Journal of Monetary Economics 58 (2011) 551–563

Contents lists available at SciVerse ScienceDirect

Journal of Monetary Economics

journal homepage: www.elsevier.com/locate/jme

Credit reallocation

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ARTICLE INFO

Article history:
Received 7 June 2007
Received in revised form
9 November 2011
Accepted 9 November 2011
Available online 9 December 2011

ABSTRACT

A growing empirical literature finds that the allocation of credit across firms is as important as its total volume for economic performance. This paper investigates the process through which credit is reallocated across US businesses employing the methodology developed by Davis and Haltiwanger (1992) for the analysis of job reallocation. We find that credit reallocation is intense, highly volatile and moderately procyclical and that it primarily occurs across firms similar in size, industry or location. The results suggest that microeconomic heterogeneity can play a key role in the interaction between the credit market and the aggregate economy.

1. Introduction

The study of the aggregate economy often builds on the simplifying assumption of homogenous firms. An implication of this assumption is that the total volume of physical and financial inputs (labor, capital, external finance) employed by the business sector is the major force driving economic activity. It is then not surprising that a large body of empirical literature focuses on the aggregate dynamics of these inputs. This approach has been challenged in recent years. There is growing evidence that the allocation of labor and physical capital across firms plays a role as important as their total volume for economic performance (Davis and Haltiwanger, 1999; Foster et al., 2001; Caballero and Hammour, 2005). This has prompted researchers to investigate empirically the dynamic process of inter-firm reallocation of jobs (Davis and Haltiwanger, 1992; Davis et al., 1996) and capital (Eisfeldt and Rampini, 2006; Ramey and Shapiro, 1998). By contrary, the inter-firm reallocation of financial resources remains under-explored. Yet, there is also growing evidence on the importance of the allocation of finance. Jayaratne and Strahan (1996) document that the liberalization of the credit markets of US states that occurred between the 1970s and the 1990s promoted economic activity by affecting the allocation of credit across businesses. Beck et al. (2000), De Gregorio and Guidotti (1995), Wurgler (2000) and Galindo et al. (2007) draw similar conclusions studying credit market development and liberalization in broad sets of countries. These papers complement the traditional finding that the total volume of credit available to the business sector matters for firm performance (Levine and Zervos, 1998).

In light of these considerations, it appears important to integrate the empirical literature with a study of the dynamic process of reallocation of financial resources and its relation with key macroeconomic aggregates. It is worth stressing upfront that our objective is not to test a specific theory: we still lack a fully fledged dynamic general equilibrium model that incorporates the financing choices of heterogeneous firms and investors as well as aggregate and idiosyncratic shocks and that can therefore yield clear-cut predictions for the inter-firm reallocation of financial resources. Yet, building on

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0304-3932/$ - see front matter
doi:10.1016/j.jmoneco.2011.11.008

established models (e.g., Bernanke and Gertler, 1989), a growing literature on the interaction between financial markets and the macroeconomy argues that the credit market is characterized by significant microeconomic heterogeneity (see, e.g., Caballero and Hammour, 2005; Wasmer and Weil, 2004; Den Haan et al., 2003; Dell'Ariccia and Garibaldi, 1998). In particular, even within sectors, size classes and regions, firms can have differential access to credit and be subject to continuous idiosyncratic shocks to their borrowing capacity. Moreover, according to this literature, the reallocation of financial resources induced by microeconomic heterogeneity can be hindered by credit market frictions. Therefore, if the allocation of credit matters for firm performance, as the above empirical studies suggest, the interaction between the process of credit reallocation induced by microeconomic heterogeneity and the frictions in the reallocation process can significantly affect macroeconomic variables. The empirical facts uncovered in this paper can thus provide guidance for models that investigate the impact of financial markets on the macroeconomy.

This study focuses on credit (debt from firms' perspective), which represents the main form of external finance of US businesses (Rajan and Zingales, 1995).[1] The Flow of Funds Accounts of the United States published by the Board of Governors of the Federal Reserve System reveal that over the second half of the 20th century US non-financial businesses generally increased their reliance on debt while in many years they repurchased more equity than they issued. Debt is not only the main form of external finance of US firms but it also has distinct costs and benefits that sharply differentiate it from equity (Myers, 2001). For example, unlike equity, debt is a "hard claim" that can prevent firms from wasting cash flow and provide creditors with incentives to monitor firms; at the same time, being a hard claim, debt can exacerbate firms' incentive to carry out risky projects.

In order to measure credit reallocation, this paper adopts the statistical methodology developed by Davis and Haltiwanger (1992) and Davis et al. (1996) for the measurement of job reallocation. Since the Flow of Funds Accounts are silent on the allocation of credit within the business sector, we resort to firm balance sheet data from US Compustat tapes. We compute inter-firm flows of credit and compare their empirical properties with those of the inter-firm flows of jobs, physical capital and sales. The paper documents that at any phase of the business cycle inter-firm credit flows exceed those needed to accommodate net credit changes and are even larger than the inter-firm flows of jobs, capital and sales. Thus, credit reallocation is a continuous, quantitatively important process. The data also reveal that the intensity of credit reallocation varies substantially across size classes (being stronger for smaller firms) and across industries, while it does not vary much geographically (across census regions or states). Next, the paper turns to study the time series properties of credit flows. Credit reallocation is highly volatile (no less volatile than the reallocation of jobs and sales), with credit destruction being more volatile than credit creation. Moreover, it is moderately procyclical, due to a procyclical credit creation and a more mildly countercyclical credit destruction.[2] In the data, instead, the reallocation of jobs appears to be slightly countercyclical (or acyciclical). Finally, the analysis examines intrasectoral and intersectoral dynamics. The reallocation of credit within groups of firms similar in size, industry or location is more intense than the reallocation across groups. In addition, the dynamics of credit reallocation reflect the idiosyncratic behavior of debt changes within these groups more than translations of the sectoral distributions of the debt changes.

The rest of the paper unfolds as follows. Section 2 reviews the prior literature. Section 3 describes the methodology while Section 4 investigates the magnitude and cross-sectional properties of credit reallocation. Section 5 characterizes the time series properties of reallocation. Section 6 concludes.[3]

2. Prior literature

There is a small but growing literature on finance and reallocation. Using data from US banks' Call Report Files, Dell'Ariccia and Garibaldi (2005) present evidence of an intense inter-bank reallocation of loans. Their work provides valuable information on the dynamics of liquidity in the financial intermediation sector but limited information on the inter-firm reallocation of credit. A bank can contract its loans to a firm and expand its loans to another: this will induce credit reallocation across firms but not across banks. Analogously, a firm can contract its borrowing from a bank and expand its borrowing from another: this will induce credit reallocation across banks but not across firms. In fact, many firms borrow from multiple banks and compensate for the contraction of credit by one bank by increasing their borrowing from another (Detragiache et al., 2000; Petersen and Rajan, 1994). Together with the fact that many firms can also replace bank loans with non-bank credit, these arguments imply that in periods in which inter-bank loan reallocation is intense inter-firm credit reallocation can be moderate and viceversa. Thus, the processes that govern reallocation on the supply and demand side of the credit market can be very different. Our work also relates to the analyses of "flights to quality", episodes of reallocation of credit from small to large firms that occur during some recessions (Bernanke et al., 1996; Oliner and Rudebusch, 1996). One version of the flight to quality argument is that following negative aggregate shocks financiers contract credit to informationally opaque small firms, whereas they accommodate the increasing credit demand of informationally transparent big firms. The facts uncovered in this analysis imply that inter-firm credit reallocation is a continuous, major process with different properties from the flight to quality episodes.

[1] Following an extensive literature, we consider financial debt and exclude trade debt.

[2] Credit reallocation exhibited a more persistent drop during recent recessions (1990–1991 and 2001) than in previous ones.

[3] An Appendix with details on the data and other Supplementary materials is available on ScienceDirect.

The second related literature examines the impact that the financial system has on the macroeconomy through the allocation of financial resources (see, e.g., Jayaratne and Strahan, 1996; Beck et al., 2000; De Gregorio and Guidotti, 1995). Typically, this literature has looked at the evolution of credit allocation using measures of firm performance in the credit market (e.g., non-performing loans) or of firm productivity. These measures do not permit one to discern whether an improvement in the performance of borrowing firms reflects a change in the allocation of credit across businesses or, for instance, an improvement in creditors' monitoring of established businesses. By studying the dynamics of credit allocation, our work uses a methodology that can help separate these channels.

3. Methodology

This section describes the data and the methodology used to construct credit flows.

3.1. Overview of the data

Our main data source is the Standard and Poor's Full-Coverage Compustat tapes, which provide information on the balance sheets and income statements of all publicly traded US firms. Being interested in firms that demand rather than supply credit, we remove all firms in the "finance, insurance, and real estate" industry group. There are advantages and drawbacks in using Compustat data. On the negative side, Compustat excludes small firms. For example, in 1995 the average net sales of non-financial Compustat firms amounted to 784.54 million dollars while the median (25th percentile) was 61.11 (11.11) millions; in the same year, firms with less than 500 employees accounted for 51% of the total. On the plus side, despite the exclusion of small businesses, Compustat firms represent a large fraction of the US economy. For instance, in 1995 the firms in our sample accounted for roughly one third of the employment and one-half of the debt of non-financial US businesses. Using an adjustment factor to exclude sales of intermediate goods, Chun et al. (2008) calculate that in the 1971–2000 period the sales of Compustat firms represented on average about half of the US GDP. Again on the plus side, the comprehensive scope of Compustat enables us to analyze credit reallocation both in the aggregate economy and in the manufacturing sector alone. This is important because, as pointed out by the job reallocation literature (e.g., Foote, 1998), the reallocation of resources can exhibit different dynamics in these two contexts. In addition, Compustat covers a long period, which allows us to investigate the long-run behavior of credit flows: the original sample comprises annual data from 1950 to 2009. For the first 2 years, the number of observations is disproportionately lower than for other years. Moreover, the results might be biased by the disruption of the credit market that occurred during the 2008–2009 financial crisis. Thus, we work with annual data from 1952 to 2007.

3.2. Definitions

In finance, perhaps the majority of studies concentrate on long-term debt (see, e.g., Bradley et al., 1984) while others include short-term debt (see, e.g., Ferri and Jones, 1979). Short-term debt mostly covers the time lag between the financing of current business operations (e.g., payment of inventories or wages) and the accrual of returns. Long-term debt typically finances long-term plans (e.g., purchases of equipment or structure). To the extent that long-term investment plans have the most persistent impact on firm output and productivity, the reallocation of long-term debt can be particularly informative. Thus, the paper presents results for both total debt and long-term debt.

Following an established practice in the literature, our notion of debt includes all forms of financial debt but excludes accounts payable to suppliers. There are strong reasons for this. Trade credit is frequently used for purposes unrelated to financing, for example, to reduce the frequency of payments to suppliers and, hence, transaction costs or to ensure recourse in case of inferior product quality (Rajan and Zingales, 1995). It is also used like advertising to differentiate products. The transaction purposes of trade credit tie its dynamics to firms' commercial policy rather than to their financing policy. Second, even when used for financing purposes, trade credit and other forms of finance differ along important dimensions and are poor substitutes. Trade credit is extended by firms under specific contracts; it is very costly and firms use it only when they cannot obtain cheaper financing (Petersen and Rajan, 1994). Indeed, because of its cost, firms do not rely on trade credit to finance long-term investment and production plans, which have the most persistent impact on firm performance.

3.3. Measurement issues

The measurement of credit flows involves some methodological issues. The first is that ideally one would want to measure the reallocation of credit across projects. However, the firm constitutes our unit of observation and credit flows within firms cannot be measured. Thus, the analysis will tend to underestimate credit reallocation.[4] The second issue regards firm entry. Some firms that enter the data-set are newly founded while others are existing firms that file with the Securities and Exchange Commission, become incorporated, or result from the divestiture of bigger firms. To avoid counting the debt of existing firms that enter the data-set as additions to the aggregate stock of credit, we adopt the

[4] A problem of underestimation also arises from the point-in-time nature of the data.

criterion put forward by Ramey and Shapiro (1998). Typically, the gross book value of physical capital of a new firm is similar to its net book value. Thus, we drop firms that appear in the data-set for the first time and have a ratio between the end-of-period gross capital and the end-of-period net capital above 120%.

The third issue is firm exit. Compustat specifies why a firm exits from the data-set: merger and acquisition, bankruptcy, liquidation, conversion to a private company, leveraged buyout, or unspecified. We consider exits due to merger or acquisition, bankruptcy or liquidation as credit subtractions, but not exits for other reasons (see Ramey and Shapiro, 1998, for an analogous approach). There is a strong reason to treat the exit of a merged or acquired firm as a credit subtraction. When two firms merge, the management and workforce of one acquires control over the financial resources of the other. Thus, for the financiers of either firm this is at least partly equivalent to reallocating credit between two firms. Indeed, a large body of the literature (e.g., Servaes, 1991) finds that the announcement of mergers significantly affects the stock market valuation of target and acquirer, suggesting that mergers have important real effects.

The fourth issue regards the use of fiscal or calendar year. In Compustat the data for a whole fiscal year are attributed to the calendar year in which the fiscal year ends if the fiscal year ends after May 31st and to the previous one otherwise. We recalculated credit flows partitioning fiscal year data proportionally into calendar years. The results were virtually identical and therefore the original data were used.

The final issue concerns inflation. To capture changes in firms' real exposure to financiers and relate the dynamics of inter-firm credit flows to those of real variables, we deflate the original data using the implicit GDP deflator. While nominal (non-deflated) credit flows might offer different insights from real flows, our qualitative results are robust to using nominal flows.[5]

3.4. Aggregation

To measure credit flows, this paper adopts the well-established methodology developed by Davis and Haltiwanger (1992) and Davis et al. (1996) for the measurement of job flows. Denote by c_{ft} the average of the debt of a firm f at time $t-1$ and at time t. For a set s of firms, define C_{st} in an analogous manner. We define the time t debt growth rate of a firm (g_{ft}) as the first difference of its debt divided by c_{ft}. This measure g_{ft} takes values in the interval $[-2,2]$; for newborn firms g_{ft} equals 2 while for dying firms g_{ft} equals -2. This measure of the growth rate is a monotonic transformation of the percentage change and roughly coincides with it for small growth rates. It involves two crucial benefits relative to the percentage change. First, it is bounded, facilitating an integrated treatment of births, deaths and continuing firms (Davis and Haltiwanger, 1992). Second, it is symmetric about zero, while the percentage change ranges from -1 (exit) to $+\infty$ (entry). Törnqvist et al. (1985) discuss the importance of the symmetry property for measures of relative change. The distribution of the growth rates of total debt (not displayed) reveals that 79% of the observations are clustered in the interval $[-1,+1]$.

Given a set s of firms, credit creation at time t (POS_{st}) is calculated as the weighted sum of the debt growth rates of firms with rising debt or newborn firms. Analogously, credit destruction (NEG_{st}) is calculated as the weighted sum of the absolute values of the debt growth rates of firms with shrinking debt or dying firms. Both these sums are computed weighting the debt growth rate of a firm f by the ratio c_{ft}/C_{st}, that is

$$POS_{st} = \sum_{\substack{f \in s_t \\ g_{ft} > 0}} g_{ft} \left(\frac{c_{ft}}{C_{st}} \right), \tag{1}$$

$$NEG_{st} = \sum_{\substack{f \in s_t \\ g_{ft} < 0}} |g_{ft}| \left(\frac{c_{ft}}{C_{st}} \right), \tag{2}$$

where s_t is the set of firms at time t. Credit reallocation (SUM_{st}) is then defined as the sum of credit creation and credit destruction ($SUM_{st} = POS_{st} + NEG_{st}$) and excess credit reallocation (EXC_{st}) is defined as the reallocation in excess of the net credit change (NET_{st}) expressed in absolute value ($EXC_{st} = SUM_{st} - |NET_{st}|$, where $NET_{st} = POS_{st} - NEG_{st}$). A net increase in credit can be attained through a positive value of credit creation and a zero value of credit destruction; a net decrease in credit can be attained through a positive value of credit destruction and a zero value of credit creation. Thus, EXC_{st} measures credit reallocation in excess of the minimum required to accommodate net credit changes.

4. Magnitude and cross-sectional properties

The intensity of credit reallocation can signal whether reallocation may have a sizable impact on economic activity. Furthermore, investigating which firms engage more in reallocation can help shed light on the factors that stimulate or hinder it. This section thus studies the magnitude and cross-sectional properties of credit reallocation.

[5] Results with nominal data are available from the authors.

4.1. Magnitude

Fig. 1 plots real net debt changes, net equity issues (issues minus repurchases) over net worth and the aggregate leverage ratio (debt over net worth) of non-financial US businesses computed using the Flow of Funds Accounts.

In the 1952–2007 period debt changes were generally positive. This reflected not only the expansion of the business sector but also its increasing reliance on debt. Indeed, in several years net equity issues were negative; moreover, the aggregate leverage ratio rose from the 1960s to the 1980s (with an acceleration during the 1980s) and slightly dropped thereafter. The dynamics of debt changes of the whole business sector closely resemble those of Compustat firms (compare Fig. 1 with Fig. 2).

Unlike the dynamics of aggregate credit changes just outlined, the inter-firm reallocation of credit has received little attention so far. Besides the average net credit change of Compustat firms, Panel A of Table 1 reports the average credit creation, destruction, reallocation and excess reallocation for the 1952–2007 period and for various sub-periods. The average rate of creation of total credit over the sample period approximately equals 11.5% while the average credit destruction equals 6.5%. Hence, the average reallocation is 18% and the average net change is 5%. The average excess reallocation is slightly more than 12% (see Fig. 2 for the plot of credit reallocation). These figures imply that on average flows of credit in and out of firms substantially exceed net flows, an observation that is confirmed if one restricts attention

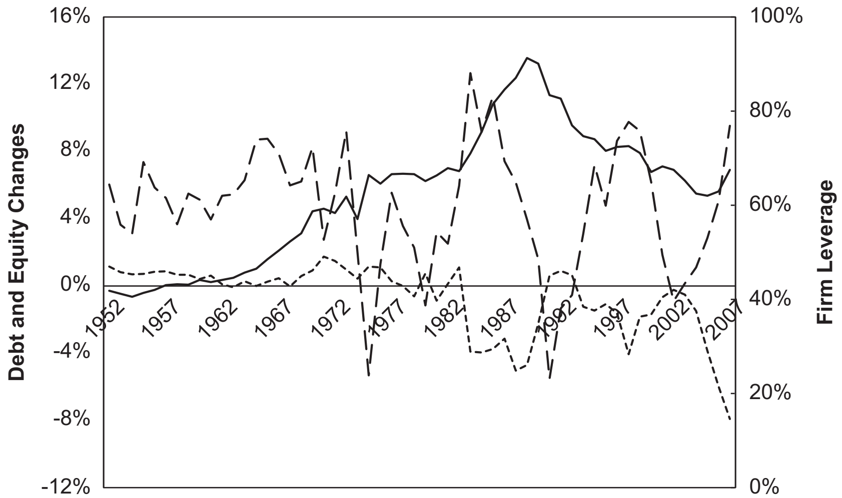

Fig. 1. This figure plots annual data for real debt changes, net equity issues over net worth, and the leverage ratio (debt over net worth) of non-financial US businesses for the 1952–2007 period (computed using the Flow of Funds Accounts). The dashed line denotes the percentage net debt change; the dotted line denotes net equity issues over net worth; the solid line denotes the leverage ratio.

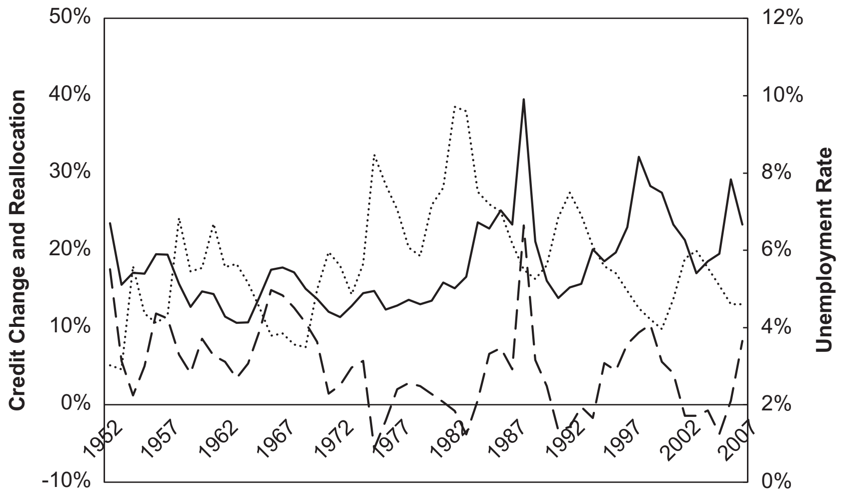

Fig. 2. This figure plots annual data for aggregate real credit flows for Compustat firms and the US rate of unemployment in the 1952–2007 period. The dashed line denotes the percentage net credit change; the solid line denotes the percentage credit reallocation rate; the dotted line denotes the unemployment rate.

Table 1
Magnitude and volatility of gross flows.

Variable (period)	POS	NEG	NET	SUM	EXC
Panel A: average flows					
Total credit (52-07)	11.40	6.69	4.72	18.09	12.38
Long-term credit (52-07)	11.14	6.69	4.35	17.84	12.80
Jobs (52-07)	6.04	4.61	1.43	10.65	8.08
Sales (52-07)	7.81	4.26	3.55	12.07	7.03
Total credit (59-95)	13.40	8.09	5.31	21.50	14.23
Physical capital (59-95)	9.70	7.30	2.40	17.10	14.20
Total credit (52-59)	12.71	4.83	7.88	17.55	9.67
Total credit (60-69)	11.71	2.60	9.10	14.31	5.21
Total credit (70-79)	7.66	5.43	2.23	13.09	9.32
Total credit (80-89)	13.09	8.56	4.53	21.66	16.21
Total credit (90-99)	11.71	8.55	3.17	20.26	15.46
Total credit (00-07)	11.93	10.54	1.39	22.47	19.26
Variable (period)	POSbig	NEGbig	NETbig	SUMbig	EXCbig
Panel B: average flows due to large changes					
Total credit (52-07)	8.51	4.39	4.12	12.91	8.20
Jobs (52-07)	3.09	2.82	0.27	5.90	4.62
Sales (52-07)	3.95	2.84	1.11	6.79	4.21
Variable (period)	POS	NEG	NET	SUM	EXC
Panel C: coefficient of variation of the flows					
Total credit (52-07)	42.14	46.44	120.20	31.88	45.43
Long-term credit (52-07)	38.03	54.45	97.69	37.00	52.93
Jobs (52-07)	30.59	51.75	211.75	28.15	51.69
Sales (52-07)	35.88	71.21	131.30	29.22	58.88

Notes: Panel A of this table reports average annual flows of credit, jobs and sales for firms in Compustat in the sample period (1952–2007) and in various sub-periods. POS stands for creation, NEG for destruction, NET stands for net change, SUM for reallocation and EXC for excess reallocation. The panel also reports average annual flows of physical capital for Compustat firms in 1959–1995 from Ramey and Shapiro (1998). Panel B of the table reports average annual flows for Compustat firms constructed from large changes of credit, jobs and sales. Panel C reports the coefficient of variation of the annual flows of credit, jobs and sales in the sample period.

to the flows of long-term credit. In addition, the yearly data (not tabulated) reveal the simultaneous presence of large positive and negative credit flows at any phase of the business cycle. For example, in each year between 1980 and 2007 both credit creation and destruction exceeded 5%. Since the largest 1% of firms in Compustat account for a sizable share of total sales (between 20% and 30% in most years of the sample) the reader may wonder whether the intensity of reallocation changes when one drops these firms. Truncating the data at the 99th percentile of sales leads to marginal differences from the whole sample: the average reallocation of total credit equals 20% and the average excess reallocation 15%. These figures just slightly exceed those for the whole sample, reflecting the fact that credit reallocation is less intense for large businesses, as it will be shown shortly.

Inspection of Table 1 and Fig. 2 suggests that, though large in all time periods, credit reallocation varies in intensity across periods. For instance, both reallocation and excess reallocation were more intense in the 1980s than in the 1970s, with the reallocation in the 1990s lying in between. The intensification in the 1980s is interesting as it coincides with a reorganization carried out by the US business sector that some argue produced significant productivity gains (Holmstrom and Kaplan, 2001).[6]

One may also suspect that the intensity of credit reallocation is due to purely temporary debt changes. To address this potential concern, we borrow from Davis and Haltiwanger (1992) the following measure of persistence of the changes underlying the flows:

$$P_{ft} = \min\left[1,\max\left(\frac{debt\ growth\ rate\ between\ t\ and\ t+2}{debt\ growth\ rate\ between\ t\ and\ t+1},0\right)\right]. \tag{3}$$

The maximum persistence occurs when $P_{ft}=1$, in which case all the debt change of a firm f between t and $t+1$ will last one additional year; the minimum occurs when $P_{ft}=0$, in which case the debt change will be purely temporary. For total debt the unweighted average value of P_{ft} across positive and negative growth rates is 0.70 over the sample period; for long-term debt the mean value of P_{ft} is 0.71. This signals that a sizable portion of the credit flows reflects persistent firm-level debt changes.

[6] Since inflation fluctuated substantially over the sample period (high inflation in the 1970s and moderate inflation in the 1980s and the 1990s), the reader could however be concerned that the effects of inflation confound the comparison of real credit flows across sub-periods. In particular, since debt contracts are mostly held in nominal terms, inflation dampens the growth of firm debt in real terms. One could therefore suspect that in periods of high inflation excess credit reallocation tends to be large not because firms engage in a voluntary reallocation but because inflation depresses the real net debt change. However, the comparison of nominal credit flows across sub-periods left the qualitative results essentially unaffected.

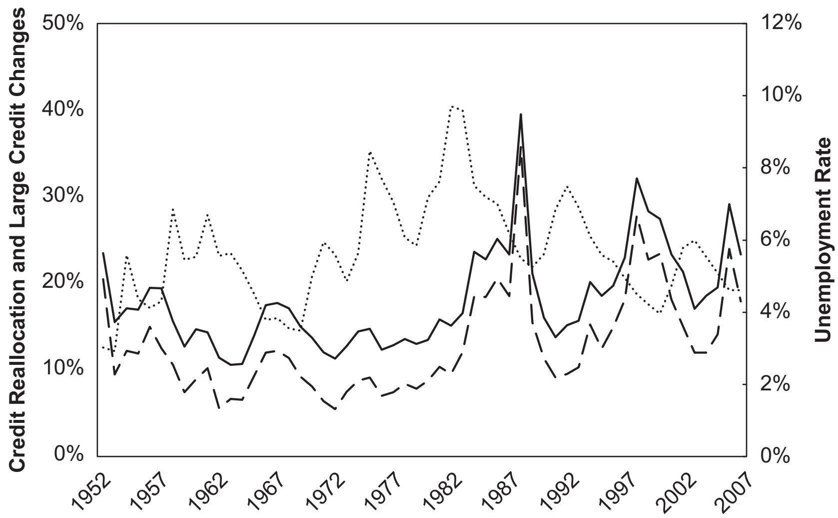

Fig. 3. This figure plots annual data for aggregate real credit flows for Compustat firms and the US rate of unemployment in the 1952–2007 period. The dashed line denotes the percentage rate of credit reallocation due to large credit changes; the solid line denotes the percentage credit reallocation rate; the dotted line denotes the unemployment rate.

4.1.1. Comparison with other gross flows

To better understand the intensity of credit reallocation, it is useful to compare it with the intensity of the inter-firm reallocation of jobs, sales and physical capital. Panel A of Table 1 reports average flows of jobs and sales for Compustat firms in the sample period (the flows are again constructed using the methodology in Section 3.4).[7] The average rate of job creation (destruction) is 6% (4.5%), the average reallocation 10.5%, the average net change roughly 1.5%, and the average excess reallocation slightly more than 8%. For sales, the average rate of creation (destruction) equals 8% (4%), the average reallocation 12%, the average net change is 3.5%, while the average excess reallocation is 7%. Panel A also reports average credit flows in the 1959–1995 period together with the average flows of physical capital among Compustat firms documented for the same period by Ramey and Shapiro (1998).[8] On average, in 1959–1995 credit reallocation was 21.5% and excess credit reallocation was 14%, while capital reallocation was 17% and excess capital reallocation equalled 14%. Thus, credit reallocation is even more intense than the reallocation of jobs, sales and capital.[9]

4.1.2. Non-linear adjustments

An extensive literature argues that firms adjust labor and capital in a lumpy way (see, e.g., Davis et al., 2006). In fact, changing labor and capital would entail sizable non-convex adjustment costs so that firms would prefer making large changes in few periods rather than frequent, small adjustments. An implication of this argument is that the reallocation of physical inputs could be driven especially by firms that adjust jobs and capital significantly. There is no established literature on the costs for adjusting credit, so it is unclear whether a similar argument applies to credit. Nevertheless, it is interesting to explore to what extent large credit changes contribute to credit reallocation. To this end, firms were partitioned into three groups: the firms with debt growth rate $g_{ft} > 18\%$, those with $g_{ft} < -18\%$ and those with $-18\% \leq g_{ft} \leq 18\%$. Clearly, the choice of the threshold $|g_{ft}|$ above which a credit change is considered to be large is somewhat arbitrary. Gourio and Kashyap (2007) study the role of large changes in physical capital (investment spikes) and set a threshold of 20% for the percentage change of physical capital. Following their approach, we choose $|g_{ft}| = 18\%$ (which corresponds to $g_{ft} = 18\%$).[10]

After partitioning firms into three groups as detailed above, we aggregate credit growth rates across the firms in each group using the methodology in Section 3.4, obtaining the credit creation due to large credit increases ($POSbig_{st}$), the credit destruction due to large credit decreases ($NEGbig_{st}$) and a flow of "small" absolute changes ($SMALLabs_{st}$). We then compute the credit reallocation due to large credit changes as $SUMbig_{st} = POSbig_{st} + NEGbig_{st}$ and the excess credit reallocation due to large credit changes as $EXCbig_{st} = SUMbig_{st} - |NETbig_{st}|$, where $NETbig_{st} = POSbig_{st} - NEGbig_{st}$. Fig. 3 plots the credit reallocation due to large credit changes ($SUMbig_{st}$) together with the total credit reallocation (SUM_{st}) and the unemployment rate. Table 1, Panel B, reports the average value of the flows of credit creation, destruction and reallocation due to large credit changes (for comparison purposes, the panel also reports corresponding figures for jobs and sales).

[7] Davis et al. (2007) compare Compustat data on employment with the data of the Longitudinal Business Database. They show that businesses in Compustat have exhibited an increase in firm-level volatility from the sixties while this has not been the case for the smaller firms covered by LBD.

[8] There is some debate in the literature on how to measure capital reallocation and it is beyond the scope of this analysis to enter this debate. So we do not compute our own measure of capital reallocation but rely on a previous study that uses Compustat data.

[9] Davis and Haltiwanger (1992) use data from the Census Longitudinal Research Datafile and find that in the 1973–1998 period the average reallocation of manufacturing jobs was 19.4 while the average excess reallocation was 15.4. Their study uses plant-level data and, hence, captures more reallocation than ours.

[10] To preserve symmetry, we set the same threshold $|g_{ft}|$ for credit increases and credit decreases.

Inspection of the figure and the panel reveals that an important share of credit reallocation is indeed due to large credit changes. In fact, computing the ratios $SUMbig_{st}/SUM_{st}$ and $EXCbig_{st}/EXC_{st}$ for each year between 1952 and 2007 and taking the mean, one obtains that on average about two-thirds of credit reallocation and excess credit reallocation are attributable to large credit changes. This figure is of the same order of magnitude as that obtained for jobs and sales: on average about 55% of the reallocation of jobs and sales is attributable to large changes. Fig. 3 also shows that the reallocation of credit due to large credit changes tracks movements in the total reallocation of credit quite closely. Interestingly, this resembles the finding of Gourio and Kashyap (2007) that large investment changes dominate the variation in aggregate investment, while small investment changes tend to be constant.

4.2. Cross-sectional properties

The reallocation of credit may stem from the reshuffling of credit within sectors or groups of firms (e.g., firms of similar size or in the same industry) and from the reallocation of credit across groups. The factors driving these two processes can be very different: the former reflects intrasectoral heterogeneity in firms' financing behavior while the latter can reflect sectoral shocks or the different impact of aggregate shocks on sectors. To gain insights into the factors driving reallocation, it is thus useful to disentangle the contribution of the within-group and the cross-group reallocation. Focusing first on the sub-sample of manufacturing firms, we sub-divide it into two-digit SIC industries. Next, the aggregate sample is partitioned according to firm size and location. To gauge the magnitude of the within-group reallocation, we employ an index proposed by Davis and Haltiwanger (1992)

$$W_t = 1 - \frac{\sum_{j=1}^{J}(|NET_{jt}|)}{\sum_{j=1}^{J} SUM_{jt}}, \qquad (4)$$

where $j = 1,\dots J$ denotes the groups. If in group j there is only credit creation or destruction, $SUM_{jt} = |NET_{jt}|$. If this occurs for every group, then $W_t = 0$, signalling the absence of reallocation within groups. Yet, there could still be reallocation across groups. If, instead, $|NET_{jt}| = 0$ for each group and $SUM_{jt} > 0$ for some group, then $W_t = 1$ and all the reallocation will occur within groups.

4.2.1. Industry, size and location

Table 2, Panel A, reports the average credit creation, destruction and reallocation in manufacturing industries. The intensity of reallocation varies substantially across industries. However, significant flows of credit creation and destruction coexist within all industries. The value of the W-index (where the generic group j is a manufacturing industry) ranges between 0.24 in 1966 and 0.75 in 1979 and its mean is 0.54. This confirms that, although the reshuffling of credit across industries is important, a significant fraction of reallocation is generated by heterogeneity in firm-level debt dynamics within the single industries. Indeed, the importance of intrasectoral flows is similar to that observed for jobs and sales: on average, $W = 0.52$ for the reallocation of jobs and $W = 0.45$ for the reallocation of sales.

Panel B of Table 2 partitions firms in quartiles according to their sales. A significant amount of credit reallocation occurs within all the size quartiles (on average $W = 0.64$), suggesting that the reallocation activity in the credit market goes well beyond the flights to quality from small to large firms observed during some recessions. As the panel shows, the intensity of credit reallocation exhibits a negative relationship with firm size. This finding resembles that in Davis and Haltiwanger (1992) who for the 1975–1986 period produce evidence that excess job reallocation was almost three times larger for plants with 1–99 employees than for plants with more than 1000 employees. Consistent with their study, the reallocation of jobs and sales is significantly less intense for bigger firms in our data: the average reallocation rate of jobs (sales) decreases with size, ranging from 9% (10%) in the quartile of largest firms to 35% (46%) in the quartile of smallest firms.

The last classification scheme considered is a geographical one. Panel C shows that in all census regions an intense process of credit reallocation is at work suggesting that the reshuffling of credit across regions can only explain a fraction of the observed reallocation ($W = 0.62$ on average). Moreover, the reallocation rate varies across regions less than across industries or size classes. Considering a classification based on states confirms these results. While this is outside the scope of the paper, we believe that analyzing the geographical properties of credit reallocation (for example, disentangling credit flows into and out of countries, besides net flows of credit) may yield insights into several debates in international finance and trade.

5. Time series properties

The dynamic behavior of credit reallocation and its relation with macroeconomic variables can offer important insights into the interplay between the credit market and the aggregate economy. For instance, if the allocation of credit matters for firm performance, it is important to investigate whether recessions depress or foster reallocation. This section first studies the volatility of credit flows and then examines their interaction with the business cycle.

5.1. Volatility

Credit reallocation is highly volatile (see Table 1, Panel C). The coefficient of variation (100*standard deviation/mean) of credit creation is 42%, that of credit destruction exceeds 46%; for reallocation and excess reallocation, the coefficient of

Table 2
Credit flows in manufacturing industries, sales quartiles, and census regions (total credit).

	POS	NEG	NET	SUM	EXC
Panel A: manufacturing industries					
Food	13.77	9.46	4.31	23.23	15.30
Tobacco	10.55	8.21	2.34	18.76	4.30
Textiles	14.09	10.73	3.36	24.82	12.80
Apparel	16.31	11.80	4.51	28.12	15.05
Lumber	16.26	9.23	7.03	25.49	10.14
Furniture	17.74	11.20	6.54	28.94	13.46
Paper	13.49	7.69	5.81	21.18	11.81
Printing	20.27	12.42	7.85	32.69	20.59
Chemicals	13.91	7.82	6.09	21.73	14.37
Petroleum	11.27	8.24	3.03	19.51	10.46
Rubber and plastics	11.56	8.87	2.69	20.42	10.83
Leather	13.86	14.32	−0.46	28.17	11.28
Stone, clay and glass	13.70	9.96	3.74	23.66	11.90
Primary metal	12.52	10.61	1.91	23.13	14.76
Fabricated metal	12.97	10.06	2.91	23.03	13.85
Machinery	15.63	9.66	5.96	25.29	15.02
Electronic	17.74	11.85	5.88	29.59	18.04
Transportation	15.02	8.28	6.75	23.30	10.44
Instruments	16.43	9.79	6.64	26.22	13.80
Miscellaneous	18.10	13.46	4.64	31.56	18.19
Manufacturing	13.56	8.59	4.97	22.14	15.14
Panel B: sales quartiles					
0–25%	33.70	18.93	14.77	52.63	32.45
25%–50%	23.69	13.35	10.34	37.04	24.99
50%–75%	17.33	8.31	9.02	25.64	15.75
75%–100%	10.71	5.32	5.39	16.02	9.99
Panel C: census regions					
New England	13.84	6.29	7.55	20.13	9.90
Middle Atlantic	10.81	7.25	3.56	18.06	11.95
South Atlantic	11.83	6.70	5.13	18.52	11.66
East South Central	10.88	5.32	5.56	16.20	8.75
West South Central	11.47	6.45	5.02	17.92	11.85
East North Central	10.87	6.65	4.23	17.52	10.67
West North Central	13.24	7.55	5.69	20.79	13.34
Mountain	12.72	7.02	5.69	19.74	12.94
Pacific	11.68	7.39	4.29	19.07	13.27

Notes: Panel A of the table reports average annual credit flows for Compustat firms in two-digit manufacturing industries and in the whole manufacturing sector in the sample period (1952–2007). POS stands for creation, NEG for destruction, NET for net change, SUM stands for reallocation and EXC for excess reallocation. Panel B of the table reports average annual credit flows for Compustat firms in quartiles of sales in the sample period. Panel C reports average annual credit flows in census regions in the sample period.

variation is 32% and 45%, respectively. Let us compare these figures with those for jobs and sales. The coefficient of variation of job creation (destruction) is 31% (52%); for job reallocation and excess reallocation, it is 28% and 52%, respectively. As for sales, the coefficient of variation of reallocation and excess reallocation is 29% and 59%, respectively. Thus, credit reallocation is no less volatile than the reallocation of jobs and sales. Moreover, the volatility of credit reallocation is even more pronounced if one focuses on large credit changes (the coefficients of variation of $POSbig_{st}$, $NEGbig_{st}$, $SUMbig_{st}$, $EXCbig_{st}$ are not reported). Panel C also reveals that credit destruction is more volatile than credit creation, especially for long-term credit. This resembles the finding that job destruction is more volatile than job creation (Davis and Haltiwanger, 1992), which is confirmed in our data (Panel C).[11]

The previous section established that a large amount of credit reallocation occurs within groups of firms similar in size, industry or location. We now assess how much of the volatility of reallocation is accounted for by idiosyncratic firm-level debt changes and how much by sectoral or aggregate shocks to the distribution of debt changes. Following Davis and Haltiwanger (1992), one can decompose the debt growth rate of each firm into the sector growth rate (g^S_{ft}), which bundles together aggregate and sectoral effects, and an idiosyncratic component (g^I_{ft}), that is, $g_{ft}=g^S_{ft}+g^I_{ft}$. Then, one can recompute credit flows using only the idiosyncratic growth rates. Using simple algebra, the variance of a flow equals the sum of the variance of the idiosyncratic flow, the variance of the sectoral-mean component and twice the covariance between the idiosyncratic and the sectoral-mean component. For instance,

$$var(SUM_t)=var(SUM^I_t)+var(SUM_t-SUM^I_t)+2cov(SUM_t-SUM^I_t,SUM^I_t). \quad (5)$$

[11] Dell'Ariccia and Garibaldi (2005) find that bank loan destruction is more volatile than loan creation.

Table 3
Properties of idiosyncratic flows.

	Manufacturing	Size quartile	Region
Panel A: total credit			
Share of reallocation variance due to			
(i) Sectoral/aggregate effects	0.1292	0.0733	0.0322
(ii) Idiosyncratic effects	0.6931	0.9924	1.1813
(iii) Covariance term	0.1777	−0.0657	−0.2135
Corr. idiosyncratic effects with unemployment	−0.1519	−0.2199	−0.1855
Corr. sectoral/aggregate effects with unemployment	−0.0716	−0.0750	−0.2108
Panel B: long-term credit			
Share of reallocation variance due to			
(i) Sectoral/aggregate effects	0.0483	0.0411	0.0179
(ii) Idiosyncratic effects	0.8722	0.8229	1.1265
(iii) Covariance term	0.0795	0.1360	−0.1444
Corr. idiosyncratic effects with unemployment	−0.1380	−0.1261	−0.0914
Corr. sectoral/aggregate effects with unemployment	−0.0318	−0.1258	−0.3206
Panel C: jobs			
Share of reallocation variance due to			
(i) Sectoral/aggregate effects	0.0872	0.1737	0.0529
(ii) Idiosyncratic effects	1.2706	0.4653	1.1600
(iii) Covariance term	−0.3578	0.3610	−0.2128
Corr. idiosyncratic effects with unemployment	−0.0649	0.0155	0.0588
Corr. sectoral/aggregate effects with unemployment	0.1401	0.0733	−0.0967
Panel D: sales			
Share of reallocation variance due to			
(i) Sectorial/aggregate effects	0.4004	0.1756	0.1646
(ii) Idiosyncratic effects	0.7620	0.6378	1.2374
(iii) Covariance term	−0.1624	0.1866	−0.4020
Corr. idiosyncratic effects with unemployment	−0.0595	−0.0006	0.0102
Corr. sectoral/aggregate effects with unemployment	−0.0074	−0.2173	−0.2537

Notes: The table reports the variance decomposition of the reallocation (SUM) of credit, jobs and sales for Compustat firms in the sample period (1952–2007). It also reports the correlation of idiosyncratic and aggregate/sectoral effects with unemployment.

If the volatility of credit reallocation is entirely driven by mean translations of the aggregate or sectoral distributions of debt changes, $var(SUM_t^I)/var(SUM_t)=0$; if it is mostly driven by changes in their cross-sectional variance, $var(SUM_t^I)/var(SUM_t)$ will take a high value. The covariance term captures the share of variance that cannot be attributed directly to either effect and signals whether the sectoral/aggregate effects and the idiosyncratic effects work in the same or in the opposite directions.

Table 3 reports the variance decomposition using three classification schemes: size classes, census regions and manufacturing industries. The table reveals that a large share of the total variance of credit flows is directly attributable to idiosyncratic effects. For total credit within manufacturing industries, almost 70% of the total variance of credit reallocation is directly accounted for by idiosyncratic effects (see line (ii) in Panel A). The results for long-term credit within manufacturing industries are even more remarkable: 87% of the total variance of credit reallocation is directly accounted for by idiosyncratic effects (see line (ii) in Panel B of the table).[12]

5.2. Cyclical behavior

The literature debates the cyclical behavior of the reallocation of physical and financial inputs. Davis and Haltiwanger (1992) and Davis et al. (1996) find that job reallocation fluctuates countercyclically; Ramey and Shapiro (1998) find that capital reallocation is also countercyclical. By contrary, Foote (1998) finds a procyclical pattern of job reallocation in US non-manufacturing industries; Eisfeldt and Rampini (2006) use data on acquisitions and sales of property, plant and equipment from Compustat and document that capital reallocation is procyclical. Moreover, on the financial side Dell'Ariccia and Garibaldi (2005) document that the excess inter-bank reallocation of loans is countercyclical.

Table 4, Panels A to D, shows correlation coefficients of the flows of credit, jobs and sales with the unemployment rate in the full sample and in various sub-periods. The net change of credit is procyclical: the contemporaneous correlation with unemployment is −0.64 and the correlation with unemployment led (lagged) 1 year is also negative (Panel A). This suggests that the contraction in credit supply that occurs during downturns outweighs the expansion in firm credit demand due to the reduced availability of internal funds. Panel A shows that credit reallocation is also procyclical, as a

[12] In line with the results of Davis and Haltiwanger (1992) for job flows, the table also reveals that a large share of the variance of the reallocation of jobs and sales is attributable to idiosyncratic effects.

Table 4
Correlation with unemployment.

Variable (period)	Un.(-2)	Un.(-1)	Un.	Un.(+1)	Un.(+2)
Panel A: total credit					
POS (52-07)	−0.0056	−0.3407	−0.5236	−0.4710	−0.2460
NEG (52-07)	0.2582	0.3467	0.3658	0.2279	0.1313
NET (52-07)	−0.1460	−0.4783	−0.6436	−0.5236	−0.2801
SUM (52-07)	0.1343	−0.0973	−0.2394	−0.2698	−0.1343
Panel B: jobs					
POS (52-07)	0.1487	−0.0074	−0.4553	−0.5616	−0.4042
NEG (52-07)	0.2327	0.2028	0.4047	0.3184	0.2341
NET (52-07)	−0.0923	−0.1638	−0.5950	−0.5920	−0.4299
SUM (52-07)	0.2768	0.1567	0.0411	−0.0930	−0.0630
Panel C: sales					
POS (52-07)	−0.1036	−0.1472	−0.5266	−0.3809	−0.2052
NEG (52-07)	0.1045	0.1047	0.3796	0.2792	0.1557
NET (52-07)	−0.1305	−0.1568	−0.5643	−0.4112	−0.2250
SUM (52-07)	0.0077	−0.0269	−0.0915	−0.0622	−0.0290
Panel D: total credit					
NET (52-59)	0.8006	−0.2334	−0.5459	−0.3138	0.4272
SUM (52-59)	0.5262	−0.5261	−0.5345	−0.5131	0.0340
NET (60-69)	−0.6312	−0.7902	−0.8091	−0.6237	−0.3142
SUM (60-69)	−0.5880	−0.7778	−0.6427	−0.4825	−0.1239
NET (70-79)	−0.0556	−0.5238	−0.9130	−0.2664	0.0787
SUM (70-79)	0.0539	−0.3063	0.2304	0.7260	0.4807
NET (80-89)	−0.0342	−0.5142	−0.7093	−0.6460	−0.5274
SUM (80-89)	0.2297	−0.1782	−0.6159	−0.7083	−0.7068
NET (90-99)	−0.3579	−0.7340	−0.9441	−0.8863	−0.7073
SUM (90-99)	−0.2966	−0.6205	−0.8569	−0.8886	−0.7573
NET (00-07)	−0.3351	−0.7133	−0.6997	0.2690	0.8284
SUM (00-07)	−0.1283	−0.6410	−0.8312	−0.3367	0.3526

Notes: The table reports the correlation with unemployment of the flows of credit, jobs and sales for Compustat firms in the 1952–2007 sample period (Panels A–C) and in various sub-periods (Panel D). POS stands for creation, NEG for destruction, NET for net change and SUM for reallocation.

result of a procyclical credit creation and a more mildly countercyclical credit destruction. The contemporaneous correlation with unemployment is −0.24 and reallocation is also negatively correlated with unemployment led or lagged 1 year. The procyclical behavior of credit reallocation has been especially pronounced from the 1980s, due to a lack of response of the destruction rate to cyclical fluctuations (see Panel D). For space considerations, the tables for long-term credit, for manufacturing and for credit flows due to large credit changes are omitted, but the result that credit reallocation is procyclical carries through.[13] Further, a procyclical behavior of reallocation can be detected even in single industries or size classes. Turning to other flows, the findings are broadly in line with those of previous literature. The reallocation of jobs exhibits a small positive correlation with unemployment, which might broadly match the finding of Davis and Haltiwanger (1992) that job reallocation tends to be countercyclical. The reallocation of sales exhibits instead a small negative correlation with unemployment.

Panels A to D of Table 3 report the correlation coefficient of the idiosyncratic flows with unemployment. Consistent across classification schemes, the idiosyncratic credit flows are negatively correlated with unemployment while, interestingly, the evidence for sectoral/aggregate effects is less clear-cut. All in all, idiosyncratic flows explain most of the volatility of credit reallocation but they are also a central driving force of its procyclical pattern.

5.3. Recessions and credit reallocation

The recent recessionary episodes of 2001 and 1990–1991 were characterized by more persistent unemployment than previous ones (for a discussion, see, e.g., Faberman, 2008, and references therein). Did inter-firm credit flows behave differently during these recessionary episodes? Inspection of the annual and quarterly credit flows reveals that during the recession of 1973–1975 and the double-dip recession of 1980 and 1981–1982, credit destruction exhibited a large increase and credit creation exhibited a significant, albeit smaller, drop.[14] However, both the increase in credit destruction and the drop in credit creation were short-lived: credit creation and destruction were back to their pre-recession levels after about 1 year. In fact, the recovery from both these recessions was characterized by positive net credit growth and by an intensity

[13] The contemporaneous correlation of the credit reallocation due to large credit changes ($SUMbig_{st}$) with unemployment equals −0.23. The contemporaneous correlations of $POSbig_{st}$ and $NEGbig_{st}$ with unemployment equal −0.41 and 0.21, respectively.

[14] During our sample, recessions, as defined by the NBER, also occurred in 1953–1954, 1957–1958, 1960–1961, 1969–1970.

of credit reallocation similar to the pre-recession period (see also Fig. 2). The behavior of credit flows was quite different in the recessionary episodes of 2001 and 1990-1991. Both the increase of credit destruction and the drop of credit creation were less pronounced but more persistent. As a result, during the recovery the net credit change remained low. Furthermore, since the drop in credit creation was more pronounced than the increase in credit destruction, credit reallocation exhibited a persistent drop. An interesting question for future research is whether the persistence of unemployment was linked to the low intensity of credit reallocation.

6. Conclusion

The hypothesis that has motivated this paper is that microeconomic heterogeneity can play a significant role in the interaction between the credit market and the macroeconomy. Thus, studying the process through which credit is reallocated across businesses can usefully complement the analysis of the aggregate dynamics of credit. We have found that credit reallocation is quantitatively important (at least as large as the reallocation of labor, sales and capital) and that the reallocation of credit within groups of firms similar in size, industry or location is more intense than the reshuffling of credit across these groups. Credit reallocation exhibits significant volatility, with the destruction rate being more volatile than the creation rate. Finally, credit reallocation appears to be moderately procyclical. In particular, credit creation slows down substantially during downturns while credit destruction is only mildly countercyclical. Idiosyncratic debt changes play an important role in the volatility and procyclical behavior of credit reallocation.

The analysis raises interesting topics for future research. On the empirical side, while the finding that downturns are accompanied by a moderate stifling of credit reallocation is interesting in its own right, it is important to understand whether credit reallocation contributes to determining economic activity, besides comoving with it. On the theoretical side, it appears crucial to build a dynamic general equilibrium model that incorporates the financing choices of heterogeneous firms and investors as well as aggregate and idiosyncratic shocks and that can replicate the empirical properties of credit reallocation. Such a model could help shed new light on the impact of the credit market on the aggregate economy.

Acknowledgments

We appreciate comments from the editor, Robert King, two anonymous referees, Stephen Williamson, Steven Haider, Matteo Iacoviello, Garey Ramey, Peter Schmidt, and several seminar participants. All remaining errors are ours.

Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jmoneco.2011.11.008.

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