The evolution of financial fragility: A quantile decomposition of firm balance sheets

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Abstract

The post-1980 period has seen sustained changes in the balance sheet of the average nonfinancial corporation in the U.S., but also important heterogeneity across firms. In particular, firms across the distribution have seen an increase in cash holdings and, while average indebtedness has remained stable, firms at the bottom 60% of the distribution have become less indebted. At first sight, these trends are puzzling, given that the post-1980 period has also seen a growing share of firms unable to generate sufficient cash flows to service their financial obligations (such that they are net borrowers). In this paper, we reconcile these trends by decomposing observed trends in firm balance sheets into two components: the contribution of within-firm changes in financial behavior, and the contribution of changes in the composition of firms in the corporate sector. Using a two-step quantile decomposition method, we find that the observed changes in balance sheets are driven by firms entering and exiting the corporate sector, rather than by the behavior of continuing firms. Furthermore, these compositional effects are particularly strong among more financially fragile firms. Our findings suggest that 'churning' and, in particular, changing IPO behavior, are key mechanisms through which changing financial norms have been realized after 1980 in the U.S. corporate sector.

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1   Introduction

The post-1980 period in the U.S. economy has seen sustained changes in the financial behavior of nonfinancial corporations (NFCs), as well as important heterogeneity in these changes across firms. These changes in financial behavior are reflected in long-term shifts in the structure of NFC balance sheets, including both an across-the-distribution increase in cash holdings and changing patterns of financing. Median cash holdings across NFCs have, in particular, grown from an average of 3.4% of sales in the 1970s and 1980s to over 10% in the 2000s.[1] In turn, this increase in cash holdings also has implications for the evolution of leverage. Bates, Kahle & Stulz (2009) show, for instance, that cash growth is so significant that, by 2006, the average firm could retire all outstanding debt with its cash. Accordingly, while average debt relative to equity or total assets is approximately constant, average *net* debt (debt less cash holdings) declines after the early 1980s (see Kahle & Stulz, 2017). Together, these changes in NFC financial behavior have been cited as evidence of the 'financialization' of nonfinancial corporations and, importantly, have been linked to key nonfinancial outcomes, including slowing investment rates in the U.S. economy (see Davis, 2017, for a survey).

There has also been a concurrent, and substantial, increase in cash flow-based measures of financial fragility. Consider a Minskian framework, which defines financial fragility by the relationship between firms' operational cash flows and obligatory financial commitments (Minsky, 1964, 1986).[2] The most financially fragile ('Ponzi') firms cannot meet either interest or principal obligations with current income, such that both must be rolled into future debt. Davis, de Souza & Hernandez (2017) show that, since 1980, the share of U.S. NFCs with Ponzi financial structures has risen dramatically, from 9.1% in 1980 to 31.6% by 2014. As such, by 2014, almost a third of U.S. NFCs are unable to cover *either* the interest *or* the principal due on outstanding debt with current income. Notably, this expansion in Ponzi finance takes place as leverage declines and cash holdings rise across these same firms. These observations are striking: Ponzi firms are, by definition, unable to meet their financial commitments with current income and, as such, are expected to accumulate debt and decumulate cash over time. Taken together, these trends, therefore, suggest the possibility that the post-1980 evolution of Ponzi firms' balance sheets is produced by changing patterns of entry and exit, rather than by within-firm changes over time.

Recent research has documented changing entry and exit dynamics among U.S. corporations. Following an expansion through the 1980s and early 1990s, the number of public firms peaked in the mid-1990s, after which time entry rates declined and de-listing rates rose (Fama & French, 2004; Decker, Haltiwanger, Jarmin

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[1]These are medians based on Compustat data. The data and sample are discussed in Section 2.

[2]See Minsky (1986, Ch.9) for an introduction to the Financial Instability Hypothesis. A large theoretical and institutional literature, in turn, follows in this Minskian tradition; for a survey, see Nikolaidi & Stockhammer (2017).

& Miranda, 2016a,b; Doidge, Karolyi & Stulz, 2017; Kahle & Stulz, 2017). Concurrently, the composition of the nonfinancial corporate sector has changed: product markets have become increasingly concentrated (Autor, Dorn, Katz, Patterson & Van Reenen, 2017; De Loecker & Eeckhout, 2017; Furman, 2016), and public corporations have become more R&D intensive, older, and larger (Kahle & Stulz, 2017). Given that one expects differences in the financial structure of entering, exiting, and continuing firms, changing patterns of entry/exit may be an important driver of recent changes in NFC balance sheet structure.

In this paper, we analyze the extent to which 'churning' within the nonfinancial corporate sector, produced by changing patterns of entry and exit, explains post-1980 changes in NFC financial structure. To do so, we decompose changes in NFC cash holdings, debt, and total liabilities over time to disentangle the effect of *changes in the composition of firms* on the evolution of NFC financial structure, from the effect of *within-firm changes in behavior*. We do so, first, for the full nonfinancial corporate sector. Second, we narrow in on the most financially fragile set of Ponzi firms, to analyze the intersection between balance sheet structure and this cash flow-based indicator of fragility. Notably, Ponzi firms are a particularly relevant subset of the full sample for analyzing the importance of churning and, in particular, new entry: as the share of NFCs with Ponzi financial structures grew during the 1980s and 1990s, the share of new firms that go public with Ponzi structures also increased substantially.

We distinguish the effect of changes in the composition of firms from the effect of within-firm behavior using quantile decomposition methods that allow us to decompose changes in cash, debt, and total liabilities across their full distributions, rather than only at the mean. This property of the decomposition method is important in our context: because the distributions of these variables are highly skewed, trends in the mean do not well describe their full distributions.[3] We implement the decomposition in two steps. First, we use a re-weighting approach in the spirit of DiNardo, Fortin & Lemieux (1996) to disaggregate the independent contributions of continuing firms (a *within-firm effect*) and of incoming and outgoing firms (a *compositional effect*) to changes in cash holdings and financial obligations over time. We, similarly, disaggregate the compositional effect to measure the independent roles of incoming and outgoing firms. Second, we turn to the sub-sample of Ponzi firms. Using unconditional quantile regressions (Firpo, Fortin & Lemieux, 2009; Fortin, Lemieux & Firpo, 2011), we implement a detailed decomposition that also differentiates how firms are incoming or outgoing with respect to Ponzi finance. Specifically, we distinguish incoming Ponzi firms that go public as Ponzi, from those that become Ponzi after previously having had a more robust financial structure. Similarly, we distinguish outgoing Ponzi firms that exit the sector entirely (e.g. went bankrupt or

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[3]Additive decompositions (e.g. Oaxaca-Blinder decompositions) rely on the linearity of the weighted mean and, therefore, cannot be extended to decompositions of the median or other quantiles.

were acquired), from those that become more financially robust.

We find, first, that across-firm trends in cash holdings and outstanding financial obligations are driven by compositional effects – and, in particular, by new entry – rather than by the behavior of continuing firms, both in the full sample and among Ponzi firms. The observed increase in the median cash-to-sales ratio and decline in the debt-to-asset ratio is, therefore, the result of firms entering the corporate sector with more cash and less debt than the median incumbent firm. In contrast, continuing firms decumulate cash and accumulate debt over time, such that within-firm behavior moves opposite to the across-firm trends. These results, also, hold at quantiles away from the median. These results, therefore, point to churning within the nonfinancial corporate sector – and, most notably, to practices surrounding the initial public offering (IPO) – as a crucial driver of post-1980 changes in the financial structure of U.S. NFCs, and a key mechanism through which new financial norms have been disseminated. Importantly, the years leading up to the mid-1990s were a period of high IPO activity. We suggest, in turn, that new entry has shaped aggregate measures of firm balance sheets both because the IPO generates a large infusion of cash (Alti, 2006), and also through the dissemination of firm characteristics – most notably, higher firm-level volatility among new entrants (Brown & Kapadia, 2007) – that are correlated with higher cash holdings.

Second, we find that these compositional effects are particularly important for the most financially fragile, Ponzi, firms: continuing Ponzi firms not only decumulate cash and accumulate debt, but they do so at a much faster pace than more financially robust firms. In turn, churning within the group of Ponzi firms offsets these within-firm trends. We, also, find that exit is a key mechanism limiting the aggregate impact of unsustainable financing practices among Ponzi firms. Importantly, the period of expansion of Ponzi finance is followed by an increased rate of exit 'for cause' (Doidge et al., 2017), and a post-1997 surge in mergers and acquisitions targets 'young' firms (Arikan & Stulz, 2016; Doidge et al., 2017), which are increasingly likely to be Ponzi as the share of new entrants with Ponzi structures increases over this time. Our results, therefore, resolve the apparent puzzle of a growing share of firms unable to meet their financial obligations, but that nonetheless have acquired cash and deleveraged. These results tie closely to a Minskian story explaining long-term changes in the degree of financial fragility across an economy via periods characterized by increased or decreased tolerance for fragile financing (Minsky, 1964, 1986, 1992). Rather than locating growing fragility primarily in increased risk-taking by continuing firms, however, our results point to a long-run evolution in financial norms rooted, specifically, in when and how firms access equity finance.

Together, these results highlight a key, and previously unexplored, link between changing entry and exit rates after 1980, and the evolution of NFC balance sheet structure. Our results, therefore, also speak to an

existing literature that has emphasized within-firm explanations for changes in firm balance sheet structure. For example, growth in cash holdings has been linked to tax costs associated with repatriating profits earned abroad (Foley, Hartzell, Titman & Twite, 2007); rising idiosyncratic risk (Bates et al., 2009); and competitive strategies wherein cash is held as a means of acquiring future market share (Fresard, 2010). Similarly, a body of literature links a decline in the stock of fixed capital relative to financial assets (including cash) held by NFCs to increased managerial short-termism (e.g. Asker, Farre-Mensa & Ljungqvist, 2015; Gutierrez & Philippon, 2016; Davis, 2018). In contrast, our results suggest that within-firm explanations of changes in financial behavior have limited explanatory power for understanding the post-1980 U.S. nonfinancial corporate sector by pointing, instead, to the evolution of norms surrounding access to equity finance.

This paper is organized as follows. In Section 2 we introduce the data and describe the main trends in firm cash holdings and financial obligations over the post-1980 period. Section 3 introduces the quantile decomposition method, and Section 4 presents the empirical results. Section 5 discusses these results, and Section 6 concludes.

2   Describing the evolution of firms' balance sheets

2.1   Data

2.1.1   Main variables

Our data is drawn from Compustat. We include all firm-year observations for firms incorporated in the U.S. with non-negative recorded sales, assets or interest payments between 1970 and 2014, and exclude financial firms (SIC codes 6000-6799). To define transitions in and out of Minskian financing regimes when analyzing Ponzi firms, we also eliminate firms with gaps (0.64% of the sample). Finally, we exclude observations that we cannot assign as hedge, speculative or Ponzi (these categories are defined below) due to missing data. Our final sample includes 222,799 observations describing 20,587 firms.

Our analysis focuses on three main variables: cash, debt, and total liabilities. Cash is the sum of cash and short-term liquid securities readily transferable to cash, such as certificates of deposit, commercial paper, money-market funds, and marketable securities (Compustat item #1). We normalize cash by sales (#12) to capture firm size.[4] Total debt is the sum of debt in current liabilities (#34) and long-term debt (#9). Finally, total liabilities include both debt and non-debt liabilities (accounts payable, #70; income taxes

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[4]We use sales, rather than total assets, to avoid composition effects on the asset side of the balance sheet wherein an increase in one asset category necessarily implies a fall in another asset category (relative to total assets). However, both the descriptive time patterns and the decomposition results shown below are qualitatively robust to normalizing cash by total assets.

payable, #71; other current liabilities, #72; other liabilities, #75; and deferred taxes and investment tax credit, #35).[5] We normalize both measures of financial obligations by total assets (#6), to capture the share of assets financed by debt (or other liabilities).

Our analysis, also, requires us to define incoming and outgoing firms. We define outgoing firms, simply, as firms exiting the sample in the subsequent year. In turn, a firm is classified as incoming in year t if: (1) it joins Compustat for the first time in t with enough data for a regime classification (such that they are in our sample, as described above); (2) it was in Compustat with a missing regime classification in $t-1$, and now has a regime assignment for the first time; and (3) it was in Compustat with a missing a regime classification in $t-1$, but had a regime classification in some previous period (i.e. 'rejoined' the sample).

### 2.1.2 A cash flow-based measure of financial fragility

In this paper, we also analyze the intersection between the evolution of NFC balance sheet structure and a cash flow-based measure of financial fragility. We draw, specifically, on Hyman Minsky's work on financial fragility by defining a firms' degree of fragility by the relationship between its operational cash flows and financial commitments (Minsky, 1964, 1986). In this framework, firms are classified into one of three financing regimes, which form a continuum from financially robust to financially fragile. The most robust, *hedge*, firms can meet all required financial obligations (i.e. both interest and principal obligations) using current cash flows. *Speculative* firms, which can meet interest but not principal obligations, are relatively more fragile. The most fragile, *Ponzi*, firms cannot meet either interest or principal obligations with current cash flows. Ponzi firms must, therefore, roll both interest and principal obligations into future debt, further increasing the fragility of their balance sheets.

We follow the empirical application of Minskian regimes to Compustat data in Davis et al. (2017) to classify each firm-year observation as hedge, speculative or Ponzi. To do so, we first define each firm's relevant sources of cash and obligatory financial commitments in each year. Sources of cash include liquid cash inflows net of expenses like wages and salaries (which have a prior claim on cash flow, relative to financial obligations), and exclude any new sources of funds (e.g. from new borrowing or equity issues). Financial commitments include interest and principal payments due that year; as such, these are obligatory commitments and exclude all discretionary uses of cash, including principal payments in excess of what is due that year. In turn, a firm-year observation is *hedge* if sources of cash exceed both interest and principal obligations. *Speculative* firms have sufficient sources of cash to cover interest but not principal. Finally,

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[5]We exclude minority interest (i.e. shares in consolidated subsidiaries not owned by the parent company), which we instead treat as equity.

Figure 1: Cash and short-term assets relative to sales (medians)
All firms and by regime type; 1970-2014
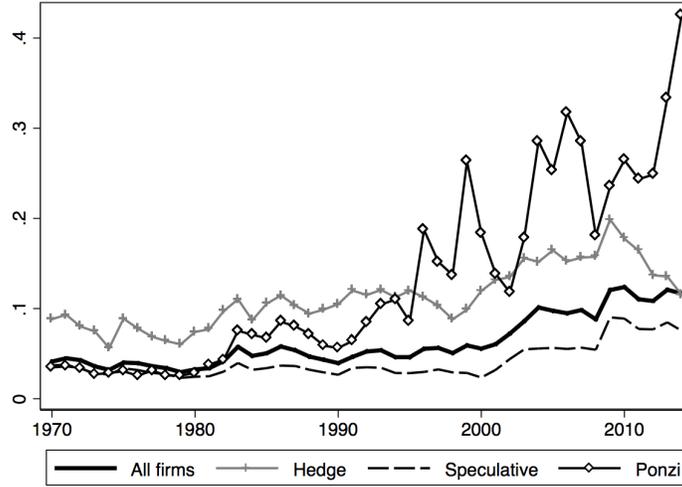
Notes: The figure shows the across-firm yearly medians of cash and short-term investments, normalized by sales, for the full sample of NFCs, and by financing regime. For details describing the sample and for variable definitions, see Section 2.1.

Ponzi firms have insufficient sources of cash to cover either interest or principal. Details describing this classification are in the appendix (Table 5); see also Davis et al. (2017, pgs. 5-8).

Using these classifications, Davis et al. (2017) show that the share of Ponzi firms in the U.S. nonfinancial corporate sector increases from 10.8% to 31.6% of firms between 1970 and 2014, with this growth in Ponzi finance concentrated during the 1980s and 1990s. The share of speculative firms concurrently declines from 72.3% to 45.3% of NFCs, while the share of firms with hedge structures is relatively stable. Davis et al. (2017), furthermore, show that the increase in Ponzi finance occurs across industries (i.e. does not reflect the expansion of a financially fragile industry), and is primarily concentrated among small firms. Specifically, by 2014 almost 70% of firms in the bottom quartile of the asset distribution are Ponzi.

2.2 Cash and financial assets

Figure 1 plots the across-firm yearly medians of cash to sales for the full sample, as well as for subsamples of hedge, speculative and Ponzi firms. Across the full sample, shown by the solid black line, median cash holdings rise from 4.1% to 11.7% of sales between 1970 and 2014. This growth in cash holdings begins after 1980 and accelerates after 2000, approximately doubling (from 5.6% to 11.7%) between 2000 and 2014.

Figure 1 also shows that cash to sales rises in all three Minskian financing regimes, but with notable heterogeneity in the pattern of cash growth by regime. Most strikingly, Ponzi firms' cash-to-sales ratio

Figure 2: Estimated cumulative distribution functions (truncated at 1)
Cash-to-sales ratio
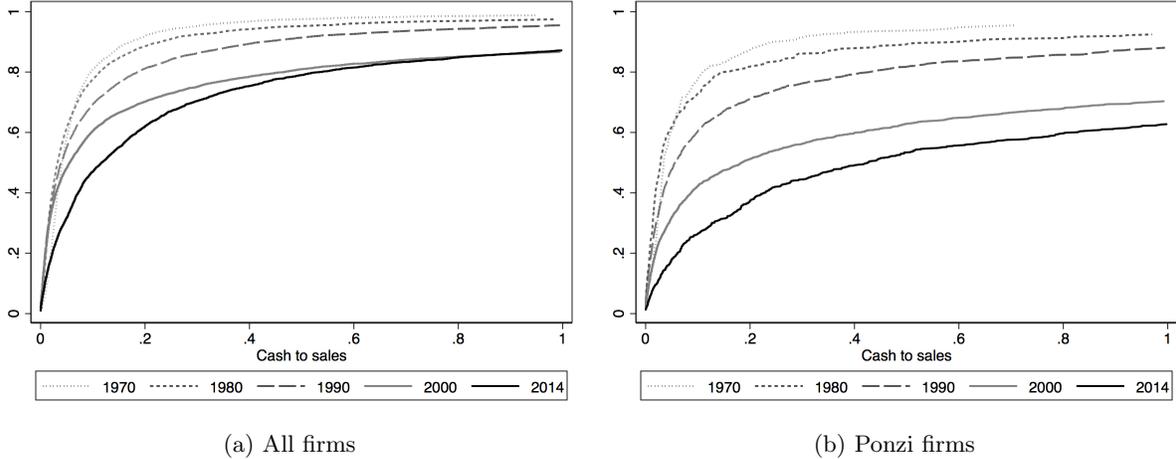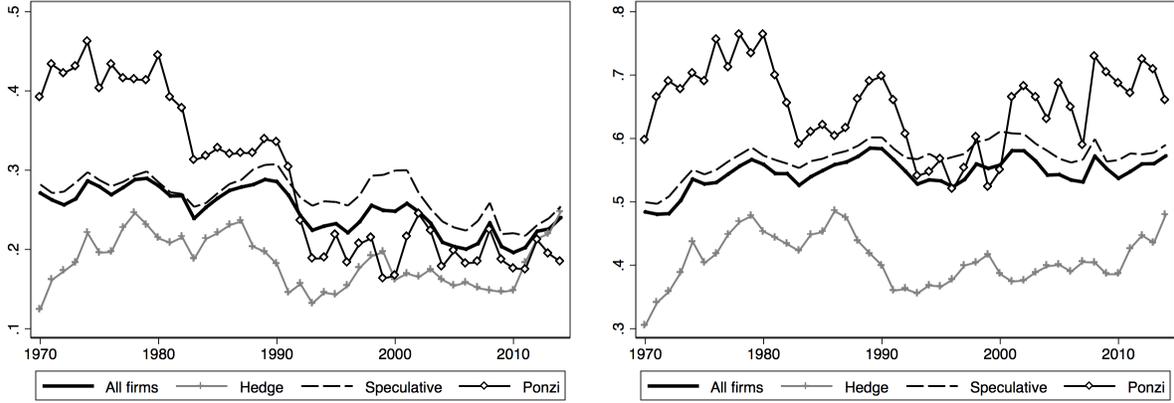

(a) All firms

(b) Ponzi firms

Notes: The figure shows the estimated cumulative distribution functions for the full sample of firms and Ponzi firms, respectively. The cumulative distribution functions are truncated at 1. For details describing the sample and for variable definitions, see Section 2.1.

increases from 3.5% to 46.2% between 1970 and 2014, dwarfing that of both the other regimes and the full sample. Hedge firms' median cash holdings concurrently rise from 8.8% to 11.5% of sales and those of speculative firms rise from 3.7% to 7.5%. Furthermore, despite both a close intersection between a firms' likelihood of being Ponzi and of being small (Davis et al., 2017), and the fact that small firms hold relatively large stocks of cash (Bates et al., 2009; Davis, 2016), Ponzi firms' cash growth substantially exceeds that of small firms. Between 1970 and 2014, the cash holdings of firms in the bottom quartile of assets, for instance, increase from 4.4% to 22.2% of sales — an increase that exceeds the full sample, but is considerably less than among Ponzi firms. As indicated in the introduction, this growth in Ponzi firms' cash holdings is surprising: as these firms cannot meet their financial commitments with current income, they are expected to utilize available resources to meet financial obligations, rather than to accumulate cash. This pattern could be explained, however, by changing patterns of entry and exit. For instance, when accompanied by an increase in new entries to Ponzi finance (as took place during the 1980s and 1990s, (Davis et al., 2017)), higher cash holdings across Ponzi firms could reflect that, after the IPO, new firms hold relatively more cash than incumbent firms. Accordingly, these trends point to the possibility that changes in entry and exit behavior underlie the trends observed on firm balance sheets.

Figure 2, which plots the estimated cumulative distribution functions (CDFs) of cash to sales by decade, in turn, shows that the increase in cash holdings extends beyond the median. First, Figure 2a, which plots the CDFs for all firms, captures a monotonic downward shift between 1970 and 2000 at all quantiles

Figure 3: Financial obligations relative to assets (medians)
All firms and by regime type; 1970-2014

(a) Total debt

(b) Total liabilities

Notes: The figure shows the estimated cumulative distribution functions for the full sample of firms and Ponzi firms, respectively. The cumulative distribution functions are truncated at 1. For variable definitions, see Section 2.1.

of the cash to sales distribution. Below approximately the 60th percentile, this downward shift continues after 2000. Figure 2a, therefore, reiterates the median full sample trend in Figure 1, but also captures heterogeneity across the cash-to-sales distribution, wherein this downward shift is particularly pronounced at lower quantiles. Turning only to Ponzi firms, Figure 2b echoes the full sample pattern, but also highlights that this pattern is more dramatic among Ponzi firms.

2.3 Financial obligations

Turning to liabilities, Figures 3 and 4 plot the across-firm yearly medians of debt and total liabilities as shares of total assets, again for the full sample and by regime type. Recall that total debt is the sum of short-term (current) and long-term debt, whereas total liabilities also include non-debt obligations: accounts payable, income taxes payable, deferred taxes and investment tax credit, and other current and non-current liabilities. The full sample trends for debt and total liabilities, shown by the solid black lines, indicate that median total debt trends slightly downwards, from 27.1% of assets in 1970 to 24.0% by 2014. Total liabilities concurrently rise from 48.4% to 57.3% of assets. Notably, however, these full sample trends mask important heterogeneity in not only the magnitude, but also in the direction of change, both across the distributions of these variables over time and by regime type.

First, Figure 3 shows that the most financially robust (hedge) firms both hold less debt and have lower overall liabilities, relative to more financially fragile firms, over the full period. In fact, through approximately

Figure 4: Estimated cumulative distribution functions (truncated at 1)
Debt-to-assets ratio
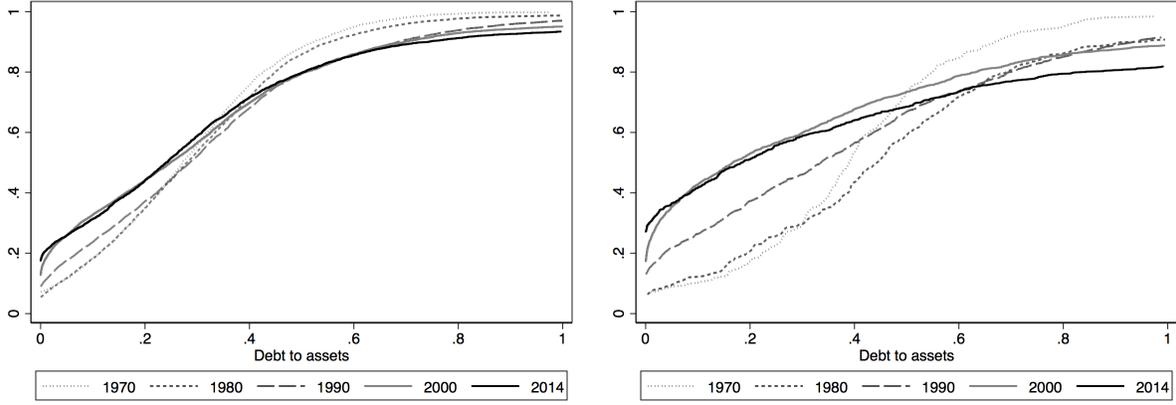
(a) All firms   (b) Ponzi firms

Notes: The figure shows the estimated cumulative distribution functions for the full sample of firms and Ponzi firms, respectively. The cumulative distribution functions are truncated at 1. For variable definitions, see Section 2.1.

1990, the relationship between regime type and outstanding debt and liabilities is 'ranked' by the degree of financial fragility, where more financially fragile firms have more outstanding debt and financial liabilities. However, Ponzi firms' total debt as a share of assets declines dramatically during the 1980s and 1990s, falling from 44.4% in 1980 to 16.7% of assets in 2000. Figure 3b, in turn, shows that, despite this decline in debt, Ponzi firms' total liabilities as a share of assets are far more constant. Therefore, the median Ponzi firm's debt falls as its non-debt obligations (in particular, accounts payable and other current liabilities) rise. Nonetheless, the decline in debt is surprising: with insufficient current income to meet financial obligations, Ponzi firms should be net borrowers that accumulate debt over time. Notably, this decline in Ponzi firms' outstanding debt coincides closely with the timing of the expansion in Ponzi finance during the 1980s and 1990s (Davis et al., 2017), suggesting that the median decline in Ponzi firms' debt-to-asset ratio could reflect lower leverage among new entries to Ponzi finance.

Finally, Figure 4 describes the distribution of debt to assets, by decade, for all firms and Ponzi firms. The dominant pattern is an upward shift in the distribution between 1980 and 2000 until approximately the 60th percentile, such that firms below the 60th percentile become *less* indebted over the post-1970 period. Above the 60th percentile, however, the pattern flips, and firms in these higher quantiles of the debt distribution become *more* indebted after 1970. The same pattern holds, but more dramatically, among Ponzi firms. Importantly, because these patterns are invisible in the weighted means, the CDFs identify a key role for quantile decomposition-based methods that allow for analysis across the full distribution.

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3 A quantile decomposition method

The trends shown above, particularly for Ponzi firms, suggest that entry and exit ('churning') — rather than within-firm behavioral changes over time — may play an important role in the evolution of aggregate trends on firm balance sheets. Furthermore, Section 2 highlights that the magnitudes — and, in the case of debt, also the direction — of shifts in the distributions of cash holdings and financial obligations over time vary across quantiles of these variables. Accordingly, standard decompositions of the (weighted) means of these variables are not well-suited to analyzing these variations in firm balance sheets over time. This point is particularly important given that the expansion of Ponzi firms after 1980 is concentrated among firms at lower quantiles of the asset distribution (Davis et al., 2017), and that small firms tend to hold more cash and less debt over this period (see Davis, 2016).

We, therefore, use quantile decompositions to analyze the role of churning in the nonfinancial corporate sector across the full distributions of these variables. In each case, we conduct rolling decompositions between adjacent years. This choice of interval is key: as the two years over which the decomposition is performed become further apart, there are fewer continuing firms and more incoming/outgoing firms. If, for example, we choose a decade-long interval (e.g. 1900-2000), a firm entering in 1991 and staying until 2000 (in the sample for all years but one) is classified as incoming—even though its behavior is conceptually closer to a continuing firm in the later years of the interval. Accordingly, with a longer time interval, the interpretation becomes more arbitrary.

We, first, use a re-weighting method in the spirit of DiNardo et al. (1996) to distinguish the contribution of changes within the set of *continuing* firms, from those of *incoming* and *outgoing* firms, to the evolution of the cash-to-sales, debt-to-assets, and total liabilities-to-asset ratios. Second, we turn to Ponzi firms. Using unconditional quantile regressions (Firpo et al., 2009; Fortin et al., 2011), we also distinguish the ways a firm can be incoming or outgoing with respect to Ponzi finance. Specifically, we distinguish incoming Ponzi firms that enter the sample as Ponzi (i.e. go public as Ponzi) from firms that become Ponzi after previously being in a more robust (i.e. hedge or speculative) regime. Similarly, we distinguish firms that leave Ponzi because they exit the sector entirely, from firms that leave Ponzi by becoming more robust (i.e. transition to a speculative or hedge regime). Each of these reasons for entry and exit are relevant. Between 1970 and 2014, 17.7% spells of Ponzi finance began when the firm went public as Ponzi, whereas 53.4% become Ponzi from a speculative regime (Davis et al., 2017). In turn, the share of Ponzi firms that go public as Ponzi increases to a small majority by the end of the sample period. In addition, between 1970 and 2014, 30.2% of Ponzi firms exit after a spell of Ponzi finance, whereas 49.8% transition to a speculative regime.

3.1 Measuring the contributions of continuing, incoming and outgoing firms

We follow the re-weighting approach in DiNardo et al. (1996) to decompose changes in the medians of cash-to-sales, debt-to-assets, and total liabilities-to-assets over time into contributions made by continuing, incoming, and outgoing firms. The discussion here focuses on the median; in Appendix B, we extend the procedure to other quantiles of these variables' distributions. As an illustration of this procedure, consider Figure 5, in which F denotes the unconditional cumulative distribution functions of a variable Y at times t and $t + k$.[6] These functions are defined as $F_{Y,t}(q) = \text{Prob}[Y \leq q]$, such that the median at time t is defined as $q_{0.5,t} = F_{Y,t}^{-1}(0.5)$.

Figure 5: Illustration of the Decomposition Procedure
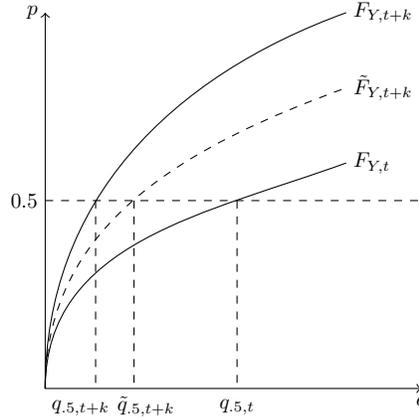
We, first, decompose the median change between t and $t + k$ ($q_{0.5,t+k} - q_{0.5,t}$) into the contribution of changes within the set of continuing firms, and the total contribution of incoming and outgoing firms. To do so, we construct a counterfactual distribution for period $t + k$ ($\tilde{F}_{Y,t}$, with median $\tilde{q}_{0.5,t+k}$), which holds the composition of firms between two years (t and $t+k$) constant. This counterfactual includes the observations of Y for continuing firms in $t + k$ and for outgoing firms in t (and excludes all incoming firms in $t + k$). This counterfactual distribution allows us to decompose the total change in the median between t and $t+k$ into two components. The first component ($\tilde{q}_{0.5,t+k} - q_{0.5,t}$) measures the contribution of changes in the distribution of Y between t and $t+k$ within the set of continuing firms (the *within-firm effect*), holding the composition of firms in period t constant. The second component ($q_{0.5,t+k} - \tilde{q}_{0.5,t+k}$) measures the contribution of changes in the composition of firms (the *composition effect*). This compositional component is obtained by replacing the distribution of Y across outgoing firms with the distribution of Y across incoming firms, while holding

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[6]Following the discussion above, we implement decompositions between adjacent years, such that $k = 1$.

the distribution of continuing firms (observed in $t + k$) constant. As such, this decomposition uses outgoing firms as the reference group against which the contribution of continuing firms is assessed.[7]

Second, we use the same method to further decompose the compositional effect, to identify the independent contributions of incoming and outgoing firms. To do so, we construct a second counterfactual sample comprised only of continuing firms in the second period. If $\tilde{q^C}_{0.5,t+k}$ denotes the median of this sample, the overall composition effect can be partitioned into two terms:

$$q_{0.5,t+k} - \tilde{q}_{0.5,t+k} = (q_{0.5,t+k} - \tilde{q}^C_{0.5,t+k}) + (\tilde{q}^C_{0.5,t+k} - \tilde{q}_{0.5,t+k}) \tag{1}$$

where the first term in parentheses is the contribution of incoming firms, the second term is the contribution of outgoing firms, and each effect is assessed relative to the reference group of continuing firms.

For intuition, consider a hypothetical decomposition of the cash-sales ratio, in which both terms on the right-hand side in Equation (1) are positive. The first term gives the change in the median cash-to-sales ratio at $t + k$ when incoming firms enter the sample, after outgoing firms have left. A positive value, therefore, implies that – relative to continuing firms in period $t + k$ – incoming firms *raise* the median cash-sales ratio. In turn, the second term defines the change in the median value of the cash-sales ratio at time $t + k$ when outgoing firms leave the sample, before they are replaced by incoming firms. A positive value, therefore, implies that – relative to the firms that continue in $t + k$ – outgoing firms would have lowered the median cash-sales ratio *had they stayed* in the sample with the same cash-sales ratio they had in period t. By instead leaving, these outgoing firms *raise* the median cash-sales ratio. In this example, a positive composition effect is therefore produced by both incoming and outgoing firms.

3.2   A detailed decomposition for Ponzi firms

Next, we turn, specifically, to Ponzi firms. Because there is more than one way a Ponzi firm may be incoming or outgoing with respect to Ponzi finance, the re-weighting method in Section 3.1 – which generates a path-dependent decomposition – has limited applicability in this context. In particular, the results of the re-weighting method depend on the order in which the effects are computed, such that the resulting terms are not directly comparable.[8] We, therefore, use unconditional quantile regressions (Firpo et al., 2009) to

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[7]This decomposition is not unique. We could, instead, use incoming firms as the reference group by computing a counterfactual distribution for period t (rather than $t + k$) that replaces the observations for outgoing firms with those of incoming firms, and assess the contribution of continuing firms against the distribution of incoming firms. Our primary results use outgoing firms as the reference group (as in Figure 5); however, the main results are robust to changing the reference group.

[8]This path dependence is a well-documented property of decompositions based on counterfactual samples (Fortin et al., 2011). To illustrate this path dependency in our context, consider the following decomposition of the effect of incoming firms

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estimate the individual effects of entry into the sample and regime transitions on the median, and of exit out of the sample and regime transitions on the median, relative to a counterfactual sample of only continuing firms in $t + k$. In doing so, we decompose the total effects of incoming and outgoing firms into two terms each, which have the same interpretation as in the aggregate decomposition above.

Specifically, we estimate the following two unconditional quantile regressions:

$$RIF(\tilde{Y}, 0.5)_{t+k} = \alpha_O + \beta_O O^X_{t+k} + \gamma_O O^T_{t+k} + \epsilon_{O,t+k}$$
$$RIF(Y, 0.5)_{t+k} = \alpha_I + \beta_I I^E_{t+k} + \gamma_I I^T_{t+k} + \epsilon_{E,t+k}$$

(3)

where $RIF(Y, 0.5)_{t+k}$ is the recentered influence function of Y at the median of the distribution of Y in $t + k$. In turn, $\tilde{Y}$ denotes the counterfactual sample for $t + k$, and O^X_{t+k}, O^T_{t+k}, I^E_{t+k} and I^T_{t+k} are dummy variables indicating the subsequent status of outgoing firms (exit from the sample, or transition into another financing regime), and the prior status of incoming firms (entry into the sample, or transition from another financing regime). The expectation of $RIF(Y, 0.5)_{t+k}$ is the unconditional median of Y; thus, estimating the equations in (3) using OLS estimates the effect of changes in the composition of each group on the medians $\tilde{q}_{0.5,t+k}$ and $q_{0.5,t+k}$.[9]

By estimating Equation (3), we obtain fitted values for the coefficients which, when evaluated at the sample means of the covariates, yield the medians of each sample:

$$\tilde{q}_{0.5,t+k} = \hat{\alpha}_O + \hat{\beta}_O \bar{O}^X_{t+k} + \hat{\gamma}_O \bar{O}^T_{t+k}$$
$$q_{0.5,t+k} = \hat{\alpha}_I + \hat{\beta}_I \bar{I}^E_{t+k} + \hat{\gamma}_I \bar{I}^T_{t+k}$$

(4)

where bars denote sample means (i.e. observed shares of exiting, entering, and transitioning firms). The detailed decomposition is obtained by combining Equations (1) and (4):

$$q_{0.5,t+k} - \tilde{q}^C_{0.5,t+k} = (q_{0.5,t+k} - \tilde{q}^{C,T}_{0.5,t+k}) + (\tilde{q}^{C,T}_{0.5,t+k} - \tilde{q}^C_{0.5,t+k})$$

(2)

where $\tilde{q}^{C,T}_{0.5,t+k}$ is the median of a counterfactual sample that includes continuing (C) and incoming firms that transitioned from other size or regime cells (T). The first term on the right-hand side is the contribution of firms entering the sample; the second term is the contribution of firms transitioning from other financing regimes. Path dependency arises because each term represents a different comparison (the first term is assessed against continuing firms, and the second term is assessed against both continuing and transitioning firms), thereby complicating interpretation of the results. For example, a group may contribute positively to the median when assessed against continuing firms, but negatively when assessed against continuing firms and the other group. Furthermore, while one could in principle choose a common reference group, the resulting decomposition would not add up to the observed change it is meant to decompose.

[9]For any given observation, the recentered influence function at the median is $RIF(Y, 0.5) = q_{0.5} + \frac{0.5 - \theta\{Y \le q_{0.5}\}}{f_y(q_{0.5})}$, where $f_Y(q_{0.5})$ is the probability density function of Y evaluated at the median, and θ is the indicator function. The second term on the right-hand side is the influence function; it yields the effect of an individual observation on the median of Y. The recentered influence function is obtained through the addition of $q_{0.5}$, such that its expectation is equal to the median. The regressions in Equation (3) use a non-parametric (kernel) method to estimate $f_Y(q_{0.5})$ in order to compute the RIF. For further discussion, see Firpo et al. (2009).

$$\tilde{q}^{C}_{0.5,t+k} - \tilde{q}_{0.5,t+k} = -\hat{\beta}_{O}\bar{O}^{X}_{t+k} - \hat{\gamma}_{O}\bar{O}^{T}_{t+k} - e_{O}$$

$$q_{0.5,t+k} - \tilde{q}^{C}_{0.5,t+k} = \hat{\beta}_{I}\bar{I}^{E}_{t+k} + \hat{\gamma}_{I}\bar{I}^{T}_{t+k} + e_{I} \tag{5}$$

For example, consider the contribution of incoming firms to the change in the median cash-to-sales ratio $(q_{0.5,t+k} - \tilde{q}^{C}_{0.5,t+k})$. The second expression in Equation (5) decomposes this contribution into the individual effects of entry into the sector $(\hat{\beta}_{I}\bar{I}^{E}_{t+k})$ and of transition from other regimes $(\hat{\gamma}_{I}\bar{I}^{T}_{t+k})$. Each effect is the product of two terms: the estimated partial effect of increasing the number of firms entering the sample $(\hat{\beta}_{I})$ or transitioning from other regimes $(\hat{\gamma}_{I})$, and the observed shares of firms entering the sample $(\bar{I}^{E}_{t+k})$ or transitioning from other regimes $(\bar{I}^{T}_{t+k})$. Note that the contributions of outgoing firms by subsequent status $(\hat{\beta}_{O}\bar{O}^{X}_{t+k}$ and $\hat{\gamma}_{O}\bar{O}^{T}_{t+k})$ are recorded with the opposite sign of the regression output (as these firms are leaving the sample).

Note, finally, that the detailed decomposition features unexplained residuals, given by $e_{O} = \tilde{q}^{C}_{0.5,t+k} - \hat{\alpha}_{O}$ and $e_{I} = \tilde{q}^{C}_{0.5,t+k} - \hat{\alpha}_{I}$. They stem from the fact that, when the RIF is computed over the full distribution of Y, its expectation conditional on specific covariate values will generally differ from the median of Y conditional on these same covariate values.[10] In our estimations, the magnitude of these residuals is generally small and, more importantly, tends to move in the same direction as the estimated effects (i.e. the residuals do not affect the direction of our results).

4   Results

We present our results in two parts. First, in Section 4.1, we decompose trends in the cash-to-sales, debt-to-assets, and total liabilities-to-assets ratios across the full sample of firms into the contributions of continuing, incoming, and outgoing firms using the re-weighting method in Section 3.1. Second, in Section 4.2 we use the regression-based method in Section 3.2 to present detailed decompositions for Ponzi firms. We show

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[10]Consider the case of the residual $e_{I} = \tilde{q}^{C}_{0.5,t+k} - \hat{\alpha}_{I}$. The function $RIF(Y,0.5)_{t+k}$, which is computed over the full distribution of Y, has an unconditional expectation equal to the unconditional median of Y. In other words, $E\left[RIF(Y,0.5)_{t+k}\right] = Q_{0.5}\left[Y_{t+k}\right]$, where $Q_{0.5}[.]$ is the median function. When firms are classified as incoming and continuing, however, $E\left[RIF(Y,0.5)_{t+k}|I^{E}_{t+k} = 0, I^{T}_{t+k} = 0\right] \neq Q_{0.5}\left[Y_{t+k}|I^{E}_{t+k} = 0, I^{T}_{t+k} = 0\right]$. Now consider Equation (3) as a linear model of the conditional expectation of $RIF(Y,0.5)_{t+k}$. The law of iterated expectations ensures that its expected value is equal to the unconditional median of Y, that is, $E\left[RIF(Y,0.5)_{t+k}\right] = E\left[E\left[RIF(Y,0.5)_{t+k}|I^{E}_{t+k}, I^{T}_{t+k}\right]\right] = \alpha_{I} + \beta_{I}E\left[I^{E}_{t+k}\right] + \gamma_{I}E\left[I^{T}_{t+k}\right]$. Since $\alpha_{I} = E\left[RIF(Y,0.5)_{t+k}|I^{E}_{t+k} = 0, I^{T}_{t+k} = 0\right]$, its OLS estimate — the fitted intercept $\hat{\alpha}_{I}$, which is equal to the sample mean of $RIF(Y,0.5)$ when $I^{E}_{t+k} = 0$ and $I^{T}_{t+k} = 0$ — will generally differ from the sample median when $I^{E}_{t+k} = 0$ and $I^{T}_{t+k} = 0$. In other words, $\hat{\alpha}_{I} \neq \tilde{q}^{C}_{0.5,t+k}$. Analogous reasoning applies to the interpretation of e_{O}.

decompositions of the across-firm median, using outgoing firms as the reference group for the counterfactual, and average results of the rolling decompositions over four sub-periods of the full sample. In the Appendix, we also include robustness analysis in which we present decomposition results for hedge and speculative firms; extend the analysis to a large set of quantiles; and change the reference group from outgoing to incoming firms.[11] In each case, the robustness analysis corroborates our main findings that observed trends in NFC balance sheets reflect changing patterns of entry and exit – rather than changing within-firm behavior – and that these compositional effects are strongest among more financially fragile firms. Finally, in Section 5 we discuss economic and behavioral mechanisms that may underlie these empirical findings.

4.1 The full sample

To begin, Table 1 shows the contributions of continuing, incoming and outgoing firms to median trends in cash to sales, debt to assets, and total liabilities to assets for the full sample of firms. Table 1, first, reports the average annual change in the median of each ratio for each sub-period, and then disaggregates these average annual changes into the contribution of continuing firms (the within-firm effect), and the contribution of churning (the composition effect). In turn, the last two columns disaggregate the compositional effect into the independent contributions of incoming and outgoing firms.

Table 1 shows, most importantly, that – for both cash and debt – the median trends described in Section 2 are produced by compositional effects, rather than behavioral changes occurring within firms over time. To begin, the top panel of Table 1 shows that the increase in the median cash-to-sales ratio since the 1980s is produced entirely by *incoming* firms. Specifically, incoming firms make a positive contribution to the median cash-to-sales ratio averaging 0.31% per year after 1982 — more than enough to offset the negative within-firm effect, which concurrently averages -0.08% per year (while the effect of outgoing firms is close to zero). In other words, the median firm entering the nonfinancial corporate sector has higher cash holdings than the median incumbent firm. As is discussed in Section 5, below, these findings are consistent both with the fact that the IPO generates an inflow of funds to the firm, and with the fact that new firms enter with higher idiosyncratic risk over this period. In contrast, the negative within-firm contribution indicates that the median continuing firm runs down its cash holdings (relative to sales), such that — if we could ignore

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[11]Appendix A shows results for hedge and speculative firms using both decomposition methods (Tables 6-9). These results show that our primary conclusion about the relative importance of compositional effects versus within-firm effects also holds for less fragile firms in the nonfinancial corporate sector. Second, Appendix B extends the decompositions to a large set of quantiles, highlighting the robustness of our main conclusions to a large set of quantiles (Figures 6 and 7), and briefly discussing these results. Third, Appendix C explores robustness to using incoming firms as the reference group. Tables 10-11 in Appendix C show the results are largely robust to changing the reference group, particularly for the first step of the decomposition dividing the within-firm effect from the total compositional effect.

Table 1: All Firms: Decomposing average annual changes in the median.

	Cash as % of Sales				
	Annual	Within		Composition	
	Change	Firm	Total	Incoming	Outgoing
1971-1981	-0.07	-0.12	0.05	0.07	-0.01
1982-1992	0.14	-0.19	0.33	0.33	-0.00
1993-2003	0.24	-0.05	0.29	0.35	-0.06
2004-2014	0.14	-0.02	0.16	0.26	-0.10

	Debt as % of Assets				
	Annual	Within		Composition	
	Change	Firm	Total	Incoming	Outgoing
1971-1981	-0.03	-0.24	0.21	0.06	0.14
1982-1992	-0.18	0.44	-0.62	-0.58	-0.04
1993-2003	-0.09	0.36	-0.45	-0.67	0.21
2004-2014	0.16	0.26	-0.10	-0.26	0.16

	Liabilities as % of Assets				
	Annual	Within		Composition	
	Change	Firm	Total	Incoming	Outgoing
1971-1981	0.56	0.32	0.24	0.18	0.06
1982-1992	0.09	0.97	-0.88	-0.63	-0.25
1993-2003	0.18	0.78	-0.60	-0.32	-0.28
2004-2014	0.18	0.35	-0.17	0.12	-0.29

Notes: The reference group for the counterfactual sample is outgoing firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

the effect of changes in the composition of firms — median cash holdings would have *fallen* after 1980.

The second and third panels of Table 1 turn to debt and total liabilities, respectively. These results show, first, that the declining median debt-to-asset ratio (which falls 0.13% per year during 1982-2003) is again produced entirely by *incoming* firms. Specifically, relative to continuing firms, incoming firms lower the median debt-to-asset ratio by an average of 0.62% per year. Even when the median debt-to-asset ratio begins to rise in the final subperiod (2004-2014), incoming firms continue to bring down indebtedness. These two patterns also hold for total liabilities: continuing firms become more leveraged over time, whereas during the 1980s and 1990s, incoming firms tend to be less leveraged than continuing firms. As such, directly following the IPO, firms have less debt and fewer outstanding liabilities than incumbent firms, whereas the median continuing firm acquires liabilities over time.

Finally, outgoing firms contribute *positively* to the median debt-to-asset ratio in most subperiods, although not enough to offset the negative contribution of incoming firms. Therefore, outgoing firms are relatively *less indebted* than continuing firms, such that the median debt-to-asset ratio increases when they

leave the sector. This result is at first sight surprising, as it suggests that crushing debt obligations are not correlated with exit. However, it is important to recognize at least two caveats. First, the full-sample decompositions mask significant sub-group heterogeneity. Turning to Ponzi firms below helps unpack the effect of exit, by showing that – among financially fragile firms – those that exit are indeed more indebted than those that continue. Second, while outgoing firms contribute positively to the median debt-to-asset ratio, they make negative contributions to the evolution of total liabilities relative to assets. As such, the median outgoing firm may not be more *indebted* than the median continuing firm, but it is more leveraged. This result, accordingly, suggests a possibly important role for rising non-debt obligations as a correlate of exit. Furthermore, with total liabilities the positive within-firm effect is large enough to compensate for the combined negative effect of incoming and outgoing firms, such that the median liabilities to assets have not fallen after 1980.

Together, the results in Table 1 highlight that, if we could ignore changes in the composition of the corporate sector, the trends in Section 2.1 and 2.2 would look quite different: the median firm would have falling cash holdings, rising indebtedness, and rising leverage. However, these within-firm trends are countered by churning and, most importantly, a high rate of new entry rate into the corporate sector in the 1980s and 1990s (see Doidge et al., 2017; Kahle & Stulz, 2017). As such, these results point to decision-making surrounding the IPO – rather than changing within-firm behavior – as a key channel through which new financial practices are realized in the post-1980 nonfinancial corporate sector.

4.2 Ponzi firms

Next, we turn to the most financially fragile set of Ponzi firms. We emphasize Ponzi firms for two main reasons. First, Ponzi firms may help explain why *entry* into the nonfinancial corporate sector is the prime driver of overall trends in cash holdings and indebtedness. As shown in Table 2, the share of firms that *enter as Ponzi* increases substantially over the sample period, from 14.2% of new entries in 1971-1981 to 49.2% in 2004-2014, while the shares of new firms entering in both speculative and hedge regimes fall. Additionally, like the main trends in cash holdings and indebtedness, the expansion of Ponzi firms is concentrated during the 1980s and 1990s (Davis et al., 2017), and (as shown in Section 2) the median Ponzi firm has greater increases in cash to sales and decreases in debt to assets than the median firm in other regimes. Second, the median Ponzi firm has become less indebted and accumulated cash, even though it, by definition, does not generate enough net operational income to meet its financial obligations. The decompositions resolve this apparent puzzle: firms that continue over time as Ponzi *do* run do'wn cash holdings and accumulate debt,

Table 2: Incoming firms entering in each finance regime by subperiod
Number and share of total

	Total	Hedge		Speculative		Ponzi	
	N	N	%	N	%	N	%
1971-1981	4,161	1,205	29	2,365	56.8	591	14.2
1982-1992	5,482	1,484	27.1	2,271	41.4	1,727	31.5
1993-2003	6,893	1,201	17.4	2,694	39.1	2,998	43.5
2004-2014	3,851	736	19.1	1,219	31.7	1,896	49.2

Notes: The table shows the total number and share of incoming firms that enter the sample in each of the three financing regimes for each sub-period. For details describing the sample and for variable definitions, see Section 2.1.

while the overall median trends are dominated by changes in the composition of firms, with important roles for both entry and exit.

Table 3: Ponzi firms : Decomposing average annual changes in the median.

Cash as % of Sales											
	Annual	Within	Composition		Incoming Firms				Outgoing Firms		
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.01	-0.10	0.10	0.19	0.18	0.05	-0.04	-0.08	0.08	-0.13	-0.03
1982-1992	0.19	-0.85	1.04	-0.21	0.86	-0.90	-0.17	1.25	0.29	0.50	0.46
1993-2003	0.23	-1.23	1.46	-2.97	1.10	-2.99	-1.09	4.44	0.76	2.19	1.48
2004-2014	0.58	-1.72	2.30	-2.28	0.82	-2.43	-0.67	4.58	1.26	1.99	1.33
Debt as a % of Assets											
	Annual	Within	Composition		Incoming Firms				Outgoing Firms		
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.04	1.86	-1.82	-5.88	-1.74	-3.87	-0.26	4.05	0.17	3.91	-0.02
1982-1992	-1.16	2.82	-3.98	-2.00	-2.73	1.05	-0.32	-1.98	-0.87	-0.85	-0.26
1993-2003	-0.23	1.88	-2.11	1.80	-0.97	2.60	0.17	-3.91	-0.93	-2.72	-0.26
2004-2014	0.10	1.35	-1.25	1.00	0.09	0.59	0.33	-2.25	-0.87	-1.03	-0.36
Total liaiblities as a % of Assets											
	Annual	Within	Composition		Incoming Firms				Outgoing Firms		
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	1.05	3.11	-2.05	-9.50	-1.75	-6.51	-1.25	7.45	0.08	6.58	0.79
1982-1992	-0.35	5.81	-6.17	-6.72	-3.28	-1.81	-1.63	0.55	-1.37	1.61	0.32
1993-2003	0.68	4.47	-3.79	0.71	-1.06	1.95	-0.18	-4.50	-1.95	-2.57	0.03
2004-2014	0.48	3.44	-2.95	0.16	1.09	-0.85	-0.09	-3.11	-2.68	-0.19	-0.24

Notes: The reference group for the counterfactual sample is outgoing firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

Using the regression-based decomposition described in Section 3.2, Table 3 disaggregates median changes in cash and outstanding liabilities held by Ponzi firms into contributions from continuing firms, entry into the sample, exit out of the sample, and transitions into or out of Ponzi finance from more robust financing regimes. The top panel analyzes the cash-to-sales ratio. As with the full sector, the within-firm effect is negative (such that continuing firms decumulate cash over time), while the compositional effect is positive

(such that the observed increase in cash to sales reflects churning in the group of Ponzi firms). Their combined effect yields an average increase in the median cash-to-sales ratio among Ponzi firms that, at least during the 1982-2003 period, was only moderately larger than the full sector: 0.21% per year versus 0.13% per year. These apparently similar trends, however, mask that the independent magnitudes of each effect are much larger among Ponzi firms. After 1982, the within-firm effect for Ponzi firms, for example, averages -1.26% per year, versus -0.09% for the full sector. As such, not only do firms decumulate cash between two consecutive years of being Ponzi, but they do so at a much faster rate than firms in other financing regimes.

Disaggregating the contributions of incoming and outgoing firms, in turn, highlights that – unlike in the sector-wide decompositions – incoming Ponzi firms make a negative contribution to the cash-to-sales ratio. In turn, the detailed decomposition shows that this overall effect is the product of a positive effect from new firms *entering* the sector and a (larger) negative effect of firms *transitioning* into Ponzi from a more robust regime. The large and positive contribution of new entry among Ponzi firms, which averages 0.92% per year after 1982, therefore, corroborates the full sample result that new firms enter with higher cash holdings. Furthermore, as the share of firms that IPO as Ponzi doubles between 1971-1981 and 1982-1992 (as shown in Table 2), the positive contribution of new entry among Ponzi firms increases substantially. In contrast, firms transitioning into Ponzi finance from more robust regimes are likely to hold less cash than incumbent Ponzi firms. Notably, approximately 80% of firms that transition into Ponzi after 1970 do so from a speculative regime (in which they can meet interest, but not principal obligations) in which they were reliant on current credit conditions to refinance debt (Davis et al., 2017). This result, therefore, suggests that firms that are becoming increasingly fragile 'wear down' their stocks of cash as their financial positions deteriorate.

Like entering Ponzi firms, *outgoing* firms make a positive contribution to increasing median cash holdings— both when they transition into a more robust regime, and when they exit the sector entirely. In other words, outgoing Ponzi firms have *lower* cash holdings as compared to continuing firms. Given that the within-firm effect is negative and that the average duration of a spell of Ponzi finance exceeds one year, this result is intuitive: during a spell of Ponzi finance, firms wear down their stocks of cash such that when they leave Ponzi finance, regardless of the reason, their cash holdings are low.[12] By leaving the Ponzi firm subsample, outgoing firms – no matter the outcome – thereby make large positive contributions to the median cash-to-sales ratio.

The main lessons from the median cash-to-sales ratio also apply to the evolution of financial obligations, particularly during the 1980s and 1990s, when the expansion of Ponzi finance is concentrated. The second

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[12]Specifically, the average duration of Ponzi finance for a firm that then transitions into a speculative regime is 1.9 years, and the average duration of Ponzi finance for a firm that then exits the sector entirely is 2.8 years.

and third panels of Table 3 show that within-firm effects are consistently positive, for both debt and total liabilities, such that the median firm continuing as Ponzi acquires more debt and more total liabilities relative to assets. Furthermore, like the speed at which Ponzi firms decumulate cash, the rate of accumulation of debt and liabilities by continuing Ponzi firms far exceeds that of firms with more robust financial structures. Since 1982, the within-firm contribution to the change in the median debt-to-asset ratio averages 2% per year among Ponzi firms, compared to 0.35% for the full sample. The within-firm contribution to the median liability-to-asset ratio, in turn, averages a remarkable 4.57% per year among Ponzi firms, versus 0.7% among all firms. These numbers confirm the *a priori* expectation that Ponzi firms, which have to roll both interest and principal into future obligations between two years, become more leveraged over time, and do so far more quickly than more financially robust firms. In contrast, the total compositional effect for both debt and total liabilities is negative, indicating that churning within the group of Ponzi firms has reduced median debt liabilities to assets. Between 1982 and 2003, this composition effect was, furthermore, large enough to offset the within-firm effect, thereby producing the sizable decline in the median Ponzi firms' outstanding debt shown in Section 2.3.

The detailed breakdown of the composition effect for debt and total liabilities is also instructive. First, new *entry* into the nonfinancial corporate sector reduces both the median debt- and liability-to-asset ratios during the 1980s and 1990s. As such, when a firm IPOs as Ponzi, it not only holds more cash than incumbent Ponzi firms, but also holds less debt and has lower overall leverage. The high rate of new entry (IPOs) in the 1980s and 1990s, therefore, moderates falling liquidity and rising leverage within continuing Ponzi firms.[13] Second, *exit* from the sector also acts to reduce both the median debt- and liability-to-asset ratios after 1982. Specifically, because firms become increasingly indebted and leveraged when facing a spell of Ponzi finance between two years, they tend to have more debt and total liabilities when they exit, as compared to the remaining Ponzi firms. By exiting, these firms therefore reduce median debt and liabilities (i.e. make a negative contribution to these trends).

Third, the negative contribution of exit to the debt-to-asset ratio is consistently reinforced by a negative contribution of transitions into other regimes, such that the total contribution of outgoing firms is negative throughout the post-1982 period.[14] This pattern could again reflect the mechanical effect of a spell of Ponzi finance, but it could also reflect that firms transitioning out of Ponzi finance to a more robust regime have

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[13]In contrast, firms that transition into Ponzi from other regimes tend to increase median indebtedness and, during 1993-2003, median leverage. As a result, the total contribution of incoming firms to the overall medians oscillates between positive and negative depending on the relative strength of these two components.

[14]In the case of total leverage, the effect of regime transitions was positive between 1982-1992 but negative between 1993-2003, such that the total contribution of outgoing firms oscillates between positive and negative.

an increase in net operational income relative to financial commitments, which may make them creditworthy to the point of being able to borrow more than other Ponzi firms.[15] Note, furthermore, that Table 4, which decomposes changes in median interest payments as a share of sales for Ponzi firms, corroborates the patterns above. In particular, as continuing Ponzi firms become more indebted over time, they also face a growing interest burden. In turn, churning within the group of Ponzi firms acts to reduce the interest burden.

Table 4: Ponzi firms: Decomposing average annual changes in the median
Interest payments to sales

| | Annual | Within | Composition | Incoming Firms | | | | Outgoing Firms | | | |
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.20	0.25	-0.05	-0.83	-0.09	-0.58	-0.17	0.78	0.10	0.57	0.11
1982-1992	-0.18	0.12	-0.30	-0.50	-0.04	-0.40	-0.06	0.21	-0.04	0.25	0.00
1993-2003	-0.00	0.11	-0.11	-0.25	0.03	-0.24	-0.04	0.14	0.00	0.12	0.01
2004-2014	0.03	0.18	-0.15	-0.76	0.02	-0.45	-0.32	0.61	-0.01	0.36	0.25

Notes: The reference group for the counterfactual sample is outgoing firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

Finally, Tables 6-7 in Appendix show decomposition results for hedge and speculative firms. Two points are useful to recognize in the context of this discussion about Ponzi firms. First, while within-firm and compositional effects for both hedge and speculative firms continue to pull the median ratios in opposite directions, the magnitudes of these effects are far smaller than for Ponzi firms. This point is particularly important for speculative firms, as it highlights that periods of speculative finance have not caused spirals of falling liquidity and rising leverage. Second, like incoming Ponzi firms, incoming speculative firms make consistently positive contributions to the median cash-to-sales ratio, and consistently negative contributions to the debt- and liability-to-asset ratios. Applying the detailed decomposition methodology to the subsample of speculative firms, furthermore, reiterates that *entry* is an important source of these effects.[16] Thus, the role of new entry (IPOs) in driving median cash-to-sales ratios also characterizes the most common financial regime (speculative firms) in the sector.

Together, this analysis highlights that spells of Ponzi finance lead firms to decumulate cash and accumulate debt far more quickly than in other regimes. In turn, entry and exit play a fundamental role in preventing these within-firm trends from dominating the evolution of the full sector's balance sheet. The effect of entry into the corporate sector is similar outside of Ponzi finance as well: across the sector, new

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[15]Note that Davis et al. (2017) document that a high share of Ponzi firms are Ponzi due to negative sources of cash net of operational expenses – i.e. before even considering their financial obligations. Over the full period, 84.1% of Ponzi firms in our sample have negative sources of cash; the share of Ponzi firms with negative sources of cash that subsequently transition to a more robust regime is still high, but more than ten percentage points lower (71.8%).

[16]We show detailed decompositions for hedge and speculative firms in Appendix Tables 8-9.

firms tend to have more robust balance sheets than their incumbent counterparts. The fact that exit also contributes to more robust balance sheets is, however, unique to Ponzi firms, and captures that bankruptcy or changes in ownership (mergers and acquisitions) limit how insolvent the overall group of Ponzi firms can become.[17] Ponzi firms, therefore, highlight the key role of IPOs in the post-1980 evolution of firm balance sheets, but also highlight that exit 'checks' the aggregate influence of unsustainable within-firm trends.

5 Discussion

Our empirical results show that 'churning' caused by entry into and exit out of the nonfinancial corporate sector is key to explaining the evolution of balance sheets after 1980. Notably, the post-1980 period is also one during which entry and exit behavior evolves substantially. An increased pace of entry between the early 1980s and mid-1990s is particularly well documented (Fama & French, 2004; Doidge et al., 2017; Kahle & Stulz, 2017). In our sample, 5% of all firms in 1980 are entering firms, and this share trends up (with the exception of a brief drop between 1988 and 1990) until 1996, when 17.7% of firms are entering firms. The share of entering firms, subsequently, declines during the 2000s, settling at an average 8% of all firms between 2000 and 2014.

Entry can shape the distribution of cash holdings and leverage through at least two mechanisms. First, the IPO generates an infusion of cash to the firm that is large relative to the firm's pre-IPO assets. Alti (2006) finds, for example, that proceeds from the IPO amount on average to 53% of a firm's pre-IPO assets in periods of low IPO activity, and to 75% in periods of high IPO activity. Furthermore, a significant proportion of the new capital is initially held as cash (Alti, 2006). As such, increased entry rates during a period of high IPO activity drive up median cash holdings. Similarly, Dudley & James (2013) find large reductions (of over 50%) in both average and median leverage following the IPO.

Second, entry affects the distribution of cash holdings by disseminating firm characteristics that correlate with higher cash holdings. Of particular importance is rising firm-level volatility, both in stock prices (Campbell, Lettau, Malkiel & Xu, 2001) and in sales and operating income (Comin & Philippon, 2005). Higher firm-level volatility not only increases firms' precautionary demand for liquidity (cash) (Opler, Pinkowitz, Stulz & Williamson, 1999; Bates et al., 2009), but has, also, been linked to new entry. Brown & Kapadia (2007) show that, between the 1960s and the mid 2000s, each cohort of newly listed firms exhibits higher idiosyncratic risk (in stock returns) than the preceding cohort, and that the year of entry statistically dom-

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[17]There is a positive association between financial fragility (namely, being in a more fragile financing regime) and the likelihood of exit for the full sector. The analysis in Davis et al. (2017), for instance, indicates that being in a Ponzi regime enhances a firm's likelihood of exit in the subsequent year, whereas being in a more robust regime reduces the likelihood of exit.

inates other covariates in explaining the trend in idiosyncratic risk. Brown & Kapadia (2007), furthermore, find that differences in risk across cohorts are persistent. In other words, new corporations are not simply going public at an earlier stage in their life cycle; instead, an increasingly risky segment of the economy has gained access to equity markets.

Given a rising proportion of new firms that enter the corporate sector with Ponzi financing structures, entry is particularly key for understanding shifts in the distribution of cash among Ponzi firms. Over our sample period, 36% of all instances of Ponzi finance begin when a firm enters the corporate sector with a Ponzi structure (as opposed to entering the corporate sector with a robust financial structure and becoming Ponzi over time). Furthermore, the share of new firms entering with Ponzi financing structures increases over time (Davis et al., 2017). Finally, most Ponzi firms (60% on average) are also small firms. These numbers suggest that the mechanisms described above are likely to have been even more important drivers of changes in the distribution of cash holdings among Ponzi firms, as compared to across the full sample.

The mid-1990s, also, mark changes in exit behavior and, in particular, a distinct surge in exit rates begins in 1997 (Doidge et al., 2017). Using 1997 as a break, we can divide the sample into two sub-periods: 1975-1996 and 1997-2012.[18] Between these two periods, exit rates rise from an average of 6.39% per year in the first period to 9.84% per year after 1997. Among Ponzi firms, which have higher rates of exit in most years, exit rates increase from 11% to 14.7%. This increase in exit rates, also, coincides with an increase in the contribution of exiting firms to aggregate changes in balance sheet structure. Applying the decomposition method in Section 3.1 to 1975-1996 and 1997-2013 shows that, among Ponzi firms, the contribution of exit to the change in the median debt-to-assets ratio doubles after 1997 (from -0.46 to -0.94 percentage points per year); the contribution to the change in the median liabilities-to-assets ratio almost triples (from -0.86 to -2.45 percentage points per year); and the contribution to the change in the median cash-to-sales ratio increases almost fivefold (from 0.23 to 1.04 percentage points per year). Each of these contributions is, also, large relative to the actual changes in these ratios (see Table 3). Large proportional increases in the contribution of exit, similarly, occur in the full sample of firms.

The results suggest that exit plays a key role in countering the within-firm trends of financially fragile firms, thereby preventing them from dominating aggregate measures of liquidity and indebtedness. For this period, two mechanisms are particularly important. First, unsustainable finance can lead firms to be delisted 'for cause' – i.e. due to bankruptcy or non-compliance with requirements imposed by stock exchanges. It is reasonable to expect a period in which many financially fragile firms enter the sector will be followed by a

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[18]The 1970-1974 period features a small number of Ponzi firms, which yields noisy exit rates for that group. We do not observe exit rates in 2014, which is the last year of our sample.

period with high rates of exit for cause. Notably, Doidge et al. (2017) show that the rate of exit for cause surged in the late 1990s and mid-2000s, from under 3% in the early 1990s to a peak of 7.13% in 2001.[19] This surge in exit for cause, therefore, follows a period of rapid entry through the mid-1990s that, importantly, expanded the share of financially fragile (Ponzi) firms. As such, these trends suggest that the rise in exit for cause after 1997 is a direct result of the prior entry of firms with unsustainable financial structures.

Second, firms with unsustainable financing structures can be absorbed into financially stable firms via mergers and acquisitions. Even when the rate of exit for cause declines after the early 2000s, overall exit rates remain high due to mergers and acquisitions. In fact, Doidge et al. (2017) show that mergers and acquisitions are the leading reason for exit after 1997. Specifically, their data shows that 73% of the increased rate of exit after 1997 results from an increased rate of mergers and acquisitions, whereas 'for cause' and voluntary delists account for only 17% and 18% respectively. Furthermore, the post-1997 surge in mergers and acquisitions is driven by targeting 'young' firms – namely, those within five years of listing (Arikan & Stulz, 2016; Doidge et al., 2017). Mergers and acquisitions account for over 55% of delists among these young firms between 1997 and 2012 (up from 40% in 1977-1996), while no change occurs among seasoned firms. Given that new firms have increasingly entered the corporate sector with Ponzi financial structures, these trends suggest that these financially fragile firms have been prime targets for acquisitions. In turn, to the extent that the acquiring firms are more financially robust than their targets, a rise in mergers and acquisitions also helps to explain the contribution of exit to the evolution of firm balance sheet structure.[20]

6 Conclusion

The results in this paper highlight that churning in the nonfinancial corporate sector is a crucial determinant of post-1980 changes in the financial structure of U.S. nonfinancial corporations. First, for both the full sector and subsamples defined by Minskian financing regimes, the results point to changes in *entry* dynamics – and, specifically, increasing numbers of IPOs during the 1980s and 1990s – as a central mechanism through which changing financial norms are realized. As such, these results suggest that analyses of changes in

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[19]See also Fama & French (2004) for early evidence along the same lines. Note that our sample differs somewhat from that in Doidge et al. (2017), which calculates delisting rates using a sample that matches Compustat and CRSP data. In addition to the fact that we do not require matching to CRSP, we only include firms that we can classify into a hedge, speculative, or Ponzi financing regime, and we define 'exit' as an interruption (without return) in the observations for a given firm. Our sample, therefore, includes fewer firms between 1980 and 2001 (an average difference of 429 firms per year), and more firms thereafter (an average difference of 229 firms per year). Despite these sample differences, however, our measure of exit rates closely tracks that of Doidge et al. (2017) both in levels and rates of change.

[20]Acquisitions of younger (and arguably more financially fragile firms) have become a key aspect of leading firms' growth strategies. Gutiérrez & Philippon (2016) show, for example, that sales concentration increases between 22% and 30% since 1995, driven largely by mergers and acquisitions. Against this backdrop, the role of exit highlights that this evolution is closely tied to changing dynamics of inter-firm competition.

IPO behavior, as well as the intersection with the increasing incidence of firms that IPO as Ponzi, are an important focus for further research on the evolution of firm financial structure. Second, we find that, among Ponzi firms in particular, exit is also a key mechanism that 'checks' the aggregate impact of unsustainable financing patterns among Ponzi firms. Third, and in notable contrast, the behavior of continuing firms tends to move in the opposite direction of the aggregate trends, highlighting that an exclusive focus on within-firm behavioral changes will yield an incomplete picture of the causes and consequences of post-1980 changes in firm financial structure. Instead, the dynamics of entry and exit, as well as links between changing entry and exit dynamics and inter-firm competition, come center stage.

The analysis in this paper also provides particular insight into the evolution of the most fragile subset of Ponzi firms in the U.S. economy. The post-1980 period has seen a sustained expansion in the incidence of Ponzi finance, and a concurrent increase in the share of firms that go public as Ponzi. Even though Ponzi firms are, by definition, unable to meet their financial commitments with current income, aggregate trends show Ponzi firms are net acquirers of cash and become less indebted over time. Importantly, our results show that these trends are produced entirely by entry and exit, whereas firms that continue as Ponzi decumulate cash and become increasingly leveraged. Thus, Ponzi structures *are* in fact unsustainable: firms become Ponzi with relatively more robust financing structures, but run down liquid financial assets and become increasingly indebted over time. Exit by Ponzi firms is, in turn, a key mechanism preventing unsustainable within-firm trends from acquiring substantial aggregate influence. This role of exit , furthermore, becomes increasingly important after 1980. Importantly, speculative firms—which tend to be large and well-established—also become more indebted and decumulate cash over time, but do not 'spiral' out of control.

Together, these results establish a clear, and previously unexplored, link between changing entry and exit dynamics in the post-1980 nonfinancial corporate sector and firm-level financial fragility. Importantly, the evolution of firm balance sheet structure analyzed in this paper, together with the growing share of Ponzi firms after 1980, point to a long-run evolution of financial norms. On the one hand, these trends suggest a 'long wave' of increasing financial fragility, characterized by increased tolerance for riskier ventures and higher risk taking (Minsky, 1964; Ryoo, 2010; Wray, 2016; Davis et al., 2017). On the other hand, however, these trends also coincide with higher cash holdings and reduced indebtedness among the majority of firms. By considering these two sets of trends simultaneously, our analysis is explicit about the source of changing financial norms over this period in the U.S. nonfinancial corporate sector. In particular, our results suggest that – as opposed to reflecting more risk-taking within continuing firms – new financial norms after 1980 in the U.S. are rooted in when and how firms access equity finance.

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A   Additional tables

Table 5: Empirical definitions of financing regimes
Reproduced from Davis, de Souza and Hernandez (2017)

	Compustat #
Sources of funds	
Funds from operations	
Income before extraordinary items[1]	18 + 15
Depreciation and amortization	14
Extraordinary items and discontinued operations	48
Deferred taxes[2]	126
Equity in net loss[2]	106
Sale of property, plant and equipment, and sale of investments (loss)[2]	213
Funds from operations - other[2]	217
Funds from investment activities	
Sale of property, plant and equipment[2]	107
Sale of investments[2]	109
Other funds from current activities[2]	218
Cash commitments	
Interest and Related Expenses	15
Debt in current liabilities – Total[3]	34
Notes payable	
Long-term debt due in one year	
Trade accounts payable[3]	70
Current liabilities - other[3]	72

Notes: [1] Income before extraordinary items is reported net of interest expense; we, therefore, add interest payments back into this income category to measure sources of cash available to meet financial obligations. [2] Items with zeros imputed for missing observations. [3] Items evaluated at the end of the previous year.

Table 6: Hedge firms : Decomposing average annual changes in the median.

Cash as % of Sales

	Annual	Within		Composition	
	Change	Firm	Total	Incoming	Outgoing
1971-1981	-0.10	-0.31	0.22	-0.45	0.67
1982-1992	0.32	-0.03	0.35	0.02	0.34
1993-2003	0.35	-0.28	0.62	-0.19	0.81
2004-2014	-0.33	-0.12	-0.21	-0.58	0.37

Debt as % of Assets

	Annual	Within		Composition	
	Change	Firm	Total	Incoming	Outgoing
1971-1981	0.76	0.08	0.68	2.27	-1.59
1982-1992	-0.47	0.60	-1.07	-0.25	-0.82
1993-2003	0.17	1.15	-0.98	0.30	-1.28
2004-2014	0.67	0.84	-0.17	-0.41	0.24

Liabilities as % of Assets

	Annual	Within		Composition	
	Change	Firm	Total	Incoming	Outgoing
1971-1981	1.26	0.51	0.75	3.15	-2.40
1982-1992	-0.72	1.00	-1.72	0.42	-2.15
1993-2003	0.23	0.93	-0.70	1.37	-2.08
2004-2014	0.78	0.90	-0.12	0.57	-0.68

Notes: The reference group for the counterfactual sample is outgoing firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

Table 7: Speculative firms : Decomposing average annual changes in the median.

Cash as % of Sales

	Annual	Within	Composition		
	Change	Firm	Total	Incoming	Outgoing
1971-1981	-0.11	-0.07	-0.04	0.14	-0.18
1982-1992	0.09	-0.04	0.13	0.47	-0.35
1993-2003	0.18	0.10	0.08	0.49	-0.41
2004-2014	0.19	0.10	0.09	0.70	-0.61

Debt as % of Assets

	Annual	Within	Composition		
	Change	Firm	Total	Incoming	Outgoing
1971-1981	-0.09	-0.45	0.36	0.44	-0.08
1982-1992	-0.06	-0.09	0.03	-0.03	0.07
1993-2003	-0.13	-0.52	0.39	-0.63	1.02
2004-2014	0.03	-0.20	0.23	-0.35	0.59

Liabilities as % of Assets

	Annual	Within	Composition		
	Change	Firm	Total	Incoming	Outgoing
1971-1981	0.60	0.09	0.51	0.10	0.41
1982-1992	0.03	-0.12	0.15	-0.50	0.65
1993-2003	0.19	-0.55	0.74	-0.73	1.47
2004-2014	-0.02	-0.49	0.47	-0.51	0.98

Notes: The reference group for the counterfactual sample is outgoing firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

Table 8: Hedge firms: Detailed decompositions of the median

				Cash as % of Sales							
	Annual	Within	Composition			Incoming Firms				Outgoing Firms	
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	-0.10	-0.31	0.22	-0.45	0.03	-0.52	0.03	0.67	-0.08	0.79	-0.04
1982-1992	0.32	-0.03	0.35	0.02	0.50	-0.47	-0.01	0.34	-0.09	0.40	0.03
1993-2003	0.35	-0.28	0.62	-0.19	0.29	-0.45	-0.04	0.81	-0.16	0.85	0.12
2004-2014	-0.33	-0.12	-0.21	-0.58	-0.11	-0.47	0.00	0.37	-0.30	0.61	0.07

				Debt as a % of Assets							
	Annual	Within	Composition			Incoming Firms				Outgoing Firms	
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.76	0.08	0.68	2.27	0.18	2.30	-0.21	-1.59	0.38	-2.09	0.12
1982-1992	-0.47	0.60	-1.07	-0.25	-0.80	0.61	-0.05	-0.82	0.28	-1.13	0.03
1993-2003	0.17	1.15	-0.98	0.30	-0.41	0.57	0.14	-1.28	0.56	-1.67	-0.17
2004-2014	0.67	0.84	-0.17	-0.41	-0.59	0.23	-0.05	0.24	0.79	-0.61	0.05

				Total liaiblities as a % of Assets							
	Annual	Within	Composition			Incoming Firms				Outgoing Firms	
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	1.26	0.51	0.75	3.15	0.36	2.79	0.01	-2.40	0.32	-2.56	-0.16
1982-1992	-0.72	1.00	-1.72	0.42	-0.96	1.33	0.05	-2.15	0.19	-1.94	-0.40
1993-2003	0.23	0.93	-0.70	1.37	-0.11	1.49	0.00	-2.08	0.30	-2.28	-0.09
2004-2014	0.78	0.90	-0.12	0.57	-0.34	1.10	-0.19	-0.68	0.63	-1.43	0.12

				Interest payments as a % of Sales							
	Annual	Within	Composition			Incoming Firms				Outgoing Firms	
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.14	0.02	0.12	0.13	0.02	0.12	-0.00	-0.02	0.03	-0.04	-0.01
1982-1992	-0.09	-0.02	-0.06	-0.01	-0.06	0.05	-0.00	-0.05	0.01	-0.06	-0.00
1993-2003	-0.02	0.01	-0.02	0.08	-0.02	0.07	0.03	-0.11	0.02	-0.10	-0.03
2004-2014	0.05	0.01	0.04	-0.03	-0.02	0.01	-0.02	0.06	0.04	-0.01	0.03

Notes: The reference group for the counterfactual sample is outgoing firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

Table 9: Speculative firms: Detailed decompositions of the median

Cash as % of Sales

| | Annual | Within | Composition | Incoming Firms | | | | Outgoing Firms | | | |
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	-0.11	-0.07	-0.04	0.14	0.03	0.12	-0.01	-0.18	-0.01	-0.18	0.01
1982-1992	0.09	-0.04	0.13	0.47	0.12	0.35	0.01	-0.35	-0.02	-0.33	0.01
1993-2003	0.18	0.10	0.08	0.49	0.09	0.41	-0.01	-0.41	-0.06	-0.37	0.02
2004-2014	0.19	0.10	0.09	0.70	0.08	0.63	-0.01	-0.61	-0.09	-0.53	0.02

Debt as a % of Assets

| | Annual | Within | Composition | Incoming Firms | | | | Outgoing Firms | | | |
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	-0.09	-0.45	0.36	0.44	0.15	0.35	-0.06	-0.08	0.11	-0.20	0.00
1982-1992	-0.06	-0.09	0.03	-0.03	-0.18	0.09	0.06	0.07	0.03	0.10	-0.06
1993-2003	-0.13	-0.52	0.39	-0.63	-0.23	-0.43	0.03	1.02	0.19	0.88	-0.04
2004-2014	0.03	-0.20	0.23	-0.35	-0.05	-0.33	0.02	0.59	0.11	0.60	-0.12

Total liaiblities as a % of Assets

| | Annual | Within | Composition | Incoming Firms | | | | Outgoing Firms | | | |
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.60	0.09	0.51	0.10	0.20	-0.05	-0.04	0.41	0.11	0.35	-0.05
1982-1992	0.03	-0.12	0.15	-0.50	-0.23	-0.32	0.04	0.65	-0.06	0.74	-0.03
1993-2003	0.19	-0.55	0.74	-0.73	-0.11	-0.69	0.07	1.47	0.09	1.50	-0.12
2004-2014	-0.02	-0.49	0.47	-0.51	0.10	-0.64	0.03	0.98	-0.00	0.97	0.01

Interest payments as a % of Sales

| | Annual | Within | Composition | Incoming Firms | | | | Outgoing Firms | | | |
	Change	Firm		Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.08	0.03	0.04	0.07	0.02	0.06	-0.01	-0.03	0.01	-0.04	0.00
1982-1992	-0.05	-0.07	0.02	0.12	0.01	0.12	-0.01	-0.10	-0.01	-0.09	0.01
1993-2003	-0.03	-0.06	0.03	0.05	0.00	0.05	-0.00	-0.02	0.00	-0.02	-0.00
2004-2014	-0.02	-0.04	0.02	0.04	0.00	0.04	-0.00	-0.02	-0.00	-0.02	0.00

Notes: The reference group for the counterfactual sample is outgoing firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

B Extending to a large set of quantiles

The results in Section 4.1 and 4.2 show that, for the median firm, rising cash-to-sales and declining debt-to-asset ratios are produced by changes in the composition of firms, despite offsetting within-firm changes over time. To show the robustness of this main result across the distributions of these variables, Figures 6 and 7 generalize the analysis in Section 4.1 and 4.2 to a wide set of quantiles, by plotting average annual changes in the 20th quantile to the 90th quantile in increments of ten. To keep the analysis manageable, we focus on cash to sales and debt to assets; the aggregate decomposition that divides changes over time into within-firm and composition effects; and the 1980s and 1990s (specifically, the 1982-1992 and 1993-2003 periods used above).[21] To facilitate comparisons across quantiles, we divide the average annual changes by the average levels of the corresponding quantiles and report the results in percentages. For example, the data point for the 40th quantile of the cash-to-sales ratio for all firms was 2% during 1982-1992, implying that the average annual increase in cash-to-sales at the 40th quantile was equal to 2% of its average level from 1982-1992.

First, in Figure 6 shows that – consistent with the trends in Section 2 – the cash-to-sales ratio increases almost uniformly across the distribution, while the debt-to-asset ratio declines up until the 60th percentile. In addition, for the debt-to-asset ratio, the lowest quantiles display the steepest relative declines. This pattern reflects that the distribution of debt is skewed, and, therefore, magnifies the effects of any absolute changes in these quantiles when assessed relative to their corresponding levels.[22] In turn, these decompositions analysis confirms our main findings: during 1982-1993, the within-firm effect works to lower all quantiles of the cash-to-sales ratio and raise all quantiles of the debt-to-asset ratio, while the composition effect works in the opposite direction. The same pattern holds during 1993-2003, with the exception that the within-firm effect also makes a slight positive contribution to raising the cash-to-sales ratio until the 40th quantile.

Second, Figure 7 shows that the patterns among Ponzi firms are even more pronounced: the relative declines in the lowest quantiles of the debt-to-asset ratio are between two and four times larger than those in the full sample, as are the contributions of the within-firm and composition effects. Likewise, the negative within-firm contribution to the change in the cash-to-sales ratio is about twice as large as in the full sample, without any sign reversals in either period.

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[21]While not reported, decompositions for other measure and over the full set of periods analyzed above indicate that the qualitative results regarding the relative importance of compositional versus within-firm effects hold for a wide range of quantiles, and especially in the lower half of the distributions.

[22]For example, from 1993-2003 the median debt-to-asset ratio averages 23.9% while the 20th quantile averages only 2.2%. This difference magnifies the relative impact of arguably similar absolute changes in these quantiles, which average -0.13 percentage points for the median and -0.25 percentage points for the 20th quantile.
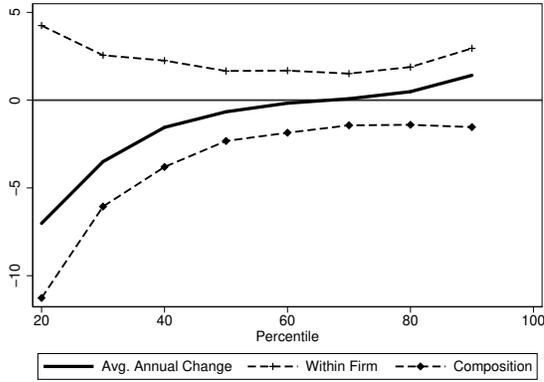
Figure 6: All firms: Decompositions across quantiles
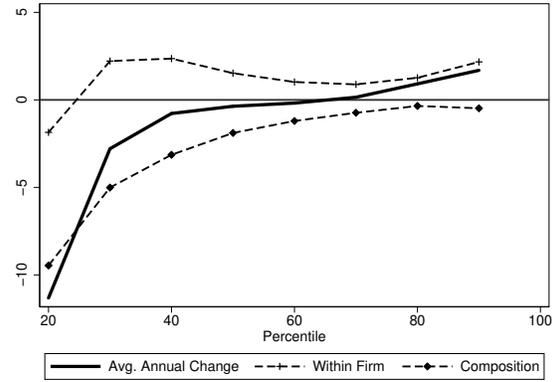(As % of average levels per period)
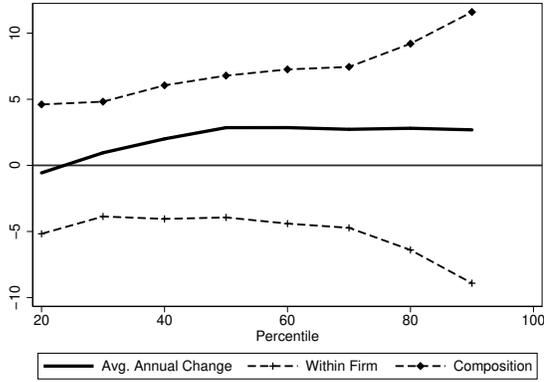
(a) Cash-to-Sales, 1982-1992
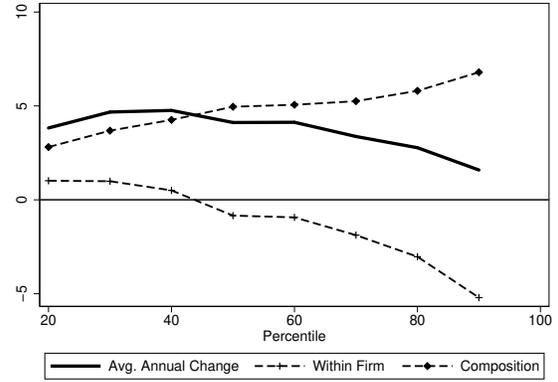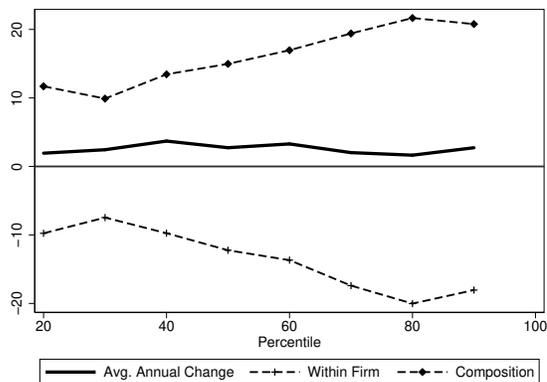
(b) Cash-to-Sales, 1993-2003

(d) Debt-to-Assets, 1982-1992

(e)Debt-to-Assets, 1993-2003

Notes: The figures plot the average annual change in selected quantiles of the cash-to-sales and debt-to-asset ratios, as well as their decomposition into within-firm and composition effects. The average annual changes are reported as percentages of the average levels of the quantiles over each period.

Figure 7: Ponzi Firms: Decompositions across quantiles
(As % of average levels in each period)

(a) Cash-to-Sales, 1982-1992

(b) Cash-to-Sales, 1993-2003

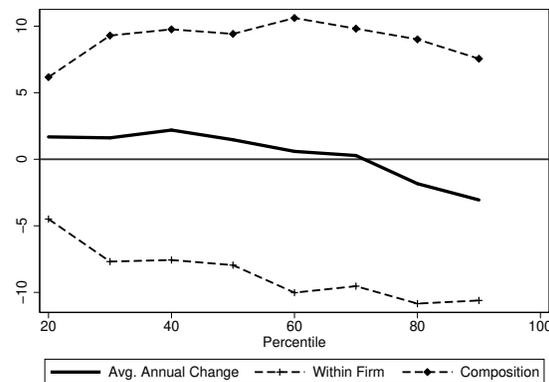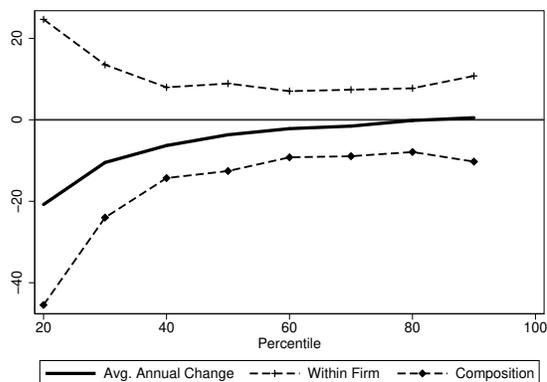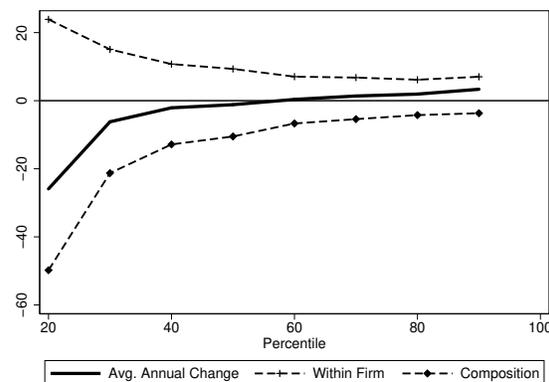
(d) Debt-to-Assets, 1982-1992

(e)Debt-to-Assets, 1993-2003

Notes: The figures plot the average annual change in selected quantiles of the cash-to-sales and debt-to-asset ratios, as well as their decomposition into within-firm and composition effects. The average annual changes are reported as percentages of the average levels of the quantiles over each period.

C   Changing the reference group, incoming firms

Table 10: All Firms: Median decompositions with incoming firms as reference

| | Annual | Within | Composition | | |
	Change	Firm	Total	Incoming	Outgoing
Cash as % of Sales					
1971-1981	-0.07	-0.12	0.05	0.06	-0.01
1982-1992	0.14	-0.17	0.31	0.30	0.01
1993-2003	0.24	-0.04	0.27	0.34	-0.07
2004-2014	0.14	-0.01	0.15	0.24	-0.09
Debt as % of Assets					
1971-1981	-0.03	-0.26	0.22	0.09	0.13
1982-1992	-0.18	0.46	-0.64	-0.55	-0.08
1993-2003	-0.09	0.42	-0.51	-0.65	0.14
2004-2014	0.16	0.33	-0.17	-0.29	0.12
Liabilities as % of Assets					
1971-1981	0.56	0.36	0.20	0.12	0.08
1982-1992	0.09	0.99	-0.90	-0.55	-0.36
1993-2003	0.18	0.75	-0.57	-0.31	-0.26
2004-2014	0.18	0.37	-0.20	0.20	-0.39

Notes: The reference group for the counterfactual sample is incoming firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.

Table 11: Ponzi firms: Median decompositions with incoming firms as reference

Cash as % of Sales

	Annual Change	Within Firm	Composition	Incoming Firms				Outgoing Firms			
				Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.01	-0.12	0.12	-0.06	0.16	-0.15	-0.07	0.18	0.11	0.03	0.04
1982-1992	0.19	-1.06	1.25	-1.85	0.79	-1.91	-0.74	3.11	0.57	1.14	1.39
1993-2003	0.23	-1.34	1.56	-5.62	0.95	-4.09	-2.47	7.18	1.15	2.92	3.12
2004-2014	0.58	-1.78	2.36	-3.72	0.51	-3.34	-0.89	6.08	1.78	2.64	1.65

Debt as a % of Assets

	Annual Change	Within Firm	Composition	Incoming Firms				Outgoing Firms			
				Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.04	1.63	-1.59	-1.09	-0.79	-0.41	0.12	-0.50	-0.62	0.45	-0.33
1982-1992	-1.16	2.15	-3.31	1.51	-1.68	3.26	-0.06	-4.82	-1.69	-3.17	0.03
1993-2003	-0.23	1.74	-1.98	2.54	-0.55	3.10	-0.01	-4.51	-1.28	-3.32	0.08
2004-2014	0.10	1.44	-1.34	1.48	0.28	0.88	0.32	-2.82	-0.99	-1.21	-0.61

Total liaiblities as a % of Assets

	Annual Change	Within Firm	Composition	Incoming Firms				Outgoing Firms			
				Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	1.05	2.97	-1.92	-1.49	-0.04	-0.53	-0.92	-0.43	-0.95	0.35	0.17
1982-1992	-0.35	4.39	-4.75	1.08	-1.70	2.82	-0.04	-5.83	-2.88	-2.92	-0.02
1993-2003	0.68	3.98	-3.30	3.61	-0.17	4.06	-0.27	-6.91	-3.01	-4.50	0.60
2004-2014	0.48	3.80	-3.32	2.19	1.51	0.67	0.01	-5.51	-3.61	-1.40	-0.51

Interest payments as a % of Sales

	Annual Change	Within Firm	Composition	Incoming Firms				Outgoing Firms			
				Total	Entry	Transition	Resid.	Total	Exit	Transition	Resid.
1971-1981	0.20	0.18	0.02	-0.28	0.02	-0.17	-0.13	0.30	-0.00	0.19	0.11
1982-1992	-0.18	0.08	-0.26	-0.33	-0.01	-0.31	-0.01	0.07	-0.08	0.14	0.01
1993-2003	-0.00	0.11	-0.12	-0.13	0.06	-0.18	-0.01	0.01	-0.03	0.05	-0.01
2004-2014	0.03	0.17	-0.14	-0.50	0.05	-0.36	-0.18	0.36	-0.04	0.28	0.13

Notes: The reference group for the counterfactual sample is incoming firms. The first column measures the average annual change in the variable of interest. Cash is measured relative to sales. Debt and total liabilities are measured relative to total assets. For details describing the sample and for variable definitions, see Section 2.1.