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Diversification and Outsourcing in the Taxicab Industry

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This paper studies the origins of diseconomies of scope, and how firms reorganize following diversification to manage scope diseconomies. Specifically, we propose that outsourcing, or vertical dis-integration, can alleviate diseconomies of scope. We also examine the mechanisms underlying diseconomies of scope, showing that alternative theories lead to contrasting predictions about how within-firm task heterogeneity mediates the link between diversification and outsourcing. We test these propositions using micro-data on taxicab and limousine fleets from the Economic Census. The results show that taxicab fleets outsource, by shifting towards owner-operator drivers, when they diversify into the limousine business. Moreover, the magnitude of this shift toward driver ownership is larger in less urban markets, where the tasks of taxicab and limousine drivers are similar, but compensation systems differ. The findings suggest that: (1) firms use outsourcing to manage diseconomies of scope; and (2) that social comparison costs are an important source of diseconomies of scope in related diversification.

Key words: Diversification, diseconomies of scope, adaptation, outsourcing, asset ownership.

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1. Introduction

Why do firms become less efficient as they increase their scope of activities? The fields of corporate strategy and organizational economics propose several explanations for decreasing returns to scope. However, there is little empirical evidence on the origins of scope diseconomies, or on how firms manage the challenges of diversification. This paper studies the origins of scope diseconomies and analyzes how firms reorganize to reduce the costs of diversity. Our main findings show that diseconomies of scope lead diversified firms to outsource formerly integrated activities, and that social comparison costs are an important source of scope diseconomies.

By focusing on reorganization, this paper departs from an established literature on diversification and firm performance, which tests whether related diversification outperforms conglomerate diversification (Wernerfelt and Montgomery 1988; Lang and Stulz 1994). Since

firm performance could be a cause or consequence of diversification, the prior literature has produced a vigorous debate over selection effects and whether diversification is a managerial mistake (Villalonga 2004). Instead of analyzing performance effects, we study the link between diversification and organizational change—specifically outsourcing—to learn about the origins of scope diseconomies.

Following Coase (1937) and Williamson (1975), we assume that firms outsource, or vertically dis-integrate, when the costs of integration exceed the costs of using markets or long-term contracts to govern a transaction. However, we link outsourcing to diversification by suggesting that coordinating activities across multiple divisions can raise the cost of governing particular transactions or activities inside the firm, which we define as diseconomies of scope. Our theory predicts that when there are aggregate benefits of diversification, but diseconomies of scope are larger than the benefits of governing a subset of transactions or activities internally, firms will diversify and outsource. Thus, in our theory diseconomies of scope create inefficiencies, at the transaction or activity level, that causes firms to rethink their vertical boundaries.

We draw on three broad theories of corporate governance to explain the source of scope diseconomies. First, diversification may exacerbate monitoring costs that arise from cognitive limitations (Penrose 1959; Schoar 2002) or incomplete information (Holmstrom 1979). Second, diversification may increase influence costs associated with rent-seeking behavior among competing divisions (Milgrom 1988; Rajan, Servaes and Zingales 2000). Third, diversification may increase social comparison costs when employees in a multi-divisional firm perceive differences in the compensation or promotion practices of a new division to be unfair (Fehr and Schmidt 1999; Nickerson and Zenger 2008).

Our first hypothesis predicts that when diversification produces diseconomies of scope at the transaction or activity level, firms will respond by outsourcing. Outsourcing replaces monitoring with market incentives and relaxes constraints on managerial attention. By subjecting transactions

to market pricing and shifting decision rights to a new entity, outsourcing reduces rent-seeking behavior by divisional managers. And by moving employees outside the boundary of the firm, outsourcing can limit the heterogeneity in incentives, abilities and rewards that would otherwise produce envy and social comparison costs.

Our second hypothesis discriminates between alternative theories of the origins of scope diseconomies to generate contrasting predictions about the mediating effect of task diversity on diversification and outsourcing. In particular, we show that increasing task diversity exacerbates monitoring costs, and, therefore, increases a firm's propensity to outsource following diversification. Envy theory predicts the opposite effect. Social comparison costs increase when business units in the same firm perform similar tasks but receive different incentives and rewards because the salience of envy increases with spatial proximity, interaction and transparency—all of which are increasing in task similarity (Kulik and Ambrose 1992; Festinger 1954). We exploit the sharp competing predictions of monitoring and envy theories to test the relative importance of the mechanisms driving diseconomies of scope, by evaluating how task diversity mediates the link between diversification and outsourcing.

We test these hypotheses using data from the taxicab and limousine industry.[1] This industry is well-suited to study diversification and outsourcing for several reasons. First, a regulatory shock in the early 1990s led to a wave of diversification, which generates exogenous variation in the incentive to diversify.[2] Second, vertical integration, measured in terms of fleet versus driver ownership of taxicabs, is continuous and readily observable, which allows us to estimate the impact of diversification on outsourcing at an unusual level of precision. Third, differences in the size of the local market provide a meaningful measure of task differentiation as the markets for cab and limousine service are more differentiated in urban than rural settings. Finally, since

[1] We use the term limousine to describe vehicles that are often called black cars, town cars, sedans or executive limousines. These vehicles are distinct from "prom" or stretch limousines.
[2] Since each local market is distinct, this paper could be thought of as a study of hundreds of similar taxicab and limousine industries.

diversified fleets are a relatively simple example of the multiproduct firm, this setting limits unobserved heterogeneity in outputs, prices, incentives and internal organization that might otherwise bias empirical tests.

Our baseline result shows that diversifying firms outsource more intensively than firms that do not diversify, suggesting that outsourcing reduces diseconomies of scope. Specifically, diversifying firms outsource an additional 30 percent of the assets (i.e., taxicabs) in their legacy business compared to non-diversifiers. Moreover, conditional on diversification, the shift toward outsourcing is less pronounced in markets where there is more task differentiation, suggesting that monitoring costs are not a key driver of outsourcing in our setting. Specifically, doubling the population density of a local market, which increases task differentiation between business units, leads to an 11 percent reduction in the number of assets outsourced in a diversified firm.

To further explore the origins of scope diseconomies in our setting, we conducted a series of interviews with taxicab fleet managers. The interviews revealed that diversification created substantial efficiencies, particularly in dispatching operations. However, firms faced considerable operational challenges related to social conflicts when combining non-owner ("shift") taxicab drivers with a more professional group of limousine drivers. Thus, diversified fleets preferred contracting with owner-operator taxicab drivers, whose skills, and backgrounds are closer to limousine drivers'. Taken together with the statistical evidence, our field interviews suggest that social comparison costs are a particularly important driver of diseconomies of scope in our setting.

This study makes four main contributions to the literature on diversification and the scope of the firm. First, we show that outsourcing is an important organizational strategy for managing diseconomies of scope. Thus, we connect the literature on the costs of diversification to a literature that emphasizes efficient organizational adaptation through resource redeployment and asset divestiture following diversification (Capron, Dussauge and Mitchell 1998; Capron,

Mitchell and Swaminathan 2001).[3] Second, we show that social comparison costs are an important source of diseconomies of scope using both qualitative evidence and a novel statistical test for discriminating between alternative sources of diseconomies of scope. Third**,** by linking changes in the horizontal and vertical boundaries of the firm, we take a small step towards integrating the literature on diversification as an organizational strategy (Teece 1980; Levinthal and Wu 2006) with organizational economics' longstanding emphasis on buyer-supplier relations (Macher and Richman 2008). Finally, our main findings point towards a broader normative interpretation of this research: diseconomies of scope at the transaction or activity level make it difficult to manage parallel divisions with different priorities, processes or incentive schemes, even when operational and market similarities create aggregate economies of scope. While other scholars have noted the importance of strategic fit (Porter 1996), or complementarities (Milgrom and Roberts 1990), in firm strategy, we provide large sample statistical evidence that diseconomies of scope can produce complementarities between diversification and outsourcing.

2. Diseconomies of Scope, Diversification and Outsourcing

In this section, we develop a simple theory where diseconomies of scope lead firms to reconsider their vertical boundaries following diversification. We assume diversification is exogenous, but rational: firms only diversify if they expect synergies to be greater than costs. However, diversifying firms do more than simply combine operations. They also reorganize to minimize frictions or capture efficiencies created by the merger. While reorganization might take a variety of forms, our theory emphasizes outsourcing, or vertical dis-integration, as a way to reduce diseconomies of scope.[4] One of our key messages is that by studying the link between diversification and outsourcing, we can draw inferences about the size and nature of scope

[3] For a review of the literature on the costs of diversification see Montgomery (1994).
[4] Outsourcing does not imply that payments flow in a particular direction. A firm might outsource upstream manufacturing operations (in which case it would pay for the inputs) or a downstream sales force (in which case it would be paid for the outputs).

diseconomies. We begin by developing this broad idea, before describing the underlying causes of scope diseconomies and proposing a set of hypotheses.

Figure 1 provides a stylized illustration of our theoretical framework. In the figure, two vertically integrated firms merge and subsequently outsource the activities of one downstream division. Diversification is motivated by upstream economies of scope, while outsourcing reduces downstream diseconomies of scope. The figure highlights several important aspects of our theory. First, the unit of analysis is a group of related transactions or activities. The firms' objective is to draw a set of boundaries, or choose a set of governance mechanisms, that maximize total surplus. Second, we apply the term diseconomies of scope to any increase in governance costs caused by diversification. Thus, diversification can produce diseconomies of scope but still be rational, as long as it generates even greater synergies elsewhere. Finally, our framework naturally links diseconomies of scope to both transactions and activities, which are often omitted from studies of diversification and vertical integration respectively.

The mechanism behind Figure 1 is straightforward. Diseconomies of scope lead to outsourcing when they push the cost of governing intra-divisional activities or transactions above the costs of market or contractual solutions.[5] Alternatively, one could say that firms outsource activities that produce large negative spillovers in other divisions. This argument can be formalized, as we show in the appendix using a simplified version of Milgrom and Roberts' (1990) model of complementarities.[6] However, in order to understand the deeper links between diversification and diseconomies of scope, we need to unpack the specific mechanisms that produce these added

[5] One can think of our theory in terms of transaction cost analysis. Empirical tests of transaction cost economics typically assume that internal governance costs are fixed and examine the correlation between outsourcing and asset specificity, or some other driver of external contracting costs. We assume that external contracting costs are fixed—or at least uncorrelated with diversification—and interpret a positive correlation between diversification and outsourcing as evidence of increased internal governance costs.

[6] Diversification and outsourcing are complements if the marginal returns to outsourcing increase with scope. The appendix shows that the assumption of complementarity is both necessary and sufficient to produce Hypothesis 1. Moreover, when diversification does not alter the costs of governing a transaction in the market, complementarity is equivalent to diseconomies of scope at the transaction or activity level.

costs. The literature on firm governance suggests three different explanations for diseconomies of scope: monitoring, rent-seeking and envy.

Monitoring costs arise from centralized oversight of divisions, and are the main focus of the literature on diversification. We conceptualize monitoring costs more broadly than simply bureaucratic costs, which will arise whether divisions are managed jointly or as separate firms. In particular, monitoring costs include the opportunity costs of using a common set of people and processes to manage a heterogeneous portfolio of businesses. Thus, diversification may increase monitoring costs if increased scope exacerbates the cognitive or informational constraints on corporate management. For example, one source of monitoring costs is managerial distraction, an idea that dates back at least to Penrose (1959). Her central argument is that a corporate manager's job is to monitor divisions, and that this task grows more difficult with the number, size and variety of business units. Because a manager's cognitive capacity is limited, increasing the scope or diversity of operations increases the probability they will make poor strategic decisions that will negatively impact the operations of their business units. Schoar (2002) provides empirical support for the managerial distraction hypothesis, finding that when manufacturing firms diversify into new segments the productivity of their existing plants tends to fall.

Incomplete information can also lead to monitoring costs. Since the early moral hazard models of Jensen and Meckling (1976) or Holmstrom (1979), many studies have examined how a corporate principal might optimally respond when the agent who runs a division takes hidden actions or holds private information. Specific answers to that question range from monitoring to incentive contracts to delegation and job design. However, a common thread is that incomplete information makes the agency relationship costly to manage. If the severity of the underlying information problem depends on the scope of a firm, then these principal-agent models yield a theory of scope diseconomies.

A second broad explanation for diseconomies of scope is that agents in a diversified firm waste resources seeking preferential treatment from the corporate center. For example, Milgrom and Roberts (1988) conceive of corporate politics as a rent-seeking process, where division-level agents take actions that are privately beneficial, but unproductive for the firm as a whole. Corporate managers seek policies that discourage these behaviors (e.g. through budgeting or transfer pricing), but the CEO's authority invites lobbying by division heads, who hope to influence the rules of the game. The formal structure of influence cost models is similar to the incomplete information monitoring cost theories described above. However, we place them in a separate category because they emphasize the interaction between divisions. In particular, rent-seeking incentives depend on both monitoring costs and the actions taken by other divisions.

Rajan, Servaes and Zingales (2000) develop an empirical test for influence costs in the capital budgeting process. They find that increased diversity, measured as variation in the asset-weighted Tobin's q of a firm's divisions, is correlated with inefficient investment decisions. Specifically, firms invest more heavily in divisions with low values of Tobin's q. Their argument for indexing influence costs to diversity draws on the monitoring cost component of the theory: they assume that returns to lobbying increase as divisions grow more heterogeneous, since corporate managers are easier to mislead when they have a less comprehensive understanding of a division's operational activities.

Finally, Nickerson and Zenger (2008) develop a third theory of scope diseconomies that emphasizes employees' taste for fairness, as in Fehr and Schmidt (1999). They argue that variance in compensation tends to produce a group of agents who envy their better-paid peers and consequently engage in a variety of inefficient behaviors, including "reduced effort, (engaging in) influence activities, departure, non-cooperativeness or even outright sabotage" (p.1431). This theory builds early social psychology research (e.g. Festinger 1954; Adams 1965) that describes the origins of individual perceptions of inequity and highlights the importance of endogenous

reference groups. Extending the early research, Kulik and Ambrose (1992) suggest that firm boundaries are a natural point of reference for employees, who are much more sensitive to inequities within a firm than between firms. Thus, by combining agents who perform similar tasks but have different compensation systems, incentives and ability levels, related diversification can lead to increased envy across divisional lines. Bandiera, Barankay and Rasul (2005) provide empirical support for envy theory by showing that when teams of fruit-pickers are switched from piece-rates to compensation based on relative performance, there is a substantial decline in average productivity.

We build on the governance literature by focusing on the operational impact of diseconomies of scope at the activity or transaction level. When diversification creates diseconomies of scope, which increases internal governance costs, it also changes the marginal returns to outsourcing formerly integrated activities or transactions. Specifically, outsourcing mitigates scope diseconomies associated with managerial distraction costs by shifting the basis of monitoring from behavioral to contractual, placing operating decisions in the hands of the (now independent) division. Outsourcing also attenuates scope diseconomies associated with influence costs, reducing agents' incentives to lobby the corporate center by shifting the nature of resource allocation decisions from behavioral to contractual. By placing buyers and suppliers under separate management, outsourcing simplifies corporate oversight. Outsourcing also reduces rent-seeking incentives by placing decision rights in the hands of an independent firm. Finally, outsourcing shifts the nature of social comparison costs from within to between firms. If within-firm comparisons are more salient to agents than comparisons to a supplier or contractor, then outsourcing activities performed by agents at the extremes of the incentive or skill distributions will reduce the overall level of envy. Thus, by changing the nature of monitoring, influence and social comparison costs, outsourcing alleviates diseconomies of scope at the activity or transaction level.

In summary, when diversification increases the costs of governing a bundle of related transactions internally, firms will rethink vertical boundary choices that were efficient prior to diversification. Outsourcing offers the firm a targeted mechanism to reduce diseconomies of scope arising from monitoring problems, rent-seeking or envy. Therefore, our first hypothesis predicts that firms will use outsourcing to reduce diseconomies of scope.

HYPOTHESIS 1: *When diversification creates diseconomies of scope, diversification leads to outsourcing.*

Our second hypothesis distinguishes between underlying mechanisms that create diseconomies of scope, showing how different theories yield opposing predictions about the mediating effect of task differentiation on the diversification-outsourcing relationship. When diseconomies of scope are caused by an increase in monitoring costs, they should grow larger as the tasks performed in different divisions grow more diverse, leading to more outsourcing following diversification. Theories of managerial distraction predict that managers will make worse decisions when asked to monitor a more heterogeneous portfolio of divisions (Penrose 1959; Schoar 2002). Incomplete information models generate the same prediction as long as increased heterogeneity leads to weaker signals of division-level performance (Holmstrom 1979, 1982).

When diseconomies of scope arise from social comparison costs, we expect the opposite result: increased task diversity should lead to a weaker relationship between diversification and outsourcing as reducing task differentiation increases the likelihood that workers will make inter-agent comparisons (Kulik and Ambrose 1992). Nickerson and Zenger (2008, p.1434) observe that the saliency of envy increases with "spatial proximity, degree of interaction and availability of information" to a reference group, where spatial proximity is broadly defined to include measures of social difference and contextualized measures of variation in ability (Festinger 1954). Because lower task differentiation increases spatial proximity, while integration increases worker interaction and availability of information, social comparisons are naturally more salient

among employees who perform similar tasks within the same firm. For example, we might expect more enmity between investment and commercial bankers who both underwrite corporate debt offerings, than between a sales force with strong incentives and the employees of a manufacturing division in the same firm. Thus, inter-agent envy makes it more costly for a firm to maintain operationally similar activities in different divisions when heterogeneity in incentives or individual ability leads to a substantial divergence in compensation (Adams 1965). Therefore, when diseconomies of scope arise due to the adverse impact of social comparison costs, we expect the link between diversification and outsourcing to grow stronger when the tasks performed in different divisions are more similar.

Since monitoring and social comparison cost theories make opposing predictions about how heterogeneity in tasks mediates the relationship between diversification and outsourcing, we test these mechanisms as competing hypotheses.

HYPOTHESIS 2

H2A: *When diseconomies of scope are caused by monitoring costs, the impact of diversification on outsourcing will increase with task differentiation.*

H2B: *When diseconomies of scope are caused by social comparison costs, the impact of diversification on outsourcing will decrease with task differentiation.*

If we find more outsourcing when task differentiation is high, that suggests firms use outsourcing to address diseconomies of scope that are primarily associated with monitoring. If diversification leads to less outsourcing when task differentiation is high, that would point toward the envy cost mechanism.[7]

[7] In the case of influence costs increased task diversity leads to countervailing effects, so we cannot offer a simple prediction. When diversity places corporate managers at an informational disadvantage, increased task diversity increases influence costs, as in monitoring theories. On the other hand, when heterogeneity reduces the importance of inter-divisional resource sharing, or relative performance evaluation, diversity may reduce the incentives to play organizational politics. When scope diseconomies are caused by influence costs, the mediating effect of task diversity will depend on which channel produces a larger effect. We address the ambiguous effect of influence costs on H2 by relying on qualitative evidence from our interviews, as we discuss below.

We conclude the theoretical discussion with a caveat. Our simple story of diversification and outsourcing holds all other aspects of the firm's organization constant. In general, firms might adapt their organization in a variety of ways following diversification, and these adaptations could interact in complex ways. For instance, Eccles (1985) describes how firms use transfer-pricing policies to ration scarce resources, prevent free-riding and promote a sense of fairness. Shin and Stulz (1998) study capital budgeting and coordination. Rather than work towards an omnibus theory that predicts when and how much each policy will respond to diversification, we focus on a single margin—outsourcing—using a simple model of the multi-divisional firm.

3. The Taxicab and Limousine Industry

Our empirical setting is the private-for-hire vehicle industry, or taxicab and limousine fleets. This industry provides a unique opportunity to study diversification and outsourcing for several reasons. First, in response to a wave of deregulation, many taxicab fleets diversified into the limousine market during the early 1990s. We show that a taxicab fleet's propensity to diversify was linked to concentration levels in the local limousine market, and use that variation in initial conditions as a source of exogenous variation in the incentive to diversify. Second, a ubiquitous regulatory requirement that limousine rides be pre-arranged produces a clear demarcation between the two market segments, leading to different compensation arrangements by vehicle type. Third, since there is relatively little asset specificity between drivers and firms, it is reasonable to assume that diversification does not change the costs of transacting between drivers and fleets through the market, but does alter the cost of organizing the same relationship through a firm. This section describes the industry in greater detail, focusing on the legal factors that led to a wave of diversification between 1992 and 1997, and the economic factors that influence the decision to diversify into limousines and contract with owner-operator taxicab drivers.

Taxicab and limousine markets are highly regulated. The number of taxicab licenses granted in a given market is typically fixed by a local taxicab commission, which provides medallions, or

permits, that are associated with a specific vehicle. In most markets, these regulators also set prices and coordinate regular inspections. Entry into the limousine segment is considerably more flexible and restrictions on the number of vehicles in use are rare. However, while taxicabs can legally accept spot market hails from any passenger who solicits a ride, all limousine rides must be pre-arranged through a centralized dispatcher.

The exclusion of limousines from the hail segment leads to some important differences in the organization of taxicab and limousine fleets. For example, taxicab drivers typically have stronger incentives than limousine drivers. A study by the Transit Cooperative Research Program (1998) found that 50 percent of limousine drivers are paid a fixed hourly wage and 35 percent share a large portion of each trip's revenue with the firm, while 90 percent of cab drivers are full residual claimants; they pay a flat fee to the dispatcher and keep all of their gross receipts. This arrangement gives diversified firms a strong incentive to allocate their most lucrative rides to limousines. When firms favor limousines over taxicabs, this contributes to a sense of alienation felt by taxicab drivers (Sheahan and Smith 2003).

There are two basic types of drivers in the taxicab segment: shift drivers and owner-operators. Shift drivers lease cars, permits and dispatching services from a fleet. In 1990, fifty-one percent of the vehicles in US fleets were staffed via these day or half-day leases (TLPA 1990). The same survey suggests that roughly one-third of the vehicles in U.S. fleets are leased on a weekly or monthly basis. Owner-operators are drivers who have purchased a vehicle and medallion, and are free to choose whether to contract with a fleet for dispatching services.

Interestingly, vehicle ownership does little to change a taxicab driver's short-term incentive to locate rides, since both fleet-drivers and owner-operators are typically full residual claimants. However, owning a taxicab and medallion may solve moral hazard problems, or promote long-term investments to acquire industry-specific knowledge. Given the benefits of using owner-operators, the level of fleet-ownership in the taxicab segment is at first puzzling (Schneider

2008). However, many shift drivers are recent immigrants with very few marketable skills, who would find it difficult to finance a car and medallion, which can cost over $300,000 (Luo 2004).

Before the early 1990s, the taxicab and limousine segments were kept separate through regulation. This situation changed in the early 1990s, following a series of legal challenges to local regulatory authority. One of the most famous examples was the 1993 "Freedom Cab" case (*Jones v. Temmer*) in Denver**,** where a small firm challenged Colorado's broad regulatory authority over entry into the taxicab market (Cox 1993). Within four years of the Freedom Cab case, most cities (or states) had deregulated entry into the limousine segment. The practical result of these changes was to remove any legal or political obstacles to cross-ownership, which led to a broad wave of diversification. In our data, 54 percent of the taxicab fleets that survived from 1992 to 1997 diversified into limousines during that period (see Table 1).

The logic behind diversification into the limousine segment is predicated on fixed cost sharing and cross-selling. While opportunities for cost sharing extend to a wide range of activities—from servicing vehicles to negotiating group rates for insurance—shared marketing and dispatch operations present the greatest opportunity. However, our discussions with fleet managers suggest that conflicts over shared dispatching also create significant organizational challenges for the firm. In some cases, taxicab drivers scoop limousine dispatches by arriving in advance of the limousine and giving customers the mistaken impression that their limousine had been cancelled. Other firms reported that taxicab drivers had vandalized limousines and threatened limousine drivers during shift changes, accusing limousine drivers of skimming the best rides. At a minimum, integration creates confusion among shift drivers over contract terms, engendering ill will between taxicab and limousine drivers. [8]

While the leasing system allows fleets to tap a large low-skilled labor pool, managing shift drivers, who are only weakly committed to their job, was often described as a major challenge,

[8] Taxicab drivers in diversified firms pay lower lease prices because they receive fewer and less attractive dispatches, but this is often not well understood by the shift drivers.

particularly in diversified firms. Shift drivers are often characterized as having limited knowledge of the city, poor language skills, and exhibit strong tendencies to engage in anti-social behavior. Owner-operators, by contrast, are characterized as professionals with an intricate knowledge of their city, who are fluent English speakers, keep their vehicle clean and in good operating condition, drive safely and give the impression that they take pride in their work.

Our field research suggests that outsourcing is a common organizational strategy to reduce diseconomies of scope that arise from social conflicts between taxicab and limousine drivers in a diversified fleet. Fleet managers invoke the difficulty of integrating shift (taxicab) drivers with limousine drivers as a reason for shifting toward contracting with (taxicab) owner-operators. Because owner-operators more readily understand the *quid pro quo* inherent in their contract with a diversified fleet, there is a reduced chance of conflicts between drivers. Moreover, owner operators' investments in market-specific knowledge makes them less reliant on the dispatcher than are shift drivers and, therefore, less likely to subvert the dispatching system through scooping. Taken together, the professionalism and knowledge of owner-operators serves to simplify the dispatching system, which alleviates some of the managerial problems associated with an integrated taxicab and limousine business, particularly envy-based conflicts between taxicab and limousine drivers.

4. Data and Measurement

We use data from the 1992 and 1997 Economic Census of Transportation and Warehousing, which includes every taxicab (SIC 412100) and limousine (SIC 411920) firm in the United States with at least one employee. These data contain establishment-level information on line of business revenue at the six-digit industry level, number of vehicles by type (taxicab vs. limousine) and geographic identifiers. We focus on taxicab fleets with at least two taxicabs, $10,000 of taxicab revenue and at least one other taxicab fleet in their market (county).[9] The

[9] Alternative samples did not change the results presented below.

1992 and 1997 Economic Censuses contain 1,020 and 1,106 fleets, respectively, that meet these criteria.[10] Our panel regressions are based on a set of 560 fleets that reported complete data in both years. Table 1 presents descriptive statistics for these fleets, which account for over 70 percent of industry revenue and approximately two-thirds of all vehicles.

Our dependent variable *FLEETOWN* is the share of all taxicabs owned by the fleet, which is equal to the number of taxicabs owned by the fleet divided by the total number of taxicabs operated by the fleet. Table 1 shows that the mean fleet ownership rate fell from 86 percent in 1992 to 63 percent in 1997. We measure diversification using an indicator variable *DIVERSIFY* that equals zero for taxicab fleets with no limousines, and one for taxicab fleets with one or more limousines in their fleet.[11]

We use county-level population density as a proxy for task differentiation between the taxicab and limousine segments in a diversified fleet. In dense urban markets where a substantial fraction of all rides are street hails, taxicabs and limousines locate rides differently and serve very different customer segments. In less urban markets, where most rides are dispatched through the same central switchboard, task differentiation between the taxicab and limousine segments is low. We measure population density in two ways: the log of 1992 county population per square mile (*DENSITY*) and an indicator variable (*URBAN*) that equals one for fleets located in counties with population density above 4,000 people per square mile.[12]

Table 1 shows a large increase in the total number of taxicabs in our sample between 1992 and 1997. The increase reflects the fact that many formerly independent owner-operators chose to contract with taxicab fleets during this time period, which is, in part, a response to increased competition following entry deregulation.[13] Our theory predicts that these owner-operators will

[10] We discard very small establishments that the Census imputes values for, rather than surveying directly.
[11] Alternative measures, such as a threshold for the percentage of total revenue or capital in the limousine segment, yielded very similar results.
[12] This measure of *URBAN* is based on the average population density of the 1,000 largest cities (by population) in the United States during the last quarter of the 20th century (Kim 2007).
[13] Independent drivers are only captured by the Economic Census when they contract with a fleet.

seek to join fleets that have diversified into the limousine segment because the match between an owner-operator and a diversified fleet creates more value than a match to a focused taxicab firm. This matching process suggests an implication of our hypotheses in terms of the evolution of firm-level capabilities. Fleets that are vertically integrated and focused compete by minimizing capital investment in vehicles and managing a pool of low-skill drivers, while diversified and vertically dis-integrated fleets compete by establishing a brand that attracts the high quality rides valued by independent limousine and taxicab drivers.

5. Methods

Our core specification uses a simple OLS regression in first differences. Let *i* index the fleets in our sample, and Δ represent the first-difference operator (between 1992 and 1997). To test Hypothesis 1, we regress $\Delta FLEETOWN$ on *DIVERSIFY* and a vector of control variables *X* that might influence firms' asset ownership decisions, including: firm size (measured by lagged dollar value of a firm's capital stock); changes in local market population; changes in the share of taxicabs owned by other firms in the same market; changes in the number of taxicabs in other firms in the market; changes in the number of limousines in other firms in the market; a dummy for fleets that register as a corporation; and a dummy for urban markets.[14] Thus, our initial specification is:

$$\Delta FLEETOWN_i = \alpha + \beta DIVERSIFY_i + X_i \delta + \varepsilon_i, \quad (1)$$

where the parameter α measures the sample average change in *FLEETOWN*, and ε is the unexplained portion of any changes in outsourcing. Since we only observe two time-periods, taking first-differences is similar to introducing firm fixed-effects, as either approach controls for unobserved time-invariant fleet-level factors that might influence the level of *FLEETOWN*.

While (1) controls for correlation between diversification and time-invariant fleet-level unobservables that affect outsourcing, one still might be concerned about selection based on time-

[14] Similar results were obtained using models with a full set of legal form of organization dummies.

varying factors. In an experimental design, we would randomly assign diversification status and measure *ex post* differences in fleet asset-ownership across the treatment and control groups. In practice, we observe changes in both diversification and asset ownership, following a regulatory shift that creates new opportunities for expansion into related markets. In this setting, we might expect diversifiers to be those fleets who will benefit most from expanding, which could confound our estimates. For example, if fleets that experience a positive productivity shock expand through both diversification into limousines and increased contracting with owner operators, the coefficient on *DIVERSIFY* will be biased.

We address the potential endogeneity of diversification by using the lagged concentration of limousines in a given county (*CONCENTRATION*) as an instrument for *DIVERSIFY*. Industry observers suggest that diversification is less attractive when there are strong limousine incumbents that have already developed deep relationships in the lucrative corporate segment. High limousine concentration also represents an entry barrier because of the increased threat of retaliation.[15] Therefore, *CONCENTRATION* should be uncorrelated with factors in the error term that influence taxicab fleets' outsourcing decisions, and negatively correlated with the probability of diversification following deregulation.

To complement our instrumental variables analysis, we use propensity score methods (Rosenbaum and Rubin 1983) to control for selection bias. Specifically, we estimate a probit model of the decision to diversify and use fitted values from that model as estimates of the

[15] Our instrumental variables identification strategy would not be valid if *ex ante* limousine concentration were correlated with factors that influence of the relationship between taxicab fleets and drivers in local markets. However, the cross-sectional correlation between *FLEETOWN* and *CONCENTRATION* was not significant (raw correlation of 0.04), and our informal discussions suggest that the primary factor limiting entry in the limousine market was access to a base of corporate customers. Another concern might be that the timing or nature of deregulation is correlated with both *ex ante* limousine concentration and factors that influence *FLEETOWN*. However, our discussions with local regulators suggest that deregulation was often carried out at the state level with little concern for variation in local market conditions. Finally, a practical drawback of our instrumental variable is that it only generates market-level variation; we could not identify any fleet-level shifters of the costs or benefits of diversification that would satisfy the exclusion restriction for an instrument. However, we find that our IV generates substantial between-fleet variation in practice, since the 560 fleets in our balanced panel operate in hundreds of different local markets.

propensity score Pr(*DIVERSIFY*$_i$ = 1| X_i). We then drop all fleets that do not fall on the common support of the estimated propensity score distribution, and weigh the included observations by the inverse probability of treatment to balance the treatment and control groups (Imbens 2004). Compared to the standard approach of adding controls to a linear regression, the propensity score methodology makes fewer functional form assumptions and eliminates the influence of non-comparable control and treatment group observations that are off the common support of the estimated propensity score distribution.[16]

Table 2 presents estimates from the probit model that we use to estimate the propensity score: column (1) reports coefficients and column (2) reports marginal effects at the average value of each regressor. Only firm size, population density and limousines per capita had a statistically significant effect on the diversification decision. Columns (3) through (8) in Table 2 compare the sample means of *X* for diversifying and non-diversifying fleets, in both the full and matched samples. While the percentage differences are typically small, they are statistically significant for several variables, and trimming the sample produces only a modest improvement. This suggests that using propensity score weights is appropriate; though we do not expect large changes in the coefficient estimate on *DIVERSIFY* given the modest explanatory power of our first stage results.

We test Hypothesis 2 by adding a proxy for task differentiation (*DENSITY*) and the interaction between *DENSITY* and *DIVERSIFY* to our baseline specification (1) yielding:

(2) $\Delta FLEETOWN_i = \alpha + \beta_1 DIVERSIFY_i + \beta_2 DENSITY_i + \beta_3 (DIVERSIFY_i \times DENSITY_i) + X_i \delta + \varepsilon_i$.

The key coefficient in model (2) is based on a triple-difference: β_3 measures how the difference in outsourcing between focused and diversified fleets changes over time in more or less urban markets.[17] For ease of interpretation (and to ensure that our results are not driven by outliers in

[16] Intuitively, this approach will outperform standard regression control methods when the response of *FLEETOWN* to *DIVERSIFY* varies with *X* (i.e. there is treatment heterogeneity), and *X* is correlated with *DIVERSIFY*.

[17] We might nevertheless wish to adjust for endogenous diversification, and if *DENSITY* is exogenous, its interaction with *CONCENTRATION* should provide a valid second instrument. Unfortunately, this approach performed poorly. Although our second stage point estimates were similar to the OLS estimates,

the *DENSITY* distribution), we run an alternative specification where *DENSITY* is replaced with the binary measure *URBAN*. Once again, we use propensity score matching to control for observable differences between diversifiers and non-diversifiers.

6. Results

Figure 2 foreshadows our main result by showing that there is a strong correlation between *DIVERSIFY* and changes in *FLEETOWN*. Moreover, this correlation does not appear to be driven by heterogeneity in fleet size, which might be the case if both diversification and increased use of owner operators were correlated with unobserved productivity shocks. Figure 3 illustrates our second key result: the link between diversification and changes in *FLEETOWN* is much stronger in non-urban markets.

Table 3 presents our baseline regressions, which show the impact of diversification into the limousine market on the asset-ownership mix of a taxicab fleet. We estimate four different versions of equation (1): OLS, firm fixed-effects, propensity score weighted regression and the instrumental variables analysis (2SLS). Column 1 contains the baseline OLS results. The average change in the fleet vehicle ownership rate for diversifiers relative to focused incumbents is estimated to be negative 31 percent, and this effect is significant at the 1 percent level. This estimate suggests that diversification accounts for roughly half of the large secular shift towards driver-owned cabs shown in Table 1.

Column 2 in Table 3 presents estimates from the traditional within estimator, in part to show that they are not substantially different from our preferred first-differences specification. In column 3, we report estimates from the propensity score model, which are indistinguishable from those produced by OLS.[18]

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they were very imprecise, perhaps due to the high degree of correlation between the instruments. We therefore, omit the 2SLS robustness tests.

[18] We also obtained similar results on changes in limousine ownership in limousine firms that diversified into taxicabs.

Since the decision to diversify is endogenous, the results shown in columns 1-3 can only be interpreted as correlations. In column 4, we present estimates from our 2SLS instrumental variables model, which controls for the potential endogeneity of the treatment by using *CONCENTRATION* as an instrument for diversification. The first-stage relationship between limousine-market concentration and diversification is strongly negative: the t-statistic on *CONCENTRATION* in an OLS regression is -5.4 and the first-stage F-statistic of 11 indicates a powerful instrument. In the second stage, the estimated average change in the fleet vehicle ownership rate is negative 50 percent, which is statistically significant at the 1 percent level. We interpret this result as evidence of a causal relationship between diversification and changes in firm asset ownership rates in this industry. While the 2SLS point estimate is larger than the OLS estimate in column 1, they are not statistically different. Collectively, the findings in Table 3 indicate that outsourcing is an important method for managing diseconomies of scope.

Table 4 presents tests of our second hypothesis, based on equation (2). We are particularly interested in the coefficient on the interaction between *DIVERSIFY* and *URBAN*, our proxy for task differentiation across divisions. Since our dependent variable is based on fleet ownership, a negative coefficient would provide evidence of outsourcing in response to monitoring costs, or the monitoring component of influence costs. A positive coefficient would provide evidence of outsourcing in response to social comparison costs.

Column 1 in Table 4 shows the OLS result, where task differentiation is measured using the categorical variable *URBAN*. The main effect of diversification continues to be large, negative and strongly statistically significant, with a point estimate of negative 45 percent. The point estimate on the interaction term is large and positive, at positive 55 percent, and statistically significant, indicating that outsourcing is far more extensive following diversification in non-urban markets where task differentiation between taxicabs and limousines is low. Using propensity score matching to control for *ex ante* observable differences between diversifiers and

firms that remain focused has little effect on the parameter estimates (column 2). Column 3 replaces the discrete measure *URBAN* with the continuous measure *DENSITY*. The results show that doubling population density leads to an 11 percent increase in the impact of diversification on outsourcing.[19] Once again, propensity score matching has little impact on the results (column 4). Thus, the results in Table 4 suggest that focused taxicab fleets outsource in response to social comparison costs associated with diversification.[20] This finding is consistent with our qualitative interview evidence, where fleet managers pointed out the importance of misunderstandings and conflicts between taxicab shift-drivers and limousine drivers in a diversified firm.

7. Conclusions

This paper studies the mechanisms behind diseconomies of scope by examining how firms reorganize their vertical boundaries after diversifying. We show that changes in firm scope alter the marginal costs and benefits of vertical integration, leading firms to re-think their vertical boundaries. We also investigate the mediating effect of task diversity on the diversification-outsourcing relationship, using it to discriminate between sources of scope diseconomies. A major challenge for empirical work on these questions is finding exogenous variation in the scope of the firm. To address that challenge, we exploit a unique opportunity, created by widespread diversification in response to entry deregulations in the taxicab and limousine industry between 1992 and 1997.

We find that diversifying taxicab fleets outsource extensively, deploying 30 percent more owner-operator drivers than fleets who continue to focus only on the taxicab segment, which supports our contention that diversification leads to outsourcing in the presence of diseconomies of scope. Consistent with the idea that outsourcing helps reduce social comparison costs, we find that the link between diversification and outsourcing is stronger in less urban markets, where task differentiation between taxicab and limousine drivers is less pronounced. Our interviews with

[19] The same results were obtained with *DENSITY* winsorized at the 1st and 99th percentile.
[20] We also replicated all of the results in this section using a Tobit specification (results omitted).

taxicab fleet managers also support our conclusion that the main source of scope diseconomies, in our context, are envy-based conflicts between agents with heterogeneous incentives and ability levels, who perform similar tasks in different divisions.

Our findings have implications for both corporate strategy and organizational economics. While other studies have suggested that diversification can increase governance costs, this observation is rarely reconciled with the idea that firms make organizational changes following diversification to enhance efficiency. Indeed, the conceptual basis for diseconomies of scope is often predicated on systematic managerial mistakes. We develop a theoretical framework, based on efficient adaptation following diversification, and present evidence that diversified firms use outsourcing to manage diseconomies of scope. This research also contributes to a literature which emphasizes that firm boundaries may be jointly determined (Argyres and Liebeskind 1999). While others have focused on externalities across vertical supply relationships, we believe this is the first study to provide evidence of a link between the horizontal and vertical boundaries of the firm.

The existence of complementarities between diversification and outsourcing also has ramifications for how scope diseconomies should be analyzed. Perhaps for analytical convenience, diseconomies of scope are often modeled as an increasing and convex function of the number of boundaries or divisions in a firm. While this leads naturally to a simple analysis of optimal firm size, it provides little practical guidance in a world where complex interactions among activities or transactions in different divisions produce significant non-linearities in the total costs of governance. Our findings highlight the importance of research that unpacks the interrelationships amongst divisions as a source of organizational diseconomies of scope.

Finally, we believe this work has normative implications for corporate strategy. In particular, we show that outsourcing is a tool corporate managers can use to manage diseconomies of scope.

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Figure 1: Diversification and Outsourcing

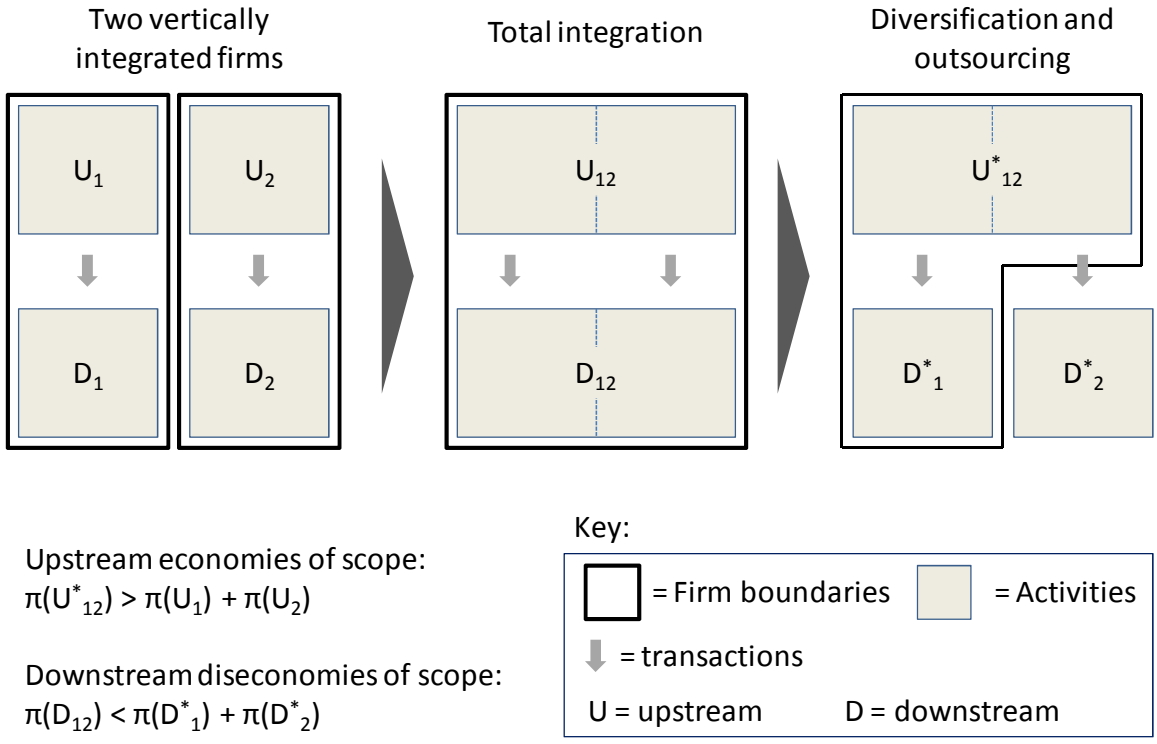

Figure 2: Diversification and asset ownership *(FLEETOWN)* by firm size

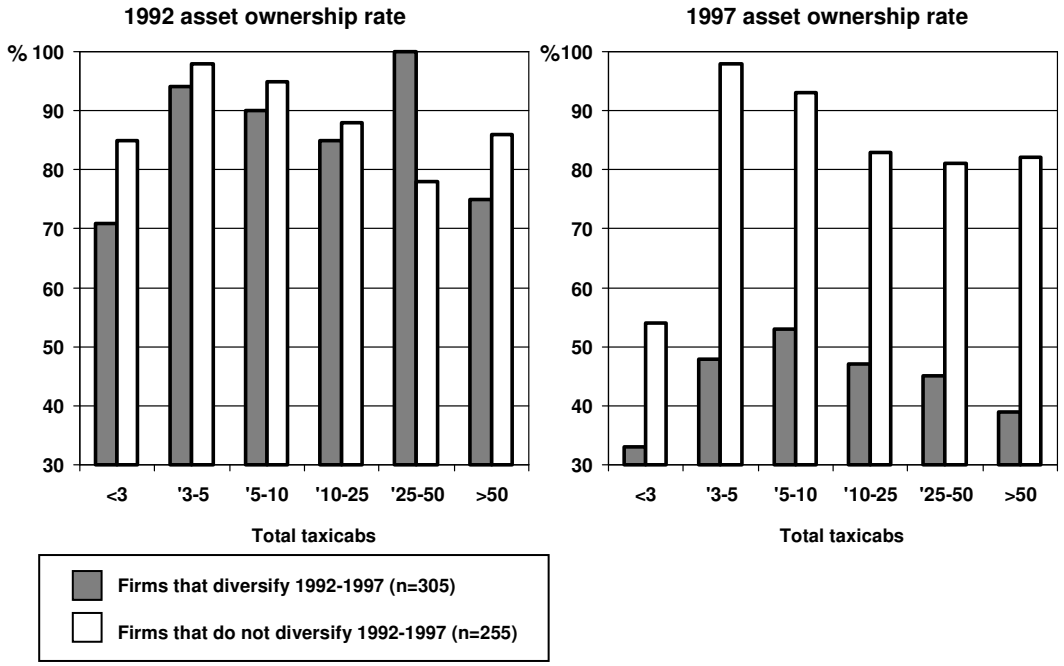

Figure 3: Diversification and asset ownership *(FLEETOWN)* by urban vs. non-urban

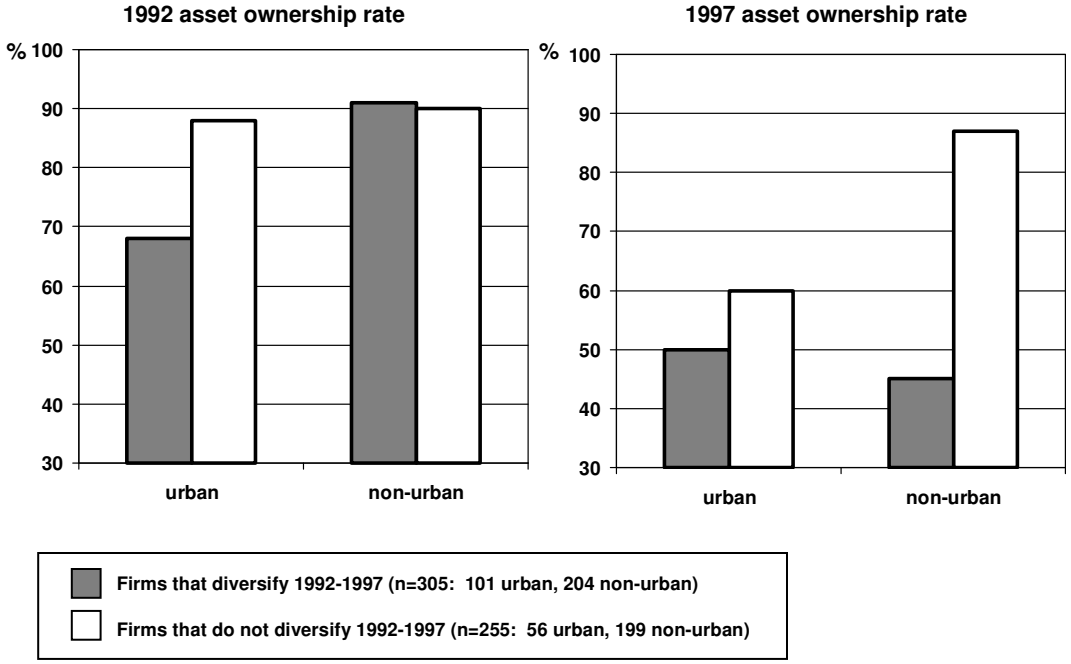

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Table 1 – Descriptive statistics

	1992		1997	
Test sample (n=560)	Mean	Std dev	Mean	Std dev
FLEETOWN	0.86	0.33	0.63	0.36
DIVERSIFY	0.00	0.00	0.54	0.50
Taxicab revenue ($000)	675	1890	849	2739
Taxicab capital ($000)	230	673	319	934
Total taxicabs	24	64	35	83
Fleets with 2 taxicabs	0.27	0.44	0.09	0.29
Fleets with 3-5 taxicabs	0.19	0.39	0.22	0.42
Fleets with 6-10 taxicabs	0.19	0.39	0.20	0.40
Fleets with 11-25 taxicabs	0.17	0.38	0.21	0.40
Fleets with 26-50 taxicabs	0.09	0.29	0.10	0.30
Fleets with >50 taxicabs	0.10	0.30	0.17	0.38
Taxicabs in the county	231	480	474	673
Limousines in the county	103	228	221	414
CONCENTRATION	0.05	0.13	0.32	0.36
County population (000)	885	1036	985	1147
County square miles	861	1642	878	1714
URBAN	0.37	0.48	0.36	0.48
Partnership	0.02	0.13	0.02	0.15
Corporation	0.80	0.40	0.80	0.40

All firms	Total 1992	Total 1997
Taxicab revenue ($M)	521	669
Number of taxicabs	20,014	29,960
Number of fleet owned taxicabs	16,426	18,303
Number of fleets	1,020	1,106

Table 2 – Probit model of diversification from taxicabs to limousines

Dependent variable = Diversified from taxicabs to limousines between 1992 and 1997 {0,1}									
				Full sample			Common Support		
	(1) Coef.	(2) dy/du at $\bar{\mathbf{u}}$		(3) Focus	(4) Diver-sified	(5) t-test on Δ	(6) Focus	(7) Diver-sified	(8) t-test on Δ
1992 total factor productivity	-0.05 (0.09)	-0.02 (0.03)		0.11 (0.05)	-0.00 (0.04)	1.98	0.02 (0.05)	-0.02 (0.04)	0.54
1992 Fleet taxicab ownership rate	0.17 (0.22)	0.07 (0.09)		0.89 (0.02)	0.83 (0.02)	1.95	0.88 (0.02)	0.83 (0.02)	1.65
1992 log (taxicab capital)	-0.86 (0.52)	-0.34 (0.21)	*	4.75 (0.09)	3.93 (0.07)	7.42	4.34 (0.07)	3.82 (0.06)	5.25
1992 log (taxicab capital^2	0.02 (0.02)	0.01 (0.01)		9.50 (0.21)	7.86 (0.15)	6.35	8.68 (0.20)	7.64 (0.14)	4.26
Partnership	-0.37 (0.46)	-0.15 (0.18)		0.03 (0.02)	0.01 (0.03)	0.56	0.02 (0.02)	0.01 (0.02)	0.36
Corporation	0.20 (0.16)	0.08 (0.06)		0.80 (0.03)	0.81 (0.02)	-0.24	0.79 (0.03)	0.81 (0.02)	-0.64
1992 log (county pop.)	0.11 (0.11)	0.04 (0.04)		12.88 (0.09)	12.86 (0.09)	0.19	12.71 (0.10)	12.84 (0.09)	-1.02
1992 log (county pop.^{2})	0.00 (0.00)	0.00 (0.00)		6.15 (0.08)	5.73 (0.08)	3.67	6.06 (0.09)	5.71 (0.08)	3.02
Log (county miles^2)	-0.11 (0.06)	-0.04 (0.02)	*	3.14 (0.22)	2.85 (0.18)	1.02	3.13 (0.21)	2.87 (0.17)	0.96
1992 log (taxicabs in the county$_{-i}$)	-0.03 (0.08)	-0.01 (0.03)		2.18 (0.10)	1.70 (0.09)	3.55	2.05 (0.11)	1.71 (0.10)	2.29
1992 log (limousines in the county)	-0.16 (0.06)	-0.06 (0.02)	***	0.25 (0.03)	0.34 (0.03)	-2.27	0.23 (0.03)	0.35 (0.03)	-2.83
Urban	0.07 (0.26)	0.03 (0.10)		0.43 (0.08)	0.61 (0.10)	-1.41	0.44 (0.08)	0.60 (0.09)	-1.33
Constant	0.28 (1.05)	0.03 (0.10)							
Pseudo R^2	0.09								
N	560			254	306		213	292	

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

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Table 3 – Diversification and asset ownership

Dep. Variable = Change in the % of vehicles in the fleet owned by the firm (ΔFLEETOWN) [†]								
	(1) OLS		(2) F.E.		(3) Matched		(4) 2SLS[††]	
DIVERSIFY	**-0.31**	***	**-0.40**	***	**-0.27**	**	**-0.50**	***
	(0.07)		**(0.05)**		**(0.11)**		**(0.09)**	
1992 log (taxicab capital)	-0.03		0.21	***	-0.09	*	-0.05	*
	(0.02)		(0.05)		(0.05)		(0.03)	
ΔCounty taxicab ownership rate$_{-i}$	0.09	*	0.08		0.04		0.09	*
	(0.05)		(0.06)		(0.04)		(0.05)	
Δlog(taxicabs in the county$_{-i}$)	0.03	**	-0.00		0.03		0.03	**
	(0.02)		(0.02)		(0.02)		(0.02)	
Δlog(limousines in the county$_{-i}$)	-0.02		0.02		-0.03		-0.02	
	(0.02)		(0.02)		(0.02)		(0.02)	
Δlog(county pop.)	-0.13		-0.04		-0.12		-0.13	
	(0.15)		(0.10)		(0.19)		(0.15)	
Corporation	0.10	**			0.11	**	0.12	**
	(0.05)				0.05		(0.05)	
Urban	-0.05				-0.09		-0.05	
	(0.07)				(0.11)		(0.06)	
Year dummy			-0.02	**				
			(0.01)					
Constant	0.11		34.51	**	0.28		0.29	
	(0.11)		(16.58)		(0.21)		(0.18)	
560 firm fixed effects	N		Y		N		N	
R^2 /Psuedo-R^2	0.12		0.23		0.09		n/a	
N	560		1120		505		560	
<u>2SLS 1st stage summary statistics</u>								
F-statistic							11	
t-statistic on *CONCENTRATION*							-5.4	
Adjusted R^2							0.13	

Standard errors are robust and clustered at the market (county) level, except in the fixed effect model where they are clustered at the firm level

[†] In the fixed effects model (column 2) the dependent variable is *FLEETOWN*

[††] 1st stage of the 2SLS model: $\Delta DIVERSIFY_i = \Gamma CONCENTRATION_{i1992} + \mathbf{X_{ic}}\boldsymbol{\gamma} + \eta_i$

The Durbin-Wu-Hausman test rejects the null hypothesis that the instrument is not necessary at the 1% level (χ^2= 20 in the 2SLS specification, column 4)

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

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Table 4 – Diversification, task differentiation and asset ownership

$\Delta FLEETOWN_i = a + B_1\sigma_i + B_2URBAN_i + B_3(\sigma_i \times URBAN_i) + \mathbf{X_{ic}B_c} + e_i$

Dep. variable = Change in the % of vehicles in the fleet owned by the firm (ΔFLEETOWN)

	(1) OLS		(2) Matched		(3) OLS		(4) Matched	
DIVERSIFY (σ)	**-0.45**	***	**-0.46**	***	**-1.03**	***	**-1.11**	***
	(0.04)		**(0.04)**		**(0.20)**		**(0.22)**	
DIVERSIFY x URBAN	**0.55**	**	**0.57**	***				
	(0.17)		**(0.19)**					
URBAN	**-0.20**	**	**-0.20**	**				
	(0.09)		**(0.10)**					
DIVERSIFY x LOG (1992 POP. DENSITY)					**0.11**	***	**0.11**	***
					(0.03)		**(0.04)**	
LOG(1992 POPULATION DENSITY)					**-0.03**	*	**-0.04**	*
					(0.02)		**(0.02)**	
1992 log(taxicab capital)	-0.03		-0.08	*	-0.03		-0.08	*
	(0.02)		(0.04)		(0.02)		(0.04)	
ΔCounty taxicab ownership rate$_{-i}$	0.06		0.07		0.06		0.08	*
	(0.05)		(0.05)		(0.05)		(0.05)	
Δlog(taxicabs in the county$_{-i}$)	-0.00		-0.00		-0.00		-0.00	
	0.01		(0.02)		0.01		(0.02)	
Δlog (limousines in the county$_{-i}$)	0.01		0.02		0.01		0.01	
	(0.02)		(0.02)		(0.02)		(0.02)	
Δlog (county pop.)	-0.00		-0.00		-0.00		-0.00	
	(0.00)		(0.01)		(0.00)		(0.00)	
Corporation	0.10	**	0.11	**	0.10	**	0.11	**
	(0.05)		(0.05)		(0.05)		(0.05)	
Constant	-0.14	**	-0.14	**	0.04		0.06	
	(0.06)		(0.05)		(0.09)		(0.10)	
R^2	0.18		0.18		0.18		0.18	
N	560		505		560		505	

Standard errors are robust and clustered at the market (county) level
*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Appendix: A Model of Diversification and Outsourcing

This appendix develops a simple analytical framework that illustrates the link between diseconomies of scope, diversification and outsourcing. Suppose there are two lines of business that could be horizontally integrated (M=1) or managed as independent firms (M=0). One line of business has a two-stage production process where downstream activities could be vertically integrated (N=1), or outsourced (N=0). For simplicity, the other line of business is always integrated, so there are two boundary decisions: one "vertical" and the other "horizontal." Joint expected profits are written as $\Pi(M,N)$.

To analyze outsourcing, we define the net benefits of vertical integration as a function of scope $V(M) \equiv \Pi(M,1) - \Pi(M,0)$, and an exogenous fixed costs e_v that is only incurred under vertical integration. The probability of vertical integration is then $\Pr[V(M) > e_v]$, reflecting the Coasian (1937) logic that boundaries are determined by the relative cost of markets and hierarchies.

To analyze diversification, we define scope economies as a function of vertical integration $X(N) \equiv \Pi(1,N) - \Pi(0,N)$. For fixed prices and quantities, $X(N) > 0$ is equivalent to sub-additivity of the cost function; a sufficient condition for mergers to be efficient (Baumol 1977, Evans and Heckman 1984). If diversified firms pay an exogenous fixed cost e_x, the probability of a merger is $\Pr[X(M) > e_x]$.

Many studies treat diversification and outsourcing as independent decisions. That would be true if both V(M) and X(N) were constant, so changes in firm scope have no impact on vertical integration (and vice versa). Figure A.1 illustrates this scenario, where firms cannot move from horizontally focused and vertically integrated (M=0, N=1) to diversified and outsourced (M=1, N=0) without changing both V and X, or (equivalently) e_v and e_x.

When diversification changes the net benefits of vertical integration, we say there are complementarities, defined as $D \equiv X(0) - X(1) = V(0) - V(1)$. When D=0, both X and V must be constant, and we are back to the situation depicted in Figure A.1. When $D < 0$, diversification lowers the returns to outsourcing. We focus on the case where $D > 0$, so the benefits of outsourcing increase following diversification (perhaps because of increased conflicts at a particular stage of the production process, as discussed in the text).

When $D > 0$, there is a straightforward link between diversification and outsourcing. Specifically, since $D > 0$ implies that the net benefits of vertical integration are decreasing in scope, a switch from M=0 to M=1 must lower the probability of vertical integration. Figure A.2 illustrates the choice of firm boundaries when diversification and outsourcing are complements. Note that firms can move directly from horizontally focused and vertically integrated (M=0, N=1) to diversified and outsourced (M=1, N=0) by crossing the diagonal line segment. We can use this simple cost benefit framework to state a more general version of Hypothesis 1. Specifically,

Hypothesis A.1: Diversification (increasing M) causes outsourcing (decreasing N) if and only if they are complements (D>0).

Proof: Diversification causes outsourcing $\Leftrightarrow \Pr[N=0|M=1] > \Pr[N=0|M=0] \Leftrightarrow \Pr[V(1) < e_v] > \Pr[V(0) < e_v] \Leftrightarrow V(0) > V(1)$, since V(M) is independent of $e_v \Leftrightarrow D>0$.

To see the relationship between Hypothesis A.1 and diseconomies of scope, suppose that X(N) can be separated into an upstream piece X^u that does not depend on N, and a downstream part X^d

that does. Further, assume that diversification has no impact on (joint) downstream profits unless there is vertical integration; so that $\Pi^d(0,0) = \Pi^d(1,0)$, or equivalently $X^d(0) = 0$. This implies that $D \equiv X(0) - X(1) = -X^d(1) = \Pi^d(0,1) - \Pi^d(1,1)$, which will be positive if and only if diversification reduces downstream profits under vertical integration. We refer to this reduction in expected profits from merging vertically integrated downstream divisions as diseconomies of scope.

Scope diseconomies are less general than complementarities. In particular, Hypothesis A.1 says that under very weak assumptions (i.e. boundary choices maximize Π) our empirical results imply that diversification and outsourcing are complements. To interpret the same results as evidence of scope diseconomies, somewhat stronger assumptions are required; specifically, X^u does not vary with N and $X^d(0)=0$. Similar assumptions are standard in the empirical literature on buyer-supplier relationships[21] and we argue that they are reasonable in our empirical setting. Moreover, evidence of complementarities may be interesting in its own right (Argyres and Liebeskind 1999).

Since D measures diseconomies of scope (the costs of merging vertically integrated downstream divisions), our second hypothesis can be stated in terms of cost shifters. Suppose Z is an index of task-diversity. In the text, we argue that changing Z has different implications for D under different theories about the source of scope diseconomies. These predictions can be summarized as:

Hypothesis A.2.A: Monitoring cost theories predict that D(Z) is increasing in Z.
Hypothesis A.2.B: Social comparison costs theories predict that D(Z) is decreasing in Z.

Before concluding, we offer two comments. First, Figures A.1 and A.2 highlight the importance of finding exogenous variation in M for our empirical tests. In particular, when the unobserved e_x and e_v are negatively correlated, diversification and outsourcing will be positively correlated, even if M and N enter expected profits independently, as in Figure A.1. Thus, we can only test the hypothesis that D>0 by finding some source of variation in M that is uncorrelated with these unobserved variables, and asking whether that variation also leads to a change in outsourcing.

Second, Milgrom and Roberts (1990) and Athey (1995) have shown how to generalize this simple framework to larger systems with many complementary business practices. Our assumption that D>0 corresponds to their concept of super-modularity, or increasing differences in expected profitability. Unfortunately, more complex models can only deliver sharp predictions when all of the relevant business practices are pair-wise complementary, so the number of assumptions (or interaction terms in an empirical setting) grows very large as one moves toward corporate restructurings that involve many divisions, each with many vertical stages.

Additional appendix references

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[21] For example, to measure transaction costs, one typically assumes that asset specificity changes the costs of contracting without altering the costs of hierarchy.

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Figure A.1: Independent Boundaries (D=0)

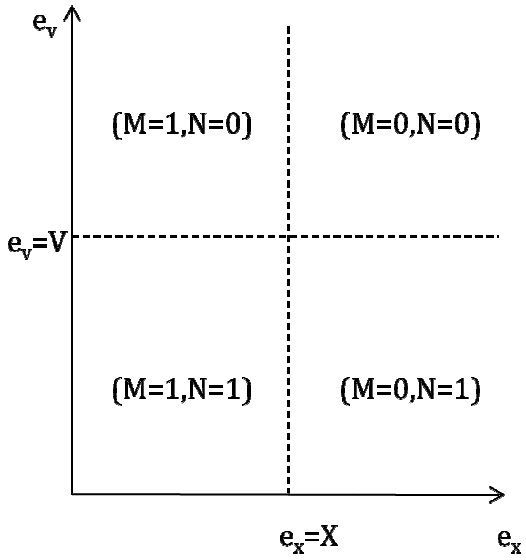

Figure A.2: Complementarities (D>0)