Are Private and Public Firms Friends or Foes? Evidence from Millions of Webpages

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Abstract

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1 Introduction

A large number of studies in economic disciplines focus on publicly traded firms both because data is easy to obtain and because these firms are "important". Yet the majority of firms in developed economies such as the U.S. are private firms, and due to their sheer numbers, their impact can be large. Smaller businesses also potentially can be more important than large public firms on several dimensions policymakers care about, such as (A) the opportunities they offer to less wealthy citizens, (B) their hypothesized role as drivers of novel innovation, and (C) the countervailing force they offer against domination by the largest firms.[1] The void in private firm research is particularly large regarding the dynamics of their impact on market structure and how shocks (either policy-driven or unintended consequences of events such as real estate price increases) transmit from smaller private firms to larger public firms.[2]

Understanding how small and large firms interact, and how policy shocks can impact these interactions, has elevated importance given the evidence of increasing large firm dominance and indications of increased market power. For example, Kwon et al. (2024) find that U.S. concentration has been rising steadily over the past 100 years and Autor et al. (2020) illustrate that the rise of super-star firms is likely responsible for a lower overall labor share in GDP. Grullon et al. (2019) also find increasing concentration among U.S. public firms. Our study develops a dynamic spatial model of the product market with public and private firms represented in the same model, which along with data on the geography of policy initiatives, can test how small firm shocks propagate (or not) to large public firms. The framework can also inform policymakers regarding potential broader impacts of their initiatives. Our findings underscore how even policies targeted at boosting small private firms can, in fact, further increase the success and growth of the largest public firms.

We use a comprehensive database of U.S. private and public firms in time series from 2000 to 2021 constructed using webpages from the Internet Archive's WayBack Machine

[1]Related policy focus on small business span decades, including the creation of the U.S. Small Business Administration in 1953, the Jumpstart Our Business Startups Act of 2012 (JOBS Act), and the strong focus on small businesses during the Covid pandemic through the Paycheck Protection Program and the Small Business Debt Relief Program.

[2]Noteworthy exceptions are Becker and Ivashina (2023) and Farre-Mensa et al. (2020) that study private VC backed firms. Yet the majority of smaller private firms are neither VC-backed nor publicly traded and do not have the benefits of institutional support.

(see Hoberg et al. (2024)).[3] This database is a dynamic, annually-updated spatial model of a large fraction of the U.S. economy that jointly covers approximately 500,000 private firms and 5,000 public firms per year from 2000 to 2021. We refer to this resource as the Web-based Textual Network Industry Classification (WTNIC) database. It enables us to follow the dynamics of both public and private firms using a spatial structure that measures how firm products and services evolve. We able to assess these dynamics at a relatively high annual frequency given the annual updating. See Hoberg and Phillips (2016) for a detailed summary of the benefits of dynamic spatial modeling of industry classifications.

This paper uses this WTNIC database to assess the impact of state-level positive shocks to small private firms on public firms in related product markets. We examine the impact specifically on public firms that have high product similarity to the shocked private firms. We exclude private firms in the same state as the focal public firm from this analysis to ensure exogenous treatment. Understanding this relationship can help to understand the economy-wide impact of policies such as state-level R&D tax credits that are aimed at bolstering small businesses. We test central hypotheses motivated by the extent to which private firms either position themselves as competitors to related public firms (their products are substitutes), or whether private firms develop products that are complementary to related public firms. The former would predict wide ranging negative spillovers to public firms and the latter wide-ranging positive spillovers. Finally, we test related predictions that complementarity versus substitution should also depend on a private firm's spatial position in the product market relative to the focal firm and the focal firm's fiercest public rivals (Hoberg and Phillips, 2010). We find that private peers most proximate to a focal public firm's rivals are most important regarding future investment and firm performance outcomes.

The first economic shock we examine is shocks to the incentives for conducting R&D that occur after states pass tax credits for R&D. We focus on small private firms that operate in these states. Under the complementarity (substitution) hypothesis, we expect these positive shocks to private firms to be positive (negative) for the related public firms. Our results strongly favor the complementarity thesis for R&D shocks (innovation inspires complementary investment), and we explore two potential channels for these effects.

[3]This work was made possible by research funded by the National Science Foundation developing scalable and informative natural language processing techniques customized to websites.

The first channel is public firms can acquire the shocked private firms, who increase the development of synergistic products or features. The public firms would subsequently rapidly commercialize these complementary products "at scale" given their large size. This channel is consistent with the view that public firms optimally outsource their R&D and initial new product development to private firms, and then buy them to commercialize the products. Public firm acquisitions of private firms would then increase as in Phillips and Zhdanov (2013).

The second channel is the shocked private firms might develop more innovative products that complement public firms' products directly (without the need for acquisitions). For example, private firms might not have the depth to fully compete with large public firms, and instead might offer products that consumers purchase to enhance the consumption of the public firm's products.[4] If complementary products are highly prevalent among smaller private firms, then we would expect positive shocks to smaller private firms will create positive spillovers for larger public firms in the form of increased sales, higher profits, and increased investment as public firms benefit from increased demand arising from the complementary products of the private firms.

The second economic shock we consider is state-level real estate shocks that impact the private firms operating in each state. Real estate price shocks may relax private firms' financial constraints as studied by Adelino et al. (2015). These real estate price shocks could then enable private firms to expand by relaxing the financial constraints. We examine if these positive shocks to small private firms spill over to affect the larger public firms in their markets.

Our results for this non-innovation shock favor substitution and not complementarity. These liquidity-focused shocks are thus consistent with the shocked private firms becoming stronger competitors to the public firms in their markets. Under substitution, we expect lower sales, lower profits, and reduced levels of investment for public firms. We explore three theoretical channels. First, most directly, these results would arise if private firm competitors simply grow faster given the reduced constraints and crowd out market share from the

[4]An example is Jibbitz, a smaller private company that produced charms that could be attached to the well-known Crocs shoes (Crocs was publicly traded). These products can be strong complements as the success of one leads to more sales of the other. Another example would be a small software developer creating apps that run on the Apple platform, making Apple's products more attractive and vice-versa.

public firms. While crowd-out effects are the most direct prediction, a second theoretical perspective specifically regarding investment is the "escape the competition hypothesis" of Aghion et al. (2005). This second candidate mechanism would predict increased investment as firms attempt to escape competition through product differentiation and R&D. Finally, the acquisitions channel is also possible for substitution affects as firms might use killer acquisitions to reduce the negative impacts of substitution (Cunningham et al., 2021).

Ultimately, whether private firms act as competitive substitutes or complements is an empirical question that might also depend on the type of shock to the small private firms, or the characteristics of the impacted public firms. For example, a shock specifically targeting private firm incentives to innovate might stimulate more exploratory innovation, whereas more generic positive shocks might instead incentivize investments such as advertising or increasing the scale of existing operations. The impact of such different private firm shocks on public firm peers can be quite different. Impact might also vary with firm characteristics such as size or age, as larger firms might be better positioned to internalize technological gains at scale.

The identification challenge we face is that both public and private firms may benefit from increasing demand in an industry, and thus, any interactions or changes we document may be based on their reactions to these shocks. We use two plausibly exogenous *local* positive shocks that impact groups of private firms operating in product markets. The first is based on state-level R&D tax credits as studied in Bloom et al. (2013), and is a positive innovation-specific shock to private firms in treated states. The second is based on state-year real estate price appreciation rates from the Federal Housing Finance Authority and is a non-innovation-focused shock to private firms. From the perspective of private firms in a given state, this second shock identifies either local demand shocks (which pushed up real estate prices) or improved liquidity via borrowing by founders (from higher valued real estate collateral), neither of which is a primitive shifter of innovation. Thus, we can compare the impact of a definitive positive innovation shock to the impact of a more general positive non-innovation shock.

We find that positive innovation shocks to private firms' innovation incentives generate positive complementarities for large public firm peers in many ways. Public firms increase investments both in the form of R&D and acquisitions, and they realize sales growth as predicted by the complementarities hypothesis. These results are particularly strong for larger public firms, which specifically increase acquisitions more than R&D, consistent with our second hypothesis and the possibility of large gains through public firms scaling new technologies produced by small private firms. These firms also experience improved profits and lower competition as overall product similarity with public rivals decreases. These gains for large firms are consistent with the innovation-outsourcing theory of Phillips and Zhdanov (2013), which predicts acquisitions by public firms of smaller firms after smaller firms initially increase innovation. Smaller public firms are very different as they actually decrease acquisitions and instead increase R&D investment. This is consistent with a substitution toward organic investment as they are not as capable of generating acquisition scale-based synergies relative to large public firms. These small public firms ultimately realize smaller gains in real performance, consistent with some gains but less scalability. Regarding other subsamples such as those based on age or innovativeness, we find only modest differences across groups. Overall, our results strongly support the conclusion that firm size is core to understanding the impact of private firm shocks on peer public firm outcomes.

We find diametrically opposite results for non-innovation-focused positive shocks that impact private firm demand and relax their financial constraints, as these shocks enable private firms to expand and increase their competitiveness. Affected public firms (especially larger public firms) experience declines in acquisitions and increases in R&D. These shifts come with lower profits and increased competitive threats in the form of product market fluidity (Hoberg et al., 2014). This suggests that the increases in R&D are likely defensive to escape competition. These findings are consistent with the predictions of increased competition from private firms. The impact of these non-innovation-focused shocks is generally uniform across subsamples although the negative consequences are a bit stronger for larger public firms.

Our findings of positive effects for public firms following positive innovation shocks that directly impact private firms indicate a positive economic "multiplier effect" when policies increase small firm innovation incentives. However, our findings for non-innovation-focused shocks show a negative impact on public firms, consistent with increased competition and substitution effects as predicted by our first hypothesis. A simple explanation based on the characteristics of growth options might explain these opposing results. The net present values of exploratory innovation growth options might have a very diffuse distribution and a high-risk profile, and only shocks targeting innovation directly are strong enough to materially shift the likelihood of exercising such growth options. On the other hand, the value of growth options aimed at "emulating successful peers" likely have a tighter distribution around zero and a lower risk profile. Thus, general shocks to demand and liquidity are adequate to shift these growth options into ones that can be exercised, but these shocks are not impactful enough on innovation incentives to shift exploratory innovation specifically.

We find additional results that confirm our interpretation of the R&D tax credits shock as an innovation-focused shock and the real estate values shock as a non-innovation-focused shock. In particular, we examine a validation test where we predict growth in the size of private firm websites as a way to measure private firm product innovation. We find strong results that only the R&D tax credits shock strongly shifts growth in private firm website size. The non-innovation real estate shock only has a weak impact on the growth of private firm websites. Economically, the impact of the R&D tax credit shock is 15x more important than the non-innovation real estate shock in predicting the growth of private firm websites.

Although our study makes significant progress regarding the dynamics of joint market evolution for public and private firms, some limitations remain for future research to address. First, although we study hundreds of thousands of private firms, our study only includes those in popular private firm databases such as Capital IQ and Orbis. Extending the sample could be fruitful. Future studies might consider ultra-small "mom and pop" enterprises or sole proprietorships, although the impact of such operations on public firms is likely smaller and plays out over longer horizons. Second, our data only goes back to 2000 given the limitations of the Wayback Machine. Finally, gains in artificial intelligence tools, although currently costly to implement given the trillions of pairwise comparisons needed to construct the WTNIC database, should become more scalable in the coming years. Finally, while our evidence suggests important considerations policymakers might examine when assisting small enterprises, more research is needed to refine how policies might be optimized further.

2 Theoretical Predictions

We use our large webpage text-based network industry classification (WTNIC) database to assess the impact of positive shocks to private firms on the public firms operating in related product markets. We start by noting that theoretical predictions crucially hinge upon whether the positive shocks induce the private firms to expand in ways that are complements or substitutes to the existing public firms in their markets.

If the private firms in a public firm's product market generally offer complementary products and services, positive shocks to these private firms should transmit positively to the focal public firms. A wide array of positive effects could follow including sales growth, more investment as growth options increase in value, and more innovation as markets overall are more valuable. Gains in performance might also come with reduced competition as the incentives to innovate lead to further product differentiation and increased barriers to entry.

A second channel is complementary firm innovation shocks might also result in more public firm acquisitions of the private firms themselves. These acquisitions can create valuable synergies as the larger public firms can use their resources to more rapidly commercialize the new products and features. This is consistent with Phillips and Zhdanov (2013), and public firms optimally outsourcing their R&D to private firms, and then buying them to commercialize and advertise the products. An example would be video games developed by private firms that use Microsoft's X-box platform. Microsoft has subsequently purchased many small game producers, including the private companies that developed Halo, Doom, Redfall, and Gears of War.[5] This discussion motivates our first hypothesis based on complementarity.

Hypothesis 1 [Complementarity]: Positive shocks to the private firms will have two primary effects on public firms.

Hypothesis 1a: Sales, profits, and organic investment of public firms will increase as private firms develop more complementary products.

Hypothesis 1b: Acquisitions by public firms of private firms will increase after the private firm innovation shocks.

[5] For a list of the 13 game developer companies that Microsoft has purchased see: https://www.pcgamer.com/every-game-and-studio-microsoft-now-owns/

If the private firms in a public firm's product market generally offer substitute products and services, positive shocks to these private firms should transmit negatively to the focal public firms. The positive shocks would enable the private firms to expand by relaxing their financial constraints, making them stronger competitors. We then might expect the public firms to experience lower sales growth, lower profits, and investment might be negatively impacted as the value of growth options broadly declines as more present and future rents are extracted by the stronger competitors.

While declines in performance are the baseline prediction under substitution, we note two additional theories that might impact investment specifically. First, the "escape the competition hypothesis" of Aghion et al. (2005) predicts that public firms may increase their investments in the face of competitive threats even as their accounting performance declines. Second, the killer acquisitions hypothesis of Cunningham et al. (2021) predict that increased substitution threats might induce more acquisitions under the substitution thesis, as large public firms might seek to shut down the newly empowered small public rivals. We consider the baseline prediction and the additional theories of investment and acquisitions and summarize the substitution hypothesis as follows:

Hypothesis 2 [Substitution]: Positive shocks to private firms will negatively affect larger public firm performance in related product markets. Performance in the form of sales and profits will decline. Investment will also decrease as the relative value of related growth options declines. Regarding investment, two alternative hypotheses are:

Hypothesis 2a: Innovative investment might increase as affected public firms might incrase innovative investment to build barriers to entry and "escape competition".

Hypothesis 2b: Acquisitions by public firms of private firms will increase as "killer acquisitions" can eliminate the increased competition.

The extent to which a private firm is more complementary or a substitute with respect to a focal public firm likely depends on the private firm's product market position relative to the focal firm's most significant competitors (other public firms in the same market). For example, Apple would be particularly interested in private firms that develop technology highly relevant to Google and vice-a-versa, as internalizing this technology might help Apple to develop a stronger position to better compete with Google. Hence overall we examine the consequences of shocks to two categories of private firms: (A) a narrow set of private peers that are most similar to the focal public firm itself (own rivals) and (B) a broader set of peers that are most similar to the public competitors of the focal public firm. In the context of public firms alone, (Hoberg and Phillips, 2010) provides much motivation for examining these economically distinct sets of peers. We consider the final Hypothesis 3:

Hypothesis 3 [Near vs Far Private Rivals]: Positive shocks to private firms will favor substitution (H1) when the private firms are most similar to the focal public firm (own peers) but will instead favor complementarity (H2) when they are instead most similar to the most significant public competitors of the focal public firm.

The prediction of complementarity for the rivals of public competitors is particularly salient in innovative settings. In particular, more successful private rivals to a firm's most significant competitors offer valuable opportunities to strengthen the focal firm's competitive position relative to its most significant product market threats. By acquiring these private firms, the focal firm could improve barriers to entry and potentially increase market share through more comprehensive and higher quality products relative to its competitors. In innovative markets, these benefits are often more easily scaled quickly from the small impact of the private firm to the larger market impact of large public firms.

A final important note is that specific shocks to private firms can be quite different depending on their specific treatment effects. Hence we study two shocks, one focusing on the incentives to innovate specifically (innovation shocks), and one focused on liquidity and demand but not innovation specifically (non-innovation shocks). Because innovation can create new products and opportunities, it is possible that these shocks might have different impacts regarding the above hypotheses. Testing these heterogeneous shocks through this lens is a core objective of this study. We indeed find heterogeneous affects as innovation shocks favor complementarity and non-innovation shocks favor substitution.

Overall, little is known regarding the potential validity of these hypotheses given data limitations. The consequences are policy-relevant given the plethora of policy initiatives to support smaller private firms, and the dearth of knowledge of their impact on the larger public firms in the economy. Our hypotheses are general and motivated from seminal theories. It is thus an empirical question whether any specific shock favors complementary or substitute impacts on public firms.

3 Data and Methods

3.1 Web-based Product Market Peers & website Embeddings

We use and extend the foundational network of web-based private firm peers that was developed by Hoberg et al. (2024) (henceforth HKP24). In this expanded network, we include all firms with 25 employees or more, including firms that expand to 25 employees in their earlier years. We extend this database by expanding its time series to include years from 2000 to 2021. We also expand its cross-sectional coverage of URLs to include all URLs from Compustat, Capital IQ, and Orbis (original database) and also include private firms from Venture Expert and Preqin.[6] We refer to this extended database as the WTNIC database (Web-based Textual Network Industry Classification). We briefly summarize the methodology here but refer readers to the above study for details.

WNTIC is constructed by following five steps. The first is to gather the universe of URLs from all of the above databases, clean them to only include the root domain (the first part of any URL that does not include any forward slashes). The second step is to query the Wayback Machine once per URL x year, and extract each website's latest snapshot in each calendar year. This step is completed by then downloading all verbal content from these website snapshots up to three levels of depth (sub-URLs with no more than 3 forward slashes). The website text is then purged of html tags and images to only include verbal content using Beautiful Soup.

The third step is to train a doc2vec embedding model separately for each year, where the websites from the universe of public firms plus 32,000 private firms are used for training. We use a Doc2vec dimensionality of 300, with each website in each year is represented spatially as a 300-element vector. The pairwise similarity between the two firms in a given pair is then the cosine similarity between the two vectors of the two firms. Because websites contain much content that is not about the products the firm sells, and because such website

[6] Firms with fewer than 25 employees are unlikely to be on a growth path and including more would result in scalability challenges as the existing sample already requires trillions of pairwise similarity calculations and adjustments that take months to run even with parallel processing on a well-equipped University server.

content has a strong "verbal factor structure", a fourth step is required to purge the resulting similarity scores of non-product content. This is done using a pairwise regression-based approach to purge the pairwise scores of the non-product content (see HKP24 for detailed documentation). The result is a set of pairwise similarity scores purged of non-product content for every permutation of public and private firms in our sample of URLs in each year.

The fifth and final step is to condense the resulting trillions of pairwise similarities over the 22-year sample. There are three types of pairwise similarities: public-to-public, public-to-private, and private-to-private. This study focuses on the public-to-private similarities. Due to the large number of these observations, we sort the pairwise similarities in each year and take only the top 1%. This level of granularity is similar to that of four-digit SIC codes. We classify the resulting 1% of pairs as "product market peers," and this constitutes the public-to-private WTNIC database. The database consists of a gvkey for the public firm in the pair, a URL for the given private firm in the pair, and a pairwise similarity score. The private firms can then be linked back to the underlying databases (Capital IQ, ORBIS, Venture Expert, or Prequin) by using the URL as the crosswalk.

3.2 Private Firm Innovation Shocks and Non-Innovation Shocks

We measure private firm innovation and non-innovation shocks at the state-year level. For innovation shocks, we first obtain measures of the user-cost of R&D from Bloom et al. (2013).[7] The core variation in this measure relates to R&D tax credits, which experience significant variation throughout our sample and that are plausibly exogenous from the perspective of a public firm that is not in the same state as the private firms being "treated" by time-varying tax breaks for R&D spending. We invert the sign of this variable for ease of interpretation, making its intuition as a form of plausibly exogenous variation in private firm incentives to conduct R&D. As noted later, to ensure variation is just driven by changes in tax incentives (plausibly exogenous) and not changes in peer composition over time, we hold fixed each public firm's peers based on the first year of our sample when constructing both shocks. We also avoid contamination to the public firm in each public-private pair by only considering private firms that are located in a different state than the focal public firm. For each state

[7] We thank the authors for sharing an extended version of this database through 2016 on their websites.

in each year, we thus have a measure of R&D incentives for private firms operating in the state.

We measure positive non-innovation-focused shocks using state-level annual real estate price changes from the Federal Housing Finance Authority (FHFA), which are available at the state-year level during our entire sample from 2000 to 2021. The primary impact of high residential real estate price appreciation on a private firm is likely to manifest through either (or both) of two specific channels. First, higher real estate prices in a region can improve liquidity as the firm's owners can raise additional capital using their home as collateral. Second, higher real estate price appreciation can affect private firms due to the existence of local state-wide demand shocks (or local economic booms that increase both home prices and local product demand). Our thesis incorporates either view, as we label this shock as a non-innovation-focused positive shock, i.e., it benefits private firms in a region primarily via primitive gains that are not directly tied to innovation as was the case for the R&D shock noted above. To the extent that increased collateral or cashflows from higher demand can facilitate innovation, this too would be part of the treatment effect of such shocks that we will examine. Yet our own thesis goes the other way, as primarily non-innovation positive shocks (to either cashflows or liquidity) can empower the private firm peers to become more aggressive in the product market, moving their products closer to becoming substitutes to the existing public firm products. Our results support this negative view and are not consistent with real estate shocks primarily acting as exploratory innovation shocks.

For both shocks, we only assess the impact of private firm peers located in different states than where the focal public firm is headquartered. This helps to ensure these shocks are plausibly exogenous from the perspective of the focal public firms in our sample, which are in different states and not directly impacted by these shocks.

As our goal is to assess the impact of private firms on public firm investment and outcomes, we next aggregate these shocks over the set of private firms operating in related markets for each focal public firm. To do so, we simply average both shocks (which exist at the private firm-year level) over all of the private firm peers that are 1% granularity peers to the focal public firm (excluding private firms located in the same state as the focal public firm). Because 1% granularity is fine (similar to 4-digit SIC codes), this first version of our measure focuses on the narrow band of mist similar private firms for each focal public firm.

We next compute a "broader version" of these shocks that focus on a broader set of private firms that are also specifically relevant to the focal firm's most significant competitors (other public firms in its markets). We compute this version in two steps. First, we average these same quantities over the 5% granularity WTNIC private peers for each public firm in our sample. We then average the result across the 5% granularity WTNIC public peers around each focal public firm. We compute these two variables in a rather stark narrow fashion for own-private-peers and a broad fashion for public-competitor's-private-peers to leverage theoretical predictions about substitution (most predicted for the most narrow and most highly similar competitors relative to a focal firm) and complementarity (most predicted for broader peers having technologies related to the focal firm but not identical). The granularity of the resulting narrow own-firm measure is similar to 4-digit SIC codes (which have approximately 1% granularity). The broader peers-of-competitors measure is similar to 2-digit SIC codes, which have approximately 5% granularity.[8]

An important fine point is that averaging shocks over these sets of private peers over time (our goal is to run analysis in a standard public firm panel database with firm-year observations so this calculation must be done yearly) can generate variation from two sources: (A) the shock itself (changes in a state's R&D tax credits) or (B) changes in the set of peers themselves from year to year as private firms enter and exit. Importantly, only the first source is plausibly exogenous as entry and exit are significant endogenous decisions. We thus fully shut down this second channel by fixing the set of private peers for each set of peers used to compute the average shocks based on the first year values. For example, if a firm has 24 private peers in the first year of our sample, we compute our shock variables by averaging the tax credit variables over the same distribution of 24 states over all years of the sample for each given public firm's calculation. Hence the second channel (B) is fully eliminated in this calculation and our treatment variables are pure derivatives of variation in either R&D tax credits or real estate prices. A result is that our framework can be viewed as a pure "intent to treat" framework where we focus on the exogenous variation alone and naturally avoid conditioning on actual outcomes when computing our key RHS variables. Yet we note that our results obtain regardless of whether we purge this endogenous channel, although they are slightly stronger if do purge the endogenous content relative to a robustness test

[8]Following Hoberg and Phillips 2016, granularity is the odds that two randomly drawn firms are in the same classification such as a 2-digit SIC code.

where we do not. Hence the plausibly exogenous variation in our core treatment variables is key to our reported results.

Overall we will document modest results for the narrow own-firm measure and strong results for the broader competitor shocks in our main analysis. This indicates strong positive spillovers for complementary product market positioning of private firms. Further robustness explorations reinforce the importance of focusing on private firms that are peers to the focal firm's public rivals, suggesting that complementarities that can improve competitive positioning are particularly important in value creation. These results offer important implications for regulators attempting to boost success rates of smaller private firms, or entrepreneurs and venture capitalists seeking the best odds of success and material market-impact from their investments.

4 Descriptive Information and Validation

Table 1 displays the top ten most related domestic private firms for 20 well-known public firms.

Insert Table 1 here

The examples in Table 1 are intuitive and well-illustrate the sometimes-competitive and sometimes-complementary nature of smaller public firms that are similar to these large public firms and also why many might be relevant acquisition candidates when they receive positive innovation shocks through R&D tax credits providing incentives for them to increase innovation. For example, the most similar private firm to Apple is elgato.com, which primarily produces complementary products to Apple. Elgato is a company that sells a collection of hardware devices such as computer cams, a light that can be attached to a computer, wire devices, and teleprompters. These devices do not directly compete with Apple's offerings but are generally seen as complementary devices that make the experience of using Apple's products better.

Another example of a purely complementary relationship is General Dynamics' nearest private peer firm, aerosimulation.com. This company provides flight simulation services to train pilots, whereas General Dynamics manufactures airplanes through the Gulfstream brand. Carnival Cruise's most similar peer is also complementary as it is a travel agency focused on cruises, a business that is likely built around the potentially lucrative market of marketing cruises to various audiences. This relationship is also unambiguously complementary, as both parties benefit when there are positive shocks to travel agencies. As with the prior examples, any significant innovation on the part of this company could make it an acquisition candidate for Carnival, which might be able to quickly scale up the business (or public firms in this situation might simply copy the new technology if it is not protected). Blackrock's nearest peer, Numerix, is also complimentary as it provides risk management technology to investment firms.

Yet, not all peers are complementary. Boeing's nearest peer, boomsupersonic.com, produces supersonic aircraft, a product that is arguably more of a substitute than a complement to Boeing's aircraft offerings. Similarly, CVS' closest private peer is Maxor, a competing pharmacy company. Also, Markel Group's nearest peer is allrisks.com, and both are insurance companies. Yet, although these companies are generally positioned as substitutes, they nevertheless could become relevant acquisition candidates should any of these companies increase their innovativeness. The public firms might acquire them or simply adopt the new technologies without acquisition if the technology is not protected. Both mechanisms are elements of our thesis. Overall, the relative size between the large public firm and the average private firm in our sample is substantial, and thus, the public firm in such pairs can generate significant synergies by scaling up any innovation produced by its smaller private peers, making these complementarities valuable. The intellectual foundation behind this kind of innovation synergy, as is the case for the complementary peers noted above, obtains from Phillips and Zhdanov 2013's theoretical model, suggesting that larger firms can benefit from outsourcing some innovation to smaller private firms, which might be more agile. They later become acquisition candidates.

The examples also illustrate that, in rare cases, unintended peers entered our database. For example, airbus.com appears as a peer to Boeing. This company is neither private nor a U.S. domestic company. Yet Airbus does have locations in the U.S. including manufacturing facilities, indicating why it might appear in the Capital IQ or Orbis databases with a U.S. address (as is required to be in our sample). It was also not filtered out as a public firm because airbus.com does not appear as a public firm URL in the Compustat database. We note that we simply chose 20 intuitive examples to display in Table 1 as we wish to document both strengths and weaknesses in our approach. Yet, in reviewing the list of peers in this table, we believe that the error rate is very low.

Insert Table 2 here

Table 2 summarizes the total number of private firm peers in the full extended WTNIC database. The first column shows the number of URLs with a valid snapshot present on the WayBack Machine each year. Counts range from a quarter of a million in the early years of our sample to over a half-million peers in the middle of our sample. The second column reports the number of peers for which we have a valid U.S. state address, a necessary condition to be included in our final sample as we use state information to compute our key innovation and non-innovation shock variables. The third column summarizes the fraction with state information, and this ranges from 35% to just over 50%, with a higher fraction earlier in our sample. These trends are consistent with less important peers having somewhat lower coverage in earlier years, a pattern seen in many financial databases. We note that our results are robust if we run our analysis in the first half or second half of our sample, indicating that it is unlikely to produce bias.

Insert Table 3 here

Table 3 documents the cross-sectional coverage of our final WTNIC database, which we use to construct our main shock variables. It reports the average number of both private peers and public firms for each Fama-French-12 sector in our final sample. The third column reports the ratio between the two and indicates that our final sample of private peers is significantly larger than the sample of public firms itself, and the ratio of private firms to public firms varies by industry. For utilities where private firms are least prevalent, the ratio of private to public is just 14.4x. For consumer non-durables where private firms are most prevalent, this ratio is 156.5x. Overall these high ratios indicate that we have a large sample of private firms in many sectors and we should have high power to test our hypotheses.

4.1 Public Firm Investment and Outcomes Database

We start with all public firms in the Compustat database from 2000 to 2021. We drop observations with missing assets or assets less than $1 million and retain those that are in the WTNIC database (they have a valid URL and an available WayBack Machine snapshot) in year $t-1$ (we lag all RHS variables). We also exclude firms that do not have a valid CRSP permno in the merged CRSP Compustat database and that are not in the TNIC database of Hoberg and Phillips (2016), these last steps ensure that we focus on firms that are definitively publicly traded and that are domestic U.S. firms (our results are fully robust if we skip this last step). There are 89,985 observations in our final sample. Table 4 displays summary statistics for our key variables.

Insert Table 4 here

Panel A of Table 4 presents summary statistics for our WTNIC variables, including our innovation-focused R&D Shock and our non-innovation-focused Real Estate Shock. We also report the average log of each focal firm's private firm peer website size (we use this variable in a two-stage IV regression later) and the total similarity of each firm's private rivals as measured in the WTNIC database. All variables have minimum and maximum values that are not extreme relative to the mean and standard deviation, indicating an absence of outliers and there is no need to winsorize these variables.

Panel B displays summary statistics for our standard firm-year corporate and investment variables widely used in the existing literature. All financial ratio variables are winsorized at the 1/99% level. The number of acquisitions and divestitures are from the SDC Platinum database and are also winsorized. The average firm year in our sample has 0.33 acquisitions and 0.18 divestitures. We identify the number of patents for each firm in each year from Kogan et al. (2017).

Table 5 displays Pearson correlation coefficients for our key variables.

Insert Table 5 here

Table 5 shows that our two shock variables, *Private Rivals R&D Shock* and *R.E. Shock*, are 16% and 27% correlated for the narrow own-firm private firm shock and the broad public-competitors private firm shock, respectively. These modest correlations indicate an absence of multicollinearity when we include both in regressions. We also note that the R&D Shock and the real estate shock often have different magnitudes or in some cases opposite signs in how they correlate with economic variables such as sales growth and fluidity. This foreshadows a major conclusion we draw later in that innovative shocks are quite different in their impact as compared to non-innovative shocks. However, we note that Table 5 correlations are only univariate associations, and our later results are formal as they control for firm and year fixed effects and controls.

4.2 Validation of Private Firm Tests

We construct two plausibly exogenous variables that measure shocks to the private firm peers of focal publicly traded firms. The first is based on R&D tax credits and is a shock specifically to the innovation incentives of these private firms. The second is based on home price appreciation, and we view this shock as a non-innovation-based shock to these private peers (this shock is rooted either in liquidity or demand, as discussed earlier).

We consider an important validation test in this section. If our interpretation of these shocks as primarily innovation-based and non-innovation based is correct, we should observe that the first shock specifically shifts the treated private firms to increase their innovation. The second shock, being non-innovation-based at its roots, should have a much smaller effect on these private firms' innovation. Note that we do not expect zero impact on these private firms' innovation levels because liquidity or demand shocks can also stimulate some increased investment in innovation through the alleviation of financial constraints channel or the demand-induced growth-option to innovate channel. In conclusion, crucial for this validation is that the first shock should strongly and positively predict innovation, and the second should much more weakly positively predict innovation.

Although we do not observe the actual spending on innovation for these private firms, we do observe the number of words in their websites. Because growth in a specific firm's website is likely a direct indicator of innovation (Hoberg and Phillips (2010) use this approach for 10-Ks to model innovation in the form of mergers synergies), we consider a regression of the average website size of the focal firm's private peers on the key RHS variables (the two shocks). We also include firm and year fixed effects and controls for size and age. We display the results in Table 6.

Insert Table 6 here

The table shows that the ex ante Private Rivals R&D shock very strongly predicts the ex post average size of the private peer's websites. The t-statistic is 22.8, indicating that the R&D tax credit shock indeed is a strong shifter of innovation investment by the treated private firms. The table also shows that the ex ante Private Rivals Real Estate Shock only weakly predicts ex post private firm website size. Here the t-statistic is only 3.11. Because we standardize the RHS variables in this regression prior to running the regression, we can also compare the coefficient magnitudes. The table shows that the R&D shock's coefficient (0.031) is 15 times larger than the Real Estate shock's coefficient (0.002). This confirms that not only is the R&D shock statistically far more important to innovation, but it is also economically much larger. We conclude that our interpretation of these two shocks as being innovation-based and non-innovation-based is validated.

5 Economic Results

5.1 Regression Methodology

In this section, we directly examine the impact of positive innovation-focused and non-innovation focused private firm shocks on their public firm peers. As discussed earlier, we construct these shocks using plausibly exogenous variation relating to R&D tax credits and the price appreciation of residential real estate, both measured in the states where private firms are located. To further ensure the variation is plausibly exogenous, for each focal public firm in our sample, we ensure that these shocks are measured only using private firms located in states other than the state where the public firm is headquarted. In addition, we lag all RHS variables including these two shock variables to ensure all are measurable by year t, and predict ex-post outcomes in year $t+3$. We consider three year outcomes as we expect the full effects of private firm shocks materialize over some time. Yet we also report results for $t+1$ (one-year outcomes) in the Online Appendix. These results are robust but slightly weaker as expected. We cluster standard errors by firm and hence are not exposed to any potential bias in standard errors due to overlapping windows. In all of our regressions, the dependent variable is the focal public firm's investment or outcome variable and the panel is a pubic-firm x year panel. We include firm and year fixed effects in all regressions as well as controls for log size and log age.

5.2 Baseline Results

Our first test examines the unconditional impact of both innovation and non-innovation shocks on public firm investment and outcomes. The results for firm investment and innovation are displayed in Table 7. As we do for all tables, we report results for narrow own-firm private firm shocks in Panel A, and broad shocks to the private rivals of the closest competitors in Panel B.

Insert Table 7 here

We first focus on the innovation-focused private firm shock, which is the variable "Priv Rivals R&D Shock". We immediately observe one of the more important conclusions of our study by comparing Panel A coefficients with Panel B coefficients. We broadly find moderate results for own-firm private firm shocks in Panel A, but very strong and consistent results for major rival private firm shocks in Panel B (especially when we later examine results for small vs large firms). The weaker but sometimes-significant results for own-firm private peers in Panel A are consistent with very similar peers being positioned relatively more as substitutes than complements, and positive shocks to them negatively impacting the focal public firm. Yet, on the other hand, these private firms do not always operate in precisely the same markets as the focal public firm, and thus might also offer differentiated products, and hence some complementarities as well. The confluence of these competing effects likely results in the small or insignificant results in Panel A.

We significant results in Panel B. The first column shows that ex-ante shocks to the innovation incentives of competitor private firm peers do not significantly impact acquisitions in the full sample, but we do find significantly fewer divestitures. We also observe insignificant impact on R&D/assets (we show later this is due to heterogeneous effects for large and small firms) and increases in patents/assets. These results indicate significant and positive complementarities. Finally, the last column in Panel A shows that public firms in markets where private firms realize innovation shocks also weakly increase their use of non-compete agreements. This result suggests that these spillovers are not without competitive threats as non-compete agreements indicate more proactive competition management. Overall, the results indicate strong and consistent positive spillovers.

The results for the non-innovation shock in Panel B (second row) show very different results relative to those in the first row for innovation shocks. We observe significant reductions in acquisitions and significant increases in R&D. These results are consistent with the escape-competition hypothesis as innovative investment increases despite overall results favoring substitution and Hypothesis 2 (especially our performance outcome findings below). The reduced acquisition activity also supports reduced activity levels predicted by substitution.

Panels A and B of Table 8 analogously display performance outcomes for own-private-peers and rival-private-peers, respectively. We continue to find weak and mostly insignificant results in Panel A. We find strong performance results in Panel B. We thus focus our discussion on the Panel B findings.

The results in the first row of Panel B of Table 8 are stronger and we find that innovation-focused shocks to private peers result in higher ex post profitability (ROA), sales growth and asset growth. These results are highly significant, consistent with the high statistical power obtained from such a large number of private firms in our sample. The results overall show that private firm innovation shocks generally bring consistent and material improvements not only to investment but also to performance. This favors hypothesis H1 and complementarities.

The second row of Panel B of Table 8 displays results for the non-innovation focused private firm shock. We find diametric-opposite findings for the non-innovation shock (real estate prices) compared to the innovation shock (R&D tax credits). Because these variables are only modestly correlated, we note that these results are robust to including both in the regression separately. The non-innovation shock leads to lower ROA, lower asset growth, and increased competitive threats in the form of product market fluidity. These results point to negative outcomes consistent with the substitution hypothesis H2. Moreover, the increased competitive threat (product market fluidity) finding is particularly consistent with substitution as competitive threats are a rather direct mechanism for substitution effects.

Overall our baseline findings support the conclusion that innovation-focused shocks to private firms lead to positive complementarities along many dimensions. However, policies aimed at supporting private firms, but not through innovation incentives, are less likely to have positive multiplier effects on public firms. On the other hand, positive non-innovation-focused shocks have the opposite effects and lead to increased substitution between public and private firms. Policies aimed at improving non-innovation gains for smaller private firms are thus less likely to result in multiplier effects and might have more modest impact on overall growth. To further understand the mechanisms behind these effects and understand where complementarities versus substitution arises, we next explore a number of theoretically motivated subsamples including large versus small firms, young versus old firms, and fluid versus non-fluid firms.

5.3 Large versus Small Firms

We next explore the impact of these shocks on smaller versus larger publicly traded firms. Given that much of our thesis rests on ideas rooted in complementarities, innovation and acquisitions, we expect these subsamples to generate novel insights. For example, larger public firms have particularly strong incentives to acquire new technologies as they can more easily scale the benefits to a much larger market, generating potentially large synergies. Smaller public firms, on the other hand, might not be the "best buyers" of such firms but instead might be more agile, and might realize organic innovation spillovers through increased R&D.

In each year, we sort our sample of public firms by lagged assets and define large (small) firms as those with above (below) median assets in the given year. We then rerun our baseline model in Tables 7 and 8 after adding interactions between the large and small firm dummies and the two private firm shocks. The results are presented in Table 9 and 10 for investments and performance results, respectively.

Insert Table 9 here

Table 9 examines investment and shows that the impact of the private firm innovation shock is quite different for large versus small public firms. As was the case for our baseline results, we see much stronger results in Panel B regarding broader shocks to the private firm peers of a large competitors than we do for the focal firm tests in Panel A. For example, Panel B shows that smaller public firms increase R&D and patenting, and reduce the rate of acquisitions and divestiture. This indicates a pattern of organic investment spillovers and retention of existing assets to facilitate the growth.

Most novel, and perhaps most important, we find strong and different results for larger public firms as they significantly increase acquisitions (t-statistic 3.3) while reducing divestitures (t-statistic -2.6). These results support central aspects of our thesis as large public firms are likely the "best buyers" of new products, features, and technologies that private peers might invent, and rents to "scaling" these features are likely to be large. These results are also consistent with Phillips and Zhdanov (2013) and the outsourcing of innovation by large firms to highly agile and incentivized startups that can later be acquired. Consistent with merger synergies driving innovation at these firms and a strong focus on inorganic investment, we find they also reduce organic R&D spending. Yet they patent more indicating an important role for the acquired assets. This is consistent with higher innovative efficiency of the acquired technology relative to organic R&D.

Finally, it is further interesting that these large firms also increase the usage of non-compete agreements following these shocks. This intuitive result further supports the conjectured mechanisms as it would be important for these public firms to ensure that the acquired assets are optimized and protected from leakage to competitors. These agreements ensure that employees stay on to implement the scaling of the synergies. The importance of this result is underscored by the fact that Panel B shocks are to the private firms that are specifically peers to the focal firm's major public competitors. Indeed these public competitors would have incentives to hire away these innovators. While a formal assessment of labor outcomes is beyond the scope of the current study, we believe these results motivate more research on innovative labor allocation and entrepreneurship in these markets.

Overall regarding the innovation shock, the results suggest that large firms internalize the significant innovation complementarities primarily through acquisition, and they protect these gains using non-compete agreements. Smaller firms are not competitive as acquirers but instead expand innovation investments organically through R&D. Both small and large firms then patent more. These results are consistent with Hypothesis 1 and smaller firms expanding organically (H1A) while larger firms primarily through acquisitions (H1B). In both cases, the impact of the private firms is as complements and not as substitutes (as will be further echoed in our performance analysis).

Results are less striking but quite different for the real estate shock. Large firms significantly curtail acquisitions but increase R&D. Small firms also increase R&D. When viewed alongside the negative performance results for this shock, the higher R&D is consistent with the escape competition hypothesis and is likely intended to rebuild barriers to entry. The generally modest results for the real estate shock on investment, and the stronger results for performance (reported next), are consistent with substitution and a general shrinkage of opportunities.

Insert Table 10 here

Table 10 examines the performance consequences for these same large and small public firms. We again focus on Panel B where the results are significantly stronger. Our performance results further support Hypothesis 1. Both small and large firms experience sales growth, asset growth, and improved profitability over our three year horizon (although the profitability results are not significant for small firms). These results are not consistent with substitution, which would predict decreasing performance. Regarding competitive positioning, large firms do not experience significant changes in total similarity although smaller public firms experience an increase. This suggests that the acquisition-based approach is likely most conducive to rapid and large gains from complementarities that are generally protected from competitors. Smaller firms experience gains in performance but the increased similarity is consistent with an "emulation-based" innovation strategy that does not result in reduced total similarity. A consequence is higher sales but no corresponding gains in the relative profitability of the expanded business.

In contrast, the real estate shock results favor Hypothesis 2 and decreased performance, and generally a weakening of competitive positioning. Indeed both large and small firms experience lower profitability and declining assets. Both also experience very significant increases in competitive threats (fluidity). Results are mixed for sales growth and total similarity, with larger public firms faring worse on both metrics. Hence overall negative impact is more significant for larger firms.

Overall we conclude that results are quite different for the innovative shock (R&D tax credits) versus the non-innovation shock (local real estates prices). The former strongly generates complementary gains across public firms, who use different strategies to harvest the gains depending on their overall size and scale. For non-innovation shocks, we generally observe substitution effects, especially for larger public firms as they experience losses in performance on all dimensions. Yet they also increase innovative spending to some degree, likely consistent with some offsetting effects relating to the "escape competition" theory of Aghion et al. (2005). Smaller public firms experience less severe substitution effects.

5.4 Old versus Young Firms

We next explore the impact of these shocks on younger versus older publicly traded firms. This is a potentially important test as younger firms might be more agile in these shock-based settings, but on the other hand, older firms might have more established barriers to entry. In each year, we thus sort our sample of public firms by firm age and define old (young) firms as those with above (below) median age in the given year. We then rerun our baseline model in Table 7 after adding interactions between the old and young firm dummies and the two private firm shocks. The results are presented in Tables 11 and 12.

Insert Tables 11 and 12 here

To make the exposition more concise, we discuss the results at a high level relative to our baseline tests and our small versus large firm tests in the last section. The most significant conclusion that arises from comparing the young versus old firms across both panels, across both shocks, and for innovation and performance, is that firm age is a far less important consideration than is firm size. The results for size were stark and highly significant indicating sharp differences in business strategies following shocks and rather sharp differences for large and small public firms. For young verses old firms, we only note a few nuanced differences that we believe are overall less consequential.

One material difference is, following the non-innovative shock in Panel B, younger public firms more aggressively increase R&D consistent with the young firm agility thesis. A second result in Panel B is that older firms are more impacted regarding profitability for both shocks. They have larger increases following the innovation shock and larger decreases following the non-innovation shock. These results are consistent with life cycle effects where profits from mature assets-in-place are a larger fraction of the firm's value-generating process as compared to growth options. Most other differences across young and old are not significant although some are suggestive. For example, older firms tend to use non-compete agreements slightly more, but this difference is not significant.

Overall we conclude that firm age is not as important as firm size as a moderator of our results.

5.5 Firms in Fluid vs non-Fluid Product Markets

We next explore the impact of these shocks on firms in more dynamic fluid product markets (Hoberg et al., 2014) relative to those in less fluid product markets. This is a potentially important test as business strategies can be quite different, especially regarding growth option impact versus assets in place. In each year, we thus sort our sample of public firms by product market fluidity and define high (low) fluidity subsamples as those with above (below) median product market fluidity in the given year. We then rerun our baseline model in Table 7 after adding interactions between the high and low firm dummies and the two private firm shocks. The results are presented in Tables 13 and 14.

Insert Tables 13 and 14 here

As in the last section, to make the exposition more concise, we discuss the results at a high level relative to our main result baseline tests and our strong small versus large firm tests. The most significant conclusion that arises from comparing the high versus low fluidity firms, across both shocks, and for innovation and performance, is that (like firm age) the innovativeness of the industry is less important than firm size. Yet, though less important than size, innovativeness does have some impact. We do note two material differences below that are important results in their own right.

The first material difference across the two groups is that the acquisition results are primarily found in the high product market fluidity subsamples. For the innovative shock in Panel B, the acquisitions coefficient is only significant and positive for the high fluidity group. For the non-innovation shock, the negative impact on acquisitions is 4x larger and only significant for the high fluidity subsample. Although these results are mainly suggestive, they indicate that our broad support for the outsourcing of innovation hypothesis (Phillips and Zhdanov, 2013) is intuitively most important in more innovative fluid markets.

The second material result is in Panel B of Table 14 for the non-innovation shock. We generally find that firms in more innovative markets with higher fluidity experience more severe negative impacts on performance than do firms in lower fluidity markets. This suggests, consistent with intuition that product market fluidity indicates a sensitivity to competitive threats, and hence substitution effects are more important. These results are also consistent with weaker barriers to entry in high fluidity markets as suggested by Hoberg et al. (2014).

We conclude that the impact of fluid markets is important and new insights emerge regarding acquisitions and potentially barriers to entry. Yet these differences are not as stark as are the results for small versus large firm size.

6 Robustness and Two-Stage Tests

Our main results indicate strong evidence that private firm peer innovation shocks result in strong complementarities for public firm peers, especially larger firms in technology markets. In contrast, non-innovation-focused shocks lead to substitution effects and poor performance by public firm peers, especially larger firms. In this section, we examine the robustness of these findings.

6.1 Shorter Horizon

Our baseline effects examine three-year investment and performance results following private firm shocks. This horizon is theoretically motivated by the fact that the impact of new innovation and business strategies likely takes a couple years to materialize. Nevertheless, many studies in corporate finance find faster results as many firms are quite agile. In addition, some anticipation might accelerate impact. We report results for one-year ex-post outcomes for our baseline regressions and also for our key results regarding large versus small firms in four Online Appendix Tables IA1 to IA4. To avoid excessive exposition, we highlight differences at this shorter horizon relative to the baseline.

We note three key observations. First, most results remain statistically significant with the same sign at these one year horizons, indicating robustness overall. Second, we find novel results for profitability at the one-year horizon that are consistent with adjustment costs for smaller firms following the innovation shock. In the immediate first year after the shock, these firms experience negative impact on profitability as they ramp up their organic investment. Yet these lower profits essentially are transient "adjustment costs" as profits begin to increase by year three as shown in our main results. Larger firms, on the other hand experience insignificant impact on profitability in the first year, and then substantially positive impact by the third year indicating much smaller adjustment costs for larger firms. The final observation is that small firms facing non-innovation shocks experience a short term decline in acquisitions in the first year only. Larger firms experience this decline both in the first year and also in the third year.

Overall our results are robust to shorter horizons but yet we note additional results of interest when comparing long versus short horizons.

6.2 Two-Stage Models

Our main tests in Table 7 and the corresponding subsamples utilize plausibly exogenous shocks, and we find strong results regarding complementarity and substitution, as noted above. These tests are done using a reduced-form one-stage model. In this section, we explore whether results are similar using a two-stage instrumental variables model.

In order to do so, we first need to clarify that, from the perspective of our innovation-focused private firm shock, this plausibly exogenous shock is a shifter of private firm innovative output. In particular, our mechanism posits that the private firms increase their exploratory innovation following the R&D tax credits being increased, and in turn, this induces complementarities on the related public firms. In order to build the two-stage model, we thus need a measure of the endogenous innovative output of the private firms that are treated by the shock.

We measure exploratory innovation using the number of words in the private firm websites. Intuitively, a private firm investing in innovation will develop new products or features, and a consequence is that its website will increase in size and richness. To aggregate website size over the private peers of each public firm, we simply average the website size over the given private peers of each focal firm (following the same methods as used to build our shock variables).[9] We then take the natural logarithm of the resulting average to reduce the impact of outliers.

In our two-stage model, the first stage regresses the log average website size on the private peer innovation-focused shock variable. The precise specification is column (2) of our validation Table 6. This table shows that the innovation-focused shock is a very strong shifter of website size with a t-statistic of 22.8, indicating a strong effect.

Insert Table 15 here

Table 15 displays the second stage results where we focus on our most interesting results based on private peers of a firm's nearest public competitors. We regress our investment and performance outcome dependent variables on the instrumented private firm rival website size. The results in Panel A for investment variables and in Panel B for performance variables show similar results as our reduced form evidence presented earlier.

7 Conclusions

We use a large dynamic spatial network of over 500,000 public and private firms to examine how private firms impact publicly traded firms. This network captures inter-firm relatedness for both private and public firms. We examine how shocks to the private firms in this network impact public firm investment, profitability, growth, and acquisitions of private firms by public firms.

The spatial network is based on the newly introduced WTNIC website-based industry classification database. The database provides a dynamic spatial model of market structure covering the U.S. economy, and that includes all publicly traded companies with available website URLs along with over 500,000 private firms with valid URLs in each year.

[9]For example, we also exclude private firms in the same state as the focal public firm).

We use the spatial model to examine two plausibly exogenous shocks to the private firm peers in the same markets as each focal public firm. The first is based on R&D tax credits and is an innovation shock, and the second is based on real estate price appreciation and is a non-innovation-based shock. These shocks are calculated using shocks to related private firms that operate in states outside where the public firm headquarters is located. Such local shocks are likely to strongly impact the small private firms who concentrate their operations in each specific state.

We document that positive private firm innovation shocks (based on the R&D tax credits) benefit public peers consistent with complementarities. The impacted public firms realize improved profitability, sales growth, and investments including R&D. We also find that large public firms engage in more acquisitions of private firms following this shock, as predicted by Phillips and Zhdanov (2013)'s theory of large firms outsourcing innovation to smaller private firms. Small public firms decrease acquisitions and instead increase R&D to benefit from the complementarities using organic investment. These firms also perform well, but overall, large firms are the most significant beneficiaries. These results suggest that complementarities and positive spillovers arise in multiple forms following private firm innovation shocks.

In contrast, state-level positive real estate shocks, which improve the liquidity of private firms, negatively impact related public firms. Public firms decrease investments and perform poorly when private peers receive positive real-estate shocks. These results are consistent with increased competition for public firms from treated private firms as these shocks improve the liquidity and demand for the treated private firms. We also observe increasing competition for public firms from the private peers (measured as total product market similarity with peers).

Overall, these results suggest that innovation shocks increase private firm complementarity, whereas non-innovation demand or liquidity shocks indicate substitution, and enable private firms to challenge public firms as competitors. These results should prove useful to policymakers regarding incentives for small private firms to grow. Our results suggest that improving the incentives to innovate will create significant positive complementarities to the public peers of these firms, suggesting a positive economic multiplier effect to such policies. In contrast, policies that target small firm liquidity or that increase demand (such as economic stimulus) do not create analogous positive spillovers for public firms. Rather, these shocks increase competition for public firms.

We believe more research on how these shocks propagate through firm networks is needed and should prove fruitful, as well as more research exploring the efficacy of small-business policy initiatives.

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Table 1: Examples of top ten most similar websites to U.S. public firms (pg 1 of 4)

The table first reports the top ten most similar websites in 2021 to example well-known public firms.

Company Name	Company Website	Rank	Peer Website	Similarity
Apple Inc	apple.com	1	elgato.com	0.429
Apple Inc	apple.com	2	dashlane.com	0.427
Apple Inc	apple.com	3	intego.com	0.413
Apple Inc	apple.com	4	terracycle.com	0.410
Apple Inc	apple.com	5	moto.com	0.406
Apple Inc	apple.com	6	bittorrent.com	0.399
Apple Inc	apple.com	7	universalclimate.com	0.399
Apple Inc	apple.com	8	storedvalue.com	0.396
Apple Inc	apple.com	9	beatsbydre.com	0.392
Apple Inc	apple.com	10	revent.com	0.390
Barrick Gold Corp	barrick.com	1	apollogold.com	0.417
Barrick Gold Corp	barrick.com	2	twin-metals.com	0.373
Barrick Gold Corp	barrick.com	3	doerun.com	0.371
Barrick Gold Corp	barrick.com	4	aquilaresources.com	0.365
Barrick Gold Corp	barrick.com	5	sedgman.com	0.355
Barrick Gold Corp	barrick.com	6	easternresourcesinc.com	0.344
Barrick Gold Corp	barrick.com	7	hatch.com	0.338
Barrick Gold Corp	barrick.com	8	gsr.com	0.330
Barrick Gold Corp	barrick.com	9	vitgoldcorp.com	0.319
Barrick Gold Corp	barrick.com	10	theaureport.com	0.302
Blackrock Inc	blackrock.com	1	numerix.com	0.410
Blackrock Inc	blackrock.com	2	causewaycap.com	0.397
Blackrock Inc	blackrock.com	3	eqderivatives.com	0.386
Blackrock Inc	blackrock.com	4	kingstreet.com	0.364
Blackrock Inc	blackrock.com	5	smartstream-stp.com	0.353
Blackrock Inc	blackrock.com	6	fxcm.com	0.348
Blackrock Inc	blackrock.com	7	circleci.com	0.341
Blackrock Inc	blackrock.com	8	gatescap.com	0.332
Blackrock Inc	blackrock.com	9	kurtosys.com	0.331
Blackrock Inc	blackrock.com	10	liquidplanner.com	0.330
Boeing Co	boeing.com	1	boomsupersonic.com	0.582
Boeing Co	boeing.com	2	airbus.com	0.514
Boeing Co	boeing.com	3	airwaysmag.com	0.487
Boeing Co	boeing.com	4	motoart.com	0.486
Boeing Co	boeing.com	5	propilotmag.com	0.471
Boeing Co	boeing.com	6	speednews.com	0.466
Boeing Co	boeing.com	7	syberjet.com	0.461
Boeing Co	boeing.com	8	elitetraveler.com	0.451
Boeing Co	boeing.com	9	nextantaerospace.com	0.446
Boeing Co	boeing.com	10	evertsair.com	0.446
Carnival Corporation Plc	carnivalcorp.com	1	cruises-n-more.com	0.392
Carnival Corporation Plc	carnivalcorp.com	2	sailami.com	0.349
Carnival Corporation Plc	carnivalcorp.com	3	vacationstogo.com	0.341
Carnival Corporation Plc	carnivalcorp.com	4	islandwindjammers.com	0.326
Carnival Corporation Plc	carnivalcorp.com	5	gatewaytrvl.com	0.326
Carnival Corporation Plc	carnivalcorp.com	6	northsails.com	0.315
Carnival Corporation Plc	carnivalcorp.com	7	monroetravel.com	0.314
Carnival Corporation Plc	carnivalcorp.com	8	faredeals.com	0.312
Carnival Corporation Plc	carnivalcorp.com	9	prestigecruises.com	0.309
Carnival Corporation Plc	carnivalcorp.com	10	pathfinderstravel.net	0.308

Table 1: Examples of top ten most similar websites to U.S. public firms (pg 2 of 4)

The table first reports the top ten most similar websites to sample well-known public firms.

Company Name	Company Website	Rank	Peer Website	Similarity
Cvs Health Corp	cvshealth.com	1	maxor.com	0.485
Cvs Health Corp	cvshealth.com	2	optum.com	0.427
Cvs Health Corp	cvshealth.com	3	serve-you-rx.com	0.424
Cvs Health Corp	cvshealth.com	4	americanhealthcare.com	0.419
Cvs Health Corp	cvshealth.com	5	carecentrix.com	0.416
Cvs Health Corp	cvshealth.com	6	valuedrugco.com	0.404
Cvs Health Corp	cvshealth.com	7	worldcongress.com	0.399
Cvs Health Corp	cvshealth.com	8	aetna.com	0.396
Cvs Health Corp	cvshealth.com	9	cvs.com	0.394
Cvs Health Corp	cvshealth.com	10	medimpact.com	0.385
Dell Technologies Inc	delltechnologies.com	1	tig.com	0.475
Dell Technologies Inc	delltechnologies.com	2	cimasg.com	0.433
Dell Technologies Inc	delltechnologies.com	3	madeit.com	0.425
Dell Technologies Inc	delltechnologies.com	4	workspot.com	0.422
Dell Technologies Inc	delltechnologies.com	5	greenpages.com	0.421
Dell Technologies Inc	delltechnologies.com	6	redapt.com	0.420
Dell Technologies Inc	delltechnologies.com	7	inxero.com	0.420
Dell Technologies Inc	delltechnologies.com	8	allinestech.com	0.419
Dell Technologies Inc	delltechnologies.com	9	ndm.net	0.413
Dell Technologies Inc	delltechnologies.com	10	involta.com	0.413
Dish Network Corp	dish.com	1	sling.com	0.495
Dish Network Corp	dish.com	2	directv.com	0.471
Dish Network Corp	dish.com	3	directstartv.com	0.412
Dish Network Corp	dish.com	4	mlgc.com	0.403
Dish Network Corp	dish.com	5	xfinity.com	0.399
Dish Network Corp	dish.com	6	allconnect.com	0.397
Dish Network Corp	dish.com	7	etex.net	0.392
Dish Network Corp	dish.com	8	bctelco.com	0.389
Dish Network Corp	dish.com	9	secv.com	0.378
Dish Network Corp	dish.com	10	godish.com	0.372
Disney (Walt) Co	thewaltdisneycompany.com	1	vreg.com	0.483
Disney (Walt) Co	thewaltdisneycompany.com	2	nbcuniversal.com	0.475
Disney (Walt) Co	thewaltdisneycompany.com	3	unifiedpictures.com	0.436
Disney (Walt) Co	thewaltdisneycompany.com	4	henson.com	0.431
Disney (Walt) Co	thewaltdisneycompany.com	5	entertainmentbenefits.com	0.424
Disney (Walt) Co	thewaltdisneycompany.com	6	rsafilms.com	0.417
Disney (Walt) Co	thewaltdisneycompany.com	7	digitaldomain.com	0.415
Disney (Walt) Co	thewaltdisneycompany.com	8	alkemy-x.com	0.415
Disney (Walt) Co	thewaltdisneycompany.com	9	paragontheaters.com	0.413
Disney (Walt) Co	thewaltdisneycompany.com	10	swank.com	0.410
General Dynamics Corp	gd.com	1	aerosimulation.com	0.438
General Dynamics Corp	gd.com	2	gdmissionsystems.com	0.437
General Dynamics Corp	gd.com	3	elbitsystems-us.com	0.418
General Dynamics Corp	gd.com	4	dynetics.com	0.417
General Dynamics Corp	gd.com	5	ltc-ltc.com	0.416
General Dynamics Corp	gd.com	6	i3-corps.com	0.405
General Dynamics Corp	gd.com	7	pesystems.com	0.399
General Dynamics Corp	gd.com	8	ndieng.com	0.390
General Dynamics Corp	gd.com	9	linquest.com	0.386
General Dynamics Corp	gd.com	10	clearedconnections.com	0.383

Table 1: Examples of top ten most similar websites to U.S. public firms (pg 3 of 4)

The table first reports the top ten most similar websites to sample well-known public firms.

Company Name	Company Website	Rank	Peer Website	Similarity
Kraft Heinz Co	kraftheinzcompany.com	1	brfoods.com	0.281
Kraft Heinz Co	kraftheinzcompany.com	2	sfrindustries.com	0.278
Kraft Heinz Co	kraftheinzcompany.com	3	gehls.com	0.275
Kraft Heinz Co	kraftheinzcompany.com	4	frischs.com	0.275
Kraft Heinz Co	kraftheinzcompany.com	5	eggstrategy.com	0.273
Kraft Heinz Co	kraftheinzcompany.com	6	kerry.com	0.270
Kraft Heinz Co	kraftheinzcompany.com	7	nestleusa.com	0.263
Kraft Heinz Co	kraftheinzcompany.com	8	dennisexpress.com	0.262
Kraft Heinz Co	kraftheinzcompany.com	9	purestrategies.com	0.259
Kraft Heinz Co	kraftheinzcompany.com	10	qualitydairy.com	0.259
Lowes Cos Inc	lowes.com	1	keimlumber.com	0.481
Lowes Cos Inc	lowes.com	2	shadesoflight.com	0.481
Lowes Cos Inc	lowes.com	3	hollywoodhillsrehab.com	0.479
Lowes Cos Inc	lowes.com	4	alvarezhomes.com	0.479
Lowes Cos Inc	lowes.com	5	marvinsbuildingmaterials.com	0.473
Lowes Cos Inc	lowes.com	6	doityourself.com	0.454
Lowes Cos Inc	lowes.com	7	sterlingenergy.info	0.441
Lowes Cos Inc	lowes.com	8	madseninc.com	0.440
Lowes Cos Inc	lowes.com	9	kitchens.com	0.433
Lowes Cos Inc	lowes.com	10	ccair.com	0.432
Markel Group Inc	markel.com	1	allrisks.com	0.415
Markel Group Inc	markel.com	2	propertyandcasualty.com	0.366
Markel Group Inc	markel.com	3	seibels.com	0.362
Markel Group Inc	markel.com	4	amwins.com	0.356
Markel Group Inc	markel.com	5	jmwilson.com	0.354
Markel Group Inc	markel.com	6	hudsoninsgroup.com	0.352
Markel Group Inc	markel.com	7	stonepoint.com	0.352
Markel Group Inc	markel.com	8	westernlitigation.com	0.348
Markel Group Inc	markel.com	9	hilbgroup.com	0.341
Markel Group Inc	markel.com	10	thewrcgroup.com	0.337
Merck Co	merck.com	1	merck-animal-health-usa.com	0.371
Merck Co	merck.com	2	bioplusrx.com	0.359
Merck Co	merck.com	3	targethealth.com	0.356
Merck Co	merck.com	4	gumberg.com	0.336
Merck Co	merck.com	5	biospace.com	0.334
Merck Co	merck.com	6	decisionresourcesgroup.com	0.330
Merck Co	merck.com	7	prahs.com	0.326
Merck Co	merck.com	8	us.sandoz.com	0.316
Merck Co	merck.com	9	inventprise.com	0.315
Merck Co	merck.com	10	spectrumscience.com	0.312
Microsoft Corp	microsoft.com	1	aschereenergy.com	0.257
Microsoft Corp	microsoft.com	2	kensington.com	0.257
Microsoft Corp	microsoft.com	3	winzip.com	0.249
Microsoft Corp	microsoft.com	4	thinksmartinc.com	0.247
Microsoft Corp	microsoft.com	5	munters.com	0.245
Microsoft Corp	microsoft.com	6	smartavi.com	0.241
Microsoft Corp	microsoft.com	7	hafeezcontractor.com	0.236
Microsoft Corp	microsoft.com	8	mhi.com	0.234
Microsoft Corp	microsoft.com	9	lacomputercompany.com	0.231
Microsoft Corp	microsoft.com	10	haascnc.com	0.230

Table 1: Examples of top ten most similar websites to U.S. public firms (pg 4 of 4)

The table first reports the top ten most similar websites to sample well-known public firms.

Company Name	Company Website	Rank	Peer Website	Similarity
Salesforce Inc	salesforce.com	1	technologyadvice.com	0.403
Salesforce Inc	salesforce.com	2	demandgen.com	0.389
Salesforce Inc	salesforce.com	3	simplus.com	0.380
Salesforce Inc	salesforce.com	4	ismsystems.com	0.377
Salesforce Inc	salesforce.com	5	sigstr.com	0.376
Salesforce Inc	salesforce.com	6	immediatelyapp.com	0.375
Salesforce Inc	salesforce.com	7	mothernode.com	0.369
Salesforce Inc	salesforce.com	8	improveit360.com	0.367
Salesforce Inc	salesforce.com	9	financialforce.com	0.364
Salesforce Inc	salesforce.com	10	redargyle.com	0.362
Starbucks Corp	starbucks.com	1	crimsoncup.com	0.379
Starbucks Corp	starbucks.com	2	scooterscoffee.com	0.355
Starbucks Corp	starbucks.com	3	ipsento.com	0.349
Starbucks Corp	starbucks.com	4	gavina.com	0.347
Starbucks Corp	starbucks.com	5	cdccoffee.com	0.341
Starbucks Corp	starbucks.com	6	newenglandcoffee.com	0.335
Starbucks Corp	starbucks.com	7	dunkindonuts.com	0.320
Starbucks Corp	starbucks.com	8	badasscoffee.com	0.309
Starbucks Corp	starbucks.com	9	victrolacoffee.com	0.308
Starbucks Corp	starbucks.com	10	moustachecoffeeclub.com	0.307
Tesla Inc	tesla.com	1	arm.com	0.325
Tesla Inc	tesla.com	2	spacex.com	0.315
Tesla Inc	tesla.com	3	getcruise.com	0.311
Tesla Inc	tesla.com	4	mbrdna.com	0.306
Tesla Inc	tesla.com	5	ultracell-llc.com	0.305
Tesla Inc	tesla.com	6	commutercars.com	0.300
Tesla Inc	tesla.com	7	transphormusa.com	0.297
Tesla Inc	tesla.com	8	listentech.com	0.296
Tesla Inc	tesla.com	9	herasys.com	0.295
Tesla Inc	tesla.com	10	in.mathworks.com	0.295
Uber Technologies Inc	uber.com	1	firsttransit.com	0.288
Uber Technologies Inc	uber.com	2	honkforhelp.com	0.286
Uber Technologies Inc	uber.com	3	motolingo.com	0.276
Uber Technologies Inc	uber.com	4	drivemode.com	0.274
Uber Technologies Inc	uber.com	5	tripactions.com	0.263
Uber Technologies Inc	uber.com	6	spothero.com	0.261
Uber Technologies Inc	uber.com	7	all-startransportation.com	0.259
Uber Technologies Inc	uber.com	8	deem.com	0.257
Uber Technologies Inc	uber.com	9	flycorona.com	0.254
Uber Technologies Inc	uber.com	10	carvertise.com	0.248
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	1	valuedrugco.com	0.375
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	2	burnsgroupnyc.com	0.306
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	3	astrupdrug.com	0.303
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	4	rangeme.com	0.300
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	5	maxor.com	0.296
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	6	acosta.com	0.295
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	7	knipper.com	0.295
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	8	pharmacarehawaii.com	0.290
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	9	medicalpharmacyct.com	0.287
Walgreens Boots Alliance Inc	walgreensbootsalliance.com	10	kohlberg.com	0.286

Table 2: Private Firm Website Coverage Over Time

The table first reports the total number of private firms in our sample of websites in each year in the first two columns. The third column indicates how many of these website-year observations have available headquarter state data from Orbis or Capital IQ.The final column indicates the fraction of observations that have information on HQ location in the given year.

Year	Total # Private Firms	# Private FIrms w/ State Data	Fraction Covered
2000	128,814	67,450	0.524
2001	224,651	115,552	0.514
2002	253,200	129,017	0.510
2003	284,619	143,252	0.503
2004	321,762	159,015	0.494
2005	308,165	153,427	0.498
2006	286,951	144,067	0.502
2007	298,420	147,961	0.496
2008	353,979	172,109	0.486
2009	353,465	169,716	0.480
2010	362,302	171,669	0.474
2011	390,945	182,081	0.466
2012	419,655	193,397	0.461
2013	507,914	225,227	0.443
2014	478,383	208,656	0.436
2015	554,184	233,727	0.422
2016	554,662	226,675	0.409
2017	452,830	184,474	0.407
2018	406,182	159,914	0.394
2019	377,458	147,715	0.391
2020	415,398	150,879	0.363
2021	426,827	150,441	0.352

Table 3: Private Firm Website Coverage by Fama-French-12 Sectors

The table first reports the average number of public rivals and private rivals each firm has during our sample for each of the Fama-French-12 industry sectors. Both calculations are done at the 5% granularity level, which is similar to how coarse 2-digit SIC codes are.

Fama-French-12 Sector	Average # Private Peers	Average # Public Peers	Ratio: Public to Private
Chemicals	4,049	66	61.6x
Cons Durables	4,219	48	88.4x
Cons NonDurables	8,122	52	156.5x
Energy	2,928	240	12.2x
Finance	22,402	462	48.5x
Health	8,308	434	19.1x
Manufacturing	5,644	60	94.7x
Misc	6,911	284	24.3x
Retail/Wholesale	8,679	118	73.6x
Tech + Bus Equp	5,258	219	24.0x
Telecom	4,574	180	25.4x
Utilities	3,293	229	14.4x

Table 4: Summary statistics

Summary statistics are reported for our sample based on annual firm observations from 2000 to 2021. Panel A summarizes three characteristics of the private firms operating in a public firm's product market including their tax-credit-based R&D incentives and the non-innovation positive shock implied by real estate gains in the states the private firms operate in (multiplied by 1000 for reporting purposes). The Focal Firm Private Peer shocks are based on the 1% most similar private firms in its WTNIC industry. The Public Rival Private Peer shocks are based on the average shocks of the 1% private peers of the given focal firm's 2% WTNIC public peers. This follows convention in the literature as public firms are less in number (so 2% granularity) and private firms are much larger in number (so 1% granularity). We also report the total similarity of the public peers operating in the given firm's product market (public peer total similarity). Panel B reports summary statistics for various investment and outcome variables from Compustat, the SDC Platinum database, and the HP2016 TNIC data repository. See Section 3 for more details on how variables are constructed.

Panel A: WTNIC Website Variables	Mean (1)	SD (2)	Min (3)	Median (4)	Max (5)	Obs (6)
Focal Firm Priv Peer RnD Shock	0.094	1.780	-7.399	0.173	8.382	72,822
Focal Firm Priv Peer R.E. Shock	0.206	6.006	-56.511	0.032	50.012	87,871
Public Rival Priv Peer RnD Shock	0.135	0.429	-1.351	0.063	1.776	74,708
Public Rival Priv Peer R.E. Shock	0.268	1.818	-9.864	-0.028	7.661	89,985
Log Priv Rivals Avg WebSize	8.516	0.161	8.065	8.500	9.057	89,985
Public Peer Total Simil.	0.930	1.332	0.010	0.374	6.305	81,557

Panel B: Corporate Finance Variables	Mean (1)	SD (2)	Min (3)	Median (4)	Max (5)	Obs (6)
Log(Assets)	6.467	2.204	0.703	6.492	15.136	89,985
Log(Age)	2.724	0.793	0.693	2.773	4.277	89,985
Operting Income/Assets	0.014	0.267	-2.007	0.074	0.469	86,782
Log Asset Growth	0.055	0.330	-7.022	0.044	4.881	84,316
Log Sales Growth	0.063	0.463	-9.508	0.059	9.453	82,060
Product Market Fluidity	0.071	0.038	0.001	0.064	0.301	89,424
TNIC-3 Total Similarity	0.112	0.201	0.010	0.021	1.279	89,985
# Acquisitions	0.326	0.816	0.000	0.000	6.000	89,985
# Divestitures	0.179	0.520	0.000	0.000	3.000	89,985
RnD/Assets	0.056	0.130	0.000	0.000	1.141	89,985
# Patents/Assets	0.004	0.014	0.000	0.000	0.169	89,977

Table 5: Pearson Correlation Coefficients

Pearson Correlation Coefficients are reported for our sample of public firm-years from 2000 to 2021. The first three variables are characteristics of the private firms operating in a public firm's product market including their tax-credit-based R&D incentives, the non-innovation positive shock implied by real estate gains in the states the private firms operate, and the average number of words in their websites. The Focal Firm Private Peer shocks are based on the 1% most similar private firms in its WTNIC industry. The Public Rival Private Peer shocks are based on the average shocks of the 1% private peers of the given focal firm's 2% WTNIC public peers. This follows convention in the literature as public firms are less in number (so 2% granularity) and private firms are much larger in number (so 1% granularity). We report correlations with various investment and outcome variables from Compustat, and the HP2016 TNIC data repository. See Section 3 for more details on how variables are constructed.

Variable	Focal Private Rivals R&D Shock	Focal Private Rivals R.E. Shock	Pub Peer Private Rivals R&D Shock	Pub Peer Private Rivals R.E. Shock	Private Peers Avg Website Size	Log Assets	Log Age	Operating Income /Assets	Log Sales Growth	Product Market Fluidity
Focal Firm Priv Peer RnD Shock	1.000	0.222	0.273	0.072	0.096	-0.081	0.024	-0.043	-0.014	-0.053
Focal Firm Priv Peer R.E. Shock	0.222	1.000	0.114	0.377	0.097	-0.045	-0.040	-0.039	-0.005	0.038
Public Rival Priv Peer RnD Shock	0.273	0.114	1.000	0.263	0.501	-0.291	-0.084	-0.229	0.006	0.015
Public Rival Priv Peer R.E. Shock	0.072	0.377	0.263	1.000	0.221	-0.125	-0.111	-0.080	0.005	0.126
Log Priv Rivals Avg WebSize	0.096	0.097	0.501	0.221	1.000	-0.253	-0.344	-0.340	0.041	0.272
Log(Assets)	-0.081	-0.045	-0.291	-0.125	-0.253	1.000	0.312	0.415	0.001	-0.006
Log(Age)	0.024	-0.040	-0.084	-0.111	-0.344	0.312	1.000	0.243	-0.070	-0.303
Operting Income/Assets	-0.043	-0.039	-0.229	-0.080	-0.340	0.415	0.243	1.000	-0.055	-0.305
Log Sales Growth	-0.014	-0.005	0.006	0.005	0.041	0.001	-0.070	-0.055	1.000	0.034
Product Market Fluidity	-0.053	0.038	0.015	0.126	0.272	-0.006	-0.303	-0.305	0.034	1.000

Table 6: Private Peer Website Size vs Shocks

The table reports OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks, and where the dependent variable is the natural logarithm of the number of words in the websites of a given focal public firm's private peers. This is a measure of implicit innovation undertaken by these private peers. Our key RHS variables of interest are the "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock". Both are computed by, for each public firm in each year, identifying the set of private firms from the WTNIC database that operate in the same product markets as the focal firm (1% granularity). As we have the state each private firm is located in, we then average the user cost of R&D (from Bloom, Schankerman, and Van Reenen 2013) across these private firms to generate the user cost of R&D for a given public firm's peers. We then average the result over a given focal public firm's public firm peers (5% granularity using public firm website peers) to generate the Rivals Private Firm R&D user cost of R&D. We flip the sign on the result to make it a positive shifter of innovation, and the result is the "Rivals Priv R&D Shock," and this variable indicates a plausibly exogenous (esp. from the perspective of the focal public firm) positive innovation shock for these private peers. The "Rivals Priv R. E. Shock" is the average price appreciation averaged over these same private firm peers, and hence a higher value indicates a plausibly exogenous positive non-innovation shock for these peers. We also include controls for size, age, and all regressions include firm and year fixed effects. All right-hand side variables are standardized for comparison and computed in year $t-1$, and the dependent variables are computed in year t to ensure no look-ahead bias. t-statistics are clustered by firm.

Panel A: Investment	Priv Peer Web Size (1)	Priv Peer Web Size (2)	Priv Peer Web Size (3)
Priv Rivals R&D Shock	0.031***	0.031***	
	(22.82)	(22.70)	
Priv Rivals R.E. Shock	0.002***		0.002***
	(3.11)		(3.06)
Log Assets	-0.007**	-0.007**	-0.007**
	(-2.12)	(-2.04)	(-2.29)
Log Age	-0.007**	-0.008**	-0.010***
	(-2.17)	(-2.24)	(-3.05)
Firm + Year F.E.	Yes	Yes	Yes
Observations	71,493	71,493	77,700

+

Table 7: Baseline Investment Results

The table reports OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks, and where the dependent variable is a firm investment policy such as acquisitions, divestitures, R&D/assets, patenting, as specified in the column headers. Our key RHS variables of interest are the "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock". Both are computed, for each public firm in each year, by first identifying a set of private firms from the WTNIC database that operate in related product markets as the focal firm. In Panel A, we consider the narrow set of private peers of the focal firm itself. In Panel B, we consider a broader set of private peers of the focal firm's most important public competitors. As we have the state each private firm is located in, we can average the user cost of R&D (from Bloom, Schankerman, and Van Reenen 2013) across these private firms to generate the user cost of R&D for a given public firm's peers. We flip the sign on the result to make it a positive shifter of innovation, and the result is the "Rivals Priv R&D Shock," which indicates a plausibly exogenous (esp. from the perspective of the focal public firm) positive innovation shock for these private peers. The "Rivals Priv R. E. Shock" is the average real estate price appreciation averaged over the states of these same private firm peers, and hence a higher value indicates a plausibly exogenous positive non-innovation shock for these peers. We also include controls for size, age, and all regressions include firm and year fixed effects. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Investment (Focal Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Priv Rivals R&D Shock	0.010	-7.091**	2.644	0.063	-1.716
	(0.00)	(-2.08)	(1.49)	(0.65)	(-0.09)
Priv Rivals R.E. Shock	-0.581	0.268	0.278**	0.020*	-0.993
	(-1.36)	(0.91)	(2.56)	(1.81)	(-0.99)
Log Assets	-0.027***	0.049***	-0.083***	0.001***	-0.037**
	(-4.30)	(11.79)	(-22.40)	(9.37)	(-2.06)
Log Age	-0.050**	0.100***	-0.016***	-0.001***	-0.086*
	(-2.51)	(7.94)	(-2.83)	(-4.68)	(-1.69)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	79,334	79,334	58,833	79,327	61,990

Panel B: Investment (Rival Public Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Priv Rivals R&D Shock	12.755	-31.651***	3.336	2.254***	92.789*
	(0.77)	(-2.75)	(0.70)	(7.66)	(1.78)
Priv Rivals R.E. Shock	-6.400***	-0.701	1.878***	0.034	-2.778
	(-3.95)	(-0.59)	(4.47)	(0.98)	(-0.69)
Log Assets	-0.026***	0.048***	-0.082***	0.001***	-0.038**
	(-4.19)	(11.82)	(-22.93)	(9.42)	(-2.14)
Log Age	-0.052***	0.097***	-0.012**	-0.001***	-0.082*
	(-2.69)	(8.04)	(-2.23)	(-4.18)	(-1.71)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	81,367	81,367	60,371	81,359	63,657

Table 8: Baseline Performance Results

The table reports OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks, and where the dependent variable is a firm outcome variable such as ROA, sales growth, asset growth, etc, as specified in the column headers. Our key RHS variables of interest are the “Rivals Priv R&D Shock” and “Rivals Priv R.E. Shock”. Both are computed, for each public firm in each year, by first identifying a set of private firms from the WTNIC database that operate in related product markets as the focal firm. In Panel A, we consider the narrow set of private peers of the focal firm itself. In Panel B, we consider a broader set of private peers of the focal firm’s most important public competitors. As we have the state each private firm is located in, we can average the user cost of R&D (from Bloom, Schankerman, and Van Reenen 2013) across these private firms to generate the user cost of R&D for a given public firm’s peers. We flip the sign on the result to make it a positive shifter of innovation, and the result is the “Rivals Priv R&D Shock,” which indicates a plausibly exogenous (esp. from the perspective of the focal public firm) positive innovation shock for these private peers. The “Rivals Priv R. E. Shock” is the average real estate price appreciation averaged over the states of these same private firm peers, and hence a higher value indicates a plausibly exogenous positive non-innovation shock for these peers. We also include controls for size, age, and all regressions include firm and year fixed effects. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Outcomes (Focal Firm Private Peers)	OI/Assets (1)	Sales Growth (2)	Asset Growth (3)	Total Similarity (4)	Prod Mkt Fluidity (5)
Priv Rivals R&D Shock	-0.658	-0.978	6.241	1.543*	0.047
	(-0.18)	(-0.12)	(0.91)	(1.70)	(0.19)
Priv Rivals R.E. Shock	-0.428*	0.239	0.129	-0.023	0.082***
	(-1.89)	(0.35)	(0.29)	(-0.61)	(6.16)
Log Assets	-0.014*	-0.302***	-0.400***	0.007***	0.002***
	(-1.78)	(-21.15)	(-43.87)	(6.56)	(6.78)
Log Age	0.009	-0.069***	0.029	0.002	-0.007***
	(0.86)	(-2.81)	(1.42)	(0.64)	(-8.44)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	56,570	57,263	58,677	61,245	60,892
Panel B: Outcomes (Rival Public Firm Private Peers)	**OI/Assets (1)**	**Sales Growth (2)**	**Asset Growth (3)**	**Total Similarity (4)**	**Prod Mkt Fluidity (5)**
Priv Rivals R&D Shock	26.654**	89.543***	197.260***	9.934***	-0.604
	(2.47)	(3.46)	(9.00)	(4.65)	(-0.86)
Priv Rivals R.E. Shock	-2.179**	3.339	-6.569***	0.284	0.944***
	(-2.50)	(1.46)	(-3.99)	(1.50)	(15.04)
Log Assets	-0.014*	-0.308***	-0.399***	0.006***	0.002***
	(-1.87)	(-22.03)	(-45.26)	(6.58)	(6.29)
Log Age	0.010	-0.067***	0.034*	0.002	-0.006***
	(0.90)	(-2.82)	(1.71)	(0.66)	(-7.68)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	57,995	58,744	60,205	62,892	62,523

Table 9: Big vs Small Investment Results

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks analogous to those in Table 7 with the following changes. We first sort firms in each year into Small and Large groups using firm assets from year $t-1$. Small (Large) firms are those with below (above) median in the given year. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and characteristic dummies. We also include the Small firm dummy itself in the regression. All other aspects of these regressions are as defined in Table 7. In Panel A, we explore the impact of the focal public firm's private firm peers. In Panel B, we examine the private peers of the focal firm's nearest public competitors. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Investment (Focal Firm Private Peers)	# Acq- uisitions (1)	# Div- estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non- Compete (5)
Small x Priv Rivals R&D Shock	-1.852	-6.199**	4.161*	0.070	-6.350
	(-0.37)	(-1.96)	(1.71)	(0.54)	(-0.29)
Big x Priv Rivals R&D Shock	1.959	-8.027	1.782	0.052	2.377
	(0.28)	(-1.62)	(1.03)	(0.50)	(0.13)
Small x Priv Rivals R.E. Shock	-0.343	-0.204	0.347*	0.039**	-2.476*
	(-0.89)	(-0.73)	(1.84)	(2.23)	(-1.67)
Big x Priv Rivals R.E. Shock	-0.911	0.926	0.181***	-0.006	0.904
	(-1.04)	(1.58)	(2.85)	(-0.64)	(0.73)
Small	0.028*	-0.006	-0.047***	0.001***	0.015
	(1.76)	(-0.66)	(-10.48)	(3.09)	(0.33)
Log Assets	-0.023***	0.048***	-0.090***	0.001***	-0.036*
	(-3.54)	(10.81)	(-22.25)	(9.23)	(-1.95)
Log Age	-0.050**	0.100***	-0.016***	-0.001***	-0.086*
	(-2.50)	(7.92)	(-2.84)	(-4.66)	(-1.69)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	79,334	79,334	58,833	79,327	61,990

Panel B: Investment (Rival Public Firm Private Peers)	# Acq- uisitions (1)	# Div- estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non- Compete (5)
Small x Priv Rivals R&D Shock	-42.066**	-21.602*	35.774***	2.229***	55.952
	(-2.28)	(-1.95)	(4.61)	(5.27)	(0.82)
Big x Priv Rivals R&D Shock	73.061***	-43.040**	-22.306***	2.346***	115.937**
	(3.27)	(-2.56)	(-5.49)	(7.66)	(2.03)
Small x Priv Rivals R.E. Shock	-1.456	-2.250*	2.677***	0.139**	-10.037
	(-0.84)	(-1.87)	(3.41)	(2.30)	(-1.59)
Big x Priv Rivals R.E. Shock	-11.662***	0.940	1.169***	-0.076**	4.378
	(-4.13)	(0.46)	(4.13)	(-2.24)	(0.89)
Small	0.037**	-0.006	-0.057***	0.001***	0.032
	(2.33)	(-0.67)	(-13.54)	(3.02)	(0.74)
Log Assets	-0.022***	0.047***	-0.089***	0.001***	-0.034*
	(-3.50)	(10.90)	(-22.89)	(9.19)	(-1.95)
Log Age	-0.049**	0.097***	-0.013**	-0.001***	-0.084*
	(-2.57)	(7.99)	(-2.42)	(-4.04)	(-1.75)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	81,367	81,367	60,371	81,359	63,657

Table 10: Big vs Small Performance Results

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks and non-innovation positive shocks analogous to those in Table 8 with the following changes. We first sort firms in each year into Small and Large groups using firm assets from year $t-1$. Small (Large) firms are those with below (above) median in the given year. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and both the Small and Large firm dummies. We also include the Small firm dummy itself in the regression. All other aspects of these regressions are as defined in Table 7. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Outcomes (Focal Firm Private Peers)	OI/Assets	Sales Growth	Asset Growth	Total Similarity	Prod Mkt Fluidity
	(1)	(2)	(3)	(4)	(5)
Small x Priv Rivals R&D Shock	-0.939	-2.871	3.608	1.671	0.348
	(-0.21)	(-0.27)	(0.42)	(1.56)	(1.26)
Big x Priv Rivals R&D Shock	-1.533	0.147	8.173	1.475	-0.203
	(-0.45)	(0.02)	(1.15)	(1.59)	(-0.72)
Small x Priv Rivals R.E. Shock	-0.633*	0.550	0.174	-0.106*	0.075***
	(-1.71)	(0.46)	(0.24)	(-1.88)	(4.48)
Big x Priv Rivals R.E. Shock	-0.114	-0.125	0.073	0.080	0.092***
	(-0.64)	(-0.24)	(0.16)	(1.56)	(4.39)
Small	0.124***	0.027	0.025*	-0.002	-0.000
	(13.66)	(1.25)	(1.67)	(-1.16)	(-0.37)
Log Assets	0.006	-0.298***	-0.397***	0.006***	0.002***
	(0.66)	(-19.43)	(-40.70)	(5.78)	(6.46)
Log Age	0.009	-0.069***	0.029	0.002	-0.007***
	(0.82)	(-2.81)	(1.43)	(0.64)	(-8.46)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	56,570	57,263	58,677	61,245	60,892

Panel B: Outcomes (Rival Public Firm Private Peers)	OI/Assets	Sales Growth	Asset Growth	Total Similarity	Prod Mkt Fluidity
	(1)	(2)	(3)	(4)	(5)
Small x Priv Rivals R&D Shock	19.553	85.110**	201.865***	16.900***	-0.850
	(1.25)	(2.17)	(6.68)	(5.40)	(-0.95)
Big x Priv Rivals R&D Shock	35.945***	98.246***	193.914***	3.875	-0.374
	(3.32)	(3.91)	(9.23)	(1.56)	(-0.45)
Small x Priv Rivals R.E. Shock	-2.745*	12.236***	-7.990***	-0.671**	1.018***
	(-1.81)	(2.93)	(-2.82)	(-2.51)	(12.66)
Big x Priv Rivals R.E. Shock	-1.731**	-4.910**	-5.234***	1.205***	0.873***
	(-2.19)	(-2.51)	(-3.10)	(5.18)	(9.99)
Small	0.129***	0.023	0.033**	-0.003	-0.000
	(13.60)	(1.09)	(2.20)	(-1.45)	(-0.59)
Log Assets	0.006	-0.304***	-0.394***	0.006***	0.002***
	(0.68)	(-20.29)	(-41.71)	(5.96)	(5.86)
Log Age	0.010	-0.062***	0.033*	0.001	-0.006***
	(0.92)	(-2.65)	(1.67)	(0.42)	(-7.61)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	57,995	58,744	60,205	62,892	62,523

Table 11: Young vs Old Investment Results

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks analogous to those in Table 7 with the following changes. We first sort firms in each year into Young and Old groups using firm age in year $t-1$. Young (Old) firms are those with below (above) median age in the given year. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and both the Young and Old firm dummies. We also include the Young firm dummy itself in the regression. All other aspects of these regressions are as defined in Table 7. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Investment (Focal Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Young x Priv Rivals R&D Shock	-5.795	-6.027*	2.249	0.079	-5.714
	(-1.10)	(-1.69)	(0.96)	(0.61)	(-0.27)
Old x Priv Rivals R&D Shock	8.176	-8.511*	3.163*	0.036	3.327
	(1.18)	(-1.81)	(1.65)	(0.32)	(0.17)
Young x Priv Rivals R.E. Shock	-0.494	0.299	0.325*	0.019	-1.580
	(-0.92)	(0.88)	(1.82)	(1.17)	(-1.10)
Old x Priv Rivals R.E. Shock	-0.625	0.227	0.241**	0.021	-0.314
	(-0.92)	(0.45)	(2.03)	(1.39)	(-0.22)
Young	-0.015	-0.008	-0.014***	0.001*	0.019
	(-0.87)	(-0.74)	(-3.28)	(1.85)	(0.40)
Log Assets	-0.027***	0.049***	-0.083***	0.001***	-0.037**
	(-4.30)	(11.78)	(-22.41)	(9.37)	(-2.06)
Log Age	-0.052**	0.099***	-0.016***	-0.001***	-0.084*
	(-2.58)	(7.98)	(-2.95)	(-4.49)	(-1.67)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	79,334	79,334	58,833	79,327	61,990

Panel B: Investment (Rival Public Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Young x Priv Rivals R&D Shock	-6.432	-19.744	6.845	3.259***	61.525
	(-0.33)	(-1.50)	(0.99)	(6.78)	(0.87)
Old x Priv Rivals R&D Shock	30.029	-42.553***	1.134	1.287***	115.854*
	(1.35)	(-2.74)	(0.19)	(3.88)	(1.92)
Young x Priv Rivals R.E. Shock	-7.728***	-0.631	3.190***	-0.043	0.621
	(-3.65)	(-0.45)	(4.51)	(-0.74)	(0.11)
Old x Priv Rivals R.E. Shock	-4.851**	-0.903	0.738	0.091**	-5.357
	(-2.09)	(-0.49)	(1.62)	(2.05)	(-0.94)
Young	-0.010	-0.010	-0.015***	0.000	0.031
	(-0.58)	(-0.90)	(-3.94)	(1.18)	(0.64)
Log Assets	-0.026***	0.048***	-0.082***	0.001***	-0.037**
	(-4.17)	(11.82)	(-22.93)	(9.42)	(-2.13)
Log Age	-0.055***	0.098***	-0.011**	-0.001***	-0.077
	(-2.87)	(8.12)	(-2.16)	(-4.18)	(-1.62)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	81,367	81,367	60,371	81,359	63,657

Table 12: Young vs Old Performance Results

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks analogous to those in Table 7 with the following changes. We first sort firms in each year into Young and Old groups using firm age in year $t-1$. Young (Old) firms are those with below (above) median age in the given year. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and both the Young and Old firm dummies. We also include the Young firm dummy itself in the regression. All other aspects of these regressions are as defined in Table 7. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Outcomes (Focal Firm Private Peers)	OI/Assets	Sales Growth	Asset Growth	Total Similarity	Prod Mkt Fluidity
	(1)	(2)	(3)	(4)	(5)
Young x Priv Rivals R&D Shock	0.472	11.663	5.464	1.148	0.355
	(0.10)	(1.04)	(0.65)	(0.96)	(1.29)
Old x Priv Rivals R&D Shock	-2.121	-15.042	7.178	2.003**	-0.307
	(-0.56)	(-1.56)	(0.92)	(2.09)	(-1.01)
Young x Priv Rivals R.E. Shock	-0.415	0.201	-0.011	-0.021	0.077***
	(-1.16)	(0.19)	(-0.02)	(-0.35)	(4.13)
Old x Priv Rivals R.E. Shock	-0.465*	0.176	0.279	-0.022	0.086***
	(-1.70)	(0.22)	(0.50)	(-0.48)	(4.56)
Young	0.019**	-0.007	0.012	-0.000	-0.000
	(2.08)	(-0.31)	(0.70)	(-0.08)	(-0.32)
Log Assets	-0.014*	-0.302***	-0.400***	0.007***	0.002***
	(-1.78)	(-21.21)	(-43.89)	(6.56)	(6.78)
Log Age	0.010	-0.071***	0.030	0.002	-0.007***
	(0.94)	(-2.88)	(1.45)	(0.65)	(-8.50)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	56,570	57,263	58,677	61,245	60,892
Panel B: Outcomes (Rival Public Firm Private Peers)	**OI/Assets**	**Sales Growth**	**Asset Growth**	**Total Similarity**	**Prod Mkt Fluidity**
	(1)	(2)	(3)	(4)	(5)
Young x Priv Rivals R&D Shock	-2.660	86.172**	212.531***	-0.443	1.598*
	(-0.17)	(2.09)	(6.87)	(-0.15)	(1.78)
Old x Priv Rivals R&D Shock	47.175***	92.694***	187.704***	16.952***	-2.046**
	(4.02)	(3.05)	(8.20)	(5.35)	(-2.40)
Young x Priv Rivals R.E. Shock	-0.355	7.761*	-6.013**	0.428	1.080***
	(-0.25)	(1.93)	(-2.21)	(1.56)	(12.42)
Old x Priv Rivals R.E. Shock	-3.342***	-0.302	-7.303***	0.315	0.789***
	(-3.18)	(-0.11)	(-3.73)	(1.46)	(9.67)
Young	0.027***	-0.003	0.007	0.002	-0.001
	(2.91)	(-0.13)	(0.43)	(0.89)	(-0.80)
Log Assets	-0.014*	-0.308***	-0.399***	0.007***	0.002***
	(-1.85)	(-22.04)	(-45.33)	(6.70)	(6.19)
Log Age	0.013	-0.063***	0.035*	0.002	-0.006***
	(1.21)	(-2.65)	(1.75)	(0.75)	(-7.49)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	57,995	58,744	60,205	62,892	62,523

Table 13: Fluid vs Non-Fluid Investment Results

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks analogous to those in Table 7 with the following changes. We first define firms in innovative industries as those having TNIC peers with above-median R&D/assets. Non-innovative industry firms are those with below median values. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and both the Tech and Non-Tech firm dummies. We do not include the Tech and Non-Tech firm dummies in the regression because they are subsumed by the firm fixed effects. All other aspects of these regressions are as defined in Table 7. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Investment (Focal Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Non-Innov Industry x Priv Rivals R&D Shock	-1.820	-7.940**	2.453*	0.167	0.347
	(-0.31)	(-2.06)	(1.67)	(1.46)	(0.02)
Innov Industry x Priv Rivals R&D Shock	-1.031	-8.807**	3.505*	-0.051	-0.918
	(-0.19)	(-2.29)	(1.90)	(-0.45)	(-0.05)
Non-Innov Industry x Priv Rivals R.E. Shock	-0.196	0.114	0.163**	0.020	-1.011
	(-0.31)	(0.26)	(2.11)	(1.42)	(-0.65)
Innov Industry x Priv Rivals R.E. Shock	-0.798	0.344	0.400**	0.023	-1.185
	(-1.36)	(0.84)	(2.11)	(1.38)	(-1.04)
Log Assets	-0.026***	0.052***	-0.063***	0.001***	-0.042**
	(-3.70)	(11.53)	(-18.92)	(9.50)	(-2.11)
Log Age	-0.048**	0.114***	0.013***	-0.002***	-0.105*
	(-2.13)	(7.66)	(2.61)	(-4.76)	(-1.86)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	75,813	75,813	56,292	75,806	59,271

Panel B: Investment (Rival Public Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Non-Innov Industry x Priv Rivals R&D Shock	-20.422	-27.710**	5.797*	1.935***	115.185*
	(-0.99)	(-1.99)	(1.68)	(5.18)	(1.90)
Innov Industry x Priv Rivals R&D Shock	36.284**	-37.929***	11.881**	2.543***	67.758
	(1.98)	(-2.87)	(2.10)	(7.01)	(1.21)
Non-Innov Industry x Priv Rivals R.E. Shock	-2.205	-2.121	0.570**	0.014	-0.156
	(-0.96)	(-1.31)	(2.04)	(0.32)	(-0.03)
Innov Industry x Priv Rivals R.E. Shock	-8.956***	0.005	2.125***	0.063	-3.633
	(-4.11)	(0.00)	(2.81)	(1.16)	(-0.77)
Log Assets	-0.025***	0.051***	-0.063***	0.001***	-0.042**
	(-3.68)	(11.43)	(-19.21)	(9.48)	(-2.12)
Log Age	-0.049**	0.110***	0.016***	-0.001***	-0.101*
	(-2.27)	(7.63)	(3.30)	(-4.23)	(-1.84)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	77,313	77,313	57,462	77,306	60,516

Table 14: Fluid vs Non-Fluid Performance Results

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks analogous to those in Table 7 with the following changes. We first define firms in innovative industries as those having TNIC peers with above-median R&D/assets. Non-innovative industry firms are those with below median values. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and both the Tech and Non-Tech firm dummies. We do not include the Tech and Non-Tech firm dummies in the regression because they are subsumed by the firm fixed effects. All other aspects of these regressions are as defined in Table 7. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Outcomes (Focal Firm Private Peers)	OI/Assets	Sales Growth	Asset Growth	Total Similarity	Prod Mkt Fluidity
	(1)	(2)	(3)	(4)	(5)
Non-Innov Industry x Priv Rivals R&D Shock	-2.727	-3.386	6.125	1.315	0.080
	(-0.82)	(-0.42)	(0.88)	(1.63)	(0.32)
Innov Industry x Priv Rivals R&D Shock	-1.045	3.726	9.610	1.860*	-0.008
	(-0.28)	(0.42)	(1.29)	(1.89)	(-0.03)
Non-Innov Industry x Priv Rivals R.E. Shock	-0.063	0.921	0.783	0.070***	0.058***
	(-0.28)	(1.36)	(1.43)	(3.15)	(3.79)
Innov Industry x Priv Rivals R.E. Shock	-0.787**	-0.927	-0.511	-0.106	0.108***
	(-2.11)	(-0.75)	(-0.78)	(-1.47)	(5.20)
Log Assets	-0.035***	-0.306***	-0.413***	0.006***	0.002***
	(-4.66)	(-20.45)	(-42.55)	(5.58)	(7.26)
Log Age	-0.013	-0.086***	-0.012	0.002	-0.007***
	(-1.22)	(-3.19)	(-0.52)	(0.44)	(-7.67)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	54,091	54,901	56,142	58,543	58,378

Panel B: Outcomes (Rival Public Firm Private Peers)	OI/Assets	Sales Growth	Asset Growth	Total Similarity	Prod Mkt Fluidity
	(1)	(2)	(3)	(4)	(5)
Non-Innov Industry x Priv Rivals R&D Shock	20.367**	69.038***	168.038***	7.916***	0.947
	(2.06)	(2.75)	(7.69)	(4.56)	(1.32)
Innov Industry x Priv Rivals R&D Shock	12.318	102.861***	194.594***	11.737***	-0.453
	(0.99)	(3.40)	(7.64)	(4.42)	(-0.54)
Non-Innov Industry x Priv Rivals R.E. Shock	-0.113	6.049***	-0.141	0.358**	0.443***
	(-0.13)	(2.58)	(-0.07)	(2.40)	(6.53)
Innov Industry x Priv Rivals R.E. Shock	-3.679***	0.898	-11.174***	0.365	1.413***
	(-2.65)	(0.23)	(-4.48)	(1.27)	(15.66)
Log Assets	-0.036***	-0.309***	-0.413***	0.006***	0.002***
	(-4.76)	(-20.83)	(-43.59)	(5.43)	(6.77)
Log Age	-0.013	-0.073***	-0.007	0.001	-0.006***
	(-1.23)	(-2.80)	(-0.32)	(0.38)	(-6.59)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	55,182	56,047	57,304	59,766	59,596

Table 15: Baseline Reduced Form w/ Shocks (IV Method)

The table reports two-stage IV regressions where the first stage uses our plausibly exogenous shifter of related-private-firm innovation based on R&D tax credits and the first stage dependent variable is the private firm peers' average website length. The instrumented length of the peer websites is then used in the second stage. The second stage dependent variables are public firm investment policy or outcome variables such as acquisitions, divestitures, R&D/assets, ROA, sales growth etc, as specified in the column headers. Our instrument "Rivals Priv R&D Shock" is computed by first identifying the set of private firms from the WTNIC database that operate in the same product markets as the focal firm (1% granularity). As we have the state each private firm is located in, we then average the user cost of R&D (from Bloom, Schankerman, and Van Reenen 2013) across these private firms to generate the user cost of R&D for a given public firm's peers. We exclude private firms (and their shocks) that are located in the state of focal public firm's headquarters. We then average the result over a given focal public firm's public firm peers (5% granularity using public firm website peers) to generate the Rivals Private Firm R&D user cost of R&D. We flip the sign on the result to make it a positive shifter of innovation, and the result is the "Rivals Priv R&D Shock," and this variable indicates a plausibly exogenous (esp. from the perspective of the focal public firm) positive innovation shock for these private peers. All right-hand side variables are computed in year t and the dependent variables are computed as three-year impacts (to year $t+3$) to ensure no look-ahead bias and for innovation incentives to affect outcomes. t-statistics are clustered by firm.

Panel A: Investment	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Instrum Website Size	-17.768	103.735*	6.389	-7.376**	89.400
	(-0.33)	(1.95)	(1.37)	(-2.44)	(1.63)
Log Assets	-0.025**	0.034***	-0.082***	0.002***	-0.042**
	(-2.52)	(3.64)	(-22.46)	(3.78)	(-2.33)
Log Age	-0.001	-0.182	-0.023***	0.019**	-0.236**
	(-0.01)	(-1.27)	(-2.73)	(2.28)	(-2.16)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	81,367	81,367	60,371	81,359	63,657

Panel B: Outcomes	OI/Assets (1)	Sales Growth (2)	Asset Growth (3)	Total Similarity (4)	Prod Mkt Fluidity (5)
Instrum Website Size	21.793**	102.040***	188.382***	10.308***	0.846
	(2.12)	(3.28)	(5.50)	(4.75)	(1.22)
Log Assets	-0.016**	-0.316***	-0.411***	0.006***	0.002***
	(-2.07)	(-20.73)	(-33.08)	(5.97)	(6.32)
Log Age	-0.027	-0.223***	-0.288***	-0.016***	-0.008***
	(-1.39)	(-4.21)	(-4.37)	(-3.50)	(-5.58)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	57,995	58,744	60,205	62,892	62,523

Online Appendix: Small Private Firms: Friend or Foe of Larger Public Firms?

Gerard Hoberg and Gordon M. Phillips

(not for publication)

Table IA1: Baseline Investment Results (1-Year instead of 3-Years)

The table reports OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks, and where the dependent variable is a firm investment policy or outcome variable such as acquisitions, divestitures, R&D/assets, ROA, sales growth etc, as specified in the column headers. Our key RHS variables of interest are the "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock". Both are computed, for each public firm in each year, by first identifying a set of private firms from the WTNIC database that operate in related product markets as the focal firm. In Panel A, we consider the narrow set of private peers of the focal firm itself. In Panel B, we consider a broader set of private peers of the focal firm's most important public competitors. As we have the state each private firm is located in, we can average the user cost of R&D (from Bloom, Schankerman, and Van Reenen 2013) across these private firms to generate the user cost of R&D for a given public firm's peers. We flip the sign on the result to make it a positive shifter of innovation, and the result is the "Rivals Priv R&D Shock," which indicates a plausibly exogenous (esp. from the perspective of the focal public firm) positive innovation shock for these private peers. The "Rivals Priv R. E. Shock" is the average real estate price appreciation averaged over the states of these same private firm peers, and hence a higher value indicates a plausibly exogenous positive non-innovation shock for these peers. We also include controls for size, age, and all regressions include firm and year fixed effects. All right-hand side variables are computed in year t and the dependent variables are computed in year t to ensure no look-ahead bias. t-statistics are clustered by firm.

Panel A: Investment (Focal Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Priv Rivals R&D Shock	0.010	-7.091**	2.644	0.063	-1.716
	(0.00)	(-2.08)	(1.49)	(0.65)	(-0.09)
Priv Rivals R.E. Shock	-0.581	0.268	0.278**	0.020*	-0.993
	(-1.36)	(0.91)	(2.56)	(1.81)	(-0.99)
Log Assets	-0.027***	0.049***	-0.083***	0.001***	-0.037**
	(-4.30)	(11.79)	(-22.40)	(9.37)	(-2.06)
Log Age	-0.050**	0.100***	-0.016***	-0.001***	-0.086*
	(-2.51)	(7.94)	(-2.83)	(-4.68)	(-1.69)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	79,334	79,334	58,833	79,327	61,990

Panel B: Investment (Rival Public Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Priv Rivals R&D Shock	12.755	-31.651***	3.336	2.254***	92.789*
	(0.77)	(-2.75)	(0.70)	(7.66)	(1.78)
Priv Rivals R.E. Shock	-6.400***	-0.701	1.878***	0.034	-2.778
	(-3.95)	(-0.59)	(4.47)	(0.98)	(-0.69)
Log Assets	-0.026***	0.048***	-0.082***	0.001***	-0.038**
	(-4.19)	(11.82)	(-22.93)	(9.42)	(-2.14)
Log Age	-0.052***	0.097***	-0.012**	-0.001***	-0.082*
	(-2.69)	(8.04)	(-2.23)	(-4.18)	(-1.71)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	81,367	81,367	60,371	81,359	63,657

Table IA2: Baseline Performance Results (1-Year instead of 3-Years)

The table reports OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks, and where the dependent variable is a firm investment policy or outcome variable such as acquisitions, divestitures, R&D/assets, ROA, sales growth etc, as specified in the column headers. Our key RHS variables of interest are the "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock". Both are computed, for each public firm in each year, by first identifying a set of private firms from the WTNIC database that operate in related product markets as the focal firm. In Panel A, we consider the narrow set of private peers of the focal firm itself. In Panel B, we consider a broader set of private peers of the focal firm's most important public competitors. As we have the state each private firm is located in, we can average the user cost of R&D (from Bloom, Schankerman, and Van Reenen 2013) across these private firms to generate the user cost of R&D for a given public firm's peers. We flip the sign on the result to make it a positive shifter of innovation, and the result is the "Rivals Priv R&D Shock," which indicates a plausibly exogenous (esp. from the perspective of the focal public firm) positive innovation shock for these private peers. The "Rivals Priv R. E. Shock" is the average real estate price appreciation averaged over the states of these same private firm peers, and hence a higher value indicates a plausibly exogenous positive non-innovation shock for these peers. We also include controls for size, age, and all regressions include firm and year fixed effects. All right-hand side variables are computed in year t and the dependent variables are computed in year t to ensure no look-ahead bias. t-statistics are clustered by firm.

Panel A: Outcomes (Focal Firm Private Peers)	OI/Assets	Sales Growth	Asset Growth	Total Similarity	Prod Mkt Fluidity
	(1)	(2)	(3)	(4)	(5)
Priv Rivals R&D Shock	0.511	5.694**	2.701	-5.181***	-0.175
	(0.34)	(1.98)	(1.19)	(-5.93)	(-0.79)
Priv Rivals R.E. Shock	-0.308**	-0.393	0.142	0.031	0.115***
	(-2.46)	(-1.24)	(0.75)	(0.81)	(7.92)
Log Assets	0.008***	-0.117***	-0.155***	0.008***	0.002***
	(3.35)	(-21.98)	(-41.23)	(8.32)	(6.98)
Log Age	0.006	-0.072***	-0.008	0.003	-0.009***
	(1.22)	(-7.19)	(-0.95)	(1.01)	(-11.49)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	76,600	72,349	74,178	79,334	78,835
Panel B: Outcomes (Rival Public Firm Private Peers)	**OI/Assets**	**Sales Growth**	**Asset Growth**	**Total Similarity**	**Prod Mkt Fluidity**
	(1)	(2)	(3)	(4)	(5)
Priv Rivals R&D Shock	-17.305***	62.535***	35.953***	-48.518***	4.597***
	(-3.78)	(5.90)	(4.91)	(-17.83)	(6.51)
Priv Rivals R.E. Shock	-2.327***	-1.132	-1.248*	0.969***	1.352***
	(-5.26)	(-1.09)	(-1.85)	(5.67)	(21.22)
Log Assets	0.008***	-0.119***	-0.153***	0.008***	0.002***
	(3.47)	(-22.55)	(-38.65)	(8.23)	(6.89)
Log Age	0.002	-0.074***	-0.008	-0.001	-0.007***
	(0.32)	(-7.62)	(-1.08)	(-0.25)	(-10.07)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	78,499	74,207	76,117	81,367	80,843

Table IA3: Big vs Small Investment Results (1-Year instead of 3-Years)

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks analogous to those in Table 7 with the following changes. We first sort firms in each year into Small and Large groups using firm assets from year $t-1$. Small (Large) firms are those with below (above) median in the given year. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and both the Small and Large firm dummies. We also include the Small firm dummy itself in the regression. All other aspects of these regressions are as defined in Table 7. All right-hand side variables are computed in year t and the dependent variables are computed in year t to ensure no look-ahead bias. t-statistics are clustered by firm.

Panel A: Investment (Focal Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Small x Priv Rivals R&D Shock	-7.092	5.107*	0.123	0.291**	-23.346
	(-1.30)	(1.68)	(0.12)	(2.05)	(-1.16)
Big x Priv Rivals R&D Shock	2.507	-0.339	0.277	0.072	-1.928
	(0.34)	(-0.07)	(0.53)	(0.71)	(-0.10)
Small x Priv Rivals R.E. Shock	0.346	-0.139	0.020	-0.009	-1.678
	(0.87)	(-0.52)	(0.21)	(-0.45)	(-1.18)
Big x Priv Rivals R.E. Shock	-0.137	0.786	0.020	-0.005	0.515
	(-0.16)	(1.42)	(0.69)	(-0.75)	(0.43)
Small	0.004	0.008	0.001	0.001***	-0.032
	(0.23)	(0.83)	(0.91)	(2.80)	(-0.75)
Log Assets	0.029***	0.045***	-0.008***	-0.000	0.060***
	(4.31)	(10.08)	(-6.42)	(-1.63)	(3.44)
Log Age	-0.021	0.096***	0.005**	0.002***	-0.073
	(-1.02)	(7.35)	(2.29)	(6.92)	(-1.53)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	79,334	79,334	79,334	79,327	71,733

Panel B: Investment (Rival Public Firm Private Peers)	# Acq-uisitions (1)	# Div-estitures (2)	R&D /Assets (3)	# Patents /Assets (4)	Non-Compete (5)
Small x Priv Rivals R&D Shock	-36.953**	14.005	20.377***	4.033***	-31.387
	(-1.96)	(1.31)	(6.88)	(8.87)	(-0.47)
Big x Priv Rivals R&D Shock	19.484	-45.838***	-0.848	1.111***	53.096
	(0.77)	(-2.74)	(-0.57)	(3.54)	(0.95)
Small x Priv Rivals R.E. Shock	-2.065	-1.870	-1.073***	-0.272***	-6.625
	(-1.12)	(-1.55)	(-3.08)	(-3.85)	(-1.09)
Big x Priv Rivals R.E. Shock	-9.514***	4.735**	0.251**	-0.105***	3.481
	(-3.13)	(2.20)	(2.05)	(-3.35)	(0.77)
Small	0.009	0.003	-0.000	0.000*	-0.009
	(0.55)	(0.35)	(-0.21)	(1.76)	(-0.21)
Log Assets	0.029***	0.044***	-0.007***	-0.000	0.063***
	(4.34)	(10.26)	(-6.27)	(-1.40)	(3.80)
Log Age	-0.019	0.091***	0.006***	0.002***	-0.080*
	(-0.97)	(7.31)	(2.74)	(7.55)	(-1.78)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	81,367	81,367	81,367	81,359	73,639

Table IA4: Big vs Small Performance Results (1-Year instead of 3-Years)

The table presents results using OLS regressions with plausibly exogenous shifters of related-private-firm innovation and non-innovation positive shocks analogous to those in Table 7 with the following changes. We first sort firms in each year into Small and Large groups using firm assets from year $t-1$. Small (Large) firms are those with below (above) median in the given year. We then include interactions between "Rivals Priv R&D Shock" and "Rivals Priv R.E. Shock," and both the Small and Large firm dummies. We also include the Small firm dummy itself in the regression. All other aspects of these regressions are as defined in Table 7. All right-hand side variables are computed in year t and the dependent variables are computed in year t to ensure no look-ahead bias. t-statistics are clustered by firm.

Panel A: Outcomes (Focal Firm Private Peers)	OI/Assets (1)	Sales Growth (2)	Asset Growth (3)	Total Similarity (4)	Prod Mkt Fluidity (5)
Small x Priv Rivals R&D Shock	0.142	3.870	0.464	-6.030***	-0.052
	(0.07)	(0.94)	(0.16)	(-5.45)	(-0.19)
Big x Priv Rivals R&D Shock	0.875	7.440**	5.116**	-4.238***	-0.311
	(0.71)	(2.55)	(2.11)	(-5.34)	(-1.33)
Small x Priv Rivals R.E. Shock	-0.312	-0.640	0.219	-0.053	0.095***
	(-1.57)	(-1.21)	(0.74)	(-1.10)	(5.71)
Big x Priv Rivals R.E. Shock	-0.301***	-0.073	0.036	0.148**	0.143***
	(-3.08)	(-0.31)	(0.18)	(2.42)	(5.72)
Small	0.019***	0.025***	-0.004	-0.001	0.000
	(5.73)	(2.71)	(-0.64)	(-0.64)	(0.46)
Log Assets	0.011***	-0.113***	-0.156***	0.008***	0.002***
	(4.12)	(-19.12)	(-38.69)	(7.54)	(6.73)
Log Age	0.006	-0.072***	-0.008	0.003	-0.009***
	(1.23)	(-7.18)	(-0.95)	(1.01)	(-11.50)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	76,600	72,349	74,178	79,334	78,835

Panel B: Outcomes (Rival Public Firm Private Peers)	OI/Assets (1)	Sales Growth (2)	Asset Growth (3)	Total Similarity (4)	Prod Mkt Fluidity (5)
Small x Priv Rivals R&D Shock	-34.440***	55.685***	31.106***	-58.294***	5.687***
	(-5.22)	(3.44)	(3.05)	(-15.12)	(6.06)
Big x Priv Rivals R&D Shock	1.761	69.877***	41.331***	-38.611***	3.392***
	(0.44)	(7.15)	(5.33)	(-16.88)	(4.46)
Small x Priv Rivals R.E. Shock	-1.164	0.907	-0.387	0.429*	1.213***
	(-1.49)	(0.48)	(-0.33)	(1.90)	(15.27)
Big x Priv Rivals R.E. Shock	-3.615***	-3.167***	-2.125***	1.535***	1.498***
	(-10.46)	(-3.92)	(-2.98)	(7.19)	(16.54)
Small	0.022***	0.024***	-0.002	0.001	0.000
	(6.83)	(2.64)	(-0.32)	(0.54)	(0.09)
Log Assets	0.011***	-0.115***	-0.153***	0.008***	0.002***
	(4.20)	(-19.75)	(-35.58)	(7.48)	(6.67)
Log Age	0.002	-0.073***	-0.008	-0.001	-0.007***
	(0.45)	(-7.52)	(-1.04)	(-0.30)	(-10.15)
Firm + Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	78,499	74,207	76,117	81,367	80,843