FIRMS' BOUNDARIES AND THE DIVISION OF LABOR: EMPIRICAL STRATEGIES

Luis Garicano
University of Chicago GSB, CEPR

Thomas N. Hubbard
University of Chicago GSB, NBER

Abstract
A large theoretical literature focuses on the question: What determines firms' boundaries? Recently, Garicano and Santos and Holmstrom and Milgrom have proposed theories in which firms' boundaries reflect the division of labor across individuals. This paper discusses strategies for generating and testing empirical propositions from this emerging class of theories. We propose that variation in the returns to specialization is extremely useful to test and quantify the effect of the division of labor on firms' boundaries. We discuss the use of two shifters to the returns to specialization, and relate how we exploit one of these, market size, in preliminary work on the determinants of law firms' boundaries in the United States. (JEL: L14, L22, L24, L84)

1. Introduction

A large theoretical literature focuses on the question: what determines firms' boundaries? One branch of this literature proposes that firms' boundaries reflect organizational responses to incentive problems associated with specific investments in physical or human capital (Grossman and Hart 1986; Klein, Crawford, and Alchian 1978; Williamson 1979). Much of the existing empirical literature on firms' boundaries tests propositions derived from this branch of theory. Researchers have found evidence consistent with these propositions in a wide variety of procurement contexts.

More recently, some theorists have proposed that firms' boundaries reflect the division of labor across individuals (Garicano and Santos 2002; Holmstrom and Milgrom 1994). Whether a set of tasks is organized within one or multiple firms depends on the extent to which individuals specialize. While the particular trade-offs these theories emphasize differ from each other, together they represent a departure from the earlier literature: there is far less emphasis on specificity and far greater emphasis on issues related to the division of labor such as specialization and job design. This class of theories is important because it has the potential to explain firms' boundaries in a wide range of contexts where specificity is unlikely to have an important effect on individuals' incentives.

E-mail addresses: Garicano: garicano@gsb.uchicago.edu; Hubbard: thomas.hubbard@gsb.uchicago.edu

This paper discusses strategies with respect to generating and testing empirical propositions from this emerging class of theories. We propose that a source of variation not explicitly present in Garicano and Santos' (2002) and Holmstrom and Milgrom's (1994) models, variation in the returns to specialization, is extremely useful with respect to testing general propositions from these theories, and in some circumstances can allow researchers to quantify the effect of the division of labor on firms' boundaries. It can help researchers assess not only how and why the division of labor might affect firms' boundaries, but how much it does as well. We then discuss the use of two shifters of the returns to specialization—market size, and the extent to which tasks can be automated—and relate how we exploit the first of these in some preliminary work on the determinants of law firms' boundaries in the United States.

2. Firms' Boundaries, Specialization, and Job Design

Garicano and Santos (2002) propose that firms' boundaries—defined as the scope of revenue-sharing arrangements across individuals—reflect trade-offs associated with "referral problems," problems of matching economic opportunities to individuals efficiently. The idea is that individuals with specialized skills sometimes have private information about economic opportunities for which others have a comparative advantage in exploiting. This can happen, for example, when a client with a legal problem involving corporate law approaches a tax lawyer. Incentive problems arise because private information about such opportunities is valuable, and transferring them involves adverse selection problems. As a consequence, too few opportunities may be transferred: individuals may hold onto opportunities that they do not have a comparative advantage in exploiting. Garicano and Santos (2002) demonstrate that arrangements in which individuals agree to share the revenues from all opportunities they encounter, regardless of who exploits them, mitigate this problem. In this view, the benefit of transacting within firms is that it improves the exchange of referrals. It follows that this benefit tends to be higher when individuals are more specialized, because the gains from trade associated with referrals between specialists tend to be larger than those between generalists.

In contrast, Holmstrom and Milgrom (1994) propose that firms' boundaries reflect trade-offs associated with "multitasking" problems, problems associated with inducing individuals to allocate effort across tasks efficiently. If incentive instruments are imperfect, giving individuals strong incentives—for example by giving them ownership of physical assets—may lead them to allocate their effort across tasks inefficiently. It follows that if the allocation of effort is important, weak but balanced incentives may be preferable to strong but unbalanced incentives. It may therefore be optimal to deny individuals ownership rights, thereby making them employees rather than independent contractors, because this would better support complex job designs in which individuals have

multiple responsibilities. As a consequence, firms' boundaries—here defined in terms of asset ownership—are interrelated with how tasks are allocated across individuals.

3. Empirical Strategies

Both of these theories emphasize relationships between the division of labor and firms' boundaries, though they use different terms ("specialization" and "job design," respectively) to depict the former. They also share the feature, elaborated upon in Holmstrom (1999), that the benefit of transacting within firms is that it weakens individuals' incentives.

But because both the trade-offs and definition of firms' boundaries differ between these two models, so does the relationship between the division of labor and firms' boundaries. Holmstrom and Milgrom's theory implies that narrowing the scope of individuals' responsibilities tends to make it more valuable to provide them strong incentives through asset ownership: specialization tends to lead transactions to be mediated by markets rather than within firms. In contrast, Garicano and Santos' theory implies the opposite: referrals should become more valuable as individuals specialize; thus, specialization should tend to lead transactions to be mediated within firms rather than markets.

Combined, the potential importance of this class of theories and the differences in propositions generated by theories within this class implies high returns to empirical evidence. Such evidence would help researchers understand a series of related issues, including:

- Are firms' boundaries related to the allocation of tasks among individuals?
- If so, how, and why does this relation vary across contexts?
- How much does the division of labor affect firms' boundaries? Where and why is its effect important?

3.1 Proposition Testing

While both theories stress relationships between the division of labor and firms' boundaries, testing the propositions that follow from the theorists' specific models can be difficult because the parameters of the models do not always closely correspond to variables that are both observable and are otherwise empirically unrelated to organizational form.

Consider first Garicano and Santos' model. These authors model a situation where individuals differ in their skills—individuals' specializations are given—and compare welfare under spot contracting and ex ante revenue sharing arrangements. They show that the relative benefit of transacting within a firm varies with such factors as the quality of the opportunities individuals confront

and the direction of information flows. Directly testing predictions involving such factors is clearly difficult. First, these factors are difficult to observe (or proxy for). Variables that correspond closely to these may not be part of existing data sets. Second, although these factors are treated as exogenous in the model, in many cases they may be empirically endogenous. For example, the direction of information flows is related to which individual is likely to encounter opportunities first, something that can be influenced by organizational decisions. An implication of Garicano and Santos' theory is that ex ante revenue sharing arrangements are not the only responses to the referral problem: agents may instead do things that change the direction of information flows. If so, relationships between information flows and organizational form may not provide strong evidence regarding the model's predictions.

Similar issues arise with respect to Holmstrom and Milgrom's (1994) model. In the model, there is a principal and an agent, and the agent is assumed to have a given set of tasks across which he or she allocates effort. The model concentrates on how the strength of incentives with respect to these tasks (and thus firms' boundaries, since one of the incentive instruments is asset ownership) varies with the marginal productivity of effort and cost of monitoring with respect to each of the tasks, particularly the latter. The problems associated with testing this model directly are similar to above. Monitoring costs can be difficult to observe, although as Baker and Hubbard (2001) emphasize there are some cases where technological or legal differences in the contracting environment provide a useful source of variation empirically. However, even in these cases, empirical researchers must address the issue of whether this variation is econometrically exogenous. For example, adoption of monitoring technologies is unlikely to be random, an issue that Baker and Hubbard (2002a, 2002b) confront in their work on asset ownership and contracting in the U.S. trucking industry.

We explore here an alternative approach to testing the implications of these theories that circumvents these difficulties. The basic argument behind this approach is straightforward: if these theories are a correct description of organizational design, then it follows that exogenous shifters of the division of labor must affect firm boundaries. This approach thus relies on a different source of variation in the data from the ones explicitly considered in the models: differences in the returns to specialization (and the resulting division of labor) across particular markets or activities.

Concentrating on the relationship between the division of labor and the scope of the firm may be particularly fruitful because although the division of labor is endogenous, there are several candidate factors that shift the returns to specialization in an observable manner. Furthermore, in some cases these factors are less likely to be econometrically endogenous than the sources of variation described before, and thus can be applied both to test theoretical propositions and to quantify the effect of the division of labor on firms' boundaries.

3.2 Market Size, Returns to Specialization, and Firms' Boundaries

One of the oldest ideas in economics, attributed to Adam Smith, is that the returns to specialization increase with market size. The reason, emphasized by Rosen (1983), is that learning involves fixed costs that are independent of its subsequent utilization. Individuals in large markets have stronger incentives to specialize than in smaller markets because they can utilize a particular set of knowledge more intensively when demand is higher. Market size, the size of demand for a particular skill or service, is hence a useful source of variation for the returns to specialization. One can exploit this source of variation in industries comprised of many local markets, especially in circumstances where the extent of local markets can be plausibly proxied for with population (in consumer markets) or the employment or output of firms demanding the service.

Whether this source of variation is useful depends on whether it is econometrically exogenous—in this case, whether the relationship between market size and firms' boundaries reflects something other than variation in the division of labor.

One possibility is that the distribution of demands could differ with market size, and this in turn could affect firms' boundaries. For example, suppose that in small markets, individual demanders demand a narrow range of services but in larger markets they demand a broader range of services. Firms' scope may be broader in larger markets, reflecting demand characteristics, even if there was no difference in the range of services any particular individual supplied. Relationships between firms' boundaries and market size would then exist, but not only reflect relationships between the division of labor and firms' boundaries, but also between the distribution of demand and firms' boundaries. They would thus not provide strong evidence with respect to the theories described before.

It is thus important for researchers exploiting this source of variation to carefully control for differences in the distribution of demands. Fundamentally, the "experiment in the data" should be one of *replication:* consider two markets with the same distribution of demands but of different sizes. How do the specialization patterns and firms' boundaries differ? That is, the useful variation in the data corresponds to rotations rather than shifts in the demand for labor.

In Garicano and Hubbard (2002), we exploit this source of variation to examine the determinants of law firms' boundaries and test propositions derived from Garicano and Santos (2002). Our study uses detailed data collected by the United States Bureau of the Census on 26,151 law offices from 23,465 law firms in 1992. The data contain information on the specialization of the individual lawyers that work in each of these offices: how many lawyers within the office work primarily in the field of corporate law, tax law, probate and estate law, and ten other specialties. The data also report the number of lawyers that do not specialize in a single field ("general practitioners"). These data thus provide firm-level information on (a) size, in terms of number of lawyers, (b) the specialization of lawyers, and (c) the specialization of firms. With respect to the

latter, we define firms as specialized if every lawyer in the firm specializes in the same field: for example, if all lawyers in the firm specialize in tax law.

We examine two empirical relationships. One is the relationship between local market size—defined as total employment in the county in which the law office is located—and the share of individual lawyers at the law office who specialize: that is, between market size and lawyer specialization.[1] The other is the relationship between local market size and the share of lawyers who work at a specialized firm: that is, between market size and firm specialization. In doing so, we account carefully for cross-market differences in the distribution of demand for legal services by controlling for differences in the size and sectoral distribution of firms in the county.

Combined, these two relationships shed light on Garicano and Santos' theory. This theory predicts that when referrals are valuable, specialization should take place within the firm rather than in the market. Thus, the share of lawyers working at field-specialized firms should not increase with market size, even if the share of lawyers who specialize does. In contrast, when referrals are not valuable, markets rather than firms should mediate specialization: the share of lawyers working at a specialized firm should increase with market size more than in situations where referrals are valuable. Increases in market size increase the returns to specialization at the individual level, but this should lead to a greater increase in firm-level specialization when referrals are not valuable than when they are.

Our evidence is consistent with this proposition. Individual lawyers specialize more in larger than smaller markets. But whether specialization takes place within or between firms differs with clients' ability to "self-refer." We propose that clients can more easily identify the range of expertise they require when they are faced with problems with existing contracts than when initially structuring contractual arrangements. As a consequence, cross-field referrals tend to be less valuable when clients' demands concern "ex post" fields such as negligence or insurance law than "ex ante" fields such as corporate, real estate, or tax law. We find that both lawyers and firms specialize more in "ex post" fields as market size increases: lawyers specialize more in these fields, and relationships between them and specialists in other fields tend to be mediated by markets rather than firms. In contrast, while the specialization of lawyers in "ex ante" fields increases with market size, the specialization of firms in these fields does not: lawyers specialize more in these fields, but relationships between them and lawyers in other fields is mediated by firms rather than markets.

Above we emphasized the importance and difficulty of obtaining econometrically exogenous sources of variation. In our context, market size is econo-

1. This preliminary evidence thus examines the boundaries of law offices rather than law firms. Future versions will better deal with the issue of multioffice law firms. We do not expect that our main results will change, since about 98 percent of law firms in the United States consist of a single office, and the patterns we observe do not change when excluding offices that are part of multioffice firms.

metrically exogenous if it does not directly affect firms' boundaries (or effectively proxy for an omitted variable that does so). In making a case for this in the context of "replication strategies," it is useful to appeal to two broad views that are maintained in much of the recent organizational literature and are particularly compelling in our context. One is that *firms' boundaries are a contractual rather than a technological issue.* This view is especially compelling in contexts such as law where the sources of increasing returns are related to human rather than physical capital, and thus any firm-level scale economies are contractual. If so, market size is unlikely to directly affect firms' boundaries, because merely changing market size is unlikely to directly affect the contracting environment. The second view is that *demands exist for goods (or services), but not for firms per se.* If so, this rules out explanations in which different-sized firms appear in different-sized markets for purely demand-side reasons ("all else equal, firms in large markets prefer large firms"). This view is particularly compelling in law, where to a first approximation, firm-level demand amounts to the aggregation of demands for the individual partners' services.

Assuming that these conditions hold and market size is in fact econometrically exogenous, our preliminary evidence also indicates how much the division of labor across individuals affects firms' boundaries. For "ex ante" fields, we find no evidence that it has an effect. In contrast, we find an effect for "ex post" fields; as lawyers specialize in "ex post" fields, they tend to spin off into specialized firms. The magnitude of our estimates suggests that it leads to such spin offs slightly over one-half of the time.

3.3 Other Sources of Variation

"Replication experiments" are not the only possible sources of variation in the returns to specialization. Sometimes the benefits from multitasking (the inverse of specialization) are limited by factors that are exogenous in the short-run. An example of this arises in trucking. As Baker and Hubbard (2002b) explain, a central organizational issue in trucking is whether truck drivers should handle cargo upon delivery as well as drive trucks. But in some cases, the benefits of multitasking are zero. Some cargo such as grain and ores need no handling upon delivery, because they can be dumped out the back or bottom of the truck where recipients want them. In contrast, the benefits are potentially positive for other classes of cargo, such as packaged goods. The returns to specialization thus vary exogenously with the physical properties of the cargo, and this provides a useful source of variation in examining firms' boundaries. These authors exploit this in testing propositions from Holmstrom and Milgrom (1994).

The use of objects' physical characteristics as sources of variation for the returns to specialization at first may seem limited to very few circumstances. But the example suggests analogous sources of variation applicable to a much wider range of contexts. One way to interpret the example is in terms of automation:

the delivery of bulk goods can be "automated" but that of packaged goods cannot. This reinterpretation suggests that comparing circumstances where necessary tasks are easy and hard to automate would provide a similar source of variation in the returns to specialization. For example, some services involve a combination of diagnostic work and problem-solving. In some contexts, technological change has led diagnostic work to become more automated: for example, computers can assess problems associated with electronically controlled automobile engines, but not nonelectronically controlled engines. This variation affects the returns to multitasking (or specialization), and thus can enable researchers to examine how the division of labor affects auto repair firms' boundaries.

References

Baker, G. and T. N. Hubbard (2001). "Empirical Strategies in Contract Economics: Information and the Boundary of the Firm." *American Economic Review,* 91, pp. 189–194.

Baker, G. and T. N. Hubbard (2002a). "Contractibility and Asset Ownership: On-Board Computers and Governance in U.S. Trucking," mimeo.

Baker, G. and T. N. Hubbard (2002b). "Make Versus Buy in Trucking: Asset Ownership, Job Design, and Information," mimeo.

Garicano, L. and T. N. Hubbard (2002). "Specialization, Firms, and Markets: The Division of Labor Within and Between Law Firms," mimeo.

Garicano, L. and J. Santos (2002). "Referrals," mimeo.

Grossman, S. and O. Hart (1986). "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." *Journal of Political Economy,* 94, pp. 691–719.

Holmstrom, B. (1999). "The Firm as a Subeconomy." *Journal of Law, Economics, and Organization,* 15, pp. 74–102.

Holmstrom, B. and P. Milgrom (1994). "The Firm as an Incentive System." *American Economic Review,* 84, pp. 972–991.

Klein, B., R. G. Crawford, and A. A. Alchian (1978). "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process." *Journal of Law and Economics,* 21, pp. 297–326.

Rosen, S. (1983). "Specialization and Human Capital." *Journal of Labor Economics,* 1, pp. 43–49.

Williamson, O. E. (1979). "Transaction-Cost Economics: The Governance of Contractual Relations." *Journal of Law and Economics,* 22, pp. 233–261.