Creative Destruction and Finance: Evidence from the Last Half Century[ψ]

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Abstract

The rate of creative destruction increases in the U.S. during the period 1960-2009. We document statistically significant, increasing trends in big business turnover, changes in market share, the difference in growth rates between firms that gain and lose market share, and other measures that show an increasingly dynamic economy. The increase in economic dynamism is driven by increasingly younger, smaller, faster-growing firms that exhibit increasingly high growth in total factor productivity and value-added, and have increasingly high R&D spending and patent grants. Firms that gain market share tend to be financially dependent, and grow increasingly so throughout the sample period. The results suggest that external finance helped promote a good deal of the innovation during the last half century.

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"*The opening up of new markets, foreign or domestic, and the organizational development from the craft shop to such concerns as U.S. Steel illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism.*"

Joseph Schumpeter in *Capitalism, Socialism, and Democracy* (1942), page 83.

This paper studies creative destruction and its relation to finance among U.S. firms during the period 1960-2009. Following Schumpeter (1942), we refer to creative destruction as a process in which new goods and services and the processes that create them replace existing ones.[1] Schumpeter (1912) contends that creative destruction enhances economic efficiency, which can be measured using total factor productivity (TFP) growth.[2] Therefore, the automobile replacing the horse-drawn carriage is an example of creative destruction, as is a more efficient means of automobile production replacing a less efficient one. Creative destruction is important, because it is this process that brings us new goods and services, and more efficient means to produce existing ones. With these effects in mind, we report two major findings regarding creative destruction in the U.S. economy during the last half century.

First, using several different measures that capture the levels of dynamism and innovation in the economy, we find that the rate of creative destruction increases in a trend-like manner throughout our sample period. Like Fogel, Morck, and Yeung (2008), we use big business turnover as a measure of economic dynamism, and find that turnover among the largest firms increases significantly during our sample period. We generate additional turnover measures that capture aggregate changes in market share and value-added, and find that all of these measures exhibit positive and significant trends during our sample period. The firms gaining market share

[1] Several studies link creative destruction to economic growth. See Schumpeter (1912), Aghion and Howitt (1992, 1998, and 2006), Klette and Kortum (2004), Fogel, Morck, and Yeung (2008), and Lentz and Mortensen (2008).

[2] King and Levine (1993), Beck, Levine, and Loyoza (2000), and Chun, Kim, Morck, and Yeung (2008) use total factor productivity growth to estimate growth in efficiency.

are increasingly younger, smaller, and faster growing relative to the firms that suffer losses in market share. These "creator" firms exhibit increasingly high growth in TFP and value-added relative to the firms that they replace, which is consistent with increasing innovation. Also consistent with increasing innovation, creator firms spend increasingly more on R&D, and have increasingly more patent grants relative to firms that lose market share. Taken in their entirety, our findings are consistent with the rate of creative destruction increasing during the last half century.

Our second main finding is that the firms that drive the creative destruction process are increasingly dependent on external finance. This finding is important, because it shows that the financial sector helps the real economy innovate.[3] The average firm that gains market share would have run out of cash had it not issued shares or debt, and this financial dependence increases throughout the sample period. Moreover, among firms that gain market share those that grow the fastest exhibit the highest levels of financial dependence. These findings are inconsistent with Schumpeter (1942), who contends that mature, profitable firms drive the creative destruction process with internal cash flow (e.g. Microsoft), but consistent with Schumpeter (1912) who contends that creative destruction is driven by young, financially dependent firms. The findings suggest that finance is a necessary condition for high levels of creative destruction, albeit not a sufficient one.

Our paper contributes to the literature along several different dimensions. With respect to the types of firms that drive the creative destruction process, several papers predict the opposite of our findings. As we mention above, Schumpeter (1942) contends that large, profitable firms

[3] Finance can make innovation possible, because entrepreneurs and firms may not have sufficient resources to finance their innovations. However, stocks, bonds, and bank loans by themselves do not create new products and technologies. For this reason, we do not state that finance "causes" creative destruction, but rather point out that finance appears to be "necessary" for creative destruction.

are best equipped to finance innovation. Galbraith (1967) argues that larger firms can better absorb marketing costs, which he contends are necessary for creating demand for new products. Romer (1986) reasons that larger firms can apply their innovations over a larger scale, and therefore have a greater incentive to innovate. Holmstrom (1989) notes that innovative investments are riskier, so managers and employees of smaller companies may avoid such undertakings due to career concerns. Alternatively, Schumpeter (1912), Aghion and Howitt (1992, 1998, and 2006), Rajan and Zingales (2003a and 2003b), and Fogel et al. (2008) contend that new, less established firms tend to drive innovation, so our findings are consistent with these studies.

Our finding of increasing creative destruction in the U.S. during the last half century is consistent with several studies, which document various effects that could help to foster increasing creative destruction during our sample period. Aghion and Howitt (2006) claim that recent U.S. economic growth rates exceed those of European countries because U.S. economic policies better promote creative destruction. Greenwood and Jovanovic (1999), Hobjin and Jovanovic (2001), and Chun, Kim, Morck, and Yeung (2008) contend that information technology induced a surge of creative destruction among U.S. manufacturing firms in the late 20th century. Focusing on firm-specific innovations among non-manufacturing firms, Comin and Phillipon (2005) and Comin and Mulani (2009) show that industry R&D spending, which increases during our sample period, causes higher stock return volatility and higher turnover. Greenspan (2002) contends that deregulation caused a wave of creative destruction in the U.S. economy during the later part of the 20th century. Black and Strahan (2002) show that bank deregulation in the 1990s contributed to an increase in new incorporations. Our paper is unique,

because none of these studies directly measure an increase in the rate of creative destruction over the last 50 years, or link it to external finance as we do.

Our finance findings are consistent with studies that show cross-country relations between financial development and the existence and growth of new firms (See Guiso, Sapienza, and Zingales (2004), Klapper, Laeven, and Rajan (2005), Alfaro and Charlton (2006), Aghion, Fally, and Scarpetta (2007), Beck, Demirguc-Kunt, Laeven, and Levine (2008), and Samaniego (2009)). In contrast, we find that within-country differences in creative destruction over time are associated with within-country differences in financial dependence.[4] Moreover, our firm-level tests both reveal high levels of financial dependence among the firms that drive the creative destruction process, and show that this effect gets stronger over time. We therefore provide a direct, firm-level link between finance and creative destruction, whereas the above papers report cross-country associations between financial development and the existence and growth of new and small firms.

Hall (2002), Brown, Fazzari, and Petersen (2009), and Brown and Petersen (2010) show that equity financing is important for research and development (R&D) spending among high technology firms, especially younger firms. Although our financing results are consistent with these studies, the effects that we document are not limited to high technology firms or even industries that are R&D intensive. Patents also reflect innovation, and in our sample many firms and industries with low R&D spending have high levels of patent grants.[5] Moreover, creative destruction can result from efficiency improvements in production processes, which are reflected in TFP growth, rather than new products and services, resulting from R&D spending. As an

[4] Throughout our sample period there is a large increase in the amount of external capital raised by public firms. See Frank and Goyal (2003), Fama and French (2005), and McLean (2010).

[5] As examples, the agriculture, consumer goods, and rubber and plastics industries have below average R&D spending, but high levels of patent grants.

example, the creative destruction that Greenwood and Jovanovic (1999), Hobjin and Jovanovic (2001), and Chun et al (2008) study is driven by the manufacturing sector's adoption of information technologies, which are not reflected in R&D expenses.

The remainder of this paper is organized as follows. Section 1 describes the paper's measures and data and reports summary statistics and simple correlations. Section 2 reports our main findings regarding turnover and creative destruction. Section 3 reports our finance findings. Section 4 concludes the paper.

1. Measurement and Data

1.1. Measures of Economic Dynamism

Big Business Turnover. Fogel, Morck, and Yeung (2008) use big business turnover as a measure of creative destruction. To measure big business turnover we generate subsamples that consist of all firms that are in our sample in both years *t* and *t*-5. We rank firms on revenues in year *t*, and then measure the percentage of firms that are in the top revenue decile in year *t*-5, but not in year *t*. A higher value of this measure shows more turnover among big businesses.

$$Big\ Business\ Turnover_t = \frac{1}{n}\sum_{i=0}^{n} E_i$$

$$E = 1\ if\ the\ firm\ is\ not\ in\ the\ top\ declie\ in\ year\ t; 0\ otherwise$$

In parts of the paper we study the characteristics of the new entrant firms that create the turnover by replacing the big businesses. In some years we have as few as 15 new entrants, and we don't want our findings to be driven by outliers. We therefore remove firm-year sales growth outliers from our sample when we construct this measure. We calculate annual sales growth for

each firm each year and remove firm-year observations with annual sales growth above the 99th percentile of the entire sample.

Big Business Share Turnover. Big business share turnover is the aggregate, beginning of period market share of the big businesses that turnover during a period. To compute this measure, we measure the market share of each firm in the top revenue decile. Market share is the firm's revenue in year *t-5*, scaled by the aggregate revenue of all of the firms in the top revenue decile in year *t-5*. *Big Business Share Turnover* is the aggregate market share in year *t-5* of the firms that are no longer in the top revenue decile in year *t*.

$$Big\ Business\ Share\ Turnover_t = \sum_{i=0}^{n} Top\ Decile\ Market\ Share_{i,t-5} * E_i$$

$$E = 1\ \ if\ the\ firm\ is\ not\ in\ the\ top\ declie\ in\ year\ t; 0\ otherwise$$

Revenue Share Change. This measure reflects the aggregate change in market share in the economy. We generate a subsample of firms that exist in both years *t-1* and *t*. We then measure each firm's market share in both years. The firm's market share in a year is the firm's revenue scaled by the aggregate revenue of all the firms in the sample during that year. We measure each firm's change in market share from one year to the next, and sum up the absolute value of the market share changes to create a single yearly measure.

$$Revenue\ Share\ Change_t = \sum_{i=0}^{n} abs(Share_{i,t} - Share_{i,t-1})$$

One benefit of this measure is that it is unaffected by the number of firms in the sample. A large number of firms results in a lower market share, however this is offset by the larger number of observations in the summation.

Value-Added Share Change. This measure is like revenue share change, only we use value-added in place of revenues. Value-added is operating income before depreciation plus labour and related expenses, which follows Chun et al (2008).

Across-Industry vs. *Within-Industry Measurements*. We also estimate both share change measures across- and within-industries. To measure share changes across-industries, we use industry-aggregate revenue and industry-aggregate value-added. To measure share changes within-industry, we create each of the share change measures within each industry, and then average the industry-year values across industries to create a single yearly measure.

1.2. Measures of External Finance

Pro Forma Cash. In order to measure the firm's financial dependence we estimate a pro forma cash holdings measure, which is estimated as the firm's cash holdings minus the net proceeds from share and debt issues. Deangelo, Deangelo, and Stulz (2010) also use a pro forma cash measure to estimate financial dependence. If this measure is positive, then the firm could have undergone its operational and investment activities without the net proceeds from share and debt issues.

To see why, consider the following accounting identity:

$$Cash_t = Cash_{t-1} + Issue_t + Debt_t + Cash\ Flow_t + Other\ Sources_t - Investment_t - Other\ Uses_t.$$

What this identity says is that the firm's year-end cash balance is its beginning of year cash balance plus cash from share and debt issuance, plus cash generated by operations and other sources, minus investment, and minus any other uses of cash. The identity can be rewritten as:

$$Cash_t - Issue_t - Debt_t = Cash_{t-1} + Cash\ Flow_t + Other\ Sources_t - Investment_t - Other\ Uses_t.$$

This is our measures of pro forma cash. If the measure is positive, then no share or debt issues were needed to complete year *t* operations and investments.

Share Issuance and *Debt Issuance*. Our measurement of share and debt issuance follows Baker, Stein, and Wurgler (2003). Share issuance is measured as the change in book equity, plus the change in deferred taxes, minus the change in retained earnings. Debt issuance is measured as the change in assets, minus the change in book equity, minus the change in deferred taxes. Both measures are scaled by lagged assets.

1.2. Data Sources and Sample

To create our sample we obtain firm-level accounting data from Compustat for the period 1960-2009. We exclude financial companies, utilities, and American Depositary Receipts from our analyses. All of the accounting variables are winsorized at the 1st and 99th percentiles. Data on inflation and gross domestic product comes from the Bureau of Economic Analyses (BEA). Patent grants data are obtained from the NBER Patent Data Project (PDP). We obtain industry definitions from Ken French's website. The final sample consists of 211,072 firm-year observations during the period 1960-2009.

1.3. Summary Statistics and Correlations

Panel A of Table 1 reports summary statistics for the economic dynamism and financing measures used in this study. To compute the summary statistics for the external finance measures we first compute yearly averages for each measure, and then report summary statistics for the yearly averages. The mean value for big business turnover is 0.126, showing that on average during our sample period 12.6% of the firms in the highest revenue decile were replaced over the

subsequent 5 years. Big business share turnover is 0.041, showing that on average the firms that leave the top decile represent 4.1% of the total revenue within the top decile. Smaller firms should be more likely to leave the top decile, so although 12.6% of the firms leave in an average year, these firms represent only 4.1% of the market share. Both of these measures display a fair amount of yearly variability. Big business turnover has a standard deviation of 0.029, so 95 percent of its observations fall between 18% and 7%. Big business share turnover's standard deviation implies that 95% of its values range between 2% and 6%.

Revenue share change has a mean value of 0.098. This means that in an average year 9.8% of the revenue market share turns over in our sample. The turnover in value-added share is even greater, as value-added share change has a mean value of 0.153. Like the big business turnover measures, both of the share changes measures vary significantly from year to year. The 25^{th} and 75^{th} percentiles for the revenue share change measure are 0.078 and 0.113, while those of the value-added share change measures are 0.119 and 0.182. All of the measures in Panel A show that the level of turnover in the U.S. economy has a good deal of yearly variability.

Pro forma cash has an average value of -0.022, showing that the average firm in our sample would not have been able to complete its operations and investments without external finance. Recall that pro forma cash is cash holdings minus net share issues and net debt issues, all scaled by total assets, so a negative value shows that the average firm would have run out of cash if it had not raised external funds. Cash flow averages 0.068, while share and debt issues average 0.084 and 0.109, showing that firms get more funds from external sources than from internal sources. As with the turnover measures, the standard deviations and percentile values of the financing measures reveal a good deal of yearly variability in financing.

Panel B reports the correlations among the dynamism and finance variables, and a couple of interesting patterns emerge. First, the turnover measures are all highly correlated with one another, suggesting that the measures tend to capture a common effect. Second, the turnover measures tend to be correlated with the external financing measures, showing that the average firm relies more heavily on external finance during years in which there is a large amount of turnover. This is especially true for equity issues, which have a correlation of 0.377 or greater with each of the dynamism measures. Moreover, each of the dynamism measures is negatively correlated with the cash flow measure, suggesting that internal cash flow does not promote turnover. If turnover reflects creative destruction, then the correlations are consistent with Schumpeter's (1912) intuition that creative destruction requires external finance, and inconsistent with Schumpeter's (1942) intuition that creative destruction requires internal cash flow.

2. Economic Dynamism and Its Causes

In this Section we report our main empirical findings. Tables 2 reports how our economic dynamism measures evolve over time. Tables 3 and 4 explore the characteristics of the firms that drive these effects. Tables 5-8 explore the relation between turnover and finance.

2.1. Economic Dynamism during the Period 1960-2009

In Table 2 we study whether business turnover varies over time during our sample period. We estimate time trends by regressing each turnover measure on a time variable that is equal to 1 in the first year of the sample, and increases by 1 in each sample year. The resulting time coefficient estimates the yearly increase in the dependent variable. Visual examination of the

data (displayed in Figures 1-2) suggests that some of the measures are cyclical, so we control for real gross domestic product (GDP) growth in each of our regressions. The big business turnover variables are measured with overlap, so we use the method of Newey and West (1987) to correct the standard errors in the big business turnover regressions.

The first column in Table 2 shows that the time coefficient for the big business turnover measure is 0.002 (t-statistic = 8.82), showing that big business turnover increases by 0.01 every five years. Big business turnover has a mean value of 0.126, so the time coefficient reflects an average yearly increase of 0.002/0.126 = 1.60% per year. The yearly values for the big business turnover measure are displayed in Figure 1. The time coefficient in the big business share change regression is also positive and statistically significant. This shows that the amount of market share leaving the top decile increases significantly over time as well. We estimate a yearly increase of 1%. The GDP coefficient is positive and statistically significant in both regressions, showing that big business turnover is procyclical. This suggests that it is easier for smaller firms to grow faster than larger firms when the economy is expanding.

The next six regressions in Table 2 show that all of the share change measures have positive and statistically significant trends (see Figure 2). Regressions 3-6 report the regression results for the revenue share change measure. Regressions 3 shows that revenue share change increases at a rate of 0.0009 (*t*-statistic = 4.10) per year, which reflects an average yearly increase of 0.92% per year. Regressions 4 and 5 show that this increase occurs both across- and within industries; the within- and across-industry revenue share change measures increase at rates of 0.42% and 1.21% per year.

The value-added share change measures tell a similar story. The time coefficients in the three regressions all have *t*-statistics greater than 2.5, and reflect yearly increases of 0.98% for

value-added share change, and 0.80% and 0.82% for the within- and across-industry value-added share change measures. Hence not only are revenue share changes increasing, but shares of the value created in the economy are also shifting among firms at an increasingly higher rate.

Interestingly, the GDP growth is coefficient negative and significant in five of the six share change regressions. This is in contrast to the positive GDP coefficient in the big business turnover regressions. Taken together, these findings show that the replacement of large firms by smaller firms happens more in expansions, while overall changes in market share are greater in contractions. One reason for this difference could be that big business turnover requires high levels of growth among medium-sized firms, and that this growth can only be achieved in economic expansions. In contractions, weak firms can lose share quickly, resulting in a negative relation between GDP growth and the share change measures.

The findings in Table 2 consistently show that the dynamism the U.S. economy has been increasing. In the next Section we try to understand what causes this increase.

2.2. Why is Economic Dynamism Increasing?

As Fogel et al. (2008) explain, in an economy with no creative destruction business is stable, with the same firms dominating the economy for long periods of time. In an economy with ongoing creative destruction, business is less stable, with new firms growing and replacing old firms. The level of business turnover could therefore be indicative of the level of creative destruction in an economy. Yet other factors could also cause increases in economic dynamism. As an example, business turnover could increase due to an increase in price competition, as studied in Irvine and Pontiff (2009). Irvine and Pontiff (2009) point to credit card solicitations that encourage consumers to transfer balances and long-distance carrier promotions that pay

customers to switch carriers as examples of price competition, and provide evidence that price competition has increased during our sample period. To test whether increasing creative destruction is causing the increase in economic dynamism we study the characteristics winning firms that drive the increases in economic dynamism reported in Table 2, and test whether these characteristics increase over time along with turnover.

2.2.1. Firm-Level Measures of Innovation

Total Factor Productivity (TFP) Growth. Schumpeter (1912) contends that creative destruction leads to gains in economic efficiency. Like King and Levine (1993), Beck, Levine, and Loayza (2000), and Chun et al. (2008) we use total factor productivity (TFP) growth as a measure of economic efficiency. If the increase in turnover is the result of increasing creative destruction, then the firms gaining market share ought to exhibit increases in TFP growth. Increasing price competition does not predict increases in TFP growth. Our estimation of TFP growth is as follows:

$$TFP_{i,t} = g_{i,t} - \gamma_{\mathrm{L}} L_{i,t} - \gamma_{\mathrm{k}} K_{i,t}$$

The variable g is the firm's growth in revenues. L is growth in the number of employees and K is growth in the firm's capital stock. Growth is measured as the difference between the beginning and end of period log of revenue values. In unreported tests we estimate TFP with value-added growth and have similar findings. The parameters γ_{L} and γ_{k} are the firm's capital and labour shares. We follow many papers in the growth literature (e.g. King and Levine (1993), Beck, Levine, and Loayza (2000), and Fogel et al. (2008)) and use 0.30 for capital's share and 0.70 for labour's share. Casseli (2005) confirms these values, showing that capital's share in the U.S. has been close to 0.30 since 1970.

To estimate capital stock we convert reported net property, plant and equipment (PPE) to real terms following a procedure similar to Chun et al. (2008) and Hall (1990). First, we approximate the average age of firm *i*'s physical assets in year *t* ($a_{i,t}$) by dividing balance sheet depreciation (accumulated depreciation and amortization) by income statement depreciation and amortization. If $a_{i,t}$ is more than 20 years old, it is capped at 20. A firm-year with an abnormal decline or increase of PPE age (defined as a drop or jump greater than 3 years compared with neighboring years and a deviation of at least 3 years compared with the firm's average PPE age) is treated as an outlier and the corresponding PPE is removed from the sample. Then, assuming all of firm *i*'s physical assets in year *t* are $a_{i,t}$ years old, i.e. the assets are purchased in year $t\text{-}a_{i,t}$. the reported net PPE for year *t* is deflated with the appropriate deflator for year $t\text{-}a_{i,t}$.

Value-Added Growth. Value-added is estimated as operating income before depreciation plus labour costs and related expenses. This follows Chun et al (2008). Price competition predicts declines in value-added growth, as profit margins tend to shrink as a result of price competition. Creative destruction, on the other hand, could lead to increases in value-added growth, as firms capture the rents resulting for their innovations. New and unique products tend to have higher margins than more mature products that have already been imitated by competitors. Innovations in production processes that have yet to be mimicked can also lead to improvements in profit margins. Increasing valued-added growth is therefore consistent with increasing creative destruction, but not increasing price competition.

R&D Expenditures. R&D spending reflects investment in the development of new products. An increase in R&D spending among firms that gain market share is therefore consistent with an increase in creative destruction. We study both overall R&D spending and industry-adjusted R&D spending.

Advertising Expenditures. Advertising spending might reflect the marketing of new products, but it can also reflect competition among existing products. An increase in advertising among firms that gain share could therefore be consistent with increasing innovation and increasing price competition. We study both overall advertising spending and industry-adjusted advertising spending.

Patent Grants. We use patent grants over the last 5 years scaled by number of employees as a measure of innovation. Patent grants are obtained from the NBER Patent Data Project (PDP). This database compiles U.S. utility patent grants from 1976 to 2006 and contains information on patent number, application year, grant date, assignee and links between patent assignees and Compustat company identifiers (gvkey).

Alternatively, we could use patent applications as a proxy for innovation. However, patent applications available in the PDP database suffer from the truncation problem discussed in Hall, Jaffe, and Trajtenberg (2001). The issue is that because the database is based on granted patents, applied not yet assigned patents are not recorded. As a result, there is a sharp decline in patent applications in the later years of the data period. We therefore use patent grants to avoid potential complications arising from the truncation problem associated with patent applications.

2.2.2. The Effects of Mergers and Acquisitions

In a merger, the acquiring firm absorbs the sales of the target, so mergers can affect our turnover measures. Our turnover measures require that firms exist throughout the measurement period, so delistings do not affect these measures. To test whether our turnover findings are affected by mergers, we obtain mergers data from SDC. SDC Merger is fairly robust during the period 1983-2009, but before 1983 the data are less complete. In unreported tests, we excluded

any firm that completed an acquisition and re-estimated all of our turnover measures, and found that the results were unchanged.

We chose to report findings that include acquiring firms because in some cases merger activity may reflect creative destruction. Hobjin and Jovanovich (2001) contend that some firms are better at adopting new technologies than others, and as a result there can be large divergences in operating efficiencies among firms. The more efficient firms should therefore acquire the less efficient firms. Hobjin and Jovanovich (2001) posit that the adoption of information technology can explain the high number of mergers in the 1980s relative to the 1970s. Consistent with this framework, Litchenberg and Siegel (1987) show that among manufacturing firms targets had TFP growth that was 5% lower than the industry average during this period. Morck, Shleifer and Vishny (1988) also show that target firms were inefficient during this period. Morck, Shleifer and Vishny (1988) find that values of Tobin's q are on average 40% lower for targets than their sample's average. These studies suggest that some mergers could be the result of creative destruction.

What if mergers have nothing to do with creative destruction? Consider the case in which an acquiring firm's sales grow only because it now has the sales of the firm it acquired, and not because the acquirer did anything innovative. This type of merger would probably decrease our big business turnover measure, as large firms are more likely to acquire smaller firms, thereby making it easier for large firms to remain in the top decile. This type of merger would however increase our share change measures, as the merger increases the acquirer's revenues. Yet building an additional factory with no innovative improvements will also increase our share change measures, and this is why we study TFP growth. If a firm increases its sales by buying a second firm or expanding existing operations in a non-innovative manner, then non-TFP growth

would increase but TFP growth would not, and the effects would not be recognized as growth by innovation.

2.3. Causes of Big Business Turnover: New Entrants' Characteristics

Table 3 reports results regarding the characteristics of the new entrants firms that create the big business turnover reported in Table 2. The first three regressions in Panel A test for time trends in real sales growth, TFP growth and non-TFP growth among the new entrants. Recall that real sales growth is decomposed into TFP growth and non-TFP growth. Sales growth is measured over the same 5-year period during which the business turnover measures are constructed. The results show that new entrants' sales growth increases during the sample period. In the sales growth regression, the time coefficient is 0.018 (t-statistic = 6.33), reflecting an increase of 1.76% per year. Consistent with increasing creative destruction, the next two regressions show that the increasing sales growth is largely driven by increasing TFP growth. In the TFP regression, the time coefficient is 0.007 (t-statistic = 3.98), showing an increase of 5% per year in TFP growth (see Figure 3). As we explain previously, increasingly higher TFP growth is consistent with increasing creative destruction. The time coefficient in the non-TFP growth regression is 0.010 (t-statistic = 2.74), showing that growth by capital and labour increased by 1.19% per year, which is a sizeable trend, although smaller than the TFP trend.

The fourth column in Panel A reports the new entrants' real value-added growth. New entrants' real value-added growth increases by 0.018 (t-statistic = 8.06) per year, which reflects a yearly increase of 1.78%. This result is consistent with increasing creative destruction, but not increasing in price competition, which would result in declining value-added growth.

The final two regressions in Panel A study the average age of new entrants relative to the average age of the entire population of firms outside of the top decile. Taken together, these two regressions show that new entrants are becoming increasingly younger, even as the population that they come from becomes increasingly older. In the new entrants' age regression the time coefficient is -0.143 (t-statistic = 3.44), showing that the average age of the new entrants declined by more than 1-year during each of the decades in our sample. Hence, firms are becoming large enough to enter the top decile within shorter periods of time. Moreover, the average age of the firms not in the top decile increases over time, as it should because the existing firms are getting older. The time coefficient for this regression, reported in Column 6, is 0.158 (t-statistic = 5.52), showing that the average age within this group of firms increases by about a year every 6 years. This shows that there is a good deal of entry and exit among these firms, or the average age would increase by 1 each year.

The first two regressions in Panel B show that new entrants spend increasingly more on R&D spending, although this effect is not observed within-industry. Taken together, these two regressions suggest that new entrants increasingly come from R&D intensive industries, however new entrants do not spend increasingly more on R&D relative to their industry peers. The next two regressions study advertising expenditures. Neither of the time coefficients is significant, showing that an increase advertising spending did not play a role in increasing big business turnover. As we mention previously, an increase in advertising could reflect an increase in price competition, so here we find no evidence of price competition as an increasingly popular strategy among new entrants.

The final two regressions in Panel B look for trends in patents among new entrants. Consistent with increasing innovation, both of the time coefficients are positive and statistically

significant in the regressions. The effects are very large; time coefficients reflect yearly increases of 4.10% and 3.37% for patents and industry-adjusted patents measures.

Taken in their entirety, the results in Table 3 suggest an increase in creative destruction over the last half century. Younger firms are increasingly driving the turnover, which is consistent with Schumpeter (1912), Aghion and Howitt (1992, 1998, and 2006), Rajan and Zingales (2003a and 2003b), and Fogel et al. (2008), all of whom contend that new firms are most likely to bring innovations to the economy. The results are inconsistent with Schumpeter (1942), Galbraith (1967), Romer (1986), and Holmstrom (1989), who expect innovation to largely come from more mature firms.

2.4. Causes of Share Changes: Differences in Creators vs. Destroyees over Time

In this Section we explore the causes behind the increasing market share changes that we document in the Table 2. To conduct our analyses we break our sample into two types of firms: creators and destroyees. Creators are firms that gain revenue market share during the year, while destroyees are firms that lose revenue market share. If the increases in share changes reported in Table 2 are caused by creative destruction, then we expect differences in measures that reflect innovation between creators and destroyees to increase during the sample period.

The differences between creators and destroyees are reported in Table 4. Panel A reports the mean differences, while Panel B reports the results from regressions that test whether the differences increase over time. In Panel A.1 the difference in real sales growth, TFP growth, non-TFP growth and real value-added growth between creators and destroyees are all large and significant. The creator and destroyee portfolios are formed by sorting firms based on gains and losses in market share, so we expect the difference in revenue growth between the two groups to

be large. The difference is 0.415 (*t*-statistic = 26.62), showing that creators have yearly revenue growth rates that exceed destroyees by 41.5%. The average creator is 3 years younger, and has sales that are half a billion dollars (real 2005 dollars) less than the average destroyee. Both of these differences are significant at the 1% level.

In Panel A2, we examine the differences in advertising, R&D spending, and patents (both total and industry-adjusted) between creators and destroyees. Consistent with innovation, creators spend significantly more on R&D spending and have significantly higher number of patents. Consistent with both innovation and price competition, creators spend significantly more on advertising. Hence, creators appear make their gains through both marketing and innovation, although it could be that marketing is done in effort to promote innovation.

Panel B reports the findings from the time-series regressions. Panel B.1 shows that the growth differential between creators and destroyees increases over time; the time coefficient in the sales growth regression is 0.006 (t-statistic = 8.39), representing a yearly increase of about 1.45% per year. Panel B further shows that both the TFP and non-TFP growth differentials increase as well, at rates of about 2.35% and 1.03% per year. Hence, creators are increasingly growing faster than destroyees, and are doing so in part by increasing TFP, which is consistent with increasing creative destruction (see Figure 4).

The difference in value-added growth between creators and destroyees also increases throughout the sample period, at a rate of 0.85% per year. As we mention previously, innovation could lead to increases in value-added, as new products and production processes may improve profit margins. Price competition by definition should shrink margins. These findings therefore reflect an increase in innovation among new entrants, but not price competition.

In the size regressions, the trend coefficient is -8.433 (t-statistic = 2.80) representing decrease in the size differential between creators and destroyees of 1.7% per year. The time trend for the age coefficient is -0.035 (t-statistic = 2.93), showing that over the entire sample period the age differential between creators and destroyees decreases by approximately 1% per year. Hence, relative to destroyees, creators are increasingly younger and smaller. Taken together with the findings of increasing TFP and value-added, the findings support Schumpeter's (1912) vision of young, small firms driving the creative destruction process. This effect is also described in Aghion and Howitt (1992, 1998, and 2006), Rajan and Zingales (2003a and 2003b), and Fogel et al. (2008).

The regressions in Panel B.2 show that creators increasingly have higher R&D spending relative to destroyees, but not higher advertising expenses. The time coefficient from the total R&D regression is 0.0003 (t-statistic = 3.63), representing a yearly increase of 3.33% per year. In the industry-adjusted R&D trend regressions the coefficient is 0.0002, reflecting an increase of 4.00% per year. The time coefficients in the advertising regressions are both insignificant, showing that the increase in creative destruction is not associated with an increase in advertising by creators relative to destroyees. The patent regressions reveal large increase in the number of patents among creators relative to destroyees. The time coefficients in both of the regressions are positive and statistically significant, and reflect yearly trends of 5.67% and 5.0% for the patents and industry-adjusted patents differences. These findings are consistent with creators making gains through innovation, rather than price competition.

3. How is Creative Destruction Financed?

The results in Table 2 show that turnover has increased during our sample period. The results in tables 3 and 4 suggest that this increase is at least partly driven by an increase in creative destruction. In this next Section we study how the increase in creative destruction was financed. Schumpeter (1942) contends that creative destruction is financed by internal cash flow. Schumpeter (1912) posits that creative destruction is dependent on external funding. In this next Section we attempt to ascertain which of these two frameworks is correct.

3.1. Big Business Turnover: The Financing of New Entrants

We begin this part of our analyses by studying the use of finance by the new entrants that cause the big business turnover reported in Table 2. The financing variables are pro forma cash, cash flow from operations, share issuance, and debt issuance. Recall that pro forma cash is cash holdings minus share and debt issues. A negative pro forma cash value indicates that a new entrant had to use external funds in order to complete its operations and investments. For business turnover measured during years *t*-5 to *t*, we examine new entrants' financing from years *t*-6 to *t*-1. We lag our financing measures by 1-year because we assume that capital raised in year *t*-1 finances growth in year *t*. Tables 2 and 3 suggest an increase in creative destruction during the sample period. If creative destruction is externally financed, then pro forma cash should decrease, while share and/or debt issues should increase over the sample period.

The findings are reported in Table 5. The average pro forma cash among new entrants is -0.135. This shows that on average new entrants are heavily dependent on external finance. New entrants issue both shares and debt, with debt issues averaging 0.181 and share issues averaging 0.082. Therefore, new entrants rely more on debt than share issuance to fund their financing

deficits, although as we explain below over time this gap has narrowed, and new entrants have begun to rely more on equity.

The regressions show that new entrants' pro forma cash holdings declined during the sample period (see Figure 5.1). The time coefficient in this regressions is -0.004 (t-statistic = 3.67), which represents a yearly decline of 2.96% per year. This means that financial dependence among new entrants increases over the sample period. The trend regressions show that cash flow does not have a significant trend, so cash flow is not financing the additional business turnover. Debt issues do have a significant tend, and increase at a rate of 1.1% per year. Share issues also have a significant trend. The time coefficient in the share issues regressions is 0.004 (t-statistic = 7.60), which represents a yearly increase of 4.88% per year, so equity plays an increasingly important role in financing new entrants. The time series variations in the equity, debt, and cash flow measures are displayed in Figure 5.2 as well. Taken together, the results in Table 5 show that big business turnover is externally financed, and increasingly so throughout the sample period.

3.2. Creators vs. Destroyees: Differences in Financing

In Table 6 (Figure 6) we continue to study the role of finance in creative destruction by comparing the use of finance between creators and destroyees. Like in Table 5, creators are defined as firms that gain market share, while destroyees are defined as firms that lost market share. Panel A reports whether the two groups have different mean values of the financing variables, while Panel B tests whether any differences have increased over time.

Panel A shows that creators are on average financially dependent, but destroyees are not. Creators have average pro forma cash of -0.090, while destroyees have an average value of

0.049, showing that destroyees did not rely on external funds to complete their operations and investments, but creators did. Creators generate slightly more internal cash flow than destroyess, but also raise almost four times as much debt and more than twice as much equity. All of the differences are significant at the 1% level. The findings show that firms that gain market share rely more on finance than firms that lose market share.

Panel B reports the results from the trend regressions. The results show that creators have become increasingly dependent on external finance relative to destroyees. The regressions reveal that the differences between creators and destroyees in cash flow and pro forma cash decrease, while differences in share and debt issues increase. In the pro forma cash regression, the time coefficient is -0.003 (t-statistic = 3.41), showing a yearly decrease of 2.19% in the pro forma cash of creators relative to destroyees. This reflects an increasing reliance on external funds by creators relative to destroyees. During the same period, the difference in cash flow between the two groups falls at a rate of 5.56% per year, so creators have increasingly fewer internal resources than destroyees. Differences in debt and equity issues increase by 0.96% and 4.40% per year, so like new entrants creators are increasingly relying on equity financing. The results in Table 3 show that creators are growing at increasingly faster rates relative to destroyees, and here we see that this growth is externally financed, by equity in particular. The findings here are consistent with the results in the Table 5, which show that new entrants also increasingly rely on the equity finance.

3.3. Finance and Creative Destruction: Firm-Level Regressions

Table 7 tests for a relation between creative destruction and finance with firm-level regressions. In these regressions growth is the dependent variable and pro forma cash, a creator

dummy, and interactions between these two variables and time are the independent variables. Like in the previous tables, we measure growth as real revenue growth, TFP growth, non-TFP growth, and real value-added growth. The regressions include year-fixed effects. In Panel B we also include industry-fixed effects. All of the regressions have standard errors clustered on industry. The findings in Panels A and B are similar, so we focus our discussion on Panel A's findings.

In regressions 1-4 the growth measures are regressed on pro forma cash, a creator dummy, and an interaction between pro forma cash and the creator dummy. In the sales growth regression, the pro forma cash coefficient is 0.024 (t-statistic = 4.45), while the creators-pro forma cash interaction term is -0.186 (t-statistic = 21.34). The overall pro forma cash coefficient for a creator is therefore -0.186 + 0.024 = -0.162, showing that among creators firms that grow faster have lower pro forma cash and are thus more financially dependent. For a destroyee, the overall pro forma cash coefficient is 0.024, showing that among destroyees firms that grow faster are less reliant on external funds. Taken together these findings show that among firms that gain market share (creators), growth is increasing in financial dependence, whereas among firms that lose market share (destroyees) finance is used more heavily by slower growing firms, and therefore appears to be used more for survival, rather than to fund growth. The pro forma cash-creators interactions are negative and significant in regressions 2-4 as well, showing that financial dependence is more strongly related to growth among firms that gain market share.

In regressions 5-8 the pro forma cash-creator interaction is interacted with a time variable. This interaction therefore not only tests whether the fastest growing creators are more financially dependent, but also whether this effect has increased during the sample period. In the first regression, the pro forma cash coefficient is -0.003 (t-statistic = 0.50), while the pro forma

cash-creator interaction coefficient is -0.004 (t-statistic = 19.56). Hence, in this regressions for a creator in 1960 the overall pro forma cash coefficient is -0.004 * 1 = -0.004, while for a creator in 2009 the overall pro forma cash coefficient is -0.004 * 50 = -0.020, or fifty times greater. The results therefore show that among creators, growth is increasing in external finance, and this effect strengthens over the sample period. The results are similar in the TFP growth, non-TFP growth, and value-added regressions. The results in Table 7 therefore show that firms that gain market share tend to be financially dependent, and that this effect increases during the sample period. These findings are consistent with the findings in tables 5 and 6.

3.4. Finance and Creative Destruction: Evidence from the Financial Crisis

This Section of the paper uses the 2007-08 financial crisis to test for a link between creative destruction and finance. Brunnermier (2009) contends that the financial crisis began in August of 2007. The findings in Almeida, Campello, Laranjeira, and Weisbenner (2010), Campello, Graham, and Harvey (2010), and Ivashina and Scharfstein (2010) suggest that the financial crisis caused financing constraints. We therefore estimate regressions in which the absolute value of the firm's change in market share between years t and t+1 is regressed on contemporaneous GDP growth, revenues measured at year t, and a crisis indicator variable that is equal to 1 if the year is equal to 2007, 2008, or 2009 and zero otherwise. We begin the sample in 2004, so that we have an equal number of crisis and non-crisis years. Table 3 shows that share change is greater when GDP is declining, and GDP growth is weak or negative during 2007-2009, so it is important to control for the effects of GDP in these regressions.

Market share is measured as the firm's revenue (or value-added) scaled by the aggregate revenue (or value-added) in the sample in year t. A larger number of firms reduces each firm's

market share, so we limit our sample to firms that have revenue data in each of the years for the period 2004-2009. The regressions include revenues measured at year *t* as a control variable, because on average firms with higher revenues have larger market share and can therefore more easily have large changes in market share. We experimented with other controls (e.g. R&D, advertising, cash flow) and found that none of them had significant effects. Although one could see how these variables might be associated with gains or losses in market share, our dependent variable is the absolute value of market share change, and ex-ante it is not clear why these variables would affect this measure.

We estimate each regression with either firm- or industry-fixed effects. If the regressions have firm-fixed effects, then the coefficients reflect how within-firm variations in the independent variables are associated with within-firm variations in the dependent variable. The crisis dummy tests whether the average firm in our sample had smaller changes in market share relative to its own mean during the crisis years. When we estimate the regressions with industry-fixed effects, the crisis dummy shows whether the average firm's change in market share was greater during the crisis years relative the average share change within the firm's industry over the entire period. There are six years of data, so we have six observations per firm; however we have over 2,000 firms, so we have a high degree of power, which is reflected in our *t*-statistics.

We report our findings in Table 8. Regressions 1 and 2 use the absolute value of revenue-market share change as the dependent variable, while the last two regressions 3 and 4 use the absolute value of value-added share change. In all four regressions the crisis-dummy is negative and significant, showing that firms have smaller changes in market share in the crisis years as compared to the pre-crisis years. In the first regression, the crisis-dummy coefficient is -0.002 (t-statistic = 3.09). The average revenue-share change variable has a mean value of 0.004, so during

the pre-crisis years the average revenue-share change is about 0.006, while the average revenue-share change during the crisis years is 0.002. The GDP coefficient is negative and significant in all of the regressions, which is consistent with the findings in Table 3. The findings in Table 8 are consistent the findings in tables 5-7, and suggest that the firms that drive the creative destruction process are financially dependent.

4. Conclusion

This paper documents a significant increase in economic dynamism in the U.S. economy during the period 1960-2009. This increase is the result of a secular trend, and we document this trend using several different turnover measures. Our findings suggest that at least part of the increase can be explained by an increase in creative destruction. Throughout the sample period we also observe increasing trends in sales growth, TFP growth, value-added growth, R&D spending, and patent awards of the firms that gain market share and cause the dynamism. These findings support the notion that the increase in turnover is at least in part driven by increases in creative destruction, rather than increasing price competition.

Consistent with Schumpeter's (1912) intuition, we find that the increase in creative destruction is externally financed. On average, winning firms are financially dependent, and would have run out of cash during the year if not for share and debt issues. Moreover, this effect increases over the sample period as creative destruction increases. Increases in share issues, rather than debt issues, increasingly fill the increasing finance shortfalls. Our findings suggest that finance helped promote a good deal of the innovation in the U.S. economy during the last half century.

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Table 1: Summary Statistics

This table reports summary statistics for the primary variables used in this study. Panel A shows the mean, standard deviation and 25th, 50th and 75th percentiles of the time series data for each variable. Panel B is the correlation matrix among the turnover and financing measures. Big Business Turnover in year t measure the portion of the firms that are ranked among the top decile firms in the entire sample universe by revenue in year t-5 but fail to rank among the top decile firms in year t. Big Business Share Turnover measures the total market share at year t-5 of those firms that exist among top decile firms in year t-5 but fail to be among the top decile in year t. These turnover rates are measured in a rolling 5-year fashion. Sale-Based (VA-Based) Share Change in year t is the summation of the absolute value of market share change for each firm in the sample universe between year t-1 and year t. A firm's Sale-Based (VA-Based) market share in year t is measured as firm revenue (value-added) / sum of the revenue (value-added) of firms in the universe in year t. For the measurement of Sale-Based (VA-Based) Share Change between year t-1 and year t, the universe for market share calculations in years t-1 and t consists of the same group of firms - firms whose revenue (value-added) figures are available from Compustat for both years t-1 and t. Pro Forma Cash is measured as the firm's cash and cash equivalent minus the total debt and equity issues during the year scaled by lagged assets. CF/Assets is firms' cash flow scaled by lagged assets. Cash flow is calculated as net income plus depreciation. Debt Issue/Assets is the change in assets, minus the change in book equity, minus the change in deferred taxes, all scaled by lagged assets. Equity issuance/Assets is change in book equity, plus change in deferred taxes, minus change in retained earnings, all scaled by lagged assets.

Panel A: Mean, Percentile and Sample Period

Variables	Mean	25th Percentile	50th Percentile	75th Percentile	Standard Deviation	Sample Period	Frequency
Turnover Measures:							
Big Business Turnover	0.126	0.100	0.127	0.147	0.029	1965-2009	Rolling 5-yr
Big Business Share Turnover	0.041	0.036	0.041	0.047	0.009	1965-2009	Rolling 5-yr
Sale-Based Share Change	0.098	0.078	0.093	0.113	0.026	1960-2009	Annual
VA-Based Share Change	0.153	0.119	0.150	0.182	0.042	1960-2009	Annual
Finance Measures:							
Pro Forma Cash	-0.022	-0.062	-0.025	0.017	0.068	1961-2009	Annual
CF / Assets	0.068	0.029	0.065	0.110	0.047	1960-2009	Annual
Debt Issue/Assets	0.084	0.057	0.087	0.109	0.042	1961-2009	Annual
Equity Issue/Assets	0.109	0.029	0.092	0.178	0.086	1961-2009	Annual

Table 1: Continued

Panel B: Correlations

	Big Business Turnover	Big Business Share Turnover	Sale-Based Share Change	VA-Based Share Change	Pro Forma Cash	CF / Assets	Debt Issue/Assets	Equity Issue/Assets
Turnover Measure								
Big Business Turnover	1							
Big Business Share Turnover	0.908	1						
Sale-Based Share Change	0.594	0.491	1					
VA-Based Share Change	0.545	0.389	0.845	1				
Finance Measures								
Pro Forma Cash	-0.082	-0.021	-0.092	0.220	1			
CF / Assets	-0.751	-0.516	-0.557	-0.686	-0.043	1		
Debt Issue/Assets	0.014	0.030	-0.017	-0.360	-0.860	0.239	1	
Equity Issue/Assets	0.613	0.420	0.431	0.377	-0.536	-0.721	0.246	1

Table 2: Time Trends of Turnover Measures

This table reports the mean values and time trends of turnover measures. The time trends are tested by regressing the time series data against t. Real GDP growth over five years is included to control for overall economic growth. Big Business Turnover in year t measure the portion of the firms that are ranked among the top decile firms in the entire sample universe by revenue in year t-5 but fail to rank among the top decile firms in year t. Big Business Share Turnover in year t measures the total market share at year t-5 of those firms that exist among top decile firms in year t-5 but fail to be among the top decile in year. These turnover rates are measured in a rolling 5-year fashion. For example, Big Business Turnover Rate for year 1965 measures turnover from year 1960 to year 1965, and that for year 1966 measures turnover from year 1961 to 1966 and so on. Sale-Based (VA-Based) Share Change in year t is the summation of the absolute value of market share change for each firm in the sample universe between year t-1 and year t. A firm's Sale-Based (VA-Based) market share in year t is measured as firm revenue (value-added) / sum of the revenue (value-added) of firms in the universe in year t. For the measurement of Sale-Based (VA-Based) Share Change between year t-1 and year t, the universe for market share calculations in years t-1 and 1 consists of the same group of firms - firms whose revenue (value-added) figures are available from Compustat for both years t-1 and t. We estimate each of the share change measures both within- and across-industries as well. For across-industries measures, we use aggregate-industry revenues (value-added) for Share Change. For within-industry measures, we create each of the measures within each industry, and then average the industry-year values across industries to create a single yearly measure. The standard errors are Newey-West standard errors with 4 lags. The t statistics are shown in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

	Big Business Turnover	Big Business Share Turnover	Total Share Change (Sales)	Within Share Change (Sales)	Across Share Change (Sales)	Total Share Change (VA)	Within Share Change (VA)	Across Share Change (VA)
Mean	0.126	0.041	0.098	0.096	0.050	0.153	0.201	0.085
Time Trend regressions								
Time	0.002***	0.0004***	0.0009***	0.0004**	0.0006***	0.0015***	0.0016**	0.0007***
	(8.82)	(6.16)	(4.10)	(2.48)	(3.11)	(5.49)	(2.57)	(3.15)
Real GDP Growth (5-yr)	0.263***	0.080***	-0.292*	0.052	-0.463**	-0.706***	-1.421*	-0.704***
	(3.49)	(2.81)	(1.82)	(0.57)	(2.53)	(2.97)	(1.89)	(2.91)
Constant	0.038**	0.018***	0.084***	0.084***	0.049***	0.135***	0.203***	0.088***
	(2.56)	(3.94)	(9.08)	(13.62)	(5.28)	(12.42)	(8.92)	(8.55)
Observations	45	45	50	50	50	50	50	50
R-squared	0.60	0.35	0.37	0.11	0.36	0.54	0.34	0.43
Yearly % Change	1.59%	0.97%	0.92%	0.42%	1.21%	0.98%	0.80%	0.80%

Table 3: Time Trends of New Entrants Characteristics

This table reports the mean values and time trends of new entrants' characteristics. The time trends are tested by regressing the time series data against t. Real GDP growth over five years is included to control for overall economic growth. Real Sales Growth is measured as log real sales growth from year t-5 to year t. Total Factor Productivity Growth is measured as total real sales growth minus 0.3 times total real capital stock growth (growth in property, plant, and equipment), and 0.7 times total employee growth. Real capital stock is adjusted by following Hall (1990) and Chun et al. (2008). Non-TFP Growth is the real sales growth not resulting from the growth in factor productivity. Real Value-Added growth is the log growth of value-added from year t-5 to year t. Value-added is measured as the operating income before depreciation plus labour and related expenses. Average Age- New Entrants is measured as the average number of years since IPO (to year t-5) for firms not in the top decile in year t-5, but in the top decile in year t. Average Age-Non-Top Decile Firms is measured as the average number of years since IPO (to year t-5) for firms that are not in the top decile in year t-5. R&D/assets is the average research and development expenditure scaled by lagged assets during year t-6 to t-1. Advertising/Assets is the average advertising expenditure scaled by lagged assets during year t-6 to t-1. Patent Per Employee is the average number of patent per employee over the year t-6 to t+1. Industry adjustment is calculated as each variable minus its industry medians. The standard errors are Newey-West standard errors with 4 lags. The t-statistics are shown in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Panel A

New Entrants	Real Sales Growth	TFP Growth	Non-TFP Growth	Real Value-Added Growth	Age-New Entrants	Age-Non-Top Decile
Mean	1.020	0.140	0.840	1.014	20.92	14.42
Time Trend Regressions						
Time	0.018***	0.007***	0.010***	0.018***	-0.143***	0.158***
	(6.33)	(3.98)	(2.74)	(8.06)	(3.44)	(5.52)
Real GDP Growth (5-yr)	4.062***	0.272	3.404***	5.396***	-13.528	0.408
	(7.60)	(0.73)	(4.60)	(11.53)	(1.32)	(0.06)
Constant	-0.049	-0.063	0.054	-0.259**	26.998***	10.519***
	(0.35)	(0.58)	(0.26)	(2.21)	(11.58)	(7.00)
Observations	45	45	45	45	45	45
R-squared	0.68	0.51	0.47	0.70	0.39	0.76
Yearly % Change	1.76%	5.00%	1.19%	1.78%	0.68%	1.10%

Table 3: Continued

Panel B

New Entrants	R&D / Assets	Industry-Adjusted R&D / Assets	Advertising / Assets	Industry-Adjusted Advertising / Assets	Patent Per Employee	Industry-Adjusted Patent Per Employee
Mean	0.021	0.006	0.018	0.011	0.732	0.534
Time Trend Regressions						
Time	0.0003*	-0.0001	0.0001	0.0001	0.030**	0.018*
	(1.98)	(1.19)	(0.27)	(0.58)	(2.54)	(1.88)
Real GDP Growth (5-yr)	-0.016	0.005	-0.093*	-0.055*	0.028	1.102
	(0.45)	(0.43)	(1.88)	(1.84)	(0.02)	(0.71)
Constant	0.015*	0.007**	0.030**	0.017**	0.276	0.093
	(1.80)	(2.43)	(2.59)	(2.45)	(1.37)	(0.45)
Observations	45	45	45	45	29	29
R-squared	0.23	0.08	0.15	0.16	0.35	0.20
Yearly % Change	1.58%	1.35%	0.34%	0.66%	4.10%	3.37%

Table 4: Creator versus Destroyee Differences

This table reports the difference between creators and destroyees in their real sales growth, total factor productivity growth, sales growth not resulting from factor productivity, age, R&D scaled by lagged assets, advertising expense scaled by lagged assets, and industry median adjusted advertising and R&D expense. Real Sales Growth is measured as log real sales growth from year t-1 to year t. Total Factor Productivity Growth is measured as total real sales growth minus 0.3 times total real capital stock growth (growth in property, plant, and equipment), and 0.7 times total employee growth. Real capital stock is adjusted by following Hall (1990) and Chun et al. (2008). Non-TFP Growth is the real sales growth not resulting from the growth in factor productivity. Real Value-Added growth is the log growth of value-added from year t-1 to year t. Value-added is measured as the operating income before depreciation plus labour and related expenses. Real sale is value of sales in 2005 constant dollars at year t-1. Age is the average number of years since the firm's IPO (to year t-1). R&D/assets is the research and development expenditure scaled by lagged assets. Advertising/Assets is the advertising expenditure scaled by lagged assets. Patent Per Employee is the average number of patents per employee at year t-1. Industry adjustment is calculated as each variable minus its industry medians. Creators are firms that gained market share from year t-1 to year t, and destroyees are firms that lose market share from year t-1 to year t. In Panel A, we report the mean average differences between creators and destroyees over the sample period. In Panel B, we report the time trend regressions on the annual differences in each of the variables in Panel A. Real GDP growth over year t-1 to t is included to control for overall economic growth. The t statistics are calculated with robust standard errors (following White(1980)) and shown in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Panel A: Mean Differences

Panel A1

	Real Sales Growth	TFP Growth	Non-TFP Growth	Real Value-Added Growth	Real Sales	Age
Creators	0.283	0.100	0.156	0.227	1035	12.10
Destroyees	-0.131	-0.070	-0.039	-0.127	1534	15.49
difference	0.415***	0.170***	0.195***	0.354***	-499***	-3.39***
	(26.62)	(17.38)	(26.83)	(33.68)	(11.65)	(19.24)
Observations	50	50	50	50	50	50

Panel A2

	R&D / Assets	Industry-Adjusted R&D / Assets	Advertising / Assets	Industry-Adjusted Advertising / Assets	Patent Per Employee	Industry-Adjusted Patent Per Employee
Creators	0.036	0.014	0.014	0.009	1.661	1.575
Destroyees	0.027	0.009	0.012	0.008	1.467	1.394
difference	0.009***	0.005***	0.001*	0.001***	0.194***	0.180***
	(8.45)	(7.53)	(1.88)	(2.97)	(4.34)	(4.15)
Observations	50	50	50	50	50	50

Table 4: Continued

Panel B: Time Trend of Differences - Creators vs. Destroyees

Panel B1

	Real Sales Growth	TFP Growth	Non-TFP Growth	Real Value-Added Growth	Real Sales	Age
Time	0.006***	0.004***	0.002***	0.003***	-8.433***	-0.035
	(8.39)	(11.10)	(5.20)	(6.94)	(2.80)	(2.93)
Real GDP Growth (1-yr)	0.375	-0.360	0.516	-1.093***	-5,982.18***	-16.683**
	(0.83)	(1.54)	(1.58)	(3.19)	(2.80)	(1.99)
Constant	0.247***	0.080***	0.120***	0.301***	-100.019	-1.992***
	(11.18)	(6.48)	(8.03)	(17.46)	(0.74)	(4.43)
Observations	50	50	50	50	50	50
R-squared	0.63	0.76	0.39	0.68	0.24	0.18
Year % Change	1.45%	2.35%	1.03%	0.85%	1.69%	1.03%

Panel B2

	R&D / Assets	Industry-Adjusted R&D / Assets	Advertising / Assets	Industry-Adjusted Advertising / Assets	Patent Per Employee	Industry-Adjusted Patent Per Employee
Time	0.0003***	0.0002***	-0.00001	0.00001	0.011**	0.009**
	(3.63)	(2.77)	(0.18)	(0.32)	(2.59)	(2.21)
Real GDP Growth (1-yr)	0.037	0.049	-0.054	-0.027	-0.380	-0.072
	(1.07)	(1.56)	(1.51)	(1.40)	(0.18)	(0.04)
Constant	0.001	-0.000	0.003	0.002	0.028	0.033
	(0.27)	(0.02)	(1.44)	(1.62)	(0.27)	(0.32)
Observations	50	50	50	50	31	31
R-squared	0.27	0.18	0.08	0.06	0.17	0.12
Year % Change	3.33%	4.00%	0.67%	0.71%	5.67%	5.0%

Table 5: Top Decile New Entrants - Financing

This table reports the time trends of each of the financing measures for the new entrants. New entrants are those firms that do not belong to the top decile in year t-5 (ranked by total sales), but they are among the firms in the top decile in year t. We measure each of the financing variables over years t-6 to t-1, and report the 5-year averages in the table. Pro Forma Cash is measured as the firm's cash and cash equivalent minus the total debt and equity issues scaled by lagged assets. CF/Assets is cash flow scaled by lagged assets. Cash flow is calculated as net income plus depreciation. Debt Issue/Assets is the change in assets, minus the change in book equity, minus the change in deferred taxes, all scaled by lagged assets. Equity issuance/Assets is change in book equity, plus change in deferred taxes, minus change in retained earnings, all scaled by lagged assets. The time trends are tested by regressing the time series data against time. Real GDP growth over year t-5 and t is included to control for overall economic growth. The standard errors are Newey-West standard errors with 4 lags. The t-statistics are shown in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

	(1) Pro Forma Cash	(2) CF / Assets	(3) Debt Issue /Assets	(5) Equity Issue /Assets
Mean	-0.135	0.135	0.181	0.082
Time Trend Regressions				
Time	-0.004***	-0.0001	0.002***	0.004***
	(3.67)	(0.42)	(3.12)	(7.60)
Real GDP Growth (5-yr)	-0.999***	0.033	0.788***	0.398***
	(3.40)	(0.51)	(5.38)	(2.81)
Constant	0.120*	0.133***	-0.001	-0.070**
	(1.83)	(7.72)	(0.02)	(2.64)
Observations	42	45	42	42
R-Squared	0.55	0.03	0.51	0.73
Yearly % Change	2.96%	0.07%	1.10%	4.88%

Table 6: Creators vs. Destroyees: Financing Trends

This table reports the difference in financing trend among creators and destroyees. Creators are firms that gained market share from year t-1 to year t, and destroyees are firms that lose market share from year t-1 to year t. Panel A reports the mean differences between creators and destroyees in each of the financing measures. Panel B test the time trend of the annual difference between these two groups. The financing variables are measured with a 1-year lag. Pro Forma Cash is measured as the firm's cash and cash equivalent minus the total debt and equity issues scaled by lagged assets. CF/Assets is net income plus depreciation scaled by lagged assets. Cash flow is calculated as net income plus depreciation. Debt Issue/Assets is the change in assets, minus the change in book equity, minus the change in deferred taxes, all scaled by lagged assets. Equity issuance/Assets is change in book equity, plus change in deferred taxes, minus change in retained earnings, all scaled by lagged assets. The time trends are tested by regressing the time series data against time. Real GDP growth over year t-1 and t is included to control for overall economic growth in the time trend regressions. The t-statistics are calculated with robust standard errors (following White(1980)) and shown in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Panel A: Mean Financing Differences - Creators vs. Destroyees

	(1) Pro Forma Cash	(2) CF / Assets	(3) Debt Issue /Assets	(4) Equity Issue /Assets
Creators	-0.090	0.085	0.138	0.153
Destroyees	0.049	0.067	0.034	0.064
Differences	-0.137***	0.018***	0.104***	0.091***
	(14.43)	(7.55)	(21.05)	(8.11)
Observations	47	50	47	47

Panel B: Time Trend Regressions of the Financing Differences

	(1) Pro Forma Cash	(2) CF / Assets	(3) Debt Issue/Assets	(4) Equity Issue/Assets
Time	-0.003***	-0.001***	0.001**	0.004***
	(3.41)	(3.07)	(2.52)	(5.88)
Real GDP Growth (1-yr)	-0.730*	-0.124	0.355	0.937**
	(1.93)	(1.37)	(1.56)	(2.44)
Constant	-0.047*	0.037***	0.066***	-0.050**
	(1.87)	(6.56)	(4.52)	(2.17)
Observations	47	50	47	47
R-squared	0.26	0.22	0.16	0.49
Yearly % Change	2.19%	5.56%	0.96%	4.40%

Table 7: Firm-Level Regression of Growth on Finance

This table reports results from firm-level regressions in which the dependent variables are real sales growth, total factor productivity growth sales growth not resulting from factor productivity. Real Sales Growth is measured as log real sales growth from year t-1 to year t. Total Factor Productivity Growth is measured as total real sales growth minus 0.3 times total real capital stock growth (growth in property, plant, and equipment), and 0.7 times total employee growth during the same period. Real capital stock is adjusted by following Hall (1990) and Chun et al. (2008). Non-TFP Growth is the real sales growth not resulting from the growth in factor productivity. Real Value-Added growth is the log growth of value-added from year t-1 to year t. Value-added is measured as the operating income before depreciation plus labour and related expenses. Pro Forma Cash is measured as the firm's cash and cash equivalent minus the total debt and equity issues scaled by lagged assets. Creator equals 1 for firms that gained market share from year t-1 to year t, and zero otherwise. Time is the discrete variable that equals one for the beginning sample year and increases by one for each recent year. In Panel A, year dummy is included in each of the regressions. In Panel B, both year dummy and industry dummy are included in each of the regressions. Time does not enter the regressions by itself because we include year dummy in all the regressions. Standard errors are robust and clustered by industry. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Panel A

	Real Sales Growth	TFP Growth	Non-TFP Growth	Real Value-Added Growth	Real Sales Growth	TFP Growth	Non-TFP Growth	Real Value-Added Growth
Pro Forma Cash	0.024***	-0.012**	0.036***	0.007	-0.003	-0.024***	0.019***	-0.015*
	(4.45)	(2.15)	(5.65)	(0.71)	(0.50)	(3.71)	(3.01)	(1.69)
Creators	0.398***	0.164***	0.198***	0.355***	0.399***	0.164***	0.198***	0.355***
	(15.55)	(7.67)	(21.41)	(21.24)	(15.51)	(7.67)	(21.36)	(21.24)
Creators*Pro Forma Cash	-0.186***	-0.106***	-0.080***	-0.089***				
	(21.34)	(14.55)	(11.59)	(5.47)				
Creators*Pro Forma Cash*Time					-0.004***	-0.003***	-0.002***	-0.002***
					(19.56)	(17.04)	(9.17)	(4.80)
Constant	-0.340***	-0.125***	-0.179***	-0.557***	-0.330***	-0.119***	-0.175***	-0.552***
	(13.33)	(5.90)	(19.54)	(33.56)	(12.96)	(5.64)	(19.21)	(33.09)
Observations	162308	139212	139215	129201	162308	139212	139215	129201
R-squared	0.399	0.134	0.183	0.188	0.397	0.134	0.182	0.187
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Continued

Panel B

	Real Sales Growth	TFP Growth	Non-TFP Growth	Real Value-Added Growth	Real Sales Growth	TFP Growth	Non-TFP Growth	Real Value-Added Growth
Pro Forma Cash	0.024***	-0.013**	0.035***	0.007	-0.003	-0.024***	0.020***	-0.015*
	(4.35)	(2.13)	(5.60)	(0.63)	(0.47)	(3.79)	(3.08)	(1.74)
Creators	0.397***	0.164***	0.196***	0.354***	0.398***	0.164***	0.196***	0.353***
	(15.53)	(7.74)	(21.05)	(21.06)	(15.49)	(7.74)	(21.01)	(21.07)
Creators*Pro Forma Cash	-0.186***	-0.107***	-0.079***	-0.087***				
	(21.28)	(14.53)	(11.40)	(5.36)				
Creators*Pro Forma Cash*Time					-0.004***	-0.003***	-0.002***	-0.002***
					(19.40)	(17.02)	(9.14)	(4.74)
Constant	-0.381***	-0.129***	-0.215***	-0.609***	-0.372***	-0.123***	-0.211***	-0.604***
	(15.20)	(6.21)	(23.02)	(35.88)	(14.75)	(5.95)	(22.62)	(35.33)
Observations	162,308	139,212	139,215	129,201	162,308	139,212	139,215	129,201
R-squared	0.400	0.136	0.186	0.188	0.398	0.135	0.184	0.188
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Creative Destruction and the Financial Crisis

This table reports the changes in market share around financial crisis. Only firms that exist in Compustat and have non-missing data for the years from 2004 to 2009 are included. The dependent variables are Sale-Based Share Change and VA-Based Share Change. A firm's Sale-Based (VA-Based) market share in year t is measured as firm revenue (value-added) / sum of the revenue (value-added) of all the firms in year t. Changes are measured between years t-1 and t. Post Fin Crisis is the dummy variable equal to one for firm year observations at and after the end of year 2007, zero otherwise. Log(sales) is the log of sales at year t-1. Value-added is measured in t-1 as well. Real GDP growth is included as control variable. Industry fixed effects are included in regressions 1 and 3; firm fixed effects are included in regressions 2 and 4. Standard errors are robust and clustered at industry-level. * Significant at 10%; ** significant at 5%; *** significant at 1%.

	(1)	(2)	(3)	(4)
	Share Change (Sale-Based)	Share Change (Sale-Based)	Share Change (VA-Based)	Share Change (VA-Based)
Post Fin Crisis	-0.002***	-0.001**	-0.002***	-0.001*
	(3.09)	(2.34)	(2.68)	(1.71)
Real GDP Growth (1yr)	-0.051***	-0.063***	-0.094***	-0.118***
	(3.62)	(4.05)	(3.48)	(4.28)
Log(Sales)	0.003***	0.001***		
	(7.72)	(3.24)		
Value-added			0.005***	0.001***
			(9.07)	(3.72)
Observations	16,124	16,124	13,790	13,790
R-squared	0.112	0.006	0.132	0.008
	Industry-Fixed Effect	Firm-Fixed Effect	Industry-Fixed Effect	Firm-Fixed Effect

Figure 1: Big Business Turnover and Big Business Share Turnover

This Figure plots Big Business Turnover, as defined in Table 1, against time.

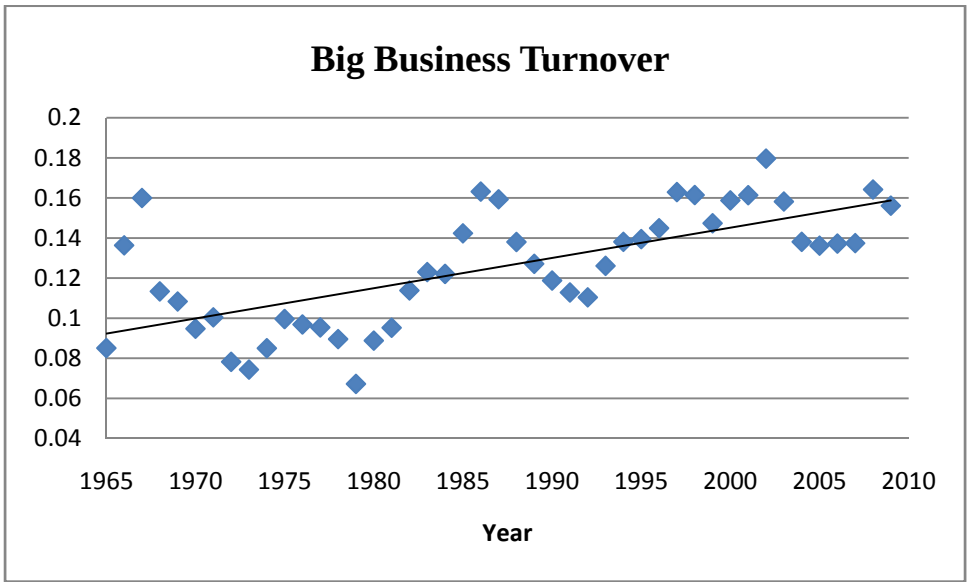


Figure 2: Share Change

This Figure plots the five-year moving average for yearly Share Change, as defined in Table 1.

Figure 2.1: 5-Year Moving Average for Total Sale-Based Share Change

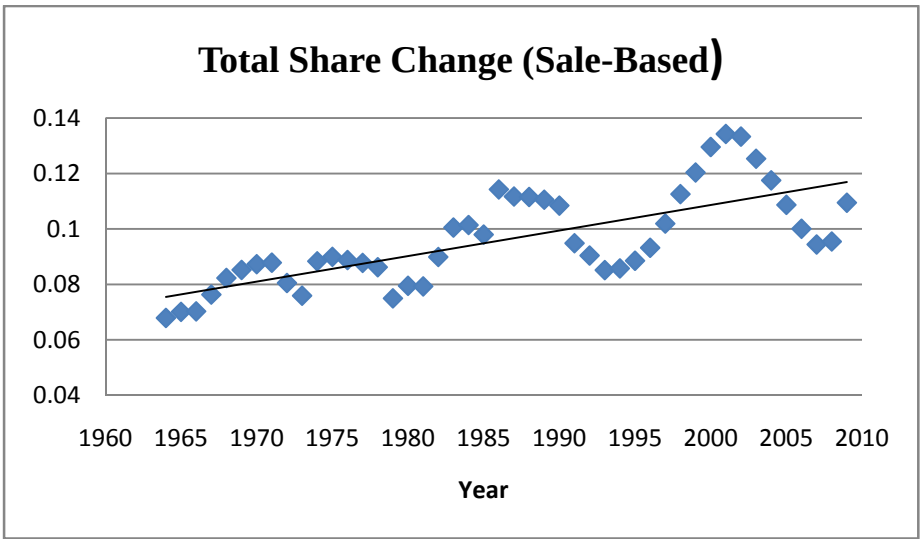


Figure 2.2: 5-Year Moving Average for Total Value-Added Based Share Change

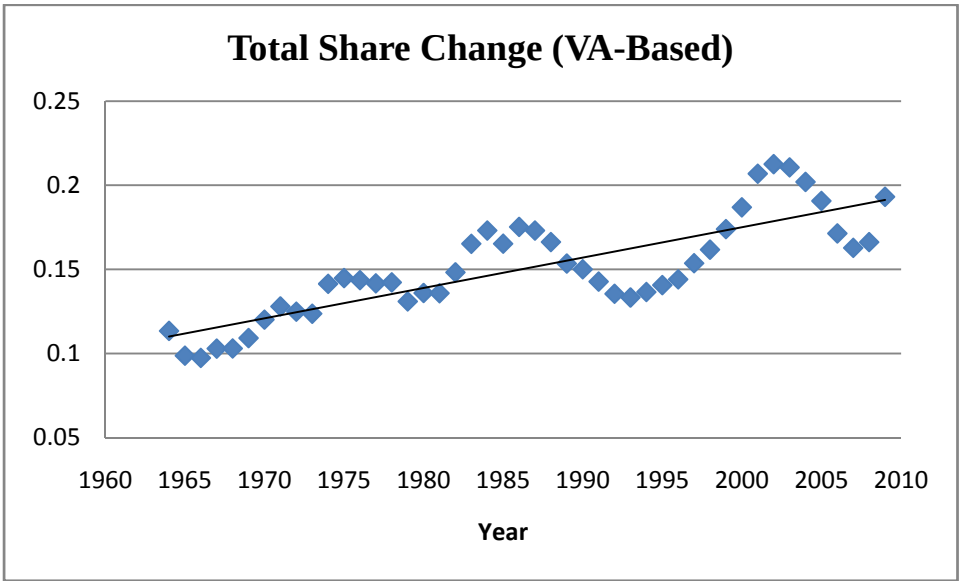


Figure 3: Growth of Top Decile New Entrants

This Figure plots top decile new entrants' total factor productivity (TFP) growth against time.

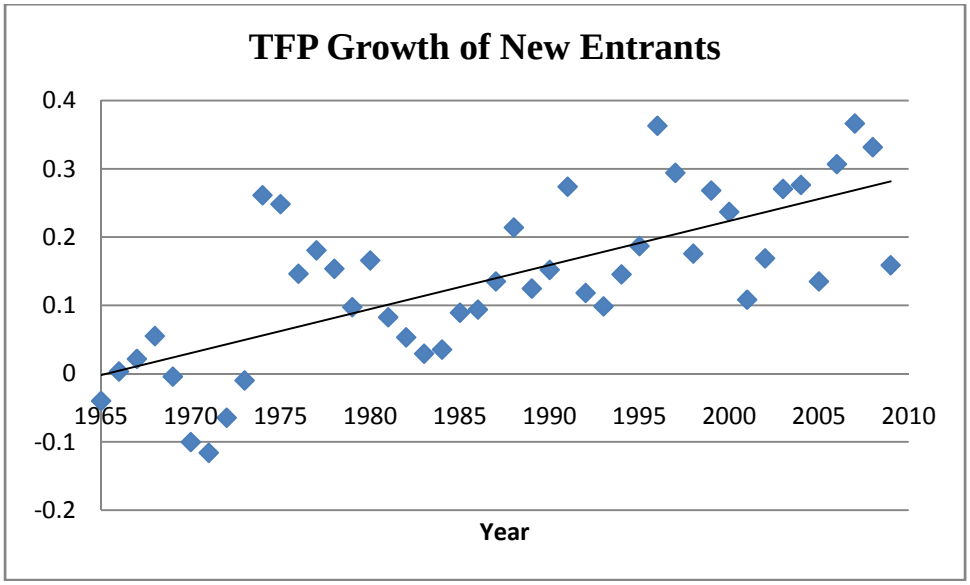


Figure 4: Creators vs. Destroyees and TFP Growth

This figure plots 5-year moving average of the yearly difference in factor productivity growth between creators and destroyees, as defined in table 4.

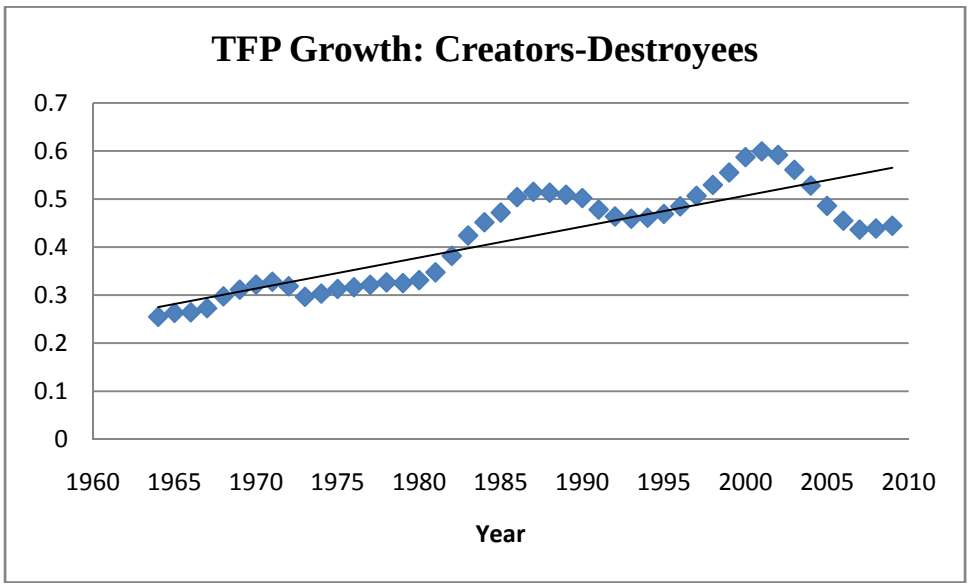
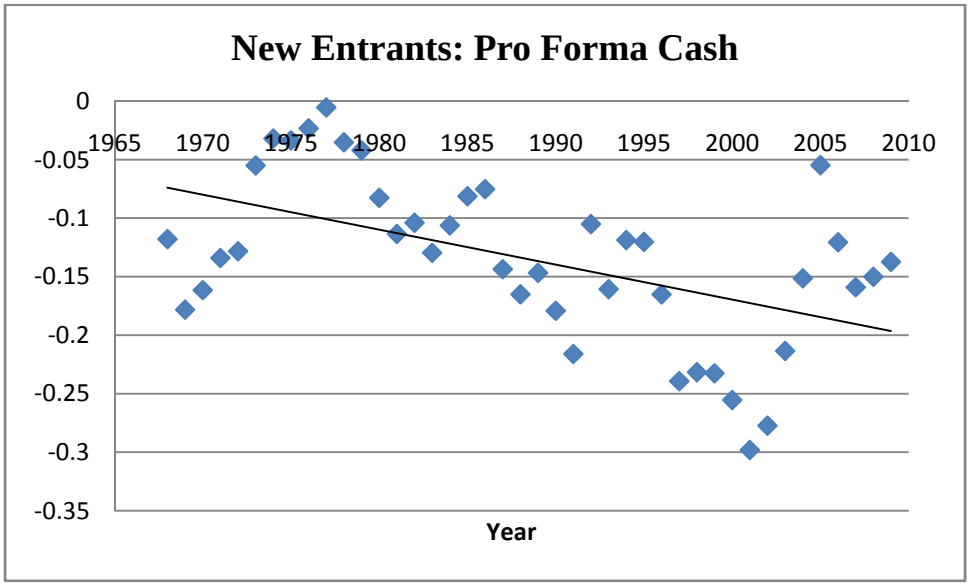


Figure 5: Top Decile New Entrants and Financing

Figure 5 provides plots of new entrants' Pro Forma Cash (Figure 5.1) and different components of financing (Figure 5.2).

Figure 5.1



Firgure 5.2

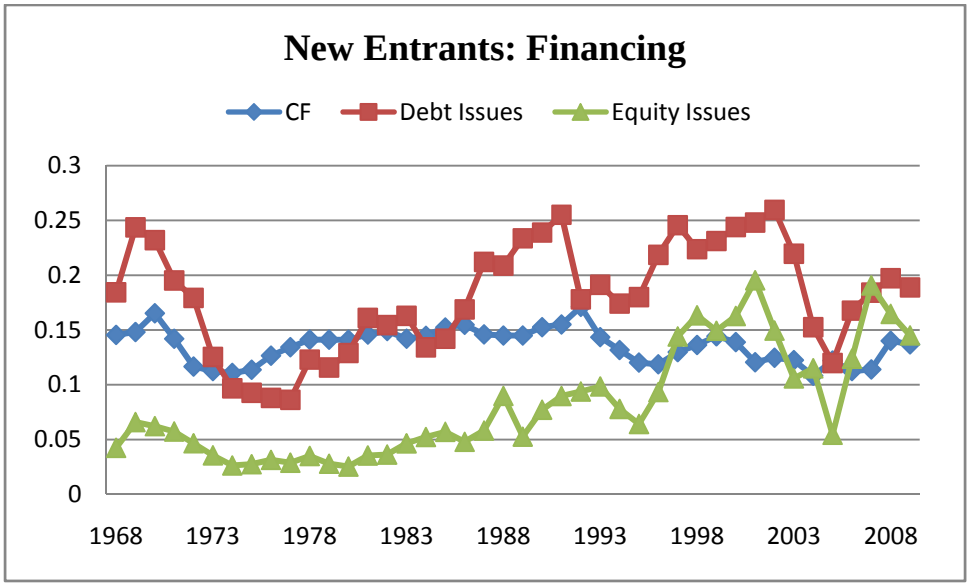


Figure 6: Creators vs. Destroyees and Financing

Figure 6 provides plots the 5-year moving averages of the annual differences in Pro Forma Cash (Figure 6.1) and different components of financing (Figure 6.2) between creators and destroyees, defined in Table 4.

Figure 6.1

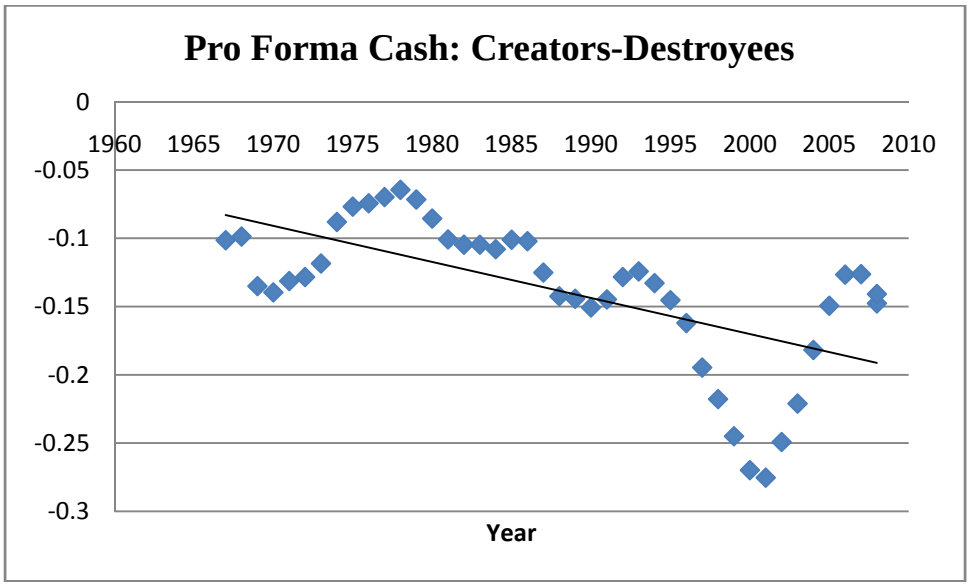
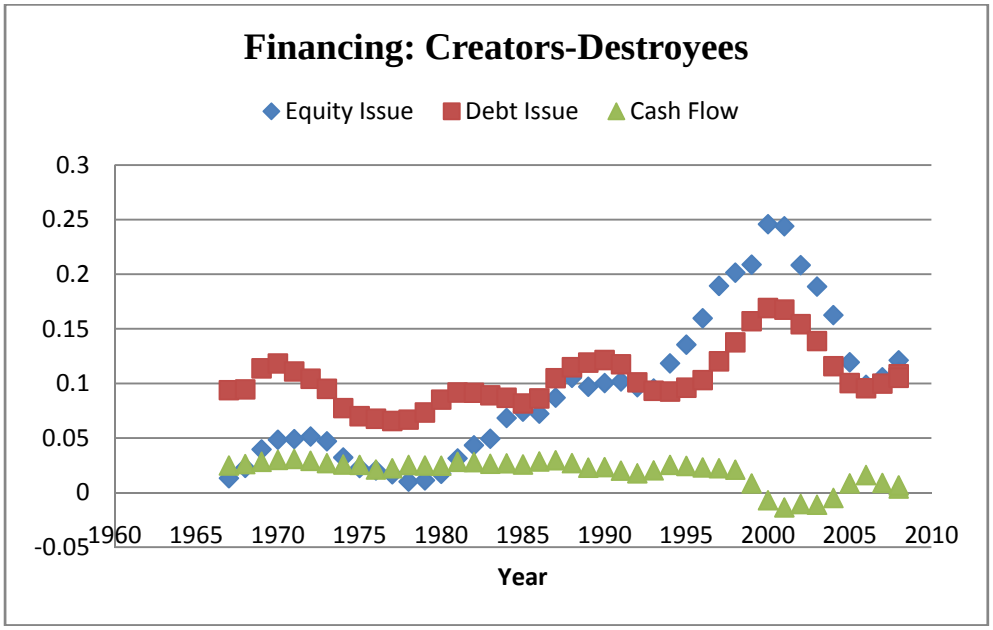


Figure 6.2



Appendix A1: Time Series of Dynamism Measures

year	Big Business Turnover	Big Business Share Turnover	Sale-Based Share Change	VA-Based Share Change
1960			0.061	0.159
1961			0.075	0.109
1962			0.071	0.101
1963			0.062	0.117
1964			0.071	0.081
1965	0.085	0.034	0.072	0.085
1966	0.136	0.052	0.076	0.103
1967	0.160	0.060	0.101	0.129
1968	0.113	0.041	0.092	0.117
1969	0.108	0.037	0.085	0.112
1970	0.095	0.033	0.083	0.140
1971	0.100	0.037	0.078	0.142
1972	0.078	0.030	0.064	0.114
1973	0.074	0.028	0.069	0.111
1974	0.085	0.031	0.147	0.201
1975	0.100	0.037	0.091	0.157
1976	0.097	0.035	0.072	0.135
1977	0.095	0.034	0.059	0.104
1978	0.090	0.031	0.061	0.114
1979	0.067	0.019	0.091	0.144
1980	0.089	0.028	0.113	0.182
1981	0.095	0.030	0.072	0.135
1982	0.114	0.036	0.112	0.166
1983	0.123	0.041	0.114	0.199
1984	0.122	0.040	0.096	0.183
1985	0.142	0.047	0.096	0.143
1986	0.163	0.060	0.153	0.185
1987	0.159	0.055	0.100	0.155
1988	0.138	0.044	0.113	0.165
1989	0.127	0.040	0.091	0.119
1990	0.119	0.040	0.085	0.126
1991	0.113	0.037	0.085	0.148
1992	0.110	0.038	0.077	0.119
1993	0.126	0.041	0.087	0.154
1994	0.138	0.040	0.094	0.136
1995	0.139	0.041	0.099	0.146
1996	0.145	0.044	0.108	0.166
1997	0.163	0.046	0.121	0.167
1998	0.161	0.049	0.140	0.194
1999	0.147	0.044	0.133	0.197
2000	0.159	0.048	0.145	0.211
2001	0.161	0.046	0.132	0.265
2002	0.180	0.051	0.116	0.195
2003	0.158	0.047	0.101	0.184
2004	0.138	0.042	0.094	0.153
2005	0.136	0.046	0.101	0.155
2006	0.137	0.050	0.089	0.169
2007	0.137	0.041	0.088	0.152
2008	0.164	0.053	0.106	0.201
2009	0.156	0.051	0.164	0.288