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ABSTRACT

Mergers and acquisitions are a fast way for a firm to grow. Using plant-level data, we examine how firms redraw their boundaries after acquisitions. We find that there is a large amount of restructuring in a short period following mergers. Acquirers sell 27% and close 19% of acquired plants within three years of the acquisition. Plants in the target's peripheral divisions, especially in industries in which asset values are increasing, and in industries in which the acquirer does not have a comparative advantage, are more likely to be sold by the acquirer. Acquirers with skill in running their peripheral divisions tend to retain more acquired plants. Plants retained by acquirers increase in productivity whereas sold plants do not. The extent of post-merger restructuring activities and their cross-sectional variation do not support an empire building explanation for mergers. Acquirers readjust their firm boundaries in ways that are consistent with the exploitation of their comparative advantage across industries.

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1 Introduction

Mergers and acquisitions are a fast way for a firm to grow and reconfigure its asset portfolio.[1] Through mergers firms frequently acquire portfolios of assets spanning several industries. After the merger, the acquiring firm faces decisions on how to redraw its boundaries by keeping some newly acquired assets and selling or closing others. At one end of the spectrum, the acquiring firm may match the assets it retains to its ability, keeping only assets which it can operate efficiently and selling off or closing the remainder. At the other extreme, in mergers motivated by pure empire building, the acquirer may decide to retain all its newly acquired assets. Although how the firm redraws its boundaries may affect the long run productivity of the retained assets and their value, little is known about the extent and outcomes of post-merger restructuring.

In this paper, we analyze whether firms retain, close, or sell off the assets acquired in a merger and characterize the productive efficiency of retained and sold off assets. We start by showing that acquiring firms do not passively retain the assets acquired in a merger. Rather, the merger starts a vigorous restructuring that involves a significant number of selloffs and closures of the target firm's assets. We examine two related questions about the post-merger restructuring process. First, are acquirers more likely to keep certain assets than others? Second, are decisions to retain assets consistent with acquirers' exploiting their comparative advantage? To answer these questions we examine the cross-sectional variation of the plant retention, closure, and sales decisions of acquirers and characterize the changes in productive efficiency of kept and sold plants over a short time period of three years after merger completion. Our study extends our knowledge of post-merger restructuring beyond the (very) long term firm divestitures after merger that are examined by Kaplan and Weisbach (1992) and Porter (1987).

Our sample comprises 1,483 mergers completed between 1981 and 2000 in which the target firm operates at least one plant in manufacturing (SIC codes 2000-3999). We use data from the Longitudinal Research Database (LRD), maintained by the Center for Economic Studies at the Bureau of the Census. The LRD database contains plant-level data for manufacturing plants. The plant-level coverage means that we can track plant performance even as they change owners or are closed down. This tracking is key to our study as it allows us to look inside each acquisition and to identify individual plants that change hands each year after the merger. We benchmark each plant's performance against comparable plants in the same industry and also examine how operating margins and productivity change in the post-merger period for both kept and sold plants.

We find that in mergers, the acquisition of the target's assets is merely the first step in the process

[1] There is a vast literature on mergers. See Andrade, Mitchell and Stafford (2001)) for a survey, and Betton, Eckbo, and Thorburn (2007) for a more recent perspective.

of redefining firm boundaries. In the typical merger, an acquirer does not passively absorb all the target plants obtained in the merger. Instead, a merger is quickly followed by a period of vigorous restructuring of target assets that significantly impacts the boundaries of the acquiring firm. Within three years after the completion of an acquisition, 27% of plants are sold and 19% are closed down, leaving the acquirer with about half the plants that are initially obtained in an acquisition.

The readjustment of firm boundaries after acquisitions varies cross-sectionally in ways that are consistent with the view that acquirers exploit their comparative advantage across industries. We find that acquirers are more likely to retain plants of firms they purchase if they already operate a plant in the same industry and acquirers are particularly likely to retain purchased plants that add to their largest divisions. Plants in the target's peripheral divisions, which are less likely to be the object of the acquisition, are significantly more likely to be sold. These findings suggest that even when acquirers buy whole firms, they are ex-ante interested in a subset of the target firm's assets.

Furthermore, we find that acquirers are more likely to retain acquired plants if the pre-merger productivity of plants in their own peripheral segments is high. Low productivity of existing peripheral segments/plants indicates that a firm is likely to already be beyond its optimal size, while high peripheral plant productivity indicates that the firm has the capacity to absorb and run new operations. The effect of the marginal plant productivity is economically significant. A one standard deviation increase in the productivity of the acquirer's own marginal plants increases the probability that the acquirer retains a newly acquired target plant by 17 to 19%. Moreover, the this effect increases to 39% in industries that experience a positive return shock, consistent with neoclassical theories of firm scope based on comparative advantage.

We also examine the performance of plants transferred in acquisitions. We use two measures of operating performance: the change in the industry-adjusted operating margin of the plant as well as the change in its total factor productivity in the three year period following mergers. We find that the plants kept by the acquirer show significant increases in productivity. In contrast, the productivity of sold plants tends to be flat. The kept plants show more improvement in performance for firms that are skilled in running their peripheral businesses, consistent with neoclassical merger theories in which firms acquire businesses in a manner that exploits their comparative advantage. Firms sell plants in areas in which they do not have a comparative advantage. Consistent with the neoclassical view, this effect is more pronounced when there are industry shocks that alter the opportunity costs that firms face in operating assets.

While the above deals with the disposition of *target* plants after an acquisition, a related question is how acquirers dispose of their *own* assets in the short period after a merger. Unconditionally, we find that acquirers close and sell their own plants at higher rates than their industry benchmarks but that these rates are lower than the disposal rates of target plants. These post-merger differences in the rates of disposal of acquirer- and target-owned plants are driven by differences in plant characteristics. Controlling for plant characteristics, we find no evidence that prior ownership status matters. Thus acquirers in our sample do

not sell and close target plants at higher rate just because they belonged to the target rather than the acquirer. We also examine the changes in productive efficiency of plants that were owned by the acquirer prior to the merger. Once again, we find an asymmetry in plant performance between kept and sold plants. The plants owned by the acquirer prior to the acquisition improve in performance while sold plants tend to be flat or have slight decreases in performance over three years after an acquisition. In addition, in each case we compare the plant performance with our, counterfactual, estimate of the performance that would have been observed had the acquirer picked the *unchosen* disposal decision. We find little evidence that the observed retention decisions are inefficient.

Evidence from event studies suggests that the acquisition announcement effects depend on whether the acquisition is for stock or for cash. We examine whether the use of stock explains post-merger restructuring or its productivity outcomes. We find that the method of financing is statistically insignificant and economically negligible and remains so when we instrument for stock acquisitions. Thus, we find no evidence that the method of payment is predictive of future uneconomic decisions. We also find no evidence that the operating performance of acquired plants is higher when the parties to the merger have similar market-to-book ratios. Our results are also robust to the inclusion of industry concentration ratios and industry fixed effects.

We conduct additional tests to examine the disposition decisions of repeat acquirers, who may be particularly disposed towards empire building. If so, we might expect to see particularly inefficient retention decisions associated with low performance or retained plants in this sub-sample. We find little evidence of these inefficiencies. In fact, disposition rather than retention is more likely for repeat acquirers.

In sum, our evidence suggests that at the operational level the deployment and disposal of assets by acquirers is broadly consistent with neoclassical theories of the scope of firms such as Lucas (1978) and Maksimovic and Phillips (MP) (2002).[2] These theories emphasize the role of marginal returns and opportunity costs in determining the boundaries of the firm. Firms retain assets in which they have a comparative advantage in operations, but sell assets that they do not have a comparative advantage in or assets are peripheral to their operations, especially when the market price of such assets is high. The evidence is less consistent with empire building motivations for mergers in which acquisitions are driven by pure taste for firm size. Of course, the results do *not* preclude other types of agency problems. For example, acquirers may waste resources by dissipating proceeds of asset sales on perquisites, or they may overpay for acquisitions. However, there is little evidence they systematically mismanage the assets that they acquire.[3]

[2] MP extend Lucas (1978) to multiple industries and study the changes in firm scope and growth in response to demand and other value shocks the firm receives in each of the industries in which the firm operates.

[3] Other studies present evidence from the stock market consistent with market value not being destroyed in mergers. Combined excess returns are slightly positive at announcement of mergers (Andrade, Mitchell and Stafford (2001)).Graham, Lemmon and Wolf (2002) show that post-acquisition market value is not dissipated after conglomerate mergers as combined firm market values do not decrease.

Previous studies of divestitures include Porter (1987), who argues that many mergers are eventually divested in the long-term. Porter interprets this finding as evidence that mergers are misconceived ventures. In a careful study, Kaplan and Weisbach (1992) refute Porter's view. Kaplan and Weisbach examine divestitures of targets over relatively long time periods of up to 17 years after a merger. They find that 44% of their sample of mergers occurring in the years 1971-1982 had been wholly divested by 1989. Using firm write-off accounting data, up to half of divested mergers were deemed successful. The focus of our work is rather different. We study the restructuring that occurs in a relatively short time period of 3 years after a merger is consummated. Additionally, we are not restricted to examining the timing of total divestitures because our dataset is at the level of the individual plant. Thus, we are able to track individually all acquired plants, including plants absorbed by the acquirer's existing divisions, plants sold between acquisition and final divestitures of the acquired assets. The disaggregate view of targets at the level of plants also enables us to test predictions of theories of the firm about both the disposal and post-acquisition profitability of the acquired plants.

Ravenscraft and Scherer (1987) use Line of Business data to examine the 1975-1977 performance of segments acquired in 65 tender offers. Because the Line of Business data is only available in the narrow 1975-1977 time window, they cannot compare the performance of individual business lines of the merged firm with the pre-merger performance of the same units. Thus, Ravenscraft and Scherer are forced to compare Line of Business data after the merger with the whole target firm pre-merger, which in their sample may operate several such lines. Furthermore, the tender offers in their sample occur a median 7 years before the start of the window. As a result, for most offers they do not observe dispositions in the years immediately following the tender offer. Finally, their dataset cannot isolate acquired assets as their data commingles the asset acquired in the tender offers with the acquirer's own assets. Given these limitations, they argue that the data "compels an agnostic inference that takeovers neither degraded nor improved the basic operating performance of target firms.(p. 153)." In a subsequent paper, Ravenscraft and Scherer (1992) analyze whether sales of firms' lines of business are higher for post merger divestitures in the period 1977-81. However, the indicators of merger activity they use do not address post merger disposition of acquired assets directly. Thus, for example, they examine whether lines of business created before 1950, but which grow through (some) mergers, have the same total divestiture rates as similar lines that do not grow through any mergers, or as lines of business created after 1950.

Schlingemann, Stulz, and Walkling (2002) study sales of industry segments using COMPUSTAT segment data. They find that firms are more likely to sell assets in periods of high industry liquidity. Maksimovic and Phillips (2001) and Schoar (2002) look at the changes in plant productivity around acquisitions. However, none of these papers explores the plant retention/sales/closure decisions, their cross-sectional determinants, or the asymmetry in the productivity changes depending on whether the plant is retained or sold off.

In the next section, we present theoretical predictions coming from prior work on mergers and acqui-

sitions. In Section 3 we describe our sample and the data and variables we use. Sections 4 and 5 estimate models of the decision to retain, sell, or close plants. Section 6 examines the changes in productive efficiency after mergers. Section 7 concludes.

2 Hypotheses Tested in Our Study

In our study, we exploit the fact that in mergers the target firm consists of a collection of assets that have varying degrees of fit with the acquirer's core competence. The acquiring firm has to decide how to redraw its boundaries — which plants to keep and which to sell. By examining how this decision is made we can test the implications of alternative theories that explain mergers, such as empire building driven by acquirer taste for firm size or neoclassical theories of firm growth based on comparative advantage.

The hypothesis that firms' investment and acquisitions are driven by managerial desire to maximize firm size have received a great deal of attention in the finance literature especially since Jensen (1986).[4] In the post-merger context, inefficient investment observationally similar to empire building might also occur if merger decisions are motivated by hubris, as in Roll (1977), so that the acquirer's managers' incorrectly believe that they have the ability to operate the target's assets more productively than they can. If the firm's actions are driven by either a pure taste for large size or hubris, then after a merger we would expect the following hypotheses to hold:

H1: All or most of the acquired assets are retained after the merger.

H2: The retained assets do not increase in productivity.

An alternative view of mergers and acquisitions is based on a neoclassical theory of the firm, in which firms' boundaries shift across industries in response to shocks that alter their and their competitors' comparative advantage (Lucas (1978), Maksimovic and Phillips (2002)). Under this view, a firm's organization and talent is likely to be better suited for some industries than for others.[5] The payoffs from using that talent depends on the demand level in each industry and the level of competition. Industry shocks change these payoffs. At the margin, the firm deploys its managerial assets in industries where it obtains the greatest marginal payoff. After the purchase, acquirers would sell off assets that are found not to be a good match for them.

Firms alter their boundaries in response to new information about their comparative advantage across industries. Following a merger, the firm retains plants in which it has a comparative advantage and disposes of plants where it does not. A firm's comparative advantage may vary by industry, and may shift over time

[4] See also Morck, Shleifer and Vishny (1990), and Hart and Moore (1992). Early authors in economics that consider empire building include Baumol (1959) and Meuller (1969).

[5] Fluck and Lynch (1999) develop a theory related to financial synergies why firms buy and sell firms across the business cycle. Under their theory managers make optimal decisions in the face of financial frictions.

within an industry as shocks disproportionately advantage highly productive and less productive producers, leading to plant sales between firms.[6] These considerations yield several predictions about the acquirer's decisions to keep, sell, or close acquired plants which we formalize as the following hypotheses:[7]

H3: An acquirer is more likely to retain an asset if he can improve or maintain its productivity, and sell or close an asset if he cannot.

This comparative advantage hypothesis also suggests a relation between the disposal of assets and the target's internal structure. As shown by MP, the firm is more likely to be an efficient producer in its main divisions than it its peripheral divisions. Moreover, the acquirer is more likely to do a whole firm takeover when he wishes to retain the main division rather than a peripheral division. In the latter case, it would be more efficient for the firm to acquire the peripheral divisions only. Hence,

H4: The assets that are sold are more likely to belong to the target's peripheral divisions rather than to its main divisions.

We also examine three additional predictions of the MP model for post-merger disposal. First, the model suggests that the boundary line between assets that are retained and assets that are sold depends on the opportunity cost of retaining the assets. Thus,

H5: The acquirer is more likely to sell assets that he or she cannot improve when the external market price of these assets is higher.

Second, the neoclassical model predicts that a firm expands until the marginal value of a plant equals its opportunity cost under alternative ownership. Thus, a firm whose marginal plants are efficient is less likely to have grown beyond its optimal size. When such a firm acquires additional assets in a merger, it is less likely to sell such assets. Specifically,

H6: An acquirer whose marginal plants are efficient is less likely to sell plants acquired in a merger.

Figure 1 illustrates this hypothesis. In order to focus on the essentials, we illustrate the hypothesis assuming that the acquirer operates in only one industry. Optimum acquirer size is where the productivity of operating the marginal plant is equal to the opportunity cost that can be realized by selling the plant to another firm. In Figure 1, the acquirer's marginal plant's productivity exceeds its opportunity cost and the firm is initially below its optimum size. Following the merger, the acquirer size is greater than its optimal size and it sells plants until its optimal size is established. Acquirers with highly productive marginal plants are further away from optimal size and thus keep a larger proportion of acquired plants.

[6] See Maksimovic and Phillips (2002) for details. Yang (2008) presents a dynamic model of trade in assets as comparative advantage shifts over time. Matsusaka (2001) develops a neoclassical model of organizational ability with learning in which acquirers are not certain ex ante if a target is a good match for their capabilities.

[7] Note that we examine the evolution in the post-merger boundaries of the firm, not the original motivation for the merger. The broader question of when it is optimal for an acquirer to buy a whole division and when it is optimal to buy a segment is left for further research.

Note that Hypothesis 6 pertains to the productivity of the acquirer's *marginal* plants prior to the merger. It makes no predictions about the relation between the average productivity of the acquirer's plants prior to the merger and the probability of a sale. Empirically, Maksimovic and Phillips (2001, 2002) show that the plants in the peripheral divisions of a multi-industry firm are likely to be the firm's marginal plants. Plants in peripheral divisions have lower productivity and are more likely to be sold than plants in main industries. With the identification of efficiency of marginal plants as the efficiency of peripheral plants, we can test Hypothesis 6. It is possible that the efficiency of peripheral plants may be related to the overall skill or efficiency of an acquirer. Thus, in the estimations below we also include data on the average operating margin of acquiring firms as a control in specifications that include acquirer skill in peripheral plants.

We also examine how efficient and inefficient producers in an industry react differently to a value increasing shock that could, for example, be caused by a positive demand shock.[8] As a result of a positive industry shock, acquirers who are less efficient in running marginal plants will find it costlier to retain their newly acquired plants because their expertise could be used elsewhere more profitably. The higher opportunity costs of retaining their newly acquired plants should make acquirers more likely to sell. By contrast, acquirers who are more efficient at the margin will face a lower incentive to sell.

Figures 2 and 3 illustrate these effects. A positive shock to the industry has two effects. First, it increases the productivity of each plant, depicted by a vertical movement in the plant productivity curve. Second, it increases the value of the plant to other producers, depicted as an upward shift of the opportunity cost of operating a plant. The full effect depends of the relative magnitudes of the two shifts. Figure 2 shows the case in which the increase in the acquirer's productivity is high relative to the increase in the opportunity cost of operating plants. In this case, the acquirer retains more plants. Figure 3 shows the case in which the acquirer's productivity is small in comparison to the increase in the opportunity cost. In this case, relatively few plants are retained. As argued in Maksimovic and Phillips (2002), the relative effect of a positive shock on productivity compared to the opportunity cost is higher for more productive acquirers. We formalize this in the following hypothesis:

H7: Acquirers whose marginal plants are efficient are less likely to sell a plant if the industry in which the plant operates receives a positive value shock.

While hypotheses (H1)-(H7) are the primary focus of our study, we also provide secondary evidence on the main hypotheses and conduct other tests to shed light on merger theories. The first of these additional tests investigates whether operating gains in mergers are related to operating synergies or other sources of gains such as reduced corporate overhead. Rhodes-Kropf and Robinson (2006) find that the greatest stock market gains in mergers occur when the acquirer and target have similar book equity to market equity ratios. However, their data does not disentangle the source of the stock market gains, specifically whether

[8] See MP and the Appendix to Maksimovic and Phillips (2007) for a model demonstrating this effect, together with an explicit discussion of assumptions and empirical justification.

the pattern reflects greater operational synergies in similar BE/ME firms or whether it reflects other causes such as reduced administrative overheads. By using plant-level data, and distinguishing between kept and sold plants, we can test whether synergies arise in the form of productivity gains for kept plants when acquirer and target book equity to market equity ratios are similar. We therefore test the following:

H8a: Efficiency gains of kept plants are higher in acquisitions in which the acquirer and target have similar book equity to market equity ratios. No such relation exists for sold plants.

The next two hypotheses represent additional cross-sectional tests that further examine agency-related motives for mergers. One possibility is that only a subset of firms engage in empire building. Firms engaging in multiple acquisitions may have a particular taste for empire building. To allow for this possibility, in our empirical specifications we also test agency hypotheses H1 and H2 on the subset of acquisitions made by firms that engage in multiple acquisitions, namely

H8b: Repeat acquirers keep a greater proportion of the assets that they acquire and operate acquired assets less efficiently than other firms.

While the above argument focuses on empire building by acquirers, it is also possible that mergers are a mechanism for resolving empire-building related agency problems in targets. Under this view, some firms build empires and hold a suboptimally large portfolio of assets. They may find it hard to break up these assets on their own because managers develop loyalties to employees or certain projects. Mergers facilitate the break up of such firms and liberate trapped assets (e.g., Jensen (1986); Boot (1992)). Under this view, the acquirer need not have any comparative advantage in operating the acquired assets, so there is no particular asymmetry in performance between assets that are kept by acquirers and assets that are sold off.

H8c: Efficiency gains in kept and sold off plants are equal.

Our last hypothesis examines whether the method of financing matters. The method of financing acquisitions has received a good deal of attention in the mergers literature. Empirically, Andrade, Mitchell and Stafford (2001) show that acquirer announcement effects are lower for stock financed acquisitions, perhaps because acquirers might be using overpriced equity (Shleifer and Vishny (2003); Rhodes-Kropf and Viswanathan (2004)). These firms may be more likely to engage in acquisitions and operate plants in ways that do not create wealth. In particular, they may not sell newly acquired plants if doing so signals to the market that they do not have a comparative advantage in operating such plants. Alternatively, Eckbo, Giammarino and Heinkel (1988) argue that cash transactions could signal superior bidder quality, in which case bidders may be less likely to dispose of plants. This discussion suggests the following hypothesis:

H8d: Disposal of assets differs in stock and cash transactions.

It should be noted that while our data allow us to test whether the aquirers' disposition of the targets assets is consistent with their comparative advantage, we cannot rule out all forms of agency problems.

Our tests of efficient post-merger restructuring do not rule out every form of agency and do not imply that acquirers have no unresolved agency problems. For instance, asset outcomes could be efficient but there could still be redistributive effects from acquirer to target shareholders because acquirers overpay for their acquisitions, as suggested by Roll (1986), Morck, Shleifer and Vishny (1990) and Moeller, Schlingemann and Stulz (2005). Alternatively, acquirers managers may divest efficiently, but divert a portion of the proceeds for their own benefit as higher overhead at the firm level.

3 Data

3.1 Sample

Our initial sample comes from the Securities Data Company (SDC) mergers and acquisitions database, where we identify all mergers announced between 1981 and 2000, involved U.S. targets, had a completion code equal to 1, and as in Schwert (1996), were completed within 180 days of announcement. To be a potential candidate for our final sample, we require that at least one of the target's 4-digit SIC codes as reported in SDC be in the manufacturing sector, i.e., have 4-digit SIC codes between 2000 and 3999. We match the resulting sample with the Longitudinal Research database (LRD) maintained at the Census Bureau. The LRD tracks approximately 50,000 manufacturing plants every year in the Annual Survey of Manufactures (ASM). The ASM contains plant level information on output, employment, and expenditures of all manufacturing plants that have at least 250 employees. All smaller plants are surveyed every fifth year. In addition, a random sample of smaller plants is selected every fifth year to participate in a rotating five-year panel. Once selected, plants are required by federal law to answer the survey questions. Many data items used also represent items that are also reported to the IRS (e.g., the number of employees, employee compensation, total value of shipments).

To track the acquired plants in the LRD, we require that the selected M&A deals have a match with the LRD. The sample period we study is based on data availability in the Census Bureau and SDC. The start date is based on availability of reliable data on M&A transactions in the SDC database. The end date of 2000 is dictated by the fact that we need three years after the completion date to track ownership changes. When we conducted the analysis, the Census Bureau data were available only until 2004.

For every target that is matched to the LRD database, we record the owner of the plant in the reporting year prior to the acquisition completion date. We track the plant ownership forward three years after the acquisition completion year. For ownership change we rely on this identification which was available for all years. If the plant is shut down within the three year period, we record the year in which it was shut. If the plant remains open, we trace its ownership. In some cases, we cannot track the plant disposition decision reliably, because the output or the number of employees is below the Census reporting cutoff in the next five year sample. We discard these cases. They account for about 5% of the total plants transferred

in our sample. Given we calculate productivity and cash flow changes as well as use lagged year data, we also lose the initial year a firm or firm segment enters the database. We also lose observations that are non-contiguous. Finally, we only include firms if their plants in an industry (at the three-digit SIC code) have a total shipments value of at least $1 million in real 1982 dollars.

Table 1 shows the composition of our sample over time and how many of potential mergers we matched to the LRD manufacturing database. In our final sample of 2,030 acquisitions, the target has at least one reported SIC code between 2000 and 3999 according to the SDC database or the COMPUSTAT database and had matching target data in COMPUSTAT (both the SDC and COMPUSTAT database report multiple SIC codes, with the COMPUSTAT database reporting segment SIC codes beginning in 1984). We then match these deals to the Department of Commerce LRD database. Of these 2,030 transactions, we matched 1,303 transactions to the LRD database. By examining deals classified as outside manufacturing by SDC and COMPUSTAT, we also match an additional 180 transactions giving us a total match of 1,483 deals. The 1,483 M&A deals constitute our primary sample. Failures to match Compustat to Department of Commerce data occur for several potential reasons. First, firms with smaller plants will not match up to the database as plants of firms are only covered if the plants have more than 200 employees. Second, we are using Compustat data that was matched by Department of Commerce staff by name and address. In many cases, names in the Commerce Department data represent divisions and not ultimate parents and thus the firm may not be matched. Comparing the Compustat data median and mean sales data for matched and unmatched firms, we find that the matched firms are three to four times larger than unmatched firms, supporting the first explanation. Matched firms have median (mean) sales of 187.166 (980.551) million dollars, while unmatched firms have median (mean) sales of 43.988 (342.813) million dollars.

Insert Table 1 here

The time period from 1981 to 2000 covers two cycles in M&A transactions. The number of transactions in our sample increase in the 1980s, peak in the late 1980s, then decline in the early 1990s, before picking up again towards the end of our sample period. The dates of the peaks in M&A activity are related to the NBER business cycle dates. They are also consistent with the literature on merger waves (Andrade and Stafford (2001), Maksimovic and Phillips (2001), Harford (2005)).

3.2 Characteristics of Acquirers and Targets

Table 2 describes the cross-sectional characteristics of the firms involved in the transaction. In columns 2 and 3, we report the mean and median market value and book-to-market decile of targets for each sample year. The book to market ratio is computed from COMPUSTAT data following the algorithm of Fama and French. We obtain the cutoffs for the deciles of the distribution of BE/ME from Ken French's website for

the relevant year. The market value of each firm is also obtained as the market value in the December of the year prior to the transaction and is assigned deciles based on Ken French's website. Target firms tend to have below median market capitalization. The median target's market capitalization decile is under 3 in every year except 1982. In each year the target firms' book-to-market deciles are higher than their corresponding market value deciles. However, the median target's book-to-market decile is consistently below the market's median book-to-market decile. The target's mean book-to-market decile is close to 5, and reaches a maximum of 5.84 in 1991.

Insert Table 2 here

Columns 4 and 5 of Table 2 report the industry-adjusted margins of plants owned by acquirers and targets in the year prior to the acquisition. We find that both acquirers and targets operate profitable plants that tend to earn above-industry margins. For 16 out of 18 years covered by our sample, the median industry-adjusted margins of acquirer-owned plants are positive. Target owned plants display a similar pattern. In 15 out of 18 years, industry-adjusted margins of acquirers exceed those of targets, suggesting that acquirers are more productive than targets.

The last two columns of Table 2 report data on the deflated shipments of acquirers and targets. The median deflated shipments of acquirer plants are between 1.5 and 7.7 times the median shipments of target plants. Thus, manufacturing plants of acquirers tend to be larger than plants operated by targets. The ratio of plant sizes is somewhat lower than the (unreported) ratio of market values of acquirers to targets, reflecting the fact that in our sample, acquirers not only own larger plants than targets but also operate more plants than targets.

We also investigated the cross-sectional characteristics of the subset of mergers for which both acquirer and target characteristics are available on COMPUSTAT and LRD. Except for 1983, the median and mean BE/ME deciles for acquirers are below 5. The median and mean BE/ME deciles for acquirers are significantly lower in the 1990s, when they are close to 2, suggesting that acquirers are more likely to be glamour firms in the 1990s. Interestingly, targets also tend to have median and mean BE/ME below 5, as in the larger sample in Table 2. Thus, both the acquirers and the targets tend to be growth firms rather than distressed or value firms. The low BE/ME deciles and the higher BE/ME for acquirers relative to targets mirrors similar evidence on the high margins and productivity in Table 2. One interpretation of this pattern is that the opportunity cost of suboptimally used capacity is high when there are more growth opportunities, so mergers tend to concentrate in firms and time periods in which there are more growth opportunities. Alternatively, it is also possible that mergers tend to occur when market valuations are relatively high, perhaps because firms can use their stock as currency for acquiring other companies, as in Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004).

For this subsample, we also examined the size of acquirers as reflected in the Fama-French market capitalization deciles. Except for 1981, the median and mean market capitalization decile for acquirers

exceed 5, while median and mean target market value deciles are consistently below 4. In terms of actual market capitalization, the median acquirer size by year ranges from $381mm to $1.9 billion, about ten times the median size of targets. Acquirers in the late 1990s tend to have especially high market values relative to the target size.

3.3 Variable Construction

i. Organizational Form and Relatedness

To obtain a measure of organizational structure, we aggregate each firm's plants that operate in each industry into portfolios at the three-digit SIC code level. We call these firm-level industry portfolios of plants "segments." Segments, defined this way, capture all the plant-level operations of a firm in an industry.[9] We classify firms as single segment or multiple segment, based on the three-digit SIC code. We classify a firm as a multi-segment firm if it produces more than 10 percent of its sales in a second SIC code outside its principal three-digit SIC code. Using the 10 percent cut-off facilitates comparison with previous studies as 10 percent is the cut-off that public firms report. For multiple-segment firms, we also classify each segment as either a main segment or a peripheral segment. Main segments are segments whose value of shipments is at least 25% of the firm's total shipments. We classify a target firm's plants as being related to the acquiring firm if it has the same 3-digit SIC code as a main division of the acquirer. Thus, within acquisitions some plants can be classified as related and others as unrelated.

ii. Plant-level Measures of Productive Efficiency

We use two measures of productive efficiency: operating margin and total factor productivity. We calculate operating margins for each plant. The numerator of this margin is the value of shipments less the value of labor costs and all input costs, such as materials and energy. We divide this numerator by the value of shipments made by the plant. We industry adjust a plant's operating margin in each year by subtracting out the industry median operating margin. All dollar values for this calculation are deflated to 1982 dollars using three-digit price with separate deflators from the Bureau of Economic Analysis for shipments, wage costs, materials, and energy. This operating margin differs from a typical cash flow number because our plant-level data does not measure indirect segmental level costs, such as advertising and research and development. Our measures focus on the operating or productive efficiency of plants.

A related measure of productive efficiency is the total factor productivity (TFP) of a plant. We compute TFP to capture acquirer skill and also to examine post-merger performance. We use as our measure of acquirer skill, the average TFP of a plants firm's peripheral divisions (divisions with less than 10% of firm

[9] The segments we construct do not correspond to those reported by COMPUSTAT. Segment data reported by COMPUSTAT are subject to reporting biases. Firms have considerable flexibility in how they report segments as shown by Pacter (1993). Firms may also have strategic reasons for the specific segments they choose or choose not to report, as Hayes and Lundholm (1996) shows. Hyland (1999) finds that only 72 percent of firms that report under the FASB standards that they go from one segment to more than one segment actually increase their number of segments. See also Vilalonga (2004).

output). TFP takes the actual amount of output a plant produces with a given amount of inputs and compares it to a predicted amount of output. "Predicted output" is what the plant is expected to have produced, given the amount of inputs it used. A plant that produces more than the predicted amount of output has a greater-than-average productivity. This measure does not impose the restrictions of constant returns to scale and constant elasticity of scale that a "dollar in, dollar out" cash flow measure would require.

To calculate a plant's TFP and predicted output, we assume that the plants in each industry have a translog production function. This functional form is a second-degree approximation to any arbitrary production function, and therefore takes into account interactions between inputs. In estimating the production function we use the last five years of data for each plant - thus the first year of our data for which we have calculated productivity is 1979. For each industry we estimate this production function using an unbalanced panel with plant-level fixed effects. To estimate productivity, we take the translog production function and run a regression of log of the total value of shipments on the log of inputs, including cross-product and squared terms:

$$\ln Q_{it} = A + f_i + \sum_{j=1}^{N} c_j \ln L_{jit} + \sum_{j=1}^{N} \sum_{k=j}^{N} c_{jk} \ln L_{jit} \ln L_{kit}, \tag{1}$$

where Q_{it} represents output of plant i in year t, and L_{jit} is the quantity of input j used in production for plant i for time period t. A is a technology shift parameter, assumed to be constant by industry, f_i is a plant-firm specific fixed effect (if a plant changes owners a new fixed effect is estimated. We leave off the firm subscript for tractability), and $c_j = \sum_{i=1}^{N} c_{ji}$ indexes returns-to-scale. We deflate for industry price at the four digit level.

We obtain our measure of plant-level TFP from equation (1). This measure has two components that we add together to get a measure of productivity. First we have a plant-firm fixed effect, f_i,. The fixed effect captures persistent productivity effects, such as those arising from managerial quality (Griliches (1957) and Mundlak (1961, 1978)). It also captures a segment's ability to price higher than the industry average. Second, we obtain a plant residual in each year. In each case we standardize plant-level TFP by subtracting out industry average TFP in each year and dividing by the standard deviation of TFP for each industry. We standardize to control for differences in precision with which productivity is estimated within industries. This correction is analogous to a simple measurement error correction and is similar to the procedure used to produce standardized cumulative excess returns in event studies.[10]

We examine the change in industry-adjusted operating margins and TFP after mergers. In analyzing the changes over time, we control for predictable time series variation in margins and TFP by subtracting the typical change that occurs for plants. For instance, we estimate the typical change in TFP by regressing

[10] This standardization does not affect the results we report. The results have similar levels of significance when we do not standardize productivity in this manner.

future changes in TFP (and operating margins) on initial TFP (operating margins) levels for all plants. Analogous to obtaining a coefficient of mean reversion, we obtain a coefficient for predicting the change in performance based on the initial level of productivity or operating margin for each year. We apply this coefficient to the initial levels of TFP (operating margins) for the plants of merging firms in our sample and compare actual performance to predicted performance. We also examine the mean and median changes in industry-adjusted performance without conditioning on the level of performance.

In estimating the operating margins and TFPs in our sample, we use data for over one million plant years, and for approximately 50,000 plants each year. In the productivity regression for each industry, we include three different types of inputs, capital, labor, and materials, as explanatory variables. All these data exist at the plant level. Our productivity calculations do not capture any headquarters or divisional level costs that are not reported at the plant-level (i.e. overhead, research and development). The ASM also does not state the actual quantity shipped by each plant, but shows only the value of shipments. We thus deflate the value of shipments by 1982 price deflators to get a real value of shipments. For all inputs and outputs measured in dollars, we adjust for inflation by using four-digit SIC deflator data from the Bartelsman and Gray (1994) database. Each input has to have a non-zero reported value. Kovenock and Phillips (1997) describe these inputs and the method for accounting for inflation and depreciation of capital stock in more detail.

iii. Other Firm and Industry Control Variables

We also include other firm and industry variables in our regressions. We include the log of firm size and the number of plants operated by the firm at the beginning of the year. We also include the log of target size divided by acquirer size as a measure of relative size for the target to the acquirer. We define firm size as the total deflated value (using industry price deflators) of shipments in 1982 dollars. We also include four industry-level variables: INDRET - the two-year buy and hold return for the Fama-French 48-industry group to which a target plant belongs, industry R&D ratio, INDMARG - the industry operating margin, and the standard deviation of the industry operating margin (SD - INDMARG). Industry R&D (IND R&D) is calculated as the sum of firm-level R&D from Compustat at the three-digit SIC code level, divided by the sum of firm-level sales in each year. INDMARG is the sum of firm-level operating income before depreciation from Compustat at the three-digit SIC code level, divided by the sum of firm-level sales in each year. SD(INDMARG) is the standard deviation of the industry operating margin using the last ten years of data.

We include the target's book-to-market value of equity ratio in all regressions. This variable is constructed using the book value of equity from Compustat divided by the market value of equity in each year. An analogous variable is calculated for the acquiring firm. We also calculate a measure of related using market value measures. We construct a variable called "diagonal." We first compute the decile of a firm's book-to-market ratio using breakpoints obtained from Ken French's website. We then define diagonal to

be equal to one if the target and acquirer book-to-market deciles are the same or have deciles within one of each other, and zero otherwise.

4 The Decision to Sell, Keep, or Close Target Plants

4.1 Overall Disposition Rates

Table 3 describes the status of target-owned plants acquired in a merger at the end of three years after the merger. We benchmark the selloff and closure rates against industry rates for firms not involved in mergers. These asset sales and closure rates are based on firms not involved in mergers that are in industries that experience a merger transaction in the same 3 digit SIC code and year. Even in the relatively narrow window of three years, there is a surprising degree of turnover of just-acquired plants in our sample. In the aggregate sample, 12,893 plants change hands in acquisitions. Of these, only 54.4% continue to be operated by the acquirer 3 years after the acquisition is completed. Of the remaining, 18.6% are closed, while 27.0% of the plants are sold off. We discuss basic patterns in these selloff rates and then turn to the cross-sectional tests. These tests examine whether the plant retention decision is in accordance with neoclassical theories of comparative advantage.

Insert Table 3 here

4.2 Disposition by number of plants acquired

We also classify targets based on the number of target plants transferred in the M&A transaction. We sort the sample into five bins: 1-5 plants acquired, 6-10 plants acquired, 11-25 plants acquired, 26-50 plants acquired, and more than 51 plants acquired. We examine whether the tendency to dispose of acquired plants is more pronounced when a large number of target plants are acquired. This outcome is likely, for instance, if the acquirer has a comparative advantage in operating only some of a multi-division targets lines of business or if it buys multi-plant targets with a view to the view of creating value by breaking up the plants, as in the bustup mergers analyzed by Berger and Ofek (1996).

Table 3 suggests that the tendency to dispose of acquired plants is not necessarily concentrated in multi-plant target acquisitions. To the first order, the fraction of the target plants kept at the end of year 3 by the acquirer remains flat at about 55% when up to 50 plants are transferred in acquisitions. The kept proportion declines to about 52% when more than 50 plants are acquired. About one quarter of all plants acquired are sold off by year 3 and this proportion does not vary much with the number of plants transferred in the acquisition.

The industry-size-year benchmarks for firms not involved in mergers are much lower than the rates shown for firms involved in mergers. The benchmark probability of plant sale is 7.2% if the firm has

1-5 plants, rising to 14% if firms have 26-50 plants, with an overall sale rate of 8.98%. These rates are only about one-third of the proportion sold off for target firms involved in acquisitions. The probability of plant closure after mergers is 16% if only 1-5 plants are transferred in the acquisition and is relatively flat at about 20% when at least five plants are transferred in the merger transaction. The closure rates for industry-size-year benchmarks for firms not involved in mergers are much lower than the rates shown for firms involved in mergers. The probability of plant closure is 2.4% for matched industry firms with 1-5 plants and is relatively flat at about 5% for matched firms with more than five plants. The last two columns of Table 3 report selloff and closure rates for plants owned by the acquirer prior to merger. These rates tend to be higher than benchmarks but lower than target plant disposal rates. As we discuss below, this difference is due to observable differences in plant characteristics rather than different propensities based on whether the plant was owned by the acquirer or it belonged to the target.

Overall, the summary statistics suggest that there is significant post-merger restructuring of plants in a short period of three years after merger completion. Acquirers do not passively absorb the newly acquired plants. This finding provides little a priori support for the predictions of Hypothesis 1, or a pure empire building motivation for acquisitions that would predict that acquirers retain the bulk of assets acquired through a merger.

4.3 Disposition in the 1980s versus 1990s

The merger wave in the 1980s is often characterized as the unwinding of the conglomerate expansion wave of the 1960s and 1970s. If so, the probability either retaining a plant should be higher in the 1990s compared to the 1980s. Table 4 shows that the overall percentage of kept plants is higher at 59% in the 1990s deals compared to 50% in the 1980s. Also, the total number of plants in large acquisitions involving at least 51 plants, in which the undoing of inefficiently large conglomerates is more likely to be a prime objective, is 2,497 plants in the 1980s, almost 55% more than the 1,596 plants transferred in large acquisitions in the 1990s.

4.4 Relatedness

We next classify the post-merger disposition decision by the type of acquisition. If expansion of managerial scope motivates related acquisitions, as in MP, related acquisitions should result in greater retention of target plants. On the other hand, if acquisitions are carried out with the view of shutting down extra capacity, perhaps for reasons of maximizing profits in an oligopolistic setting, there could be more closures in related acquisition. Anti-trust concerns would also predict lower likelihood of retention in acquisitions that are related, since anti-trust concerns would require less retention in cases where there are related acquisitions.

We measure relatedness on the plant level, based on whether target plants have the same 3-digit SIC

code as an acquirer's main division, as described earlier in the variable section above. In our sample, 4,080 related plants are acquired while 8,813 plants are not related. We find that 55% of related plants are kept while 51% of unrelated plants are kept. There are similar differences in the selloff decision. 22.5% of related plants are sold off while 27.5% of unrelated plants are sold off.

5 Disposal of Plants: Multinomial Logit

The high proportion of target plants that are sold suggests that unconditional empire building is not the sole driver of acquisitions. In this section, we analyze the cross-sectional variation in disposition decisions of acquirers to test neoclassical theories of firm scope. To test these hypotheses, we examine how the proportion of plants acquired depends on the marginal skill of the acquirer and the opportunity cost of retaining the acquired plants. We also include other control variables, including the size of the acquisition, acquirer characteristics, industry conditions, the characteristics of the acquired plants and their position in the organizational structure of the target.

We model the decision to keep, sell, or close a target plant acquired after a merger using a multinomial logit model. The dependent variable in this model is 0, 1, or 2 depending on whether the plant is sold, kept, or closed, respectively. Thus, the baseline decision is to keep a plant, and Table 4 reports estimates for the decision to sell off an acquired target plant (upper Panel) or the decision to close the plant (lower Panel) relative to the baseline decision to keep. The results in Table 4 focus on statistical significance. To assess the economic impact of the explanatory variables in the logit specification .we report estimates of the marginal effects in Table 5.

Insert Tables 4 and 5 here

Panels A and B of Table 4 show the estimated coefficients in the decision to sell or close an acquired plant, respectively. We report estimates of five specifications that vary according to the explanatory variables included in the model. We divide the explanatory variables into several groups. One group includes characteristics of the transacting firms and the plants' position in their organizational structure. The second group pertains to the target plants' industry. The final group of explanatory variables includes additional acquirer characteristics and interactions with industry variables, which allow us to further test predictions about efficient disposal decisions. Specification (1) reports the effect of the target plant characteristics to test hypotheses H1 and H2. Acquirer characteristics are added in specification (2). Here, we also introduce a dummy variable for the 1980s time period to control for the potential changes in the disposal decision between the 1980s and the 1990s. Specification 3 includes the key acquirer operating margins and skill variables are added in specification (3) to test H5 and H6 and the key prediction of the comparative advantage theory. Finally, specifications (4)-(5) show the effects of several industry-level variables on the plant disposal decision to test hypotheses H3, H4, and H5 - including the key industry

return variable to capture the opportunity cost facing the acquiring firm. As in Table 4, Panels A and B of Table 6 focus on the marginal effects related to the sell and close decisions, respectively, while Panel C reports the marginal effects for the keep decision.

5.1 Target Characteristics

Panels A and B of Tables 4 and 5 show that plants that are related (RELATED) (a plant that produces in a similar 3-digit SIC code) to the acquirer's existing divisions and the centrality (TMAIN) of the plant in the target's organization are less likely to be sold than a similar plant belonging to the target's peripheral divisions. Both variables are statistically significant and economically material and their effects persist across all the specifications in the tables which include industry and acquirer's characteristics. At the median of the sample data, the marginal effects of belong to the target's main division and being in an industry related to the acquirer are of similar magnitude and each reduce the probability of the plant being sold by approximately 13% in most specifications.

The significance of the RELATED variable is consistent with the acquirer exploiting its core ability and expanding in divisions that are more productive. Its sign is not consistent with anti-trust motivations for divestment, since anti-trust concerns would predict less retention of related assets while we find greater retention of assets that are related.[11] Other evidence we do not report shows that related divisions are more productive. The significance of TMAIN, and more broadly the fact that acquirers tend to keep only some parts of the target suggests that acquirers buy whole firms when they are only interested in some parts of the target firm.

A question that naturally arises is whether acquirers should buy the parts of the target they are interested in or acquire the whole firm and divest its unwanted parts. We leave this interesting theoretical and empirical issue for future work. From conversations with investment bankers, it appears that taxes are partially responsible for this choice. Asset purchases above their book values from C corporations would result in taxes paid by the selling firm and also additional taxes when proceeds are distributed to shareholders. Full firm purchases structured as stock purchases, followed by sale of unwanted peripheral divisions, can reduce taxes paid at the time of transaction.

The next variable in the logit model is the industry-adjusted profitability of a target plant, TMARG. We expect that profitable plants are a priori less likely to be closed, but it is not clear what relation plant profitability should have to the decision to sell a plant. Weaker plants may have the greater potential for improvement, suggesting a positive relation between selloff and plant profitability. On the other hand, acquirer plants tend to be more profitable (Maksimovic and Phillips (2002), Schoar (2002)). If more productive target assets tend to be more complementary, the weaker assets acquired should be more likely

[11] We also discuss later how including industry concentration measures from the Census Department do not change these results.

to be sold off. We find evidence for this view. The TMARG profitability variable is a statistically significant predictor of the decision to sell and it has a negative coefficient. The marginal effect of a target plant's operating margin lowers the odds of a selloff between 8 and 9 percent. Target plant profitability matters even after including other controls for the decision to sell. On the retention decision,the marginal effect of a plant's operating margin is associated with a 18-19% increase in probability that the plant will be retained. Profitability is also significant in explaining the closure decision, as expected by a significant 9 percent.

The variable TMARG controls for profitability at the plant level. We supplement this with the target book-to-market ratio as a potential predictor of the disposition decision. The associated variable, TBEME, which is the BE/ME decile to which a target belongs. TBEME should capture the future profitability or the growth prospects of targets, at the level of the enterprise being acquired. The target firm's book-to-market ratio is positively related to the probability of sale at significance levels of between 1% and 10% depending on specification.[12] An alternative interpretation is that high TBEME indicates targets with low valuations. Thus, a positive coefficient for TBEME indicates that low valued targets are more likely to result in a post-merger asset sale, perhaps because the target's portfolio of assets was suboptimal. Table 5 indicates that the marginal effect of book-to-market is more modest than that of TMARG, ranging from 1% to 3% in the selloff decision at significance levels ranging from 1% to 10%. TBEME has relatively little effect on the closure decision, where it tends to be economically and statistically insignificant.

5.2 Acquirer Characteristics

Specification (2) of Table 4 introduces controls for acquirer size. Following Healy, Palepu, and Ruback (1991), we include the size of the acquirer relative to target size (TRELSIZE). In addition, we include the logarithm of the deflated output and following Table 3, the number of plants transferred in the acquisition as additional controls. The coefficient for the aggregate acquirer output is positive, suggesting that large acquirers are more likely to divest target plants. The marginal effect of this variable is only about 1%. Neither the relative size of the target nor the number of plants transferred is significant.

Specification (3) of Table 4 introduces other acquirer characteristics. The overall acquirer margin, AMARG, is insignificant. Thus, the probability that a plant is sold does not depend on the acquirer's overall operating margin, so more profitable acquirers do not sell plants with a higher probability than less profitable acquirers. On the other hand, the acquirer's productivity in its marginal businesses matters. Consistent with neoclassical models of firm scope, we find that in specifications (3) and (4) that as predicted, the profitability of acquirer's peripheral plants (ASKILL) reduces the probability that the acquirer will sell an acquired plant. Thus, a firm whose marginal divisions have low profitability is less likely to retain

[12] Note that high values of book-to-market are associated with higher target plant sales even after controlling for industry margins, stock price run-ups and R&D levels in specifications (4) and (5).

a newly acquired plant. From Table 6, the marginal effect is economically significant. A one standard deviation in the efficiency of peripheral divisions, holding all other factors including firm wide operating margins constant, is associated with a 17% increase in the probability of the plant being retained.

The significance of ASKILL is consistent with the prediction that as a firm's scope increases, its ability to operate plants efficiently at the margin decreases. A firm whose marginal divisions are relatively inefficient is less likely to increase its size by retaining plants acquired in a merger, holding all other things equal. The significance of ASKILL is particularly striking in light of the insignificance of the *overall* acquirer margin, AMARG. In other words, the acquirer's average industry-adjusted operating margin does not affect the disposition decision significantly. The decision to retain a plant is function of the acquirer's ability at the margin rather than its average ability, precisely as predicted by neoclassical theories in which mergers are driven by changes in optimal firm scope.

5.3 Industry Characteristics

Specifications (4) and (5) in Table 4 introduce several industry variables. These variables capture the industry conditions because the decision to retain or sell a plant is likely to depend on the value of assets to other industry participants and based on industry shocks as studies by Mitchell and Mulherin (1996). We capture the opportunity cost and the value in the industry after industry shocks using the industry return in the two years subsequent. Furthermore, the changing opportunities within an industry, which is captured by industry variability, could also affect the decision to sell a plant.

Specification (4) shows that plants in industries that experience a large run up in market valuation have a significantly higher probability of being sold, as shown by the significant coefficient of INDRET. Table 5 shows that a one standard deviation in INDRET increases the probability of an asset sale by 3%. Following Maksimovic and Phillips (2002), the opportunity cost of retaining a plant following a positive shock in the industry is likely to be higher when the plant owner is *less* efficient. Such producers are better off selling their capacity after a positive industry shock because the capacity they own is more productively used outside the firm. We test for this explanation in specification (6) by interacting the industry return runup (INDRET) with the efficiency of the acquirer's peripheral divisions (ASKILL). Consistent with this opportunity cost prediction, while newly acquired plants are more likely to be sold following positive industry returns, these sales are less likely to occur when the acquirer is not efficient in running in running peripheral divisions. Efficient acquirers are significantly less to sell plants following a positive shock their industry than at other times. Table 5 shows that the estimated marginal effects are significant. A one standard deviation increase in the interacted variable results in a 55% reduction in the probability of a plant sale.

Table 4 also reports coefficients for other variables. Plant sales following mergers are more likely in high R&D industries. Greater variability in industry margins is not related to the probability of sale. However,

the level of industry margin matters. Sales are more likely when industries have high operating margins. A one standard deviation in operating margin increases the probability of sales by an economically significant 12%. We also find evidence that the time period matters. The 1980s dummy variable has a positive and significant effect. The rate of plant sales is approximately 4% higher in the 1980s.

The estimates for the probability of plant closure are presented in Panel B of Table 4, with the marginal effects presented in Panel B of Table 5. Acquired plants in the target's main division, plants with high operating margins and plants in industries related to the acquirer are less likely to be closed. Plants in mergers where the target is large relative to the acquirer, and where the acquirer itself is large are also likely to be closed. We also find other significant industry effects. The probability of a closure of an acquired plant is higher in high R&D industries, industries with high operating margins and industries in which the dispersion of plant productivities is high. Closures were significantly higher in the 1980's, running at an about 7-9% higher rate as shown in Panel B of Table 5. The lower probability of plant retention in the 1980s transactions supports a widely held view that the 1980s mergers reversed the conglomerate wave of the 1960s and 1970s.

In contrast to the sales decision, we do not find that the decision to close a plant is related to the productivity of the acquirer's peripheral divisions, the run-up is stock prices, or the interaction of the two. Thus, closure does not depend on changes in the opportunity cost of operating the plant by the acquirer or another producer. Similarly, the acquirer's operating margin does not predict plant closures. The requirement that the NPV be non-negative for the plant to remain open is less likely to be sensitive to the marginal changes in the comparative advantage of the owner, especially since the opportunity cost of closing the plant is selling it to the highest bidder, whose bid may change in different ways from that of the owner in response to an industry shock. This contrasts with the sale decision, which is sensitive to shifts in the relative opportunity costs of ownership, which themselves changes as the efficiencies of different producers in the industry shift in response to industry shocks.

Taken together the findings in Tables 4 and 5 provide strong evidence that acquiring firms on average make economically rational asset disposal decisions. Assets in the target's main divisions and assets that are in industries related to acquirer are more likely to be retained (Hypothesis 4). Assets whose opportunity costs have increased are more likely to be sold (Hypothesis 5). Acquirers who are efficient in operating marginal plants are more likely to retain purchased plants (Hypothesis 6). In particular, acquirers who are efficient at operating marginal plants are more likely to retain them following positive shocks to the industry (Hypothesis 7). There are the states in which the neoclassical model predicts that the acquirer has a higher comparative advantage in retaining the plant. Importantly, the decision to dispose or retain the asset depends on the efficiency of the acquirer's marginal plants (Hypothesis 6).

5.4 Other Unreported Results

5.4.1 Method of Payment

Hypothesis 8d suggests that acquirers may treat assets acquired in stock transactions differently than assets acquired in cash transactions. Ex-ante, one might expect that selloffs and closures are more likely in acquisitions that are cash financed. To test this we included (but do not report) the method of payment as an explanatory variable. Specifically, we included in the multinomial logit model a binary variable that equals 1 if an acquisition is financed with at least 51% cash and is zero otherwise. We find that the method of financing an acquisition is not significant in explaining the disposition decisions, both statistically and economically.

We also consider an instrumental variables specification to further explore whether predicted stock explained the disposition decision. Accordingly, we reestimate the logit equation in Table 5 with instruments for the stock variable. Our instruments include the acquirer's industry average R&D expenditure to sales, the industry level market-to-book ratio, the industry-adjusted profitability, the standard deviation of the industry-adjusted profitability, and whether an acquirer is a conglomerate. The predicted stock variable is insignificant. These results suggest that, contrary to Hypothesis 8d, the method of payment does not matter in determining post-merger restructuring decisions, which are instead dominated by asset side considerations about what type of assets fit best in the merged entity.

5.4.2 Industry Concentration and Industry Fixed Effects

We reestimate Tables 4 and 5 after replacing all the industry variables by 3-digit industry fixed effects. With one exception, the coefficient estimates for acquirer and target variables were within 5% of values reported here, and at the same level of significance. The exception is the coefficient of ASKILL, which increased from a 5% to a 1% level of significance with the 3-digit industry dummies.

We also examine if industry concentration ratios impact our results. Antitrust officials may require acquiring firms to sell off target plants in highly concentrated industries. Industry concentration is not significant in explaining post-merger restructuring decisions. In fact, the coefficient for concentration is opposite to the antitrust explanation. As industry concentration increases, acquiring firms are less likely to sell off plants and more likely to close plants. The sign of industry concentration is more consistent with the conjecture that acquirers in concentrated industries are eliminating productive capacity belonging to rivals. The coefficients are never significant, as the p-value for the coefficient on the concentration ratio in the sell off specification is 0.133 and for the closure specification is 0.142.

6 Post-Merger Performance

Plants obtained in an acquisition can be kept, sold, or closed off after the acquisition. In this section, we analyze the changes in performance of the kept and sold plants still in operation at the end of year 3 after the acquisition is completed. Not surprisingly, closed plants tend to shrink and have poor profitability prior to their closure; we do not report the performance data for these plants. We partition our sample into kept plants and sold off plants and analyze the changes for each sub-sample separately. We also analyze the cross-sectional determinants of the performance changes within each sample.

6.1 Unconditional Changes in Performance

We examine changes in the performance of acquired plants over a four-year window, from $t-1$ to $t+3$, where t denotes the merger year. We measure performance by the post-merger changes in the operating margins and productivity of the acquired plants.

Insert Table 6 here

Table 6 reports the data on post-acquisition performance of acquired plants. The upper panel reports data for kept plants while the lower panel deals with sold plants. As discussed in Section 3.2, we employ two measures of performance: the total factor productivity (TFP), which is reported in the first row of each panel, and the adjusted operating margin, which is reported in the second row of a panel. Table 6 reports the TFP or margin level as of year -1 and the changes in these measures between year -1 and years +1, +2, and +3.[13]

When we separate the acquired plants into those sold by the acquirer and those kept, we find striking differences in performance between kept and sold plants.[14] We find that on an unconditional basis, kept plants tend to be strong performing prior to acquisition and these plants continue their strong performance after the merger. For instance, the average change in TFP for kept plants over the three year window is 6.3% while the average change in margin is about 2.1% and both are significant at the 1% level. Sold plants also have positive performance changes although these changes are less pronounced than changes for kept plants. The average TFP change for sold plants is about 2.7% while the improvement in operating margin is 0.7%, both significant at the 10% level.

The performance changes for sold plants are between one-half and one-third the corresponding changes for plants kept by the acquirer. The evidence seems less consistent with the view that mergers are motivated

[13] Consistent with prior work, in this sample we find that combined (value-weighted) target-acquirer 3-day announcement returns are slightly greater than zero (1.69% median return, 3.05% mean return), target returns are highly positive (13.5% median return, 18.0% mean return), while acquirer returns are insignificant but slightly negative.

[14] We also separately analyze plants that are closed between t and $t+3$. As expected, plants that were closed plants tend to shrink and have poor profitability prior to their closure. We exclude closed plants from all subsequent analysis.

by empire building and hubris and more in line with the view that acquirers keep the portions of the target that they can improve operationally but tend to shed the assets in which they have no comparative advantage in running. The asymmetry between the performance changes for kept and sold plants is also inconsistent with Hypothesis 8c, the view that mergers resolve agency problems by liberating and reallocating less productive assets trapped in targets unwilling to shed these assets.

6.2 Changes in Performance and Acquirer and Target Characteristics

The summary statistics in Table 6 reflect unconditional changes in performance. We next present a cross-sectional analysis of the performance changes as a function of the ex ante acquirer and target characteristics.

Our cross-sectional analysis adjusts for selection effects by employing a switching regression with endogenous switching (Maddala (1983) or Li and Prabhala (2007)), which also allows us to estimate the counterfactual performance changes if kept (sold) assets were sold (kept) instead. In the underlying choice model, let $V_{K,i}$ be the latent value to an acquirer from keeping the plant i and $V_{S,i}$ the latent value from selling plant i. We specify the latent functions as

$$V_{D,i} = Z_{D,i}\gamma_D + \eta_{D,i} \tag{2}$$

where the decision to keep or sell is $D\varepsilon\{K,\ S\}$, $Z_{D,i}$ denotes observable explanatory variables and $\eta_{D,i}$ denotes unobserved or private information about the value of the plant, given the decision D. We specify a standard selection mechanism based on the limited dependent variable literature. An acquirer keeps asset i if $V_{K,i} > V_{S,i}$ and sells the asset otherwise. If a plant is kept, the change in productive efficiency is $\Delta Y_{K,i}$ and if it is sold, the change in productive efficiency is a potentially different function $\Delta Y_{S,i}$. We specify the change in productive efficiency in each case as the regression system

$$\Delta Y_{K,i} = X_{K,i}\beta_K + \epsilon_{K,i} \tag{3}$$

$$\Delta Y_{S,i} = X_{S,i}\beta_S + \epsilon_{S,i} \tag{4}$$

In the system of equations (2) and (3)-(4), there are two possible outcomes for each acquired plant, either it is kept or sold. However, we observe only one outcome, the actual outcome arising out the firm's choice. We do not observe the counterfactual outcome. For instance, if a firm keeps an acquired plant i, we observe the fact that it kept the plant and the change in its productive efficiency $\Delta Y_{K,i}$ but we do not explicitly observe the productivity change which would have occurred had the firm chosen to sell the plant, $\Delta Y_{S,i}$. However, the counterfactual can be estimated, so we can determine whether the average efficiency of kept plants would be higher or lower if the kept plant were instead divested, based on the estimates of system (2) and (3)-(4).

We estimate the switching regression system using a two step method. In step 1, we estimate the choice

model implied by equation (2). The probit estimates are qualitatively similar to the estimates from the multinomial coefficient for the probability of selling a plant in Table 4. For brevity, we do not discuss these results again. In step 2, the inverse Mills ratio is included in each of the equations (3) and (4) and the regression coefficients β_K and β_S are estimated. Tables 7 and 8 analyze the post-merger changes in the operating margins and productivity of the acquired plants that are the retained by the acquirer and those that the acquirer sells. We regress these changes on ex ante acquirer skill as well as target ex ante variables, in addition to the inverse Mills ratio.[15]

Insert Table 7 here

Tables 7 reports regression results in which the dependent variable is the change in performance for kept target plants. The change in performance is measured from the year prior to the merger to three years after. Specifications (1) and (2) in Table 8, the left columns, report the results when performance is measured using TFP. The two columns to the right use operating margins as the measure of efficiency. As in Section 2, our dependent variable is the change in performance adjusted for the predictable portion of performance changes.

From Table 7, the variable TMARG, the ex-ante profitability of the target plant, has a negative coefficient. It is significant in three of the four specifications, consistent with the view that underperforming plants that are kept tend to improve more after mergers. The second variable, AMARG, denotes the current (industry-adjusted) profitability of acquirers. If above-industry margins reflects acquirer skill, more profitable acquirers should be more likely to improve future profitability of plants that they elect to keep. The evidence is supportive of this view. AMARG is significant and has a positive sign in Table 6 This is in contrast to the insignificance of the AMARG in the decision to keep or sell a plant in Table 4. This difference in coefficients across the equations suggests that while an acquirer whose plants are more profitable on average does not have an advantage in operating an average acquired plant, for those plants for which there is a match between the acquirer's skill and the target plant, so that $V_{K,i} > V_{S,i}$, higher acquirer productivity leads to improved performance.

The third variable is ASKILL, or the skill of the acquirer in the peripheral divisions. We find that this variable has a positive coefficient and it is significant. Thus, firms with relatively more expertise in running their peripheral businesses tend to improve the productive efficiency of the plants they keep. This finding is consistent with neoclassical theories of the firm would suggest that firms who are relatively skilled in running their peripheral businesses should be more likely to make improvements in the plants they keep.

[15] While it is not our focus, we also examine the relation between merger announcement effects and disposal decisions and ex ante firm characteristics. Announcement effects are not significantly related to disposition decision or ex-ante characteristics with two exceptions: a positive relation of target returns to target B/M, and a negative relation to industry operating margins. The general absence of significance for acquirer and combined returns is perhaps not surprising given that announcement effects also reflect (in varying degrees) information revealed about acquirers' own existing businesses, information about the level and type of payment, and synergies (Hietala, Kaplan and Robinson (2003)) plus any changes in administrative overheads.

The finding is not predicted by agency theories that suggest that plant acquisition and retention is an outcome of agency-motivated empire building by firms who spend cash generated by main divisions that happen to be profitable.

Other variables in our specification include TRELSIZE, the size of the target relative to acquirer size, following Healy, Palepu, and Ruback (1991), who argue that gains are likely to be more concentrated in relatively smaller acquisitions. We find little evidence for a size effect in explaining the gains in productive efficiency of kept plants. This suggests that the gains related to size reported in Healy, Palepu, and Ruback may be attributable to economies of scale in reducing overheads rather than synergistic gains arising out of manufacturing efficiencies. In unreported results, we also used the number of plants acquired as an alternative proxy for size; it was insignificant and had little effect on the other coefficients.

We include the acquired target's book-to-market ratio, TBEME, as a control variable. Plants may have unobserved future efficiency gains not reflected in current productivity levels. TBEME should capture this effect, to the extent it is capitalized in target firms' share prices. There is no consistent pattern in the data. In one specification (TFP, column 1), TBEME does have a negative sign and it is economically significant, but the variable is not significant elsewhere.

We also include a dummy for the 1980s time period. This variable controls for the hypothesis that target plant efficiency gains may be a pure 1980s effect. Perhaps the deconglomeration wave of the 1980s corrected inefficient resource allocation in conglomerates formed in the 1960s and 1970s, while the 1990s mergers are pure financial transactions caused by firms exploiting overvalued stock. We find no support for this view. There is mixed evidence on the significance of the 1980s dummy: it is significant in one specification but not in the others. However, all coefficients, including the significant one, are negative. If the efficiency gains are time period effects, they are *more* concentrated in the 1990s rather than the 1980s. Thus, even if the 1990s merger wave are caused by firms exploiting their overvalued stock as acquisition currency, it is still the case that the acquisitions resulted in more productive efficiency gains for the kept plants.

For both the TFP specification and the operating margin specification, we report two specifications that incorporate acquirer-related stock market information. As before, the requirement that we have acquirer data shrinks our sample. For instance, we have a sample of 4,239 plants in the TFP specifications that do not require acquirer data, but the sample is 2,356 plants when we impose the requirement that acquirer stock market data is available. Interestingly, the acquirer BE/ME has a negative coefficient. It is not significant in the TFP specification but is significant at 1% in the operating margin specification. These results show that low BE/ME acquirers, i.e., glamour acquirers, are able to achieve greater efficiency gains in the targets' plants they keep. If acquisitions merely reflect bidders using overvalued stock to pay for targets, we would not necessarily see greater real efficiency gains concentrated among glamour bidders. Our view is that using overvalued stock as currency is probably not the whole story for why acquisitions occur. While firms do probably use their stock as currency for acquisitions, the systematic variation in the

pieces they keep after such acquisitions also needs to be explained in such a theory.

The second acquirer stock market variable is DIAGONAL, which is equal to 1 if the BE/ME ratios of the target and acquirer are similar. This variable is motivated by the observation in Rhodes-Kropf and Robinson (2006) that mergers between similar BE/ME firms have greater gains, perhaps because the operating synergies between the firms are greater. If so, Hypothesis 8a predicts that performance changes of firms would be greater in mergers of firms with similar BE/ME ratios. We test this proposition. Empirically, we specify a merger as a being a "diagonal" merger if the absolute value of the difference in BE/ME of the acquirer and that of the target is less than 1. We find no evidence that the economic gains are more when the merger is between similar BE/ME firms. In fact, the point estimate is negative and significant at between 10% and 1%, suggesting that other variables are capturing the potential for synergies between firms. If such synergies exist in similar BE/ME mergers, the place to look for these is in the administrative or headquarter level overheads of firms rather than operating level efficiency changes. It is worth stressing that the results do not support the view that similar BE/ME acquisitions produce more operating gains. However, our evidence certainly backs the more general proposition that complementary assets produce greater operating gains.[16]

The selection term, the inverse Mills ratio, has a negative coefficient in all specifications. It is significant at 10% in the TFP specifications and at 1% in the operating margin specification for the full sample but it is insignificant in the smaller sample that requires acquirer stock market data. The inverse Mills ratio variable is the expectation of the unobserved error term, or the private information, in the probit specification modeling whether a plant is kept or sold. For the kept plant sample, the inverse Mills ratio takes negative values because it is the expectation of the unobserved error given that a plant is kept given that probit dependent variable is 1 if a plant is sold and zero if the plant is kept. Thus, a negative coefficient for the inverse Mills ratio indicates that the unobserved private information that makes firms more likely to keep plants is positively related to the change in plant performance.

Insert Table 8 here

Table 8 reports the results for sold plants. Theories make no particular predictions about efficiency changes for the sold plants. Thus, it may not be surprising that sold plants show few of the patterns for kept plants. A common element in both kept plants and sold plants is the negative sign for TMARG, the prior performance of plants, which indicates that ex-post performance improvements are greater for plants that have less strong performance ex-ante. Interestingly, the relative size of the target plant is *negatively* related to changes in efficiency, while target size is insignificant in the kept equation. Thus, increases in efficiency in sold plants are concentrated in the subset of small plants sold off by acquirers.

[16] For instance, in our sample, skilled acquirers acquire good quality assets that tend to be related to their main businesses, are more likely to retain them, and improve the productivity of retained assets.

Interestingly, the 1980s dummy variable is insignificant in the sold specification. If the 1980s mergers were intended to undo agency-related inefficiencies of large conglomerates, one might expect that the post-merger selloffs in the 1980s should result in greater productive efficiency gains for sold plants, a version of hypothesis 8c. However, the coefficient for 1980s is insignificant, and in any case, the point estimate is *negative* in all specifications. Thus, we find no support for the view that the plants sold off during the 1980s deconglomeration wave became more efficient in the hands of the new owners.

The results in Tables 7 and 8 can be used to construct estimates of the counterfactual changes in productivity that would occur had the acquirer chosen to sell (keep) the plants that were kept (sold). From equation (3), the counterfactual efficiency gain if kept plants were sold equals $\Delta Y_{K,i} - \Delta Y_{S,i}$, whose expected value is $X_{K,i}\beta_K - X_{S,i}\beta_S$. Likewise, the expected productivity sold plant were kept, its productivity would be $X_{S,i}\beta_S - X_{K,}\beta_K$. The results are interesting. For sold plants, the operating margin would be lower by 0.33% on average (t-statistic = 1.40) if the plant were kept instead of being sold. The results are quite strong for plants that are kept. If the kept plants were sold instead, the average abnormal operating margin would be lower by 2.57% (t-statistic = 18.0). The actual efficiency is insignificantly different for sold plants and much higher for plants that are kept relative to the efficiency under the unchosen alternative.

Even after adjustment for selection and reversion to the mean in performance, our evidence suggests that the post-merger asset retention/sale decisions lead to efficient outcomes on average. Sold plants do not demonstrably improve or deteriorate in performance. However, as predicted by Hypotheses 3, plants that are retained by acquirers, which are efficient to begin with as shown in Table 6, become even more efficient on average. We find efficiency gains both in an absolute sense and relative to the counterfactual efficiency that would be realized had the plants been sold. Thus, even after adjustments for selection, our is more consistent with a neoclassical view of firm growth driven by comparative advantage rather than a pure empire building motive for mergers.

6.3 Repeat Acquirers

This section considers an additional within-sample cross-sectional test to shed light on the empire building motive for acquisitions. From an agency theory perspective, repeated acquisitions could be associated with firms or managers with particularly strong tastes for empire-building (Hypothesis 8b). An alternative view is that repeated acquisitions might lead to organizational learning and therefore superior outcomes in later acquisitions as firms become more skilled at post-merger restructuring, thereby making better decisions about what target assets to keep or divest and how to improve the assets they keep. Matsusaka (2001) and Bernardo and Chowdhry (2002) present models in which conglomerate growth is driven by organizational capability and learning about this capability over time.[17]

[17] A separate and now extensive literature studies announcement effects associated with repeat acquirers. Early papers include Schipper and Thompson (1983) and Asquith, Bruner, and Mullins (1983), while more recent work includes Fuller, Netter, and Stegemoller (2002) and Ahern (2007). See Ahern (2007) for an excellent overview of this literature.

Insert Table 9 here

We include indicator variables for the subsequent acquisitions by a firm. DEALNUM2 indicates plants are part of a second acquisition by a firm. DEALNUM3 indicates plants are part of a third acquisition by a firm and DEALNUM4 indicates plants are part of a fourth or higher acquisition by a firm.

Table 9 examines the asset disposal decisions and the performance changes associated with acquisitions by firms that have already acquired other firms previously. Panel A provides the multinomial logit estimates for the plant keep, sale or closure decision for repeat acquirers. The logit specification is a full model that includes the explanatory variables of Table 5 as controls (and obtain similar results) but to conserve space, we report only the coefficients related to repeat acquirers. These include DEALNUM2, DEALNUM3, and DEALNUM4, which indicate plants that are transferred in the second, third, or fourth or higher acquisitions by a firm. Panel A shows that the coefficients on the repeat deal variables for the closure decision are not significant. Thus, one average repeat acquirers do not retain more of the target's assets. Target assets acquired in third or later deals are *more* likely to be sold off. The marginal effects associated with sell-off are economically significant: a plant acquired in the third or fourth deal of an acquisition program is 10% more likely to be sold off.

The performance results are reported in Panel B. Once again, to conserve space, we just report the coefficients estimates related to repeat acquirers and suppress the other results, which are similar to the results in Tables 8 and 9. The results indicate that when repeat acquirers buy target plants, the target plant performance for kept plants is relatively flat in the second deal, worse in two out of the four specifications for the third deal with significance of between 5% and 10%, but improves significantly in the fourth deal and beyond in all specifications at 5% to 1% significance. Sold plants in later deals tend to show positive performance improvements in most specifications as indicated by positive significant coefficients for DEALNUM3 and DEALNUM4.

Overall, the productivity of the kept assets improves and that of the sold assets remains flat for the chosen decision relative to the counterfactual outcome, as in Tables 8 and 9. From an economic standpoint, there is little evidence that serial acquisitions result in destructive allocation of real resources, contrary to the predictions of Hypothesis 8b.

6.4 Acquirer's Existing Assets

While the previous tests deal with the disposition of *target* plants after an acquisition, a related question is how acquirers dispose of their own assets in the short period after a merger. We present some evidence on this issue. We test whether acquirers treat their existing plants symmetrically with their newly acquired plants or whether they have different propensities to dispose of their own plants. Our tests control for the other characteristics that drive plant disposal decisions.

We combine all the target and acquirer plants in one specification. We then estimate one specification with all common variables for acquirers and target and add an acquirer plant indicator variable that we interact all common independent variables. Specifically, we estimate a specification similar to the one we estimate for targets in Table 5 for all plants incorporating acquirer interaction variables. In the interest of space we just discuss these results here and do not report them.

In the (unreported) multinomial logit model for plant disposal, we find that the acquirer plant indicator variable is insignificant as are most of its interactions with the right-hand-side explanatory variables. Thus, most of the differences between the sell off and closure decisions of acquirer and target plants can be explained by differences in plant and firm characteristics. The notable exceptions include negative signs on acquirer skill variable and the industry operating margin both interacted with the acquirer plant indicator variable. The negative signs indicate that skilled acquirers and acquirers in industries with high margins are less likely to sell off their plants than they are to sell plants those of the target. Acquirer skill continues to matter in asset retention decisions.

We also examine the post-merger change in performances of acquirer's plants existing plants. Theory does not make strong predictions about the productivity of such plants. The increase in the scope of the firm might decrease the productivity of existing plants. On the other hand, the restructuring (sales and closures of inefficient plants) following the merger might improve the match between the remaining plants and the firm's core ability, leading to increases in productivity.

Insert Tables 10A and 10B here

Table 10A presents the results for the post-acquisition performance for plants owned by the acquirer prior to the acquisition. As in Table 6 for target plants transferred in the acquisition, the upper panel reports results for kept plants and the lower panel reports data for sold plants. In each panel, we report results for the full sample and for the sub-sample of acquirers for which the book-to-market ratio is available. As before, we employ two measures of performance: the total factor productivity (TFP), which is reported in the first row of each panel, and the adjusted operating margin, which is reported in the second row of a panel. These tables report the TFP or margin level as of year -1 and the changes in these measures between year -1 and years +1, +2, and +3.

The unconditional averages show that kept plants exhibit strong performing prior to acquisition and these plants continue their strong performance after the merger. For instance, the average change in TFP for kept plants over the three year window is 6.9% while the average change in margin is about 1% and both are significant at the 1% level. The evidence on the performance of sold plants shows a mixed pattern, with some evidence of positive and negative changes depending on the horizon and measure of productive efficiency. The subsample of sold plants where acquirer BE/ME is available shows a notable decline in operating margins across all horizons. The more significant and robust finding from the table is, however, the asymmetry between kept and sold plants. Kept plants tend to improve far more than sold plants,

regardless of whether the plant was owned by the acquirer before acquisition or whether the plant was obtained in the acquisition. The results partially explain the decline in acquirer's plants that was found by Schoar (2002), who analyzes the post-merger changes of all acquirer plants regardless of whether the plants are kept or sold. If one looks just at the retained plants, there is no evidence to support the proposition that the acquirer's plants that are kept decrease in either productivity or operating performance.

In Table 11, we analyze the cross-sectional variation in performance changes for acquiring firms' existing plants as we did in Tables 7 and 8 for plants purchased from the target. We regress the changes in productivity and operating performance on acquiring firm skill and size variables from the year before the acquisition. As in the analysis for target plants, we also control for selection effects using the methods described in Section 6.2.

Insert Table 11 here

Panel A of Table 11 presents the results for the acquiring firms existing plants that are kept after the merger. This panel shows that acquiring firms with high ex ante margins and those acquirers that have high skill are more likely to keep plants. In the last row we also show that the performance of these kept plants less the performance had they chosen the counterfactual alternative of selling the plant. The gain relative to the counterfactual is positive. This result is consistent with the acquiring firm making an optimal decision. Panel B of this table shows the results for existing plants sold by the acquirer. In these cases, the acquiring firm variables are generally insignificant. We still find evidence consistent with the acquiring firm making optimal decisions for its existing plants that it sells. The the performance of these sold plants is higher then in the counterfactual case in which these plants would have been kept.

Overall, the evidence is consistent with the view that acquirers keep the portions of the target as well as the portions of their existing plants that they can improve operationally but tend to shed the assets in which they have no comparative advantage in running. The evidence seems less consistent with empire building and lines up better with the theories of firm growth that emphasize skill and comparative advantage.

7 Conclusions

We analyze the disposition and efficiency changes of firm plants involved in takeovers of manufacturing firms in the US between 1981 and 2000. We find that extensive post-merger restructuring takes place. Only just over one half of the acquired plants are retained by the acquirer for at least three years. Slightly more than a quarter of the acquired plants are sold within this interval, and the remainder are closed down. Plants in related transactions and plants that are in the target's main division are less likely to be sold whereas plants that are in the target's peripheral divisions or are unrelated are significantly more likely to be sold. The probability of a plant sale is also higher if market values have increased in the plant's industry.

Examining the existing plants of the acquirer, we find that they close and sell fewer of their own plants than of the target's plants. However these differences are driven by fundamental acquirer and plant level characteristics. Controlling for these characteristics, acquiring firms overall sell and close similar amounts of their own plants as they do of plants they purchase.

Overall, the plants that are retained by the acquirers (both their own plants and the plants they purchase) increase in productivity when benchmarked against industry plants, whereas the plants that are sold do not. In addition, there is little evidence that repeat acquirers disposition decisions are less efficient. If anything, repeat acquirers sell a larger proportion of acquired plants. Moreover, the gain in retained target plants' productivity is particularly high for acquirers who do the largest number of deals.

These outcomes are not consistent with the notion that pure empire building by managers explains the disposition of assets and the operating decisions following mergers. The outcomes are more consistent with neoclassical comparative advantage view of firm growth in Lucas (1978) and Maksimovic and Phillips (2002). In particular, the skill of the acquirer at the margin is an important predictor of post-merger restructuring. Acquirers with low skill in marginal businesses are more likely to sell. The average productivity of the acquirer's plants does not predict disposal decisions. In addition, acquirers are more likely to retain a plant if they are efficient in the industry and the industry has experienced a positive shock. These effects are economically significant. A further implication of the managerial scope based theory of the firm is that skill in operating peripheral divisions should matter more for the selloff decision than the closure decision. We find support for this hypothesis. The acquirer's peripheral skill variable is not significant in explaining the closure decision, which is largely driven by the profitability of the unit being considered for closure.

Our findings have broader implications. Given the magnitude of post-merger restructuring reported here, mergers should not be viewed as a stopping point in defining a firm's boundaries. Rather, each merger should be viewed as an initial step that sets in motion a vigorous restructuring process that resets the boundaries of the acquiring firm. Moreover, the resetting of boundaries appears to follow economically sensible principles. Firms tend to retain plants in which they have a comparative advantage and improve their productivity but they tend to sell or close other plants. Thus, even if the initial decision to acquire a target involves overpayment, empire building or simple hubris, our results indicate that economic rationality asserts itself soon afterwards. Acquirers find it advantageous to enter into post-merger restructuring and deals with other firms that result, on average, in an improved allocation of resources following mergers.

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Figure 1

Productivity of the acquirer's marginal plant and the number of retained and sold plants

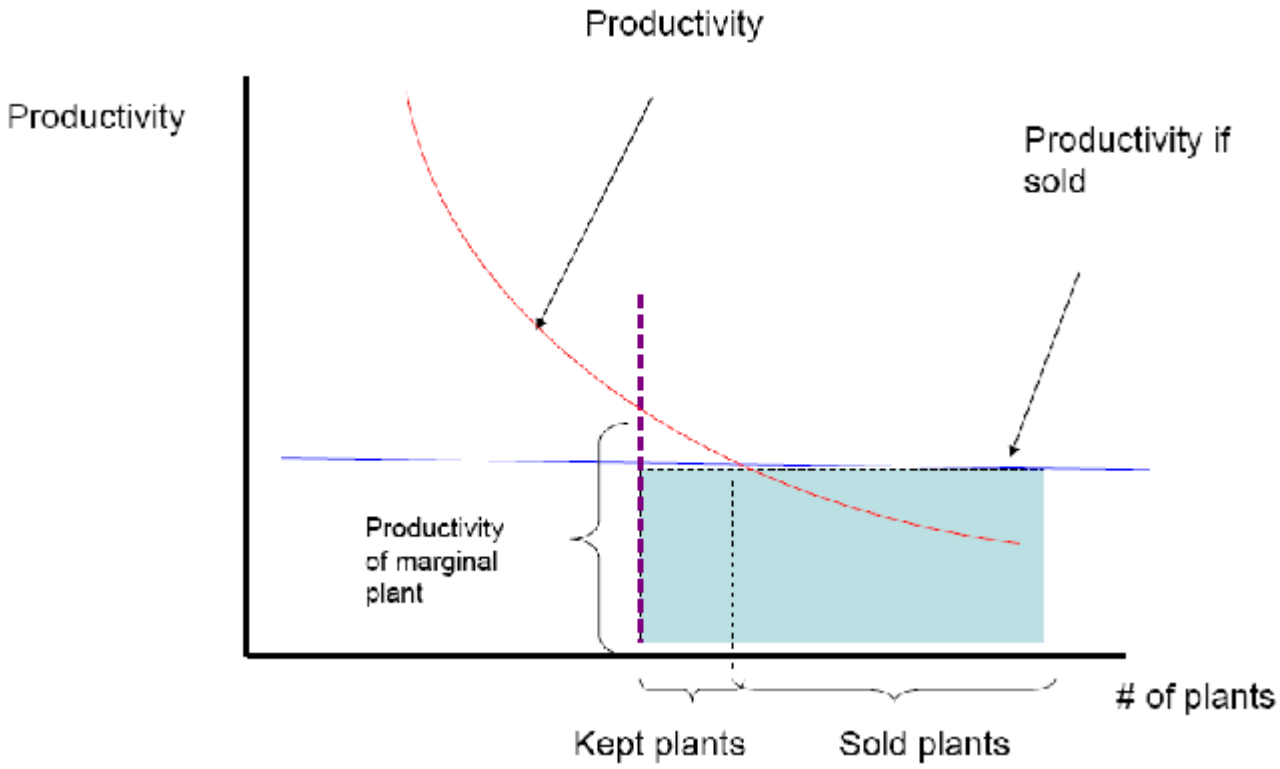

Figure 2
The effect of a positive shock on the productive acquirer

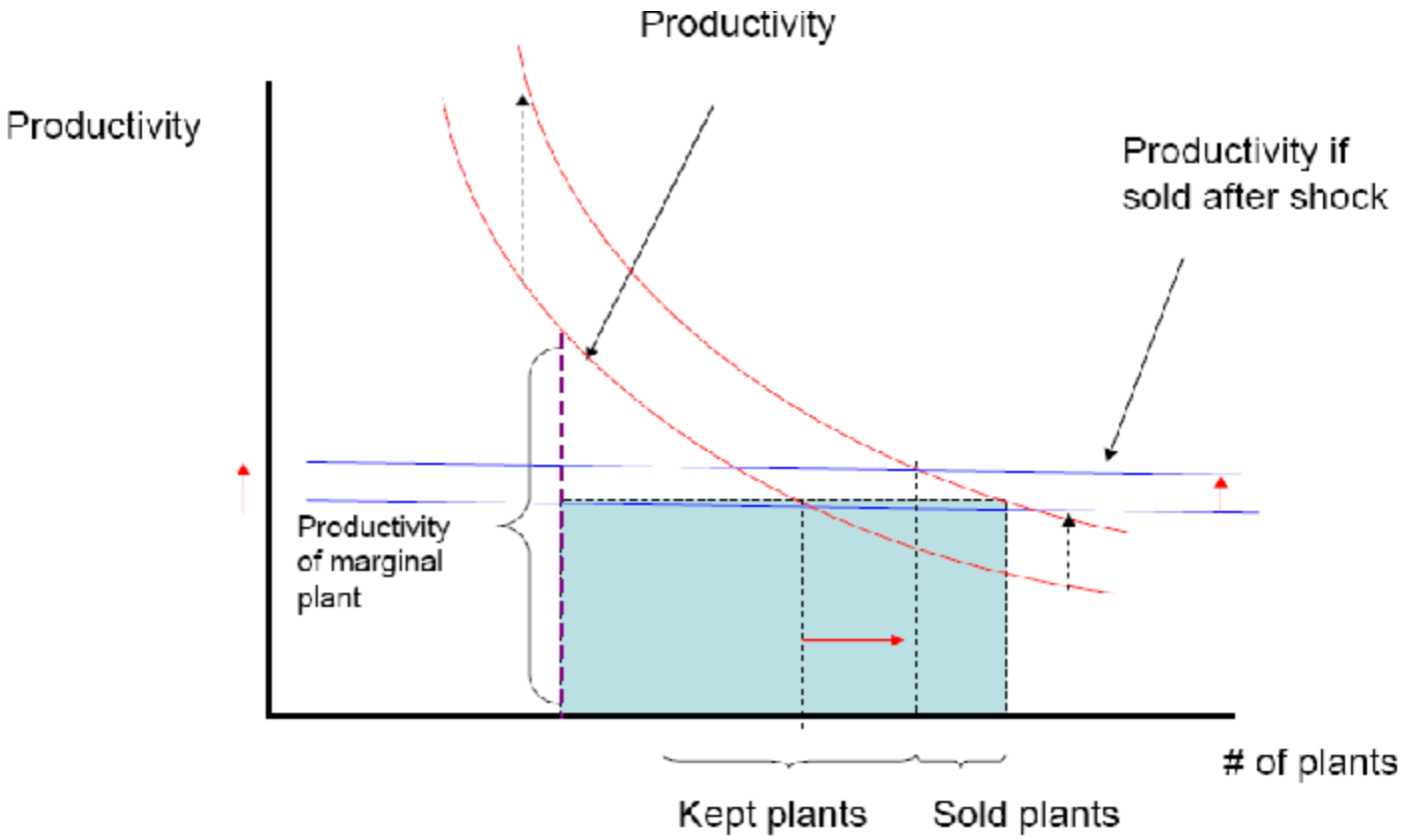

Figure 3
The effect of a positive shock on a less productive acquirer

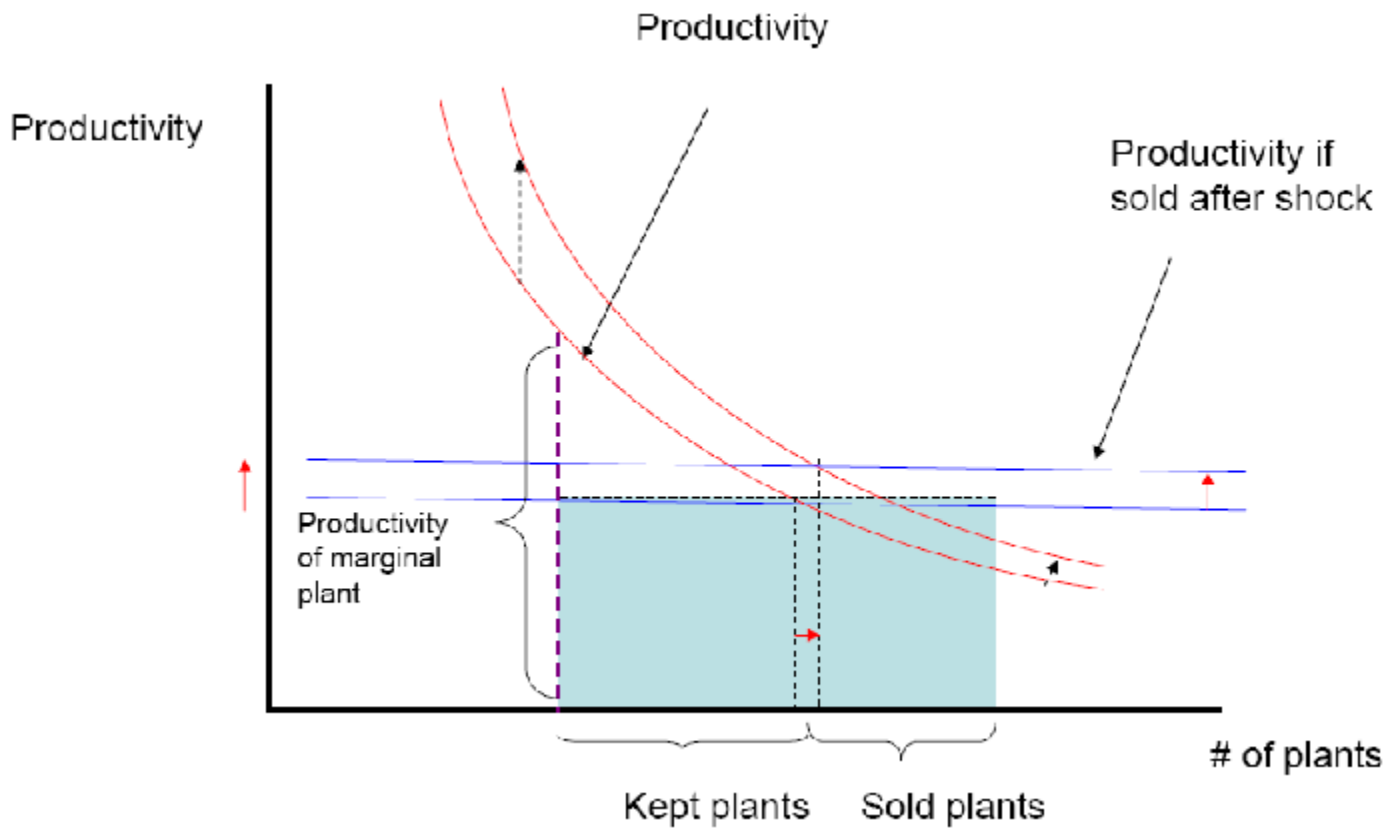

Table 1
Number of deals

Year	# Deals SDC/Compustat in Manufacturing	Total # Deals Matched to LRD
1981	33	18
1982	59	46
1983	48	41
1984	70	58
1985	74	66
1986	125	104
1987	95	77
1988	154	115
1989	115	102
1990	62	59
1991	54	33
1992	44	28
1993	54	51
1994	79	48
1995	120	66
1996	115	93
1997	158	105
1998	186	113
1999	208	139
2000	177	121
Total	2,030	1,483

Table 1 describes the number of merger transactions in our study. We obtain from the SDC M&A database a sample of acquisitions in which the announcement date is between 1981 and 2000, the completion date is within 180 days of the announcement, and the acquisition target is a domestic U.S. firm with at least one reported 4-digit SIC code from either SDC or COMPUSTAT between 2000 and 3999. Column 2 reports the number of transactions in the SDC Platinum that meet all criteria and match to Compustat. Column 3 reports the number of these transactions that were able to be matched to the Longitudinal Research Database maintained at the U.S. Department of Commerce. It includes 180 transactions that were coded as outside manufacturing by SDC and Compustat but were also found to have manufacturing assets.

Table 2

Target and acquirer characteristics: Target data market value available

	BE/ME Decile	*ME decile*	*Adjusted Margin (%)*		*Deflated Shipments*	
Year	Target	Target	Acquirer	Target	Acquirer	Target
1981	5.61 (5)	3.89 (2.5)	1.28	0.87	254,814	152,447
1982	5.07 (4)	3.60 (3)	2.46	1.02	178,348	76,465
1983	4.65 (4)	2.5 (1)	3.62	0.57	81,614	42,277
1984	4.98 (5)	2.72 (1)	0.22	2.57	326,670	114,538
1985	4.69 (4)	3.32 (2)	1.69	0.83	237,487	154,729
1986	4.58 (4)	3.18 (2)	2.38	2.22	170,048	95,584
1987	4.85(4)	2.73 (2)	3.21	0.98	293,416	85,519
1988	5.08 (5)	2.63 (2)	5.64	4.36	195,577	119,498
1989	4.38 (4)	3.05 (2)	2.93	-0.48	135,143	65,729
1990	5.18 (4)	3.02 (2)	0.69	7.80	418,129	163,169
1991	5.84 (6)	2.94 (1.5)	0.92	-2.38	422,266	155,766
1992	3.75 (3)	2.93 (2)	1.57	1.57	430,009	55,630
1993	5.09 (4)	2.50 (2)	7.65	0.29	511,955	91,724
1994	4.72 (3)	2.94 (2)	5.63	3.65	377,213	94,126
1995	4.42 (4)	3.02 (2)	4.64	1.40	160,551	64,866
1996	4.76 (4)	2.65 (1)	3.72	2.96	322,041	111,002
1997	4.88 (4)	2.90 (2)	5.17	3.72	524,207	152,392
1998	5.39 (5)	3.06 (2)	3.82	3.07	1,225,467	154,534
1999	5.12 (5)	3.58 (3)	4.65	4.04	2,718,597	146,281
2000	4.73 (4)	3.49 (3)	4.91	3.58	1,455,530	107,710

Table 2 reports the mean and median (in parentheses) of selected characteristics of acquirers and targets. The sample consists of mergers from the SDC Platinum database in which the announcement date is between 1981 and 2000, the completion date is within 180 days of the announcement, the acquisition target is a domestic U.S. firm with at least one reported 4-digit SIC code between 2000 and 3999, and the target has matching input/output data in the Longitudinal Research Database maintained at the U.S. Department of Commerce. The sample comprises firms for which the market value of the target is available. BE/ME decile and ME decile denote the book-to-market and NYSE market capitalization deciles to which the target belongs based on year $t-1$ values. The adjusted margin is the actual operating margin of a target plant minus the median margin for all plants that have the same 3-digit SIC code. The deflated shipments equals the value of shipments for a plant reported in the ASM adjusted for inflation using the SIC deflator from the Bartelsman and Gray (1994) database.

Table 3: Disposition of target and acquirer plants

# Plants in deal	# Total Bought	% Kept Target	% Closed Target	% Closed Matched Industry	% Sold Target (Partial)	% Sold Target (Total)	% Sold Matched Industry	% Sold Acquirer (Total)	% Closed Acquirer
				Full sample					
1-5	1,954	56.59%	16.15%	2.40%	9.29%	27.20%	7.19%	14.17%	3.13%
6-10	1,193	53.76%	21.38%	4.23%	13.67%	24.86%	10.8%	12.51%	3.88%
11-25	2,316	54.69%	19.96%	4.57%	17.79%	25.35%	12.62%	14.12%	5.25%
26-50	3,337	56.57%	16.98%	5.19%	22.07%	26.45%	14.01%	18.49%	5.02%
≥ 51	4,093	51.76%	19.44%	5.18%	26.07%	28.80%	10.96%	16.08%	5.08%
Total	12,893	54.42%	18.58%	3.29%	19.99%	27.00%	8.98%	14.69%	4.02%
				Transactions in 1980s					
1-5	766	54.35%	20.35%	2.77%	9.64%	25.30%	8.82%	14.72%	2.60%
6-10	535	54.53%	25.24%	4.80%	13.10%	20.23%	12.6%	11.29%	3.07%
11-25	1,035	48.08%	24.24%	5.29%	22.86%	27.69%	14.41%	15.21%	5.73%
26-50	1,877	53.25%	16.85%	5.41%	22.33%	29.80%	16.65%	19.15%	5.36%
≥ 51	2,497	46.99%	17.89%	5.49%	30.71%	35.13%	12.82%	20.33%	5.40%
Total	6,710	50.33%	19.42%	3.71%	23.40%	30.25%	10.81%	15.57%	3.88%
				Transactions in 1990s					
1-5	1,188	58.15%	13.23%	2.07%	9.04%	25.61%	5.77%	13.76%	3.53%
6-10	658	53.06%	17.86%	3.71%	14.19%	29.08%	9.18%	13.67%	4.66%
11-25	1,281	60.30%	16.33%	3.90%	13.48%	23.36%	10.99%	13.14%	4.82%
26-50	1,460	61.12%	17.16%	4.99%	21.72%	21.72%	11.53%	17.82%	4.68%
≥ 51	1,596	59.48%	21.95%	4.92%	18.57%	18.57%	8.91%	12.36%	4.81%
Total	6,183	59.15%	17.61%	2.89%	16.04%	23.24%	7.33%	13.95%	4.14%
				Relatedness					
Related	4,080	54.78%	17.72%		14.12%	22.53%			
Unrelated	8,813	51.02%	17.87%		21.51%	27.46%			

This table reports the year +3 ownership status of plants, where the merger is completed in year 0. Kept plants are still owned by the acquirer, sold plants are owned by a firm other than the acquirer, and closed plants are plants that shut down as of year +3. In each period, we classify the deals by the number of target plants acquired for target disposition and by the number of acquirer plants for acquirer disposition. 1980s transactions have a completion date between 1981 and 1989 and 1990s transactions form the complementary set. Industry benchmarks for asset sales and closures are from industries that experience a merger transaction in the same 3 digit SIC code and year. A target plant is related if it belongs to the same 3-digit SIC code as a main division of the the acquirer.

Table 4
Multinomial logit models for disposition of target plants

Independent Variable	*Dependent Variable: Decision to sell plant*				
RELATED	-0.53(-8.18)[a]	-0.80(-8.73)[a]	-0.81(-8.67)[a]	-0.75(-7.93)[a]	-0.73(-7.63)[a]
TMAIN	-1.14(-19.79)[a]	-0.91(-13.59)[a]	-0.91(-13.69)[a]	-0.95(-14.02)[a]	-0.95(-13.94)[a]
TBEME	0.15(3.42)[a]	0.09(1.77)[c]	0.08(1.62)	0.10(2.03)[b]	0.09(1.81)[c]
TMARG	-0.67(-6.00)[a]	-0.76(-6.42)[a]	-0.75(-6.22)[a]	-0.78(-6.36)[a]	-0.78(-6.4)[a]
AMARG			-0.07(-0.24)	-0.31(-0.98)	-0.31(-1.00)
INDRET				0.19(2.37)[b]	0.20(2.54)[b]
ASKILL			-0.94(-2.47)[b]	-1.00(-2.59)[b]	- 0.093 (-0.19)
ASKILL* INDRET					-3.22(-3.05)[a]
IND R&D				3.69(2.83)[a]	3.53(2.7)[a]
SD (INDMARG)				-0.55(-0.56)	-. 563 (-0.57)
INDMARG				1.01(3.23)[a]	0.99(3.18)[a]
TRELSIZE		0.08(1. 54)	0.08(1.52)	0.06(1.24)	0.06(1.26)
LN (AOUTPUT)		0.06(2.45)[b]	0.05(2.37)[b]	0.05(2.16)[b]	0.05(2.18)[b]
ANUMPLANT		0.00(0.66)	0.00(0.67)	0.00(0.8)	0.00(0.73)
1980s		0.28(4.54)[a]	0.27(4.45)[a]	0.32(5.07)[a]	0.32(4.98)[a]
Constant	-0.17(-2.68)[a]	-0.86(-2.79)[a]	-0.82(-2.63)[a]	-1.06(-2.91)[a]	-1.07(-2.93)[a]
Dependent Variable: Decision to close plant					
RELATED	-0.32(-4.63)[a]	-0.43(-4.24)[a]	-0.43(-4.18)[a]	-0.35(-3.33)[a]	-0.35(-3.36)[a]
TMAIN	-0.37(-6.58)[a]	-0.46(-6.72)[a]	-0.46(-6.77)[a]	-0.49(-7.01)[a]	-0.49(-7.02)[a]
TBEME	0.13(2.79)[a]	-0.01(-0.22)	-0.01(-0.22)	0.05(0.86)	0.04(0.85)
TMARG	-0.69(-5.92)[a]	-0.77(-6.27)[a]	-0.79(-6.17)[a]	-0.75(-5.87)[a]	-0.75(-5.86)[a]
AMARG			0.12(0.39)	-0.14(-0.46)	-0.15(-0.49)
INDRET				0.06(0.67)	0.06 (0.7)
ASKILL			-0.45(-1.17)	-0.54(-1.4)	-0.64(-1.42)
ASKILL* INDRET					0.19 (0.19)
IND R&D				4.86(3.72)[a]	4.88(3.73)[a]
SD (INDMARG)				2.55(2.4)[b]	2.55(2.4)[b]
INDMARG				1.10(3.37)[a]	1.09(3.33)[a]
TRELSIZE		-0.12(-2.36)[b]	-0.12(-2.38)[b]	-0.12(-2.33)[b]	-0.12(-2.3)[b]
LN (AOUTPUT)		-0.14(-5.69)[a]	-0.14(-5.76)[a]	-0.13(-5.42)[a]	-0.13(-5.4)[a]
ANUMPLANT		0.00(0.66)	0.00(0.72)	0.00(1.23)	0.00(1.22)
1980s		0.35(5.39)[a]	0.34(5.36)[a]	0.43(6.44)[a]	0.43(6.45)[a]
Constant	-0.76 (-10.74)[a]	1.21 (3.82)[a]	1.23 (3.88)[a]	0.16 (0.42)	0.17 (0.45)
N	8,164	8,164	8,164	8,026	8,026
Pseudo-R^2	0.033	0.04	0.04	0.045	0.046

[a] = *significant at 1%,* [b] = *significant at 5%,* [c] = *significant at 10%*

Table 4 reports estimates of multinomial logit models with different sets of explanatory variables. The unit of observation is a plant acquired in a merger. We report estimates for the decision to sell (Panel A)

or close (Panel A) a plant relative to the baseline decision to keep a plant by year +3 where the acquisition is completed in year 0. RELATED is 1 if a target's main business overlaps with an acquirer main division and zero otherwise. TMAIN equals 1 if the plant's output is at least 25% of the aggregate output of all plants owned by the target and zero otherwise. TBEME is the target's book-to-market ratio decile. AMARG and TMARG denote the acquirer and target's operating margins minus the median margin of all plants in the 3-digit SIC, respectively. ASKILL denotes the average 3-digit SIC industry-adjusted margin of all the plants owned by the acquirer outside its main divisions. IND R&D denotes the aggregate R & D expenditure by all firms in the 3-digit SIC code to which the plant belongs. INDRET is the $(t, t + 2)$ buy-and-hold return for the Fama-French 48-industry group to which the plant belongs. INDMARG and SD(INDMARG) denote the median operating margin and the standard deviation of the operating margin of all plants in the same 3-digit SIC code as the plant. TRELSIZE denotes the aggregate deflated output of all the plants owned by the target to the aggregate output of the acquirer. LN(AOUTPUT) denotes the natural logarithm of the aggregate deflated output of all plants owned by the acquirer. 1980s is 1 if the merger was completed between 1981 and 1989 and zero otherwise.

Table 5
Multinomial logit models for disposition of target plants: Marginal Effects

Independent Variable	*Marginal Effect on Sell Decision*				
RELATED	-0.08(-6.80)^a	-0.13(-7.22)^a	-0.13(-7.17)^a	-0.13(-6.74)^a	-0.12(-6.46)^a
TMAIN	-0.17(-20.29)^a	-0.13(-13.03)^a	-0.13(-13.13)^a	-0.14(-13.46)^a	-0.14(-13.37)^a
TBEME	0.02(2.87)^a	0.01(1.91)^c	0.01(1.75)^c	0.02(1.9)^c	0.01(1.67)^c
TMARG	-0.08(-4.71)^a	-0.10(-5.08)^a	-0.09(-4.89)^a	-0.10(-5.17)^a	-0.10(-5.21)^a
AMARG			-0.02(-0.34)	-0.05(-0.91)	-0.05(-0.93)
ASKILL			-0.14(-2.3)^b	-0.15(-2.36)^b	0.01(0.12)
INDRET				0.03(2.3)^b	0.03(2.47)^b
ASKILL* INDRET					-0.55(-3.21)^a
IND R&D				0.43(2.05)^b	0.40(1.92)^c
SD (INDMARG)				-0.19(-1.21)	-0.20(-1.22)
INDMARG				0.13(2.51)^b	0.12(2.46)^b
TRELSIZE		0.02(2.19)^b	0.02(2.17)^b	0.02(1.85)^c	0.02(1.88)^c
LN (AOUTPUT)		0.01(4)^a	0.01(3.93)^a	0.01(3.61)^a	0.01(3.63)^a
ANUMPLANT		0.00(0.5)	0.00(0.5)	0.00(0.5)	0.00(0.44)
1980s		0.03(3.34)^a	0.03(3.25)^a	0.04(3.65)^a	0.04(3.55)^a
Independent variable	*Marginal Effect on Close Decision*				
RELATED	-0.03(-2.45)^b	-0.03(-1.68)^c	-0.03(-1.62)	-0.02(-1.04)	-0.02(-1.17)
TMAIN	-0.01(-3.41)^a	-0.03(-3.46)^a	-0.03(-3.48)^a	-0.04(-3.69)^a	-0.04(-3.73)^a
TBEME	0.01(2.00)^b	-0.01(-0.67)	0.00(-0.64)	0.00(0.38)	0.00(0.42)
TMARG	-0.08(-4.61)^a	-0.09(-4.88)^a	-0.09(-4.85)^a	-0.08(-4.5)^a	-0.08(-4.48)^a
AMARG			0.02(0.47)	-0.01(-0.2)	-0.01(-0.22)
ASKILL			-0.03(-0.54)	-0.04(-0.76)	-0.09(-1.4)
INDRET				0.00(0.08)	0.00(0.07)
ASKILL* INDRET					0.16(1.11)
IND R&D				0.59(3.14)^a	0.60(3.18)^a
SD (INDMARG)				0.41(2.65)^a	0.41(2.65)^a
INDMARG				0.13(2.68)^a	0.13(2.66)^a
TRELSIZE		-0.02(-2.89)^a	-0.02(-2.91)^a	-0.20(-2.78)^a	-0.02(-2.8)^a
LN (AOUTPUT)		-0.02(-6.57)^a	-0.02(-6.61)^a	-0.02(-6.21)^a	-0.02(-6.23)^a
ANUMPLANT		0.00(0.52)	0.00(0.58)	0.00(1.08)	0.00(1.09)
1980s		0.04(4.47)^a	0.04(4.45)^a	0.05(5.45)^a	0.05(5.48)^a

Table 5 (continued)

Multinomial logit models for disposition: Marginal Effects

Independent Variable	*Marginal Effect on Keep Decision*				
RELATED	0.11 (7.90)[a]	0.16(8.02)[a]	0.16(7.96)[a]	0.14(7)[a]	0.14(6.81)[a]
TMAIN	0.18(17.82)[a]	0.16(13.48)[a]	0.17(13.58)[a]	0.17(13.99)[a]	0.17(13.94)[a]
TBEME	-0.03(-3.83)[a]	-0.01(-1.00)	-0.01(-0.90)	-0.18(-1.83)[a]	-0.02(-1.67)[c]
TMARG	0.16(7.41)[a]	0.18(7.87)[a]	0.18(7.66)[a]	0.18(7.56)[a]	0.18(7.57)[a]
AMARG			0.00(-0.07)	0.05(0.93)	0.06(0.95)
ASKILL			0.17(2.3)[b]	0.19(2.52)[b]	0.08(0.92)
INDRET				-0.03(-1.94)[c]	-0.03(-2.07)[b]
ASKILL* INDRET					0.39(2.02)[b]
IND R&D				-1.02(-3.98)[a]	-1.00(-3.91)[a]
SD (INDMARG)				-0.21(-1.07)	-0.21(-1.07)
INDMARG				-0.25(-4.09)[a]	-0.25(-4.03)[a]
TRELSIZE		0.00(0.34)	0.00(0.37)	0.00(0.49)	0.00(0.49)
LN (AOUTPUT)		0.01(1.82)[c]	0.01(1.92)[c]	0.01(1.8)[c]	0.01(1.8)[c]
ANUMPLANT		0.00(-0.82)	0.00(-0.86)	0.00(-1.25)	0.00(-1.2)
1980s		-0.07(-6.28)[a]	-0.07(-6.2)[a]	-0.09(-7.26)[a]	-0.09(-7.2)[a]

[a] = *significant at 1%,* [b] = *significant at 5%,* [c] = *significant at 10%*

Table 5 reports the marginal effects associated with the multinomial logit estimates reported in Table 4. The unit of observation is a plant acquired in a merger. We report estimates for the decision to sell (Panel A) or close (Panel A) a plant relative to the baseline decision to keep a plant before year +3 where the merger is completed in year 0. RELATED is 1 if a target's main business overlaps with an acquirer division and zero otherwise. TMAIN equals 1 if the plant's output is at least 25% of the aggregate output of all plants owned by the target and zero otherwise. TBEME is the target's book-to-market ratio decile. TMARG denotes the target's operating margin minus the median margin of all plants in its 3-digit SIC. AMARG denotes a similar margin averaged across all plants of the acquirer. ASKILL denotes the average 3-digit SIC industry-adjusted margin of all the plants owned by the acquirer outside its main divisions. IND R&D denotes the aggregate R & D expenditure by all firms in the 3-digit SIC code to which the plant belongs. INDRET is the $(t,\ t+2)$ buy-and-hold return for the Fama-French 48-industry group to which the plant belongs. INDMARG and SD(INDMARG) denote the median operating margin and the standard deviation of the operating margin of all plants in the same 3-digit SIC code as the plant. TRELSIZE denotes the aggregate deflated output of all the plants owned by the target divided by the aggregate output of the acquirer. LN(AOUTPUT) denotes the natural logarithm of the aggregate deflated output of all plants owned by the acquirer. 1980s is 1 if the merger was completed between 1981 and 1989 and zero otherwise.

Table 6
Changes in Performance After Acquisition

Kept Plants

	Full Sample				*Sample With Acquirer BE/ME*			
Statistic	π_{-1}	$\Delta\pi_{-1,+1}$	$\Delta\pi_{-1,+2}$	$\Delta\pi_{-1,+3}$	π_{-1}	$\Delta\pi_{-1,+1}$	$\Delta\pi_{-1,+2}$	$\Delta\pi_{-1,+3}$
$\pi = TFP$	0.201 (19.70)^a	0.063 (7.56)^a	0.081(8.91)^a	0.063 (6.61)^a	0.21 (17.64)^a	0.057 (5.76)^a	0.094 (8.87)^a	0.064 (5.31)^a
	6,348	6,346	6,346	6,346	4,452	4,452	4,452	4,452
$\pi = Margin$	0.032 (12.22)^a	0.011 (5.34)^a	0.011 (5.10)^a	0.021 (9.24)^a	0.036 (11.42)^a	0.017 (6.75)^a	0.012 (4.55)^a	0.022 (7.94)^a
	6,409	6,409	6,409	6,409	4,452	4,452	4,452	4,452

Sold Plants

	Full Sample				*Sample With Acquirer BE/ME*			
$\pi = TFP$	0.047 (3.28)^a	0.013 (1.05)	0.022 (1.60)	0.027 (1.87)^c	0.055 (2.85)^a	0.006 (0.34)	0.016 (0.87)	0.027 (1.45)
	2,871	2,871	2,871	2,871	1,530	1,530	1,530	1,530
$\pi = Margin$	0.002 (0.63)	-0.001 (-0.37)	0.003 (0.75)	0.007 (1.95)^c	-0.007 (-1.38)	0.002 (0.49)	-0.003 (-0.57)	-0.003 (-0.54)
	2,905	2,905	2,905	2,905	1,530	1,530	1,530	1,530

t-statistics from test of significance of the average from zero in parentheses
^{a} = significant at 1%, ^{b} = significant at 5%, ^{c} = significant at 10%

Table 6 reports the average total factor productivity (TFP) and operating margin in year −1 and the changes in TFP between year −1 and years +1, +2, and +3 for target plants acquired in mergers between 1981 and 2000 where the merger is completed in year 0. Acquired plants are classified as kept if the acquirer retains ownership of plants as of year +3 and as sold if he plant was operating but not owned by the acquirer as of year +3. We report statistics for two efficiency measures π: (1) Operating margin, which is ratio of the operating income before depreciation to the total plant shipments minus the industry median margin; (2) TFP, which is a plant's log output minus the predicted output based on a long-linear production function with squared and cross-product terms estimated for all plants in the industry. The sample consists of mergers from the SDC M&A database announced between 1981 and 2000 and completed within 180 days of announcement, in which the target is a domestic U.S. firm with at least one reported 4-digit SIC code between 2000 and 3999 and has matching input/output data in the Longitudinal Research Database maintained at the U.S. Department of Commerce. We report two sets of estimates, one for all target plants and one for all target plants for which the acquirer's book-to-market ratio is available in COMPUSTAT.

Table 7
Explaining changes in profitability after acquisition: target kept plants

	TFP		Operating Margin	
TMARG	-0.047 (-0.79)	-0.185 (-2.32)^b	-0.466 (34.12)^a	-0.503 (26.93)^a
AMARG	0.531 (4.63)^a	0.715 (4.34)^a	0.217 (8.19)^a	0.271 (6.95)^a
ASKILL	0.473 (3.37)^a	0.444 (2.95)^a	0.108 (3.32)^a	0.091 (2.53)^b
TRELSIZE	-0.010 (-1.14)	-0.043 (-3.41)^a	0.001 (0.30)	-0.004 (-1.49)
TBEME	-0.041 (-1.98)^b	-0.052 (-1.40)	-0.003 (-0.57)	0.004 (0.44)
1980s	-0.032 (-1.29)	-0.054 (-1.51)	-0.012 (-1.97)^b	-0.005 (-0.63)
ABEME		-0.074 (-1.46)		-0.045 (-3.67)^a
DIAGONAL		-0.131 (-4.08)^a		-0.013 (-1.67)^c
λ	-0.119 (-1.64)^c	-0.165 (-1.72)^c	-0.049 (-2.86)^a	-0.028 (-1.21)
CONSTANT	-0.011 (-0.27)	-0.031 (-0.45)	0.004 (0.43)	0.015 (0.93)
N	4,239	2,356	4,452	2,475
F-statistic	7.67 (0.00)	9.12 (0.00)	194.91 (0.00)	94.57 (0.00)
π - Counterfactual π	0.048 (17.30)^a	0.027 (7.64)^a	0.033 (11.63)^a	0.03 (8.17)^a

Robust t-statistics in parentheses

^{a} = significant at 1%, ^{b} = significant at 5%, ^{c} = significant at 10%

Table 7 reports regression estimates in which the dependent variable is either the change in the total factor productivity (TFP) or the change in operating margin for a plant between year -1 and year $+3$ where the acquisition completion is year 0. The sample used in Table 7 consists of all acquired plants **kept** by the acquirer at the end of year 3. TMARG denotes the target's operating margin minus the median margin of all plants in the target plant's 3-digit SIC. AMARG denotes a similar margin averaged across all plants of the acquirer, while ASKILL is the same margin averaged over all the plants owned by the acquirer outside its main divisions. TRELSIZE is the ratio of the aggregate deflated output of all the plants owned by the target to the aggregate deflated output of the acquirer. TBEME is the decile to which a target's book-to-market ratio belongs. 1980s is 1 if the merger was completed between 1981 and 1989 and zero otherwise. ABEME is the decile to which the acquirer's book-to-market ratio belongs. DIAGONAL is 1 if the absolute value of the difference between the acquirer and target book-to-market ratio decile is less than 1 and zero otherwise. λ is the inverse Mills ratio from a probit model (estimates not reported to conserve space) in which the dependent variable is 1 if a plant is sold and zero if a plant is kept and the independent variables are as in Table 4. The variable π - Counterfactual π is the average TFP (operating margin) of the plants that were kept, minus the predicted TFP (operating margin) if the plants had been sold off.

Table 8
Explaining changes in performance after acquisition: target sold plants

	π = TFP		π = Operating Margin	
TMARG	-0.319 (-3.10)^a	-0.272 (-1.59)	-0.612 (26.50)^a	-0.586 (15.60)^a
AMARG	-0.059 (-0.28)	0.127 (0.41)	0.004 (0.09)	-0.119 (-1.65)^c
ASKILL	0.276 (1.10)	0.175 (0.59)	0.099 (1.70)^c	0.043 (0.62)
TRELSIZE	-0.030 (-1.78)^c	-0.050 (-1.72)^c	-0.011 (-2.76)^a	-0.014 (-2.11)^b
TBEME	0.003 (0.13)	0.135 (2.01)^b	-0.003 (-0.57)	0.012 (0.76)
1980s	0.002 (0.05)	-0.102 (-1.30)	0.011 (1.09)	-0.015 (-0.57)
ABEME		0.170 (1.45)		-0.003 (-0.20)
DIAGONAL		0.150 (2.22)^b		0.019 (1.05)
λ	-0.002 (-0.02)	-0.084 (-0.73)	0.022 (1.26)	0.004 (0.16)
CONSTANT	-0.084 (-0.68)	-0.291 (-1.41)	-0.056 (-1.94)^b	-0.061 (-1.27)
N	1451	670	1,530	707
F-statistic	2.19 (0.03)	2.12 (0.03)	112.93 (0.00)	33.13 (0.00)
π - Counterfactual π	0.015 (1.72)^c	-0.006 (-1.55)	0.0048 (1.73)^c	-0.012 (-1.55)

Robust t-statistics in parentheses

^{a} = significant at 1%, ^{b} = significant at 5%, ^{c} = significant at 10%

Table 8 reports regression estimates in which the dependent variable is either the change in the total factor productivity (TFP) or the change in operating margin for a plant between year -1 and year $+3$ where the acquisition completion is year 0. The sample used in Table 8 consists of all acquired plants that were **sold off** by the acquirer by the end of year 3. TMARG denotes the target's operating margin minus the median margin of all plants in the target plant's 3-digit SIC. AMARG denotes a similar margin averaged across all plants of the acquirer, while ASKILL is the same margin averaged over all the plants owned by the acquirer outside its main divisions. TRELSIZE is the ratio of the aggregate deflated output of all the plants owned by the target to the aggregate deflated output of the acquirer. TBEME is the decile to which a target's book-to-market ratio belongs. 1980s is 1 if the merger was completed between 1981 and 1989 and zero otherwise. ABEME is the decile to which the acquirer's book-to-market ratio belongs. DIAGONAL is 1 if the absolute value of the difference between the acquirer and target book-to-market ratio decile is less than 1 and zero otherwise. λ is the inverse Mills ratio from a probit model (estimates not reported to conserve space) in which the dependent variable is 1 if a plant is sold and zero if a plant is kept and the independent variables are as in Table 5. The variable π - Counterfactual π is the average TFP (or operating margin) of the plants that were sold, minus the predicted TFP (or operating margin) if the plants had been kept.

Table 9
Repeat Acquirers: Disposition and Performance Changes
Panel A: Logit Estimates: Target Plant Disposition

		Decision to	
Independent Variable	*Sell Plant*	*Close Plant*	*Keep Plant*
	Logit Coefficients		
DEALNUM2	0.07 (0.71)	0.01 (0.83)	
DEALNUM3	0.55 (4.64)^a	0.10 (4.26)^a	
DEALNUM4+	0.55 (4.45)^a	0.11 (4.26)^a	
Control Variables	Yes, Variables from Table 5		
	Marginal Effects		
DEALNUM2	-0.04 (-0.43)	-0.01 (-0.63)	-0.003 (-0.21)
DEALNUM3	0.10 (4.26)^a	-0.02 (-0.90)	-0.08 (-3.28)^a
DEALNUM4	0.10 (4.26)^a	-0.03 (-1.87)^c	-0.07 (-2.83)^a
Pseudo-R^2	4.37%		
N	7,953		

Panel B: Target Plant Performance

Independent Variable	π = TFP		π = Operating Margin	
	Performance of Kept Plants			
DEALNUM2	0.01 (0.23)	0.07 (1.56)	0.01 (1.34)	0.03 (3.02)
DEALNUM3	-0.12 (-2.17)^b	-0.10 (-1.61)^c	-0.02 (-1.35)	-0.02 (-1.56)
DEALNUM4+	0.15 (3.14)^a	0.26 (3.74)^a	0.03 (2.37)^b	0.04 (2.61)^b
Control Variables	Yes, Table 8 specification			
F-statistic	6.83 (0.00)	7.50 (0.00)	112.62 (0.00)	59.74 (0.00)
π - Counterfactual π	0.05(4.43)^a	0.07 (4.49)^a	0.041 (3.53)^a	0.03 (2.29)^b
N	4,246	2,359	4,456	2,475
	Performance of Sold Plants			
DEALNUM2	0.048 (0.77)	-0.05 (-0.53)	-0.003 (-0.23)	-0.01 (-0.45)
DEALNUM3	0.12 (1.63)^c	0.10 (0.99)	0.04 (2.11)	0.05 (1.93)^c
DEALNUM4+	0.19 (2.21)^b	0.27 (1.90)^c	0.03 (1.40)	0.06 (1.93)^c
Control Variables	Yes, Table 9 specification			
F-statistic	2.18 (0.02)	1.95 (0.03)	59.37 (0.00)	21.86 (0.00)
π - Counterfactual π	0.009 (0.77)	0.015 (0.96)	0.009 (0.78)	-0.01 (-0.94)
N	1,451	670	1,530	707

Panel A of Table 9 reports coefficient estimates and marginal effects for a multinomial logit specification that models the decision of the acquirer to sell or close a target plant relative to the baseline decision to keep the target plant. DEAL2, DEAL3, and DEAL4+ are dummy variables that take the value 1 if the acquisition is the second, third, or at least the fourth acquisition completed by an acquirer in our sample, and zero otherwise. The models includes controls used in Table 4. Panel B reports estimates in which the dependent variable is either the change in the total factor productivity (TFP) or the change in operating margin between year -1 and year $+3$, for a plant owned by the acquirer prior to the merger. The variable π - Counterfactual π is the average TFP (operating margin) of the plants for the chosen decision minus the *unobserved* predicted TFP (operating margin) for the unobserved decision. Robust t-statistics are in parentheses. a, b, and c denote significance at the 1%, 5%, and 10% levels.

Table 10A
Changes in Performance of *Acquirer's* Own Plants After Acquisition

Kept Plants

	Full Sample				*Sample With Acquirer BE/ME*			
Statistic	π_{-1}	$\Delta\pi_{-1,+1}$	$\Delta\pi_{-1,+2}$	$\Delta\pi_{-1,+3}$	π_{-1}	$\Delta\pi_{-1,+1}$	$\Delta\pi_{-1,+2}$	$\Delta\pi_{-1,+3}$
$\pi = TFP$	0.17 (21.13)^a	0.07 (8.25)^a	0.078 (15.60)^a	0.069 (11.50)^a	0.17 (21.13)^a	0.07 (10.29)^a	0.08 (9.75)^a	0.069 (8.63)^a
	15,290	15,290	15,290	15,290	9,362	9,362	9,362	9,362
$\pi = Margin$	0.036 (22.44)^a	0.005 (3.13)^a	0.008 (6.15)^a	0.01 (6.67)^a	0.035 (17.50)^a	0.007 (4.12)^a	0.011 (5.79)^a	0.017 (8.63)^a
	15.426	15.426	15.426	15.426	9,398	9,398	9,398	9,398

Sold Plants

	Full Sample				*Sample With Acquirer BE/ME*			
$\pi = TFP$	0.059 (4.47)^a	0.006 (0.46)	0.02 (1.48)	0.036 (2.73)^a	0.07 (3.89)^a	-0.024 (-1.50)	-0.01 (-0.56)	0.035 (1.80)
	2,893	2,893	2,893	2,893	1,601	1,601	1,601	1,601
$\pi = Margin$	0.007 (2.00)^b	-0.008 (-2.85)^a	-0.005 (-1.52)	-0.001 (-0.29)	0.01 (2.85)^a	-0.02 (-4.50)^a	-0.02 (-3.40)^a	-0.008 (-1.70)^c
	3,066	3,066	3,066	3,066	1,676	1,676	1,676	1,676

t-statistics from test of significance of the average from zero in parentheses
^{a} = significant at 1%, ^{b} = significant at 5%, ^{c} = significant at 10%

Table 10A reports the average total factor productivity (TFP) and operating margin in year −1 and the changes in TFP between year −1 and years +1, +2, and +3 for plants owned by firms that make an acquisition and have matching book-to-market data are available in COMPUSTAT. Year 0 denotes the merger completion year. A plant is classified as kept if it remains in the acquirer's possession as of year +3 and sold if it is operating but not under the acquirer's ownership in year +3. We report statistics for two efficiency measures π: (1) Operating margin, which is ratio of the operating income before depreciation to the total plant shipments minus the industry median margin; (2) TFP, which is a plant's log output minus the predicted output based on a long-linear production function with squared and cross-product terms estimated for all plants in the industry. The operating margins and TFP statistics in this table are regression-adjusted for predictable time series changes.

Table 10B
Changes in Performance *Acquirer's* Own Plants After Acquisition

Kept Plants

	Full Sample				*Sample With Acquirer BE/ME*			
Statistic	π_{-1}	$\Delta\pi_{-1,+1}$	$\Delta\pi_{-1,+2}$	$\Delta\pi_{-1,+3}$	π_{-1}	$\Delta\pi_{-1,+1}$	$\Delta\pi_{-1,+2}$	$\Delta\pi_{-1,+3}$
$\pi = TFP$	0.17 (21.13)^a	0.014 (2.33)^a	0.023 (3.29)^a	0.017 (2.43)^a	0.17 (21.13)^a	0.019 (2.38)^a	0.02 (2.63)^a	0.017 (2.13)^a
	15,290	15,290	15,290	15,290	9,362	9,362	9,362	9,362
$\pi = Margin$	0.036 (22.44)^a	0.002 (1.43)	0.004 (2.50)^b	0.002 (1.17)	0.035 (17.50)^a	0 (0.00)	0.002 (0.91)	0.005 (2.27)^b
	15,426	15,426	15,426	15,426	9,398	9,398	9,398	9,398

Sold Plants

	Full Sample				*Sample With Acquirer BE/ME*			
$\pi = TFP$	0.059 (4.47)^a	-0.003 (-0.002)	0.02 (1.32)	0.04 (2.44)^b	0.07 (3.89)^a	-0.035 (-1.97)^b	-0.017 (-0.85)	0.029 (1.38)
	2,893	2,893	2,893	2,893	1,601	1,601	1,601	1,601
$\pi = Margin$	0.007 (2.00)^b	-0.004 (-1.43)	0.00 (0.00)	0.005 (1.47)	0.01 (2.75)^a	-0.014 (-2.92)^a	-0.012 (-2.50)^a	-0.001 (-0.21)
	3,066	3,066	3,066	3,066	1,676	1,676	1,676	1,676

t-statistics from test of significance of the average from zero in parentheses
^{a} = significant at 1%, ^{b} = significant at 5%, ^{c} = significant at 10%

Table 10B reports the average total factor productivity (TFP) and operating margin in year −1 and the changes in TFP between year −1 and years +1, +2, and +3 for plants owned by firms that make an acquisition and have matching book-to-market data are available in COMPUSTAT. Year 0 denotes the merger completion year. A plant is classified as kept if it remains in the acquirer's possession as of year +3 and sold if it is operating but not under the acquirer's ownership in year +3. We report statistics for two efficiency measures π: (1) Operating margin, which is ratio of the operating income before depreciation to the total plant shipments minus the industry median margin; (2) TFP, which is a plant's log output minus the predicted output based on a long-linear production function with squared and cross-product terms estimated for all plants in the industry. The operating margins and TFP statistics in this table are *not* adjusted for predictable time series changes.

Table 11

Explaining changes in profitability of *acquirer's* plants after acquisition

Panel A: Kept Plants

	TFP		Operating Margin	
AMARG	0.16 (4.87)^a	0.09 (2.09)^b	0.02 (3.02)^a	0.00 (0.39)
ASKILL	0.17(2.05)^b	0.12 (1.19)	0.12 (6.34)^a	0.11 (4.55)^a
TRELSIZE	-0.01 (-2.25)^b	-0.01 (-1.56)	0.00 (1.29)	0.00 (1.28)
1980s	0.00 (0.67)	-0.01 (0.59)	0.00 (-1.97)	0.00 (0.31)
DIAGONAL		0.01 (0.70)		0.01(2.02)^b
λ	0.14 (2.01)^b	0.16 (1.78)^c	0.06 (3.50)^a	0.05 (2.49)^a
CONSTANT	0.05(1.41)	0.05 (0.96)	0.04 (4.37)^a	0.04 (3.37)^a
N	12,026	6,578	12,667	6,901
F-statistic	10.64 (0.00)	3.20 (0.00)	15.16 (0.00)	6.48 (0.00)
π - Counterfactual π	0.069^a	0.112^a	0.058^a	0.068^a

Robust t-statistics in parentheses

^{a} = significant at 1%, ^{b} = significant at 5%, ^{c} = significant at 10%

Panel B: Sold Plants

	π = TFP		π = Operating Margin	
AMARG	-0.08 (-1.00)	-0.07 (-0.63)	-0.08 (-4.74)^a	-0.08 (-3.04)^a
ASKILL	-0.14 (-1.05)	-0.02 (-0.11)	-0.02 (-0.49)	0.00 (0.01)
TRELSIZE	-0.01 (-0.58)	-0.06 (-3.05)^a	0.01 (0.18)	-0.01 (-1.46)
1980s	-0.03 (-1.04)	-0.01 (-0.25)	0.00 (0.05)	-0.01 (-0.51)
DIAGONAL		0.07 (1.71)^c		0.01 (0.75)
λ	0.03 (0.41)	0.03 (0.24)	0.04 (1.81)^c	0.03 (0.12)
CONSTANT	-0.01 (-0.07)	-0.26 (-1.57)	-0.04 (-1.57)	-0.08 (-2.02)
N	2,569	1,153	2,700	1,200
F-statistic	0.86 (0.51)	2.52 (0.02)	5.04(0.00)	2.07 (0.01)
π - Counterfactual π	-0.001	-0.027^a	0.003	0.0036

Robust t-statistics in parentheses

^{a} = significant at 1%, ^{b} = significant at 5%, ^{c} = significant at 10%

Table 11 reports regression estimates in which the dependent variable is either the change in the total factor productivity (TFP) or the change in operating margin for a plant already owned by the acquirer between year -1 and year $+3$ where the acquisition completion is year 0. Panel A contains all acquired plants kept by the acquirer at the end of year 3. Panel B contains all acquired plants sold off by the acquirer at the end of year 3. AMARG denotes the acquirer's operating margin minus the median margin of all plants in the target plant's 3-digit SIC. TRELSIZE is the ratio of the aggregate deflated output of all the plants owned by the target to the aggregate deflated output of the acquirer. DIAGONAL is 1 if the absolute value of the difference between the acquirer and target book-to-market ratio decile is less than 1 and zero otherwise. λ is the inverse Mills ratio from a probit model (estimates not reported) in which the dependent variable is 1 if a plant is sold and zero if a plant is kept and the independent variables are as in Table 4. The variable π - Counterfactual π is the average TFP (operating margin) of the plants for the chosen decision minus the *unobserved* predicted TFP (operating margin) if the acquirer had chosen the alternative decision. Robust t-statistics are in parentheses. Superscripts a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively.