 5.6: Firing Rate by occupation category

	(1)	(2)	(3)	(4)	(5)
	White-Collar			**Blue-Collar**	
VARIABLES	Prof and Manag	Technician	Other white-collar	Skilled Blue-collar	Unskilled Blue-collar
Mean of Dep Var	0.0539	0.0611	0.0680	0.0719	0.0819
Crisis	0.0127***	0.0178***	0.0172***	0.0212***	0.0349***
	(0.00202)	(0.00200)	(0.00272)	(0.00489)	(0.00594)
Crisis x FD	0.00172	0.00435**	0.00885***	0.0109***	0.0158***
	(0.00241)	(0.00217)	(0.00270)	(0.00349)	(0.00507)
Industry FE	x	x	x	x	x
Time (quarter) dummies	x	x	x	x	x
Industry Covariates	x	x	x	x	x
Observations	5,812	5,796	5,820	5,820	5,820
R-squared	0.049	0.053	0.099	0.048	0.123

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The table report the results of the baseline specification having quarterly firing rate as dependent variable, by worker age category. I include time (quarter) dummies and industry covariates (the share of workers within each occupation category). The coefficient of interest is the one from the interaction term $CrisisxFD$. I include as a control an interaction term between the dummy *Crisis* and the share of workers within the occupation category that are employed in each 4-digit level sector.

the most skilled workers. It seems then the most of the effect of credit on the firing rate we found on Table 5.1 comes from less skilled workers.

In this section, I have shown that the heterogeneous impact of the credit crisis across sectors with different degrees of financial dependence is stronger for younger workers and for workers employed in occupations with low levels of human capital accumulation. Therefore, young and less skilled workers seem to be more vulnerable to financial shocks.

5.4 Hiring from Poaching and Worker Reallocation

We have evidence that the crisis affected the labor market through the credit channel, and the worker flow measures (especially the firing rate) capture this. However, these results do not say much about the reallocation of workers across sectors, and a lot of questions remain unanswered. For instance: once laid off from a particular industry, is the worker re-hired within the same industry or does s/he change sector? If there is evidence of reallocation across industries, can we find some pattern for this reallocation during the crisis? And if there is a pattern, is it related to the credit channel?

In this section I try to answer these questions by investigating the reallocation of workers in two ways: (i) across sectors with different degrees of financial dependence; (ii) within sectors and across firm's age and size intervals. First, I use the following definition of *hiring from poaching* (Hyatt et al. (2014)):

$$HR_{i,I,t} = TotalHirings_{i,I,t}/(Empl_{i,t-1} + Empl_{i,t}) * 0.5$$

Where $TotalHirings_{i,I,t}$ here includes only hires of sector i from sectors I , where $I \neq i$. We can explore the mobility of workers across sectors using this definition as an outcome, because it captures the flow or workers that are entering a specific industry and who was allocated in another industry in the previous job. We can do that by comparing the hiring from poaching of more financially dependent sectors to the hiring from poaching of less financially dependent sectors, before and after the crisis hit Brazil.

This is also a way to take advantage of the richness of our data set. In RAIS it is possible to follow the formally employed workers throughout the years. Also, we can see whether each worker switched jobs in a specific year and across the years [4], so we have information on whether each worker switched sector if s/he switched jobs.

Therefore, in Table 5.7 I use the same specification with hiring from poaching as a dependent variable. In columns (1) and (2) I report the results for the whole sample of workers; in column (2) I add controls and time dummies. The coefficient for the interaction term is negative, as expected, which means that we have reduced hiring from poaching as we move from the less to the more financially dependent industries. In other words, a negative coefficient means that the less financially dependent industries in the manufacturing sectors are "stealing" workers from other sectors more intensely than the more financially dependent sectors during the crisis, as compared to normal periods. However, we cannot reject the hypothesis that the coefficient is zero at the usual significance levels, which does not provide us with enough evidence of reallocation across sectors.

A problem that arises from the definition of this new outcome is that we only have a financial dependence measure for the manufacturing industry sectors. Therefore, we can consider that a worker entering the manufacturing industry from “outside” (i.e, from outside the manufacturing industry) is hired “from poaching”, but we will never know the “true” external dependence of the sector s/he is coming from. At the same time, we know that the manufacturing industry was the most affected one, and we have evidence that it was due to the credit channel. Therefore, it makes sense to investigate the labor reallocation within this industry.

In order to deal with these issues, instead of simply dropping the workers that leave the manufacturing industry, I try to mitigate this problem by constructing a definition of “typical manufacturing industry occupations”. Once

[4] To construct this flow measure by quarter I drop the workers who have switched jobs more than 5 times within the same year

I have that, I drop the workers that do not belong to these occupation categories from my sample. The idea behind it is to select the workers that are more likely to remain in the manufacturing industries; because of that, these workers are more exposed to the risk of being fired, since the manufacturing sector was the most affected by the crisis.

I define Typical Manufacturing Occupations in the following way: (1) I calculate the share of each 5-digit occupation category from CBO (Brazilian Classification of Occupations) in 4 broad sector definition (agriculture, commercial, manufacturing and services); (2) I keep the manufacturing sector only and I drop the occupation categories that are below the 75th percentile of the occupation share distribution; (3) From the remaining cells I calculate the share of each occupation in each 4-digit manufacturing sector and the Herfindhal-Hirschman Index (HHI) for the concentration of occupations across the sectors in the manufacturing industry; (4) I drop the occupations with high HHI (upper half of the distribution), i.e., the occupations that are very concentrated in few 4-digit manufacturing industry.

The first two steps simply drop "non-specialized" industry occupations, and that includes for instance office work, like receptionists and secretaries. Theses workers can easily transit between industries. However, there are occupations with a high share of workers employed in the manufacturing industry, but that are concentrated in few 4-digit manufacturing sector. Take the 5-digit level occupation "Chemical Manufacturing Production Operators"; it obviously is a manufacturing industry occupation, but it is highly concentrated in the Chemical Manufacturing Industry. That is why we calculate the HHI and drop the occupations with high Herfindahl, i.e., highly concentrated in a few 4-digit manufacturing sector.

In columns (3) and (4) of Table 5.7 I report the results for hiring from poaching of workers whose occupation is a typical manufacturing occupation as defined above. In column (4) I include time dummies and industry covariates. Contrary to the first two columns, I do find evidence of poaching from more financially dependent industries to less financially dependent industries. Now the coefficient of the interaction term $CririsxFD$ is negative and statistically significant, which suggests a reallocation of workers from the more to the less financially dependent manufacturing industries.

These results are quite interesting, because they suggest that not only have the firms in the more financially dependent sectors fired more workers; it also means that the workers employed in these sectors during the crisis were less likely to remain in the same sector once laid off, as compared to workers in the less financially dependent sectors.

Table 5.7: Reallocation: Hiring From Poaching

	(1)	(2)	(3)	(4)
	All Workers		Typical Manufacturing Occupations	
VARIABLES	Hiring Poaching	Hiring Poaching	Hiring Poaching	Hiring Poaching
Mean of Dep Var	0.0928	0.0928	0.0376	0.0376
Crisis	-0.0119***	-0.0546***	-0.00925***	-0.0191**
	(0.00254)	(0.00472)	(0.000857)	(0.00147)
Crisis x FD	-0.00239	-0.00731	-0.00321**	-0.00324**
	(0.00597)	(0.00518)	(0.00145)	(0.00130)
Industry FE	x	x	x	x
Time (quarter) dummies		x		x
Industry Covariates		x		x
Observations	5,832	5,808	5,832	5,808
R-squared	0.562	0.67	0.716	0.808

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the quarterly hiring from poaching of other sectors. The coefficient of interest is the one from the interaction term $CrisisxFD$. The results reported in the frist two columns include all workers; the remaining columns include only workers employed in typical manufacturing occupations. In columns (1) and (3) we have industry fixed effects; in columns (2) and (4) I add time dummies (quarter) and industry covariates (the share of workers within each occupation category).

The previous results have investigated the reallocation of workers across sectors during the crisis, exploring the role of the credit channel on these worker transitions. In Table 5.8 we take one step further and explore the reallocation of workers within sectors and across firm's size and age intervals. Firm size and firm age are closely related, because young firms tend to be small. For that reason, certain factors (financial constraint among then) interact both with firm age and firm size and its role can be confounded if we consider only one of the two factors. I divide the sample into two groups of firm age: young firms (up to 6 years old) and mature firms (more than 6 years old)[5]. In order to explored the role of firm size, I divide the sample into two groups of firm size: small firms (up to 14 employees) and medium size/large firms (more than 14 employees). For this analysis the dependent variable is also the hiring from poaching, but now its definition is the following:

$$HR_{i,j,t} = TotalHirings_{i,j,t}/(Empl_{i,j,t-1} + Empl_{i,j,t}) * 0.5$$

Where $TotalHirings_{i,j,t}$ here includes only hires of firms of sector i and of size/age group j from firms of the same sector but from a different size/age

[5]We consider the first appearance of the firm in our sample as the year the firm was born. We do not observe the age of the firm when it is born before 1995, so I set the year of the first appearance as 1995. Therefore, the maximum age of the firms in the sample is 15 years old; according to this criterium, the median of the distribution of the firm's age is then 6 years old.

group. $Empl_{i,j,t}$ is the total employment of within the age (or size)/sector cell. That is, the total hiring here is the poaching of workers across firm age or size thresholds within a 4-digit level manufacturing industry sector. The total hiring from poaching across sizes of small (young) firms in the Furniture Manufacturing sector, for example, is its hiring rate from medium size and large firms (mature) firms within the Furniture Manufacturing sector.

Columns (1) and (2) of Table 5.8 show the results of our baseline specification with hiring from poaching as defined above as a dependent variable, for young and mature firms, respectively. The coefficient of our dummy *Crisis* in column (1) indicates that during the crisis there was a drop in the poaching of young firms from mature firms within a sector, suggesting a reallocation of workers from young to mature firms within a sector during the crisis. If we look at the coefficient of the interaction term in columns (1) and (2) we cannot find enough evidence that this reallocation from young to mature firms was stronger for the more financially dependent sectors. The remaining columns report the same results, separately for small and medium size/large firms. Contrary to the first two columns there didn't seem to be any strong reallocation between size groups within a sector, but we do find that the poaching from small firms to larger firms is stronger for the more financially dependent sector, as shown by the interaction term in column (4).

This is another way to explore the heterogeneity of the worker flows across firms with different degrees of credit constraint; firm age and firm size are often used as a proxy for access to the credit market across firms. We have both theoretical and empirical evidences that financial intermediaries find it much riskier to lend to younger and/or smaller firms[6]. It is common to assume that there is a heterogeneity and uncertainty among entrants, and this uncertainty creates constraints for these firms in the capital market.

We should therefore expect that within a specific sector younger/smaller firms will be particularly harmed by a credit shock. Fort (2013) show that young and small business are hit especially hard in the 2007-2009 recession in the United States. My results in columns (1) and (2) of Table 5.8 are consistent with these predictions. In addition to that, even though we can't find any evidence that the same happened to small firms versus large firms, in columns (3) and (4) we do have evidence that the poaching from small to medium size/large firms was higher in more financially dependent industries. Therefore, if we take firm size and the FD measure as proxies for credit constraint (the first is a measure at the firm level and the second at the sector level), the results from columns (3) and (4) of Table 5.7 and from Table 5.8 reinforce each other

[6]See Gertler & Gilchrist (1994), Sharpe (1994) and Davis & Hawtiwanger (2001)

towards the conclusion that credit indeed played a role in the determination of the reallocation of workers, both within and across sectors.

Table 5.8: Hiring from Poaching by Age/Size and Sector

	(1)	(2)	(3)	(4)
	Age		**Size**	
VARIABLES	Young Firms	Mature Firms	Small Firms	Medium Size/Large Firms
Mean of Dep Var	0.0046	0.0016	0.192	0.0163
Crisis	-0.00191**	-0.00172	-0.0294	-0.00396
	(0.000917)	(0.00130)	(0.0222)	(0.00282)
Crisis x FD	0.000936	0.00107	0.0114	0.00595*
	(0.00104)	(0.00290)	(0.0222)	(0.00353)
Industry FE	x	x	x	x
Time (quarter) dummies	x	x	x	x
Industry Covariates	x	x	x	x
Observations	5,728	5,728	5,728	5,728
R-squared	0.432	0.146	0.068	0.185

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the quarterly hiring from poaching across firm size and firms intervals within a sector. I include time (quarter) dummies and industry covariates (the share of workers within each occupation category). The coefficient of interest is the one from the interaction term $CrisisxFD$. The results reported in the frist two columns are by firm age category (young and mature); the last two columns report results by firm size (small and medium size/big firms).

Table 5.9 takes a further step in the investigation of the heterogeneity of the worker flows across employers with different degrees of financial dependence. Now, the hiring here is the poaching of workers within a firm age or size group from other 4-digit level manufacturing industry sectors. The goal is to investigate if the reallocation of workers across sectors varies significantly depending on the age and the size of the firm. Columns (1) and (2) present the results by firm age category, and columns (3) and (4) present the results by firm size category. If we look at the coefficient of the interaction term in the last two columns, it is clear that the heterogeneity of the hiring from poaching across sectors is stronger for small firms (the coefficient of $CrisisxFD$ is only statistically significant for the small firms, although it is negative for both size intervals), which again reinforces the conclusion that was a more intese movement of workers out of employers that were more exposed to the credit shock.

The concept of hiring from poaching might be hard to grasp, especially in a dif-in-dif approach with continuous treatment intensities (i.e., the FD measure). At the same time, the analysis of the poaching between sectors with different degrees of financial dependence is very important to investigate labor reallocation. In order to have a more concrete sense not only of the direction of

Table 5.9: Hiring from Poaching by Age/Size

	(1)	(2)	(3)	(4)
	Age		**Size**	
VARIABLES	Young Firms	Mature Firms	Small Firms	Medium Size/Large Firms
Mean of Dep Var	0.247	0.129	1.199	0.0664
Crisis	-0.0365***	-0.0154***	-0.368***	-0.0384***
	(0.00463)	(0.00253)	(0.0922)	(0.00654)
Crisis x FD	-0.00919***	-0.00692***	-0.223**	-0.00149
	(0.00332)	(0.00179)	(0.0890)	(0.00888)
Industry FE	x	x	x	x
Time (quarter) dummies	x	x	x	x
Industry Covariates	x	x	x	x
Observations	5,728	5,728	5,728	5,728
R-squared	0.529	0.653	0.597	0.434

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the quarterly hiring from poaching across sectors by firm age and firm size. I include time (quarter) dummies and industry covariates (the share of workers within each occupation category). The coefficient of interest is the one from the interaction term $CrisisxFD$. The results reported in the frist two columns are by firm age category (young and mature); the last two columns report results by firm size (small and medium size/big firms).

Table 5.10: Share of Hiring from Poaching by Quantiles of FD

Distrubution of FD	Normal Period	Crisis	Variation
Bottom Half	0.0400	0.0310	-29.03%
Upper Half	0.0360	0.0208	-73,08%

the reallocation across sectors, but also of the magnitude of this reallocation, in Table 5.10 I split the sectors into 2 quantiles of FD; it give us a discrete treatment intensity measure, which is easier to interpret. $FD = 0$ (the bottom half of the distribution) refers to non financially dependent industries and $FD = 1$ (the upper half of the distribution) refers to financially dependent industries. For each quantile, I calculate the quarterly hiring from poaching and then I take the mean of this measure within the "normal period" of our sample, i.e., before the crisis, and during the crisis (using my usual definition of *Crisis*).

Notice that as we move from the bottom to the upper half of the distribution of FD, the decreasing of the hiring from poaching during the crisis becomes more pronounced. This was already illustrated by the sign of the coefficient of the interaction term crisis x FD on the hiring from poaching regressions.

In this section I presented evidences of reallocation of worker across employers with different degrees of financial dependence/credit constraint. Taking firm size and the FD measure as proxies for credit constraint (the first

is a measure at the firm level and the second at the sector level), the results of Tables 5.7, 5.8 and 5.9 suggests a mobility of workers across sectors; there was a more intese movement of workers out of employers that were more exposed to the credit shock, i.e., more financially dependent/constrained employers.

6
Conclusion

In this paper, I analyze the impact of the 2008 financial crisis over the labor market in Brazil, using the flow approach. My main data source comes from RAIS, a dataset that matches employer-employee data. I investigate if the credit channel was an important propagation channel for the spread of the crisis into the real economy.

The outcome variables that I am interested in are the hiring and separation rates. The idea behind it is that a financial crisis should have a relatively larger impact on sectors with greater *ex ante* financial dependence. I find that credit is an important mechanism of transmission of the shock in the credit markets to the labor market. I find that, although the crisis had an effect on the hiring rate it was not through the credit channel. The cross-sector impact of credit on firings, on the other hand, was significant and economically relevant; during the crisis, an industry in the 90th percentile of the distribution of FD fires approximately 0.9 percentage points more than an industry in the 10th percentile of the distribution. I also find a cross sector impact of the credit shock on the hiring rate on the extensive margin, i.e., the hiring rate from entrant firms. These results are robust to the inclusion of a proxy to control for demand effects.

Moreover, I investigate whether there was a heterogeneity in the cross sector impact of the crisis across workers with different degrees of vulnerability to economic downturns. Firstly, I separate the workers into 5 age categories; I find that younger workers were particularly harmed by the crisis in terms of both diminished hirings and increased firings (the cross sector heterogeneity on firings disappears for workers older than 45 years old), though the effect on the hiring rate is weaker. Secondly, I split the workers into 5 categories of occupations with decreasing degrees of skills; I find that the cross sector impact of the crisis over less skilled workers is higher in terms of firings. There was no heterogeneous impact across sectors on the firing rate among the most skilled occupation category, whereas among the less skilled workers the role of credit is enhanced (as we move from the 10th percentile to the 90th percentile of the financial dependence distribution the firing rate increases by 1.6 percentage points during the crisis).

I also investigate whether the hiring from poaching from more to less financially dependent industries increase during the crisis, as compared to other

periods in our sample. The magnitude and the sign of the coefficient of the interaction term tell us if there was a reallocation of workers across sectors, and whether or not we can find a pattern for this reallocation which is related to the degree of financial dependence of the sector. I find sufficient evidence of a more intese movement of workers out of sectors that were more financially constrained. When we divide the sample at the median, the decreasing of hiring from poaching was 44.05 percentage points higher for the financially dependent sectors.

I also find that within the sector, smaller firms will be particularly harmed by a credit shock. The cross sector impact on poaching from small firms to medium size and big firms within a sector is higher than the cross sector impact on poaching from medium size/big firms to small firms. Moreover, I show evidence that the reallocation of workers across sectors varies significantly depending on the size of the firm. More specifically, the heterogeneity of the hiring from poaching across sectors is stronger for small firms. If we consider the size of the firm as another proxy for the degree of access to the financial markets, these last two results strengthen the conclusion that the credit shock indeed played an important role in the reallocation of workers across sectors (and within sectors and across firm size intervals) with different degrees of financial dependence.

My results are robust to changes in the definition of my treatment intensity variable (i.e., FD) and to different samples, as shown in the Appendix. The 2008 financial crisis was a credit shock that affected worker dismissals and the mobility of workers across sectors and within sectors of the manufacturing industry. A potential next step for this research would be to investigate the reallocation of workers across employers with different degrees of exposure to credit shocks more deeply, using probabilities of transition of workers across firms and sectors.

7
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A
Data Appenddix

Table A.1 describes each 4-digit level CNAE 1.0 sector and its measure of financial dependence according to 12. To create the FD measure for each sector, they use the 3-digit SIC code. I merge the SIC codes and the CNAE 1.0 codes on its most disaggregate level (5-digit level) using a mapping provided by Marc Andreas Muendler. Because the level of some classifications are different in the two systems, when merging the two codes it made sense to work at the 4-digit level of CNAE 1.0 instead of the 3-digit one.

The correspondence between the CNAE 1.0 and the SIC is not straightforward; we don't have a 1 to 1 mapping from the 3-digit SIC to the 4-digit CNAE 1.0. For instance, for one industries in CNAE there might be more than one correspondent industry in SIC and vice-versa. I deal with this issue by simply taking the average of the FD measure across the SIC sectors that correspond to one CNAE 4-digit sector. In Appendix B I do robustness checks using the minimum and the maximum value within each 4-digit level sector.

Table A.1: Financial Dependence

CNAE 1.0	CNAE Description	Financial Dependency
1600	Tobacco Product Manufacturing	-2.572116
2481	Paint, Varnish, Lacquer and Enamel Manufacturing	-1.224618
2142	Printed and Plain Tape and Forms Manufacturing	-1.221747
1932	Athletic Footwear Manufacturing	-1.197611
1931	Leather Footwear Manufacturing	-1.197611
1939	Footwear Manufacturing from Other Materials (except athletic footwear)	-1.197611
2222	Printing Services for Didactic and Commercial Materials	-1.044289
3612	Metal Furniture Manufacturing	-.7588455
3599	Other Transportation Equipment Manufacturing	-.7185011
2922	Electric Industrial-Process Furnace and Oven Manufacturing	-.7124268
2915	Transmissions and Gears Manufacturing	-.7124268
2914	Compressor Manufacturing	-.7124268
2921	Non-Electric Industrial Oven and Thermic Installation Manufacturing	-.7124268
3613	Furniture Manufacturing from Other Materials	-.6772022
3611	Wooden Furniture Manufacturing	-.6719012
3614	Mattress Manufacturing	-.6652992
1561	Sugar Milling and Distilling	-.6406347
1562	Sugar Grinding and Refining	-.6406347
2620	Cement Manufacturing	-.5664647
2511	Tire and Rubber Hose Manufacturing	-.5656249
1933	Rubber and Plastics Footwear Manufacturing	-.5543793
3151	Lamp Bulb Manufacturing	-.5316932
3122	Electrical Equipment for Current-Carrying Wiring	-.5316932
2842	Hardware Manufacturing	-.5294714
2229	Other Printing and Reproduction Services	-.5064406
1556	Prepared Feeds for Animals	-.5018976
1552	Wheat Milling and Wheat Products Manufacturing	-.5018976
1572	Soluble Coffee Manufacturing	-.5018976
1581	Bakery Product, Cakes and Other Pastries Manufacturing	-.4522614
1582	Cookie and Cracker Manufacturing	-.4522614
1554	Corn Milling and Flour Manufacturing	-.4440819
2834	Powder Metallurgy Product Manufacturing	-.4378433
2482	Printing Ink Manufacturing	-.4209324
2491	Adhesives and Sealants Manufacturing	-.4209324
2492	Explosives Manufacturing	-.4209324
2483	Coatings, Solvants and Allied Products Manufacturing	-.4209324
2493	Chemical Catalyst Manufacturing	-.4209324
1583	Chocolate Manufacturing from Cacao Beans and Confectionery Manufacturing	-.4171559
3531	Aircraft Manufacturing	-.4086454
3532	Aircraft Overhauling and Rebuilding	-.4086454
2141	Stationery Products Manufacturing from Paper and Paperboard	-.4051705
2131	Paper Bags and Containers Manufacturing	-.4051705
3511	Ship and Floating Structure Building and Repairing	-.3967446
3512	Boat Building and Repairing for Sports and Leisure	-.3967446
2843	Handtool Manufacturing	-.3929728
2010	Wood Sawing	-.387566
1553	Manioc Milling and Manioc Products Manufacturing	-.3862662
1586	Diet, Infant and Other Canned Food Manufacturing	-.3862662
1523	Fruit and Vegetable Juice Manufacturing	-.3862662
2211	Publishing and Printing of Newspapers	-.3787763
2429	Other Organic Chemical Manufacturing	-.3730887
2310	Coal Products Manufacturing	-.3700115

CNAE 1.0	CNAE Description	rajan_mean
2110	Pulp Manufacturing	-.3618203
2421	Basic Petrochemical Products Manufacturing	-.3571408
2340	Alcohol Production	-.3571408
2422	Intermediates for Resin and Fiber Manufacturing	-.3571408
2972	Heavy Military Equipment Manufacturing	-.3562658
1533	Fats, Oils and Margarine Processing from Plants and Animals	-.34915
2913	Valve and Plumbing Fixture Manufacturing	-.3401584
2029	Other Wood Products Manufacturing (except furniture)	-.3321218
2022	Cut Wood, Wood Structures and Prefabricated Wood Buildings Manufacturing	-.3223675
1521	Fruit Processing and Canning	-.3220698
2023	Wood Containers and Packaging Material Manufacturing	-.3136405
1559	Other Grains and Seeds Milling and Manufacturing	-.3135681
3696	Fastener, Button, Needle and Pin Manufacturing	-.3107086
2473	Perfumes and Cosmetics Manufacturing	-.305454
2471	Soap and Synthetic Detergent Manufacturing	-.305454
2472	Sanitation Good and Polish Manufacturing	-.305454
1555	Corn Oil Manufacturing and Other Grain Preparations	-.2982341
1531	Oilseed Milling	-.2982341
1532	Plant Oil Refining	-.2982341
2122	Paperboard Manufacturing	-.2973194
1513	Rendering and Meat Product Processing	-.2964686
2892	Turned Product, Spring and Wire Product Manufacturing	-.2918346
2924	Commercial Refrigeration and Ventilation Equipment Manufacturing	-.2900442
1811	Underwear and Nightwear Cut-and-Sew Manufacturing	-.286947
2891	Metal Container Manufacturing	-.2822502
2932	Tractor Manufacturing for Agriculture	-.2817887
3130	Electric Wire and Wiring Device Manufacturing	-.2744054
3112	Transformer, Converter and Similar Electrical Product Manufacturing	-.26921
2494	Chemical Additives Manufacturing for Industrial Use	-.2665697
3439	Motor Vehicle Body, Interior and Trailer Manufacturing for Other Vehicles	-.253829
2221	Printing of Newspapers, Magazines and Books	-.25226
2419	Other Inorganic Chemical Manufacturing	-.2506218
2981	Household Cooking, Refrigerating and Laundry Appliance Manufacturing	-.2450849
2964	Apparel, Leather and Footwear Machinery Manufacturing	-.2450849
3695	Pen, Pencil, Marking Device and Other Office Supplies Manufacturing	-.2411577
2414	Industrial Gas Manufacturing	-.2346739
2121	Paper Manufacturing	-.2299972
2839	Metal Coating, Heat Treating and Allied Services	-.2293054
2630	Cement, Concrete Products and Gypsum Products Manufacturing	-.2246214
2812	Metal Structures and Plates Manufacturing	-.2124764
1762	Carpet and Rug Manufacturing	-.2113512
1511	Animal Slaughtering and Meat Processing	-.2075538
1522	Vegetable and Other Plant Processing and Canning	-.2035385
2813	Heavy Gauge Tank and Heater Manufacturing	-.2009244
2811	Prefabricated Metal Structures and Component Manufacturing	-.2009244
2821	Metal Tank and Central Heater Manufacturing	-.2009244
2899	Other Metal Product Manufacturing	-.2003794
3691	Precious Stone, Metal and Jewelry Etching and Engraving	-.1995788
2940	Machine Tool and Tool Manufacturing	-.1970793
2912	Pump and Pumping Equipment Manufacturing	-.1883881

CNAE 1.0	CNAE Description	rajan_mean
1595	Soft Drink Manufacturing	-.1865744
1592	Wineries	-.1865744
1591	Liquor Distilling, Purifying and Bottling	-.1865744
1594	Bottled Mineral Water Manufacturing	-.1865744
1593	Manufacturing of Stout and Beer	-.1865744
1585	Dressing and Other Prepared Sauce, Spices and Concentrate Manufacturing	-.1854133
2841	Cutlery Manufacturing	-.1792376
2522	Plastics Packaging Material Manufacturing	-.1757097
2923	Elevators, Cranes and Other Handling Machinery and Equipment Manufacturing	-.1700804
1723	Artificial and Synthetic Fabric Weaving, Knitting and Processing	-.1663932
2692	Lime and Gypsum Product Manufacturing	-.1641673
2499	Other Miscellaneous Chemical Product Manufacturing	-.159796
2132	Paperboard Containers and Coated Paperboard Manufacturing	-.1583981
2989	Other Household Appliance Manufacturing	-.1442002
1589	Other Food Manufacturing	-.1365265
2971	Fire Arms and Ammunition Manufacturing	-.1351122
1731	Cotton Finishing and Coating	-.1339847
1732	Other Natural Fabric Finishing and Coating	-.1339847
1733	Artificial and Synthetic Fabric Finishing and Coating	-.1339847
1749	Other Textile Goods Manufacturing	-.1339847
1722	Other Natural Fabric Weaving, Knitting and Processing	-.1339847
1779	Other Textile Products Knitting	-.1339847
1771	Fabrics Knitting	-.1339847
1772	Hosiery and Socks Knitting	-.1339847
2021	Plywood and Engineered Wood Products Manufacturing	-.1267722
1000	Coal Mining	-.1262801
2641	Non-refractory Structural Clay Products Manufacturing	-.1262515
1551	Rice Milling and Rice Products Manufacturing	-.1243085
2320	Petroleum Refining	-.1242253
1512	Poultry Slaughtering and Processing	-.1168735
3699	All Other Miscellaneous Manufacturing	-.1142513
2330	Nuclear Combustibles Processing	-.1122069
2411	Chlorine and Alkalies Manufacturing	-.1122069
3121	Industrial Control, Switchgear and Other Apparatus for Energy Distribution and C	-.1072763
1812	Other Apparel Cut-and-Sew Manufacturing	-.1065685
2649	Non-refractory Other Clay Products Manufacturing	-.1025434
1584	Flour Mixes and Dough Manufacturing	-.0954006
3441	Motor Vehicle Engine Parts Manufacturing	-.0939079
1724	Embroidery Fabric Weaving, Knitting and Processing	-.0926365
3152	Lighting Equipment Manufacturing (except for vehicles)	-.0922001
3449	Other Motor Vehicle Parts and Accessories Manufacturing	-.0859792
1821	Apparel Accessories Manufacturing	-.0747428
1721	Cotton Weaving and Processing	-.0718387
2751	Iron and Steel Foundries	-.0476843
3521	Railroad Rolling Stock Manufacturing	-.036966
3522	Railroad Rolling Stock Parts and Accessories Manufacturing	-.036966
2642	Refractory Products Manufacturing	-.0355704
3111	Electric Generator Manufacturing	-.0198
3191	Carbon and Graphite Product Manufacturing for Electrical Uses	-.0198
3523	Railroad Rolling Stock Overhauling and Rebuilding	-.010734
2699	Other Nonmetallic Mineral Product Manufacturing	.0002912
2213	Publishing and Printing of Books	.0056676

CNAE 1.0	CNAE Description	rajan_mean
3410	Automobile, Light Truck and Utility Vehicle Manufacturing	.0059695
3442	Motor Vehicle Transmission and Power Train Parts Manufacturing	.0059695
3420	Heavy Duty Truck and Bus Manufacturing	.0059695
3431	Motor Vehicle Body, Interior and Trailer Manufacturing for Trucks	.0059695
3450	Rebuilding of Engines for Motor Vehicles	.0059695
3432	Motor Vehicle Body Manufacturing for Buses	.0059695
3444	Motor Vehicle Steering and Suspension Components Manufacturing	.0059695
2952	Mining and Construction Machinery and Equipment Manufacturing	.0154979
2951	Oil and Gas Field Machinery and Equipment Manufacturing	.0154979
2954	Road Construction Machinery and Equipment Manufacturing	.0154979
2953	Tractor Manufacturing for Mining and Construction	.0154979
3350	Watch and Clock Manufacturing	.0217812
3443	Motor Vehicle Brake System Manufacturing	.0305401
1741	Household Textile Manufacturing	.031408
1761	Textile Products Manufacturing from Fabrics	.031408
1764	Special Fabrics and Textile Products Manufacturing	.031408
1750	Textile Production Services	.031408
1769	Other Textile Products Manufacturing (except apparel)	.031408
1571	Coffee Roasting and Grinding	.0333531
2521	Laminated Plastics Plate and Pipe Manufacturing	.0537512
1421	Chemical and Fertilizing Mineral Mining	.0551107
1422	Salt Extraction, Mining and Refining (including maritime salt extraction)	.0551107
1429	Other Nonmetallic Mineral Mining	.0551107
1410	Stone, Sand and Clay Mining and Quarrying	.0551107
2611	Flat and Security Glass Manufacturing	.058637
2612	Glass Container Manufacturing	.058637
3340	Optical Instruments and Components and Photographic and Cinematographic Equipmen	.0593426
2741	Aluminum Production and Processing	.0599195
3320	Instrument Manufacturing for Measuring, Testing and Controlling (except for cont	.0617455
1514	Seafood Processing and Canning	.0694424
2729	Iron and Steel Processing and Steel Wire Drawing	.07135
2929	Other General-Purpose Machinery Manufacturing	.0736644
1822	Industrial and Personal Security Accessories Manufacturing	.0779359
2433	Elastomers Manufacturing	.0945194
2441	Artificial Fibers and Filaments Manufacturing	.0945194
2432	Non-thermal-forming Resin Manufacturing	.0945194
2431	Thermal-forming Resin Manufacturing	.0945194
2442	Synthetic Fibers and Filaments Manufacturing	.0945194
3697	Broom, Brush and Mop Manufacturing	.0949311
2749	Other Nonferrous Metals Production and Processing	.0955563
2529	Other Plastics Product Manufacturing	.1004149
2931	Farm Machinery and Equipment Manufacturing	.1152748
2832	Nonferrous Forgings	.1183764
2831	Iron and Steel Forgings	.1183764
3330	Instruments, Equipment and Related Products Manufacturing for Automation and Con	.1358029
2712	Iron and Steel Formed Sheets Production in Integrated Mills	.1393272
2711	Iron and Steel Plain Sheets, Plates and Foils Production in Integrated Mills	.1393272
2721	Basic Iron and Steel Works	.1393272
2722	Primary and Semi-Finished Iron and Steel Production	.1393272
2731	Iron and Steel Seamed Tubes Production	.1393272
2739	Other Iron and Steel Tubes Production	.1393272
3160	Electrical Equipment Manufacturing for Vehicles (except batteries)	.149967
1910	Leather and Hide Cutting, Tanning and Finishing	.1584541
2519	Other Rubber Product Manufacturing	.1709916
2925	Air-Conditioning Equipment Manufacturing	.1842284

CNAE 1.0	CNAE Description	rajan_mean
2149	Other Pulp, Paper and Paperboard Products Manufacturing	.1893393
2742	Precious Metals Production and Processing	.1942344
3694	Toy and Game Manufacturing	.2281859
3693	Hunting, Fishing and Sporting Goods Manufacturing	.2313202
2495	Photographic Plates, Films, Paper and Other Photographic Chemicals	.2428049
1813	Professional Gear Cut-and-Sew Manufacturing	.2505202
2833	Stamped Metal Products Manufacturing	.2780268
2893	Domestic Utensil Manufacturing	.2780268
2969	Other Specific-Use Commercial Machinery Manufacturing	.3003368
3592	Bicycle and Tricycle Manufacturing	.3114415
3591	Motorcycle Manufacturing	.331234
1120	Petroleum and Gas Extraction Services	.3372929
2212	Publishing and Printing of Magazines	.3684494
1542	Dairy Product Manufacturing	.419125
1541	Fluid Milk Manufacturing	.419125
1543	Ice Cream Manufacturing	.419125
3210	Basic Electronic Component Manufacturing	.4265051
2911	Internal Combustion Engines, Turbines and Other Non-Electric Generator Manufactu	.4633065
2462	Fungicides Manufacturing	.4745706
2413	Phosphatic, Nitrogenous and Potassic Fertilizer Manufacturing	.4745706
2469	Other Agricultural Chemicals Manufacturing	.4745706
2463	Herbicides Manufacturing	.4745706
2461	Insecticides Manufacturing	.4745706
2412	Fertilizer Ingredient Processing	.4745706
3199	Other Electrical Machinery, Equipment and Supplies Manufacturing	.4779124
3230	Audio and Video Equipment Manufacturing	.5107707
2963	Textile Machinery Manufacturing	.5123384
2822	Boiler and Heat Exchanger Manufacturing	.5123384
2962	Food Product Machinery Manufacturing	.5123384
2965	Pulp, Paper, Paperboard and Paper Products Machinery Manufacturing	.5123384
2961	Machinery and Equipment Manufacturing for Metallurgy (except machine tools)	.5123384
1110	Petroleum and Gas Extraction	.5238096
2214	Publishing of Records, Tapes, Disks and Other Recording Materials	.5924613
3221	Radio and Television Broadcasting and Telephone Exchange Equipment Manufacturing	.605655
3011	Non-Electronic Typewriting, Calculating, Copying and Office Machinery Manufactur	.6430623
3012	Electronic Typewriting, Calculating, Copying and Office Machinery Manufacturing	.6430623
2619	Glass Product Manufacturing	.6582255
2232	Video Tapes Reproducing	.7343383
2233	Motion Picture Reproducing	.7343383
2231	Records, Tapes and Disks Reproducing	.7343383
3310	Medical and Therapeutic Apparatus Manufacturing	.8408564
3222	Telephone and Similar Communication Apparatus	.9241068
3192	Electrical Signals and Alarm Equipment Manufacturing	.9241068
3141	Battery Manufacturing (except for vehicles)	.9756248
3142	Battery Manufacturing for Vehicles	.9756248
3113	Electric Motor Manufacturing	.9756248
2496	Disk and Tape Manufacturing	1.009472
3021	Electronic Computer Manufacturing	1.04332
3022	Peripherals Manufacturing for Data Processing Equipment	1.04332
1321	Aluminum Mining	1.07236
1329	Other Metal Ore Mining	1.07236
1325	Radioactive Ore Mining	1.07236
1324	Precious Metal Mining	1.318469
2219	Publishing and Printing of Other Products	2.075268

B
Robusteness Checks

As mentioned before, I take the average of the 31 measure across the SIC sectors that correspond to one CNAE 4-digit sector and use it as a FD measure. To check if the results are not driven by this specific way of calculating the measure within sectors, the first two columns of Table B.1 report the results of my main specification using the maximum and the minimum of the FD measure within each 4-digit CNAE 1.0, respectively. The coefficient of the interaction term is still positive and statistically significant for both definitions, although it drops by almost 50% when we use the maximum value of FD.

In the remaining columns I run the same specifications for the three definitions of FD (maximum, minimum and mean value), but for different samples. In columns (3) to (5) I drop the years 2005 and 2006 and in columns (6) to (8) I further drop 2010. The results don't change much (except for the specifications with the FD max, in which the coefficient of interaction is actually higher with the restricted samples).

Table B.1: Firing Rate With Different Definitions of FD and Different Samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Whole Sample			**2007-2010**			**2007-2009**	
VARIABLES	Max	Min	Mean	Max	Min	Mean	Max	Min
Mean of Dep Var	0.0673	0.0673	0.0699	0.0699	0.0699	0.0708	0.0708	0.0708
Crisis	0.0192***	0.0221***	0.0196***	0.0175***	0.0206***	0.0218***	0.0196***	0.0227***
	(0.00272)	(0.00283)	(0.00280)	(0.00272)	(0.00285)	(0.00232)	(0.00227)	(0.00235)
Crisis x FD Max	0.00496**			0.00596**			0.00645***	
	(0.00220)			(0.00234)			(0.00204)	
Crisis x FD Min		0.00711***			0.00695***			0.00771***
		(0.00218)			(0.00197)			(0.00202)
Crisis x FD Mean			0.00893***			0.00997***		
			(0.00261)			(0.00226)		
Industry FE	x	x	x	x	x	x	x	x
Industry covariates	x	x	x	x	x	x	x	x
Time (quarter) Dummies	x	x	x	x	x	x	x	x
Observations	5,816	5,816	3,844	3,844	3,844	2,888	2,888	2,888
R-squared	0.207	0.209	0.170	0.168	0.168	0.199	0.196	0.197

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The table report the results of the baseline specification having the quarterly firing rate as dependent variables. I include time (quarter) dummies and industry covariates (the share of workers within each occupation category). The coefficient of interest is the one from the interaction term $Crisis x FD$. In the first two columns I use my original sample but a different definition of FD measure: its maximum and minimum value within each 4-digit level CNAE. In columns (3) to (8) I use different samples for the three definitions of FD; in columns (3) to (5) I drop years 2005 and 2006 and in columns (6) to (8) I further drop year 2010.

Columns (1) and (2) of Table B.2 reports the results for hiring from poaching, using different definitions of the FD measure (its maximum and minimum values within the CNAE 1.0 4-digit sector classification). Overall, it does not change our previous conclusion that there seems to be a reallocation of workers from the more to the less financially dependent industries, because the coefficient remains negative and significant. When we use the maximum value of FD in column (2) the coefficient's absolute value drops by almost half if compared to table 5.7, and looses statistical significance (although it is still significant at 10%).

In the regressions I presented using hiring from poaching across sectors as a dependent variable, I include only workers employed in "typical manufacturing occupations", according to the definition I presented in section 6.3. One might argue that the percentiles I've chosen (for share of occupations within the broad definition of sectors and for the Herfindahl index of concentration of occupations across the 4-digit level industries) to redefine my sample are quite arbitrary. Therefore, in Columns (3) and (4) of Table B.2 I report the same results as Columns (3) and (4) of Table 5.7, but using a different definition of "typical manufacturing occupations". Now, instead of dropping the occupation categories that are below the 75th percentile of the occupation share distribution, I drop the occupation categories that are below the 90th percentile of the occupation share distribution. I keep dropping the upper half of the distribution of concentration of occupations by 4-digit level manufacturing industries (based on the Herfindahl Index). The coefficients are still negative and statistically significant, although both the absolute value of the coefficients and its significance are lower. Once again, my general conclusions about the reallocation of workers across sectors with different degrees of financial dependence do not change.

Table B.2: Hiring From Poaching With Different Definitions of FD and Typical Manufacturing Occupations

	(1)	(2)	(3)	(4)
	FD max and min		**Manuf Occ**	
VARIABLES	Poaching	Poaching	Poaching	Poaching
Mean of Dep Var	0.0376	0.0376	0.00804	0.00804
Crisis	-0.0195***	-0.0184***	-0.00225***	-0.00344***
	(0.00147)	(0.00144)	(0.000380)	(0.000620)
Crisis x FD min	-0.00267**			
	(0.00127)			
Crisis x FD max		-0.00204*		
		(0.00107)		
Crisis x FD mean			-0.00161*	-0.00160*
			(0.000827)	(0.000869)
Industry FE	x	x	x	x
Industry covariates	x	x		x
Time (quarter) Dummies	x	x		x
Observations	5,808	5,808	5,804	5,780
R-squared	0.808	0.808	0.776	0.801

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the quarterly hiring from poaching of other sectors. I include time (quarter) dummies and industry covariates (the share of workers within each occupation category). The coefficient of interest is the one from the interaction term $CrisisxFD$. The results reported include only workers employed in typical manufacturing occupations. In columns (1) and (3) I use my original sample but a different definition of FD measure: its maximum and minimum value within each 4-digit level CNAE. In columns (3) and (4) I use different definition of typical manufacturing occupations.