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Corporate aging and investment decisions

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Paper I: Corporate aging and internal resource allocation

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Abstract

Various observers argue that established firms are at a disadvantage in pursuing new growth opportunities. In this paper, we provide systematic evidence that established firms allocate fewer resources to high-growth lines of business. However, we find no evidence of inefficient resource allocation in established firms. Redirecting resources from high-growth to low-growth lines of business does not result in lower profitability. Also, resource allocation towards new growth opportunities does not increase when managers of established firms are exposed to takeover and product market threats. Rather, it seems that conservative resource allocation strategies are driven by pressures to meet investors' expectations. Our empirical evidence, thus, favors the hypothesis that established firms wisely choose to allocate fewer resources to new growth opportunities as external pressures force them to focus on efficiency rather than novelty (Holmström 1989).

Keywords: internal resource allocation, growth opportunities, firm age, takeover threat.

JEL codes: G30; L20

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1. Introduction

We understand how to market, we know the technology, and production problems are not extreme. Why risk money on new businesses when good, profitable, low-risk opportunities are on every side?

This is a quote from a senior manager cited in the influential article of Hayes and Abernathy (1980). On the basis of such experiences, the authors conclude that managers of large and established firms are tempted to allocate resources as a means to strengthen existing operations rather than seeking new opportunities. Ample case studies exist that are in line with the authors' perception. A case in point is Intel, which initially failed to redirect its resources from its declining memory division towards the emerging microprocessor business with new and more profitable opportunities (Burgelman 1994). The most prominent example is Xerox who failed to commercialize various valuable opportunities due to a failure to commit the necessary resources towards those opportunities (Gompers et al. 2005). Yet, there is little systematic evidence of differences in internal resource allocation between established and newly listed firms. In this paper, we aim to fill this gap. To do so, we require data that allows us to divide resource allocation into low- and high-growth businesses. The COMPUSTAT business segment file provides the required data. Focusing on firms that report multiple lines of business in distinct industries allows us to explore what fraction of resources firms allocate towards business lines with relatively fewer or more growth opportunities. We document that relative to newly listed firms, established firms redirect a significant portion of their internal resources from high- to low-growth businesses.

We also aim to address the discussion concerning the efficiency of established firms' resource allocation. There is an ongoing debate about whether established firms miss valuable growth opportunities due to any sort of inefficiency in their resource allocation process. A growing strand of the literature argues that established firms may wisely choose to allocate resources to strengthen existing operations rather than pursuing new growth opportunities (Gompers et al. 2005; Holmstrom 1989; Loderer et al. 2014). One reason is that pursuing new growth opportunities may harm a firm's core business. A related reason is that managers are constrained in their capacity and should focus their limited attention to assets in place rather than exploring new growth opportunities (Loderer et al. 2014). Following these arguments, it may be optimal for established firms to allocate fewer resources to high-growth businesses. We label this the efficiency hypothesis.

In contrast to the efficiency hypothesis, Mueller (1972) argues that established firms' resource allocation is driven by managerial self-interests. This is because available internal funds from previous successful innovations prevent managers of established firms to turn to external capital markets and be subject to their scrutiny. It follows that managers of established firms may allocate too little resources to high-growth businesses because they are reluctant to evaluate new growth opportunities. According to the agency hypothesis, established firms may allocate too little resources to high-growth businesses as their managers slack or prefer a quiet life (Bertrand and Mullainathan 2003).

To differentiate between these two alternative interpretations we investigate how profitability is related to the level of resources allocated to low- and high-growth divisions. This empirical approach, however, may suffer from reverse causality or endogeneity. Thus, we also exploit two quasi-experiments, the introduction of state-level business combination laws and the reduction of industry import tariffs, to investigate how takeover and product market threats affect resource allocation in established firms. According to the agency hypothesis, lower threats would allow established firms to redirect more resources from high- to low-growth businesses for self-serving reasons. The efficiency hypothesis predicts the opposite.[1]

Our empirical investigation is based on a large sample of diversified U.S. firms over the years 1979 to 2009. The availability of business segment data allows us to examine the proportion of resources that are allocated to high-growth business. The change in business segment reporting in June 1997 hampers comparability across segments and within segments over time (Hund et al. 2010; Whited 2006). The former segment reporting standard required firms to break down accounting data into industry segments. Under the new standard, firms report disaggregated data based on their internal organizational breakdown into separate business units. Because we are interested in how firms allocate resources across distinct industries rather than organizational business units, we follow Gopalan and Xie (2010) and aggregate segment data of business units within the same industry. To assess resource allocation we examine how segment capital expenditures[2] normalized by segment sales are related to

[1] Various observers argue that incentives to explore new growth opportunities increase with product market competition. The rationale of value maximizing managers is to escape product market competition (Aghion et al. 2001). We acknowledge this alternative prediction under the efficiency hypothesis. Nevertheless, import tariff reductions enable us to test the agency hypothesis.

[2] We use segment capital expenditures as a proxy for allocated resources. Arguably, capital expenditures are the largest fraction of allocable resources. Nevertheless, we also explore broader definitions of allocable resources such as adding segment R&D expenditures.

growth opportunities at the business segment level (Scharfstein 1998; Shin and Stulz 1998). We follow standard literature and approximate segment growth opportunities by the median Tobin's Q of single-segment firms operating in the same industry.

A univariate analysis reveals that established firms allocate relatively fewer resources to business lines with high growth opportunities than their younger counterparts. Newly listed firms invest 10.4 percent of sales in high-growth segments and 8.1 percent in low-growth segments. In contrast, established firms invest 7.5 percent in high-growth and 7.0 percent in low-growth segments. The results are qualitatively the same if we look at industry-adjusted segment investment or industry- and firm-adjusted segment investment. It seems that established firms allocate a lower proportion of resources to their high-growth segments.

A more direct test requires that we aggregate a firm's segment investment across business segments into a single firm-level measure of resource allocation. Such a measure is introduced by Rajan et al. (2000) and Peyer and Shivdasani (2001) and equals the sum of excess investment in high-growth segments minus the sum of excess investment in low-growth segments. A low value implies that a firm's resource allocation is less sensitive to growth opportunities. Regression analysis reveals that established firms' resource allocation is significantly less sensitive to growth opportunities and, thus, is consistent with our univariate analysis. We interpret the empirical evidence as that established firms redirect resources from high- to low-growth segments. Despite its attractiveness to measure aggregate resource allocation at the firm-level there are several drawbacks to this approach. First, the measure is difficult to interpret (Çolak and Whited 2007). Second, if we measure segment growth opportunities with error (Chevalier 2004; Whited 2001), then our firm-level measure of resource allocation sensitivity will suffer from measurement error as well. Third, the firm-level analysis does not allow controlling for segment characteristics that might be correlated with segment growth opportunities and segment investment levels.

To circumvent these problems, we conduct our resource allocation analysis at the segment-level and relate segment capital expenditures to segment growth opportunities. We then estimate how the sensitivity of segment capital expenditures to growth opportunities (the so-called Q-sensitivity) varies between newly listed and established firms. Including segment fixed effects allows us to absorb any constant measurement error in segment growth opportunities. Also, we are able to account for various segment characteristics that might impact resource allocation, e.g., segment size or segment profitability.

Our main finding is that established firms allocate fewer resources when segment growth opportunities are high. The effect is economically meaningful. The so-called Q-sensitivity of segment investments in newly listed firms is approximately three times larger than in established firms. Our finding is robust to controlling for changes in conglomerates' reported business segments over time and is not driven by an increase in organizational scope (Ozbas 2005) or operational complexity (Boone et al. 2007; Coles et al. 2014). A potential limitation of our approach is that segment capital expenditures do not include R&D expenditures or acquisitions and, thus, are incomplete measures of allocated resources. Therefore, our results may be biased if, for example, acquisitions become more prevalent in established firms. To address this issue, we use broader measures of resource allocation and add segment R&D to capital expenditures or use the annual percentage change in segment total assets. By definition, the latter measure should include acquisitions at the segment level. We obtain the same results when using these alternative measures of resource allocation.

Another issue we address is whether any potential measurement error in segment Q is indeed constant over time and, thus, absorbed by fixed effects regressions. Marginal growth opportunities could be lower in established firms as the more profitable projects are realized first (Li et al. 2009) or be higher as relative productivity goes up because of learning-by-doing (Bahk and Gort 1993). Hence, fixed effects regressions may not solve the measurement error problem when using single-segment Q values as proxies for growth opportunities. To get around this problem, we follow two different approaches found in the literature. First, we regress single-segment firms growth opportunities on size and profitability and use that model to predict segment growth opportunities (Billett and Mauer 2003). Second, we match segment growth opportunities by taking firm age into account (Borghesi et al. 2007). The results do not change with either approach. We also conduct a variety of robustness tests. Yet, our empirical results hold. In summary, we find that established firms allocate fewer resources to new growth opportunities. This is consistent with the hypothesis that established firms are at a relative disadvantage in exploring new opportunities, especially in high-growth industries (see Bernardo et al. 2009 and the cited literature therein).

We then gauge the efficiency of established firms' resource allocation practices. It is common in the literature to interpret a lower Q-sensitivity as evidence of inefficient allocation of resources (Scharfstein 1998; Shin and Stulz 1998). Poorer governance quality in established firms (Grabowski and Mueller 1975; Helwege et al. 2007; Holderness 2009) could lead to inefficient resource allocation. For example, managers of established firms with quiet-life preferences may be "reluctant to undertake cognitively difficult activities" (Bertrand and Mullainathan 2003). Alternatively, established firms may optimally choose to allocate fewer resources to high-growth segments. Various observers argue that established firms focus on efficiency rather than novelty because they are designed to "serve production and marketing goals […]" (Holmstrom 1989; Miller and Friesen 1984). Following these arguments established firms may focus on assets in place rather than on new growth opportunities (Loderer et al. 2014).

To distinguish between these two alternative interpretations of the evidence, we explore how segment investment affects segment profitability in established firms. We find no evidence that lower investment in high-Q segments worsens established firms' profitability. If anything, it seems that higher investment in low-Q segments improves established firms' profitability. This is consistent with the efficiency hypothesis that established firms focus more on improving the profitability of assets in place rather than on generating new growth opportunities. In a similar vein, Cohen and Klepper (1996) find that large and established firms' R&D efforts are directed towards improving manufacturing processes rather than developing new innovative products.

As a further test to discriminate between the two hypotheses, we examine how exogenous shocks to established firms' competitive environment affect their resource allocation. We exploit the introduction of state antitakeover laws (Bertrand and Mullainathan 2003) and industry-wide import tariff reductions (Frésard and Valta 2013; Guadalupe and Wulf 2010) as exogenous shocks to takeover and product market threats. Under the agency hypothesis, lower takeover or product market threats should allow established firms to further deviate from high-growth businesses for self-serving reasons.

The empirical evidence of the two quasi-experiments is inconsistent with the agency hypothesis. First, we find that established firms that are shielded from the market for corporate control allocate more resources to segments with higher growth opportunities. Thus, it does not seem that quiet-life preferences explain why established firms are reluctant to fund new growth opportunities. Rather, it seems that the lower resource allocation sensitivity to growth opportunities in established firms is driven by pressures to meet investors' expectations (Holmstrom 1989). Competition in the market for corporate control means that potential acquirers are continuously assessing the performance of managers. This may deter managers of established firms from exploring new growth opportunities which are more difficult to evaluate by acquirers (Loderer et al. 2014). This is consistent with the efficiency hypothesis that established firms optimally choose to allocate fewer resources to high-growth opportunities.

Second, more foreign competition leads established firms to allocate fewer resources to high-growth segments. Again, the evidence is inconsistent with the agency hypothesis that managerial slack in established firms explains low resource allocation to new growth opportunities. A possible explanation is that established firms optimally focus on strengthening existing operations as probability of liquidation goes up (Fee and Hadlock 2000; Schmidt 1997). Yet, we are careful about interpreting our results in favor of the efficiency hypothesis. According to Aghion et al. (2001), higher product market competition should lead established firms to explore new growth opportunities as a means to escape competition. At the very least, we are able to discard the agency hypothesis.

We make several contributions to the literature. First, we document economically important differences in resource allocation between newly listed and established firms. By using a large and broad sample of US firms we provide systematic evidence that established firms are reluctant to fund high-growth businesses and complement the case study literature (see, e.g., Burgelman 1994). More importantly, we show that established firms' reluctance to fund new growth opportunities does not seem to be driven by agency-related inefficiencies. Thereby, we complement the study of Loderer et al. (2014) who argue that established firms optimally focus on exploiting assets in place rather than exploring new growth opportunities. In their study, the authors provide indirect evidence by documenting that established firms spend less on capital as well as R&D expenditures and pay out more funds to the providers of capital. Instead of examining firm-level investments, our research setting allows us to study the proportion of total investments that are allocated to high-growth businesses.

Second, our study is related to the literature arguing that established firms are at a disadvantage in exploring new growth opportunities. Various reasons are explored, such as abandonment of high-risk strategies, the fear of cannibalization of existing products (Aron and Lazear 1990), an overreliance on existing customer needs (Christensen and Bower 1996), bureaucratic structures in the context of radical technological changes (Henderson 1993), or inefficient internal capital markets (see, among others, Rajan et al. 2000). Closely related is the article of Holmström (1989) in which he highlights the role of external capital markets.

He argues that organizational impediments to innovative research are the outcome of capital market pressures to maintain a good performance reputation. We add to his study and empirically link the incentive to fund new growth opportunities in established firms to pressures from the market of corporate control and the product market.

Finally, our research study also has practical implications for regulatory policy and management consulting practices. Motivating entrepreneurial activities is a crucial issue for management consultants and regulators as it is a key to survival and economic growth. A better understanding of whether established firms' exhausted set of growth opportunities is caused by any sort of inefficiency or rather the outcome of an optimal response to external pressures is therefore essential. It sheds light on when it is optimal for established firms to motivate entrepreneurial activity through aggressive funding of new growth opportunities (Bernardo et al. 2009).

The rest of the paper is organized as follows. In the next section, we outline our research method. In section 3, we describe our data and provide sample statistics. In section 4, we compare resource allocation to growth opportunities between newly listed and established firms. In section 5, we differentiate between the agency and efficiency hypothesis by relating resource allocation to profitability and exploiting two quasi-experiments. In section 6, we conclude.

2. Empirical method

To examine internal resource allocation we investigate diversified firms' segment capital expenditures across business segments with distinct growth opportunities. We examine capital expenditures because of their importance. By focusing on diversified firms we are able to distinguish between resource allocation to low-growth and high-growth opportunities. We follow standard procedure and use the median lagged Tobin's Q of single-segment firms operating in the same industry as proxy for growth opportunities. Industry classification is based on the narrowest SIC grouping (3-, or 2-digit) that includes at least 5 segment-matched single-segment firms with available data to compute lagged Tobin's Q. Having specified our proxy for resource allocation and growth opportunities, we describe in the following sections how we gauge the sensitivity between the two.

2.1. *Correlation-based measure of resource allocation*

Rajan et al. (2000) and Colak and Whited (2007) propose a resource allocation measure that is based on the association between growth opportunities and resource allocation across business segments. The advantage of using a firm-level measure is that we are able to capture the proportion of resources that a firm allocates to low- and high-growth businesses. The measure equals the sum of excess investment in low- and high-growth segments. More specifically, we compute the firm-level measure as follows:

$$RINV_{jt} = \sum_{i=1}^{k} w_{ijt} \times Inv_{ijt} - \sum_{i=n-k+1}^{n} w_{ijt} \times Inv_{ijt}, \qquad (1)$$

where *Inv* equals the firm- and industry-adjusted segment investment and *w* equals the fraction of segment sales to total firm sales. The various indices identify observations of segment i within firm j in year t. Note that a firm has n segments of which k are high-growth segments, i.e., segments with an *Industry Q* above the sales-weighted firm average. By definition, *RINV* will be greater if firms invest less in low-Q segments and more in high-Q segments.

To investigate differences in resource allocation between established and newly listed firms we estimate the following regression equation relating *RINV* to *Firm age*, measured as natural logarithm of one plus the number of years listed:

$$RINV_{jt} = \delta_t + \gamma Age_{jt} + \beta X_{jt} + \varepsilon_{jt}, \qquad (2)$$

where indices identify a unique observation of firm j in year t. We include the number of business segments in the set of control variables (X) because Colak and Whited (2007) show that *RINV* is negatively related to it. We account for firm size, profitability, financial constraints, total resource allocation across segments, and firm-level growth opportunities. Finally, we also include year fixed effects.

A problem of the outlined approach is that the standard proxy for segment growth opportunities may be quite poor (Graham et al. 2002). If this proxy suffers from measurement error, so does our resource allocation variable *RINV*. Furthermore, any unaccounted segment characteristics that might explain growth opportunities or resource allocation may introduce an omitted variable bias.

2.2. *Regression-based measure of resource allocation*

We can circumvent the measurement error and omitted variable bias by using a regression-based measure of resource allocation. More specifically, we estimate a regression equation relating segment investment to growth opportunities and include segment fixed effects to account for time-invariant measurement error in growth opportunities and to absorb any constant unobserved segment characteristics. The estimated coefficient on growth opportunities, the so-called Q-sensitivity of segment investments, shows the sensitivity of resource allocation to growth opportunities. It is fairly common in the literature to use the Q-sensitivity to gauge investment sensitivity to growth opportunities (Scharfstein 1998; Shin and Stulz 1998). To investigate differences in internal resource allocation between established and newly listed firms, we divide our sample according to firm age into two subsamples and separately estimate the Q-sensitivity with the following regression equation:

$$\mathrm{Inv}_{ijt} = \alpha_{ij} + \delta_t + \gamma \mathrm{Q}_{it-1} + \beta \mathrm{CF}_{ijt} + \varepsilon_{ijt}. \tag{3}$$

The various indices identify observations of segment i within firm j in year t. As mentioned above, the regression equation (3) relates segment resource allocation to growth opportunities. More specifically, segment resource allocation (Inv) is regressed on median industry growth opportunities (Q), segment cash flow (CF), segment fixed effects (α), and year fixed effects (δ). We can then compare the estimated coefficient γ between the subsamples of business segments in established and newly listed firms.

Alternatively, we extend the regression model (3) with an interaction term of the Q variable and firm age (A):

$$\mathrm{Inv}_{ijt} = \alpha_{ij} + \delta_t + \gamma_1 \mathrm{Q}_{it-1} + \gamma_2 \mathrm{A}_{jt} \mathrm{Q}_{it-1} + \gamma_3 \mathrm{A}_{jt} + \beta \mathrm{X}_{ijt} + \varepsilon_{ijt}. \tag{4}$$

The coefficient of interest is γ_2, the difference in the Q-sensitivity between more established and newly listed firms. In regression equation (4) we include a set of control variables (X). At the segment level, we account for segment cash flow. We also include segment absolute and relative size to account for size effects (Ozbas and Selvili 2009) and diversity in divisional resources (Rajan et al. 2000). The final segment level control is segment depreciation. We also include various control variables at the firm level. First, we include a Herfindahl index on segment sales to account for organizational scope (Ozbas 2005; Ozbas and Selvili 2009). Second, we take into account firm-level financial constraints. There are two opposing views about the role of financial constraints on a firm's investment efficiency. One the one hand, due to information asymmetries financially constrained firms might find it costly to raise outside capital to pursue profitable growth opportunities (Baker et al. 2003). On the other hand, high levels of excess cash and unused debt capacity might lead entrenched managers to overinvest and engage in empire-building (Jensen 1986; Stulz 1990). This is especially true for established firms where investment policies due to the available internal funding are less scrutinized by capital markets (Grabowski and Mueller 1975). Hence, it is important to control for financial constraints because they may affect the Q-sensitivity of resource allocation. As mentioned above, the inclusion of segment fixed effects helps absorb any unobservable time-invariant segment characteristics. Finally, we also include year fixed effects to account for unobservable macro factors as well as time trends that might bias our estimate of Q-sensitivity.

3. Data

3.1. Sample selection

Our sample builds on data from the COMPUSTAT Business Segment, COMPUSTAT/CRSP merged annual files. The COMPUSTAT Business Segment file contains actual and restated segment data. If a conglomerate restructures its business segments in a given year, it retrospectively reports segment data of the last two years using the new segment definitions. To avoid multiple counting of segment data, we neglect any retrospectively restated segment data. Our initial sample covers the period 1979 – 2009.

It is well known that COMPUSTAT segment data lacks comparability over time. On the one hand, the introduction of SFAS 131 in June 1997 substantially changed the way firms define business segments (Dittmar and Shivdasani 2003). Under SFAS 14 business segment reporting followed an industry approach as opposed to a management approach (Berger and Hann 2003), which enabled better comparability across segments and within segments over time (Hund et al. 2010; Whited 2006). On the other hand, even under SFAS 14 firms had discretion in deciding which of their operations to report as separate segments. For example, Denis et al. (1997) find that about one of four changes in the number of segments reflect purely reporting changes. Also, Berger and Hann (2003) report that conglomerates in the pre

FASB 131-period used to aggregate segments to avoid reporting unprofitable segments. To get around these problems, we follow Gopalan and Xie (2011) and aggregate a firm's reported segment data within the same industry. For example, in 1999 AAR Corporation reported one segment in the transportation equipment and supply industry (SIC 5088), i.e., *Aircraft Services* with assets worth USD 741 million. In 2000, AAR Corporation changed its segment reporting in that industry. The new reported segments are *Aircraft and Engines* with assets USD 309 million and *Airframe and Accessories* with assets USD 292 million. To limit the bias due to such segment reporting changes over time we aggregate segment accounting data within the same SIC 3-digit industry. Thus, in 2000 we aggregate the two reported segments of AAR Corp into one segment with assets worth USD 601 million.

We limit our analysis to segment-years that report complete accounting data (sales, assets, capital expenditures, operating profits, and depreciation) and non-anomalous accounting data (positive sales, assets, and depreciation and non-negative capital expenditures) (Ozbas and Scharfstein 2010). Since we investigate resource allocation in firms with distinct lines of business, we limit our analysis to firm-year observations operating in at least two different industries. This leaves us with an initial sample of 98,482 segment-years.

Following the empirical literature, we exclude foreign firms with American Depository Receipts (ADRs) (5,339 segment-years). Similarly, we omit firm-years with total sales of less than USD 20 million (8,591 segment-years) and firm-years with at least one segment in the utility (SIC 4900 – 4941) or financial (SIC 6000 – 6999) sector (20,200 segment-years) (Berger and Ofek 1995). Moreover, we cross-validate the COMPUSTAT segment file with the COMPUSTAT industrial file and exclude firm-years where the sum of segment assets (sales) deviates from total firm assets (sales) by more than 25 (1) percent (21,266 segment-years) (Berger and Ofek 1995). These selection criteria reduce our sample to 43,086 segment-years. For firm-years that meet the above criteria, we proportionally allocate any unallocated accounting data to each of its segments (Berger and Ofek 1995; Billett and Mauer 2003). For example, if firm assets exceed the sum of segment assets by 5 percent we increase each segment assets by 5 percent.

Finally, we require that sample segments have sufficient data to compute our main variables for at least two sample years (Billett and Mauer 2003). The final sample consists of 6,947 tracked segments over 39,313 segment-years and 2,224 firms over 15,526 firm-years.

3.2. Sample characteristics

Table 1 shows the descriptive statistics of our variables from 1979 to 2009. The sample starts in 1979 since we require lagged median industry Q. Detailed variable definitions are in Table 11. All continuous and unbounded variables are winsorized at the 1 percent and the 99 percent level of their pooled distribution to account for outliers. Panel A shows the descriptive statistics of the segment-level variables, which except for *Segment size* and *Relative segment size* are normalized by segment sales. We normalize by sales because firms have less discretion in allocating sales across their segments than in allocating assets (Ozbas and Scharfstein 2010). On average, segment capital expenditures (CAPEX) equal 8.4 percent of sales. We also use broader definitions of segment resource allocation by either adding segment R&D to segment capital expenditures or by looking at the annual growth in segment assets. On average, the former equals 8.7 percent and the latter 11.9 percent. Mean segment growth opportunities (Industry Q) equal 1.4. In addition to using standard median industry Q as proxy for segment growth opportunities, we consider alternative approaches motivated by the literature. Billett and Mauer (2003) propose to predict segment growth opportunities based on segment characteristics. Borghesi et al. (2007) suggest to use median industry Q of single-segment firms that are in the same age-cohort. Those alternative measures of segment growth opportunities equal 1.37 and 1.46, on average.

Panel B shows the descriptive statistics of the firm-level variables. The average firm has 2.7 segments, which is similar to other studies despite our aggregation approach (Berger and Ofek 1995; Billett and Mauer 2003). With an average firm age of 24 years our sample firms seem older than what Loderer et al. (2014) find. This difference is likely due to the exclusion of single-segment firms, which tend to be younger. Interestingly, we find that our firm-level measure of resource allocation (RINV) is negative, namely -0.002. Thus, on average firms seem to allocate resources excessively to low-growth business segments. In the following section, we investigate differences in resource allocation between established and newly listed firms.

4. Resource allocation to growth opportunities

4.1. Univariate analysis

As a first test of different resource allocation between established and newly listed firms, we compare the proportion of resources that are allocated to high- and low-Q segments between both groups. We therefore split our sample into firms older and younger than the median firm age in a given year. We define low-Q segments as segments with an industry Q lower than the firm's sales weighted average Q of all business segments in a given year. The results are shown in Table 2. In Panel A, we show the results using raw investment levels. We find that established firms invest less than newly listed firms do, both in low-Q and high-Q segments. The difference is especially large in high-Q segments suggesting that established firms allocate relatively fewer resources to high-growth business lines. Moreover, the results are economically significant. The investment difference between young and established firms in low-Q (high-Q) segments equals 1.1 (2.9) percentage-points or 13.6 (27.9) percent.

We check whether our results are driven by differences in industry- or firm-characteristics and use industry-adjusted or industry- and firm-adjusted segment investment levels. We repeat the above analysis with industry-adjusted investment levels in Panel B. To do so, we subtract median investment levels of single-segment firms operating in the same industry. In Panel C, we further deduct a firm's weighted average industry-adjusted investment across all segments. We therefore aim to account for differences in resource allocation that are related to unobservable firm characteristics. The results remain qualitatively the same in Panel B and C. We find that managers of established firms allocate relatively fewer resources to high-growth business segments.

4.2. Correlation-based measure of resource allocation

In this section, we estimate the regression equation (2) and investigate how *RINV* differs between established and newly listed firms. The results are shown in Table 3. In column (1) we simply regress *RINV* on *Number of segments*. Consistent with Colak and Whited (2007) we find that the number of reported segments is negatively related to *RINV*. In column (2), we add *Firm age* as explanatory variable. The estimated coefficient of *Firm age* is negative and statistically significant. Thus, established firms seem to redirect relatively more resources from high- to low-growth segments. In column (3), we account for firm size but find no evidence that resource allocation, as measured by *RINV*, differs between small and large firms. We further include year fixed effects in column (4) and additional control variables, i.e, *ROA*, *KZ-index*, *Leverage*, *Firm CAPEX*, and lagged *Tobin's Q* in column (5) and continue to find that resource allocation is less sensitive to growth opportunities in established firms.

As mentioned previously, our empirical results so far may suffer from measurement error if median industry Q is a poor proxy for growth opportunities. Moreover, the univariate analysis and the firm-level measure *RINV* do not account for differences in observable segment characteristics such as segment cash flow or any time-invariant unobservable segment characteristics. In the following section, we use a regression-based measure of resource allocation to account for measurement error and omitted variable bias.

4.3. Regression-based measure of resource allocation

4.3.1. Main results

We begin with a simple test of whether the Q-sensitivity of segment investments differs between established and newly listed firms. Specifically, we divide all segment-years into subsamples of established and newly listed firms according to the median sample firm age in a given year, and estimate our regression model (3) for both groups separately. The coefficient on Q, the Q-sensitivity of segment investments, shows whether and by how much segment investments increase with growth opportunities. To account for serial correlation within segments over time we cluster standard errors at the segment level.[3] The results are shown in Table 4. We find that the estimated coefficient on segment Q in newly listed firms is significantly higher than in established firms. It is also noteworthy that segment cash flow negatively affects investment levels and is statistically weak in the subsample of established firms. Ozbas and Scharfstein (2010) also find that segment investments and segment cash flow are not positively related once segment fixed effects are included. More importantly, the results show that the Q-sensitivity of segment investments in newly listed firms is three times larger than in established firms. According to these results, when segment growth

[3] Clustering at the firm level to account for correlated standard errors across segments within firms does not alter our results.

opportunities increase by a given amount, newly listed firms invest three times more than established firms. Our results are not affected by how we divide the sample. In other words, we alternatively classify a firm as established relative to the pooled sample median firm age or within a given industry (3-digit or 2-digit SIC code) and year. We still find that the Q-sensitivity of segment investments is significantly lower in established firms.

Next, we estimate our regression model (4) with the interaction term on growth opportunities and firm age. To simplify interpretation and allow cross-study comparisons we demean *Industry Q* and *Firm age*. The results are shown in Table 5. Column (1) shows the estimation results with *Segment cash flow* as control variable. This is the standard regression equation found in the literature to gauge differences in segment Q-sensitivity (Ozbas and Scharfstein 2010). The estimated coefficient on *Industry Q* equals 0.028. Since we demean the interaction variables the coefficient on *Industry Q* can be interpreted as the Q-sensitivity of segment investments at the sample mean of firm age. Hence, the average firm in terms of firm age increases segment resource allocation by 0.028 when *Industry Q* increases by one unit. The magnitude of the Q-sensitivity is close to what Ozbas and Scharfstein (2010) find. They find a Q-sensitivity of 0.025 for diversified firms. More importantly, the estimated coefficient on the interaction term is negative and statistically significant. Hence, the Q-sensitivity of segment investment declines with firm age. The effect is economically significant. A one standard deviation increase of in the natural logarithm of firm age (0.8) reduces the coefficient on Q by 0.0176 (= -0.022×0.8) or 63 percent (= -0.0176 /0.028). Therefore, Q-sensitivity drops by 63 percent when there is a one standard deviation increase in the natural logarithm of firm age. In column (2) we add all segment control variables, namely, segment absolute and relative size, and segment depreciation. In column (3) we further account for *Focus* and firm-level financial constraints measured by the *KZ-Index*. The estimated coefficient on the interaction term remains significantly negative.

So far, our resource allocation measure captures capital expenditures. Using an incomplete measure of resource allocation, however, may be a problem. In column (4) we use the sum of segment R&D and capital expenditures as dependent variable and find similar results. We should also include asset or firm acquisitions at the segment-level. Phillips and Zhdanov (2013) show that large and established firms may not increase R&D in response to positive demand shocks but rather acquire small innovative firms. Maksimovic and Phillips (2008) show that capital expenditures are quite similar across firm size and firm organization, while acquisition rates differ significantly. Arikan and Stulz (2011) also find a life-cycle of firm acquisitions. According to these studies, not accounting for acquisitions and divestitures at the segment level might bias our results. We therefore follow the literature and use the annual percentage change in book value of assets as a proxy for total investment (Baker et al. 2003). The results are in column (5). Our findings do not change when we use this broader definition of resource allocation.

Before we proceed, we want to examine the estimated coefficients of our control variables in the table. First, the negative coefficient on *Firm age* implies that independently of available growth opportunities established firms invest less than newly listed firms. Second, *Segment cash flow* is generally unrelated to segment investment. This is in contrast to what Shin and Stulz (1998) find that abnormal cash flow shocks at the segment-level affect segment investments. Ozbas and Scharfstein (2010) also find that segment cash flow is unrelated to segment investment when segment fixed effects are included. However, when we measure allocated resources as annual change in assets we also find a statistically significant positive relation (column (5)). Third, our results show that higher beginning-of-year assets are negatively related with segment investment. This is in line with the finding of Duchin and Sosyura (2012). Fourth, *Relative segment size* is weakly and negatively related to segment investment. This is in contrast to theoretical considerations. Yet, the sign of the estimated coefficient changes once we drop segment fixed effects. There are many ways of interpreting the positive relation. For example, relative segment size may capture a segment's strategic importance (Glaser et al. 2013), lower information asymmetry (Ozbas and Selvili 2009), or the segment's past return on investments (Graham et al. 2011). Fifth, our results concerning the coefficient of *Segment depreciation* suggest that there seems to be a general tendency to restore assets in place (Ozbas and Selvili 2009). Overall, the evidence on our segment control variables is largely consistent with other studies on segment investment (Duchin and Sosyura 2012; Ozbas and Scharfstein 2010; Ozbas and Selvili 2009). Regarding our firm control variables, the estimated coefficient on *Focus* is statistically significant and positive. Thus, less diversified firms invest more. The *KZ-Index* is negatively related to segment investment suggesting that higher financial constraints at the firm-level decrease segment investments.

Overall, based on the similarity of our regression results with the empirical literature on segment investments we conclude that the documented lower Q-sensitivity in established firms is not attributable to sample selection bias.

4.3.2.Alternative measures of growth opportunities

In this section, we aim to aim to address measurement error in *Industry Q* by using alternative measures of growth opportunities proposed by the literature. First, Billett and Mauer (2003) argue that segment growth opportunities are likely to be a function of segment size and profitability. Rather than using median industry Q, the authors assign different levels of segment growth opportunities within an industry based on segment size and profitability. To do so, the authors estimate a regression equation that relates Q to size and profitability using single-segment firm observations. With the estimated coefficients the authors can then make an out-of-sample prediction for diversified firms' segment growth opportunities that account for segment size and profitability.

Second, Borghesi et al. (2007) reason that segment growth opportunities are a function of firm age. Firms go public with a lot of growth opportunities and, thus, have a high market valuation after their initial listing (Jain and Kini 1994). As firms take the valuable growth opportunities first (Li et al. 2009), their set of growth opportunities is likely to fall with the number of years listed. To account for different levels of segment growth opportunities, the authors match segment growth opportunities based on industry and age cohort. Specifically, the authors divide all firms into young (1 – 5 years), mature (6 – 20 years), and old firms (21+ years). Each segment is then matched to the median single-segment firm in a given industry and the same age cohort.

We use these alternative measures of growth opportunities to re-estimate our regression equation (4). This should help us get around measurement error in growth opportunities that are related to segment size and profitability or firm age. The results are shown in Table 6. We use *fitted Qs* according to Billett & Mauer (2003) in column (1) and (2) and *age-based Qs* according to Borghesi et al. (2007) in column (3) and (4). The estimated coefficient on the interaction term *Industry Q* × *Firm Age* is negative and statistically significant in all four columns. Also, the economic significance of the age-related decline is similar in magnitude when using alternative industry Q specifications. Hence, our results do not seem to be driven by failing to measure segment growth opportunities correctly.

4.3.3. Robustness tests

We also conduct a variety of other robustness tests. The results are in Table 7. To begin with, our measure of segment investments may be incorrect due to normalizing capital expenditures with sales instead of assets. In column (1) we re-estimate our segment investment regression using asset-normalized variables. Our results are robust to normalizing segment capital expenditures by beginning-of-year assets.

Second, some of the growth opportunities may be projects requiring SG&A or advertising expenditures. Unfortunately, SG&A and advertising expenditures are not observable at the segment level. The next best thing is to include firm-level SG&A and advertising expenditures as control variables. The results are shown in column (2). We find that resource allocation is less sensitive to growth opportunities even in established firms with similar SG&A and advertising expenditures than their younger counterparts.

Third, we explore whether our results are driven by lower governance quality in established firms. Helwege et al. (2007) and Holderness (2009) show that ownership concentration declines with firm age. Hence, our documented age-effect may in fact be a governance-effect in the sense that resource allocation is less sensitive to growth opportunities in firms with less monitoring by institutional investors. We therefore include *Institutional ownership* as additional control variable in column (3). We continue to observe a lower Q-sensitivity in established firms. Note that this tells us nothing about resource allocation efficiency in established firms. We only check whether we pick up differences in resource allocation that are related to governance quality rather than firm age. We address resource allocation efficiency in established firms in section 5.

Finally, we check whether the introduction of SFAS 131 in June 1997 and the aggregation of segment accounting data within 3-digit SIC-codes affect our results. Therefore, we re-estimate regression equation (4) using non-aggregated segment observations and limit our sample to years prior to 1997. As shown in column (4), we obtain qualitatively the same results if we limit our sample to non-aggregated business segment data prior to 1997. In untabulated regressions, we further reduce potential bias from segment reporting changes by limiting our analysis to firm-years that report the same number of segments with identical segment IDs over two consecutive years. Moreover, we allow segment fixed effects to vary whenever a firm changes its reported segments because Colak and Whited (2010) point out that the proxy quality of median industry Q depends on the operating assets of the entire firm. Again, our results remain the same.

5. Resource allocation efficiency

In the previous section, we document that established firms allocate relatively fewer resources to high-growth businesses and relative more to low-growth businesses. What remains unresolved is whether established firms allocate resources less efficiently than newly listed firms. In this section, we explore whether our results reflect evidence of inefficient resource allocation practices in established firms or whether it is consistent with value maximizing behavior.

On the one hand, one might argue that managers of established firms with presumably poor governance quality (Grabowski and Mueller 1975; Helwege et al. 2007; Holderness 2009) may be reluctant to exert great efforts to analyze new growth opportunities and implement an optimal investment policy. Alternatively, entrenched managers in established firms may engage in socialism or nepotism when allocating resources.

On the other hand, we might interpret our results in the spirit of Holmström (1989), namely, that established firms optimally choose to focus on managing existing lines of business and that, by doing so, they might neglect new growth opportunities. Similarly, Loderer et al. (2014) advocate a limited managerial attention hypothesis to explain why established firms shift their focus towards managing existing assets more efficiently. Thus, a lower resource allocation sensitivity may reflect established firms' attempt to strengthen their existing operations by allocating fewer resources to new growth opportunities. Following these arguments, established firms may wisely choose to redirect resources from high- to low-growth businesses.

5.1. Segment profitability

To differentiate between these two mutually exclusive hypotheses, we explore how resource allocation in established firms affects segment profitability. If our results are the consequence of inefficient behavior, we would expect resource allocation in established firms to worsen segment profitability. More specifically, we would expect lower investment levels in established firms to worsen profitability in high-Q segments as valuable growth opportunities are foregone. In low-Q segments, we expect higher investment levels of established firms to worsen segment profitability. However, if established firms optimally choose to allocate fewer resources to high-growth opportunities, we would expect lower segment investment in established firms' high-Q segments to have a positive impact on segment profitability. Under the efficiency hypothesis we would also expect higher segment investment in established firms' low-Q segments to have a positive impact on segment profitability.

To test our predictions, we estimate a regression model that relates segment profitability to segment investment and its interaction with firm age. We do so for low- and high-Q segments, separately. We include a set of control variables. First, we account for segment growth opportunities. Note that we already control for different growth opportunities by dividing the sample into low- and high-Q segments. By including *Industry Q* as control variable we further account for differences in growth opportunities within both subsamples. We also account for segment size, segment R&D expenditures, lagged segment sales growth, firm focus, and financial constraints. The results are shown in Table 8. The dependent variable is *Segment cash flow*. In column (3) and (4) we normalize segment profitability by beginning-of-year segment assets. To be consistent, we also normalize segment capital expenditures and R&D by beginning-of-year segment assets. In column (1) and (3) are the results for low-Q segments and in column (2) and (4) for high-Q segments.

In general, we find no evidence of inefficient resource allocation in established firms. If anything, it seems that established firms optimally choose to allocate more resources to low-Q segments. We find a positive and statistically significant coefficient on the interaction term *Segment CAPEX* × *Firm age* in the subsample of low-Q segments in column (3). Consistent with the efficiency hypothesis, it seems that established firms create value by increasing segment investment in low-growth businesses. However, the efficiency hypothesis also predicts that lower segment investment in established firms' high-Q segments increases segment profitability. We fail to find empirical evidence thereof. The estimated coefficient on the interaction term is statistically insignificant in the subsample of high-Q segments.

Overall, the estimation results are statistically weak. When using sales-normalized variables in column (1) and (2) we find no relation between segment investment and segment performance. Also, the sign of the estimated coefficients depends on whether we normalize our variables by segment sales or beginning-of-year assets. Finally, reverse causality and endogeneity may be of concern when investigating the relation between segment investment and segment profitability. We conclude that the segment performance analysis may not be appropriate to differentiate whether resource allocation in established firms is a consequence of inefficient behavior or optimal redirecting of resources towards low-growth businesses.

In the following section, we choose a quasi-experimental setting to shed light on what causes established firms to reduce resource allocation sensitivity to new growth opportunities.

5.2. Quasi-experiments

In the final section, we exploit exogenous shocks to the competitive environment to understand why established firms allocate fewer resources to high-growth business segments. We explore whether the market for corporate control and product market competition affects established firms to engage in more conservative resource allocation practices. The agency hypothesis predicts that lower takeover or product market threats induce entrenched managers of established firms to put less effort in assessing growth opportunities. As a consequence, we expect a decline in resource allocation sensitivity to growth opportunities when established firms are insulated from takeover or product market threats.

It is less clear what the efficiency hypothesis predicts regarding the impact of competitive threats on established firms' resource allocation, especially in the case of product market competition. We first discuss the market of corporate control.

5.2.1. Market for corporate control

We examine how the introduction of business combination laws affects resource allocation in established firms. Under the agency hypothesis, we would expect resource allocation in established firms to worsen when entrenched managers are insulated from the market of corporate control. This argument builds on the study of Bertrand and Mullainathan (2003). The authors investigate how the introduction of state antitakeover laws affects firm's investment behavior and find that the destruction of old plants as well as the creation of new plants fall after the passage of state antitakeover laws. The authors interpret the change in investment behavior as that a lower takeover threat allows managers to enjoy a quiet life by undertaking fewer "cognitively difficult activities". Because managers of established firms are presumably less monitored (Grabowski and Mueller 1975; Helwege et al. 2007; Holderness 2009) lower resource allocation sensitivity in established firms may be the outcome of quiet-life preferences of entrenched managers. If this is the case, we would expect established firms' resource allocation sensitivity to growth opportunities to worsen after the passage of state antitakeover laws.

Alternatively, the efficiency hypothesis predicts no such decline in established firms' resource allocation sensitivity to growth opportunities when takeover threat is reduced. A growing strand of the literature argues that after listing managers should focus on exploiting the initial growth opportunity set rather than exploring new growth opportunities (Ferreira et al. 2012; Holmstrom 1989; Loderer et al. 2014). The shift in managerial attention away from high-growth businesses should be more pronounced when pressures from capital markets are high. Takeover pressure induces managers to focus on short-term profits at the expense of riskier long-term investments (Stein 1988). Pursuing high-growth opportunities is also riskier and requires tolerance for short-term failure (Manso 2011). Takeover threats reduce that tolerance and, thus, may explain why established firms follow more conservative strategies by allocating more resources to low-growth lines of business. Following these arguments, we would predict an increase in established firms' resource allocation sensitivity to growth opportunities after the passage of state antitakeover laws.

Empirically, we re-estimate our main regression equation (4) and include a triple interaction term of *Industry Q*, *Firm age*, and the dummy variable *bBC* indicating whether business combination laws (BC laws) have been passed in a firm's state of incorporation. The results are shown in Table 9 displaying the estimated coefficients on all interaction terms and its various components. In column (1) we find, consistent with the result of Bertrand and Mullainathan (2003) that BC laws do not affect plant-level capital expenditures, that the level of segment investment is unrelated to *bBC*. Further, the estimated coefficient on the interaction term *Industry Q* × *bBC* is negative and statistically significant. It seems that firms incorporated in states that passed BC laws are more reluctant to assess available new growth opportunities for resource allocation purposes. This is in line with quiet-life preferences affecting resource allocation when the monitoring role of the market for corporate control is weak (Bertrand and Mullainathan 2003). However, the positive estimated coefficient on the triple interaction term suggests that the introduction of state antitakeover laws impacts established firms' resource allocation differently. Established firms incorporated in states that passed BC laws increase resource allocation sensitivity to growth opportunities.

We interpret the empirical results as follows. Lower takeover threats seem to have two opposing effects on established firms' resource allocation. First, after the passage of state antitakeover laws managers enjoy a quiet life by undertaking fewer "cognitively difficult activities", such as analyzing new growth opportunities and negotiating year-to-year changes in resource allocation. Second, lower takeover threats also allow established firms to be less conservative and allocate more resources to growth opportunities. This is in line with Loderer et al. (2014) showing that the decline in Tobin's Q over time is alleviated in firms that are incorporated in states that passed BC laws. Our results complement their finding by showing that established firms' indeed seem to allocate a high proportion of their resources to high-growth businesses after the introduction of state antitakeover laws.

In column (2) we repeat our empirical analysis without firms incorporated in Delaware because those firms may have chosen to reincorporate in Delaware due to more favorable legislation. This may bias our results to the extent that established firms with less conservative resource allocation practices seek takeover protection by reincorporating in Delaware. The estimated coefficient on the triple interaction term is similar in magnitude but with a p-value of 0.078 statistically less significant. However, this is not surprising given that sample size is more than halved. We conclude that takeover pressure negatively affects resource allocation to growth opportunities in established firms. The empirical evidence, thus, is in favor of the efficiency hypothesis rather than the agency hypothesis.

5.2.2. Product market competition

Our second quasi-experiment exploits large industry-specific import tariff reductions (Frésard and Valta 2013). Import tariff reductions increase competition from foreign firms and, thus, reflect an exogenous shock to product market competition. Investigating how an exogenous increase in product market threat affects established firms' resource allocation sensitivity should help us differentiate between our two hypotheses. Assuming that established firms' resource allocation is driven by entrenched managers and less shareholder monitoring, we would expect product market competition to reduce such inefficiencies (Hart 1983). Thus, the agency hypothesis predicts that established firms' resource allocation sensitivity increases after large import tariff reductions.

As mentioned previously, it is less clear how product market competition should affect established firms' resource allocation sensitivity under the efficiency hypothesis. There is an ongoing debate in the literature concerning the role of product market competition in connection with incentives to explore new growth opportunities. On the one hand, product market competition could reduce incentives to explore new growth opportunities (Aghion and Howitt 1992). Knowledge spillovers to competitors and cannibalization of the innovators' products may deter established firms from allocating resources to high-growth businesses. On the other hand, product market competition may induce established firms to seek new growth opportunities as a means to escape the consequences of increased competition (Aghion et al. 2001). Thus, there seems to be contrasting views of how product market competition should affect established firms' incentives to explore growth opportunities.

At the very least, we are able to investigate whether the empirical evidence on resource allocation and product market competition is in line with the predictions based on the agency hypothesis. Empirically, we follow the literature and argue that import tariff reductions constitute an exogenous shock in product market competition (Frésard and Valta 2013; Guadalupe and Wulf 2010). Adding tariff reductions to our regression model (4) allows us to investigate how an exogenous shock to competition affects established firms' resource allocation sensitivity to growth opportunities. We use industry-specific import tariff reductions to specify whether a firm's main industry experienced such a reduction in the past. Frésard and Valta (2013) provide industry-years with significant import tariff reductions. The data is available for manufacturing industries with product-level import data. For our sample with available import tariff data, we then investigate whether established firms exposed to foreign competition allocate more resources to high-growth businesses as predicted by the agency hypothesis.

The regression results using import tariff reductions are shown in Table 10. Due to the reduced sample size we first re-estimate our regression model without adding tariff reductions. The estimation results are in column (1). We find a positive estimated coefficient on *Industry Q*, suggesting that resource allocation increases with available growth opportunities. However, statistical significance is lower compared to previous results in Table 5, presumably, due to reduced sample size and difficulties in measuring growth opportunities. These issues might also explain why the estimated coefficient on the interaction term *Industry Q* × *Firm age* is almost zero and statistically insignificant.

In column (2) we include *bTariff* and its interactions with *Industry Q* and *Firm age*. The estimated coefficient on *Industry Q* is larger in magnitude but slightly lower in statistical significance. The estimated coefficient on the interaction term *Industry Q* × *Firm age* remains statistically insignificant. Interestingly, however, the estimated coefficient on the triple interaction term *Industry Q* × *Firm age* × *bTariff* is negative and statistically significant at the 10-percent level. The empirical evidence is inconsistent with the agency hypothesis. Rather, it seems that established firms exposed to foreign competition allocate fewer resources to available new growth opportunities. All other coefficients are statistically insignificant. Hence, segment capital expenditures are only affected through the channel of growth opportunities. To sum up, the findings in Table 10 suggest that lower resource allocation sensitivity in established firms does not seem to be driven by managerial slack.

One concern of our analysis is that import tariff reductions may affect growth opportunities as well. This will especially be a problem if tariff reductions affect growth opportunities differently in newly listed and established firms. In unreported analysis, we find no evidence that import tariff reductions impact growth opportunities. Thus, we discard this alternative interpretation.

Taken together, the empirical evidence in Table 9 and 10 is in favor of the efficiency hypothesis. It follows that established firms seem to wisely choose to allocate resources more conservatively, presumably, due to competitive pressures and associated survival concerns.

6. Conclusion

In this paper, we ask whether internal resource allocation practices in established firms differ from newly listed firms. According to the literature established firms are at a disadvantage in pursuing new growth opportunities (see Gompers et al. 2005 and the cited literature therein). We empirically explore whether established firms allocate fewer resources to high-growth lines of business. First, we show that established firms seem to redirect resources from high-growth to low-growth segments. Second, controlling for various factors that impact resource allocation we find that segment capital expenditures are less sensitive to growth opportunities in established firms. Moreover, the effect is economically significant. The resource allocation sensitivity in newly listed firms is approximately three times larger than in established firms. Third, we find no evidence of inefficient resource allocation practices in established firms. Instead of pursuing new growth opportunities, established firms seem to allocate resources as a means to strengthen performance of existing business. We find some evidence that the impact of segment capital expenditures on segment profitability in low-growth segments is higher in established firms. Finally, we also use two quasi-experiments to test whether there is any evidence that the focus by established firms away from high-growth to low-growth businesses is evidence of poor allocation of resources. The evidence rejects that hypothesis. Using the introduction of state antitakeover laws that protect management, we find that a lower takeover threat increases (rather than decreasing) established firms' resource allocation to new growth opportunities. Moreover, using import tariff reductions we show that increased product market competition leads to lower (rather than higher) resource allocation towards new growth opportunities. Overall, our empirical evidence supports the hypothesis that established firms are structured to serve production and marketing goals which compromises the pursuit of new growth opportunities (Holmstrom 1989).

Table 1: Descriptive Statistics

Table 1 shows the descriptive statistics for the segment and firm variables. Segment variables are shown in Panel A and firm variables in Panel B. Variable definitions are shown in Table 11. The data refer to segments of conglomerates from 1979 to 2009. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution.

	Mean	Median	Std.	Min	Max	N
			Panel A: Segment variables			
Segment CAPEX	0.084	0.036	0.174	0.000	1.295	42,700
Segment R&D	0.002	0.000	0.008	0.000	0.064	43,086
Segment CAPEX and R&D	0.087	0.037	0.178	0.000	1.322	42,700
Segment asset growth	0.119	0.050	0.394	-0.599	2.409	38,946
Industry Q	1.401	1.293	0.486	0.749	3.318	41,819
Fitted Q	1.456	1.412	0.477	0.273	2.974	33,820
Age-based Q	1.368	1.249	0.496	0.733	3.380	36,319
Segment cash flow	0.108	0.103	0.203	-1.095	0.782	43,082
Segment size (Mio. USD)	575.6	98.33	1,384	1.243	9,262	38,957
Relative segment size	0.399	0.321	0.291	0.014	1.000	38,957
Segment depreciation	0.054	0.031	0.080	0.002	0.545	43,084
Segment ROA	0.162	0.148	0.175	-0.509	0.885	38,942
Segment sales growth	0.149	0.077	0.436	-0.569	2.882	38,917
			Panel B: Firm variables			
Number of segments (industries)	2.714	2.000	0.987	2.000	10.000	16,209
Firm age (years)	24.025	19.000	18.149	1.000	76.000	16,209
Focus	0.582	0.557	0.187	0.135	1.004	16,209
KZ-Index	-0.890	-0.136	3.321	-17.333	4.661	15,734
SG&A	0.268	0.227	0.188	0.016	0.951	15,603
Advertising	0.009	0.000	0.021	0.000	0.132	16,209
Institutional ownership	0.396	0.383	0.260	0.003	0.971	11,575
RINV	-0.002	-0.001	0.038	-0.185	0.163	16,209
Firm size	1,688	316.0	4,001	12.81	28,804	16,209
ROA	0.156	0.153	0.094	-0.088	0.435	15,818
Leverage	0.285	0.265	0.173	0.000	0.818	16,209
Firm CAPEX	0.069	0.040	0.090	0.004	0.563	16,072
Tobin's Q	1.333	1.174	0.570	0.647	3.775	16,145

Table 2: Resource allocation in high- and low-Q segments

Table 2 displays the mean investment levels in high- and low-Q segments for young and old firms. We divide the sample in newly listed and established firms according to median firm age in a given year. Segments are classified as low-Q if its industry Q is below the sales-weighted average of all segment industry Qs in a given firm-year. Variable definitions are shown in Table 11. We adjust segment CAPEX by subtracting the median industry level of single-segment firms in Panel B and by subtracting a firm's sales-weighted average of industry-adjusted segment CAPEX in Panel C. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Statistical significance of differences in mean levels is based on two-tailed t-tests. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Low-Q segment	High-Q segment	Difference
	Panel A: Segment CAPEX		
Newly listed firms	0.081	0.104	0.023***
Established firms	0.070	0.075	0.005***
Difference	0.011***	0.029***	
	Panel B: Industry-adjusted segment CAPEX		
Newly listed firms	0.020	0.026	0.006**
Established firms	0.016	0.008	-0.008***
Difference	0.004**	0.018***	
	Panel C: Firm- and industry-adjusted segment CAPEX		
Newly listed firms	0.011	0.015	0.004**
Established firms	0.011	0.002	-0.009***
Difference	0.000	0.013***	

Table 3: Firm-level evidence

In Table 3 we investigate firm-level evidence of low resource allocation sensitivity to growth opportunities. Variable definitions are shown in Table 11. All specifications include year fixed effects. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	RINV				
	(1)	(2)	(3)	(4)	(5)
Number of segments	-0.006***	-0.005***	-0.006***	-0.005***	-0.005***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Firm age		-0.001**	-0.001**	-0.001**	-0.002***
		(0.001)	(0.001)	(0.001)	(0.001)
Firm size			0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)
ROA					-0.012**
					(0.006)
KZ-Index					-0.000*
					(0.000)
Leverage					-0.000
					(0.003)
Firm CAPEX					0.023*
					(0.013)
Tobin's Q_{t-1}					0.001
					(0.001)
Year fixed effects	No	No	No	Yes	Yes
Observations	15,901	15,901	15,901	15,901	15,281
Adj. R-squared	0.002	0.003	0.003	0.003	0.006

Table 4: Q-sensitivity in newly listed and established firms

Table 4 investigates the difference in Q-sensitivity between young and old firms. The dependent variable is segment CAPEX. We estimate the regression equation (3) relating segment investment to growth opportunities for newly listed and established firms, separately. We use median firm age in a given year to divide firm-years into subsamples of newly listed and established. To examine whether the difference in estimated coefficients between newly listed and established firms is statistically significant, we estimate a pooled regression with interaction variables between the two explanatory variables and a binary variable indicating whether a segment is part of an established firm. Variable definitions are shown in Table 11. We include year and segment fixed effects. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the segment level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

		Industry Q		Segment cash flow		
	N	Coefficient	(SE)	Coefficient	(SE)	Adj-R^2
Newly listed firms	21,259	0.042***	(0.007)	-0.044**	(0.022)	0.67
Established firms	20,179	0.014***	(0.005)	-0.036*	(0.020)	0.68
Difference		***		Insignificant		

Table 5: Q-sensitivity over time

Table 5 displays the results of our main segment investment regression model. The dependent variable is segment CAPEX in column (1) to (3), segment CAPEX and R&D in column (4), and segment asset growth in column (5). Variable definitions are shown in Table 11. We center the variables firm age and industry Q at the sample mean. All specifications include year and segment fixed effects. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the segment level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Segment CAPEX			Segment CAPEX and R&D	Segment asset growth
	(1)	(2)	(3)	(4)	(5)
Industry Q	0.028***	0.034***	0.034***	0.034***	0.075***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.010)
Industry Q × Firm age	-0.022***	-0.023***	-0.023***	-0.021***	-0.030***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.011)
Firm age	-0.027***	-0.027***	-0.026***	-0.026***	-0.054**
	(0.007)	(0.007)	(0.006)	(0.007)	(0.023)
Segment cash flow	-0.025*	-0.008	-0.009	-0.012	0.194***
	(0.015)	(0.013)	(0.013)	(0.014)	(0.026)
Segment size		-0.008***	-0.007**	-0.008**	-0.283***
		(0.003)	(0.003)	(0.003)	(0.012)
Relative segment size		-0.001	-0.013*	-0.010	-0.075**
		(0.007)	(0.007)	(0.008)	(0.030)
Segment depreciation		0.632***	0.627***	0.667***	-0.226*
		(0.087)	(0.086)	(0.089)	(0.124)
Focus			0.048***	0.046***	0.207***
			(0.011)	(0.011)	(0.044)
KZ-Index			-0.001***	-0.001**	-0.012***
			(0.000)	(0.000)	(0.002)
Segment fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	36,164	36,164	36,164	36,164	36,475
Adj. R-squared	0.669	0.683	0.684	0.683	0.232

Table 6: Alternative measures of growth opportunities

Table 6 displays the results of our segment investment regression model using alternative measures of segment growth opportunities. We use fitted Qs in column (1) and (2) and age-based Qs in column (3) and (4). Variable definitions are shown in Table 11. We center the variables firm age and industry Q at the sample mean. All specifications include year and segment fixed effects. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the segment level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Segment CAPEX			
	Using fitted Qs		Using age-based Qs	
	(1)	(2)	(3)	(4)
Industry Q	0.017***	0.018***	0.020***	0.023***
	(0.004)	(0.004)	(0.004)	(0.004)
Industry Q × Firm age	-0.014***	-0.014***	-0.013***	-0.014***
	(0.004)	(0.004)	(0.004)	(0.004)
Firm age	-0.030***	-0.029***	-0.017**	-0.014**
	(0.008)	(0.007)	(0.008)	(0.007)
Segment cash flow	-0.024	-0.007	-0.025	-0.004
	(0.016)	(0.015)	(0.017)	(0.015)
Segment size		-0.006*		-0.006*
		(0.003)		(0.003)
Relative segment size		-0.018**		-0.015*
		(0.008)		(0.008)
Segment depreciation		0.584***		0.658***
		(0.094)		(0.097)
Focus		0.050***		0.047***
		(0.012)		(0.012)
KZ-Index		-0.001***		-0.001***
		(0.000)		(0.000)
Segment fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	32,425	32,425	31,468	31,468
Adj. R-squared	0.676	0.676	0.664	0.681

Table 7: Robustness tests

Table 7 displays the robustness tests of our main segment investment regression model. In column (1) we use asset-normalized segment variables. In column (2) we include firm-level SG&A and advertising expenditures as control variables. In column (3) we account for institutional ownership. In column (4) we re-estimate our main segment investment regression using non-aggregated segment data prior to 1997. Variable definitions are shown in Table 11. We center the variables firm age and industry Q at the sample mean. All specifications include year and segment fixed effects. All continuous and unbounded variables are winsorized at the 1^{st} and the 99^{th} percentile of their pooled distribution. Standard errors are clustered at the segment level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Segment CAPEX			
	Asset-normalized variables	Account for alternative resources at the firm-level	Account for institution-al ownership	Non-aggregated seg-ment data
	(1)	(2)	(3)	(4)
Industry Q	0.025***	0.033***	0.035***	0.044***
	(0.003)	(0.005)	(0.005)	(0.006)
Industry Q × Firm age	-0.012***	-0.023***	-0.024***	-0.030***
	(0.003)	(0.005)	(0.005)	(0.006)
Firm age	-0.019***	-0.024***	-0.029***	-0.045***
	(0.004)	(0.007)	(0.008)	(0.009)
Segment cash flow	0.059***	-0.013	-0.020	-0.014
	(0.006)	(0.013)	(0.015)	(0.017)
Segment size	-0.018***	-0.006**	-0.006*	-0.014***
	(0.002)	(0.003)	(0.003)	(0.004)
Relative segment size	-0.003	-0.010	-0.015	-0.018**
	(0.005)	(0.008)	(0.009)	(0.009)
Segment depreciation	0.994***	0.575***	0.681***	0.555***
	(0.050)	(0.090)	(0.095)	(0.113)
Focus	0.018**	0.037***	0.057***	0.067***
	(0.007)	(0.011)	(0.013)	(0.015)
KZ-Index	-0.001***	-0.001***	-0.001**	-0.002***
	(0.000)	(0.000)	(0.000)	(0.001)
SG&A		-0.075***		
		(0.013)		
Advertising		0.032		
		(0.156)		
Institutional ownership			0.048***	
			(0.013)	
Segment fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	36,156	34,809	26,126	27,496
Adj. R-squared	0.541	0.690	0.695	0.697

Table 8: Segment performance analysis

Table 8 displays the results of our segment performance analysis. The dependent variable equals segment cash flow. We look at low-Q segments in column (1) and (3) and at high-Q segment in column (2) and (4). In column (3) and (4) we normalize segment cash flow, segment CAPEX, and segment R&D by beginning-of-year assets. Variable definitions are shown in Table 11. We center the variables firm age and segment CAPEX at the sample mean. All specifications include year and segment fixed effects. All variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the segment level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Segment cash flow		Segment cash flow (normalized by beginning-of-year assets)	
	Low-Q	High-Q	Low-Q	High-Q
	(1)	(2)	(3)	(4)
Firm age	-0.009	-0.012	-0.032*	-0.023
	(0.014)	(0.016)	(0.018)	(0.019)
Segment CAPEX	-0.005	-0.088	0.384***	0.306***
	(0.050)	(0.059)	(0.041)	(0.041)
Segment CAPEX × Firm age	-0.069	-0.007	0.110**	0.079
	(0.055)	(0.055)	(0.051)	(0.053)
Industry Q	0.036***	0.012*	0.036***	0.004
	(0.012)	(0.007)	(0.011)	(0.006)
Segment size	0.008	0.000	-0.057***	-0.051***
	(0.006)	(0.009)	(0.008)	(0.008)
Relative segment size	-0.050***	-0.002	-0.019	-0.034
	(0.018)	(0.026)	(0.022)	(0.027)
Segment R&D	-0.032	-0.088	0.226	0.519
	(0.555)	(0.266)	(0.447)	(0.409)
Segment sales growth$_{t-1}$	0.020***	0.010	0.031***	0.014**
	(0.006)	(0.007)	(0.007)	(0.007)
Focus	0.020	-0.016	0.001	-0.038
	(0.026)	(0.030)	(0.030)	(0.033)
KZ-Index	-0.005***	-0.006***	-0.007***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.002)
Segment fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	13,705	12,943	13,705	12,943
Adj. R-squared	0.614	0.590	0.514	0.528

Table 9: Business combination laws

Table 9 displays the results of our segment investment regression model using a difference-in-difference approach of whether firms are incorporated in states that passed antitakeover laws or not. In column (1) we use the full sample whereas in column (2) we exclude firm-year observations where state of incorporation is Delaware. Control variables are the same as in Table 5. Variable definitions are shown in Table 11. We center the variables firm age and industry Q at the sample mean. All specifications include year and segment fixed effects. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the segment level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Segment CAPEX	
	Full sample	Without firms incorporated in Delaware
	(1)	(2)
Industry Q	0.040***	0.040***
	(0.007)	(0.011)
Industry Q × Firm age	-0.027***	-0.026***
	(0.007)	(0.010)
Industry Q × Firm age × bBC	0.017**	0.020*
	(0.008)	(0.011)
Firm age	-0.023***	-0.026***
	(0.007)	(0.010)
bBC	-0.002	-0.001
	(0.005)	(0.006)
Industry Q × bBC	-0.022***	-0.032***
	(0.007)	(0.010)
Firm age × bBC	0.003	-0.006
	(0.005)	(0.007)
Other controls	Yes	Yes
Segment fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	32,483	13,773
Adj. R-squared	0.681	0.660

Table 10: Import tariff reductions

Table 10 shows the results of our segment investment regression model estimated in industries that experienced an import tariff reduction over our sample period. Control variables are the same as in Table 5. Variable definitions are shown in Table 11. We center the variables firm age and industry Q at the sample mean. All specifications include year and segment fixed effects. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the segment level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Segment CAPEX	
	(1)	(2)
Industry Q	0.008**	0.013*
	(0.004)	(0.007)
Industry Q × Firm age	0.001	0.010
	(0.005)	(0.007)
Industry Q × Firm age × bTariff		-0.014*
		(0.008)
Firm age	0.010	0.010
	(0.008)	(0.008)
bTariff		0.001
		(0.004)
Industry Q × bTariff		-0.004
		(0.007)
Firm age × bTariff		0.001
		(0.006)
Other controls	Yes	Yes
Segment fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	4,504	4,504
Adj. R-squared	0.792	0.792

Table 11: Variable definitions

Variable	Definition
Segment variables	
Segment CAPEX	Segment capital expenditures (capx) normalized by segment sales (sale). The data are from COMPUSTAT.
Segment R&D	Segment R&D expenditures (rd) normalized by segment sale (sale). We replace missing R&D observations with zero. The data are from COMPUSTAT.
Segment CAPEX and R&D	The sum of segment capital expenditures (capx) and segment R&D (rd) normalized by segment sales (sale). We replace missing R&D observations with zero. The data are from COMPUSTAT.
Segment asset growth	The annual percentage change in segment book value of assets (at). The data are from COMPUSTAT.
Standard Q	Lagged median Tobin's Q of single-segment firms operating in the same industry. Tobin's Q is computed as market value of assets divided by book value of assets (at). Market value of assets equals market value of equity (csho×prcc_f) plus book value of assets (at) minus book value of equity (ceq) minus deferred taxes (txdb). The data are from COMPUSTAT.
Fitted Q	Predicted lagged Tobin's Q using the approach of Billett and Mauer (2003).
Age-based Q	Lagged median Tobin's Q of single-segment firms being in the same age-cohort and operating in the same industry. The variable is further described in Borghesi et al. (2007).
Segment cash flow	Segment EBITDA normalized by segment sales (sale). EBITDA equals operating profit (ops) plus depreciation (dp). The data are from COMPUSTAT.
Segment size	The natural logarithm of beginning-of-year segment assets, computed as end-of-year assets (at) plus depreciation (dp) minus capital expenditures. The data are from COMPUSTAT.
Relative segment size	Beginning-of-year segment assets divided by the sum of a firm's beginning-of-year assets. The data are from COMPUSTAT.
Segment depreciation	Segment depreciation (dp) normalized by segment sales (sale). The data are from COMPUSTAT.
Segment sales growth	The annual percentage change in segment sale (sale). The data are from COMPUSTAT.
Firm variables	
Number of segments	The natural logarithm of the number of reported segments with distinct 3-digit SIC codes. We aggregate reported segments within the same 3-digit SIC codes. The data are from COMPUSTAT.
Firm age	The natural logarithm of firm age. Age is computed as one plus the difference between the year under investigation and the firm's year of birth. The year of birth is computed as the minimum value of: (a) the first year the firm appears on the CRSP tapes; (b) the first year the firm appears on the COMPUSTAT tapes; and (c) the first year for which we find a link between the CRSP and the COMPUSTAT tapes.
Focus	Focus is measured with a Herfindahl index, HI, based on the sales (sale) in the firm's different business segments: $HI = \sum_{i=1}^{N} p_i^2$, where N is the number of reported segments with distinct 3-digit SIC codes, the subscript i identifies the segments, and p_i is the fraction of the firm's total sales in the segment in question. We aggregate segment sales within 3-digit SIC codes. The data are from COMPUSTAT.

Variable	Definition
KZ-Index	The Kaplan and Zingales (1997) measure of a firm's financial constraints. We follow Lamont, Polk, and Saá-Requejo (2001) and compute the KZ-Index as: -0.001909 $\times$[(ib+dp)/ppent$_{t-1}$] + 0.2826389$\times$[Tobin's Q] + 3.139193$\times$[(dltt+dlc)/(dltt+dlc+seq)] – 39.3678$\times$[(dvc+dvp)/ppent$_{t-1}$] – 1.314759$\times$[che/ at$_{t-1}$]. The data are from COMPUSTAT.
Institutional ownership	Percentage of total institutional ownership (instown_perc). The data are from 13F INSTITUTIONAL OWNERSHIP.
SG&A	Selling, general, and administrative expenses (xsga) normalized by sales (sale). The data are from COMPUSTAT.
RINV	RINV is defined as the sum of industry- and firm-adjusted segment CAPEX in a firm's high-Q segments minus the sum of industry- and firm-adjusted segment capital expenditures in a firm's low-Q segments: $RINV_{jt} = \sum_{i=1}^{k} w_{it} \times Inv_{jt} - \sum_{i=n-k+1}^{n} w_{it} \times Inv_{it},$ where n is the number of total segments, k is the number of high-Q segments, w equals the percentage of segment sales to firm sales (sale), and Inv equals the firm- and industry-adjusted segment CAPEX. We industry-adjust segment CAPEX by subtracting median industry segment CAPEX of all single-segment firms. Industry classification is based on the narrowest SIC grouping with at least five matched single-segment firms. Firm- and industry-adjusted segment CAPEX equals then segment CAPEX minus the sales-weighted average of industry-adjusted segment CAPEX within a firm. The data are from COMPUSTAT.
Firm size	The natural logarithm of the firm's book value of assets (at). The data are from COMPUSTAT.
ROA	Firm operating profits before depreciation and amortization (oibdp) normalized by beginning-of-year firm assets (at). The data are from COMPUSTAT.
Leverage	The ratio of a firm's long-term debt (dltt + dlc) to assets (at). The data are from COMPUSTAT.
Firm CAPEX	Firm capital expenditures (capx) normalized by sales (sale). The data are from COMPUSTAT.
Tobin's Q	The ratio of a firm's market value of assets to the book value of assets (at). The market value of assets equals the sum market value of equity (csho × prcc_f) and the market value of debt (at – ceq – txdb). The data are from COMPUSTAT.
bBC	A dummy variable indicating whether state antitakeover laws have been introduced in a firm's state of incorporation (incorp). The data are from Bertrand and Mullainathan (2003) and COMPUSTAT.
bTariff	A binary variable indicating whether in a given industry-year an import tariff reduction has been passed or not. The data are from Frésard and Valta (2012).

Paper II: Corporate aging and asset sales

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Abstract

This paper asks whether divestitures are motivated by strategic considerations about the scope of the firm's activities. Limited managerial capacity implies that exploiting core competences becomes comparatively more attractive than exploring new growth opportunities as firms mature. Divestitures help established firms free management time and increase the focus on core competences. The testable implication of this attention hypothesis is that established firms are the main sellers of assets, that their divestiture activity increases when managerial capacity is scarcer, that they sell non-core activities, and that they return the divestiture proceeds to the providers of capital instead of reinvesting them in the firm. We find strong empirical support for these predictions.

Keywords: divestitures, management attention, firm age, innovation

JEL codes: G30; L20

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1. Introduction

According to Kaplan and Weisbach (1992), divestitures reflect a strategic repositioning of firms. The evidence in John and Ofek (1995), according to which firms divest assets in response to inefficient and value-reducing diversification, is consistent with that. So are the findings in Maksimovic and Phillips (2001) that divestitures improve the allocation of resources as predicted by a simple model of profit maximization. Çolak and Whited (2007), however, fail to find evidence of an improvement in investment efficiency after divestitures. We propose a simple model that explains the strategic repositioning and reconciles it with the evidence.

Our investigation builds on Loderer et al. (2014), who show that, after listing, firms optimally focus on their core competences to exploit the opportunities offered by those assets in place. In the process, they trim their organizations to serve production and marketing goals (Holmstrom 1989), inducing what has been referred to elsewhere as organizational "rigidities" (Leonard-Barton 1992). These rigidities are organizational rules and incentives that allow firms to optimally exploit their assets in place. The focus on assets in place makes the exploration of new growth opportunities progressively less profitable. The managers of established (older) firms, therefore, rationally choose to focus their attention on exploiting assets in place and to spend less time on exploring growth opportunities. Under this managerial attention hypothesis (MAH), established firms engage in divestitures to free up management time needed for refining and exploiting core competences. However, such strategic repositioning does not occur in reaction to ex ante inefficiencies in the firm's investment policy or to lack of profitability. It simply reflects the attempt to maintain current profitability.

As outlined in more detail below, the MAH has distinct testable implications for the characteristics of divesting firms, the divestiture motive, the type of divested assets, as well as the post-divestiture investment policy. In that order, its main empirical predictions are that 1) established firms are the predominant sellers of assets, 2) established firms sell assets to focus on core competences, 3) established firms sell peripheral assets, especially if they have a comparative disadvantage at managing those assets, and 4) established firms return the divestiture proceeds to the providers of capital instead of investing them into new growth opportunities. We study a large sample of asset sales by US firms reported on SDC Platinum over the years 1985 to 2010 and find strong empirical support for these predictions.

Unconditionally, firms in the upper quartile of the age distribution are responsible for 53% of all divestitures and 66% of the divested asset values. The corresponding figures for firms in the lower tail are only 12% and 7%, respectively. Moreover, the unconditional annual probability of divesting an asset is 17% for the oldest firms, compared with 4% for the youngest firms. This age effect is separate from other factors that have been found to affect divestitures. Conditionally on a broad set of control variables, the odds ratio of divesting increases by 18% if firm age increases by one standard deviation. In particular, divestitures by established firms are not driven by factors such as firm size, profitability, financing constraints, positive demand shocks (Maksimovic and Phillips 2001), high liquidity (Schlingemann et al. 2002), and past diversifying acquisitions (John and Ofek 1995; Maksimovic et al. 2011). Not only does the probability of a divestiture increase with age, but also the size of the divested assets goes up. Established firms are more likely to engage in large asset sales, both in absolute terms as well as in terms of relative values. Moreover, we find statistically the same age effect when we group the sample into small and large firms. Therefore, divestitures are indeed an older firm phenomenon.

The second set of testable implications of the MAH relates to the main motive of divestitures. According to the hypothesis, organizational rigidities induce established firms to sell assets to free management time that can then be dedicated to core competences. Consequently, established firms in which management time is more of a binding constraint should sell more assets. One way to test this prediction is to look at the firms' degree of organizational complexity. In complex organizations, managers spend a significant fraction of their time coordinating tasks and processes. In established firms, divestitures can help reduce that complexity and thereby lower coordination costs (Rawley 2010). We therefore expect that the divestiture intensity of established firms is positively related to the degree of bureaucratization. The data support this prediction. We follow Miller and Friesen (1984) and Sorensen and Stuart (2000), among others, and use the firm's selling, general, and administrative (SG&A) expenses as a proxy for organizational rules and processes. We find that a unit standard deviation increase in SG&A increases the age effect by as much as 39%.

Another way to test the prediction is to look at the firms' competitive environment. Because managerial capacity is scarcer in a dynamic environment, organizational rigidities are more of a disadvantage for firms that operate in industries where technological change is imminent. Consequently, the divestiture activity of established firms should be livelier in innovative and more competitive industries. We use the industry median R&D expenditures, normalized by assets, as a proxy for industry innovation (Mulherin and Boone 2000) and find that it significantly accelerates the age effect in divestitures. The economic magnitude of the effect is palpable as well. A one standard deviation increase in industry innovation increases the age effect by 29%.

In contrast, the need to divest to free up managerial capacity is less pressing for firms that operate in industries protected by barriers to entry. Established firms in such industries should feel less pressure to focus on core competences and therefore exhibit lower divestiture intensity. Following Bhattacharyya and Nain (2011), we use the industry's capital intensity as a proxy for supply-side entry barriers. The presence of these entry barriers significantly lowers divestitures by established firms. Economically, a one standard deviation increase in industry capital intensity decreases the age effect by 18%.

The third set of testable implications of the MAH relates to the type of divested assets. If established firms sell assets to better focus on core competences, they should be more likely to divest peripheral activities than core activities. To identify peripheral divestitures, we compare the industry classification of the selling subsidiary with that of its ultimate parent. We assume a divested asset is not part of the firm's core activities if the selling subsidiary operates in a different Fama and French (1997) 48 industry than the ultimate parent. In line with our predictions, non-core divestitures are significantly more likely in established firms. The odds ratio of divesting non-core assets increases by 25% with a unit standard deviation increase in firm age, that of core assets by only 11%. The same result holds when estimating a bivariate model with sample selection (Heckman 1979) for divesting firms.

Holding on to non-core activities is particularly unattractive if the difference between the own ability to exploit the asset and the potential buyer's ability to exploit that asset is large. To manage the asset competitively, management would have to dedicate a disproportionate fraction of its time to managing it. Efficiency considerations therefore imply that established firms sell non-core assets in areas where their comparative management disadvantage is large. We find that to be the case. Conditional on a non-core asset sale, established firms divest assets in industries with higher growth opportunities and higher R&D intensity than their main industry. Therefore, it does not look as if established firms hold on to non-core assets as options to leave the original business.[1]

Konica Minolta's divestiture of their camera business provides a good illustration of these considerations. In 2006, three years after Konica merged with Minolta to boost its ability to compete in the digital camera business, the firm sold its camera business altogether to Sony. Konica and Minolta's explanation was that "in today's era of digital cameras […] it became difficult to timely provide competitive products even with our top optical, mechanical and electronic technologies." Apparently, Konica Minolta felt unable to respond to the digitalization of cameras. Selling the growth option rather than exploiting it looked like the better alternative. Sony, who already produced so-called point-and-shoot digital cameras, successfully exploited Konica Minolta's camera technologies and launched its first single-lens reflex (SLR) camera. In the following years, Sony was the fastest growing company in that market.

The evidence so far is that established firms divest assets to improve the focus on their core competences. The last set of testable implications of the MAH addresses the post-divestiture activities. Established firms experience a decline in growth opportunities (Loderer et al. 2014). If they divest to free up managerial capacity, they will not invest the proceeds in non-core activities, but they will also have limited possibilities to invest them in profitable core investment opportunities. Hence, they will not divest to finance new growth, on average (see also Phillips and Zhdanov 2013). Instead, they will return the divestiture proceeds to investors. This is what we find. We estimate a Heckman selection model that relates post-divestiture activities to firm age. Consistent with our predictions, established firms are significantly less likely to engage in asset acquisitions or full-firm acquisitions after a divestiture. The effect holds for both diversifying and non-diversifying acquisitions. Established firms also scale back their internal growth attempts, as manifested by a decline in their R&D expenditures. In contrast, debt repayments increase and dividend payments go up. Therefore, we conclude that established firms choose to return the divestiture proceeds to their providers of capital instead of investing them into new ventures.

Taken together, we find strong empirical support for the MAH of divestitures. Alternative interpretations of the age effect we document are difficult to reconcile with the evidence in its

[1] Schlingemann et al. (2002) and Dittmar and Shivdasani (2003) also report that firms often divest segments in high-growth industries. We show that such behavior is driven by established firms.

entirety. In particular, we know from previous literature that firm age is related to the degree of financing constraints (Hadlock and Pierce 2010) and that financially constrained firms are more likely to engage in assets sales (Borisova and Brown 2013). However, because established firms are generally viewed as being financially less constrained than young firms, they should actually exhibit a lower propensity to divest. That is inconsistent with the evidence. Firm age could also correlate with post M&A divestitures. It is well-known that divestitures increase after takeovers (see, among others, Maksimovic et al. 2011). Therefore, firm age could, in principle, reflect post-takeover restructurings. Established firms are more likely to have engaged in past mergers and acquisitions. Consistent with the literature, we find that past takeovers accelerate divestitures. However, we show that this effect cannot explain the positive age-dependence of divestitures. Moreover, the positive age effect on divestitures remains positive and significant also when restricting the sample to single-segment firms and when focusing on firms without any prior M&A or asset acquisition activities in the years leading up to the divestiture.

Arguments similar to ours have been made to explain alternative restructuring activities, including spin-offs and entrepreneurial spawning. Ito (1995) and Chesbrough (2003) argue that firms tend to spin-off innovative activities because the structures in place may be an obstacle to pursuing these activities successfully. However, spin-offs are relatively rare restructuring events, at least in the U.S. (Ito 1995). In the context of entrepreneurial spawning, Gompers et al. (2005) argue that innovative employees increasingly leave established firms to start their own venture. Such behavior is consistent with the predictions of the MAH. If firms increase the focus on core activities as they get older, it follows that they also let go of employees whose skills and incentives are incompatible with that core. Entrepreneurial spawning is one way that could happen. Interestingly, however, Habib et al. (2013) argue that older firms should spawn less. We argue that established firms rationally choose to dispose of peripheral activities. These tests have no counterpart in the literature inspired by entrepreneurial spawning.

Finally, our study is related to the extensive literature in organizational theory that started with March (1991) and postulates that organizations face a trade-off between exploring new ideas and exploiting existing competences (see also Bernardo and Chowdhry 2002). Our evidence implies that firms, on average, do not pursue a dual strategy of "organizational ambidexterity" but rather choose to scale down exploratory activities as they grow older. Divestitures are an economically important way to achieve such strategic repositioning.

We add to the existing literature in various ways. First, our study contributes to a better understanding of corporate divestitures. Previous studies focus on internal and external capital market inefficiencies as primary drivers of divestiture decisions. We propose a simple hypothesis that predicts substantial divestiture activity also by firms without ex ante investment inefficiencies. The key to our hypothesis is that the core competences of firms shift from exploring new ideas to exploiting assets in place as they mature. Second, consistent with our hypothesis, we document that divestitures are an established firm phenomenon. The age effect we uncover is economically significant and cannot be explained by alternative explanations proposed by the literature. Third, we show that the purpose of divestitures in established firms is to free up managerial capacity to dedicate to the firm's core. Fourth, we also contribute to the evidence that established firms do not change their core competences over time. They choose to sell non-core assets even if these assets are located in industries with higher growth prospects than the firm's core industry.

The paper proceeds as follows. Section 2 presents the data and the empirical strategy in more detail. Section 3 documents that divestitures are an established firm phenomenon. Section 4 shows that established firms divest assets to free management time. Section 5 shows that the propensity to divest non-core assets increases with firm age. Section 6 investigates how firms use the proceeds from divestitures. Section 7 tests alternative interpretations of the evidence. Finally, Section 8 concludes.

2. Data and empirical strategy

2.1. Sample description

We use the SDC Platinum database to extract data on asset sales. Following Warusawitharana (2008), we include all transactions classified by SDC as either "Acquisition of Assets" or "Acquisition of Certain Assets" starting in 1985. Our sample period ends in 2010. The literature applies several additional sample selection criteria, which we adopt. First, we exclude transactions where the seller and the acquirer share the same CUSIP number (Gormley and Matsa 2011). Second, we omit uncompleted transactions. Third, we require that the seller's ultimate parent is a publicly listed firm with available data on CRSP and COMPUSTAT. We match the SDC database to the COMPUSTAT/CRSP merged database using the 6-digit CUSIP of the seller's ultimate parent and the historical NCUSIP on CRSP. Moreover, we check the match by comparing company names provided in SDC and CRSP.

Our initial sample consists of all firms with available data on the COMPUSTAT/CRSP merged database as well as the COMPUSTAT segment files (excluding ADRs). As in Berger and Ofek (1995), we exclude firm-years if the sum of segment sales deviates from total firm sales by more than 1%.[2] Moreover, we require that firm-years have positive assets and positive sales. Finally, we exclude firm-years that are categorized as financial firms or regulated utilities, according to the Fama-French 48 industry classification, as well as firm-years with at least one segment in the utility (SIC 4900 – 4941) or financial (SIC 6000 – 6999) sector. These screens lead to a final sample of 70,220 firm-years, with sufficient data to compute all relevant variables. Our sample includes a total of 13,001 divestiture transactions with an average deal size of USD 62.8 million.

2.2. *Basic regression models*

To test the predictions from the MAH for divestitures, we model the divestiture of a particular asset by firm *i* in year *t* as a function of *Firm age*, our main explanatory variable, a number of control variables (X) suggested by the literature, as well as industry fixed effects (α) and year fixed effects (δ). Since divestitures presumably react to their determining factors with a lag, all regression arguments are lagged by one year throughout the analysis:

$$\text{Divestiture}_{it} = \alpha_j + \delta_t + \gamma \text{Firm age}_{it-1} + \beta X_{it-1} + \varepsilon_{ijt} \qquad (1)$$

We measure divestitures in three different ways: The first and main measure is a binary variable that identifies firm-years with at least one reported asset sale on SDC Platinum (*bDivestiture*). In this case the regression model takes the form of a logistic regression. The second measure counts the number of reported divestitures in any given firm-year (*Num Divestitures*). This model is estimated with negative binomial regressions. The third measure

[2] Any unallocated sales are proportionally allocated to the firm's individual segments (Berger and Ofek 1995; Billett and Mauer 2003). To limit bias from segment reporting changes (Berger and Hann 2003; Dittmar and Shivdasani 2003), we follow Gopalan and Xie (2011) and aggregate a firm's segment accounting data over all segments that share the same 3-digit SIC code.

reflects the relative value of the divested assets by dividing the total reported value of all asset sales during a particular year by the firm's beginning-of-year market capitalization (*RelVal Divestitures*). This model is estimated with a generalized linear model (glm) with a binomial distribution and a logit link function (Papke and Woolridge 1996). To account for serial correlation in the error term, we cluster standard errors at the firm level throughout our investigation (Petersen 2009).

Our main variable of interest is *Firm age*, measured as the natural logarithm of the number of years since listing. The MAH predicts that older firms are more likely to divest assets. We control for various variables that affect divestitures according to the literature. First, Datta et al. (2003) find that the seller's managerial performance is an important determinant of the divestiture decision. Their proxy for managerial performance is Tobin's q. Tobin's q also is a proxy for the firm's growth opportunities (Hayashi 1982). Second, the literature finds that firms are more likely to divest assets following poor firm performance (John et al. 1992) and, more recently, following negative shocks in productivity (Warusawitharana 2008; Yang 2008) or demand (Maksimovic and Phillips 2001). We include return on assets (*ROA*) as a proxy for firm performance and productivity. Third, as organizations increase in size, managerial diseconomies of scale may occur (Mueller 1969). Thus, firms may divest simply to return to optimal size (Warusawitharana 2008). Therefore, we control for firm size, measured with the natural logarithm of book value of assets. Fourth, Lang et al. (1995) argue that asset sales provide funds when alternative financing channels are too expensive due to transaction costs and information asymmetries. To control for financing needs, we include a measure of a firm's financing gap (Çolak and Whited 2007), firm leverage, as well as cash reserves. Sixth, the literature finds that divesting firms exhibit slower growth and lower investments than non-divesting firms (Çolak 2010; Schlingemann et al. 2002). Hence, we control for historical sales growth as well as capital expenditures and R&D expenditures. Seventh, firms sell assets in response to inefficient and value-reducing diversification (John and Ofek 1995). To account for this, we include a Herfindahl index of segment sales as well as the firm's excess value as measured in Berger and Ofek (1995). Eighth, the takeover literature finds that divestitures are a common post-takeover restructuring activity (Bhagat et al. 1990; Bhide 1989; Maksimovic et al. 2011). Post-merger divestitures may comply with antitrust legislation or be used to retire takeover related debt (Kaplan and Weisbach 1992). Alternatively, firms could dispose of specific assets after an acquisition because they do not fit their strategy. Consistent with this hypothesis, Maksimovic et al. (2011) find that firms sell assets within three years after a merger. In the spirit of Maksimovic et al. (2011), we include the relative value of firm acquisitions over the previous three years as a control. Finally, we add industry and year fixed effects (Warusawitharana 2008). Year fixed effects help us account for the fact that more assets are reallocated in expansion years (Maksimovic and Phillips 2001) as well as for the refocusing wave of the late 1980s (Berger and Ofek 1999). As we have already mentioned, all control variables are measured in the fiscal year prior to the divestiture. Moreover, to reduce the influence of outliers, we winsorize all continuous and unbounded variables at the 1st and 99th percentiles. Detailed variable definitions are in Table 10 at the end of the paper. In all our tables, the reported statistical significance tests are two-tailed.

2.3. Summary statistics

Table 1 reports summary statistics of the main variables between 1985 and 2010. Panel A shows the summary statistics for the measures of divestiture activity. In any given year, the unconditional probability of a divestiture is 8.3%. The mean number of assets sold is 0.124 per year and these assets account for 0.8% of the firm's market value of equity. Conditional on a divestiture, we find that the average number of transactions is 1.5 per year. In that case, the divested assets account for 9.5% of firm market value (not reported in a separate table). Panel B reports the summary statistics of the firm control variables.

3. Firm age and divestitures

We start our empirical investigation by looking into the relation between firm age and divestiture activity. The main prediction of the MAH is that older firms should be more likely to divest. The first subsection shows univariate analyses of the divestiture activity across age cohorts. The second subsection turns to multivariate regressions. The third subsection provides an additional test of the prediction that the importance of divestitures is greater in older firms. In addition, it provides additional evidence that the age effect is not a firm size effect.

3.1. Univariate analysis

Table 2 compares the sample firms' divestiture activity across four age cohorts that reflect similar numbers of observations, namely ages 1 to 4, 5 to 9, 10 to 19, and older than 19, respectively. We know from Table 1 that the unconditional probability of an asset sale is 8.3% per year. Table 2 shows that this probability increases to 17% for the oldest firms (age 20 or more) and drops to 4% for the youngest firms (age 1 to 4). Old firms are also the main seller of assets in terms of transaction value. They account for 65.8% of the cumulative transaction value whereas the youngest firms account for only 6.5%. Note, however, that the oldest firms are also considerably larger, on average, as they represent 61.4% of the cumulative market value of the sample firms. In contrast, the youngest firms represent only 9.2% of the cumulative market value. However, as shown below, the divestiture activity of the oldest firms remains disproportionally high also when we control for firm size.

Panel B focuses on divestitures of non-core assets. The MAH predicts that old firms are particularly active sellers of non-core assets. We classify a divestiture as non-core if it is conducted by a subsidiary that operates in a different Fama-French 48 industry than its ultimate parent. We observe 5,681 such non-core divestitures (44% of all divestitures). The panel shows that the overwhelming majority of all non-core divestitures are conducted by firms older than 20 years. This age cohort also accounts for 61.9% of the transactions and 76.5% of the transaction value. The transaction value exceeds the old firms' fraction in market share by a factor 1.25. Non-core divestitures by younger firms are comparatively less frequent. For example, the youngest firms, which represent 9.2% of the market capitalization, account for less than 5% of the transaction value. Therefore, divestitures indeed appear to be an older firm phenomenon, especially when it comes to non-core assets.

3.2. Multivariate analysis

Table shows that the positive age dependence of divestitures also holds in a multivariate context. In regression 1, the dependent variable is a binary variable that identifies firm-years with asset sales (*bDivestiture*). In that regression, *Firm age* is positive and highly significant. Moreover, with an odds-ratio of 1.179 (column 2), the effect of a one standard deviation change in age is among the most powerful determinants of asset divestitures. Only *Firm size* (odds ratio of 2.5) and *Financing gap* (odds ratio of 1.285) have a higher effect. *ROA*, *Focus*, and *Excess value* are approximately as important, and *Tobin's q*, *Sales growth*, and the firm's investment policy (*R&D* and *CAPEX*) are less important.

Regressions 3 and 4 measure divestitures alternatively with the number of divestitures and the relative value of divested assets and find consistent evidence. Divestiture frequency and importance increases significantly with firm age.

The coefficients of the control variables are generally consistent with previous studies on asset sales. Profitability, sales growth, growth opportunities, and excess value lower the propensity to sell assets, which is consistent with the q-theory of investments (Warusawitharana 2008). The negative coefficient of profitability is particularly interesting because it confirms that poor performance increases the probability of divestiture. We also find that focused firms sell fewer assets. In contrast, larger firms and firms with limited financial resources (*Financing gap*, *Leverage*, *Cash*) are more likely to divest. This is consistent with the belief that financially constrained firms divest more. As the results show, however, the financing constraints effect is separate from the age effect. *CAPEX* is also negatively associated with divestitures, which could be another indicator of the financing constraints motive of asset sales. Finally, and consistent with Maksimovic et al. (2011), we find that firms are more likely to divest assets in the years following firm acquisitions.

Panel B shows that the results are robust to alternative age measures. In regression 1, we allow for an inverse U-shaped relation between age and divestitures and therefore use listing age (in years) as well as its squared term. The linear effect is positive and significant whereas *Firm age-squared* takes on a negative and significant coefficient. The coefficients imply a turning point around listing age 70.[3] This corresponds to the 99th percentile of the sample distribution of age. Therefore, the marginal effect of age diminishes at old age, but it does not become negative. Regression 2 measures age with a binary variable that identifies firms older than the median firm in the same industry-year (*bOld*). Being an old firm increases the odds ratio of asset divestitures by 1.24. Finally, regression 3 uses piecewise linear age measures and confirms that divestitures are an old-firm phenomenon.[4]

[3] We use non-rounded coefficients to compute the turning point of the age-effect.

[4] Because *Sales growth* is the average growth rate over the preceding three years, the youngest firm in our regression has listing age 4. The cutoff-points we choose for the piecewise-linear regressions correspond to the first, second, and third quartile of the age distribution of all firm-years that enter the regression. The results are robust to alternative cutoff-points.

In untabulated regressions, we also use the firm's net acquisition rate as a proxy for its divestiture activity. Following Warusawitharana (2008), this variable takes a value of –1 if the transaction value of the divestitures exceeds the transaction value of the asset acquisitions in any given firm-year, a value of 1 if the transaction value of the acquired assets exceeds that of the divested assets, and a value of 0 otherwise. We find that the net acquisition rate drops as firms get older and that established firms are significantly more likely to be net sellers of assets than young firms.

3.3. Large divestitures and divestitures by large firms

Before we turn to the specific predictions of the MAH concerning divestiture motives and types of divested assets, we want to buttress the evidence that the relevance of divestitures increases with company age, and that the age effect is not a firm size effect. The results are reported in Table 4. Panel A looks at large divestitures, defined alternatively as transactions with a value higher than USD 100 million, USD 10 million, and 5% of the market value of equity. Transactions for which no value is reported are classified as small divestitures (Netter et al. 2011), though the results remain the same when we exclude these transactions. For each definition, we estimate separate regressions for small and large divestitures on the determining factors. Regardless of size definition, we find that both large and small divestitures increase with company age.

Panel B compares the divestiture behavior of small and large firms. In small firms, age is associated with a 12% increase in the odds ratio of a divestiture. In large firms, the corresponding increase in the odds ratio is 20%. While numerically larger, the effect is statistically the same. Therefore, we conclude that the positive age-dependence of divestitures does not reflect a size effect.

4. Firm age, organizational rigidities, and divestitures

The MAH predicts that established firms sell assets to free up management time that can be used to manage core competences. Consequently, established firms in which management time is a more binding constraint should be particularly active sellers of assets. The following subsections test this prediction and find supportive evidence.

4.1. Organizational complexity and divestitures in established firms

First, we investigate whether the divestiture intensity of established firms increases in the degree of organizational complexity. In complex organizations, much of management's attention is diverted to coordinating activities. Holmstrom (1989) argues that in established firms this development is rational because it serves production and marketing goals. Divestitures help firms reduce organizational complexity and lower the associated coordination costs (Rawley 2010). We therefore expect that established firms with comparatively complex organizations are more likely to divest assets. Following Miller and Friesen (1984) and Sorenson and Stuart (2000), among others, we use the firm's selling, general, and administrative expenditures (*SG&A*) as a measure of the firm's administrative rules and procedures, normalized by sales.

To find out, we add the firms' *SG&A* as well as an interaction term with firm age to the standard regression model 1 from Table 3. Regression 1 in Table 5 shows the results. In that regression, the coefficient of *SG&A* alone is statistically zero, indicating that complex structures per se do not induce divestitures. *Firm age* maintains its positive and significant coefficient. More importantly, and consistent with our predictions, however, the interaction term of the two variables takes on a significantly positive coefficient. The economic effect is quite remarkable. According to our estimates, a one standard deviation increase in *SG&A* (0.614) increases the age-effect by 0.098 (= 0.614 × 0.160) or by 39% (= 0.098 / 0.250). Therefore, we conclude that established firms with complex organizational structures significantly scale up their divestiture activities, as predicted by the MAH.

4.2. Industry environment, structural rigidities, and divestitures

Another way to test whether established firms divest assets to relax constraints on management time is to look at the firm's competitive environment. Firms that operate in innovative industries face a higher risk of obsolescence (Audretsch 1995; Reinganum 1985). To fight obsolescence, management has to dedicate more of its time to optimizing assets in place. It follows that managerial capacity is scarcer in an environment where technological change is fast-paced, which is why the divestiture activity of established firms should be particularly brisk in innovative industries.

To find out, we measure the industry's innovation intensity with the median R&D-to-assets ratio (*Industry R&D*). We identify industries at the SIC 4-digit level in any given year. The results are robust to the use of alternative classifications, including the SIC 3-digit or the Fama-French 48 industry level. In regression 2 of Table 5, we extend our standard model with the addition of the variable *Industry R&D* as well as an interaction term between *Industry R&D* and *Firm age*. The coefficient of *Industry R&D* is positive and significant, indicating that the divestiture activity per se is higher in innovative industries. This shows that industry shocks spur the reallocation of assets (Harford 2005). Most important, however, the interaction term between the two variables is positive and significant, consistent with our prediction. According to our estimates, a one standard deviation increase in *Industry R&D* increases the age-effect by 29%.[5]

By the same argument we just made, firms that operate in industries protected by entry barriers should be less threatened by obsolescence and, therefore, feel less pressure to free up management time to optimize assets in place. We would therefore expect established firms to be less active divestors if they operate in protected industries. We follow Bhattacharyya and Nain (2011) and measure supply-side entry barriers with the industry-wide ratio of total assets to total sales in a particular SIC-4digit industry (*Capital intensity*). Regression 3 of Table 5 extends the standard regression with *Capital intensity* as well as its interaction term with *Firm age*. In line with our predictions, the interaction term has a negative and significant coefficient, particularly in a one-tailed test. A one standard deviation increase in *Capital intensity* decreases the age-effect by 18%.[6] Note that *Capital Intensity* itself has no impact on the likelihood of a divestiture.

Finally, in column 4, we include both measures of industry dynamics as well as their interaction terms with firm age. The results remain qualitatively the same. Industry innovation accelerates the age effect in divestitures whereas industry entry barriers slow it down.

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[5] The standard deviation of *Industry R&D* is 0.062. Hence, the age-effect increases by 0.073 (= 0.062×1.179) or by 29% (= 0.073 / 0.249).

[6] The standard deviation of *Capital intensity* is 0.660. Hence, the age-effect decreases by 0.042 (= 0.660×-0.063) or by 18% (= 0.042 / 0.231).

5. Corporate aging and non-core assets sales

The evidence so far is that established firms step up their divestiture activities to free scarce managerial capacity. The MAH predicts that the managers of established firms dedicate that capacity to managing core competences. Consequently, we would expect that established firms are particularly likely to sell assets that are not part of the firm's core business. The univariate analysis in Table 2 has shown that such non-core divestitures are indeed an older firm phenomenon. This section first investigates the relation between firm age and non-core divestitures in a multivariate context. Then we test whether established firms sell non-core assets in industries where they have a comparative disadvantage at managing the asset.

5.1. Multivariate analysis

Panel A of Table 6 distinguishes between core and non-core divestitures based on the selling subsidiary's industry affiliation. As before, an asset divestiture is considered non-core if the selling entity is a subsidiary that operates in a different industry than its ultimate parent. We estimate separate logistic regressions for core and non-core divestitures. For reading convenience, we do not report the coefficients of the control variables.

The results are consistent with our predictions. *Firm age* significantly increases the probability of both core and non-core divestitures. The economic effect, however, is considerably stronger in the context of non-core divestitures. When we define core at the Fama-French 48 industries level, a unit standard deviation increase in *Firm age* increases the odds ratio of a core divestiture by 11% (regression 1) whereas that of a non-core divestiture increases by 25% (regression 2). The results are qualitatively the same when we identify core activities at the SIC 2-digit (regression 3 and 4) or the SIC 3-digit level (regressions 5 and 6).

Panel B shows that the results are robust to alternative definitions of core and non-core divestitures. We alternatively identify non-core divestitures as a) transactions where the acquiring firm (as opposed to the selling subsidiary) operates in a different industry than the selling firm; b) transactions that increase the strategic focus of the selling entity, as measured with a segment sales-weighted Herfindahl index; and c) transactions that are followed by a reduction in the seller's number of reported segments. Regardless of how we define non-core divestitures, they are associated with a stronger age effect than core divestitures, consistent with the MAH.

In untabulated regressions, we also estimate a probit model that addresses the potential problem of sample selection with a Heckman two-stage procedure (Heckman 1979; Miranda and Rabe-Hesketh 2006). In this procedure, we first model the decision to divest and then estimate a second-stage regression for the subsample of divesting firms to examine the choice between core and non-core divestitures. We find that established firms are more likely to sell non-core assets than core assets even after correcting for potential sample selection.

5.2. Non-core assets sales in dynamic industries

Non-core asset sales of established firms should be particularly frequent if the assets in question are located in innovative and rapidly growing industries. As the firm focuses its organization on production and marketing goals in the core industry, it is at a comparative disadvantage to explore new ideas outside that core. To remain competitive, the management would have to spend a disproportionate amount of time on managing such non-core assets. It is therefore more profitable to divest these assets.

To test this prediction, we estimate a Heckman selection model that relates divestitures in rapidly growing non-core industries to firm age with limited information maximum likelihood (LIML). The Heckman selection model enables us to investigate whether established firms divest assets in high-growth industries conditional on the decision to divest non-core assets. In the first stage, we model the decision to divest non-core assets, using *Firm acquisitions* as instrumental variable. This variable strongly predicts non-core divestitures but it does not appear to affect the choice between high- and low-growth divestitures.[7] In the second stage regression, we then investigate whether, conditional on a non-core divestiture, firms divest assets that are located in non-core industries with high growth opportunities. Because the dependent variable in that regression is dichotomous, we use a probit model specification. Table 7 shows the results.

[7] In untabulated regressions, we add *Firm acquisition* as a control variable to the outcome regression. Its coefficient is statistically zero.

Regression 1 defines core and non-core assets based on the selling subsidiary's Fama-French 48 industry code. A high-growth divestiture is assumed if the subsidiary's industry has a higher median Tobin's Q than its ultimate parent's industry has. Regression 2 replicates the analysis with industry definitions based on SIC 3-digit codes. Regardless of industry definition, we find that old firms are significantly more likely to sell non-core assets that are located in comparatively high-growth industries. The significant coefficient of *rho* indicates that without the Heckman correction there would be a sample selection problem. Therefore, firms that divest non-core assets are not a random subsample. In untabulated regressions, we replicate the analysis for non-core divestitures in industries with higher R&D-intensity than the ultimate parent's main industry. Consistent with our predictions, the evidence is that established firms are more likely to divest non-core assets that are located in R&D-intensive industries.

6. Use of proceeds from asset sales

The evidence so far is that firms divest assets to free management time to focus on exploiting core competences. The last step of the investigation asks how established firms use the divestiture proceeds. Since established firms tend to have lower Q ratios (Loderer et al. 2014), they are less likely to invest them in core activities. At the same time, they will not invest them in non-core activities, since that is what they want to avoid in the first place. We therefore expect established firms to return the money to the providers of capital. That is what we find.

Table 8 estimates a Heckman selection model that relates various post-divestiture activities to firm age. In the first stage of the model, we estimate the standard divestiture model from Table 3. The second stage then examines how, conditional on divesting, firm age is related to various corporate policies. *Firm acquisitions* is the instrument to predict divestitures in the first-stage regression. We therefore exclude this variable from the second stage. The policies we consider in the second stage are asset acquisitions in column 1, diversifying firm acquisitions in column 2, non-diversifying firm acquisitions in column 3, capital expenditures in column 4, R&D expenditures in column 5, debt repayment in column 6, and payouts to shareholders in column 7. All dependent variables are measured in the year of the divestiture. The results remain qualitatively the same if we measure the dependent variables in the years following the divestiture. In columns 1 to 3, where the dependent variables are dichotomous, we implement the Heckman probit model with LIML estimation and report the correlation between the error terms of the first-stage and second-stage regression (*rho*). In columns 4 to 7, where the dependent variables are continuous, we use Heckman's (1979) two-step procedure and report the estimated coefficient of *Inverse Mills ratio* in the second-stage regression.

The evidence is consistent with the predictions of the MAH. Old firms do not scale up their investment activities in reaction to divestitures. To the contrary, we find that their propensity to acquire assets and other firms drops significantly after a divestiture. Therefore, the finding of Kaplan and Weisbach (1992) that divestitures are used to finance subsequent acquisitions does not seem to apply to older firms. Moreover, older firms significantly reduce their R&D expenditures after divestitures. Instead, they return more money to the providers of capital. Both debt repayments and dividend payouts increase significantly after divestitures.

7. Alternative interpretations

In the last step of the investigation, we turn to potential alternative interpretations of the age effect on divestitures. First, we ask whether the effect can be explained by differences in financing constraints between young and old firms. Then we test whether the age effect is driven by the unwinding of past mergers and acquisitions.

7.1. Firm age and financing constraints

The financing constraints interpretation of the evidence can easily be dismissed. As Hadlock and Pierce (2010) show, financing constraints decline significantly with firm age. The financing constraints hypothesis would therefore predict that established firms are *less* likely to engage in asset sales than young firms are. The evidence, we saw is therefore at odds with this hypothesis.

7.2. Firm age and post-merger restructurings

The second alternative interpretation we entertain relates to the observation that divestitures are a common mechanism to unwind diversification or dispose of assets that were previously acquired in a takeover (see, among others, Maksimovic et al. 2011). According to Arikan and Stulz (2011), the acquisition rate of firms does not fall with age. Still, because they have been around for a longer time, established firms are more likely to have acquired other firms or assets in the years leading up to the divestiture we observe. Therefore, the age effect we observe could, in principle, be spurious and be caused by post-takeover restructuring activities.

Table 9 tests this alternative interpretation. In regression 1, we ask how firm and asset acquisitions during the three years preceding the divestiture year affect the age-dependence of divestiture decisions. To find out, we extend our standard regression with an interaction term between *Firm age* and *Firm acquisitions*. We also interact *Firm age* with *Asset acquisitions*. Consistent with previous studies, we find that both *Asset acquisitions* and *Firm acquisitions* accelerate the divestiture intensity, as measured by their positive and significant coefficients. Moreover, the two interaction terms with *Firm age* are statistically zero, indicating that the divestiture activity of established firms is not livelier following firm and asset acquisitions. More importantly for our purposes, *Firm age* maintains its positive and significant coefficient. The size of that coefficient is the same as in the standard regression from Table 3. Consequently, post-takeover restructurings are not responsible for the age effect we observe.

We reach similar conclusions when we limit the sample to firms without any previous acquisition activities according to SDC Platinum. Regression 2 omits all firms with at least one previous firm acquisition, and regression 3 omits all firms with at least one firm or asset acquisition. In both regressions, the coefficient of *Firm age* is positive and highly significant. Finally, regression 4 limits the attention to firms with only one reported segment on the COMPUSTAT Business Segment tapes. Also in that regression, *Firm age* is positive and significant. This confirms that past acquisitions cannot explain the positive age-divestiture relation we uncovered.

8. Conclusions

This paper asks whether divestiture decisions are consistent with the managerial attention hypothesis advanced by Loderer et al. (2014). We test whether established firms use divestitures to free up management time and increase their focus on core competences. We find strong empirical support for these predictions.

First, we show that both the probability to divest and the relative value of the divested assets increase significantly with firm age. The economic effect is considerable, as a one standard deviation increase in firm age is associated with an 18% increase in divestiture probability. Second, we show that the divestiture evidence is consistent with the prediction that established firms attempt to free scarce management time. The divestiture activity of established firms intensifies at times when managerial capacity is particularly scarce and slows down when managers feel less competitive pressure. Third, the evidence supports the proposition that established firms divest assets to increase their focus on core competences. They are the main sellers of non-core assets and they dispose of peripheral activities even if these activities are located in industries with better growth prospects than the firm's core industry. This implies that firms, on average, do not keep non-core assets as options to exit the original business. Finally, established firms do not use the divestiture proceeds to finance new growth opportunities. Instead, they return that money to the providers of capital.

According to the MAH, the managers of established firms rationally choose to dispose of assets that have a poor strategic fit with the firm's core. This hypothesis can explain why a substantial part of divestitures is conducted by financially unconstrained firms and why such divestitures do not necessarily lead to observable efficiency gains for the selling firm (Çolak and Whited 2007). The reason for the latter is that the refocusing is meant to maintain profitability, something that is consistent with no changes in post-divestiture profitability.

Our study has implications for the life cycle of listed firms. Combined with the findings in Loderer et al. (2014), the regularities that seem to crystalize are as follows. Firms list to exploit available growth opportunities. They therefore choose to focus more on their assets in place than on generating new growth opportunities. This specialization affects their organization and their incentive systems and acts as a filter for the type of employees they attract. They become very efficient at what they do but comparatively strategically and operationally inflexible. In the process, to free up valuable managerial capacity to dedicate to assets in place, they divest assets, particularly valuable non-core assets. The saying that "cobblers should stick to their last" fully applies to listed corporations as well. Eventually, they are taken over or fail (Loderer and Waelchli 2014).

Table 1: Descriptive Statistics

Table 1 shows the descriptive statistics for our variables. The data refer to firm-years between 1985 and 2010. Panel A summarizes the three measures of divestiture activity and Panel B the firm characteristics. Variable definitions are in Table 10. All firm characteristics are measured at the fiscal year ending prior to the divestiture announcement.

	Mean	Median	Std.	Min	Max	N
Panel A: Asset sales variables						
bDivestiture	0.083	0.000	0.275	0.000	1	105,018
Num divestiture	0.124	0.000	0.529	0.000	16	105,018
RelVal divestitures	0.008	0.000	0.050	0.000	0.424	104,410
Panel B: Firm characteristics						
Firm age (years)	13.44	9.000	13.61	1.000	70.00	105,406
Tobin's Q	2.104	1.468	1.885	0.552	12.32	104,759
ROA	0.069	0.115	0.245	-1.045	0.574	95,886
Assets (million)	764.2	91.64	2,259	1.472	16,463	105,401
Financing gap	0.084	-0.003	0.323	-0.418	1.778	98,095
Leverage	0.229	0.184	0.222	0.000	1.011	105,398
Cash	0.190	0.095	0.222	0.000	0.895	105,380
Sales growth	0.857	0.291	2.416	-0.852	18.55	78,327
CAPEX	0.079	0.047	0.098	0.001	0.599	94,916
R&D	0.056	0.000	0.109	0.000	0.631	99,946
Focus	0.920	1.000	0.177	0.146	1.000	105,406
Excess value	0.116	0.035	0.712	-1.386	1.386	102,582
Firm acquisitions	0.034	0.000	0.125	0.000	1.810	105,406

Table 2: Univariate analysis of asset divestitures

The table shows how the number of asset sales, the value of divested assets, and the probability of an asset sale varies with firm age. We group all firm-year observations into four age-categories of approximately equal sample size. The data refer to firms from 1985 to 2010. Panel A refers to all divestitures. Panel B looks at non-core divestitures. We identify a divestiture as core if the selling subsidiary operates in the same industry as its ultimate parent. Otherwise, we assume a non-core divestiture. We use the Fama and French 48-industry classification.

	Fraction of firm-year observations	Number of asset divestitures	Transaction value (billions)	Cohort size (market value, billions)	Size-adjusted transaction value (Value/Cohort size)	Probability of an asset divestiture
			Panel A: All divestitures			
All firm-years	100.0%	13,001	816.4	180,357.8	-	8.26%
	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution
1 to 4	28.3%	12.1%	6.5%	9.2%	0.71	4.18%
5 to 9	23.7%	15.3%	11.0%	10.4%	1.06	6.07%
10 to 19	25.5%	19.9%	16.7%	19.0%	0.88	7.23%
20 or more	22.5%	52.7%	65.8%	61.4%	1.07	16.89%
			Panel B: Non-core divestitures (using subsidiary information & FF48-industry classification)			
All firm-years	100.0%	5,681	330.5	180,357.8	-	3.86%
	Distribution	Distribution	Distribution	Distribution	Distribution	Distribution
1 to 4	28.3%	10.0%	4.9%	9.2%	0.53	1.60%
5 to 9	23.7%	11.8%	6.0%	10.4%	0.58	2.25%
10 to 19	25.5%	16.3%	12.6%	19.0%	0.66	2.81%
20 or more	22.5%	61.9%	76.5%	61.4%	1.25	9.61%

Table 3: Determinants of divestitures

Panel A of the table shows the estimation results of the main regression equation relating asset sales to firm age. In column 1, the dependent variable is a binary that identifies firm-years with asset sales (*bDivestiture*). For ease of interpretation, column 2 reports the odds-ratios for a unit standard deviation increase in the respective variable. In column 3, the dependent variable measures the number of asset divestitures in any given year. The model is implemented using a negative binomial specification. In column 4, the dependent variable is the relative value of the divested assets and the model is implemented with a fractional logit glm specification. Panel B replicates regression 1 of Panel A for alternative age measures. We use the number of years since listing and its square term in column 1, a binary variable indicating whether a firm is older than the median firm in a given industry-year in column 2, and linear spline variables of number of years since listing in column 3. Variable definitions are in Table 10. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

Panel A: Firm age and divestitures

	bDivestiture		Num Divestitures	RelVal Divestitures
	Coefficient	Odds ratio		
	(1)	(2)	(3)	(4)
Firm age	0.229***	1.179	0.196***	0.112***
	(0.029)		(0.027)	(0.041)
Tobin's Q	-0.023	0.963	-0.013	-0.599***
	(0.016)		(0.016)	(0.060)
ROA	-0.881***	0.824	-1.006***	-1.618***
	(0.131)		(0.127)	(0.166)
Firm size	0.458***	2.539	0.485***	0.141***
	(0.013)		(0.012)	(0.017)
Financing gap	0.903***	1.285	0.905***	0.823***
	(0.075)		(0.071)	(0.092)
Leverage	0.638***	1.150	0.710***	1.998***
	(0.088)		(0.083)	(0.125)
Cash	-0.760***	0.858	-0.827***	-0.434**
	(0.138)		(0.135)	(0.199)
Sales growth	-0.023**	0.946	-0.025***	-0.015
	(0.009)		(0.009)	(0.012)
CAPEX	-0.784***	0.933	-0.756***	-0.747**
	(0.256)		(0.251)	(0.378)
R&D	0.067	1.007	0.078	0.737*
	(0.266)		(0.259)	(0.382)
Focus	-1.059***	0.820	-1.011***	-1.195***
	(0.095)		(0.085)	(0.125)
Excess value	-0.309***	0.813	-0.304***	-0.401***
	(0.034)		(0.033)	(0.055)
Firm acquisitions	1.228***	1.181	1.136***	1.080***
	(0.085)		(0.074)	(0.115)
Industry fixed effects	Yes		Yes	Yes
Year fixed effects	Yes		Yes	Yes
Observations	70,220		70,228	70,224
Pseudo-R^2	0.165		0.148	
Log likelihood				-2,797.03

Panel B: Alternative age measures

	bDivestiture		
	(1)	(2)	(3)
Firm age (years)	0.020***		
	(0.004)		
Firm age-squared	-0.0001**		
	(0.0001)		
bOld		0.214***	
		(0.037)	
Firm age 1 to 6			0.023
			(0.039)
Firm age 7 to 12			0.014
			(0.012)
Firm age 13 to 21			0.018**
			(0.007)
Firm age 22 or more			0.008***
			(0.002)
Controls	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	70,220	70,220	70,220
Pseudo-R^2	0.165	0.164	0.165

Table 4: Divestitures by size

The table enquires into the relation between firm age, size, and divestitures by replicating the standard regression model from Table 3 (regression 1) for different subsamples of firms. Panel A looks at the propensity to engage in large divestitures. The size cutoffs we consider are USD 100 million, USD 10 million, and 5% of the market equity, respectively. We identify large divestitures with a binary variable that equals 1 if the cumulative value of the divested assets in a firm-year exceeds the respective size cutoff. Small divestitures refer to cumulative divestiture values below the respective size cutoff. Divestitures with missing transaction values are considered small divestitures (Netter et al. 2011). Panel B then compares the divestiture activity of small, medium-sized, and large firms. We compute the size breakpoints every year using the terciles of the industry-adjusted book value of assets (based on the Fama-French 48 industry classification). Odd-numbered columns show the regression coefficients and even-numbered columns report the corresponding odds ratios for a unit standard deviation increase in the variable. All variable definitions are in Table 10. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

Panel A: Firm age and large divestitures

	Cutoff = 100 million		Cutoff = 10 million		Cutoff = 5% of market equity	
	Small divestitu-re	Large divestitu-re	Small divestitu-re	Large divestitu-re	Small divestitu-re	Large divestitu-re
	(1)	(2)	(3)	(4)	(5)	(6)
Firm age	0.204***	0.133**	0.207***	0.176***	0.224***	0.149***
	(0.029)	(0.063)	(0.032)	(0.039)	(0.034)	(0.038)
Tobin's Q	-0.035**	0.039	-0.006	-0.054*	0.075***	-0.430***
	(0.016)	(0.049)	(0.017)	(0.031)	(0.016)	(0.047)
ROA	-0.646***	-1.774***	-0.590***	-1.037***	-0.304*	-1.664***
	(0.133)	(0.312)	(0.152)	(0.188)	(0.177)	(0.162)
Firm size	0.362***	0.929***	0.323***	0.568***	0.559***	0.195***
	(0.013)	(0.031)	(0.014)	(0.018)	(0.016)	(0.016)
Financing gap	0.882***	0.480**	0.834***	0.794***	0.798***	0.786***
	(0.075)	(0.220)	(0.086)	(0.116)	(0.105)	(0.093)
Leverage	0.568***	1.406***	0.281***	1.106***	-0.015	1.587***
	(0.089)	(0.225)	(0.099)	(0.130)	(0.108)	(0.119)
Cash	-0.728***	-0.472	-0.762***	-0.658***	-0.963***	-0.362*
	(0.137)	(0.389)	(0.154)	(0.208)	(0.172)	(0.192)
Sales growth	-0.018**	-0.042	-0.025**	-0.017	-0.024**	-0.020*
	(0.009)	(0.026)	(0.011)	(0.013)	(0.012)	(0.012)
CAPEX	-0.978***	1.028*	-1.276***	-0.005	-1.019***	-0.216
	(0.264)	(0.553)	(0.316)	(0.347)	(0.321)	(0.333)
R&D	0.085	0.235	-0.287	0.750*	0.175	0.404
	(0.272)	(0.646)	(0.301)	(0.388)	(0.325)	(0.369)
Focus	-0.862***	-1.389***	-0.778***	-1.106***	-0.784***	-1.242***
	(0.093)	(0.176)	(0.102)	(0.120)	(0.111)	(0.122)
Excess value	-0.292***	-0.251***	-0.281***	-0.288***	-0.212***	-0.366***
	(0.034)	(0.089)	(0.038)	(0.053)	(0.041)	(0.051)
Firm acquisitions	0.904***	1.509***	0.873***	1.147***	1.004***	1.173***
	(0.091)	(0.150)	(0.100)	(0.108)	(0.097)	(0.117)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	70,220	70,220	70,220	70,220	70,220	70,220
Pseudo-R^2	0.115	0.318	0.096	0.197	0.189	0.107

Panel B: Divestitures by firm size

	bDivestiture					
	Small firms		Medium firms		Large firms	
	(1)	(2)	(3)	(4)	(5)	(6)
Firm age	0.184***	1.120	0.168***	1.118	0.231***	1.196
	(0.065)		(0.051)		(0.041)	
Tobin's Q	-0.095***	0.818	-0.060	0.922	0.037	1.049
	(0.029)		(0.039)		(0.026)	
ROA	-0.831***	0.790	-1.307***	0.787	-1.291***	0.851
	(0.209)		(0.236)		(0.264)	
Firm size	0.480***	1.770	0.431***	1.594	0.535***	2.085
	(0.048)		(0.053)		(0.029)	
Financing gap	0.947***	1.437	0.999***	1.234	0.554***	1.087
	(0.113)		(0.136)		(0.148)	
Leverage	0.918***	1.227	0.729***	1.178	0.544***	1.117
	(0.171)		(0.138)		(0.141)	
Cash	-0.354	0.925	-1.196***	0.781	-0.855***	0.868
	(0.235)		(0.242)		(0.232)	
Sales growth	-0.014	0.960	-0.023	0.945	-0.026	0.950
	(0.015)		(0.017)		(0.016)	
CAPEX	-1.807***	0.847	-0.856**	0.924	-0.305	0.976
	(0.583)		(0.434)		(0.383)	
R&D	-0.513	0.936	0.084	1.008	0.664	1.051
	(0.451)		(0.502)		(0.455)	
Focus	-1.186***	0.842	-1.072***	0.831	-0.968***	0.803
	(0.232)		(0.155)		(0.128)	
Excess value	-0.319***	0.779	-0.275***	0.839	-0.300***	0.846
	(0.064)		(0.061)		(0.053)	
Firm acquisitions	1.048***	1.108	0.942***	1.126	1.382***	1.263
	(0.246)		(0.173)		(0.110)	
Industry fixed effects	Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Observations	23,686		23,184		23,350	
Pseudo-R^2	0.096		0.093		0.141	

Table 5: Firm age, managerial capacity, and divestitures

The table investigates whether established firms with scarce managerial capacity are more likely to divest assets. We estimate the standard logit regression. In regression 1, we add the firm's SG&A expenditures as well as an interaction term between *SG&A* and *Firm age*. Regression 2 augments the standard regression by *Industry R&D* and its interaction term with *Firm age*, whereas regression 3 adds the industry's *Capital intensity* along with the interaction term with *Firm age*. Finally, regression 4 combines the arguments from regressions 2 and 3. *SG&A*, *Industry R&D* and *Capital intensity* are demeaned at their pooled distribution. Variable definitions are shown in Table 10. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	bDivestiture			
	(1)	(2)	(3)	(4)
Firm age	0.250***	0.249***	0.231***	0.251***
	(0.030)	(0.029)	(0.029)	(0.029)
SG&A	0.059			
	(0.041)			
SG&A × Firm age	0.160***			
	(0.049)			
Industry R&D		1.424***		1.419***
		(0.466)		(0.468)
Industry R&D × Firm age		1.179***		1.316***
		(0.449)		(0.454)
Capital intensity			0.017	0.001
			(0.034)	(0.034)
Capital intensity × Firm age			-0.063*	-0.077**
			(0.034)	(0.034)
Controls	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	64,905	70,220	70,220	70,220
Pseudo-R^2	0.162	0.165	0.165	0.166

Table 6: Core and non-core divestitures

The table shows the estimation results of the main regression equation for core and non-core asset sales. We estimate the equation using a logit specification. In Panel A, the dependent variable is a binary variable that indicates whether a subsidiary divests assets in a given year or not. Divestitures are related to core assets in uneven columns and non-core assets in even columns. In Panel B, we use alternative measures to distinguish core and non-core divestitures. In the first model, non-core divestitures are transactions where the ultimate parent of the acquirer operates in a different SIC-3digit industry than the ultimate parent of the seller. In the second model, non-core divestitures are transactions that increase the seller's strategic focus, as measured with the segment-sales weighted Herfindahl index. In the third model, a non-core divestiture is assumed if the number of reported segments decreases after the divestiture. Variable definitions are in Table 10. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

Panel A: Non-core divestitures using subsidiary industry information

	Transaction is non-core if the selling subsidiary and its ultimate parent operate in different FF48 industries		Transaction is non-core if the selling subsidiary and its ultimate parent operate in different SIC 2-digit industries		Transaction is non-core if the selling subsidiary and its ultimate parent operate in different SIC 3-digit industries	
	Core	Non-core	Core	Non-core	Core	Non-core
	(1)	(2)	(3)	(4)	(5)	(6)
Firm age	0.143***	0.307***	0.146***	0.299***	0.113***	0.283***
	(0.035)	(0.040)	(0.035)	(0.039)	(0.038)	(0.036)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	70,220	70,220	70,220	70,220	70,220	70,220
Pseudo-R^2	0.142	0.204	0.144	0.197	0.126	0.206

Panel B: Alternative measures of core and non-core divestitures

	Transaction is non-core if the acquirer and the seller operate in different 3-digit SIC industries		Transaction is non-core if the seller's ultimate parent experiences an increase in the sales-weighted Herfindahl index after the divestiture		Transaction is non-core if the seller's ultimate parent experiences a reduction in the number of reported segments after the divestiture	
	Core	Non-core	Core	Non-core	Core	Non-core
	(1)	(2)	(3)	(4)	(5)	(6)
Firm age	0.097*	0.237***	0.086	0.207***	0.158***	0.199***
	(0.050)	(0.036)	(0.061)	(0.054)	(0.053)	(0.077)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	70,220	70,220	15,022	15,246	15,276	15,276
Pseudo-R^2	0.135	0.201	0.136	0.112	0.177	0.053

Table 7: Company age and the probability of divesting non-core, high Q assets

The table shows the results of a Heckman probit selection model that relates high Q divestitures to firm age for firms that divest non-core assets. Given that a firm divests non-core assets, we investigate the decision to sell assets with higher or lower investment opportunities than in a firm's core business. The dependent variable in the first stage regression is a binary variable that identifies firm-years with non-core asset sales using subsidiary industry information. The dependent variable in the second stage regression indicates whether the subsidiary's industry Q is higher than the ultimate parent's industry Q. We compute industry Q as the median Q of all firms with no divestiture in a given industry-year. We require at least 5 firm-year observations to compute industry Q. We use the Fama-French 48-industry classification in column 1 and the SIC 3-digit classification in column 2. Industry dummies are based on the Fama-French 48-industry classification in all specifications. Variable definitions are in Table 10. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Second stage regression	
Dependent variable	Transaction is high Q if the selling subsidiary operates in a FF48 industry with industry Q above that of its ultimate parent	Transaction is high Q if the selling subsidiary operates in an SIC 3-digit industry with industry Q above that of its ultimate parent
	(1)	(2)
Firm age	0.191***	0.229***
	(0.034)	(0.054)
Tobin's Q	-0.079***	-0.162**
	(0.029)	(0.063)
ROA	-0.279	-0.441
	(0.241)	(0.401)
Firm size	0.188***	0.151***
	(0.014)	(0.036)
Financing gap	0.118	0.057
	(0.154)	(0.212)
Leverage	0.020	-0.216
	(0.134)	(0.192)
Cash	-0.774***	-0.795***
	(0.190)	(0.287)
CAPEX	-0.352	0.535
	(0.366)	(0.677)
R&D	0.226	-0.328
	(0.398)	(0.665)
Focus	-0.418***	-0.133
	(0.094)	(0.173)
Excess value	0.063	0.021
	(0.050)	(0.089)
Rho	0.959***	0.732***
	(0.020)	(0.130)
Observations	1,458	1,263

	First stage regression	
Dependent variable	bDivestiture non-core$_t$	bDivestiture non-core$_t$
Firm age	0.162***	0.099***
	(0.026)	(0.026)
Firm acquisitions	0.322***	0.519***
	(0.074)	(0.085)
Other controls	Yes	Yes
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	59,088	58,325
Censored observations	57,630	57,062

Table 8: Post-divestiture investments

The table shows the results of the Heckman selection regression model relating various post-divestiture activities to firm age. The post-divestiture activities we consider are asset acquisition in column 1, diversifying firm acquisition in column 2, non-diversifying firm acquisition in column 3, capital expenditures in column 4, R&D expenditures in column 5, debt repayment in column 6, and payout to shareholders in column 7. In the first-stage regression we estimate the main regression equation from Table 3. Variable definitions are in Table 10. Standard errors in columns 4 – 7 are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Second stage regression						
Dependent variable	bAsset acquisition	bDiversifying firm acquisition	bNon-diversifying firm acquisition	CAPEX	R&D	Debt repayment	Payout
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Firm age	-0.110***	-0.082*	-0.104***	-0.000	-0.006***	0.005**	0.032***
	(0.028)	(0.045)	(0.031)	(0.001)	(0.001)	(0.002)	(0.003)
Tobin's Q	0.093***	0.087***	0.118***	0.004***	0.018***	-0.007***	0.008***
	(0.020)	(0.028)	(0.019)	(0.001)	(0.001)	(0.001)	(0.002)
ROA	0.595***	-0.174	0.536**	0.141***	-0.081***	-0.003	0.090***
	(0.196)	(0.367)	(0.232)	(0.008)	(0.007)	(0.012)	(0.020)
Firm size	0.026	0.078*	0.014	0.008***	-0.009***	-0.002	0.013***
	(0.023)	(0.044)	(0.031)	(0.001)	(0.001)	(0.001)	(0.002)
Financing gap	-0.537***	-1.249***	-0.618***	0.059***	0.006		-0.027**
	(0.116)	(0.305)	(0.172)	(0.005)	(0.005)		(0.012)
Leverage	-0.600***	-0.811***	-0.433***	0.004	-0.032***	0.098***	-0.032***
	(0.099)	(0.163)	(0.126)	(0.005)	(0.004)	(0.008)	(0.011)
Cash	0.085	-0.268	0.917***	-0.038***	0.150***	-0.003	-0.054***
	(0.158)	(0.280)	(0.186)	(0.008)	(0.006)	(0.012)	(0.018)
CAPEX	-0.229	-0.989*	0.264		0.054***	-0.183***	-0.130***
	(0.253)	(0.584)	(0.326)		(0.010)	(0.019)	(0.028)
R&D	-0.334	0.237	-0.661	0.048***		0.008	-0.019
	(0.320)	(0.509)	(0.416)	(0.016)		(0.024)	(0.036)
Focus	-0.076	-0.486***	0.646***	-0.006	0.026***	0.004	-0.061***
	(0.093)	(0.168)	(0.098)	(0.004)	(0.004)	(0.007)	(0.010)
Relval divest	-0.603***	0.045	-0.410*	-0.003	-0.009	0.147***	0.010
	(0.144)	(0.243)	(0.209)	(0.007)	(0.006)	(0.012)	(0.017)
Inverse Mills ratio				0.044***	-0.041***	0.008	0.023**
				(0.005)	(0.004)	(0.007)	(0.010)
Rho	-0.668***	-0.367**	-0.700***				
	(0.061)	(0.157)	(0.076)				
Observations	5,594	5,594	5,594	5,574	5,594	5,392	5,591

	First stage regression						
Dependent variable	bDivestiture$_t$	bDivestiture$_t$	bDivestiture$_t$	bDivestiture$_t$	bDivestiture$_t$	bDivestiture$_t$	bDivestiture$_t$
Firm age	0.135***	0.131***	0.132***	0.130***	0.130***	0.129***	0.130***
	(0.016)	(0.016)	(0.016)	(0.013)	(0.013)	(0.013)	(0.013)
Firm acquisitions	0.658***	0.691***	0.684***	0.682***	0.685***	0.678***	0.683***
	(0.051)	(0.051)	(0.051)	(0.049)	(0.049)	(0.049)	(0.049)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	60,351	60,351	60,351	60,331	60,351	60,149	60,348
Censored observations	54,757	54,757	54,757	54,757	54,757	54,757	54,757

Table 9: Divestitures and the impact of previous firm and asset acquisitions

The table investigates whether the main results are driven by past acquisitions. Regression 1 replicates the standard regression estimated for the full sample of firms, augmented by *Asset acquisitions* and the interaction terms *Asset acquisitions* × *Firm age* and *Firm acquisitions* × *Firm age*. Regression 2 only includes firms for which SDC Platinum reports no firm acquisitions during the years prior to the divestiture year. Regression 3 also drops firms that engaged in at least one asset acquisition in the years prior to the divestiture year. Finally, regression 4 considers the subsample of firms that only report one segment on the Compustat Segment tapes. Variable definitions are in Table 10. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	bDivestiture			
	Full sample	Subsample of firms without previous firm acquisitions	Subsample of firms without previous firm or asset acquisitions	Single-segment firms
	(1)	(2)	(3)	(4)
Firm age	0.242***	0.177***	0.171**	0.243***
	(0.031)	(0.047)	(0.075)	(0.035)
Tobin's Q	-0.014	-0.075***	-0.116**	-0.031*
	(0.016)	(0.028)	(0.049)	(0.018)
ROA	-0.878***	-0.634***	-0.476	-0.786***
	(0.131)	(0.195)	(0.316)	(0.150)
Firm size	0.460***	0.281***	0.188***	0.452***
	(0.013)	(0.021)	(0.032)	(0.016)
Financing gap	0.943***	0.968***	1.107***	0.962***
	(0.074)	(0.107)	(0.171)	(0.086)
Leverage	0.555***	0.785***	0.843***	0.756***
	(0.089)	(0.138)	(0.214)	(0.102)
Cash	-0.690***	-0.818***	-0.395	-0.637***
	(0.138)	(0.205)	(0.307)	(0.157)
Sales growth	-0.035***	-0.038**	-0.071**	-0.016
	(0.010)	(0.016)	(0.034)	(0.010)
CAPEX	-0.837***	-1.063***	-1.113*	-0.723**
	(0.255)	(0.390)	(0.649)	(0.294)
R&D	0.064	0.738*	0.399	-0.158
	(0.265)	(0.414)	(0.665)	(0.297)
Focus	-1.044***	-0.948***	-0.864***	(dropped)
	(0.094)	(0.158)	(0.240)	
Excess value	-0.316***	-0.340***	-0.384***	-0.341***
	(0.034)	(0.055)	(0.090)	(0.042)
Asset acquisitions	1.055***	1.731***	(dropped)	
	(0.103)	(0.165)		
Firm acquisitions	1.136***	(dropped)	(dropped)	1.292***
	(0.089)			(0.105)
Asset acquisitions × Firm age	-0.080			
	(0.128)			
Firm acquisitions × Firm age	0.113			
	(0.106)			
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	70,220	41,909	26,939	53,401
Pseudo-R^2	0.168	0.087	0.067	0.129

Table 10: Variable definitions

Variable	Definition
Transaction variables	
bDivestiture	Dummy variable that takes the value of one if a firm divests assets (asset acquisition and acquisition of certain assets where firm is listed as ultimate parent of the target) in a given year or zero otherwise. The data are from SDC Platinum.
Num Divestitures	A count variable that takes the value of the number of asset divestitures (asset acquisition and acquisition of certain assets where firm is listed as ultimate parent of the target) a firm conducts in a given year. The data are from SDC Platinum.
RelVal Divestitures	Total transaction value of divestitures (asset acquisition and acquisition of certain assets where firm is listed as ultimate parent of the target) normalized by beginning-of-year market value of equity (csho × prcc_f). Missing transaction values are replaced with zero. The data are from SDC Platinum and COMPUSTAT.
bAsset acquisition	Dummy variable that takes the value of one if a firm acquirers assets in a given year or zero otherwise. The data are from SDC Platinum.
Asset acquisitions	The sum of relative value of acquired assets over the previous three years. The relative value of acquired assets equals the total transaction value of asset acquisitions (asset acquisition and acquisition of certain assets where firm is listed as acquirer or ultimate parent of the acquiror) normalized by beginning-of-year market value of equity (csho × prcc_f). Missing transaction values are replaced with zero. The data are from SDC Platinum and COMPUSTAT.
bDiversifying firm acquisition	Dummy variable that takes the value of one if a firm acquirers a firm in another industry in a given year or zero otherwise. Industry definition is based on 3-digit SIC codes. The data are from SDC Platinum.
bNon-diversifying firm acquisition	Dummy variable that takes the value of one if a firm acquirers a firm in the same industry in a given year or zero otherwise. Industry definition is based on 3-digit SIC codes. The data are from SDC Platinum.
Firm acquisitions	The sum of relative value of acquired firms over the previous three years. The relative value of acquired firms equals the total transaction value of firm acquisitions (acquisition of majority interest or merger where firm is listed as acquirer or ultimate parent of the acquiror) normalized by beginning-of-year market value of equity (csho × prcc_f). Missing transaction values are replaced with zero. The data are from SDC Platinum and COMPUSTAT.
Firm characteristics	
Firm age	The natural logarithm of firm age. Age is computed as one plus the difference between the year under investigation and the firm's year of birth. The year of birth is computed as the minimum value of: (a) the first year the firm appears on the CRSP tapes; (b) the first year the firm appears on the COMPUSTAT tapes; and (c) the first year for which we find a link between the CRSP and the COMPUSTAT tapes.
bOld	A dummy that takes the value of one if a firm is older than the median firm age in a given industry-year and zero otherwise. Industry definition is based on the Fama-French 48 classification.
Firm age X to Y	Spline variable of firm age from X to Y years.
Tobin's Q	The ratio of a firm's market value of assets to the book value of assets (at). The market value of assets equals the sum market value of equity (csho × prcc_f) and the market value of debt (at – ceq – txdb). The data are from COMPUSTAT.
ROA	Firm operating profits before depreciation and amortization (oibdp) normalized by firm assets (at). The data are from COMPUSTAT.

Variable	Definition
Firm size	The natural logarithm of the firm's book value of assets (at). The data are from COMPUSTAT.
Financing gap	The ratio of a firm's financing gap to assets (at) as defined in Colak and Whited (2007). A firm's financing gap equals the difference between capital expenditures (capx) and the sum of cash flow (ni + db) and net debt issue (dltis – dltr). The data are from COMPUSTAT.
Leverage	The ratio of a firm's long-term debt (dltt + dlc) to assets (at). The data are from COMPUSTAT.
Cash	The ratio of a firm's cash reserves (che) to assets (at). The data are from COMPUSTAT.
Sales growth	Cumulative sales (sale) growth over the previous three years. The data are from COMPUSTAT.
CAPEX	Firm capital expenditures (capx) normalized by beginning-of-year assets (at). The data are from COMPUSTAT.
R&D	Firm R&D expenditures (xrd) normalized by beginning-of-year assets (at). We set missing observations to zero and include a dummy indicating missing observations. The data are from COMPUSTAT.
Focus	Focus is measured with a Herfindahl index, HI, based on the sales (sale) in the firm's different business segments: $HI = \sum_{i=1}^{N} p_i^2$, where N is the number of reported segments with distinct 3-digit SIC codes, the subscript i identifies the segments, and pi is the fraction of the firm's total sales in the segment in question. We aggregate segment sales within 3-digit SIC codes. The data are from COMPUSTAT.
Excess value	The excess value, EV, is defined as natural logarithm of the ratio of a firm's market value of assets, V, to the sum of its imputed stand-alone market values of assets, I(V): $EV = \ln\left(\frac{V}{I(V)}\right)$, where $I(V) = \sum_{i=1}^{N} S_i \times Ind\left(\frac{V}{S}\right)_i$. A segment's imputed value is computed as segment sale (sale) multiplied with the median industry market value-to-sales ratio of single-segment firms operating in the same industry. We aggregate segment sales within 3-digit SIC codes. Industry classification is based on the narrowest SIC grouping (3-digit or 2-digit) with at least five matched single-segment firms. The data are from COMPUSTAT.
Debt repayment	Net debt repayment (dltr – dltis) normalized by assets. The data are from COMPUSTAT.
Payout	The sum of dividends (dvc + dvp) normalized by firm operating profits before depreciation and amortization (oibdp). The data are from COMPUSTAT.
SG&A	Selling, general, and administrative expenses (xsga) normalized by sales (sale). The data are from COMPUSTAT.
Industry characteristics	
Industry R&D	Median R&D expenditures (xrd) normalized by beginning-of-year assets (at) of all firms operating in the same industry in a given year. Industry definition is based on the 4-digit SIC code. The data are from COMPUSTAT.
Capital intensity	Total assets (at) divided by total sales (sale) of all firms operating in the same industry in a given year. Industry definition is based on 4-digit SIC-codes (Bhattacharyya and Nain 2011). The data are from COMPUSTAT.

Paper III: Corporate aging and lobbying expenditures

Demian Berchtold*

Abstract

Creative destruction forces constantly challenge established firms, especially in competitive markets. This paper asks whether corporate lobbying is a competitive weapon of established firms to counteract the decline in rents over time. We find a statistically and economically significant positive relation between firm age and lobbying expenditures. Moreover, the documented age-effect is weaker when firms have unique products or operate in concentrated product markets. To address endogeneity, we use industry distress as an exogenous non-legislative shock to future rents and show that established firms are relatively more likely to lobby when in distress. Finally, we provide empirical evidence that corporate lobbying efforts by established firms forestall the creative destruction process. In sum, our findings suggest that corporate lobbying is a competitive weapon of established firms to retain profitability in competitive environments.

Keywords: lobbying expenditures, firm age, creative destruction

JEL codes: G38; L20

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1. Introduction

When firms go public, incentives to innovate decline. Instead, public firms focus on exploiting their existing innovations (Ferreira et al. 2012). As a consequence, initial rents from successful innovation decrease due to imitation (Schumpeter 1934). Especially in competitive markets, incumbent firms are constantly challenged by new entrants that aggressively find new ways to deplete the rents of incumbent firms (Schumpeter 1942). However, "established firms are not always on the cutting edge of new products and technology, but rather, they have a number of other competitive weapons at their disposal that allow them to fend off more innovative newcomers and to thereby forestall the process of creative destruction" (Stein 1997). Various observers argue that one of those weapons is corporate lobbying (Marris and Mueller 1980; Miller and Friesen 1984). Corporate political activity has attracted considerable attention in the literature. Various empirical studies find that corporations influence political activity through appointing politicians to their board of directors (Goldman et al. 2009), making PAC contributions (Cooper et al. 2010), or through corporate lobbying expenditures (Chen et al. 2012; Hill et al. 2013). In the United States, corporate lobbying expenditures are in dollar terms by far the largest form of political activity (Chen et al. 2012; Milyo et al. 2000). For example, General Electric spent on average more than USD 20 million per year on corporate lobbying over the last 10 years. Recent empirical studies show that lobbying expenditures have positive payoffs (Chen et al. 2012; Hill et al. 2013). Such payoffs may result from favorable legal treatment (Yu and Yu 2011), lower tax rates (Richter et al. 2009), lower compliance costs (Hochberg et al. 2009), trade protection (Lenway et al. 1996), securing government contracts (Goldman et al. 2013), or receiving stimulus funds (Adelino and Dinc 2013).

In this paper we ask whether corporate lobbying is a competitive weapon of established firms to counteract the decline in rents over time and to forestall the creative destruction process. We argue as follows. Firms go public to exploit existing opportunities. Once a firm is public, the stock market's focus on short-term profits makes long-term investments in exploring new options more costly (Asker et al. 2011). Also, Loderer et al. (2014) show that due to limited managerial attention public firms devote more efforts to managing existing assets in place. One manifestation of this process should be eventually declining profitability of assets in place in reaction to competition and therefore an increase in lobbying efforts to offset that decline. We expect established firms to benefit from lobbying in several ways. First, lobbying may be a substitute for innovation as a means to increase product demand or lower production costs (Lichtenberg 1989). Second, lobbying can be undertaken to fight off competitive threats through trade protection (Lenway et al. 1996) or entry regulation (Klapper et al. 2006). The 1970 Clean Air Act is an example of how legislation limits entry by imposing stricter air quality standards on new firms (Maloney and McCormick 1982). Finally, lobbying helps firms avoid bankrupcty (Adelino and Dinc 2013).

From a politician's standpoint, one might also argue that established firms are better candidates for legislative support. These are the firms that politicians may want to support in order to avoid large job cuts that could compromise re-election (Caballero and Hammour 1996; Figueiredo and Richter 2013). Also, these are the firms that are around in the long run (Loderer and Waelchli 2014). Thus, in return for favorable legislation, incumbent politicians may receive continuing re-election campaign contributions. This is consistent with the finding that lobbying firms are more likely to give to those in positions of power (Ansolabehere et al. 2003).

Following these arguments, we reason that corporate lobbying allows established firms to contain the decline in rents over time. This is consistent with the view that in the latter stages of the corporate life-cycle, lobbying becomes a potentially cheaper substitute for innovation (Marris and Mueller 1980). Corporate lobbying may, thus, allow established firms to forestall the creative destruction process.[8]

Our empirical analysis is based on publicly listed US firms over the period between 1998 and 2012. Starting with the year 1998, the Lobbying Disclosure Act of 1995 (LDA) requires lobbying firms to disclose semi-annual lobbying expenditures to the Secretary of the Senate's Office of Public Records (SOPR). We obtain the data from the Center of Responsive Politics (CRP), which compiles annual lobbying data at the firm-level. The data include amounts spent to lobby Congress and federal agencies through lobbying firms or in-house lobbyists. In contrast to PAC contributions which are provided to fund politicians' election campaign, corporate lobbying expenditures are meant to influence how incumbent politicians vote and shape legislation. Included are all expenditures to contact policy makers or their staff regarding federal legislation. It follows that corporate lobbying expenditures are not money transfers to politicians but rather costs incurred to hire a group of people for the purpose of

[8] The literature offers various other ways of how incumbents' may gain a competitive advantage over younger firms, such as distribution cost advantages like customer loyalty (Stein 1997) or increases in technical efficiency (Loderer et al. 2014).

influencing politicians with regard to specific federal legislation. Not included are, by definition, grassroots activities and public relations efforts where companies address the public on political issues rather than legislators themselves. We merge corporate lobbying expenditures with financial data from COMPUSTAT/CRSP database and get a final sample of 53,334 firm-year observations of 8,679 firms.

We use firm age to identify established firms and find that corporate lobbying expenditures increase with the number of years listed. Moreover, the effect is economically significant. Moving from the 25^{th} to the 75^{th} percentile of the firm age distribution increases corporate lobbying activity between 17 and 49 percent depending on how we measure lobbying. Our documented age-effect is not driven by industries with a large fraction of lobbying expenditures, top lobbying spenders, concentrated lobbying activity in smokestack industries (Hochberg et al. 2009), or agency conflicts in established firms (Aggarwal et al. 2012).

Looking across firms, we find that product market competition accentuates the increase in corporate lobbying activity as firms grow older. This is consistent with the view that creative destruction forces are stronger in competitive environments (Schumpeter 1942). In our empirical analysis, we explore the role of demand-side barriers to entry such as brand names or established reputations (Mueller 1997; Stein 1997) as well as product market concentration. We use the concept of product uniqueness to capture demand-side barriers and use selling, general, and administrative expenses (SG&A) scaled by sales as a proxy for those barriers (Frank and Goyal 2009; Titman and Wessels 1988). Our findings indicate that, holding everything else the same, established firms with unique products devote significantly less resources to corporate lobbying. Because other studies suggest that SG&A expenditures capture overhead costs or bureaucracy (Stuart and Sorenson 2003) we also employ a product market concentration measure. We use the text-based Herfindahl index provided by Hoberg and Phillips (2014). We find that the increase in corporate lobbying activity over time is lower when firms operate in concentrated product markets. We interpret these findings as showing that lobbying investments are a competitive weapon of established firms.

One limitation of our product market competition measures is that they may be endogenous. According to the literature entry barriers reflect strategic choices (see Hou and Robinson 2006 and the cited literature therein). In our context one might argue that firms unable to offset competition through lobbying alternatively invest in unique products or brand management. Thus, SG&A expenditures may be a function of a firm's lobbying power. This argument also suggests that observed concentration in a product market may be driven by political activity. Recent empirical studies use industry reductions in import tariffs as an exogenous shock to product market competition (Frésard and Valta 2013). Unfortunately, import tariffs and trade protection are legislative outcomes and, hence, likely to be endogenous to corporate lobbying activity as well (Lenway et al. 1996).

An alternative way to test our hypothesis is to look at industry distress as measured in Opler and Titman (1994). We believe that these shocks are exogenous to corporate lobbying. Empirically, we investigate whether established firms are more likely to seek government help when hit by industry distress. We find supporting empirical evidence. When being in distress, established firms spend significantly more resources on corporate lobbying than young firms. This difference in lobbying activity during distress is not driven by lower financial constraints of established firms (Hadlock and Pierce 2010). When we limit our sample to dividend-paying firms the result is even stronger. Taken together, established firms increase efforts to influence legislation when facing product market threats or economic downturns.

In the last section, we test whether established firms are successful in their lobbying efforts to forestall the creative destruction process. We use industry-wide turnover rates in the top quintile of the distribution of market value of equity, operating income, and sales (Chun et al. 2008; Comin and Philippon 2006). The regression results reveal that established firms' lobbying activity significantly reduces the turnover rate of incumbent firms within an industry. Our empirical evidence, thus, coincides with the hypothesis that lobbying activity is a competitive weapon of established firms to retain their profitability in a competitive environment and to forestall the creative destruction process.

Our study identifies an economically important determinant of corporate lobbying expenditures. As Hart (2001) points out, the literature has focused on industry determinants of political activity and, thus, we still know little why firms choose to lobby and to what extent. One of the few studies to do so is Hill et al. (2013). The authors show that firms with greater payoffs from lobbying spend more on corporate lobbying and that such expenditures increase shareholder value. Bombardini (2008) argues that large firms are more likely to lobby. We add to that literature by empirically highlighting lobbying motives related to the creative destruction process (Marris and Mueller 1980). However, we are not the first to do so. In their longitudinal study of 36 corporations, Miller and Friesen (1984) show that lobbying activity is prevalent in the latter stages of the corporate life-cycle when firms focus on efficiency rather than novelty. We extend their empirical finding to a large and broad sample of US firms. More importantly, we relate established firms' lobbying efforts to competitive threats and show that these efforts forestall the creative destruction process. Linking corporate lobbying to creative destruction might also help understand why few firms lobby (Ansolabehere et al. 2003). In political equilibrium one would expect each firm to choose their lobbying effort depending on other firms' lobbying choice and the policy makers' objective function (Grossman and Helpman 1992). Because large job cuts may worsen politicians' re-election probability established firms should be more successful in lobbying for policies that will protect them from creative destruction forces (Caballero and Hammour 1996). Young firms should have lower chances in shaping legislation to their needs and, thus, may efficiently decide not to lobby in the first place. Such a view is supported by the study of Adelino and Dinc (2013) who provide evidence that distressed firms during the financial crises lobbied more than healthier firms and were more likely to receive stimulus funds.

Our study is also related to the strand of literature examining obstacles to the creative destruction process. According to Stein (1997) established firms have various competitive weapons at their disposal, one of them being customer retention. Alternatively, established firms may gain a competitive advantage through superior technical efficiency (Loderer et al. 2014). We contribute to this strand of literature by showing that corporate lobbying is another way for established firms to fend off more innovative younger firms. Using US data, Lenway et al. (1996) find similar results for the steel industry. We add to their study by showing in a much broader sample that lobbying seems to protect established firms from creative destruction forces. Other related studies examine the so-called losers' paradox describing the stylized fact that government trade policy often aims at protecting declining industries (Baldwin and Robert-Nicoud 2007). Various explanations have been put forward. Closest to our paper is Krueger's (1990) "identity bias" implying that politicians prefer to use subsidies to save jobs in a declining industry rather than to create new jobs in an expanding industry (Baldwin and Robert-Nicoud 2007). This is consistent with our view that policy makers may have a preference to support established firms.

Another strand of literature argues that industrial incumbents may lobby against financial development because better access to finance breeds competition (Perotti and Volpin 2004;

Rajan and Zingales 2003). We contribute by showing that in the US, where financial markets are developed and new entrants get financed, industrial incumbents may lobby to restore depleted profitability. An example is large and mature US corporations' push for job-creation tax breaks (Yang 2011).

Finally, we help understand how firms age. Various observers argue that listed firms rationally focus on exploiting available investment opportunities (Ferreira et al. 2012; Holmstrom 1989; Loderer et al. 2014). As a consequence, listed firms lose the ability to explore new opportunities as they grow older and, thus, reduce capital expenditures, spend less on R&D, and payout more cash (Loderer et al. 2014). Our study suggests that corporate lobbying is an effective competitive weapon for established firms to fend off younger and more innovative firms. In the context of declining investment and R&D, our results imply that established firms shift from productive activities to rent-seeking activities. This shift to lobbying might also help explain why established firms are less likely to fail and being taken over (Loderer and Waelchli 2014).

The rest of the paper is organized as follows. In the next section, we describe the data sample. In section 3, we outline the empirical regression model and provide sample statistics of our key dependent and control variables. The empirical results are covered in section 4, 5, and 6. In section 7, we conclude.

2. Data sample

We obtain data on lobbying expenditures from the Center of Responsive Politics (CRP). CRP compiles lobbying data using the lobbying disclosure reports that firms have to file since 1998 with the Secretary of the Senate's Office of Public Records (SOPR). Lobbying firms are required by the Lobbying Disclosure Act of 1995 (LDA) to report all expenditures that are spent in order to contact legislative staff (i.e., members of Congress, their staffs, and committee staffs) or high-level executive branch officials (i.e., president and white house staff) regarding formulation, modification, and adoption of legislation. Thus, lobbying expenditures are not money transfers to politicians but rather incurred costs to transfer information to politicians. For example, a firm may hire a lobbyist to meet with politicians to discuss their position on a new legislation. The LDA requires firms to report semi-annual lobbying expenditures that are rounded to the nearest USD 20,000. Following this rule firms that spend less than USD 10,000 on lobbying activities within a six-month period do not have to report their lobbying expenditures. The semi-annual lobbying expenditures are summed up to an annual figure by CRP. More importantly, lobbying expenditures by various entities of the same parent firm are combined to reflect total annual expenditures.[9] We match the CRP database to the COMPUSTAT/CRSP merged database using historical company names. Specifically, we use a firm name matching algorithm and manually check all the matches.

We start with all US public firms with available data on COMPUSTAT/CRSP and COMPUSTAT segment file between 1998 and 2012. Using business segment data in a panel is a problem because since the introduction of SFAS 131 in June 1997 firms report business segments following a management approach (Berger and Hann 2003). The management approach requires firms to report business segment in according to the internal organization. Thus, internal reorganizations lead to segment reporting changes over time even if a firm's business remains unaffected. We address this problem by aggregating our required segment accounting data of reported business and operating segments within a firm that share the same 3-digit SIC code into a single segment (Gopalan and Xie 2011). Thereby, we are able to more consistently measure our variables that are based on segment data. After the aggregation procedure, we cross-validate the COMPUSTAT segment file with the COMPUSTAT industrial file and exclude firm-years where firm sales and total segment sales deviate by more than 1 percent (Berger and Ofek 1995). For firm-years that meet the above criteria, we proportionally allocate any unallocated sales to each of its segments (Berger and Ofek 1995; Billett and Mauer 2003). For example, if firm sales exceed the sum of segment sales by 0.5 percent we increase each segment sales by 0.5 percent.

Following the empirical literature, we exclude ADRs and firms operating in regulated industries such as utilities and financial firms (Fama and French (1997) industry category 31 and 44 – 47 based on the 48-industry classification) (Hill et al. 2013). Finally, we exclude firm-years with negative assets or sales. Our final data sample consists of 53,334 firm-year observations of 8,679 firms.

[9] Further information on the CRP data methodology can be found on their website (http://www.opensecrets.org/lobby/methodology.php).

3. Empirical method and summary statistics

3.1. Regression model

We investigate the explanatory power of our hypothesis by regressing lobbying activity (Lobby) of firm *i* in industry *j* at time *t* on our main explanatory variable firm age (Age), industry fixed effects (α), year fixed effects (δ), and various control variables (X) that are measured in the previous fiscal year.

$$\text{Lobby}_{ijt} = \alpha_j + \delta_t + \gamma \text{Age}_{it-1} + \beta X_{it-1} + \varepsilon_{ijt} \quad (1)$$

In our main model specification we use the ratio of lobbying expenditures to assets reported by firm *i* in industry *j* and year *t* as dependent variable. We also use two alternative lobbying expenditure measures as dependent variables, namely the ratio of lobbying expenditures to sales and the natural logarithm of one plus the annual inflation-adjusted lobbying expenditures.[10] Finally, we estimate the regression equation (1) with a binary dependent variable indicating whether the firm *i* reports lobbying expenditures in year *t* or not. The binary response model helps to understand the decision to lobby or not. In that case we estimate the regression equation using a Logit specification. In the former three cases where the dependent variable is a corner solution response we estimate the equation using a Tobit specification (Woolridge 2002).[11]

The coefficient of interest is γ, the change in lobbying activity with respect to firm age. We measure firm age as the natural logarithm of one plus the number of years listed (Loderer et al. 2014). We control for various factors that are motivated by Hill et al. (2013). First, theoretical arguments suggest that larger firms are more likely to lobby. According to the corporate lobbying literature high up-front costs[12] to enter the lobbying process favor large firms that may spread those costs over a larger asset base (Kerr et al. 2011; Masters and Keim 1985). Also, larger firms have higher political visibility thereby increasing potential gains

[10] We deflate our variables to real values using the consumer price index (CPI) with 2001 as the base year.

[11] Interestingly, Sigelman and Zeng (1999) criticize the use of Tobit models in the case of corner solution responses. The authors argue that a Tobit model is inappropriate if zero lobbying expenditure occur not because of data censoring but because firms decide not to engage in corporate lobbying. We follow Wooldridge (2002) and use a Tobit model but address the critique of Sigelman and Zeng (1999) in the robustness section.

[12] Kerr et al. (2011) mention various costs such as learning the laws about lobbying, selecting and hiring corporate lobbyists, and investigating how to put lobbying expenditures to the best use.

from corporate lobbying (Agrawal and Knoeber 2001). Finally, to the extent that legislation affects variable costs lobbying incentives increase with firm size (Hill et al. 2013). Following these arguments we include the natural logarithm of inflation-adjusted book value of assets as a proxy for firm size. Second, the empirical literature shows that investment opportunities are positively related to lobbying expenses (Hill et al. 2013; Yu and Yu 2011). In their spirit we include Tobin's Q as additional control variable. Third, corporate lobbying spending is likely to be a function of available resources. We follow Cooper et al. (2010) and include annual cash flow as proxy for available resources and profitability. Fourth, Taylor (1997) argues that the political and regulatory environment may lag behind technological innovation. As a consequence, innovative firms may find it beneficial to lobby in order to permit the introduction of the new technology. Moreover, innovative firms might engage in lobbying to prevent other firms from depleting the rents of their innovations. In line with this argument Taylor (1997) finds that R&D expenditures and PAC contributions are complementary investments. To account for their empirical finding we include annual R&D expenditures scaled by sales in our regression model. Fifth, more highly levered firms may have less leeway to direct corporate resources towards policy-makers (Taylor 1997). Empirical evidence thereof is provided by Cooper et al. (2010) who study corporate PAC contributions. Hence, we account for financial leverage. Sixth, a Herfindahl index of business segment sales is included as a measure of corporate diversification. Diversified firms are expected to have more political interests and, hence, contribute more to corporate lobbying (Grier et al. 1994; Zardkoohi 1985). Seventh, according to the literature industry concentration should affect a firm's political behavior. The theoretical argument is as follows. Political favors, such as restraining trade, are public goods that affect all firms operating in an industry. On the one hand, gains from political investment should decline with the number of industry participants because they are spread across all firms (Pittman 1976). On the other hand, firms in concentrated industries should find it easier and less costly to collude with each other in seeking common political favors (Zardkoohi 1985). The inclusion of a Herfindahl index of industry sales captures this hypothesized relation. Eight, we follow Hill et al. (2013) and account for the location of a firm's headquarters. Specifically, their empirical analysis shows that a firm's decision to lobby is negatively affected by the number of electoral votes in its state of location as well as by the distance between its headquarter and the capital building in its state of location. The authors argue as follows. The number of electoral votes equals the number of representatives and senators the state has in Congress. The greater the number of politicians that represent a firm in Washington the lesser is the need to lobby Congress.

Moreover, representatives and senators often have offices in Washington as well as in the state capitol building. Proximity to the capital building may, thus, reduce fixed costs to lobby Congress. We measure the variables accordingly and include the natural logarithm of one plus the number of electoral votes in a firm's state of location as well as the natural logarithm of one plus the distance in miles between the firm's headquarter and the state capitol building. Detailed variable definitions are in Table 10. All control variables are measured in the year prior to the lobbying decision (Cooper et al. 2010). Ninth, by including industry and year fixed effects we consider that the benefits of lobbying depend on industry characteristics such as regulatory oversight or degree of government purchases (Zardkoohi 1985) and that lobbying activities significantly increase over time (Hill et al. 2013; Yu and Yu 2011). We use the Fama and French (1997) 48-industry classification (Cooper et al. 2010). All continuous and unbounded variables are winsorized at the 1-percent level of the full sample. Also, we cluster standard errors at the firm level (Petersen 2009) because the corporate lobbying decision is highly persistent over time (Kerr et al. 2011).

3.2. Summary statistics

Summary statistics of our variables are shown in Table 1. Panel A displays the descriptive statistics of the various corporate lobbying variables unconditional on lobbying. The propensity to lobby equals 15.05 percent. Mean annual lobbying expenditures in 2001 dollar values equal USD 59,200. In unreported results we find that both the propensity to lobby as well as annual lobbying expenditure increase over our sample period. Panel B shows the summary statistics of the various lobbying expenditure variables conditional on lobbying. Annual lobbying expenditures in 2001 dollar values on average equal USD 393,400 and range between USD 39,000 and USD 1.933 million. Note that some firms have higher annual lobbying expenditure such as General Electric with USD 15.43 million in 2001. However, in Table 1 we display winsorized variables. The ratio of lobbying expenditure to assets or sales suggests that lobbying expenditures are rather small investments relative to other expenditures such as R&D. On average, a lobbying firm spends 0.04 percent of assets or 0.07 percent of sales on corporate lobbying. Although these figures seem trivial, they are not from the politicians' perspective. Because lobbyists are mainly paid to meet with politicians to discuss legislative issues, higher lobbying expenditures imply that politicians will spend more time in private meetings.[13] Given politicians' limited available time, total corporate lobbying expenditures should have an upper bound. Moreover, it is important to keep in mind that lobbying is an unproductive activity in the sense that no products or services are produced (Bhagwati 1982). Following these arguments, it is difficult to compare the amount spent on lobbying with other corporate investments. Panel C shows the summary statistics of our control variables that enter our main regression model.

We further gauge differences in mean and median firm characteristics of lobbying and non-lobbying firms. The results are in Table 2. Lobbying firms are older and larger, have higher growth opportunities and cash flows, are more levered and less focused, operate in more concentrated industries, and are located in states with lower number of Electoral College votes and closer to the state capitol building. Differences in R&D expenditures are not conclusive. The average lobbying firm has lower R&D expenditures but we find no statistically significant difference for the median lobbying firm. Overall, the differences between lobbying and non-lobbying firms seem largely consistent with theoretical predictions from the literature.

4. Firm age and corporate lobbying expenditures

4.1. Univariate analysis

As a first test of how lobbying expenditures vary with firm age we conduct a univariate analysis. Specifically, we divide our sample firm-years in four age-cohorts of similar sample size. For each age cohort, we show aggregate lobbying expenditures in million USD, percent of total lobbying expenditures, the mean ratio of lobbying expenditures to assets (multiplied by 1,000), and the propensity to lobby. The results are shown in Table 3. Unconditionally, it seems that the bulk of lobbying expenditures accrue from firms in the oldest age-cohort. Of total lobbying expenditures in our sample 4.3 percent fall within the age-cohort of 1 to 4 years, 10.5 percent within the age-cohort of 5 to 10 years, 16.3 percent within the age-cohort of 11 to 19 years, and 68.9 percent within the age-cohort of 20 years and older. However, these numbers do not account for a size-effect. When we look at the size-adjusted ratio of lobbying expenditures to assets we get a slightly attenuated picture. On average, firms in the

[13] Alternatively, lobbying expenditures could rise due to higher wages of lobbyists or because lobbyists' required preparation effort for meeting with politicians increases.

youngest age-cohort (1 to 4 years) invest 0.0047 percent of assets and firms in the oldest age-cohort (20 and more years) invest 0.0055 percent of assets in corporate lobbying.[14] The propensity to engage in corporate lobbying increases gradually over all age-cohorts ranging from 7.7 percent in the youngest age-cohort to 25.4 percent in the oldest age-cohort. Overall, the univariate analysis shows that lobbying expenditures as well as the propensity to engage in lobbying increases with the number of years listed.

4.2. Regression analysis

The empirical results of estimating our main regression equation relating lobbying activity to firm age are shown in Table 4 Panel A. The dependent variables are denoted in the first row. We use the ratio of lobbying expenditures to assets in column (1), the ratio of lobbying expenditures to sales in column (2), the natural logarithm of inflation-adjusted lobbying expenditures plus one in column (3), and a binary variable indicating whether a firm lobbies in a given year or not in column (4). In support of our hypothesis we find that the estimated coefficient on *Firm age* is positive and highly significant in all four columns suggesting that lobbying expenditures as well as the propensity to lobby increase as firms grow older. Before we discuss the economic importance of firm age as a determinant of lobbying we briefly discuss the estimated coefficients of our control variables. First, consistent with the literature we find that firm size is positively related to lobbying expenditures (see Hill et al. 2013 and the cited literature therein). Second, the estimated coefficient on *Tobin's Q* suggests that firms with higher growth opportunities lobby more. This is in line with Hill et al. (2013) who argue that firms in growth industries have higher incentives to lobby for favorable legislation. Third, our findings seem to suggest that higher cash flow reduces incentives to lobby. Reverse causality is unlikely to explain this result since lobbying expenditures are relatively small compared to available cash flows. Our finding is consistent with the empirical literature showing that higher cash flow reduces the likelihood to lobby (Hill et al. 2013) and to contribute to political action committees (PAC) (Cooper et al. 2010). Cash flow can also be viewed as a performance measure. In that sense, the relation may be interpreted as that poorly performing firms lobby for favorable policies to improve subsequent performance. Fourth, the estimated coefficient on *R&D* is only statistically significant in columns (3) and (4). If

[14] Note that the numbers in Table 3 are multiplied by 1,000.

anything, lobbying expenditures seem negatively affected by R&D expenditures suggesting that R&D and corporate lobbying are substitutes rather than complements. However, according to the literature the relation between innovation and lobbying depends on the industry a firm is operating in. For example, Taylor (1997) finds that the relation between R&D and lobbying is positive in "high-tech" industries but negative in "low-tech" industries. He reasons that firms in the computer and medical industry may lobby to permit the introduction of a new technology or to restrict other firms' access to the new technology. In "low-tech" industries, however, political activity seems to be a substitute for innovative capability. For the US steel industry, Lenway et al. (1996) find that older and less innovative firms were more likely to lobby for trade protection. Moreover, when trade protection was put in place firms with high past R&D expenditures were more likely to exit the steel industry. Given these considerations it is not surprising that the relation between R&D and lobbying expenditures is statistically weak across industries. Fifth, we find that highly levered firms lobby less. This is consistent with Hill et al. (2013) but in contrast to the empirical literature on campaign contributions showing that more levered firms are more likely to have a corporate PAC (Cooper et al. 2010). Moreover, the study of Faccio et al. (2006) suggests that debtholders may benefit from PAC contribution because they seem to increase the chances of a corporate bailout. An important difference between campaign contributions and lobbying expenditures is that PAC contributions are raised voluntarily from managers as well as employees and do not come from corporate treasury (Zardkoohi 1985).[15] Because of this discrepancy debtholders may favor political activity in the form of campaign contributions that are essentially costless to them. Sixth, our results show that *Focus* is negatively related to lobbying expenditures. This is in line with theoretical considerations and the empirical literature (Cooper et al. 2010; Taylor 1997; Zardkoohi 1985). Seventh, we find that firms in more concentrated industries are more likely to lobby. However, statistical significance varies from column to column and, thus, seems to depend on how we measure corporate lobbying activity. Finally, the number of electoral votes in a firm's state of location and the distance to the state capitol building are negatively related to lobbying activity. Statistical significance is rather low though. These results are similar to what Hill et al. (2013) get. Overall, our regression results on corporate lobbying activity seem largely consistent with the literature. More importantly, accounting for various confounding effects we find that corporate lobbying becomes more important as firms grow older.

[15] Note that corporate funds can be used to establish or operate a corporate PAC but not to support a candidate's election campaign.

In Panel B of Table 4 we gauge economic significance. Using the regression results from Panel A we predict corporate lobbying activity at the mean of all control variables and at different percentiles of the sample firm age distribution. We do so for all firms to get an understanding of how lobbying activity varies over time regardless of being politically active or not. Specifically, we compute the so-called unconditional expected value, i.e. E(y|x).[16] Moving from the 25^{th} to the 75^{th} percentile of the firm age distribution increases lobbying expenditures normalized by assets from 0.036 to 0.044 or by 22 percent, lobbying expenditures normalized by sales from 0.070 to 0.082 or by 17 percent, inflation-adjusted lobbying expenditures from USD 8,983 to 13,378 or by 49 percent, and the propensity to engage in corporate lobbying from 0.067 to 0.087 or by 30 percent. These are large increases in lobbying activity over time. We conclude that the change in corporate lobbying activity with respect to firm age is economically important.

4.3. Robustness

We conduct various robustness tests using the ratio of corporate lobbying expenditures to assets instead of a binary variable as dependent variable. The choice is mainly motivated by our interest in the degree of lobbying activity rather than just the propensity to lobby. The results are shown in Table 5. First, we follow Hill et al. (2013) and exclude the top five lobbying industries as measured by the fraction of aggregated lobbying expenditures in column (1) or firm-year observations with large lobbying expenditures (above USD 1 million) in column (2). The estimated coefficient on *Firm age* remains positive and statistically significant in either case. Also, the age-effect is similar in magnitude if we exclude top lobbying industries or firms.

Second, Hochberg et al. (2009) find that lobbying against Sarbanes-Oxley Act (SOX) is most likely for firms operating in mature industries with low forecasted earnings. They interpret the finding as that firms with free cash flow problems as described in Jensen (1986), i.e., firms with high profitability, low growth opportunities, and poor governance, are more likely to lobby with the aim of expropriating shareholders. In column (3) we control for concentrated lobbying activity in mature industries by adding average firm age in a given

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[16] Alternatively, we could compute predicted lobbying expenditures given that lobbying expenditures are positive, i.e., E(y|y>0, x) or the so-called conditional expectation.

industry-year to our control variables. Our results are robust to the inclusion of *Industry age*. However, according to Hochberg et al. (2009) it might still be that we capture a governance-effect especially because more dispersed ownership in established firms (Holderness 2009) may allow those managers to use excess free cash flows to lobby for personal rather than firm-specific interests (Aggarwal et al. 2012). So far, our analysis assumes that the increase in lobbying with respect to firm age is driven by an increase in firm-specific lobbying. An alternative interpretation is that managers of established firms are more likely to lobby for personal interests. For example, a manager valuing the environment may lobby excessively for anti-pollution bills. Since we do not observe whether lobbying efforts are related to firm-specific interests, we account for such an explanation by including institutional ownership and its interaction with firm age to our regression model. Because concentrated institutional holdings seem to matter more for monitoring (Chen et al. 2007), we use institutional ownership concentration as proxy for a firm's level of monitoring. The results in column (4) reveal that firms with more concentrated institutional holdings lobby less. The negative estimated coefficient of the interaction term *Institutional ownership* × *Firm age* further suggests that established firms with concentrated institutional holdings lobby less. This is consistent with the view that managers of established firms are inclined to lobby in excess of what is optimal to shareholders. More importantly however, we continue to find a positive and statistically significant age-effect which is unrelated to institutional ownership concentration and similar in magnitude if we do not account for institutional ownership. We conclude that our documented age-effect cannot entirely be explained by self-interested managers' lobbying behavior in established firms with excess free cash flow problems.

Third, Sigelman and Zeng (1999) imply that using a Tobit model to study lobbying expenditures is not be appropriate if the zero values are not due to censoring but due to the corporate's decision to not engage in corporate lobbying. In that case the authors argue that it might be more suitable to model the decision to lobby. Building on that argument we assume that a corporation first decides on whether it engages in corporate lobbying in a given year and then, conditional on doing so decides on how much to spend. The empirical approach is to estimate a two-step Heckman (1979) model. Other studies have used the Heckman model to examine the amount of PAC contributions (Grier et al. 1994; Lichtenberg 1989). In the first-stage regression we simulate the decision to lobby in a given year. We therefore regress the binary variable *bLobby* on our set of control variables from Table 4. In the second-stage regression we relate the amount of corporate lobbying expenditures to *Firm age*, *Firm size*, *Tobin's Q*, *Cash flow*, *R&D*, *Leverage*, *Focus*, *Industry concentration* and the *Inverse Mills Ratio*. Note that we drop the variables *Votes* and *Distance*, since we use these variables as instruments in the first-stage regression (Hill et al. 2013).[17] The regression results of the second-stage regression are shown in column (5). We have 6,159 firm-year observations that enter the second-stage regression. First of all, the estimated coefficient on the *Inverse Mills Ratio* is not statistically significant suggesting that there is no sample selection bias. Moreover, *Firm age* is positively related to corporate lobbying expenditures in the second-stage regression. We conclude that conditional on being an active lobbying firm established firms spend larger amounts on corporate lobbying. We have to be careful with the interpretation of the coefficient because *Firm age* enters the selection model as well. Thus, a change in *Firm age* will also affect the propensity of a firm to engage in lobbying and, thus, the *Inverse Mills ratio* in the second-stage regression. Due to the overall robustness of our empirical result we conclude that young and established firms differ in their corporate lobbying behavior and that this difference is economically important.

5. Corporate lobbying and the competitive environment

So far, we have established that corporate lobbying expenditures increase as firms grow older. In this section we aim to shed more light on why established firms are more inclined to lobby the government. We advocate that established firms use corporate lobbying as a competitive weapon to slow down the depletion of rents by young and innovative firms.

5.1. Product market threat

Product market competition is likely to accentuate the decline in rents from initial innovation due to imitation (Schumpeter 1934). So, given that established firms lobby to retain rents we would expect higher political activity in established firms when product market competition is high. We use two different measures to capture product market competition at the firm-level. The first measure we employ is product uniqueness and captures demand-sided barriers to

[17] We conduct a 2SLS regression to check the validity of our instruments. The F-value of the excluded instruments equals 6, which is below the often suggested critical value of 10. Hence, our instruments are rather weak.

entry such as brand name (Mueller 1997; Stein 1997). Looking across established firms, we would expect those with unique products to engage in less lobbying because their rents are at lower risk. We follow the literature and use SG&A expenditures as a proxy for product uniqueness (Frank and Goyal 2009; Titman and Wessels 1988). To account for time-varying industry differences in SG&A expenditures we construct a binary variable *bUnique* that equals one if a firm's SG&A expenditures are in the top tercile of its industry-year distribution and zero otherwise. A drawback of this measure is that entry barriers may reflect strategic choices by firms (see Hou and Robinson 2006 and the cited literature therein). Using measures of entry barriers may, thus, introduce potential endogeneity with political activity. Moreover, other studies relate high SG&A expenditures to high overhead costs or bureaucracy (e.g. Stuart and Sorenson 2003) rather than unique products. Our second measure is a consequence of entry barriers and focuses on the number of firms that compete in the same product market. Specifically, we employ a Herfindahl index using text-based network industry classifications which is provided by Hoberg and Philips (2014).

To empirically test whether the increase in corporate lobbying expenditures over time is related to product market competition we re-estimate our main regression model with an additional interaction term between *Firm age* and one of the two competition measures. The dependent variable is either *Lobby-to-assets*, *LnLobby*, or *bLobby*. The results are shown in Table 6. For brevity we only report the estimated coefficients of *Firm age*, the respective competition variable, and the interaction variable. In column (1) to (3) we display the empirical results using the product uniqueness approach. The estimated coefficient on the interaction term *Firm age* × *bUnique* is negative and highly significant in all three columns. Moreover, the magnitude of the estimated coefficient on the interaction term in column (1) suggests that for firms with unique products the age-effect is about 62 percent lower relative to other firms operating in the same industry.[18] The economic magnitude is similar in columns (2) and (3). The estimated coefficient on product uniqueness itself is positive and statistically significant suggesting that, on average, firms with unique products lobby more. According to Titman (1984) firms with unique products lose customers when failure probability is high. Following that argument, high bankruptcy costs may induce firms with unique products to lobby more. Nevertheless, the increase in lobbying activity over time is lower for firms with unique products. Thus, we interpret our evidence as that firms with less imitable products do not need government to help slow the decline in rents related to

[18] -0.058 / 0.093 = -0.62.

competitor imitation. In column (4) to (6) we show the regression results when *Firm age* is interacted with the product market concentration variable *HHI*. Note that a concentrated product market with a low competitive pressure translates into a high value for *HHI*. First, we find that firms operating in more concentrated product markets, on average, spend more on corporate lobbying. This is consistent with the literature arguing that lobbying activity has public goods characteristics as the outcome may affect all firms in a product market (Pittman 1976). Firms operating in more concentrated product markets are more likely to lobby for industry-wide legislation such as import tariffs because the lobbying gains per dollar spent are higher (Pittman 1976) and it is less costly to collude lobbying efforts (Zardkoohi 1985).[19] Second and more importantly, the regression results show that the rise in corporate lobbying expenditures over time is lower in more concentrated industries. Looking at the regression results in column (4), a one-standard deviation increase in *HHI* (0.23) reduces the age-effect on corporate lobbying by 56 percent.[20] These results suggest that established firms' attempt to influence legislation depends on how strong product market threats are. Established firms facing high product market threats spend significantly more on corporate lobbying. Overall, our empirical results are consistent with the idea that firms invest in corporate lobbying to counteract creative destruction forces.

An alternative interpretation of our results is that corporate lobbying expenditures impact the competitive environment as firms grow older. Firms with high corporate lobbying expenditures may be successful in putting protective legislation in place, thereby, leading to lower entry rates of competitors over time and lessening the need to invest in selling, general, and administrative expenses. In other words, our competitive measures may be endogenous to political activity. A related issue is that an omitted variable may impact product market competition as well as corporate lobbying expenditures. For example, high policy risk, i.e., uncertainty about future legislation, may deter firms from entering a business and increase incumbents' lobbying activity (Bradley et al. 2013). To address endogeneity we require an exogenous shock to a firm's competitive environment. A common approach in the literature is to use industry-specific reductions in import tariffs (Frésard and Valta 2013; Guadalupe and Wulf 2010). This approach is problematic in our setting because import tariff reductions are a

[19] Note that *Industry concentration* in our main regression model in Table 4 is not statistically significant. It seems that the variable provided by Hoberg and Philipps (2014) is a less noisy measure of industry concentration. Due to multicollinearity issues we drop the variable *Industry concentration* in unreported analysis and find that the regression results remain the same.

[20] $(0.23\times-0.164) / 0.067 = -0.56$.

legislative outcome and, thus, likely to be endogenous to corporate lobbying expenditures (Lenway et al. 1996). Moreover, such a change in legislation is likely to impact future lobbying activity beyond discontinuing lobbying expenditures related to the legislation put in place. For those reasons, competitive shocks using changes in legislation may introduce potential endogeneity with corporate lobbying.

5.2. Industry distress

As an additional test of our hypothesis, we therefore look at industry distress. Industry distress is an economic shock to future rents caused by a decline in revenues or increase in production costs. Such an economic shock due to a change in the market is more likely to be exogenous to lobbying activity. Moreover, we reason that industry distress decreases incumbents' future rents and increases the probability of liquidation. This induces managers to work hard for improving profitability in order to avoid an industry-shakeout. According to Loderer et al. (2014) established firms will find it more difficult to counteract industry distress with new innovations or simply by switching industry. As a consequence, we would expect them to try to retain profitability by seeking political and regulatory support.

We follow Opler and Titman (1994) and classify an industry in year t as distressed if the median sales growth of all firms in that industry is negative and the median stock return is less than -30 percent. Industry classification is based on 3-digit SIC codes. We compute sales growth and stock return over a two-year period from beginning of year t to end of year t+1 and require at least 5 firm-years to compute our industry measures. Gopalan and Xie (2011) use the same classification and find that in their sample distressed industry-years seem to coincide with drops in revenues or increases in input prices. This industry distress identification suits our research purpose in the sense that it is more likely to be exogenous to corporate lobbying than changes in legislation. We further investigate endogeneity of industry distress by asking whether industries with high lobbying activity have a lower distress probability. In Table 7 we report the probability of industry distress and the percentage of active lobbying firms for each Fama and French (1997) 48-industry. In the entire sample we classify 6.2 percent of firm-years as distressed which is higher than what other studies find (Gopalan and Xie 2011; Opler and Titman 1994). The difference can be explained by our more recent sample that covers a period with more distressed industries

(Gopalan and Xie 2011). When looking across industries, we do not find that industry distress is clustered in a few industries. Moreover, in unreported analysis we find that the correlation between percentage of active lobbying firms and probability of distress using 2,362 industry-year observations equals -0.052. The correlation coefficient is negative but rather low in magnitude. Overall, it does not seem that industry distress is endogenous to lobbying. Although firms may successfully lobby for higher demand or lower costs it seems unlikely that large industry-wide downward shocks can be contained through lobbying. A case in point is the defense industry that experienced industry distress despite the large fraction of government demand which can be directly influenced through corporate lobbying.

To empirically test whether lobbying investment is more important to established firms during industry distress we re-estimate our main regression model and include an interaction term between firm age and industry distress. The results are shown in Table 8. The dependent variable is *Lobby-to-assets* in odd-numbered columns and *bLobby* in even-numbered columns. In column (1) the interaction term *bDistress* × *Firm age* is positively related to *Lobby-to-assets* but the p-value of 0.152 is below statistical significance. In column (2) we find that industry distress significantly increases the probability of established firms to engage in corporate lobbying. Economically, industry distress approximately doubles the age-effect on lobbying propensity, which seems to support the hypothesis that established firms lobby as a means to avoid industry shake-out. The estimated coefficient on *bDistress* itself is negative and statistically significant. This is consistent with the notion that firms face higher financial constraints during distress. Similarly, Gopalan and Xie (2011) find that distressed firms reduce R&D expenditures. In column (3) and (4) we take into account that the fraction of politically active firms is slightly negatively related to industry distress and explore whether our results are driven by industries with no distress during our sample period. Our results are not affected by this sample restriction. In unreported analysis, we also use industry dummies based on 3-digit SIC codes and find that our results are not driven by unobserved industry characteristics.

An alternative interpretation of the empirical evidence is that established firms are less financially constrained and, thus, more likely to lobby when industry distress reduces available funds for investment. Rather than a lower ability to cope with a decline in demand or increase in production costs it may simple be that higher cash levels, more collateral, or longer bank relations allow established firms to continue their lobbying activity even during economic downturns. Our hypothesis, however, postulates that during industry distress established firms are more likely to lobby than their younger counterparts with similar financial constraints. To control for cross-sectional differences in financial constraints we re-estimate our regressions in Table 8 and limit our sample to firms with positive dividend payout. Thereby, we ensure that all firms per se have enough available funds to engage in corporate lobbying. The results are in column (5) and (6). Both estimated coefficients on the interaction term *bDistress* × *Firm age* are positive and statistically significant. Thus, it does not seem that our empirical results are merely driven by differences in financial constraints between established and young firms. Overall, the empirical results in Table 8 suggest that established firms are more inclined to seek government support when an industry is in distress. This finding is consistent with corporate lobbying being a competitive weapon of established firms that seem unable to create new opportunities or to reorient themselves by exiting a distressed industry.

6. Corporate lobbying and creative destruction

In the final section we investigate whether established firms' lobbying activities slow down the creative destruction process. There are various ways that legislation can protect established firms. First, established firms may lobby Congress for trade protection (Lenway et al. 1996). Second, they may lobby for subsidies like government contracts (Goldman et al. 2013), favorable legal treatment (Yu and Yu 2011), lower compliance costs (Hochberg et al. 2009) or lower tax rates (Richter et al. 2009). Third, established firms in distress may use lobbying to receive stimulus funds (Adelino and Dinc 2013) or increase the likelihood of government bailout (Faccio et al. 2006). Finally, established firms may also lobby for entry regulation through minimum standards that handicap younger and smaller competitors (Devinney 2009).

There are therefore several ways that established firms can benefit from their lobbying efforts. The assumption, however, is that policy makers respond to established firms' protective lobbying efforts. According to Caballero and Hammour (1996) "ongoing creative destruction […] often entails distressing job losses, and can therefore result in political responses to protect those jobs." Given that politicians are mainly interested in how policies and regulation affect their chances of re-election (Figueiredo and Richter 2013), we expect established firms to be successful in lobbying for legislation that thwarts or hinders the creative destruction process in a competitive economy. If so, lobbying should reduce industry-wide churn rates.

Table 9 tests this prediction using industry turnover rates as proxies for creative destruction (Chun et al. 2008; Comin and Philippon 2006). For each industry-year, we compute the conditional probability that an incumbent firm will fall out of the top quintile of the distribution of value proxies within the next 5 years. The value proxies of relevance are market capitalization, operating income, and sales. Our main explanatory variable is average industry lobbying expenditures scaled by assets. Because turnover rate is a fractional dependent variable we estimate the regression equation using a fractional logit generalized linear model (Papke and Woolridge 1996). We control for various industry characteristics such as corporate demographics, competition, technology, and financing (Chun et al. 2008). Year fixed effects are used to control for unobserved economy wide shocks. We require at least 5 firm-year observations to compute our industry variables (Chun et al. 2008). The final sample consists of 419 industry-year observations for which we have data to compute all of our variables.

Consistent with our prediction, the estimated coefficient of *Lobbying* is negative and statistically significant regardless of how we measure turnover. Higher industry lobbying activity diminishes the turnover of incumbent firms in terms of market value (column 1), operating income (column 2), and sales (column 3). The estimated coefficient of the control variables are in line with the findings of Chun et al. (2008). In particular, industry firm size is negatively related to turnover rate and industry leverage is positively related to it. In contrast to their empirical results, we also find that higher industry concentration reduces turnover rate. This is consistent with the view that product market competition accentuates idiosyncratic return volatility (Irvine and Pontiff 2009), another proxy for creative destruction (Chun et al. 2008).

In column (4) to (6), we differentiate between lobbying by established and young firms in a given industry. We define *Lobbying by established firms* as the average lobbying-to-assets ratio of firms older than the median firm age in a given industry-year, and *Lobbying by young firms* as the average lobbying-to-assets ratio of younger firms. On average, industry lobbying expenditures are higher for established firms than for younger firms (0.061 vs. 0.054). The regression results reveal that lobbying by established firms significantly diminish within-industry turnover rates. The estimated coefficient is negative and highly significant if we measure turnover rate based on market value of equity in column (4) or sales in column (6). In contrast, the estimated coefficient of *Lobbying by young firms* is positive in all three columns. This result, however, is statistically fairly weak.

One might argue that unobserved industry characteristics are responsible for our findings. For example, in more regulated industries we would expect lobbying efforts to be higher due to the higher government involvement. At the same time, industry turnover will naturally be lower in regulated industries. To address this issue we exclude the top 5 lobbying industries. Again, we rank industries according to the percentage of total industry-specific lobbying expenditures. The results are shown in column (7) to (9). We find no evidence that our results are driven by industries with overall high lobbying activity and, presumably, a lower turnover rate caused by a more stable environment. A more direct way to account for unobserved industry characteristics is to include industry year fixed effects. The problem with industry fixed effects is that they are likely to absorb a great deal of variation due to the rather short panel of 11 years. The results are in columns (10) to (12). The estimated coefficient of *Lobbying by established firms* remains negative in all three columns. Moreover, the effect is highly significant if we measure turnover rates based on market value of equity in column (10). In column (12) the estimated coefficient of *Lobbying by established firms* is no longer statistically different from zero. Interestingly, other important determinants of industry turnover, namely *Firm size* and *Leverage*, lose their statistical significance in all three columns. This questions the validity of these regression specifications.

Overall, we interpret our regression results in Table 9 as showing that lobbying by established firms is effective at reducing the turnover rate of incumbent firms. Our empirical findings, therefore, are consistent with the hypothesis that established firms use lobbying as a means to forestall the creative destruction process.

7. Conclusion

We aim to address the question of whether corporate lobbying allows established firms to fend off younger and more innovative firms. According to the literature established firms have various competitive weapons at their disposal to forestall the creative destruction process. For example, established firms may gain a competitive advantage over new entrants through customer retention (Stein 1997) or improving technical efficiency (Loderer et al. 2014). In our study we argue that corporate lobbying is another effective way that established firms may gain such a competitive advantage.

We find empirical support for our hypothesis. First, we show an economically and statistically significant relation between firm age and corporate lobbying. Second, the age-effect is stronger for firms operating in competitive product markets where the decline in rents over time is likely to be greater. Third, using industry distress as an exogenous shock to future rents we find that established firms are relatively more inclined to lobby when being in distress. Finally, we find that corporate lobbying by established firms reduces top industry turnover rate, a common proxy for creative destruction.

We conclude that corporate lobbying is another competitive weapon that established firms have at their disposal to protect their future profitability and, thereby, forestalling the creative destruction process. A question left unexplored in this study is whether corporate lobbying by established firms affects innovative output by younger firms and subsequent economic growth. We leave that to future research.

Table 1: Descriptive statistics

Table 1 shows the descriptive statistics for our variables. Variable definitions are shown in Table 10. The data refer to firms from 1998 to 2012. Panel A shows the descriptive statistics of the lobbying variables of all firms and Panel B of lobbying firms only. In Panel C we display the descriptive statistics of the control variables measured in the fiscal year prior to the lobbying decision. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution.

	Mean	Median	Std.	Min	Max	N
			Panel A: Lobbying variables			
bLobby	0.1505	0.0000	0.3576	0.0000	1.0000	53,334
Lobbying expenditures (million)	0.0592	0.0000	0.2532	0.0000	1.9330	53,334
Lobbying expenditures (log)	0.0415	0.0000	0.1557	0.0000	1.0760	53,334
Lobby-to-assets	0.0001	0.0000	0.0003	0.0000	0.0020	53,260
Lobby-to-sales	0.0001	0.0000	0.0005	0.0000	0.0046	52,044
			Panel B: Lobbying variables conditional on lobbying			
Lobbying expenditures (million)	0.3934	0.1540	0.5426	0.0039	1.9330	8,028
Lobbying expenditures (log)	0.2759	0.1432	0.3103	0.0039	1.0760	8,028
Lobby-to-assets	0.0004	0.0001	0.0006	0.0000	0.0020	8,022
Lobby-to-sales	0.0007	0.0002	0.0012	0.0000	0.0046	7,941
			Panel C: Control variables			
Firm age (in years)	14.604	11.000	13.484	1.0000	75.000	47,271
Firm size	5.1643	5.0698	1.9243	0.9257	10.058	47,252
Tobin's Q	2.3062	1.5729	2.1638	0.5161	13.909	47,178
Cash flow	-0.0342	0.0585	0.3027	-1.8837	0.2971	47,078
R&D	0.4804	0.0065	2.2798	0.0000	18.894	46,620
Leverage	0.1989	0.1293	0.2263	0.0000	1.1437	47,241
Reported industries (log)	0.9413	1.0000	0.1503	0.1765	1.0000	47,268
Industry concentration	0.0742	0.0557	0.0752	0.0139	0.8506	47,271
Votes	2.9739	2.9957	0.7325	1.0986	4.0073	43,845
Distance	4.1858	4.4644	1.3185	0.0000	6.1335	41,702

Table 2: Descriptive statistics of lobbying and non-lobbying firms

Table 2 shows the descriptive statistics of the control variables for lobbyists and non-lobbyists separately. Variable definitions are shown in Table 10. The data refer to firms from 1998 to 2012. All the control variables are measured at the fiscal year ending prior to the lobbying decision. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. The significance of difference in means is based on a two-tailed t-test. The significance of difference in medians is based on a two-sample Wilcoxon rank-sum (Mann-Whitney) test. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Lobbyists			Non-lobbyists			Difference in	
	N	Mean	Median	N	Mean	Median	Means	Medians
Firm age (in years)	7,054	22.46	16.00	40,217	13.23	10.00	9.233***	6.000***
Firm size	7,053	7.032	7.272	40,199	4.837	4.802	2.195***	2.470***
Tobin's Q	7,052	2.431	1.738	40,126	2.284	1.539	0.146***	0.199***
Cash flow	7,026	0.021	0.078	40,052	-0.044	0.054	0.065***	0.023***
R&D	6,982	0.363	0.009	39,638	0.501	0.006	-0.137***	0.003
Leverage	7,053	0.232	0.198	40,188	0.193	0.114	0.039***	0.084***
Focus	7,054	0.894	1.000	40,214	0.950	1.000	-0.055***	0.000***
Industry concentration	7,054	0.080	0.057	40,217	0.073	0.056	0.007***	0.002***
Votes	6,832	2.891	2.708	37,013	2.989	3.045	-0.098***	-0.336***
Distance	6,254	4.039	4.441	35,448	4.212	4.464	-0.173***	-0.023***

Table 3: Univariate analysis

Table 3 shows the results of the univariate analysis. All firm-years are divided into four age-cohort of similar sample size. The percentage of firm-year observations in each age-cohort is shown in column (1). In column (2) are aggregate inflation-adjusted lobbying expenditures in USD millions and its percentage of total spending in column (3). The distribution of size-adjusted lobbying expenditures is displayed in column (4). For illustration purposes, we multiply the ratio of lobbying expenditures to assets by 1,000. Column (5) shows how the propensity to lobby varies with firm age. The data refer to firm-year observations between 1998 and 2012.

	Percent of firmyear observations	Lobbying expenditures (millions)	Percent of total lobbying expenditures	Lobby-to-assets ratio (multiplied by 1,000)	Propensity to lobby
	(1)	(2)	(3)	(4)	(5)
All firm-years	100.0%	4,522	100%	0.056	15.1%
1 to 4	19.7%	195	4.3%	0.047	7.7%
5 to 10	28.4%	472	10.5%	0.058	10.9%
11 to 19	26.4%	739	16.3%	0.062	15.0%
20 or more	25.5%	3,116	68.9%	0.055	25.4%

Table 4: Main regression results

Panel A of Table 4 shows the estimation results of the main regression equation relating lobbying activity to firm age. The dependent variable is the ratio of lobbying expenditures to assets in column (1), the ratio of lobbying expenditures to sales in column (2), the natural logarithm of inflation-adjusted lobbying expenditures plus one in column (3), and a binary variable indicating whether a firm lobbies in a given year or not in column (4). We estimate the equation in column (1) to (3) using a tobit specification and in column (4) using a logit specification. We multiply all coefficients in column (2) and (3) by 1,000. All independent variables are measured at the fiscal year ending prior to the lobbying decision. Variable definitions are shown in Table 10. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. All specifications include year and industry fixed effects. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level. The economic significance is gauged in Panel B. We show predicted values for our lobbying variables at the mean of all independent variables and at various percentiles of the age distribution.

Panel A: Regression results

	Lobbying-to-assets	Lobbying-to-sales	Lnlobby	bLobby
	(1)	(2)	(3)	(4)
Firm age (log)	0.067***	0.095***	0.045***	0.205***
	(0.018)	(0.034)	(0.008)	(0.042)
Firm size	0.228***	0.474***	0.172***	0.810***
	(0.009)	(0.022)	(0.007)	(0.028)
Tobin's Q	0.062***	0.113***	0.028***	0.143***
	(0.007)	(0.015)	(0.003)	(0.014)
Cash flow	-0.482***	-1.129***	-0.250***	-1.103***
	(0.070)	(0.145)	(0.026)	(0.141)
R&D	-0.011	0.000	-0.007***	-0.025*
	(0.007)	(0.015)	(0.002)	(0.013)
Leverage	-0.193***	-0.383***	-0.126***	-0.559***
	(0.067)	(0.135)	(0.029)	(0.155)
Focus	-0.354***	-0.590***	-0.178***	-0.924***
	(0.092)	(0.167)	(0.040)	(0.219)
Industry concentration	0.603**	1.270**	0.234*	1.750**
	(0.298)	(0.620)	(0.121)	(0.719)
Votes	-0.053*	-0.088	-0.017	-0.120*
	(0.029)	(0.058)	(0.012)	(0.063)
Distance	-0.028*	-0.071**	-0.009	-0.061*
	(0.014)	(0.030)	(0.006)	(0.033)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	40,767	40,416	40,804	40,804
Pseudo-R^2	0.155	0.130	0.410	0.285

Panel B: Economic significance

	Percentile of age distribution within regression sample				
	5th	25th	50th	75th	95th
Firm age (years)	2	5	11	19	39
Lobbying-to-assets (× 1,000)	0.031	0.036	0.041	0.044	0.050
Lobbying-to-sales (× 1,000)	0.063	0.070	0.077	0.082	0.089
Lobbying expenditures (USD)	6,742	8,983	11,397	13,378	16,422
Propensity to lobby	0.056	0.067	0.078	0.087	0.099

Table 5: Robustness tests

Table 5 shows the results of the robustness tests. The dependent variable is the ratio of lobbying expenditures to assets. We estimate the equation using a tobit specification in column (1) to (4). In column (5) we estimate a two-stage Heckman model. In the first-stage we estimate our main regression model where the dependent variable is a binary variable indicating whether a firm lobbies in a given year or not. We use a Probit specification. The second-stage regression is an OLS regression where the dependent variable equals the ratio of lobbying expenditures to assets. Note that ecollege and distance are instruments in the first-stage regression. All independent variables are measured at the fiscal year ending prior to the lobbying decision. Variable definitions are shown in Table 10. The Adj-R^2 in column (5) is based on an OLS regression. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. All specifications include year and industry fixed effects. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Lobbying-to-assets				
	Exclude top 5 lobbying-industries	Exclude lobbying expenditure > 1 million	Full sample	Full sample	Heckman two-stage model
	(1)	(2)	(3)	(4)	(5)
Firm age (log)	0.063***	0.073***	0.064***	0.068***	0.033***
	(0.022)	(0.019)	(0.018)	(0.022)	(0.006)
Firm size	0.209***	0.236***	0.228***	0.192***	-0.178***
	(0.010)	(0.010)	(0.009)	(0.012)	(0.006)
Tobin's Q	0.082***	0.065***	0.062***	0.055***	0.004
	(0.011)	(0.008)	(0.007)	(0.009)	(0.003)
Cash flow	-0.484***	-0.497***	-0.486***	-0.494***	-0.607***
	(0.085)	(0.073)	(0.070)	(0.087)	(0.029)
R&D	-0.006	-0.010	-0.012*	-0.026***	-0.006**
	(0.013)	(0.007)	(0.007)	(0.009)	(0.003)
Leverage	-0.258***	-0.201***	-0.196***	-0.211***	-0.112***
	(0.088)	(0.071)	(0.067)	(0.077)	(0.024)
Focus	-0.227***	-0.388***	-0.354***	-0.449***	0.067**
	(0.088)	(0.101)	(0.092)	(0.110)	(0.028)
Industry concentration	0.611**	0.729**	0.645**	0.014	0.339***
	(0.275)	(0.326)	(0.300)	(0.385)	(0.057)
Votes	-0.015	-0.052*	-0.053*	-0.061*	
	(0.032)	(0.031)	(0.029)	(0.032)	
Distance	-0.033**	-0.031**	-0.028*	-0.022	
	(0.015)	(0.015)	(0.014)	(0.016)	
Industry age			0.202**		
			(0.091)		
Institutional ownership				-0.270*	
				(0.139)	
Institutional ownership × Firm age				-0.218**	
				(0.105)	
Inverse Mills ratio					-0.013
					(0.018)
Industry fixed effects	Yes		Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	25,099	40,104	40,767	24,710	6,159
Pseudo-R^2 / Adj-R^2	0.183	0.135	0.155	0.154	0.544

Table 6: Unique products and product market concentration

Table 6 shows how the age-effect varies with product uniqueness and product market concentration. We estimate the main regression equation from Table 4 and interact firm age with product uniqueness in column (1) to (3) and product market concentration in column (4) to (6). The dependent variable is the ratio of lobbying expenditures to assets in column (1) and (4), the natural logarithm of inflation-adjusted lobbying expenditures plus one in column (2) and (5), and a binary variable indicating whether a firm lobbies in a given year or not in column (3) and (6). We estimate the equation using a tobit specification or a logit specification when the dependent variable is a binary variable. Firm age and product market concentration are demeaned at their pooled distribution. We include all control variables from Table 4, but due to simplicity we only report the estimated coefficients of the age covariates. All independent variables are measured at the fiscal year ending prior to the lobbying decision. Variable definitions are shown in Table 10. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Lobby-to-assets	LnLobby	bLobby	Lobby-to-assets	LnLobby	bLobby
	(1)	(2)	(3)	(4)	(5)	(6)
Firm age	0.093***	0.059***	0.264***	0.067***	0.043***	0.206***
	(0.021)	(0.009)	(0.052)	(0.020)	(0.008)	(0.046)
Firm age × bUnique	-0.058**	-0.037***	-0.140**			
	(0.027)	(0.012)	(0.065)			
bUnique	0.092***	0.032**	0.230***			
	(0.032)	(0.014)	(0.076)			
Firm age × HHI				-0.164**	-0.100***	-0.255
				(0.074)	(0.026)	(0.162)
HHI				0.388***	0.163***	0.804***
				(0.085)	(0.032)	(0.180)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	40,767	40,804	40,804	33,630	33,665	33,665
Pseudo-R^2	0.156	0.411	0.286	0.157	0.408	0.281

Table 7: Probability of distress and percentage of lobbying firms across industries

Table 7 shows for each industry the number of firm-year observations in column (1), the probability of industry distress in column (2), and the percentage of politically active firms in column (3). We use Fama and French (1997) 48-industry classification.

FF48-Industry	Observations	Probability of distress	Fraction of lobbying firms
	(1)	(2)	(3)
Overall	*37,463*	*0.062*	*0.147*
Agriculture	60	0	0.25
Food Products	667	0.006	0.168
Candy & Soda	114	0	0.114
Beer & Liquor	140	0	0.386
Tobacco Products	15	0	0.533
Recreation	396	0.071	0.040
Entertainment	565	0.057	0.164
Printing & Publishing	212	0.179	0.184
Consumer Goods	564	0.071	0.165
Apparel	557	0.036	0.047
Healthcare	827	0	0.248
Medical Equipment	1,933	0	0.189
Pharmaceutical Products	3,209	0	0.188
Chemicals	638	0.013	0.257
Rubber & Plastic Products	324	0.040	0.071
Textiles	89	0.494	0.056
Construction Materials	513	0.037	0.115
Construction	370	0.103	0.105
Steel Works etc.	427	0.136	0.208
Fabricated Products	116	0.069	0
Machinery	1,367	0.083	0.086
Electrical Equipment	719	0.113	0.166
Automobiles & Trucks	441	0.098	0.156
Aircraft	166	0	0.289
Shipbuilding, Railroad Equipment	73	0.164	0.397
Defense	63	0.048	0.603
Precious Metals	76	0	0.197
Non-Metallic and Industrial Metal Mining	107	0	0.271
Coal	66	0	0.409
Petroleum and Natural Gas	1,595	0.039	0.118
Communication	1,194	0.044	0.305
Personal Services	444	0.025	0.214
Business Services	6,201	0.087	0.128
Computers	2,159	0.148	0.115
Electronic Equipment	3,175	0.143	0.078
Measuring and Control Equipment	1,184	0.078	0.097
Business Supplies	310	0.045	0.119
Shipping Containers	92	0	0.207
Transportation	1,005	0.010	0.303
Wholesale	1,469	0.040	0.065
Retail	2,441	0.034	0.122
Restaurants, Hotels, Motels	881	0.006	0.100
Almost Nothing	499	0	0.188

Table 8: Industry distress

Table 8 shows how lobbying activities are related to industry distress. We estimate the main regression equation from Table 4 and interact firm age with industry distress. The dependent variable in odd-numbered columns equals the ratio of lobbying expenditures to assets and in even-numbered columns is a binary variable indicating whether a firm lobbies in a given year. We estimate the equation using a tobit specification in odd-numbered columns and a logit specification in even-numbered columns. Firm age is demeaned at its pooled distribution. We include all control variables from Table 4, but due to simplicity we only report the estimated coefficients of the age covariates. All independent variables are measured at the fiscal year ending prior to the lobbying decision. Variable definitions are shown in Table 10. All continuous and unbounded variables are winsorized at the 1st and the 99th percentile of their pooled distribution. Standard errors are clustered at the firm level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Full sample		Industries with at least one distress		Non-financially constrained firms	
	Lobby-to-assets	bLobby	Lobby-to-assets	bLobby	Lobby-to-assets	bLobby
	(1)	(2)	(3)	(4)	(5)	(6)
Firm age	0.066***	0.193***	0.063**	0.163**	0.084***	0.356***
	(0.019)	(0.044)	(0.030)	(0.068)	(0.023)	(0.088)
bDistress × Firm age	0.055	0.190**	0.062	0.209***	0.102*	0.446**
	(0.038)	(0.086)	(0.038)	(0.081)	(0.053)	(0.216)
bDistress	-0.185***	-0.455***	-0.148***	-0.378***	-0.133***	-0.559***
	(0.041)	(0.093)	(0.049)	(0.109)	(0.047)	(0.185)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37,463	37,384	19,148	19,129	8,940	8,883
Pseudo-R^2	0.154	0.284	0.150	0.258	0.202	0.339

Table 9: Creative destruction

Table 9 shows how lobbying activities are related to creative destruction. The dependent variable is turnover rate of incumbent firms based on market value of equity, operating income, or sales as indicated above each column. We estimate the equation using a glm specification. We follow Chun et al. (2008) and include industry-year observations with at least five firm-year observations to compute our industry variables. We use the full sample except in column (7) to (9) where we exclude the top 5 industries in terms of percentage of lobbying expenditures. Variable definitions are shown in Table 10. Standard errors are clustered at the industry level and reported in parentheses. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

	Full sample			Full sample			Exclude 5 top lobbying industries			Full sample		
	Market value	Operating income	Sales	Market value	Operating income	Sales	Market value	Operating income	Sales	Market value	Operating income	Sales
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lobbying	-2.081*	-1.371**	-1.763**									
	(1.112)	(0.632)	(0.823)									
Lobbying by established firms				-4.282***	-1.954	-3.236***	-4.365***	-2.027	-3.207**	-2.283**	-0.524	-1.857
				(1.185)	(1.237)	(1.253)	(1.292)	(1.259)	(1.334)	(0.913)	(1.280)	(1.880)
Lobbying by young firms				1.004	0.185	0.614	1.087	0.219	0.594	0.647	0.944	1.546
				(1.016)	(0.847)	(0.846)	(1.029)	(0.835)	(0.863)	(2.218)	(1.594)	(1.480)
Firm age	-0.202	0.087	0.084	-0.291	0.052	0.019	-0.200	0.211	0.127	-0.213	1.260*	1.066**
	(0.232)	(0.253)	(0.220)	(0.197)	(0.246)	(0.206)	(0.246)	(0.304)	(0.240)	(0.495)	(0.727)	(0.522)
Firm size	-0.403***	-0.360***	-0.416***	-0.368***	-0.346***	-0.390***	-0.388***	-0.381***	-0.404***	-0.390	-0.203	-0.279
	(0.119)	(0.088)	(0.117)	(0.121)	(0.090)	(0.120)	(0.135)	(0.099)	(0.134)	(0.275)	(0.235)	(0.216)
Industry concentration	-0.919**	-0.747**	-0.737**	-0.723*	-0.657**	-0.581*	-0.737*	-0.625*	-0.570	-3.402**	-0.036	-1.522
	(0.449)	(0.344)	(0.372)	(0.393)	(0.326)	(0.322)	(0.415)	(0.347)	(0.361)	(1.633)	(1.793)	(1.905)
R&D intensity	0.124	0.052	0.142**	0.085	0.033	0.112*	0.067	-0.019	0.079	-0.091	-0.171	-0.108
	(0.090)	(0.072)	(0.065)	(0.082)	(0.072)	(0.062)	(0.117)	(0.098)	(0.098)	(0.146)	(0.149)	(0.176)
Leverage	2.296**	1.747**	3.417***	1.815*	1.502*	3.046***	1.820	1.331	3.283***	-2.080	1.285	0.256
	(1.052)	(0.879)	(0.871)	(0.968)	(0.848)	(0.869)	(1.221)	(1.027)	(1.026)	(2.217)	(2.499)	(2.705)
Liquidity	-0.021	0.028	0.058	-0.009	0.032	0.066	-0.007	0.030	0.083	0.036	0.244*	0.213**
	(0.049)	(0.056)	(0.045)	(0.051)	(0.058)	(0.044)	(0.062)	(0.070)	(0.053)	(0.106)	(0.143)	(0.091)
Industry fixed effects	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	418	419	419	418	419	419	367	368	368	418	419	419
Log likelihood	-189.06	-190.70	-186.24	-187.54	-190.41	-185.40	-165.19	-167.76	-163.33	-177.69	-181.28	-178.34

Table 10: Variable definitions

Variable	Definition
Lobbying variables	
Lnlobby	The natural logarithm of annual inflation-adjusted lobbying expenditures plus one. Nominal values are deflated with the consumer price index (CPI) using 2001 as base year. The data are from the Center of Responsive Politics (CRP) and Bureau of Labor Statistics (BLS).
Lobby-to-assets	The ratio of annual lobbying expenditures to assets (at). The data are from the Center of Responsive Politics (CRP) and COMPUSTAT.
Lobby-to-sales	The ratio of annual lobbying expenditures to sales (sale). The data are from the Center of Responsive Politics (CRP) and COMPUSTAT.
bLobby	A binary variable indicating whether a firm lobbies in a given year or not. The data are from the Center of Responsive Politics (CRP).
Firm characteristics	
Firm age	The natural logarithm of firm age. Age is computed as one plus the difference between the year under investigation and the firm's year of birth. The year of birth is computed as the minimum value of: (a) the first year the firm appears on the CRSP tapes; (b) the first year the firm appears on the COMPUSTAT tapes; and (c) the first year for which we find a link between the CRSP and the COMPUSTAT tapes.
Firm size	The natural logarithm of one plus inflation-adjusted book value of assets (at). Nominal values are deflated with the consumer price index (CPI) using 2001 as base year. The data are from COMPUSTAT and Bureau of Labor Statistics (BLS).
Tobin's Q	The ratio of a firm's market value of assets to the book value of assets (at). The market value of assets equals the sum market value of equity (csho × prcc_f) and the market value of debt (at – ceq – txdb). The data are from COMPUSTAT.
Cash flow	Firm cash flow normalized by book value of assets (at). We follow Hill et al. (2013) and compute cash flow as operating profits before depreciation and amortization (oibdp) minus interest expenses (xint), total income taxes (txt), and common dividends (dvc). The data are from COMPUSTAT.
R&D	Firm R&D expenditures (xrd) normalized by beginning-of-year assets (at). We set missing observations to zero and include a binary variable indicating missing observations. The data are from COMPUSTAT.
Leverage	The ratio of a firm's long-term debt (dltt + dlc) to assets (at). The data are from COMPUSTAT.
Focus	Focus is measured with a Herfindahl index, HI, based on the sales (sale) in the firm's different business segments: $HI = \sum_{i=1}^{N} p_i^2$, where N is the number of reported segments with distinct 3-digit SIC codes, the subscript i identifies the segments, and p_i is the fraction of the firm's total sales in the segment in question. We aggregate segment sales of reported segments with the same 3-digit SIC codes. After the aggregation procedure, we proportionally allocate the difference between firm sales (sale) and the sum of segment sales (sale) to each of its segments. The data are from COMPUSTAT.
Votes	The natural logarithm of one plus the number of electoral votes in a firm's state of location (state). The data are from COMPUSTAT and from National Archives and Records Administration.
Distance	The natural logarithm of one plus the number of miles between a firm's headquarter and the state capitol building in a firm's state of location (state). We follow Bouwman (2011) and measure the distance in miles using ZIP codes of the location (city) of a firm's headquarter and the location of a state capitol building. We then assign latitude and longitude to ZIP codes using the Census 2000 U.S. Gazetter file and compute the distance using the haver-

Variable	Definition
	sine formula: $d_{HC} = R \times 2 \times \arcsin(\min(1, \mathrm{sqrt}(a)))$ where R equals 3,959 (earth radius in miles), a = $(\sin[(lat_C - lat_H)/2])^2 + \cos(lat_H) \times \cos(lat_C) \times (\sin[(lon_C - lon_H)/2])^2$, subscript H identifies a firm's headquarter and subscript C identifies the capitol building of a firm's state of location. The data are from COMPUSTAT and the Census 2000 U.S. Gazetter file.
Institutional ownership	A concentration measure of institutional ownership (instown_hhi). Concentration is measured with a Herfindahl index, HI, based on individual institutional holdings of a firm's various institutional investors. The data are from 13F INSTITUTIONAL OWNERSHIP.
bUnique	A binary variable indicating whether a firm-year observation is within the top tercile of SG&A expenditures (xsga) normalized by sales (sale) within a given industry-year or not. We use Fama and French (1997) 48-industry classification. The data are from COMPUSTAT.
HHI	The industry concentration measure (tnic3hhi) provided by Hoberg and Phillips (2014).
Industry characteristics	
Industry concentration	Industry concentration is measured with a Herfindahl index, HI, based on the sales (sale) of all firms operating in a given industry-year: $HI = \sum_{i=1}^{N} p_i^2$, where N is the number of firms operating in a given industry-year, the subscript i identifies the firm, and pi is the fraction of the firm's total sales in the industry in question. We use Fama and French (1997) 48-industry classification. The data are from COMPUSTAT and from Kenneth R. French's webpage.
Industry age	The natural logarithm of the average firm age in a given industry-year. We use Fama and French (1997) 48-industry classification.
bDistress	A binary variable indicating whether a firm's industry is in distress in a given year or not. We follow Opler and Titman (1994) and classify an industry in year t as distressed if the median sales growth of all firms in that industry is negative and the median stock return is less than -30 percent. We compute sales growth and stock return over a two-year period using sales (sale) at the end of year t-1 and t+1 and annualized stock return (ret) during year t and t+1. We use SIC 3-digit industry classification. The data are from COMPUSTAT and CRSP.
Creative destruction variables	
Turnover rate	We follow Comin and Philippon (2005) and measure turnover rate as the probability of an industry's incumbent firms in year t to fall out of the top quintile until year t+5. We rank firms according to market value of equity (prcc_f × csho), operating income (oibdp), or sales (sale). We use Fama and French (1997) 48-industry classification. The data are from COMPUSTAT.
Lobbying	Average industry lobbying expenditures scaled by assets (at). We use Fama and French (1997) 48-industry classification. The data are from CRP and COMPUSTAT.
Lobbying by established firms	Average lobbying expenditures scaled by assets (at) by an industry's established firms. A firm is classified as established if its number of years listed is above the median of the age distribution within a given industry-year. We use Fama and French (1997) 48-industry classification. The data are from CRP and COMPUSTAT.
Lobbying by young firms	Average lobbying expenditures scaled by assets (at) by an industry's young firms. A firm is classified as young if its number of years listed is equal or below the median of the age distribution within a given industry-year. We use Fama and French (1997) 48-industry classification. The data are from CRP and COMPUSTAT.
Firm age	The natural logarithm of an industry's average firm age (Chun et al. 2008). We use Fama and French (1997) 48-industry classification. The data are from CRSP and COMPUSTAT.
Firm size	The natural logarithm of an industry's average market capitalization (prcc_f × csho) (Chun

Variable	Definition
	et al. 2008). We use Fama and French (1997) 48-industry classification. The data are from COMPUSTAT.
R&D intensity	Average R&D intensity within an industry. We follow Chun et al. (2008) and measure R&D intensity as the ratio of R&D capital to net property, plant, and equipment (ppent). R&D capital is the sum of past R&D expenditures (xrd), which are depreciated by an annual rate of 20 percent: $R\&D = xrd_t + 0.8 \times xrd_{t-1} + 0.6 \times xrd_{t-2} + 0.4 \times xrd_{t-3} + 0.2 \times xrd_{t-4}$. We use Fama and French (1997) 48-industry classification. The data are from CRSP and COMPUSTAT.
Leverage	Average debt (dltt + dlc) scaled by assets (at) within an industry (Chun et al. 2008). We use Fama and French (1997) 48-industry classification. The data are from COMPUSTAT.
Liquidity	Average ratio of current assets (act) to current liabilities (lct) within an industry (Chun et al. 2008). We use Fama and French (1997) 48-industry classification. The data are from COMPUSTAT.

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Demian Berchtold

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