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Abstract

This paper studies how firms reorganize following diversification, proposing that firms use outsourcing, or vertical disintegration, to manage diseconomies of scope. We also consider the origins of scope diseconomies, showing how different underlying mechanisms generate contrasting predictions about the link between within-firm task heterogeneity and the incentive to outsource following diversification. We test these propositions using microdata on taxicab and limousine fleets from the Economic Census. The results show that taxicab firms outsource, by shifting the composition of their fleets toward owner-operator drivers, when they diversify into the limousine business. The magnitude of the shift toward driver ownership is larger in less urban markets, where the tasks performed by taxicab and limousine drivers are more similar. These findings suggest that (1) firms use outsourcing to manage diseconomies of scope at a particular point in the value chain and (2) interagent conflicts can be an important source of scope diseconomies.

Keywords

diversification, diseconomies of scope, adaptation, outsourcing, asset ownership

Disciplines

Business Administration, Management, and Operations

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Diversification, Vertical Contracting and Diseconomies of Scope: Evidence from the Taxicab Industry

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This paper studies how firms reorganize following diversification. We propose that firms use outsourcing, or vertical dis-integration, to reduce scope-induced governance costs that arise following diversification. We also consider the source of scope diseconomies, and argue that different underlying mechanisms generate contrasting predictions about the link between within-firm task heterogeneity and the incentive to outsource following diversification. 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 inter-divisional conflicts are an important source of scope diseconomies 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 sheds some light on these questions by analyzing how firms reorganize to reduce the costs of diversity. Our main finding is that diseconomies of scope cause diversifying firms to outsource formerly integrated activities.

By focusing on reorganization, we depart from an established literature on diversification and performance, which asks whether related expansion 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 underlying factors that link firm scope to governance costs. Our evidence suggests that scope diseconomies are caused by conflicts among agents or divisions, as opposed to the growing costs of corporate bureaucracy.

Our theoretical framework builds on Coase (1937) and Williamson (1975) by assuming 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 increase the cost of governing a particular transaction or activity within the firm. When there are net benefits to diversification, but scope induced internal governance costs exceed the transaction-cost savings that led to *ex ante* vertical integration, firms will diversify and outsource. Figure 1 depicts the over-arching logic: scope diseconomies are caused by transaction or activity-level inefficiencies that lead firms to re-think their vertical boundaries following diversification.

We draw on three broad theories of corporate governance to explain why internal governance costs increase with firm scope. First, diversification may exacerbate monitoring costs that arise from cognitive limitations (Penrose 1959; Schoar 2002) or incomplete information (Holmstrom 1979). Second, 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). Thirdly, diversification may increase influence costs, which arise when divisions engage in wasteful rent-seeking competition (Milgrom 1988; Rajan, Servaes and Zingales 2000), or fail to coordinate because of conflicting incentives (Bresnahan, Greenstein and Henderson 2009, Zhou 2009).

Our first hypothesis predicts that diseconomies of scope create a positive association between horizontal diversification and vertical outsourcing. By diseconomies of scope, we mean that

monitoring, influence and envy costs are greater following diversification. When the marginal costs of diversification are greater under integration than under market or contractual governance, diversification should increase the probability of outsourcing. As in transaction cost analysis, we argue that outsourcing changes governance costs by altering the nature of the supply relationship. In particular, outsourcing replaces monitoring with market incentives and relaxes constraints on managerial attention. By moving employees outside the boundary of the firm, outsourcing limits within-firm heterogeneity in incentives, abilities and rewards, thereby reducing envy and social comparison costs. Finally, by shifting decision rights to a new entity and allowing the market to set prices, outsourcing replaces the influence costs of bureaucratic rent-seeking with the arms-length bargaining and renegotiation costs that attend a contractual relationship.

Our second hypothesis examines contrasting predictions about the mediating effect of task diversity (i.e., variation in physical or intellectual production processes) on the link between diversification and outsourcing. These competing predictions emerge from two broad mechanisms, which we refer to as principal-agent and inter-agent governance problems. Principal-agent problems emphasize conflicts between employees at different levels in a formal hierarchy, while inter-agent theories focus on conflict between peers. Thus, monitoring costs are primarily a principal-agent problem, while social comparison costs are an inter-agent problem. Influence cost models often combine the two mechanisms. For instance, Milgrom (1988) models bureaucratic rent seeking as wasteful inter-agent competition induced by a corporate principal's political authority and lack of information.

Broadly speaking, principal-agent theories predict that the marginal costs of diversification (under vertical integration) are *increasing* in task diversity, since it is harder to monitor and manage more heterogeneous divisions. Thus, conditional on diversification, principal-agent theories predict more outsourcing as functional differences between formerly independent lines of business increase. Inter-agent theories, on the other hand, suggest that scope induced governance

costs are *decreasing* in task diversity. For example, social comparison costs increase when agents in different divisions perform similar tasks but receive different incentives and rewards, leading to feelings of envy (Kulik and Ambrose 1992; Festinger 1954). Inter-divisional conflicts over shared resources should also grow less frequent as tasks become less similar, leading to fewer opportunities for coordination. Thus, conditional on diversification, inter-agent theories predict less outsourcing as functional differences between divisions increase. We test the competing predictions of principal-agent and inter-agent theories by measuring the correlation between diversification and outsourcing under conditions of high and low task diversity.

Our empirical setting is the taxicab and limousine industry.[1] This industry is well suited to study diversification and outsourcing for several reasons. First, entry deregulation in the limousine market led to a wave of diversification during the early 1990s. We use pre-deregulation variation in local market conditions as an instrument for the post-deregulation incentive to diversify. Second, vertical integration, measured in terms of fleet versus driver ownership of taxicabs, exhibits considerable variation both within and between fleets. Third, differences in local market size provide a meaningful measure of task differentiation between taxicabs and limousines. In particular, "hails" are a significant revenue source in urban taxi markets, but are less important in small cities, and cannot be served by limos. We exploit the sharp difference between diversified firms in urban and non-urban environments to measure the mediating effect of task differentiation on the link between diversification and outsourcing. Finally, since 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.

[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. Since we exploit variation across many distinct local markets, this paper could also be thought of as a study of hundreds of similar taxicab and limousine industries.

Our baseline empirical tests show that diversifying firms outsource more intensively than firms that choose to remain focused. 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 owner-operator drivers is less pronounced in markets where there is more task differentiation. Doubling the population density of a local market leads to an 11 percent reduction in outsourcing at a diversified firm—suggesting that inter-agent costs are the primary source of scope diseconomies in our empirical setting. Since we do not measure governance costs directly, our interpretation of these facts rests on a revealed preference argument, i.e. the assumption that firm boundaries reflect the relative costs of alternative governance modes. Nevertheless, we argue that our findings provide strong evidence that diversifying firms outsource in response to diseconomies of scope.

To provide additional context for the statistical results, we interviewed a series of taxicab fleet managers. These managers suggested that diversification into limousines creates substantial efficiencies, particularly in dispatching operations. However, diversifying firms faced considerable operational challenges when combining non-owner taxicab drivers with a more professional group of limousine drivers. The problems ranged from driver suspicion that fleets would steer better rides to limousines, to incidents of ride "scooping" where a taxi driver would race to pick up a customer and create the impression that no limousine had been dispatched. Thus, managers of diversified fleets indicated a preference for contracting with owner-operator taxi drivers, whose skills and backgrounds are closer to a limousine driver's, making them easier to manage and a more appropriate source of spare capacity for the limousine segment. Together with the statistical evidence, our field interviews point towards inter-agent conflicts, and particularly social comparison costs, as the underlying driver of scope diseconomies.

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 the

increased governance costs associated with diversification. 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).[2] Second, we show that inter-agent conflicts in general, and social comparison costs in particular, are an important source of diseconomies of scope, using both qualitative evidence and a novel statistical test for discriminating between alternative sources of scope induced governance costs. 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 have a broader normative interpretation: diseconomies of scope at the transaction or activity level can 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.

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 manage increased governance costs.[3] 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

[2] For a review of the literature on the costs of diversification see Montgomery (1994).
[3] Outsourcing does not imply that payments flow in a particular direction. For example, 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).

scope 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 alleviates increased governance costs created by combining downstream activities. The figure highlights several aspects of our theory. First, the unit of analysis is a group of related transactions or activities, and the objective is to draw a set of boundaries (and 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 links scope diseconomies to both transactions and activities, which are often omitted from studies of diversification and vertical integration respectively.

The mechanism behind Figure 1 is straightforward. If diversification produces a larger increase in governance costs under vertical integration than under market or contractual governance, then the probability of outsourcing should increase. Put differently, diversifying firms will outsource activities that produce large negative spillovers across divisions. This argument is closely related to the familiar logic of transaction cost analysis. Empirical tests of transaction cost economics typically assume that internal governance costs are fixed and look for a positive correlation between outsourcing and asset specificity, or some other factor that increases the relative costs of market governance. We assume the costs of market governance are fixed—or at least uncorrelated with diversification—and interpret a positive correlation between diversification and outsourcing as evidence of increased internal governance costs.[4] This idea can be formalized, as

4 Assuming that the costs of market or contractual governance are fixed with respect to a change in scope is different from assuming that those costs are small. A weaker (but still sufficient) assumption is that the marginal costs of diversification are larger under vertical integration than under outsourcing; though see Gibbons (2005, section 3.2) for a critique of this approach.

we show in the appendix using a simplified version of Milgrom and Roberts's (1990) model of complementarities.[5] 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 costs. The literature on firm governance suggests three different explanations for scope diseconomies: 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

[5] 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 the marginal cost of diversification under market governance is zero, complementarity is formally equivalent to diseconomies of scope.

actions or holds private information.[6] 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 a CEO's authority and lack of commitment power invite lobbying by divisions who hope to skew the rules of the game. While the incomplete-information principal-agent problems described above are often an important component of influence cost models, we place influence costs in a separate category because they emphasize inter-divisional interactions and inefficiencies. In particular, rent-seeking incentives depend on both monitoring costs and the actions taken by agents in 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

[6] Some authors would draw a conceptual distinction between monitoring costs, and problems of moral hazard (hidden action) or adverse selection (hidden information). We group them to highlight the shared emphasis on costly information acquisition by an uninformed principal. While similar informational problems may be a necessary condition in the envy and influence cost models described below, those theories place a greater focus on alternative mechanisms as the main source of governance costs.

operational activities. Bresnahan, Greenstein and Henderson (2009) use detailed case study evidence to argue that influence costs (i.e. conflicts over shared corporate resources) create diseconomies of scope that make it difficult for large incumbents to respond to major technological changes.

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 of inter-agent conflict builds upon research in social psychology (e.g. Festinger 1954; Adams 1965) that describes the origins of individual perceptions of inequity and highlights the importance of endogenous reference groups. Extending this earlier 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. Furthermore, diversification integrates activities where both pay structures and pay levels are distinctly different, which provides fodder for envious feelings. Thus, by combining agents who perform similar tasks but have different compensation systems, incentives and ability levels, diversification can lead to increased envy across divisional lines, and unproductive behavior by disgruntled employees.

We build on theories of monitoring, influence and social comparison costs by linking governance costs to the scope of the firm, and arguing that the marginal costs of diversification are larger under vertical integration than under market or contractual governance. The marginal costs of diversification are lower under outsourcing because vertical dis-integration produces a fundamental change in the nature of governance. 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. By placing buyers and suppliers under separate management, outsourcing also simplifies corporate oversight. Outsourcing 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. 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 increased governance costs associated with diversification 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 beforehand. Our first hypothesis therefore predicts that when diseconomies of scope lead to increased managerial distraction, influence costs or envy, firms will use outsourcing to reduce the overall costs of governing the diversified firm.

HYPOTHESIS 1: *In the presence of diseconomies of scope, horizontal diversification leads to vertical outsourcing.*

Our second hypothesis examines contrasting predictions about the mediating effect of task diversity, or variation in a firm's physical or intellectual production processes. These competing predictions emerge from two broad mechanisms, which we refer to as principal-agent and inter-agent problems. Principal-agent problems focus on conflicts between employees at different levels in a formal hierarchy, while inter-agent problems emphasize conflicts between peers.

Principal-agent problems are rooted in the informational problems and cognitive limitations that prevent a corporate principal from exercising complete control over division-level agents. In

practice, managers often rely on information systems and business processes to extend their span of control. However, the efficacy of shared systems and controls declines with task diversity, since they are often poorly suited to the idiosyncratic needs of a particular agent or division. Thus, when diseconomies of scope are caused by principal-agent problems, the marginal costs of diversification (under vertical integration) will increase with task diversity.

The basic principal agent problem appears in many theories. For example, the managerial distraction hypothesis holds that it is harder to monitor a more heterogeneous portfolio of businesses, and can be viewed as an effort to explain the costs of conglomerate diversification, which represents an extreme case of task diversity (Penrose 1959; Schoar 2002). Monitoring cost theories grounded in hidden action problems will generate the same prediction if one assumes that increasing task diversity leads to weaker signals of division-level performance (Holmstrom 1979, 1982). Similarly, since task diversity places corporate managers at an informational disadvantage, it may increase division managers' rent-seeking incentives in a model of influence costs. All of these examples focus on interactions between a corporate principal and a division-level agent, and stipulate that a principal's job grows more difficult as agent-level task diversity increases.

Inter-agent problems arise from conflicts between agents over firm policies, such as compensation, promotion, transfer pricing, or access to shared resources. If perceptions of inequity or resource congestion increase with operational similarity, then governance costs created by inter-agent problems will rise along with task diversity. In some cases, firms can address the issue through a change in corporate policy. However, they will be reluctant to address inequities through a large pay increase for one group of employees, or if there are large differences in the marginal product of seemingly similar tasks performed in different divisions. Moreover, conflicts over inherently scarce resources (e.g. top management positions) may be very hard to resolve.

Inter-agent problems arise in a variety of theories. Consider envy costs. If fully dissimilar tasks are rarely viewed as salient references, then increasing task differentiation should reduce 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). To the extent that lower task differentiation increases spatial proximity by narrowing the range of social differences and ability levels, while integration increases worker interaction and availability of information, social comparisons will naturally be more salient among employees who perform similar tasks within the same firm. (Thus, for example, we might expect more enmity between investment and commercial bankers who both underwrite corporate debt, than between a sales force with strong incentives and the employees of a manufacturing division.) Influence cost models also contain inter-agent problems. For example, increasing task diversity may reduce the importance of inter-divisional resource sharing or the efficacy of relative performance evaluation, thereby reducing the incentives to play organizational politics.

To summarize, inter-agent problems make 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), or conflicts over access to shared corporate resources. By mitigating inter-agent problems, increased task diversity can reduce the marginal cost of a change in scope (under vertical integration), and therefore weaken the link between diversification and outsourcing.

Since the principal-agent and inter-agent mechanisms generate opposing predictions, we test their relative strength as a pair of competing hypotheses.

HYPOTHESIS 2

H2A: *When diseconomies of scope are caused by principal-agent conflicts, the impact of diversification on outsourcing will increase with task differentiation.*

H2B: *When diseconomies of scope are caused by inter-agent conflicts, the impact of diversification on outsourcing will decrease with task differentiation.*

If the correlation between diversification and outsourcing is stronger when task differentiation is high, the evidence suggests that principal-agent problems are the primary cause of scope diseconomies. If the link between diversification and outsourcing is stronger when task differentiation is low, the evidence points towards inter-agent problems.

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, diversifying firms might adapt their organization in a variety of ways, 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. To address inter-agent conflicts, firms might redesign their promotion and compensation policies. Rather than work towards an omnibus theory that predicts when and how much each component of a firm's internal governance structure will respond to diversification, we focus on a single margin—outsourcing—and seek an appropriate setting to test our hypotheses.

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, often leading to different compensation arrangements by vehicle type. We argue that task diversity is higher for diversified fleets in dense urban markets, where taxicabs earn a greater share of revenue from hails, as opposed to pre-arranged trips. 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 driver 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. [7]

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, 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 major reason for 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 conflict between drivers. Moreover, owner

[7] 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.

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 inter-agent conflicts that arise due to envious feelings between taxicab drivers 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).[8] The 1992 and 1997 Economic Censuses contain 1,020 and 1,106 fleets, respectively, that meet these criteria.[9] 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.[10]

[8] Alternative samples did not change the results presented below.
[9] We discard very small establishments that the Census imputes values for, rather than surveying directly.
[10] Alternative measures, such as a threshold for the percentage of total revenue or capital in the limousine segment, yielded very similar results.

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, partly in response to increased competition following entry deregulation in the limousine segment.[11] Our theory predicts that these owner-operators will 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.

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 street-hails account for a substantial share of all taxi-related revenue, taxicabs and limousines follow different processes to locate and service rides. In particular, limousines are always dispatched to pre-arranged rides while taxicabs frequently locate spot market rides by cruising or by queuing in taxicab stands. In less urban markets, where most rides are dispatched through the same central switchboard, task differentiation between the taxicab and limousine segments is low: limousines are essentially taxicabs painted black. We exploit this empirical regularity to construct two proxies for task differentiation between taxicabs and limousines. First, we use the log of 1992 county population per square mile (*DENSITY*) as a continuous measure of task differentiation. Second, we construct an easy-to-interpret indicator variable (*URBAN*) that equals one for fleets located in counties with population density above 4,000 people per square mile.[12]

[11] Independent drivers are only captured by the Economic Census when they contract with a fleet.
[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).

5. Empirical Strategy

Our baseline specification is a simple linear 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 Δ*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.[13] 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-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

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

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.[14] 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 propensity score $Prob(DIVERSIFY_i = 1 | X_i)$. We then drop all fleets that do not fall on the common support of the estimated propensity score distribution, and weight 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

[14] Our instrumental variables identification strategy would not be valid if *ex ante* limousine concentration were correlated with factors that influence 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.

influence of non-comparable control and treatment group observations that are off the common support of the estimated propensity score distribution.[15]

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) $\Delta FLEETOWN_i = \alpha + \beta_1 DIVERSIFY_i + \beta_2 DENSITY_i + \beta_3 (DIVERSIFY_i \text{ x } DENSITY_i) + X_i \delta + \varepsilon_i$.

For ease of interpretation, and to ensure that our results are not driven by outliers in the *DENSITY* distribution, we also estimate an alternative specification where *DENSITY* is replaced with the binary measure *URBAN*.

The potential endogeneity of *DIVERSIFY* remains our key identification concern in model (2). Fortunately, our proxies for task differentiation, *DENSITY* and *URBAN,* are exogenous to the dependent variable *ΔFLEETOWN*, in that they are not choice variables: firms choose where to locate before learning that the possibility of diversification exists. Moreover, 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. Thus,

[15] 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*.

time-invariant firm or market level factors that might be correlated with outsourcing are absorbed by first-differencing, and the main effect of density (β_2) controls for any difference in outsourcing trends between urban and non-urban markets from 1992 to 1997. In principle, we could instrument for the interaction term by interacting *DENSITY* with *CONCENTRATION*, but this approach performed poorly in practice. Since we fail to reject null hypothesis that *DIVERSIFY* is exogenous in model (1), our estimates of model (2) are based on a simple linear regression.

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.[16]

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 *DIVERSIFY* by using *CONCENTRATION* as an instrumental variable. 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 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 strongly suggest that firms outsource to avoid the scope-induced governance costs associated with diversification.

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 principal-agent problems, while a positive coefficient would point towards inter-agent problems.

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 at the 5 percent confidence level. Thus, we find that diversifying fleets are more likely

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

to outsource if they operate in non-urban markets, where task differentiation between taxicabs and limousines is low.

Column 3 in Table 4 replaces the discrete measure *URBAN* with the continuous measure *DENSITY*, and finds similar results: doubling population density leads to an 11 percent increase in the impact of diversification on outsourcing.[17] The models in columns 2 and 4 use propensity score matching to control for *ex ante* observable differences between diversifiers and firms that remain focused. This also has little effect on the parameter estimates.

Overall, the results in Table 4 suggest that taxicab fleets outsource in response to inter-agent problems that lead to a positive correlation between task diversity and the marginal costs of diversification.[18] 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 principal-agent and inter-agent drivers of internal governance costs. 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

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

supports our contention that diversification leads to outsourcing in the presence of diseconomies of scope. Consistent with the idea that outsourcing helps alleviate inter-agent conflict, 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 taxicab fleet managers also suggest that envy-based conflicts are in important source of scope diseconomies in this industry.

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 firms' vertical boundaries respond to scope induced internal governance costs. Our findings also suggest that firms' horizontal and vertical boundaries are jointly determined (Argyres and Liebeskind 1999). While other studies have measured transactional interdependencies across vertical supply relationships (Novak and Stern 2007; Forbes and Lederman 2009), 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 increased governance costs that arise due to diseconomies of scope.

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Figure 1: Diversification and Outsourcing

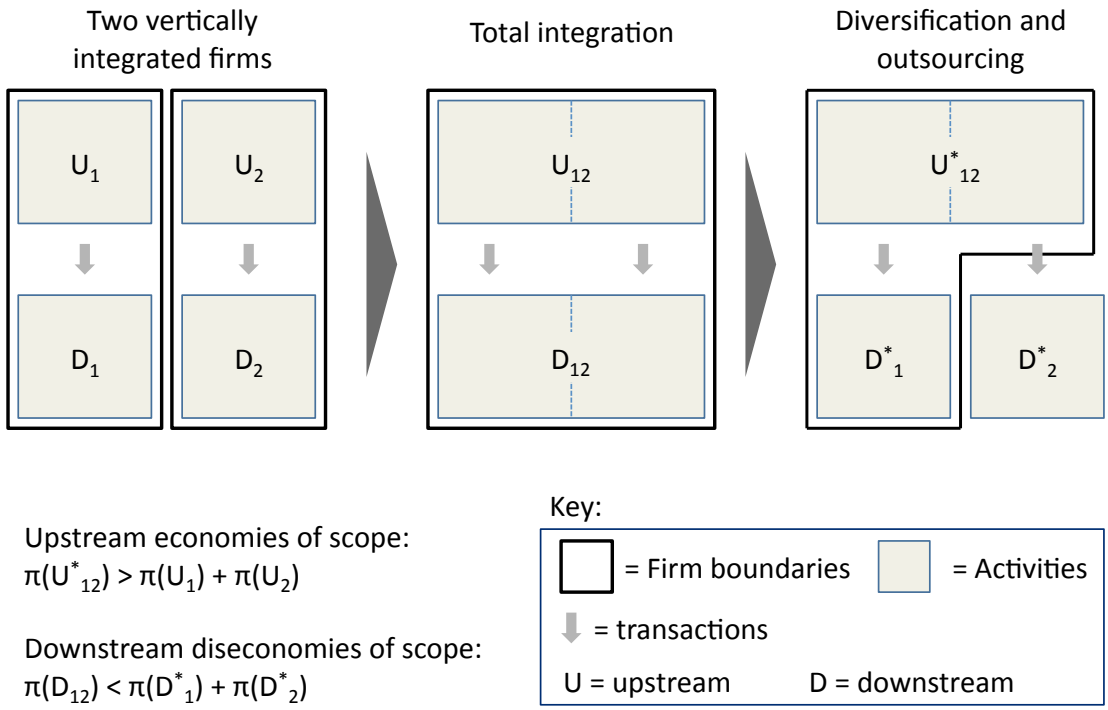

Figure 2: Diversification and asset ownership *(FLEETOWN)* by firm size

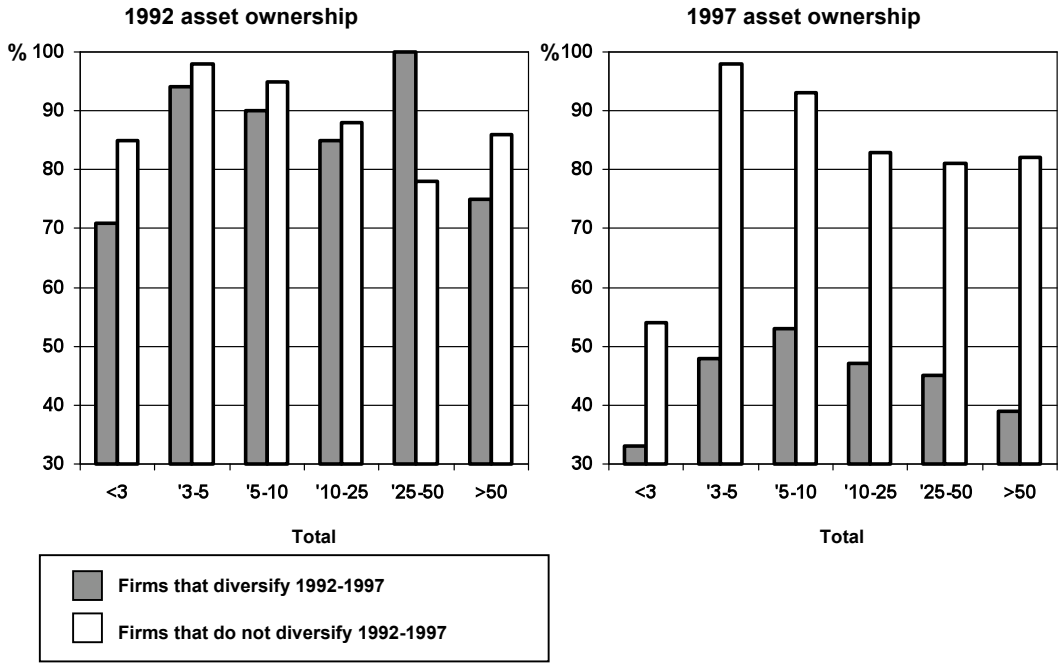

Figure 3: Diversification and asset ownership *(FLEETOWN)* by urban vs. non-urban

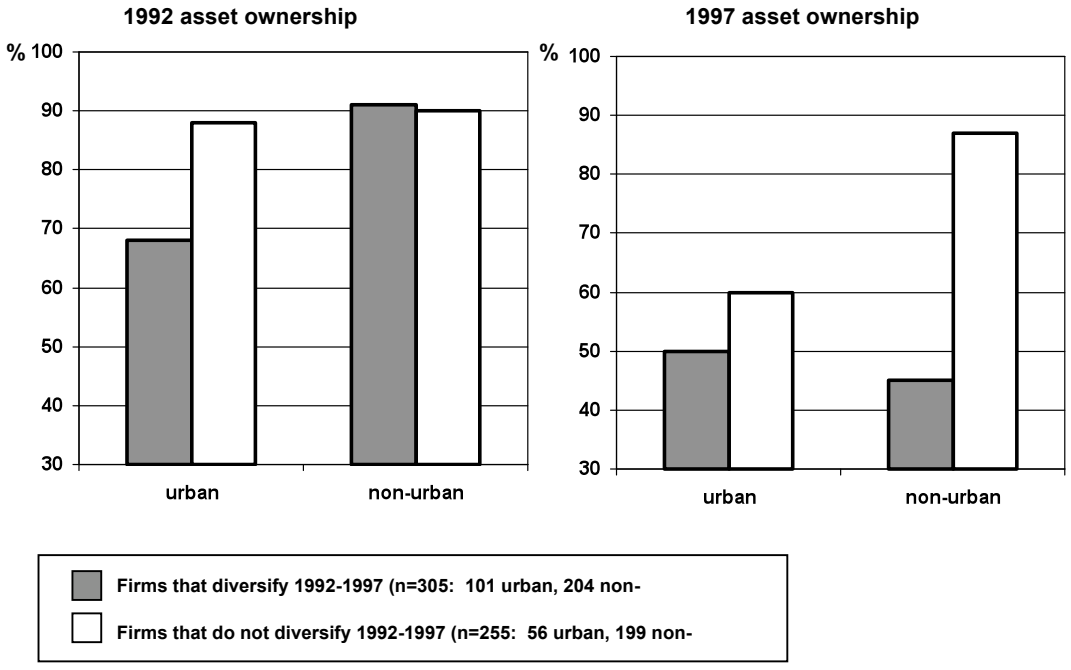

Table 1 – Descriptive statistics

	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

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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

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

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 $V(M)\Pi(M,1) - \Pi(M,0)$, and an exogenous fixed cost 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 $X(N)$ $\Pi(1,N) - \Pi(0,N)$. 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 $DX(0) - X(1) = V(0) - V(1)$. 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[19] 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 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: Principal agent problems lead to D(Z) increasing in Z.
Hypothesis A.2.B: Inter-agent problems lead to D(Z) 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 cost-benefit 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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Evans, D.S., J.J. Heckman. 1984. A Test for Subadditivity of the Cost Function with an Application to the Bell System. *American Economic Review* **74**(4) 615-623.

[19] 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)

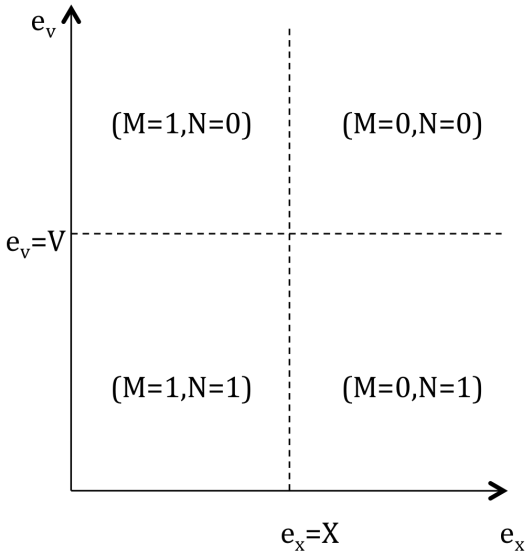

Figure A.2: Complementarities (D>0)