THE SIZE OF MARKETS AND THE SCOPE OF FIRMS

by

Birger Wernerfelt*

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* MIT Sloan School of Management, Cambridge, MA 02142, bwerner@mit.edu. This paper was started while the author visited the Department of Economics at the University of Copenhagen, whose hospitality is gratefully acknowledged. It reflects discussions with Tore Ellingsen, Bob Gibbons, Oliver Hart, Patrick Legros, Heikki Rantakari, Michael Rauh, John Roberts, and Steve Tadelis, as well as comments by seminar audiences at the 2015 AEA meetings, Berkeley, Chicago, CBS, Harvard, Imperial College, IIOC, MIT, NBER, Stockholm School of Economics, Toronto, and the University of Copenhagen. The usual disclaimer applies.

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Abstract

We contrast transactions in markets with those in firms and characterize the optimal numbers in each. Governance structures appear as equilibria and are compared in terms of production costs - determined by a tradeoff between specialization and adaptation, - and bargaining costs. Under natural conditions, employment or local markets weakly dominate all other equilibria. As local markets become smaller, the parties are better adapted to each other, but bargaining costs make it inefficient to be very small. As firms become larger, gains from specialization come at the cost of increasingly poor adaptation, ultimately bounding their scope.

I. INTRODUCTION

While we normally think of the size of markets and the scope of firms as unrelated questions, we formulate a very simple model in which firms and markets of different sizes appear as equilibria.

To get an intuitive sense of the argument, we will highlight the two key assumptions and their implications. First, we assume that there are advantages of specialization in two dimensions: If the same service is provided to many businesses or if many different services are provided to the same business. Suppose that a business needs a worker for a specific service. (For example, an apartment building wants to have a bannister fixed.) As in Adam Smith, the worker could be a service specialist (a carpenter) who enjoys efficiencies from focusing on a single service. However, the worker could also be someone who in the past has provided other services to the same business (a superintendent). Such a worker will know the preferences of the business, where things are, who to ask for clarification, etc. Note now that advantages of specialization and costs of adaptation are two sides of the same coin: Gains from specialization could be seen as costs of switching between different services or businesses. If some switches are more expensive than others, we can define a measure of distances between pairs of services and businesses. In particular, a worker who switches to nearby businesses will still preserve some of the benefits of specialization. This in turn creates incentives for entrepreneurs to expand their operations into several “related” businesses until the costs of adaptation become too large.

Second, due to various types of bargaining costs, including strategic misrepresentations, very small markets will be less efficient.[1] This means that it may be worthwhile to expand a market to include some more alternatives as long as they are close in terms of the above-mentioned distance measures. (For example, the above mentioned apartment building will probably not confine attention to the geographically closest carpenter but instead compare prices for several located in the same general area, but not any from very far away.) This allows us to build a theory of optimal market size.

We start by looking at a base model in which each entrepreneur can use at most one worker per period, thus holding the scope of the firm constant. Echoing Wernerfelt (2015), we first justify the focus on firms and markets by showing the existence of conditions under which two classes

[1] The limit of this is bilateral bargaining as originally discussed in Coase (1937).

of equilibria, suggestively labeled as "Employment" and the "Local Market", weakly dominate a large class of alternatives. (1) In the "Employment" equilibrium, an entrepreneur-worker pair agrees once-and-for-all on all components of a trading relationship. So there is only one round of bargaining, but since the worker has to be ready to perform many very different services, his way of doing things may fit some of them rather badly. (2.1) In the "Global Market" equilibrium, entrepreneurs trade with service-specialists who can meet their needs at low costs. The Global Market functions without bargaining costs, but a since workers have to be ready to serve all different entrepreneurs, they may be quite poorly adapted to some of them. (2.2) This then suggests that smaller groups of workers and businesses, who in the appropriate sense are close to each other, form their own submarkets. In our first main result, we characterize the optimal size of these "Local Markets" and discuss its determinants. Proceeding to our second main result, we then allow each entrepreneur to enter more businesses and characterize the optimal scope of the firm.

Some Related Literature – The Size of Markets. The force in favor of smaller markets; that some trades can be consummated more cheaply than others, is neither controversial, nor deep. Different literatures look at different frictions including transportation costs, tariffs, and heterogeneous tastes, but these all have the same effect. The profession has a more complicated relationship with the opposing force; that smaller markets are less efficient. It is widely believed to be true, but specific reasons tend to be controversial. In the extreme case with one buyer-seller pair, mentions of bargaining costs often raise red flags amid requests for micro-foundations. We have several such foundations, but they tend to be narrow. Myerson and Satterthwaite (1983) identify inefficiencies under two-sided incomplete information (see also Matouschek, 2004), Hart and Moore (2008) focus on ex post inefficiencies under some mildly non-standard assumptions, Bajari and Tadelis (2001) write about contracting costs, and Wernerfelt (2015) look at ex ante attempts to learn the private information of opponents. While each of these effects no doubt plays a role in some cases, none of them capture what perhaps is the main effect; the fact that many people simply do not like to bargain.

Although it seems reasonable to conjecture that part of the inefficiencies associated with two-sided bargaining will persist in larger but still small markets, there is little literature to this effect. Rustichini, Satterthwaite, and Williams (1994) show how the inefficiencies from Myerson-

Satterthwaite (1983) shrink as the number of players grows, and Hubbard (2001) provides another theory and supporting data. In the present paper we simply postulate a reduced form expression for small market inefficiencies without specifying the underlying causes.

Some Related Literature – Theory of the Firm. The theory of the firm used in the present paper is based on Wernerfelt (1997, 2015). The former paper contains the first proposal that sub-additive "communication"-cum-bargaining costs can be used to motivate the use of employees vs. contractors. The basic idea is that employment contracts give the "boss" the right to demand any one of a large set of services without further negotiation, much as in Simon (1951). So the agreement covers a lot of possible services but is postulated to be less than proportionately costly to negotiate. On the other hand, the parties can defer some bargaining costs by engaging in item-by-item negotiations on an "as needed" basis. This then leads to the prediction is that employees are used when needs change more frequently.

This concept of the firm differs from the Grossman-Hats-Moore Property Rights Theory in at least two ways. First, our argument treats vertical and horizontal integration as driven by two different forces. The model defines the firm by the employment relationship and one firm is part of another if one top-manager is an employee of the other. The prediction is then that the attractiveness of vertical integration depends on the frequency with which needs change and the relative advantages of business- and service-specialization. Second, the role of asset ownership is different. The present analysis does not depend on assets or holdup, but the nature of the employment relationship has direct implications for asset ownership. Specifically, one could argue that the boss should own most productive assets since his decisions typically are the main determinant of their rates of depreciation.[2]

Some Related Literature – Scope of the Firm. The present paper links some strands of the modern literature on the theory of the firm to the classical literature on the division of labor. The former literature has considered the effects of specialization and indivisibilities (Smith, 1965; Stigler, 1951; Rosen, 1978, 1983), and Becker and Murphy (1992) introduce the idea that firms expand to take advantage of gains from specialization. These papers typically justify specialization on technological grounds such as scale advantages or learning. The argument here

[2] This is tested in Simester and Wernerfelt (2005).

is consistent with either but is framed in term of adaptation. Specifically, we argue that adaptation by workers, whether to different services or different buyers, is costly, and that specialization is the outcome of attempts to economize on adaptation.[3] It is this connection between specialization and adaptation that allows us to make the linkage to the optimal scope of the firm.[4] Compared to the works of Oliver Williamson (e.g. 1985), we rely on a much smaller set of forces, all of which can be given a standard micro-foundation.

The contrast between the perspective proposed here and other micro-founded theories of the firm is sharpest for large firms. We bound the scope of the firm by showing that it eventually becomes too unfocused and thus loses the advantages of specialization. This has more face validity than many other proposals. For example, a merger between two Fortune 500 firms should give rise to more costs than one more person having poor incentives.

We formulate the base model and use it justify the focus on the optimal size of markets in Section II. The optimal scope of the firm is characterized in Sections III, while further research is discussed in Section IV. All proofs are relegated to the Appendix.

II. BASE MODEL – FIXED FIRM SIZE

The model covers two time periods, $t = 1, 2,$ and payments are not discounted. There is a set S of services with generic element s, a set W of workers with generic element w, a set E of entrepreneurs with generic element e, and a set B of businesses with generic element b. All four sets are finite and businesses, operated by entrepreneurs, produce output by using workers to perform services. At the start of each period, in a publicly observed randomization, nature divides the entrepreneurs into $|S|$ equally sized sets such that $|E|/|S|$ entrepreneurs will *need* each service in that period.[5] If a needed service is performed by a worker it results in one unit of output, valued at v. A worker can perform any service, but only one per period and

[3] Stigler (1939) made a similar argument about adaptation to different levels of demand for a single product, noting that high costs of ramping up and down might lead firms to keep levels of production more constant. More generally, the theme of adaptation has received a lot of recent attention in the literature on the firm (e. g. Alonso, Dessein, and Matouschek, 2015)

[4] Gibbons, Holden, and Powell (2012) and Legros and Newman (2013) also look at the interaction between firms and markets, though not on the contrast between employment and bilateral contracting.

[5] For convenience, we abstract from integer problems (effectively assuming that $|E|$ is a multiple of $|S|$).

production cannot be expanded by performing a needed service more than once, or by performing an unneeded service. All players are risk neutral.

In this Section, each entrepreneur has one business (so $|B| = |E|$ for now) and we will say that entrepreneur *e* needs the service that her business needs. The numbers of workers and entrepreneurs would be endogenous in a general equilibrium model, but we simply assume the relevant markets clear such that $|W| = |B|$.

We endow the model with two frictions: A tradeoff between adaptation and specialization and bargaining costs.

<u>*Adaptation versus Specialization.*</u> Production costs depend on an action being adapted to the unique characteristics of the business and the service. We model changes and costs of mal-adaptation in a very simple way. The *type* of business *b* is summarized in the random variable ε_b, and that of service *s* is summarized by ε_s. No two businesses have the same ε_b and these values are distributed according to a discrete uniform distribution with support on $|B|$ points in $[-\beta, \beta] \subset R$, where it is understood that the extreme types are $-\beta$ and β. Similarly, no two services have the same ε_s and their values are drawn form a discrete uniform distribution with support on $|S|$ points in $[-\varphi, \varphi] \subset R$. All types are public information.

While modelled in one dimension, we think of ε_b as reflecting the competitive environment of business *b* by indicating the best way, in terms of quality, speed, reliability, appearance etc., to perform any service in *b*. Similarly, ε_s can be thought of as indicating the best technology (tools, degree of mechanization, computerization, etc.) with which to perform *s* for any business.

When performing service *s* at business *b* in period *t*, worker *w* ideally wants to adapt to both *s* and *b*, and we model the advantages of adaptation as reduced costs. Specifically, whenever *w* performs *s* for *b* in *t*, the way he works can be summarized by his *approach*, $(a_{wst}, a_{wbt}) \in R^2$, and his effort costs will be $c + |a_{wst} - \varepsilon_s|^{\alpha} + |a_{wbt} - \varepsilon_b|^{\alpha}$ in period *t*, where $0 < \alpha < 1$. The upper bound on α reflects the intuitively appealing idea that there are decreasing marginal costs to maladaptation. For example, it is more efficient to adapt perfectly on one dimension and be *1* off on the other compared to being ½ off on both of them.[6]

We capture the cost of adaptation by assuming that w cannot adapt in every period, but has to use fixed approach in the sense that $a_{ws1} = a_{ws2} \equiv a_{ws}$ and $a_{wb1} = a_{wb2} \equiv a_{wb}$. Workers make their approach decisions before business needs for the first period are known and since an individual business almost certainly will not need the same service in both periods, a worker can best reduce his expected cost by specializing in a specific business b' or a specific service s'. So adaptation is difficult and this gives rise to advantages of specialization.

Bargaining cost. Prices are determined in assemblies that we will call *bargaining bins.* A bargaining bin specifies two sets $(S', B') \in \{0, 1\}^{|S|} \times \{0, 1\}^{|B|}$. By selecting the bin (S', B'), workers and entrepreneurs intend to negotiate a binding contract specifying a single price in exchange for which any of the workers will perform any service in S' for any business in B'. Prominent examples of bargaining bins are (s', B), (s', b'), (S, b') and $(\emptyset, \emptyset)$. We will later associate the first three with global markets, sequential contracting, and employment. Local markets are also of type (s', B') but all workers' approach a_{wb}'s and all firms' types e_b's lie in the same subset of $[-\beta, \beta]$.
We put no restrictions on the games played inside the bargaining bins except that their outcomes meet three natural conditions: (i) All efficient trades are consummated. (ii) If equal numbers of entrepreneurs and workers arrive at a bargaining bin, they all get strictly positive net payoffs. (iii) Otherwise, players on the long side of a bin get zero payoffs. Both workers and entrepreneurs incur *bargaining costs* $K(|S'|, |P'(S', B')|)/2$, where $|P'(S', B')|$ is the number of worker-entrepreneur pairs in the bin.[7] The function $K(,)$ is increasing and sub-additive in the first argument and decreases, at a decreasing rate, to zero, as the second argument grows.[8]

Strategies. The strategy of an entrepreneur has two components: In each period she selects a bargaining bin as a function of her type and need in the period ($[-\beta, \beta] \times S \rightarrow \{0, 1\}^{|S|} \times \{0,$

[6] None of the results in the present paper depend on this bound.
[7] If the bin is unbalanced, P' is the set of players on the short side.
[8] While this clearly is an unusual premise, it is not unreasonable: Most people prefer not to bargain, but if they have to, would rather bargain once over a $300 pie than 30 times over $10 pies. From a theoretical perspective, this is consistent with the rent-seeking literature (Tullock, 1967). More directly, Maciejovsky and Wernerfelt (2011) report on a laboratory experiment in which bargaining costs are found to be positive and sub-additive.

$1\}^{|B|})$. The bin with "no services" is selected in period *2* if a price covering that period's need has been agreed upon in period *1*.

The strategy of a worker has three components: At the start of period *1* he decides on his approach and in each period he then selects a bargaining bin consistent with his approach $([-\beta, \beta] \times [-\varphi, \varphi] \rightarrow \{0, 1\}^{|S|} \times \{0, 1\}^{|B|})$. The bin with "no services" is selected in period *2* if a price covering all relevant second period services has been agreed upon in period *1*. Summarizing, the sequence of events is as follows:

0. Entrepreneurs are randomly and permanently matched with businesses. All ε_b, ε_s are realized and publicly observed.

In period *1*:

1. Workers choose an approach (a_{ws}, a_{wb}).
2. Business needs for period *1* are realized and publicly observed.
3. Entrepreneurs and workers distribute themselves into bargaining bins and negotiate as indicated. Entrepreneurs and workers in each bin are randomly matched. Workers perform the agreed upon services.

In Period *2*:

4. Business needs for period *2* are realized and publicly observed.
5. Entrepreneurs and workers may distribute themselves into bargaining bins and negotiate as indicated. Entrepreneurs and workers in each bin are randomly matched. Workers perform the agreed upon services
6. All payoffs are distributed.

Note that there are a lot of equilibria because there are many ways to balance the bargaining bins. However, we will be looking for the most efficient sub-game perfect equilibria.

We now define and discuss two particularly interesting classes of equilibria:

Definition: *An Employment relationship is a bargaining bin of the type (S, b'), selected by the entrepreneur b' and one worker standardizing on (0,* ε_b*').*[9]

Workers only work for entrepreneurs in whose businesses they are specialists. On the other hand, since they are not specialists in the services they are asked to perform, they can do no better than using the mean approach and thus incur adaptation costs. Because the parties engage in bilateral negotiation over a single price for any service in *S*, they also incur bargaining costs $K(|S|, 1)$ in period *1*. The expected total (worker plus entrepreneur) costs per period are $c + \sigma_S + K(|S|, 1)/2$, where $\sum_{j=-\varphi}^{\varphi}(1/|S|)|j|^{\alpha} \equiv \sigma_S$. Workers and entrepreneurs who trade services in an Employment relationship will be called *employees* and *firms*, respectively. We say that the economy is in *Employment equilibrium* when all non-empty bargaining bins are Employment relationships.

Definition: *A Global Market is a bargaining bin of the type (s', B), selected by the* $|E|/|S|$ *entrepreneurs needing s' in t and* $|E|/|S|$ *workers with approach (*ε_s*', 0).*

Since $|E|/|S|$ is large, there are few if any bargaining costs in global markets and workers only perform services on which they are specialists. In this case the workers are not specialists in the businesses of the entrepreneurs for whom they work and thus incur adaptation costs from using the mean approach. The expected total (worker plus entrepreneur) costs per period will be $c + \sigma_{Bg} + K(1, |W|)$, where $\sum_{j=-\beta}^{\beta}(1/|B|)|j|^{\alpha} \equiv \sigma_{Bg}$. We will use the term *professionals* as shorthand for workers who sell their services in Global (and Local) Markets and say that the economy is in *Global Market equilibrium* when all non-empty bargaining bins are Global Markets.

To define a Local Market, it is helpful to label the business types who need a particular service *s'* in a particular period *t* from lowest to highest as *1* through $|B|/|S|$ and use ε_{bjt} to denote the type of the j'th of these businesses. Furthermore, $a_{bim} = Argmin\ E_{\varepsilon}\sum_{j=i}^{m+i-1}(\frac{1}{m})|\varepsilon_{bjt} - a_b|^{\alpha}$ is the ex ante most efficient approach by a worker who services numbers *i* through *i+m-1* of these

[9] Consistent with common terminology, Employment is a relationship in this model (Bartling, Fehr, and Schmidt, 2013). Linking to the famous example of Alchian and Demsetz (1972), the relationship between a boss and an employee is one in which a single wage has been agreed upon on a once-and-for-all basis, while a buyer in a grocery store is confronted with new market prices in every period.

businesses and $\sigma_{Bim} = E_\varepsilon \sum_{j=i}^{m+i-1} (\frac{1}{m}) \mid \varepsilon_{bjt} - a_{bim} \mid^{\alpha}$ are the expected adaptation costs associated with this approach. [10]

Definition: *A Local Market of size m is a bargaining bin of the type (s', B_m), selected by m entrepreneurs who need s' and have adjacent types numbered i through i + m - 1 where i ∈ {1, 2,.., $\mid B \mid / \mid S \mid$ - m+1}, as well as m workers whose approach equal (ε_s', a_{bim}).*

The bargaining costs are $K(1,m)$ and total costs per period equal $c + \sigma_{Bim} + K(1, m)$.We will henceforth use the term *m-Local Market* to denote a Local Market of size *m*.

Note that a Global Market simply is a $\mid B \mid / \mid S \mid$ - Local Market. However, depending on how $K(1, m)$ and σ_{Bim} vary with *m*, a Local Market with $m < \mid B \mid / \mid S \mid$ may be more efficient. The tradeoff is clear: Smaller Local Markets (lower values of *m*) allow a better fit between workers' approaches and business types, but suffer from higher bargaining costs. For example, if bargaining costs are very large for $m = 1$, but otherwise zero, *2*-Local Markets are more efficient than Global Markets.

To establish that it is interesting to look at firms and Markets in the model, we define "Employment equilibrium" and "Local Market equilibria" as subgame perfect equilibria in which all trades in the economy take place in these two bargaining bins.

PROPOSITION 1: *There exists regions in [v-c, β, φ, $\mid B \mid / \mid S \mid$, K(,)] where the Employment equilibrium and, for any m>,1 m-Local Market equilibria are weakly more efficient that all other sub-game perfect equilibria of the economy.*

Proof: See Appendix.

Consistent with intuition and casual observation, (Local) Markets are better when the gains from service-specialization are larger, when gains from business-specialization are smaller, and when costs of bilateral bargaining are larger. [11]

PROPOSITION 2: *The size of the most efficient Local Market, m*, minimizes $c + \sigma_{Bim} + K(1, m)$. It is larger when businesses are less diverse, when maladaptation is cheaper, when there are*

[10] These depend on *i* because the type distribution is bounded. If $2i + m = \mid B \mid / \mid S \mid + 2$, the bounds are equally far away from *i* and *i+m-1* and $a_{bim} = 0$.

[11] See also Wernerfelt, 2015.

more businesses per service in the economy, and when multilateral bargaining costs grow by a constant factor.

Proof: See Appendix.

Examples of the first three three dimensions may be the degree of differentiation in the market, the distances between businesses, and the difficulties of comparing jobs.

III. THE SCOPE OF THE FIRM

So far, we have kept entrepreneurs' sizes exogenously fixed such that each of them has one business and thus needs one service and one worker in every period. We now look at situations in which each entrepreneur is active in several businesses. To make this efficient, we need to define bargaining costs for such situations and make a different assumption about distribution of needs over businesses. Specifically, we need to assume that businesses of similar types sometimes need the same services. We will explain the new assumption through a series of analyses.

Bargaining cost. The definition $K(|S'|, |P'|)$,which we used in the base model, assumes that bargaining costs are influenced by the number of worker-entrepreneur pairs in the bin. When, as there, each business is operated by a different entrepreneur, the second argument represents the effect of competition. This is no longer the case when negotiation concerns a job in any of several businesses are operated by a single entrepreneur. Using B_e as the set of businesses operated by an entrepreneur, We will therefore define $k_1(|S'|, |B_e|)$ as the total bargaining costs associated with a contract in which the worker agrees to perform any of S' services in any of B' businesses owned by a single entrepreneur. We assume that $k_1(,)$ is increasing and sub-additive in the both arguments, with growth in either eventually converging to zero. So while $K(|S'|, 1) = k_1(|S'|, 1), k_1(|S'|,|B'|) \geq K(|S'|, |B'|)$.

The distribution of needs. Suppose that an entrepreneur has two businesses, b' and b'', and assume that b' first needs service s' and then s'', while b'' first needs s'' and then s'. Two employees, a service-specialist on s' and a service-specialist on s'', can then both standardize on their areas of specialization and the mean business type, such that $a_{1s} = \varepsilon_{s'}$, $a_{2s} = \varepsilon_{s''}$, and $a_{1b} =$

$a_{2b}=(\varepsilon_{b'} + \varepsilon_{b''})/2$. If $\varepsilon_{b'}$ and $\varepsilon_{b''}$ are random draws, total expected two-period costs are $2c + \sigma_B + k_1(1, 2)$ per worker, and there are no gains in adaptation costs. However, if $\varepsilon_{b'}$ and $\varepsilon_{b''}$ are close to each other, say adjacent, $2|\varepsilon_{b'} - (\varepsilon_{b'} + \varepsilon_{b''})/2|^{\alpha} < \sigma_B$. So depending on the relative magnitudes of $k_1(1, 2)$ and $K(2,1)$, the larger firm may well be more efficient.

Motivated by this example, we will assume that an entrepreneur can find any number of adjacent businesses, call n, and a set of services such that a fraction γ of the services is needed by an equal number of the businesses in period *1* and period *2*.[12] It is not known ex ante which businesses will need which services when, nor which services will be needed in both periods, only that the aggregate will balance out as indicated.

Now label the businesses in the economy in order of increasing types such that $\varepsilon_b = -\beta + 2\beta(b-1)/(|B|-1)$. If we consider a firm of the kind described above, the total two period payoffs are

$$(1) \qquad n[v - c - k_1(S, n)/2 - (1-\gamma)\sigma_S/2] - \beta\sum_{b=1}^{n} |n + 1 - 2b|^{\alpha}/(|B|-1).$$

To evaluate the behavior of this expression as n grows, it is easiest to consider steps of size 2. Since $k_1(1, n)$ eventually will be constant for large n, the first term in the expression will exhibit roughly linear growth. In contrast, every time n goes up by *2,* the sum in the second term will add a larger and larger component at each extreme. The second term will thus exhibit more than linear growth and the marginal gains from growing the firm will eventually decline.[13]

So we have shown:

PROPOSITION 3: *The optimal scope of the firm is a set of adjacent businesses. It is increasing in profitability (v-c) and the extent to which the same services are needed in adjacent businesses (γ). It is decreasing in the diversity of businesses in the economy (β), the bargaining costs associated with employment in multi-business firms ($k_1(S, n)$), and the magnitude of adaptation costs (α).*

[12] These are clearly extreme assumptions. We could more generally consider cases in which the new businesses need services that are merely "similar", as measured by the ε_s, rather than identical. Even more generally, we could look at a tradeoff between the heterogeneity of the businesses and the similarity of the services they need.
[13] Note that the sum in *(1)* reduces to $|B|\sigma_B$ when $n = |B|$. So the assumption suggests that, except for differences in bargaining costs, a single economy – wide firm performs exactly as the same set of single business firms.

The result suggests that costs increase with the extent of inter-industry diversification, in line with empirical results (Montgomery and Wernerfelt, 1988; Wernerfelt and Montgomery, 1988). They also suggest that a firm enter businesses that, on important attributes, are as similar as possible to those the firm already is in (Montgomery and Hariharan, 1991).

IV. CONCLUSION

We have characterized the determinants of the size of markets and the scope of firms in terms of the same basic tradeoff. As the size of the market grows, bargaining inefficiencies disappear, but adaptation costs grow (advantages of specialization decline). Conversely, as the scope of the firm grows, bargaining inefficiencies go up, but adaptation costs fall (advantages of specialization increase). Many of the predictions about market size are easily testable and do not appear in contemporary economic theories of organization. On the other hand, the factors determining the optimal scope of the firm are strongly reminiscent of those stressed in the management literature.

In terms of future research, the base model is deliberately very simple and can easily be extended in any number of directions. One could, with very little effort, look at trade between two previously isolated economies, the allocation of talent, multiple categories of needs, complementarities between needs, covariance between the types, investments in physical assets, investments in skill, and incomplete information. A more difficult, but seemingly doable, extension is to cast the model in a general equilibrium setting.

APPENDIX: PROOFS

PROPOSITION 1: *There exists regions in [v-c, β, φ, $|B|/|S|$, K(,)] where the Employment equilibrium and, for any m>1, m-Local Market equilibria are weakly more efficient that all other sub-game perfect equilibria of the economy*.

Proof: Using that all unbalanced bargaining bins give the long side zero payoffs**,** there clearly exists an equilibrium in which all active bargaining bins are Employment. Furthermore, if we assume that $|B|/|S|$ is a multiple of *m* (which we can do since we are concerned with existence only), then for any *m>1* there exists an equilibrium in which all active bargaining bins are *m*-Local Markets. For future reference we also recall from the text in the body of the paper, that the per period per worker costs of Employment, Global Markets, and *m*-Local Markets are

(A1) $$c + \sum_{j=-\varphi}^{\varphi}(1/|S|)|j|^{\alpha} + K(|S|, 1)/2,$$

(A2) $$c + \sum_{j=-\beta}^{\beta}(1/|B|)|j|^{\alpha} + K(1, |W|),\ \text{and}$$

(A3) $$c + E_{\varepsilon}\sum_{j=1}^{m+i-1}\left(\frac{1}{m}\right)|\varepsilon_{bjt} - a_{bim}|^{\alpha} + K(1, m),$$

respectively.

Looking first at Employment, it is clear that costs will be weakly lower than those in any other equilibrium as $\varphi \rightarrow 0$ and $K(|S|, 1) \rightarrow 0$.

It is more involved to make the case for *m*-Local Markets. Since *m* can take a finite number of values, there is clearly one, call *m**, for which *(A3)* is minimized. Now assume that φ is very big while β is very small. So it is very expensive to switch from one service to another and the most efficient equilibria involve service specialists.

Fix a value of *m*, say *m'*, and consider the approaches $a_{bim} = Argmax E_{\varepsilon}\sum_{j=1}^{m+i-1}\left(\frac{1}{m}\right)|\varepsilon_{bjt} - a_{bim}|^{\alpha}$ in *(A3)*. These depend on *i* because the type distribution is bounded by $-\beta$ and β. If $2i + m = |B|/|S| + 2$, the bounds are equally far away from *i* and $i+m-1$ and $a_{bim} = 0$, or the mean of the prior type distribution in the Local Market consisting of the *m'* middle types. However, close to the bounds, the optimal approaches are not equal to the prior means in the corresponding Local Markets and the expected loss may be larger. Suppose therefore, that $|B|/|S|$ grows very large relative to *m'*. In this case two things happen: The fraction of Local Markets in which the approaches differ from the above-mentioned means by more than a set amount declines (since fewer are close to the boundaries) and the distances in all Local Markets shrink (as we are holding β fixed). So by letting $|B|/|S|$ grow, we can make the term $E_{\varepsilon}\sum_{j=1}^{m+i-1}(\frac{1}{m})|\varepsilon_{bjt}\text{-}\ a_{bim}|^{\alpha}$ arbitrarily small. If we also assume that $K(1, m) = 0$ for $m \geq m'$ and positive for $m < m'$, no other subgame perfect equilibrium can be more efficient than the *m'*-Local Market equilibrium. Q.E.D.

PROPOSITION 2: *The size of the most efficient Local Market, m*, minimizes* $c + \sigma_{Bim} + K(1, m)$. *It is larger when businesses are less diverse, when maladaptation is cheaper, when there are more businesses per service in the economy, and when multilateral bargaining costs grow by a constant factor.*

Proof: The formula is derived in the text. Using standard super modularity arguments, the first three comparative statics come from the directions in which the corresponding derivatives of σ_{Bim} vary with m, and the last from λ in $\lambda K(1, m)$. Q.E.D.

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