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Capital and Labor Reallocation within Firms*

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ABSTRACT

We document how a shock to investment opportunities at one plant ("treated plant") spills over to other plants within the same firm, but only if the firm is financially constrained. To provide the treated plant with resources, headquarters withdraws capital and labor from other plants, especially from plants that are relatively less productive, not part of the firm's core industries, and located far away from headquarters. As a result of the resource reallocation, aggregate firm-wide productivity increases. We do not find any evidence of capital or labor spillovers among plants of financially unconstrained firms.

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There is a close link between the theory of internal capital markets and the theory of the firm. Accordingly, headquarters can create value by actively reallocating scarce resources across projects. In particular, headquarters' control rights enable it to take resources away from some projects and give them to other, more deserving ones (Alchian (1969), Williamson (1975), Stein (1997)). By contrast, an external lender, such as a bank, does not possess the authority to reallocate resources across borrowers.

This fundamental idea—that headquarters can create value by actively reallocating scarce resources—is testable. Stein (1997, p. 112) formulates the "efficient internal capital markets hypothesis" as follows:

> "Thus, for example, if a company owns two unrelated divisions A and B, and the appeal of investing in B suddenly increases, the argument would seem to imply that investment in A would decline—even if it is positive NPV at the margin—as corporate headquarters channels relatively more of its scarce resources toward B."[1]

Little is known about whether this hypothesis is true in the data. The paper that perhaps comes closest to testing this hypothesis is Shin and Stulz (1998). Using Compustat segment data, the authors regress investment by a segment on the industry qs of the firm's other segments. They overwhelmingly reject that the industry qs of the other segments affect the segment's investment and conclude: "unless one believes that firms face no costs of external finance, this evidence suggests that the internal capital market does not allocate resources efficiently" (Shin and Stulz (1998, p. 544)).

This paper takes a fresh look at the efficient internal capital markets hypothesis. Using plant-level data from the U.S. Census Bureau, we consider a natural experiment that is close in spirit to the thought experiment outlined in Stein's quote. To obtain

[1] Similarly, Shin and Stulz (1998, p. 543) define an internal capital market as efficient if "its allocation of funds to a segment falls when other segments have better investment opportunities."

exogenous variation in the "sudden increase in the appeal of investing in a plant," we use the introduction of new airline routes that reduce the travel time between headquarters and plants. Giroud (2013) uses this source of variation to study whether proximity to headquarters affects plant-level investment. The idea is that a reduction in travel time makes it easier for headquarters to monitor a plant, give advice, share knowledge, etc., raising the marginal productivity of capital and labor and thus making investment in the plant more appealing.[2,3] Consistent with this idea, Giroud finds that a reduction in travel time leads to an increase in plant-level productivity and investment.

In this paper, we use the "sudden increase in the appeal of investing in a plant" as our starting point and ask whether it leads to a reallocation of resources within the firm. Theory predicts that headquarters should withdraw resources from existing plants only if the firm is financially constrained. Accordingly, we provide results separately for financially constrained and unconstrained firms. We also examine whether headquarters—in order to provide the treated plant with resources—selectively "taxes" some plants more than others. We finally examine whether the reallocation is beneficial for the firm as a whole, as argued by the efficient internal capital markets hypothesis.

The main identification challenge comes from local shocks at the plant level. For instance, suppose a plant is located in a region that experiences an economic boom. As a result, headquarters may find it more attractive to invest in the plant. By the same token, airlines may find it more attractive to introduce new routes to the plant's location.

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[2]The main benefit of using travel time instead of geographical proximity is that plant location is endogenous. By contrast, holding plant location fixed, variation in travel time is plausibly exogenous with respect to plant-level outcomes. A second benefit is that travel time constitutes a more direct proxy for the ease of monitoring. For example, a plant may be located far away from headquarters, yet monitoring may be easy, because there exists a short direct flight. Conversely, a plant may be located in the same state as headquarters, yet monitoring may be costly, because it involves a long trip by car.

[3]Anecdotal evidence that proximity facilitates monitoring abound. For example, Ray Kroc, founder of McDonald's, writes in his autobiography: "One thing I liked about that house was that it was perched on a hill looking down on a McDonald's store on the main thoroughfare. I could pick up a pair of binoculars and watch business in that store from my living room window. It drove the manager crazy when I told him about it. But he sure had one hell of a hard-working crew" (Kroc (1992, p. 141)).

Thus, local shocks may be driving both plant-level investment and the introduction of new airline routes. Fortunately, we can control for such local shocks by including a full set of MSA × year fixed effects. The fixed effects are identified because not all local plants have their headquarters in the same region.

Controlling for local shocks also matters with regard to the firm's other (that is, non-treated) plants. In particular, it suggests that a decline in resources at these plants is not due to an adverse local shock that might have affected the plants anyway—that is, if they had been stand-alone entities. Thus, controlling for local shocks allows us to address a key premise of the theory of the firm, namely, that combining different projects under one roof creates an interdependence among projects.

Our plant-level results support the hypothesis that headquarters reallocates scarce resources across plants. For financially constrained firms, we find that investment and employment both increase at the treated plant, while they both decline at other plants within the same firm. Indeed, the increase at the treated plant is of similar magnitude as the decline at other plants: investment (employment) at the treated plant increases by $186,000 (five employees), while it declines by $179,000 (six employees) at all other plants combined. In contrast, we find no evidence of investment or employment spillovers among plants of financially unconstrained firms.

If headquarters actively reallocates scarce resources across plants, then the increase in investment and employment at the treated plant and the decline at other plants should occur around the same time. We find that this is indeed true: the increase at the treated plant and the decline at other plants both begin about one year after the treatment. Moreover, we find no pre-existing differential trends, strengthening a key identifying assumption underlying our analysis.

While other plants experience a decline in resources, the *average* spillover effect is relatively weak. There are several reasons for this. First, the amount of resources needed to "feed" the treated plant—and thus the amount that must be taken away from other plants—is rather modest. Second, this amount is divided among many other plants, implying that the average amount that is taken away from any individual plant is relatively small. Indeed, when we focus on firms that have relatively few other plants, the spillover effect becomes much stronger. Third, the average spillover effect is likely to be noisy. Presumably, headquarters does not uniformly "tax" all of the firm's other plants in the same way: while some plants may experience a large drop in resources, others may experience none. To address this issue, we examine which other plants are primarily affected by the resource reallocation. We find that headquarters is more likely to take resources away from plants that are relatively less productive, not part of the firm's core industries, and located far away from headquarters. When we focus on these kinds of plants, we find again that the spillover effect becomes much stronger.

Our main measures of financing constraints are the KZ-index (Kaplan and Zingales (1997)) and WW-index (Whited and Wu (2006)). In robustness checks, we additionally use the SA-index (Hadlock and Pierce (2010)), debt-to-cash flow ratio, investment in excess of cash flow, and whether firms have a credit rating. These measures have been designed to capture financing constraints, so we naturally interpret our results in this light. Still, it is conceivable that the resource reallocation occurs for reasons unrelated to financing constraints. To a certain extent, this issue can be addressed by looking at financially unconstrained firms. For instance, suppose that the treated plant produces the same type of output as other plants, while the firm's total output volume is given by its market share, which is fixed in the short run. Thus, if the firm produces more at the treated plant, it must produce less at other plants. While this creates an interdependence among plants, the mechanism causing it is unrelated to financing constraints. However, in this case, we should also observe a decline in resources at other plants of financially *unconstrained* firms ("placebo group"). We do not observe any such decline, suggesting that the likely reason why headquarters withdraws resources from existing plants is precisely because the firm is financially constrained.

Looking at financially unconstrained firms does not help if our measures of financing constraints are proxying for other variables that are (economically) unrelated to financing constraints but nevertheless affect the resource reallocation within the firm. While we cannot rule out this possibility in general, we can address specific alternative stories. For instance, our measures of financing constraints are uncorrelated with productivity measures. Thus, our results are unlikely to be driven by differences in productivity. Another unlikely candidate is firm size. While some of our measures of financing constraints are correlated with firm size, others are not, including the KZ-index, debt-to-cash flow ratio, and investment in excess of cash flow. Thus, again, our results are unlikely to be driven by differences in firm size.

In the final part of this paper, we consider the aggregate (or net) effect at the firm level. For financially constrained firms, we find that the aggregate effect on investment and employment is essentially zero, consistent with our plant-level results showing that the increase at the treated plant is of similar magnitude as the decline at other plants. By contrast, the aggregate effect on investment and employment at financially unconstrained firms is strictly positive. Given that these firms exhibit no (negative) spillovers among their plants, this is not entirely surprising, however.

A key premise of the efficient internal capital markets hypothesis is that the resource reallocation is overall beneficial: while resources may be taken away from projects that are positive NPV at the margin, they are channeled toward other projects whose investment prospects are even better. To examine this issue, we consider the aggregate effect on productivity at the firm level.[4] Doing so also helps us distinguish the efficient internal

[4]Our results are consistent with a constrained-efficient view according to which firms equalize the marginal revenue product of capital and labor across plants. The shock facilitates monitoring, knowledge sharing, etc., raising the marginal revenue product at the treated plant. Financially unconstrained firms raise new capital and equalize the marginal revenue product across plants by investing capital in the

capital markets hypothesis from alternative stories. For instance, suppose that all that is going on is that managers of the treated plant suddenly find it easier to lobby for a larger budget given that their travel time to headquarters is reduced. While such lobbying efforts can explain why the treated plant gains at the expense of other plants—provided the firm is financially constrained—they are unlikely to yield an increase in overall firm-wide productivity. However, regardless of which productivity measure we use, we find that firm-wide productivity increases.

We next consider other sources of funding. Our plant-level results suggest that financially constrained firms fund the expansion at the treated plant entirely by reallocating internal resources. Therefore, when looking at other sources of funding, we would not expect to see any changes. By contrast, financially unconstrained firms do not reallocate internal resources. Accordingly, we would expect to see changes in other sources of funding at these firms. Indeed, we find that financially unconstrained firms fund the expansion at the treated plant by issuing debt and drawing down cash reserves. By contrast, financially constrained firms exhibit no significant changes in their cash, short-term debt, long-term debt, or equity positions.

Aside from Shin and Stulz (1998), several papers examine whether segments within conglomerates are interdependent.[5] Notably, Lamont (1997) shows that in response to the 1986 oil shock—when oil prices fell by 50 percent—integrated oil companies cut investment across the board, including investment in non-oil segments. Thus, following a negative cash-flow shock to one segment, investment declines across all segments. By contrast, we show that following a shock to investment opportunities, investment at the treated plant and other plants within the same firm move in *opposite* directions.

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shocked plant, while financially constrained firms reallocate existing capital to equalize the marginal revenue product. While our results are consistent with such a view, we can, strictly speaking, only make statements about changes, not levels. Thus, while we can speak to the issue of whether the observed changes constitute an improvement, we cannot say whether the resulting allocation is second-best efficient.

[5]Stein (2003, Sections 5.1 and 5.2) and Maksimovic and Phillips (2007) provide excellent surveys of the theoretical and empirical literature on internal capital (re-)allocation.

Both Lamont (1997) and Shin and Stulz (1998) use Compustat segment data. By contrast, Maksimovic and Phillips (2002) construct segment-level data by aggregating plant-level data at the firm-industry level. The authors show that a segment's growth is negatively (positively) correlated with the other segments' productivity if the segment's growth at the industry level is lower (higher) than that of the firm's median segment. In a further study, Maksimovic and Phillips (2008) examine whether long-run changes in industry conditions have different effects on investment by single-segment firms and segments of conglomerate firms. By contrast, our paper studies whether shocks at the plant level spill over to other plants within the same firm.

The remainder of this paper is organized as follows. Section I presents the data. Section II describes the empirical methodology. Section III contains our main plant-level results. Section IV provides robustness checks. Section V examines which other plants are primarily affected by the resource reallocation. Section VI considers the aggregate (or net) effect at the firm level. Section VII concludes. The Appendix describes how our measures of financing constraints are constructed.

I. Data

A. Plant-Level Data

We employ three different data sets provided by the U.S. Census Bureau. The first data set is the Census of Manufactures (CMF). The CMF is conducted every five years ("Census years") and contains information about all manufacturing plants in the U.S. with at least one paid employee. The second data set is the Annual Survey of Manufactures (ASM). The ASM is conducted in all non-Census years and covers a subset of the plants covered by the CMF. Plants with at least 250 employees are included in every ASM year, while plants with fewer employees are randomly sampled every five years. The

CMF and ASM cover approximately 350,000 and 50,000 plants per year, respectively, and contain information about key plant-level variables, such as capital expenditures, assets, shipments, material inputs, employment, industry, and location.

The third data set is the Longitudinal Business Database (LBD), which is compiled from the business register. The LBD is available annually and covers all business establishments in the U.S. (that is, not only manufacturing plants) with at least one paid employee.[6] The LBD contains longitudinal establishment identifiers along with data on employment, payroll, industry, location, and corporate affiliation. We use the longitudinal establishment identifiers to construct longitudinal linkages between the CMF and ASM, allowing us to merge the two data sets into a single longitudinal panel.

Information about headquarters is obtained from two additional data sets provided by the U.S. Census Bureau: the Auxiliary Establishment Survey (AES) and the Standard Statistical Establishment List (SSEL). The AES contains information about non-production ("auxiliary") establishments, including headquarters. The SSEL contains the names and addresses of all U.S. business establishments.

Our sample period is from 1977 to 2005. To be included in our sample, we require that a plant has a minimum of two consecutive years of data. Following common practice (for example, Foster, Haltiwanger, and Syverson (2008)), we exclude plants whose information is imputed from administrative records rather than being directly collected. We also exclude plant-year observations for which employment is either zero or missing. To ensure that the physical distance between plants and headquarters is comparable across years, we furthermore exclude firms that change the location of their headquarters during the sample period. The results are virtually identical if we include these firms. These selection criteria leave us with 1,332,824 plant-year observations.

[6] An establishment is a "single physical location where business is conducted" (Jarmin and Miranda (2003, p. 15)). Establishments are the economic units used in the Census data sets.

B. Airline Data

The data on airline routes are obtained from the T-100 Domestic Segment Database (1990 to 2005) and from ER-586 Service Segment Data (1977 to 1989), which are compiled from Form 41 of the U.S. Department of Transportation (DOT).[7] All airlines that operate flights in the U.S. are required by law to file Form 41 with the DOT. The T-100 and ER-586 contain monthly data for each airline and route. The data include origin and destination airports, flight duration ("ramp-to-ramp time"), scheduled departures, performed departures, enplaned passengers, and aircraft type. Importantly, the T-100 and ER-586 are not samples; they include all flights that have taken place between any two airports within the U.S.

C. Financing Constraints

We use Compustat to construct measures of firms' financing constraints. We link Compustat to the CMF/ASM/LBD by using the Compustat-SSEL bridge maintained by the U.S. Census Bureau. Limiting ourselves to plants of publicly traded firms with a coverage in Compustat reduces our sample to 435,467 plant-year observations.

D. "Pure" Manufacturing Firms

As we wish to obtain a comprehensive picture of resource spillovers within firms, we focus on firms for which we have detailed information about most of the plants. As detailed plant-level data are only available for manufacturing plants, we thus limit our sample to "pure" manufacturing firms. Specifically, we use the LBD to compute the total number of employees for each firm. (Recall that the LBD covers all U.S. business establishments, not just manufacturing plants.) We then limit our sample to firms whose plants in the

[7] The T-100 Domestic Segment Database is provided by the Bureau of Transportation Statistics. The annual files of the ER-586 Service Segment Data are maintained in the form of magnetic tapes at the U.S. National Archives and Records Administration (NARA). We obtained a copy of the tapes from NARA.

CMF/ASM account for at least 90% of the firm's total employees.[8] This additional selection criterion leaves us with a final sample of 291,358 plant-year observations.

II. Empirical Methodology

A. Plant-Level Regressions

New airline routes that reduce the travel time between headquarters and plants make it easier for headquarters to monitor plants, give advice, share knowledge, etc., raising the marginal productivity of capital and labor and thus making investment in the (treated) plant more appealing. To examine the effect of this treatment on the treated plant and other plants within the same firm, we estimate the following difference-in-differences specification:

$$y_{ijlt} = \alpha_i + \alpha_t + \alpha_l \times \alpha_t + \beta_1 \times \text{ treated}_{ijt} + \beta_2 \times \text{ other}_{ijt} + \boldsymbol{\gamma}'\mathbf{X}_{ijlt} + \varepsilon_{ijlt}, \qquad (1)$$

where i indexes plants, j indexes firms, l indexes plant location, t indexes years, y is the dependent variable, α_i and α_t are plant and year fixed effects, $\alpha_l \times \alpha_t$ are location times year fixed effects, "treated" is a dummy variable that equals one if a new airline route that reduces the travel time between plant i and its headquarters has been introduced by year t, "other" is a dummy variable that equals one if a plant belongs to the same firm as the treated plant and the treated dummy is equal to one, and $\mathbf{X}$ is a vector of control variables. Location is defined at the Metropolitan Statistical Area (MSA) level.[9]

[8] Using a 90% (instead of a 100%) cutoff rule to classify "pure" manufacturing firms addresses two measurement issues. First, auxiliary establishments of manufacturing firms may be assigned non-manufacturing SIC codes in the LBD—for example, warehouse facilities may be classified as SIC 4225 (general warehousing and storage)—even though their very purpose is to support manufacturing plants. Second, assigning industries to establishments is potentially subject to measurement error.

[9] The MSA classification is only available for urban areas. For rural areas, we treat the rural part of each state as a separate region. There are 366 MSAs in the U.S. and 50 rural areas based on state boundaries. For simplicity, we refer to these 416 geographical units as MSAs.

The coefficients of interest are β_1, which measures the effect on the treated plant, and β_2, which measures the effect on other plants within the same firm.

Our main dependent variables are plant-level investment and employment. Investment is capital expenditures divided by capital stock—both are expressed in 1997 dollars. Capital expenditures are deflated using the 4-digit SIC deflator from the NBER-CES Manufacturing Industry Database. Real capital stock is computed using the perpetual inventory formula. Employment is the logarithm of the number of employees. All dependent variables are industry-adjusted by subtracting the industry median across all plants in a given 3-digit SIC industry and year. To mitigate the effect of outliers, we winsorize all dependent variables at the 2.5th and 97.5th percentiles of their empirical distributions. The control variables are plant size and age. Plant size is the logarithm of the value of shipments. Plant age is the logarithm of one plus the number of years since the plant has been in the LBD. Both variables are lagged. To account for serial and cross-sectional dependence across plants within the same firm, we cluster standard errors at the firm level. We obtain similar results if we cluster at the MSA level.

While our focus is on plant-level investment and employment, we also estimate the effect on plant-level productivity. We use two productivity measures: return on capital (ROC) and total factor productivity (TFP). ROC is the ratio of profits—shipments minus labor and material costs—to capital stock. TFP is the difference between actual and predicted output, where predicted output is the amount of output a plant is expected to produce for a given level of inputs. To compute predicted output, we follow common practice and use a log-linear Cobb-Douglas production function (for example, Schoar (2002), Bertrand and Mullainathan (2003), Syverson (2004), Foster, Haltiwanger, and Syverson (2008)). Specifically, TFP of plant i in year t is the estimated residual from the regression:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \varepsilon_{it}, \tag{2}$$

where y is the logarithm of output and k, l, and m are the logarithms of capital, labor, and material inputs, respectively.[10] To allow for different factor intensities across industries and over time, we estimate equation (2) separately for each 3-digit SIC industry and year.[11] Thus, TFP measures the relative productivity of a plant *within* an industry.

Theories of internal resource allocation based on "winner-picking" (Stein (1997)) rest on the premise that firms are financially constrained. Accordingly, we examine the effect separately for financially constrained and unconstrained firms by estimating a variant of equation (1) in which the "treated" and "other" dummies are interacted with dummies indicating whether the firm is financially constrained:

$$\begin{aligned} y_{ijlt} \;=\; & \alpha_i + \alpha_t + \alpha_l \times \alpha_t + \beta_1 \times \text{ treated}_{ijt} \times \text{ FC}_j + \beta_2 \times \text{ treated}_{ijt} \times \text{ non-FC}_j \\ & + \beta_3 \times \text{ other}_{ijt} \times \text{ FC}_j + \beta_4 \times \text{ other}_{ijt} \times \text{ non-FC}_j + \boldsymbol{\gamma}'\mathbf{X}_{ijlt} + \varepsilon_{ijlt}, \qquad (3) \end{aligned}$$

where FC (non-FC) is a dummy variable that equals one if a plant belongs to a firm that is financially constrained (unconstrained) in the year prior to the treatment.

B. Measuring Financing Constraints

Our main measures of financing constraints are the KZ-index (Kaplan and Zingales (1997)) and WW-index (Whited and Wu (2006)). The Appendix describes how both measures are constructed.

Some researchers have questioned the external validity of the KZ-index. A common critique is that the sample used to construct the KZ-index consists of manufacturing

[10] While equation (2) is typically estimated by OLS (see Syverson (2011) for a survey), research in industrial organization has proposed alternative methods to account for the endogeneity of input choices. Two prominent methods are the structural methods of Olley and Pakes (1996) and Levinsohn and Petrin (2003). We obtain similar results when computing TFP using these methods.

[11] SIC codes were the basis for all Census Bureau publications until 1996. In 1997, the Census Bureau switched to the North American Industry Classification System (NAICS). SIC codes were not discontinued until the 2002 Census, however. For the period 2002 to 2005, SIC codes are obtained as follows. For plants "born" before 2002, we use the latest available SIC code. For plants born between 2002 and 2005, we convert NAICS codes into SIC codes using the concordance table of the Census Bureau.

firms from the 1970s and 1980s. Consequently, the loadings used to construct the KZ-index may be specific to that period and the manufacturing sector (for example, Whited and Wu (2006, p. 533)). We believe this shortcoming of the KZ-index is not a serious problem in our context. First, our sample consists only of manufacturing firms. Second, although our sample period goes beyond the 1970s and 1980s, we always use pre-treatment years to classify firms as financially constrained. These pre-treatment years are mostly from the 1970s and 1980s. Nevertheless, to address concerns regarding the KZ-index, we estimate all our regressions using both the KZ-index and WW-index. In robustness checks, we additionally use the SA-index of Hadlock and Pierce (2010), debt-to-cash flow ratio, investment in excess of cash flow, and whether firms have a credit rating. All our results are similar regardless of which measure we use.

To classify firms as financially constrained, we sort in each year all firms into two groups based on whether a firm's measure of financing constraints lies above or below the median in that year. If a plant belongs to a firm whose measure of financing constraints lies above the median in the year prior to the treatment, the FC dummy is set equal to one. Conversely, if a plant belongs to a firm whose measure of financing constraints lies below the median in the year prior to the treatment, the non-FC dummy is set equal to one. Using pre-treatment values mitigates concerns that our classification might be affected by the treatment itself.

Empirical studies using Compustat typically classify 30% to 40% of firms as financially constrained. Thus, our choice of a median cutoff may seem high. However, our sample is not representative of the Compustat universe. It includes only "pure" manufacturing firms that are often smaller than the typical Compustat firm—large conglomerates with operations outside of manufacturing are excluded—and thus more likely to be financially constrained. Indeed, if we apply our cutoffs for the KZ- and WW-index to the Compustat universe, we obtain that 36.2% (KZ-index) and 31.8% (WW-index), respectively, of firms are financially constrained.

C. Identification Strategy

The identification strategy is adopted from Giroud (2013). To illustrate, suppose a company headquartered in Boston has plants located in Memphis, Chicago, and New York. In 1985, no direct flight was offered between Boston Logan International Airport and Memphis International Airport. The fastest way to connect both airports was an indirect flight operated by Delta Airlines with a stopover in Atlanta. In 1986, Northwest Airlines opened a new hub in Memphis. As part of this expansion, Northwest started operating direct flights between Boston and Memphis as of October 1986. The introduction of this new airline route reduced the travel time between Boston and Memphis and is coded as a treatment of the Memphis plant in 1986. Accordingly, the "treated" dummy switches from 0 to 1 for the Memphis plant, while the "other" dummy switches from 0 to 1 for the Chicago and New York plants.

The control group includes all plants that have not (yet) been treated or have not (yet) been "other" plants. Due to the staggered nature of the introduction of new airline routes, this implies that a plant remains in the control group until it becomes either a treated or "other" plant, which may be never.

Airlines' decisions to introduce new routes may depend on several factors, including economic and strategic considerations as well as lobbying. As long as these factors are orthogonal to plant-level outcomes, this is not a concern. However, if there are omitted factors that are driving both the introduction of new airline routes and plant-level outcomes, then our results could be spurious.

One important source of omitted variable bias are local shocks at the plant level. To continue with the example, suppose that the Memphis area experiences an economic boom. As a result, the company headquartered in Boston may find it more attractive to increase investment at the Memphis plant. By the same token, airlines may find it more attractive to introduce new flights to Memphis, possibly due to lobbying by companies with plants in Memphis. Fortunately, we can control for such local shocks by including a full set of MSA × year fixed effects. The fixed effects are identified because not all plants located in Memphis have their headquarters in Boston.[12]

All of these (endogeneity) concerns apply first and foremost to the treated plant. While it is conceivable that a local shock in the Memphis area triggers both an increase in investment at the Memphis plant and the introduction of a new airline route between Boston and Memphis, it is unlikely that a local shock in either the Chicago or New York area would trigger a new airline route between Boston and Memphis. Nevertheless, the inclusion of MSA-year fixed effects also accounts for this possibility.[13]

D. Firm-Level Regressions

To examine the aggregate (or net) effect on the firm as a whole, we estimate the following firm-level analogue of equation (1):

$$y_{jt} = \alpha_j + \alpha_t + \beta_1 \times \text{ treatment}_{jt} + \boldsymbol{\gamma}'\mathbf{X}_{jt} + \varepsilon_{jt}, \tag{4}$$

where j indexes firms, t indexes years, α_j and α_t are firm and year fixed effects, y is the dependent variable, "treatment" is a dummy variable that equals one if a plant of firm j has been treated by year t, and $\mathbf{X}$ is a vector of control variables.

[12] Put another way, the fixed effects are identified because a treatment is uniquely defined by *two* locations: the location of the plant's home airport and the location of headquarters' home airport. To estimate the three-way fixed effect model with year, plant, and MSA × year fixed effects, we employ the estimation procedure of Guimarães and Portugal (2010). (See the discussion in Gormley and Matsa (2014).) In a previous version of this paper, we used time-varying MSA × year controls—defined as the mean of the dependent variable in the plant's MSA in a given year, excluding the plant itself—in lieu of MSA × year fixed effects. The results were virtually identical.

[13] Giroud (2013) provides several tests to support the hypothesis that the introduction of new airline routes has a causal effect on plant-level outcomes. For instance, he shows that his results are robust if only new airline routes are considered that are the outcome of a merger between two airlines or the opening of a new hub, and if only indirect flights are considered where either the last leg of the flight (connecting the plant's home airport) or the first leg of the flight (connecting headquarters' home airport) remains unchanged, meaning the travel time reduction is due to a new route elsewhere in the country.

Our main dependent variables are again investment and employment. Both variables are the same as in our plant-level regressions, except they are aggregated at the firm level. For example, firm-level investment is the ratio of total capital expenditures to total capital stock, where total capital expenditures (total capital stock) is the sum of capital expenditures (capital stock) across all of the firm's plants. In addition, we estimate the effect on firm-level return on capital (ROC) and total factor productivity (TFP). Firm-level ROC is the ratio of total profits—the sum of shipments minus labor and material costs across all of the firm's plants—to total capital stock. To compute firm-level TFP, we follow Schoar (2002) and use the capital-weighted average of the individual plant-level TFPs. The control variables are firm size and age. Firm size is the logarithm of total shipments—except in the ROC and TFP regressions, where it is the logarithm of capital stock—while firm age is the logarithm of one plus the number of years the firm has been in the LBD. Both variables are lagged. To mitigate the effect of outliers, we winsorize all dependent variables at the 2.5th and 97.5th percentiles of their empirical distributions. Standard errors are clustered at the firm level.

To examine whether the effect is different for financially constrained and unconstrained firms, we estimate a variant of equation (4) in which the "treatment" dummy is interacted with dummies indicating whether the firm is financially constrained:

$$y_{jt} = \alpha_j + \alpha_t + \beta_1 \times \text{ treatment}_{jt} \times \text{ FC}_j + \beta_2 \times \text{ treatment}_{jt} \times \text{ non-FC}_j + \boldsymbol{\gamma}'\mathbf{X}_{jt} + \varepsilon_{jt}, \quad (5)$$

where FC and non-FC have been defined previously.

E. Measuring Travel Time Reductions

A new airline route is coded as a treatment if it reduces the travel time between headquarters and a plant relative to the previously optimal (that is, fastest) way of traveling. There are four possibilities: (i) a new indirect flight using a different route replaces a previously optimal indirect flight ("indirect to indirect"); (ii) a new direct flight replaces a previously optimal indirect flight, as in the Boston-Memphis example ("indirect to direct"); (iii) a new direct flight using a different route—that is, a different origination or destination airport—replaces a previously optimal direct flight ("direct to direct"); (iv) a new direct or indirect flight replaces car travel as the previously optimal means of transportation ("road to flight").

To compute the fastest way of traveling between headquarters and plants, we follow Giroud (2013) and determine the route and means of transportation that minimizes the total travel time between the plant's ZIP code and the ZIP code of headquarters. (Specifically, we use the latitude and longitude corresponding to the centroid of the area spanned by the respective ZIP code.) We first compute the driving time by car (in minutes) between the two ZIP codes using MS Mappoint. This travel time serves as a benchmark and is then compared to the travel time by air based on the fastest airline route.

To determine the fastest airline route between two ZIP codes, we use the itinerary information from the T-100 and ER-586 data. The fastest airline route minimizes the total travel time between headquarters and the plant. The total travel time consists of three components: 1) the travel time by car between headquarters and the origin airport, 2) the duration of the flight, including the time spent at airports and, for indirect flights, the layover time, and 3) the travel time by car between the destination airport and the plant. The travel time by car to and from the airport is obtained from MS Mappoint. Flight duration per segment is obtained from the T-100 and ER-586 data. The only unobservables are the time spent at airports and the layover time. We assume that one hour is spent at the origin and destination airports together and that each layover takes one hour. None of our results depend on these assumptions.[14]

[14]The average layover time based on a random sample of 100 flights is approximately one hour. The time spent at the origin and destination airports is largely immaterial as it cancels out when computing changes in travel time.

F. Summary Statistics

Table I provides summary statistics for all plants ("all plants") and separately for plants that are treated during the sample period ("eventually treated plants"), plants that become "other" plants during the sample period ("eventually "other" plants"), and all remaining plants ("remaining plants"). For each plant characteristic, we report the mean and standard deviation (in parentheses).

[Table I about here]

All three categories of plants are similar. For example, eventually treated plants have 379 employees on average compared to 432 employees at eventually "other" plants and 376 employees at all remaining plants. The only noteworthy difference is that the remaining plants have slightly lower shipments and capital stock than the other two categories. This is not a concern, however. Due to the staggered nature of the introduction of new airline routes, plants in the "eventually treated" and "eventually other" categories are initially in the control group—together with the remaining plants—until they become either treated or "other" plants. Given the large number of plants in the "eventually treated" and "eventually other" categories, this implies that the control group is indeed *very* similar to the group of treated and "other" plants. In fact, one implication of the staggered introduction of new airline routes is that we could estimate all our regressions using only "eventually treated" and "eventually other" plants.

The plants in our sample are larger than those in Giroud (2013): the average plant in our sample has 410 employees versus 213 employees in Giroud's sample. This is not surprising, given that our sample includes only publicly traded firms that are covered in Compustat. Such firms are on average larger, and own larger plants, than private firms. On the other hand, our plants are slightly smaller than those in Bertrand and Mullainathan (2003), who also use a matched Census-Compustat sample. In their sample, plants have 436 employees on average. This difference is due to the fact that our sample includes only "pure" manufacturing firms, whereas their sample also includes large conglomerates with operations outside of manufacturing.

III. Plant-Level Regressions

A. Plant-Level Investment and Employment

Table II shows the effect of the introduction of new airline routes on investment and employment at the treated plant and other plants within the same firm. As is shown in column [1], investment at the treated plant increases by 0.01 percentage points, corresponding to an increase in capital stock of about 1%. At the same time, the firm's other plants experience a small but insignificant decline in investment. As we will show below, this (negative) spillover effect becomes stronger and significant if we focus on financially constrained firms and, in particular, firms with relatively few other plants (Section V.A) as well as on particular subsets of other plants (Section V.B).

[Table II about here]

Columns [2] and [3] show the effect separately for financially constrained and unconstrained firms. In both cases, investment at the treated plant increases, albeit the effect is stronger for financially unconstrained firms. Specifically, the coefficient on treated $\times$ FC is 0.008, while the coefficient on treated $\times$ non-FC is 0.012 (KZ-index) and 0.011 (WW-index), respectively. The difference is significant at the 5% level. As for the firm's other plants, the effect is virtually zero for other plants of financially unconstrained firms. By contrast, the effect on other plants of financially constrained firms is negative and—at least when the KZ-index is used—statistically significant.

Overall, our results suggest that financially constrained firms—but not financially unconstrained firms—exhibit negative spillovers among their plants. Indeed, the increase in investment at the treated plant is of similar magnitude as the decline at other plants: investment at the treated plant increases by $186,000, while it declines by $179,000 at all other plants combined. This suggests that, for financially constrained firms, the aggregate (or net) change in investment at the firm level should be approximately zero. We will later confirm that this is indeed the case.

Columns [4] to [6] display a similar pattern with respect to employment. In particular, while there are no spillovers among plants of financially unconstrained firms, there are negative and—at least when the KZ-index is used—significant spillovers among plants of financially constrained firms. The increase at the treated plant is again of similar magnitude as the decline at other plants: employment at the treated plant increases by five employees, while it declines by six employees at all other plants combined.

That the patterns for investment and employment are similar suggests that capital and labor are complements in the firm's production function. We can examine this hypothesis more directly by using the capital-to-labor ratio (logarithm of the ratio of capital stock to the number of employees) as the dependent variable. We find that this ratio remains unchanged throughout: at the treated plant, at the firm's other plants, and at the overall firm level. Hence, it appears that firms respond to the treatment by adjusting capital and labor in a proportionate fashion.

Our employment results point to a potentially interesting "dark side" of internal labor markets. (See Tate and Yang (2011) for a "bright side.") Unless workers are physically transferred across plants—which is unlikely if the treated and other plants are located far away from one another—our results suggest that the treated plant hires new workers while other plants are forced to lay off workers. Consequently, some workers are laid off not because their plant is doing poorly, but merely because some other plant within the same firm is doing relatively better. While this is speculative, this additional layoff risk due to headquarters engaging in "winner-picking" could be an explanation for Schoar's (2002) empirical finding that conglomerate firms pay higher wages on average.

B. Plant-Level Productivity

Table III shows the effect on plant-level productivity. We use two productivity measures: total factor productivity (TFP) and return on capital (ROC). The results largely mirror those in Table II. First, productivity at the treated plant increases, consistent with the idea that a reduction in travel time makes it easier for headquarters to monitor, give advice, share knowledge, etc., raising the marginal productivity of capital and labor. Second, productivity at other plants of financially unconstrained firms remains unchanged. Third, there is a small but insignificant decline in productivity at other plants of financially constrained firms, suggesting that headquarters seeks to reallocate resources in a way that minimizes productivity losses.[15] Indeed, as we will show in Section V.B.1, headquarters primarily withdraws resources from less productive plants, that is, plants where the productivity losses are likely to be small.

[Table III about here]

C. Dynamics of the Treatment Effect

Table IV examines the dynamics of the treatment effect. Given that the T-100 and ER-586 segment data are recorded at monthly frequency, we know in which month a new airline route is introduced. Thus, we are able to reconstruct how many months before or after the introduction of a new airline route a given plant-year observation is recorded, implying that we can introduce dummy variables indicating the time interval between a

[15] Table IA.VII of the Internet Appendix shows that the effect on productivity at other plants remains small and insignificant if we interact other $\times$ FC with plant characteristics.

plant-year observation and the treatment. In Table IV, year(-1) indicates the plant-year observation in the year before the treatment, year(0) indicates the plant-year observation in the year of the treatment, and so on. Accordingly, treated × FC × year(-1) measures the effect on the treated plant at financially constrained firms in the year prior to the treatment, treated × FC × year(0) measures the same effect in the year of the treatment, and so on. Due to space constraints, Table IV only displays the relevant coefficients for financially constrained firms.

[Table IV about here]

We obtain two results. First, if headquarters actively reallocates scarce resources across plants, then the increase in investment and employment at the treated plant and the decline at other plants should occur around the same time. We find that this is indeed true: the increase at the treated plant and the decline at other plants both begin about one year after the treatment. Second, there are no pre-existing differential trends: the coefficients on treated × FC × year(-1) and other × FC × year(-1) are both small and insignificant, strengthening a key identifying assumption underlying our analysis.

D. Plant Closures

What if some of the other plants are brought to zero employment in response to the treatment? In a way, closing a plant constitutes an extreme form of taking away resources. Given that we exclude plant-year observations for which employment is either zero or missing, this would imply that we underestimate the spillover effect on other plants. To investigate this issue, we re-estimate our main plant-level regressions using as the dependent variable a dummy indicating whether the plant is closed down in the following year. The results, which are shown in Table IA.I of the Internet Appendix, suggest that plant closure is an unlikely outcome. Indeed, none of the main coefficients is significant, regardless of whether a plant is treated or whether a firm is financially constrained or unconstrained. This (non-)result may not surprise. As we have shown previously, the amount of resources that needs to be taken away from other plants is relatively small—perhaps too small to warrant closing down an entire plant.

E. Do Travel Time Reductions Matter?

We do not directly observe the travel behavior of managers.[16] However, Giroud (2013, Section IV.D) provides auxiliary evidence suggesting that reductions in travel time do matter:

a) It seems unlikely that managers would alter their travel behavior if the reduction in travel time is small. Consistent with this argument, Giroud finds that the treatment effect is only significant if the travel time reduction is at least two hours roundtrip. Indeed, a two hour travel time reduction could mean the difference between being able to fly back on the same day versus having to stay over night.

b) Larger travel time reductions should lead to stronger treatment effects: managers can spend more time at the treated plant instead of in the air or may choose to visit the treated plant more often given that traveling has become easier. Consistent with this argument, Giroud finds that the treatment effect is monotonically increasing in the amount of travel time saved.

c) The treatment effect should be weaker in the later part of the sample period, when innovations in information technology (for example, Internet, video conferencing, etc.) facilitated information flows across company units, reducing the need to personally travel to plants. Indeed, Giroud finds that the coefficient on the treatment dummy in the pre-1986 period is about twice as large as in the post-1995 period.

[16] The following quote is from *Chief Executive* magazine (October 1, 2003): "Lillie considers travel from headquarters to see a company's other plants or offices a must. "You need to see it, feel it, touch it, taste it before you make a good decision," says Lillie." James Lillie is the CEO and former COO of Jarden, a Fortune 500 company based in Rye, N.Y., with over 23,000 employees.

Further evidence that travel time matters is found in the management literature. In a recent study of 1,171 Japanese companies with U.S. subsidiaries, Boeh and Beamish (2011, 2012) find that the longer it takes to travel from Japan to the U.S. subsidiary, the lower is the subsidiary's profitability. While this relationship is purely cross-sectional, the result is consistent with Giroud (2013). Importantly, what matters is travel time, not geographical distance: controlling for local economic conditions and industry characteristics, a subsidiary in Lexington, Kentucky, is about 25% less profitable than a subsidiary in Houston, Texas, even though the two locations are equidistant from Tokyo. The reason, according to the authors, is that flying from Tokyo to Lexington takes two hours longer than does flying to Houston, because the former trip involves a layover. To understand better why longer travel time is associated with lower profitability, Boeh and Beamish conducted interviews with dozens of executives. Accordingly, "[a]dded time in transit, and the resulting fatigue, hamper executives' ability to share knowledge and learn from the local operation. They can lead to poorer oversight of people, projects, and operations; result in slower strategy execution; and reduce opportunities to develop relationships" (Boeh and Beamish (2011, p. 30)).

IV. Measuring Financing Constraints

A. Placebo Group: Financially Unconstrained Firms

It is conceivable that the reallocation of resources across plants occurs for reasons unrelated to financing constraints. To a certain extent, this issue can be addressed by looking at the group of financially unconstrained firms. For instance, suppose that the treated plant produces the same type of output as other plants, while the firm's total output volume is fixed in the short run. Thus, if the firm produces more at the treated plant, it must produce less at other plants. However, in this case, we should also observe a decline in resources at other plants of financially *unconstrained* firms. We do not observe any such decline, suggesting that the likely reason why headquarters withdraws resources from existing plants is precisely because the firm is financially constrained.

B. Financing Constraints versus Productivity

Looking at financially unconstrained firms does not help if our measures of financing constraints—the KZ- and WW-index—are proxying for other variables that are (economically) unrelated to financing constraints but nevertheless affect the resource reallocation within the firm.[17] While we cannot rule out this possibility in general, we can address specific alternative stories. Consider the following alternative stories based on differences in productivity.

1) Suppose that—in response to the opening of a new airline route—scarce managerial talent is shifted to the treated plant, reducing the NPV of marginal projects at other plants. For low-productivity firms, this may imply that some projects change from positive to negative NPV, making a withdrawal of resources optimal. In contrast, for high-productivity firms, the NPV of marginal project remains positive. Accordingly, if "financially constrained" firms are simply less productive, this story could potentially explain our results.

2) Similar to above, except that "financially constrained" firms are not less productive on average but merely have a higher dispersion in productivity. Again, this would make it more likely that the NPV of marginal projects at other plants is low, with the implication that it may change from positive to negative NPV.

3) Suppose that, unlike above, the NPV of marginal projects at other plants does not change. Still, if "financially constrained" firms are less productive, the opportunity

[17] One could plausibly imagine that our measures of financing constraints are correlated with the costs of adjusting factors of production, in the sense that financially constrained firms have more costly access to labor markets and suppliers, hampering capacity expansions. If true, a story predicated on heterogeneity in factor adjustment costs would also be consistent with our results.

cost of withdrawing resources from other plants may be low—possibly lower than the cost of raising external funds. In contrast, for high-productivity firms, the opportunity cost of withdrawing resources from other plants may be higher than the cost of raising external funds. In a sense, this story is the mirror image of the conventional view whereby financially constrained firms face a higher cost of raising external funds. By contrast, according to this story, firms differ not in their cost of raising external funds but rather in their opportunity cost of withdrawing resources from existing plants.

To examine whether our measures of financing constraints are proxying for differences in productivity, we first estimate pairwise correlations between our measures of financing constraints and measures of firm-level productivity. We find that the correlation is always small and insignificant: the correlation between the KZ-index and firm-level total factor productivity (TFP) is -0.5% ($p-$value of 0.895), that between the KZ-index and firm-level return on capital (ROC) is -0.5% ($p-$value of 0.890), that between the WW-index and firm-level TFP is -1.0% ($p-$value of 0.775), and that between the WW-index and firm-level ROC is -0.7% ($p-$value of 0.835).[18]

[Table V about here]

In Table V, we re-estimate our main plant-level regressions by replacing the FC and non-FC dummies with dummies indicating whether a firm's productivity lies below ("low") or above ("high") the median productivity across all firms in the year prior to the treatment. As is shown, there are no differences between low- and high-productivity firms. Thus, it is unlikely that our results are driven by differences in productivity.[19]

[18]The correlations are based on all treated firms in the year prior to the treatment, consistent with the definition of the FC- and non-FC dummies. The estimates are similar when using all firm-year observations in Compustat from 1977 to 2005. For example, the correlation between the KZ-index and return on assets (ROA) is -1.7%, while the correlation between the WW-index and ROA is -2.8%.

[19]We repeat this exercise in Tables IA.II to IA.IV of the Internet Appendix using other productivity measures: plant-level productivity, dispersion in plant-level productivity, and productivity of the treated

C. Financing Constraints versus Firm Size

Another unlikely candidate is firm size. While some of our measures of financing constraints are correlated with firm size, others are not. For instance, the correlation between firm size and the KZ-index is -3.7% ($p-$value of 0.280), that between firm size and debt-to-cash flow ratio is 3.3% ($p-$value of 0.341), and that between firm size and investment in excess of cash flow is 4.2% ($p-$value of 0.222).[20] Thus, some of our measures of financing constraints may be best viewed as capturing the effects of financing constraints *conditional* on firm size.

D. Alternative Measures of Financing Constraints

The KZ- and WW-index are both constructs of several variables. In Table VI, we replace these measures with alternative measures that are simpler and thus potentially less ambiguous: the SA-index of Hadlock and Pierce (2010), debt-to-cash flow ratio, investment in excess of cash flow, and a dummy indicating whether firms have a credit rating. While the SA-index is also a construct of several variables, it is a simple combination of size and age. The other measures are self-explanatory. As is shown, the results mirror our baseline results. In particular, the effect on other plants of financially unconstrained firms is always zero, or close to zero, while the effect on other plants of financially constrained firms is always negative and—in the majority of regressions—statistically significant.

[Table VI about here]

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plant alone. We always find the same result: there are no differences between low- and high-productivity firms, making it unlikely that our results are driven by differences in productivity.

[20] Debt-to-cash flow ratio and investment in excess of cash flow are introduced in Section IV.D. The correlations are based on all treated firms in the year prior to the treatment, consistent with the definition of the FC- and non-FC dummies. The estimates are similar when using all firm-year observations in Compustat from 1977 to 2005. Accordingly, the correlation between firm size and the KZ-index is 3.5%, that between firm size and debt-to-cash flow ratio is 1.0%, and that between firm size and investment in excess of cash flow is 3.4%.

E. Public versus Private Firms

Private firms are more likely to be financially constrained than public ones: they are smaller, more opaque, and less likely to have access to public debt markets. In Table VII, we extend our sample to include both public and private firms while using a "private" dummy in lieu of our measures of financing constraints. The results again mirror our baseline results. In particular, the effect on other plants of public firms is zero, or close to zero, while the effect on other plants of private firms is negative and—in the case of investment—statistically significant.

[Table VII about here]

V. Cross-Sectional Heterogeneity

A. Few versus Many "Other" Plants

While other plants experience a decline in resources, the *average* spillover effect documented in Table II is relatively weak. There are several reasons for this. First, the amount of resources needed to "feed" the treated plant—and thus the amount that must be taken away from other plants—is relatively modest. Second, this amount is divided among many other plants, implying that the average amount that is taken away from any individual plant is small. An immediate implication of this is that the spillover effect should become stronger if we focus on firms that have relatively few other plants. Accordingly, we interact other × FC and other × non-FC with dummy variables indicating whether the number of "other" plants lies below or above the median across all treated firms in the year prior to the treatment. As is shown in Table VIII, the coefficient on other × FC effectively doubles if we focus on firms with relatively few other plants. For instance, when the dependent variable is investment, the coefficient on other × FC × (#

other plants < median) is −0.004 (KZ-index) and −0.005 (WW-index), respectively, while the coefficient on other × FC in Table II is −0.002 (KZ-index) and −0.003 (WW-index), respectively. Also, the coefficient is now always significant at the 5% level, while it was previously either insignificant or only marginally significant.

[Table VIII about here]

B. Which Other Plants Are Primarily Affected?

Another reason why the average spillover effect is relatively weak is that it is likely to be noisy. Presumably, headquarters does not uniformly "tax" all of the firm's other plants in the same way: while some plants may experience a large drop in resources, others may experience none. To examine this hypothesis, we interact other × FC with various plant characteristics, such as plant productivity, whether a plant operates in a main or peripheral industry of the firm, whether it operates in the same or a different industry as the treated plant, whether it has been newly acquired during the sample period, and whether it is located close to headquarters.[21,22] All plant characteristics are measured in the year prior to the treatment. Some of our results—especially those related to plant productivity and whether a plant operates in a main or peripheral industry—are similar in spirit to segment-level results in Maksimovic and Phillips (2002) based on linkages across segments arising from differences in the segments' industry growth.

[21]Table IA.V of the Internet Appendix reports pairwise correlations among the plant characteristics. As is shown, all correlations are insignificant. The only exception is when two plant characteristics measure the same thing—for example, TFP and ROC are both measures of productivity—in which case the correlation is, and should be, large and significant.

[22]Eisfeldt and Rampini (2006) find that capital reallocation between firms is procyclical. To see whether a similar result also holds *within* firms, we have interacted treated × FC and other × FC with business cycle dummies. While we find no significant differences across business cycles, we should note that our analysis only captures reallocations following specific events, namely, the introduction of new airline routes.

[Table IX about here]

B.1. Plant Productivity

If headquarters seeks to minimize efficiency losses, then it should take resources away from plants that are less productive. To see whether this is true, we interact other × FC with dummy variables indicating whether a plant's total factor productivity (TFP) lies below ("low") or above ("high") the median TFP among all of the firm's other plants in the year prior to the treatment. Thus, productivity is measured relative to other plants within the same firm, not across firms.

As is shown in Panel A of Table IX, headquarters is more likely to take resources away from less productive plants. This is true regardless of how we measure financing constraints and whether we consider plant-level investment or employment. Indeed, the coefficient on other × FC × low is about twice as large as the coefficient on other × FC reported in Table II and always significant at the 5% level. In contrast, the coefficient on other × FC × high is always small and insignificant. Thus, if we focus on the least productive plants within a firm, we obtain robust and significant spillover effects. We obtain similar results if we measure productivity using return on capital (ROC) (see Panel A of Table IA.VI of the Internet Appendix).

B.2. Peripheral versus Main Industries

The second plant attribute proxies for how important a plant is within the firm. Specifically, we interact other × FC with dummy variables indicating whether a plant operates in a main or peripheral industry of the firm, where peripheral industries are 3-digit SIC industries that account for less than 25% of the firm's shipments in the year prior to the treatment (see Maksimovic and Phillips (2002)).

As is shown in Panel B of Table IX, firms are more likely to withdraw resources from peripheral plants. Indeed, the coefficient on other × FC × peripheral is about twice as large as the coefficient on other × FC reported in Table II and always significant at the 5% level. In contrast, the coefficient on other × FC × main is always small and insignificant. We obtain similar results if we classify industries using 4-digit SIC codes (see Panel B of Table IA.VI of the Internet Appendix).

B.3. Same versus Different Industries

The third plant attribute indicates whether a plant operates in the same or a different industry as the treated plant. There are various reasons for why headquarters may want to withdraw more resources from plants that operate in the same industry as the treated plant. For instance, doing so may minimize distortions in the firm's industry portfolio. Likewise, assuming divisions are organized by industry, adding and subtracting resources within the same industry may minimize inter-divisional rent-seeking.

While there may be good (theoretical) reasons for why headquarters may want to withdraw more resources from plants that operate in the same industry as the treated plant, we find no empirical support for such reasons. As is shown in Panels C and D of Table IA.VI of the Internet Appendix, the coefficients on other × FC × same and other × FC × different are always close to each other and consequently also to the coefficient on other × FC reported in Table II.

B.4. Acquired versus Own Plants

The fourth plant attribute indicates whether a plant has been newly acquired during the sample period. There are various reasons for why headquarters may want to withdraw more resources from newly acquired plants. For instance, newly acquired plants may have less lobbying power. However, we find no empirical support for such reasons. As is shown in Panel E of Table IA.VI of the Internet Appendix, the coefficients on other × FC × acquired and other × FC × own are always close to each other and consequently also to the coefficient on other × FC reported in Table II.

B.5. Proximity to Headquarters

The final plant attribute that we consider is the geographical distance between plants and headquarters, which is computed using the great-circle distance formula:

$$r \times \text{arcos}\ \left(\sin\lambda_P \sin\lambda_{HQ} + \cos\lambda_P \cos\lambda_{HQ} \cos[\phi_P - \phi_{HQ}]\right),$$

where λ_P (λ_{HQ}) and ϕ_P (ϕ_{HQ}) is the latitude and longitude, respectively, corresponding to the centroid of the area spanned by the ZIP code of the plant (headquarters), and r is the approximate radius of the earth (3,959 miles).

As Panel C of Table IX shows, firms are more likely to withdraw resources from more distant plants. Indeed, the coefficient on other × FC × high is about twice as large as the corresponding coefficient on other × FC reported in Table II and is (almost) always significant at the 5% level. By contrast, the coefficient on other × FC × low is always small and insignificant. We obtain similar results if we measure proximity using travel time (see Panel F of Table IA.VI of the Internet Appendix).

VI. Firm-Level Regressions

A. Firm-Level Investment and Employment

Table X shows the aggregate (or net) effect on investment and employment at the firm level. As is shown in column [1], aggregate investment increases by 0.002 percentage points, corresponding to an increase in capital stock of about 0.2%. Columns [2] and [3] show the aggregate effect separately for financially constrained and unconstrained firms. Aggregate investment at financially constrained firms remains unchanged, which is consistent with our previous results showing that the increase in investment at the treated plant is offset by a decline at other plants of similar magnitude.[23] By contrast, aggregate investment at financially unconstrained firms increases. Both results are independent of how we measure financing constraints.

[Table X about here]

Columns [4] to [6] display a similar pattern with respect to employment. While aggregate employment increases by 0.4% one average, aggregate employment at financially constrained firms remains unchanged. By contrast, the effect on aggregate employment at financially unconstrained firms is strictly positive.

B. Firm-Level Productivity

A key premise of the efficient internal capital markets hypothesis is that the resource reallocation is overall beneficial: while resources may be taken away from projects that are positive NPV at the margin, they are channeled toward other projects whose investment prospects are even better. To investigate this issue, we consider the aggregate effect on productivity at the firm level. Doing so also helps us distinguish the efficient internal capital markets hypothesis from alternative stories, for example, the resource reallocation may be the outcome of lobbying by managers of the treated plant, who suddenly find it easier to lobby for a larger budget given that their travel time to headquarters is reduced. While such lobbying efforts can explain why the treated plant gains at the expense of

[23] That aggregate investment at financially constrained firms remains unchanged does not imply that these firms are shut out of external capital markets. It merely suggests that their cost of raising external funds is higher than their opportunity cost of reallocating internal resources.

other plants—provided the firm is financially constrained—they are unlikely to yield an increase in overall firm-wide productivity.

[Table XI about here]

Table XI presents the results. We use two measures of productivity: firm-level total factor productivity (TFP) and return on capital (ROC). In both cases, we find that aggregate productivity at financially constrained firms increases. Thus, the reallocation of resources is beneficial. Moreover, Table III shows that this productivity increase comes entirely from the treated plant, while the firm's other plants experience a small and insignificant loss in productivity. As we remarked earlier, this is consistent with our cross-sectional results showing that headquarters primarily withdraws resources from less productive plants, that is, plants where the productivity losses are likely to be small. Finally, aggregate productivity at financially unconstrained firms also increases, and by more than at financially constrained firms. However, this is not surprising, given that financially unconstrained firms are not forced to take resources away from projects that are positive NPV at the margin.

C. Other Sources of Funding

Our plant-level results suggest that financially constrained firms fund the expansion at the treated plant entirely by reallocating internal resources. Therefore, when looking at other sources of funding, we would not expect to see any changes. By contrast, financially unconstrained firms do not reallocate internal resources. Accordingly, we would expect to see changes in other sources of funding at these firms. Table XII confirms these predictions: financially unconstrained firms fund the expansion at the treated plant by issuing short-term debt and drawing down cash reserves, while financially constrained firms exhibit no significant changes in their cash, short-term debt, long-term debt, or equity positions.

[Table XII about here]

VII. Conclusion

New airline routes that reduce the travel time between headquarters and plants make it easier for headquarters to monitor plants, give advice, share knowledge, etc., raising the marginal productivity of capital and labor and thus making investment in the (treated) plant more appealing. In this paper, we examine the effect of this treatment on the treated plant, other plants within the same firm, and the firm as a whole. For financially constrained firms, we find that investment and employment both increase at the treated plant, while they both decline at other plants. In fact, the increase at the treated plant is of similar magnitude as the decline at other plants. As a result, aggregate investment and employment at the firm level remain unchanged.

While aggregate investment and employment remain unchanged, aggregate firm-wide productivity increases. Thus, the reallocation of resources within the firm is beneficial. Specifically, while productivity at the treated plant increases—consistent with increased monitoring, knowledge sharing, etc., raising the marginal productivity of capital and labor—other plants within the same firm experience a small and insignificant loss in productivity. Indeed, it appears that headquarters seeks to reallocate resources in a way that minimizes such productivity losses by withdrawing resources primarily from less productive plants, that is, plants where the productivity losses are likely to be small. Overall, our results are consistent with theories of internal capital markets (and theories of the firm) predicated on the notion that headquarters plays a beneficial role by actively reallocating scarce resources across projects (for example, Alchian (1969), Williamson (1975), Stein (1997)).[24]

[24] Matvos and Seru (2014) estimate a structural model of internal capital markets to disentangle and quantify the various forces driving the resource reallocation decision.

Appendix: KZ-index and WW-index

We use two popular measures to compute firms' financing constraints: the Kaplan-Zingales (KZ) index (Kaplan and Zingales (1997)) and the Whited-Wu (WW) index (Whited and Wu (2006)).

The KZ-index loads negatively on cash flow, cash holdings, and dividends, and positively on leverage and Tobin's Q. To compute the KZ-index, we follow Lamont, Polk, and Saa-Requejo (2001, pp. 551-552), who use the original coefficient estimates of Kaplan and Zingales. Specifically, the KZ-index is computed as

$$\begin{aligned} \text{KZ-index} &= -1.001909 \times \text{cash flow/capital} + 0.2826389 \times \text{Tobin's Q} \\ &\quad +3.139193 \times \text{debt/total capital} - 39.3678 \times \text{dividend/capital} \\ &\quad -1.314759 \times \text{cash/capital}, \end{aligned}$$

where cash flow/capital is income before extraordinary items (Compustat item #18) plus depreciation and amortization (item #14) divided by property, plant, and equipment (item #8), Tobin's Q is total assets (item #6) plus the December market value of equity from CRSP minus the book value of common equity (item #60) minus balance sheet deferred taxes (item #74) divided by total assets, debt/total capital is long-term debt (item #9) plus debt in current liabilities (item #34) divided by long-term debt plus debt in current liabilities plus stockholder's equity (item #216), dividend/capital is dividends on common stocks (item #21) plus dividends on preferred stocks (item #19) divided by property, plant, and equipment, and cash/capital is cash and short-term investments (item #1) divided by property, plant, and equipment. Property, plant, and equipment is lagged by one year. All variables are obtained from the annual files of Compustat and CRSP.

The WW-index represents the shadow value of scarce funds and loads negatively on cash flow, dividends, sales growth, and total assets, and positively on long-term debt and sales growth in the firm's industry. Following Whited and Wu (p. 543), we compute the WW-index as

$$\begin{aligned}\text{WW-index} &= -0.091 \times \text{cash flow/assets} - 0.062 \times \text{positive dividend} \\ &\quad +0.021 \times \text{long-term debt/assets} - 0.044 \times \log(\text{assets}) \\ &\quad +0.102 \times \text{industry sales growth} - 0.035 \times \text{sales growth},\end{aligned}$$

where cash flow/assets is income before extraordinary items (Compustat quarterly item #8) plus depreciation and amortization (item #5) divided by total assets (item #44), positive dividend is a dummy variable that equals one if cash dividend (item #89) is positive, long-term debt/assets is long-term debt (item #51) divided by total assets, log(assets) is the natural logarithm of total assets, sales growth is the growth in firm sales (item #2), and industry sales growth is sales growth in the firm's 3-digit SIC industry. Total assets is deflated by the replacement cost of total assets, which is computed as in Whited (1992). All variables are obtained from the quarterly files of Compustat. In our regressions, we annualize the WW-index by taking the average of the quarterly indices.

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Table I
Summary Statistics

"Eventually treated plants" refers to plants that are treated during the sample period, that is, plants whose travel time to headquarters is reduced through the introduction of a new airline route. "Eventually other plants" refers to plants that become "other" plants during the sample period, that is, plants that belong to the same firms as treated plant. Shipments, capital stock, and investment are expressed in 1997 dollars (in 1,000s) using 4-digit SIC deflators from the NBER-CES Manufacturing Industry Database. Capital stock is constructed using the perpetual inventory method. All figures are sample means. Standard deviations are in parentheses. The sample period is from 1977 to 2005.

	All Plants	Eventually Treated Plants	Eventually "Other" Plants	Remaining Plants
Employees	410	379	432	376
	(929)	(756)	(968)	(975)
Shipments	97,255	95,403	103,929	79,235
	(360,818)	(304,582)	(360,623)	(411,983)
Capital Stock	42,078	41,666	45,756	31,501
	(141,084)	(139,036)	(147,219)	(122,738)
Investment	3,848	3,646	3,969	3,701
	(53,589)	(15,735)	(21,316)	(113,504)
Investment / Capital Stock	0.10	0.10	0.10	0.11
	(0.14)	(0.13)	(0.14)	(0.16)
Number of Observations	291,358	61,007	172,667	57,684

Table II
Plant-Level Investment and Employment

The dependent variable is either plant-level investment (columns [1]-[3]) or plant-level employment (columns [4]-[6]). Investment is the ratio of capital expenditures to capital stock at the plant level. Employment is the natural logarithm of the number of employees of the plant. Both variables are industry-adjusted by subtracting the industry median across all plants in a given 3-digit SIC industry and year. "Treated" is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between the plant and its headquarters. "Other" is a dummy variable that equals one if the plant belongs to the same firm as the treated plant and the treated dummy is set equal to one. FC (non-FC) is a dummy variable indicating whether the plant belongs to a firm whose measure of financing constraints lies above (below) the median across all firms in the year prior to the treatment. In columns [2] and [5], financing constraints are measured using the KZ-index of Kaplan and Zingales (1997). In columns [3] and [6], financing constraints are measured using the WW-index of Whited and Wu (2006). The control variables are plant size and plant age. Size is the natural logarithm of the plant's shipments. Age is the natural logarithm of one plus the number of years since the plant has been in the LBD. Both variables are lagged. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Investment			Employment		
		KZ-Index	WW-Index		KZ-Index	WW-Index
	[1]	[2]	[3]	[4]	[5]	[6]
Treated	0.010***			0.025***		
	(0.001)			(0.004)		
Other	-0.001			-0.002		
	(0.001)			(0.003)		
Treated × FC		0.008***	0.008***		0.019***	0.019**
		(0.002)	(0.003)		(0.006)	(0.008)
Treated × Non-FC		0.012***	0.011***		0.028***	0.026***
		(0.002)	(0.001)		(0.005)	(0.004)
Other × FC		-0.002*	-0.003		-0.006*	-0.007
		(0.001)	(0.002)		(0.004)	(0.006)
Other × Non-FC		0.000	-0.000		0.001	-0.000
		(0.001)	(0.001)		(0.004)	(0.003)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	291,358	291,358	291,358	291,358	291,358	291,358
R-squared	0.32	0.32	0.32	0.92	0.92	0.92

Table III
Plant-Level Productivity

This table presents variants of the regressions in Table II where the dependent variable is either plant-level total factor productivity (TFP, columns [1]-[3]) or plant-level return on capital (ROC, columns [4]-[6]). TFP is the estimated residual from a regression of the logarithm of output on the logarithms of capital, labor, and material inputs (see Section II.A). ROC is the value of shipments minus labor and material costs divided by capital stock and is industry-adjusted by subtracting the industry median across all plants in a given 3-digit SIC industry and year. TFP is industry-adjusted by construction. All other variables are described in Table II. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	TFP			ROC		
		KZ-Index	WW-Index		KZ-Index	WW-Index
	[1]	[2]	[3]	[4]	[5]	[6]
Treated	0.012***			0.014***		
	(0.001)			(0.002)		
Other	-0.000			-0.000		
	(0.001)			(0.001)		
Treated × FC		0.009***	0.007**		0.010***	0.007**
		(0.002)	(0.003)		(0.002)	(0.003)
Treated × Non-FC		0.014***	0.013***		0.016***	0.016***
		(0.002)	(0.001)		(0.002)	(0.002)
Other × FC		-0.001	-0.002		-0.001	-0.002
		(0.002)	(0.002)		(0.002)	(0.003)
Other × Non-FC		0.000	0.000		0.000	0.001
		(0.001)	(0.001)		(0.002)	(0.002)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	291,358	291,358	291,358	291,358	291,358	291,358
R-squared	0.61	0.61	0.61	0.62	0.62	0.62

Table IV
Dynamics of the Treatment Effect

This table presents variants of the regressions in Table II where other × FC and other × non-FC are interacted with dummy variables indicating whether a plant-year observation is measured one year before the treatment (-1), in the year of the treatment (0), one, two, and three years after the treatment (1, 2, and 3, respectively), or four and more years after the treatment (4+). All other variables are described in Table II. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Investment		Employment	
	KZ-Index	WW-Index	KZ-Index	WW-Index
	[1]	[2]	[3]	[4]
Treated × FC × Year(-1)	-0.003	0.002	-0.003	-0.002
	(0.004)	(0.005)	(0.011)	(0.017)
Treated × FC × Year(0)	0.005	0.004	0.004	0.003
	(0.003)	(0.006)	(0.010)	(0.014)
Treated × FC × Year(1)	0.014***	0.014***	0.031***	0.041***
	(0.003)	(0.004)	(0.010)	(0.014)
Treated × FC × Year(2)	0.009**	0.010*	0.029***	0.030***
	(0.003)	(0.005)	(0.008)	(0.012)
Treated × FC × Year(3)	0.008*	0.008*	0.019**	0.022*
	(0.004)	(0.005)	(0.010)	(0.014)
Treated × FC × Year(4+)	0.006	0.006	0.013	0.013
	(0.004)	(0.005)	(0.011)	(0.015)
Other × FC × Year(-1)	0.001	0.002	0.001	0.001
	(0.002)	(0.003)	(0.006)	(0.008)
Other × FC × Year(0)	-0.001	-0.002	-0.002	-0.002
	(0.002)	(0.004)	(0.007)	(0.009)
Other × FC × Year(1)	-0.005**	-0.006**	-0.017***	-0.020**
	(0.002)	(0.003)	(0.006)	(0.010)
Other × FC × Year(2)	-0.004*	-0.005	-0.011*	-0.014
	(0.002)	(0.003)	(0.006)	(0.009)
Other × FC × Year(3)	-0.002	-0.002	-0.006	-0.010
	(0.002)	(0.003)	(0.006)	(0.010)
Other × FC × Year(4+)	-0.001	-0.002	-0.003	-0.002
	(0.002)	(0.003)	(0.006)	(0.009)
Treated × Non-FC	0.012***	0.012***	0.027***	0.026***
	(0.002)	(0.001)	(0.005)	(0.004)
Other × Non-FC	0.001	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.004)	(0.003)
Control Variables	Yes	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
MSA × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	291,358	291,358	291,358	291,358
R-squared	0.32	0.32	0.92	0.92

Table V
Financing Constraints versus Productivity

This table presents variants of the regressions in Table II where FC and non-FC are replaced by dummy variables indicating whether firm-level productivity lies below ("low") or above ("high") the median across all firms in the year prior to the treatment. Firm-level productivity is measured using either total factor productivity (TFP, columns [1] and [3]) or return on capital (ROC, columns [2] and [4]). Firm-level TFP is the capital-weighted average of the individual plant-level TFPs across all of the firm's plants, where plant-level TFP is described in Table III. Firm-level ROC is the ratio of total profits—that is, the sum of shipments minus labor and material costs across all of the firm's plants—to total capital stock. All other variables are described in Table II. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Investment		Employment	
	TFP	ROC	TFP	ROC
	[1]	[2]	[3]	[4]
Treated × Low	0.009***	0.010***	0.024***	0.024***
	(0.002)	(0.002)	(0.006)	(0.006)
Treated × High	0.010***	0.010***	0.025***	0.026***
	(0.002)	(0.002)	(0.005)	(0.005)
Other × Low	-0.001	-0.001	-0.002	-0.002
	(0.001)	(0.001)	(0.005)	(0.004)
Other × High	-0.001	-0.001	-0.003	-0.003
	(0.001)	(0.001)	(0.004)	(0.004)
Control Variables	Yes	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
MSA × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	291,358	291,358	291,358	291,358
R-squared	0.32	0.32	0.92	0.92

Table VI
Alternative Measures of Financing Constraints

This table presents variants of the regressions in Table II where the KZ- and WW-index are replaced with alternative measures of financing constraints. In columns [1] and [5], FC (non-FC) is a dummy variable indicating whether the plant belongs to a firm whose SA-index (Hadlock and Pierce (2010)) lies above (below) the median across all firms in the year prior to the treatment. In columns [2] and [6], FC (non-FC) is a dummy variable indicating whether the plant belongs to a firm that does not (does) have a credit rating (Compustat item SPDRC) while having long-term debt (item #9) outstanding. In columns [3] and [7], FC (non-FC) is a dummy variable indicating whether the plant belongs to a firm whose debt-to-cash flow ratio—that is, the ratio of long-term debt plus debt in current liabilities (item #34) to income before extraordinary items (item #18)—lies above (below) the median across all firms in the year prior to the treatment. In columns [4] and [8], FC (non-FC) is a dummy variable indicating whether the plant belongs to a firm whose investment in excess of cash flow—that is, capital expenditures (item #30) minus income before extraordinary items divided by total assets (item #6)—lies below (above) the median across all firms in the year prior to the treatment. All other variables are described in Table II. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Investment				Employment			
	SA-Index	Credit Rating	Debt to Cash Flow	Investment - Cash Flow	SA-Index	Credit Rating	Debt to Cash Flow	Investment - Cash Flow
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Treated × FC	0.008***	0.008***	0.007***	0.007***	0.019**	0.020***	0.019***	0.019***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.008)	(0.006)	(0.006)	(0.005)
Treated × Non-FC	0.011***	0.011***	0.012***	0.011***	0.026***	0.028***	0.029***	0.028***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)	(0.005)	(0.005)
Other × FC	-0.003*	-0.002*	-0.002*	-0.002	-0.007	-0.007*	-0.006	-0.006*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.006)	(0.004)	(0.004)	(0.004)
Other × Non-FC	-0.000	0.000	-0.000	0.000	-0.000	0.001	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.004)	(0.004)	(0.003)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	291,358	291,358	291,358	291,358	291,358	291,358	291,358	291,358
R-squared	0.32	0.32	0.32	0.32	0.92	0.92	0.92	0.92

Table VII
Public versus Private Firms

This table presents variants of the regressions in Table II where the sample includes both public and private firms and FC and non-FC are replaced by dummy variables indicating whether the plant belongs to a public or private firm in the year prior to the treatment. Public firms are those covered in Compustat. All other variables are described in Table II. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Investment		Employment	
	[1]	[2]	[3]	[4]
Treated	0.009***		0.021***	
	(0.002)		(0.005)	
Other	-0.001		-0.003	
	(0.001)		(0.002)	
Treated × Private		0.007***		0.017**
		(0.003)		(0.007)
Treated × Public		0.010***		0.024***
		(0.002)		(0.006)
Other × Private		-0.002*		-0.005
		(0.001)		(0.003)
Other × Public		-0.000		-0.001
		(0.001)		(0.003)
Control Variables	Yes	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
MSA × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	838,382	838,382	838,382	838,382
R-squared	0.45	0.45	0.95	0.95

Table VIII
Few versus Many "Other" Plants

This table presents variants of the regressions in Table II where other × FC and other × non-FC are interacted with dummy variables indicating whether the firm's number of "other" plants lies below or above the median across all treated firms in the year prior to the treatment. All other variables are described in Table II. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Investment		Employment	
	KZ-Index	WW-Index	KZ-Index	WW-Index
	[1]	[2]	[3]	[4]
Treated × FC	0.008***	0.008***	0.019***	0.019**
	(0.002)	(0.003)	(0.006)	(0.008)
Treated × Non-FC	0.012***	0.011***	0.028***	0.026***
	(0.002)	(0.001)	(0.005)	(0.004)
Other × FC × (# Other Plants < Median)	-0.004**	-0.005**	-0.011**	-0.014**
	(0.002)	(0.003)	(0.006)	(0.007)
Other × FC × (# Other Plants ≥ Median)	-0.001	-0.002	-0.003	-0.002
	(0.002)	(0.004)	(0.006)	(0.010)
Other × Non-FC × (# Other Plants < Median)	0.000	-0.001	0.001	0.001
	(0.002)	(0.002)	(0.006)	(0.005)
Other × Non-FC × (# Other Plants ≥ Median)	0.001	0.000	-0.000	-0.001
	(0.002)	(0.001)	(0.004)	(0.004)
Control Variables	Yes	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
MSA × Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	291,358	291,358	291,358	291,358
R-squared	0.32	0.32	0.92	0.92

Table IX
Which Other Plants Are Primarily Affected?

This table presents variants of the regressions in Table II where other × FC and other × non-FC are interacted with plant characteristics. In Panel (A), other × FC and other × non-FC are interacted with dummy variables indicating whether the plant's total factor productivity (TFP) lies below ("low") or above ("high") the median across all of the firm's "other" plants in the year prior to the treatment. In Panel (B), other × FC and other × non-FC are interacted with dummy variables indicating whether the plant operates in a peripheral or main industry of the firm. Peripheral industries are 3-digit SIC industries that account for less than 25% of the firm's total value of shipments in the year prior to the treatment. In Panel (C), other × FC and other × non-FC are interacted with dummy variables indicating whether the geographical distance between the plant and its headquarters lies below ("low") or above ("high") the median across all of the firm's "other" plants in the year prior to the treatment. Geographical distance is the great-circle distance between the plant's ZIP code and the ZIP code of headquarters. All other variables are described in Table II. The coefficients on treated × FC and treated × non-FC are not displayed for brevity. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses (except for the *F*-statistics, where *p*-values are in parentheses). *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Panel (A): Plant Productivity

Dependent Variable:	Investment		Employment	
	KZ-Index	WW-Index	KZ-Index	WW-Index
	[1]	[2]	[3]	[4]
Other × FC × Low	-0.005**	-0.006**	-0.011**	-0.015**
	(0.002)	(0.003)	(0.006)	(0.008)
Other × FC × High	0.001	0.001	-0.002	0.004
	(0.002)	(0.003)	(0.006)	(0.009)
Other × Non-FC × Low	0.000	-0.001	0.000	-0.001
	(0.002)	(0.001)	(0.005)	(0.004)
Other × Non-FC × High	0.001	0.000	0.003	-0.000
	(0.002)	(0.002)	(0.005)	(0.004)
Other × FC × Low versus Other × FC × High				
F-statistic	3.92**	3.00*	3.31*	3.07*
	(0.048)	(0.083)	(0.069)	(0.080)

Panel (B): Peripheral versus Main Industries

Dependent Variable:	Investment		Employment	
	KZ-Index	WW-Index	KZ-Index	WW-Index
	[1]	[2]	[3]	[4]
Other × FC × Main	0.000	-0.001	0.002	0.003
	(0.002)	(0.003)	(0.006)	(0.008)
Other × FC × Peripheral	-0.005**	-0.006**	-0.011**	-0.017**
	(0.002)	(0.003)	(0.006)	(0.009)
Other × Non-FC × Main	0.001	0.001	0.003	0.002
	(0.002)	(0.002)	(0.006)	(0.005)
Other × Non-FC × Peripheral	-0.000	-0.001	0.000	-0.002
	(0.002)	(0.001)	(0.005)	(0.004)
Other × FC × Main versus Other × FC × Peripheral				
F-statistic	3.48*	3.03*	3.33*	3.20*
	(0.062)	(0.082)	(0.068)	(0.073)

Panel (C): Proximity to Headquarters

Dependent Variable:	Investment		Employment	
	KZ-Index	WW-Index	KZ-Index	WW-Index
	[1]	[2]	[3]	[4]
Other × FC × Low	0.000	0.001	0.002	0.004
	(0.002)	(0.003)	(0.006)	(0.009)
Other × FC × High	-0.004**	-0.006**	-0.012**	-0.015*
	(0.002)	(0.003)	(0.006)	(0.008)
Other × Non-FC × Low	0.000	0.000	0.001	0.001
	(0.002)	(0.002)	(0.005)	(0.004)
Other × Non-FC × High	0.000	-0.001	0.002	-0.001
	(0.002)	(0.001)	(0.005)	(0.004)
Other × FC × Low versus Other × FC × High				
F-statistic	2.80*	3.59*	3.08*	3.27*
	(0.094)	(0.058)	(0.079)	(0.071)

Table X
Firm-Level Investment and Employment

The dependent variable is either firm-level investment (columns [1]-[3]) or firm-level employment (columns [4]-[6]). Investment is the ratio of total capital expenditures to total capital stock, where total capital expenditures (total capital stock) is the sum of capital expenditures (capital stock) across all of the firm's plants. Employment is the natural logarithm of the total number of employees across all of the firm's plants. "Treatment" is a dummy variable indicating whether the firm has been treated, that is, if a new airline route has been introduced that reduces the travel time between headquarters and one of the firm's plants. FC (non-FC) is a dummy variable indicating whether the firm's measure of financing constraints lies above (below) the median across all firms in the year prior to the treatment. In columns [2] and [5], financing constraints are measured using the KZ-index of Kaplan and Zingales (1997). In columns [3] and [6], financing constraints are measured using the WW-index of Whited and Wu (2006). The control variables are firm size and firm age. Size is the natural logarithm of the sum of shipments across all of the firm's plants. Age is the natural logarithm of one plus the number of years the firm has been in the LBD. Both variables are lagged. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Investment			Employment		
		KZ-Index	WW-Index		KZ-Index	WW-Index
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment	0.002***			0.004**		
	(0.001)			(0.002)		
Treatment × FC		0.000	0.000		-0.000	0.001
		(0.001)	(0.001)		(0.002)	(0.003)
Treatment × Non-FC		0.004***	0.003***		0.009***	0.006***
		(0.001)	(0.001)		(0.002)	(0.002)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,695	33,695	33,695	33,695	33,695	33,695
R-squared	0.41	0.41	0.41	0.88	0.88	0.88

Table XI
Firm-Level Productivity

This table presents variants of the regressions in Table X where the dependent variable is either firm-level total factor productivity (TFP, columns [1]-[3]) or firm-level return on capital (ROC, columns [4]-[6]). Firm-level TFP and firm-level ROC are described in Table V. All other variables are described in Table X. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	TFP			ROC		
		KZ-Index	WW-Index		KZ-Index	WW-Index
	[1]	[2]	[3]	[4]	[5]	[6]
Treatment	0.003***			0.004***		
	(0.001)			(0.001)		
Treatment × FC		0.002**	0.002**		0.003**	0.003**
		(0.001)	(0.001)		(0.001)	(0.001)
Treatment × Non-FC		0.005***	0.004***		0.006***	0.005***
		(0.001)	(0.001)		(0.001)	(0.001)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,695	33,695	33,695	33,695	33,695	33,695
R-squared	0.51	0.51	0.51	0.61	0.61	0.61

Table XII
Other Sources of Funding

This table presents variants of the regressions in Table X where the dependent variable is either cash (columns [1]-[3]), equity (columns [4]-[6]), short-term debt (columns [7]-[9]), or long-term debt (columns [10]-[12]). Cash is cash and short-term investments (Compustat item #1) divided by total assets (item #6). Equity is book value of common equity (item #60) divided by total assets. Short-term debt is debt in current liabilities (item #34) divided by total assets. Long-term debt is long-term debt (item #9) divided by total assets. All other variables are described in Table X. Standard errors are clustered at the firm level. The sample period is from 1977 to 2005. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Dependent Variable:	Cash			Equity			Short-Term Debt			Long-Term Debt		
		KZ-Index	WW-Index		KZ-Index	WW-Index		KZ-Index	WW-Index		KZ-Index	WW-Index
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Treated	-0.001			-0.000			0.001			0.000		
	(0.001)			(0.003)			(0.001)			(0.002)		
Treated × FC		0.000	-0.000		0.000	-0.000		0.000	-0.000		-0.000	-0.000
		(0.001)	(0.002)		(0.004)	(0.004)		(0.002)	(0.002)		(0.003)	(0.003)
Treated × Non-FC		-0.002*	-0.002		-0.001	-0.000		0.002	0.002*		0.001	0.000
		(0.001)	(0.001)		(0.003)	(0.003)		(0.001)	(0.001)		(0.003)	(0.002)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	33,695	33,695	33,695	33,695	33,695	33,695	33,695	33,695	33,695	33,695	33,695	33,695
R-squared	0.30	0.30	0.30	0.28	0.28	0.28	0.10	0.10	0.10	0.14	0.14	0.14