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Urban economics and entrepreneurship

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ABSTRACT

Research on entrepreneurship often examines the local dimensions of new business formation. The local environment influences the choices of entrepreneurs; entrepreneurial success influences the local economy. Yet modern urban economics has paid relatively little attention to entrepreneurs. This essay introduces a special issue of *Journal of Urban Economics* dedicated to the geography of entrepreneurship. The paper frames the core questions facing researchers interested in assessing the local causes and consequences of entrepreneurship, perturbs a core urban model to incorporate entrepreneurship, and concludes by offering an agenda for future work on the spatial aspects of entrepreneurship.

1. Introduction

Can the economic history of Detroit be told without Henry Ford and Alfred Sloan? Would Ford have achieved the same success if he had worked in Houston? Would Silicon Valley have experienced its remarkable growth without Frederick Terman and William Shockley? Entrepreneurs often seem to have been significantly influenced by features of their local economies, and they have often influenced the fates of those economies. Yet, urban economists have only infrequently looked directly at the local causes and consequences of entrepreneurship.

Urban economists have not been alone in paying little attention to entrepreneurs. This is a common feature of economic research after World War II. The general equilibrium models that came to dominate economics had little room for the idiosyncrasies of the individuals who started firms. The primary role that Schumpeter (1934) had assigned to entrepreneurs was largely ignored by mainstream economic theory. Empirical economists focused more on aggregates and on patterns that held throughout the economy. But over the past decade, entrepreneurship has become an increasingly established field that has tried to understand business innovators. This special issue of the *Journal of Urban Economics* brings together papers that specifically focus on the local dimensions of entrepreneurship.

While there has been relatively little formal work on cities and entrepreneurship, the papers in this volume do not come out of a vacuum. Some urban economists, notably Vernon and Chinitz, wrote directly about entrepreneurship (i.e., Vernon, 1960; Chinitz, 1961). Moreover, urbanists from outside of economics, like Jacobs (1969) and Saxenian (1994), have had important insights about the local roots of entrepreneurship. In addition, some of the canonical work in urban economics can be interpreted as having an entrepreneurial dimension. For example, in this paper, we will discuss the entrepreneurial aspects of urban economic research on agglomeration in general and on New Economic Geography (NEG) in particular.[1]

Section 2 of this essay reviews the role of entrepreneurship in urban economics. Since entrepreneurship has many dimensions, we begin by discussing the definition of entrepreneurship. We then turn to early urbanists, who promoted a number of ideas about entrepreneurship that can help systematize research in this area. Perhaps the most important idea is that entrepreneurship is impor-

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[1] Research in agglomeration is surveyed by Duranton and Puga (2004) and Rosenthal and Strange (2004), while NEG is surveyed by Fujita et al. (1999) and Ottaviano and Thisse (2004).

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tant for urban success. Smith (1776) and Marshall (1920) both seemed to share this view, and it is the central lesson of the work of Chinitz and Vernon. While this idea may now be a consensus opinion, there is still surprisingly little statistical work that bears it out.

The other ideas relate to the reasons that different places spawn different levels of entrepreneurship. It is not at all surprising that economists have linked the level of entrepreneurship to the returns to entrepreneurship: the supply of entrepreneurship slopes up. While this idea has been around since Smith, there has been little work actually measuring the response of entrepreneurship to these financial incentives. One version of this idea, properly credited to Smith himself, is that large cities have more demand for specialized products which makes them particularly attractive places for start-ups creating new products.[2] This naturally moves the equilibrium up the entrepreneurial supply curve.

It is also not surprising that economists have looked for shifters of the entrepreneurial supply function. There are many local characteristics that might be responsible for such shifts. Chinitz, Marshall and others emphasized that the level of entrepreneurship is related to the supply of inputs needed by entrepreneurs, including material inputs, skilled labor and financing. Chinitz and Marshall both also emphasized the spread of knowledge as forces that could encourage entrepreneurship. And the list of entrepreneurial supply shifters should also include political and cultural forces, as well as natural advantage.

In Section 3, we present a brief urban model that incorporates entrepreneurship. We work with the production and consumption assumptions of Krugman (1991), a model that shares important features with Abdel-Rahman (1988), Fujita (1988), Rivera-Batiz (1988). We share with Rivera-Batiz (1988) the focus on a single small city in a large open economy. The key formal results in this section document both the impact that entrepreneurs on local success and also the local factors that influence entrepreneurship.

Section 4 then uses this framework of the causes and consequences of entrepreneurship to categorize the papers in this issue and relate them to other recent research on entrepreneurship. Many of the papers here pay particularly close attention to the supply of entrepreneurial people across space. Fewer touch on the effects of entrepreneurship or the link between entrepreneurship and the returns to entrepreneurial activity. Section 5 concludes and sets out the major questions for future research.

2. Entrepreneurship in urban economics

What is an entrepreneur? Webster's Dictionary (1970, p. 467) defines an entrepreneur as, "A person who organizes and manages a business undertaking, assuming the risk for the sake of profit".[3]

There are several distinct economic aspects of entrepreneurship. One is that entrepreneurs are their own bosses. In this conception of entrepreneurship, entrepreneurs are self-employed. However, this approach misses the proprietary aspect of entrepreneurship; entrepreneurs can also be thought of as owners, willing to assume risk in exchange for returns (Cantillon, 1931; Knight, 1921). At least initially, the firms that entrepreneurs create are small, so another dimension of entrepreneurship is its role in small business. But entrepreneurship is not simply about a choice of occupation or about ownership, it is also fundamentally dynamic. Thus, entrepreneurs can also be conceived of as being the creators of new firms, and the study of entrepreneurship is the study of entry. In this view, entrepreneurs are agents of change. That view leads to yet another possible conception of entrepreneurs as innovators, agents of transformative change (Schumpeter, 1939), and not simply entrants in a market that is fundamentally the same year after year. There are, thus, five facets of entrepreneurship: self-employment, small firms, ownership, entry, and innovation.[4]

Since all of these facets of entrepreneurship are important, it would be a mistake to take the overly narrow view that an entrepreneur must have *all* of the five characteristics listed above. Examining the various aspects of entrepreneurship is logically sensible, and the overly narrow definition excludes important activities. In the non-profit sector, for instance, entrepreneurs often cede ownership over the enterprise to an external board. In the for profit sector, shares are typically sold to outsiders, which, in principle, could lead to a separation of ownership and control. Entrepreneurs can also in some cases work for someone else. For example, Michael Porter is both an employee of Harvard University and a management consulting entrepreneur, as well as being a scholar of entrepreneurship.

Measuring these aspects of entrepreneurship is often difficult. In a sense, every self-employed person is something of an entrepreneur, but using the self-employment rate to capture the level of entrepreneurship does no weighting for the size of enterprises, or the level of risk and innovation. After all, many of the self-employed own nothing but their own human capital. Measuring entrepreneurship instead with the number of newly established firms does better at capturing size. At least initially, the firms that entrepreneurs create are small, so in some cases, entrepreneurship is empirically linked to an abundance of small firms. However, some conceptions of entrepreneurs conceive of the entrepreneur as being more than just another business owner. In this view, true entrepreneurs do more than just open another hot dog stand, they actually do something new. All of this means that it is difficult for the researcher to capture all of the potentially relevant aspects of entrepreneurship.

The history of the *Journal of Urban Economics* allows us to look quantitatively at the history of the entrepreneurship research in urban economics. An electronic search brings up the word "entrepreneur" in 57 distinct articles in the *Journal of Urban Economics.* Twenty one of these articles were prior to 1990. In many cases, the word entrepreneur occurs only once, often in the citation list. The pre-1990 articles that discuss entrepreneurs at any length generally focus on entrepreneurs who either build housing or create entire cities, as in Henderson (1985). In the 1970s and 1980s, *Journal of Urban Economics* published only two articles that focused primarily on private sector, non-housing related entrepreneurship (Bates, 1978; Sveikauskas, 1979). The situation is similar at *Regional Science and Urban Economics*, with 67 papers mentioning entrepreneurs, 15 before 1990.[5]

The lack of attention to entrepreneurs is not merely a reflection of editorial decisions of these two major urban field journals. The pioneering urban economists of the 1960s, such as William Alonso, Richard Muth, Edwin Mills, and John Kain, rarely addressed entrepreneurship outside of the housing sector.[6] The absence of entrepreneurs in urban economic papers before 1990 reflects both forces that operated throughout economics and factors specific to the field. urban economics arose as a field in part in response to the raging debates about American urban policy that took place in

[2] See also Duranton and Puga (2001), Duranton and Jayet (2010), and Waldfogel (2008) for related work.

[3] Classical economists often used the word "undertaker" to mean essentially the same thing. The alternative meaning of that word has caused it to disappear from use in the twentieth century.

[4] All of these aspects of entrepreneurship involve the entrepreneur exercising judgment, a point made by Casson (1982).

[5] The Science Direct files on the *Journal of Urban Economics* go back to 1974 and the journal's founding; the files on *Regional Science and Urban Economics begin* in 1975 with Volume 5 of that journal.

[6] In this statement, we distinguish between Mills' research published in journals and his textbook, Mills and Hamilton (1997). The latter does address entrepreneurship outside of the housing sector.

the 1960s and 1970s. The field, therefore, tended to focus on problems of housing markets and urban public policy and not so much on entrepreneurship.

Moreover, the focus of many urban economists has been on creating formal economic models of cities, following either in the linear programming tradition of Koopmans and Beckmann (1957) or the more continuous tradition of mainstream general equilibrium models. In these models, entrepreneurs may be embedded in firms, but in the embedding, much of what was interesting about entrepreneurship disappeared. The lumpy, random nature of entrepreneurship fit poorly into an agenda aimed at creating tractable models. Instead, assuming free entry of firms enabled modelers to work with the powerful zero profit condition that could deliver powerful results. The mathematical advantages of non-entrepreneurial economics were not unique to the urban field: entrepreneurs are rarely encountered in models elsewhere in economics.[7]

For this reason, some of the most important early insights on entrepreneurship in cities were written by urban economists who used prose rather than algebra. Perhaps the most important set of insights were generated by the New York Metropolitan Region Project of the 1950s that brought together, among others, Hoover, Vernon and Chinitz. These authors' work (i.e., Hoover and Vernon, 1962; Vernon, 1960; Chinitz, 1961) was stylistically closer to modern business history, which has consistently focused on entrepreneurship and place (e.g. Saxenian, 1994), than to formal urban economics. The incorporation of entrepreneurship into urban economics really started in the 1970s, with the work of Sveikauskas and Henderson, who produced a long string of articles that relate to entrepreneurship. Over the past 20 years, entrepreneurs have steadily become more important in urban economics, as urban economists have increased their focus on city economies, developed relevant models, and gotten access to data sets that are relevant to empirical research on entrepreneurship and innovation.

Yet despite the scarcity of papers with formal algebra or econometrics, the big ideas about entrepreneurship were sketched long before the current surge in entrepreneurial research. Perhaps the single most important idea that comes out of the focus on entrepreneurship in cities is the claim that entrepreneurs play a critical role in making cities economically dynamic. For example, in Smith's (1776) discussion of the rise of cities, dynamic burghers play a leading role. He describes the introduction of ''those manufactures which are fit for distant sale," which can be interpreted as technologically advanced goods and credits. He also discusses the benefits of ''the violent operation, if one may say so, of the stocks of particular merchants and undertakers." Marshall (1920) tied urban growth and entrepreneurship even more tightly, writing that ''localization and the growth of the system of capitalist undertakers were two parallel movements, due to the same general cause, and each of them promoting the advance of the other." Localization enabled the creation of large quantities of specialized, tradable products, but that production required ''capitalist undertakers," also known as entrepreneurs.

The work that grew out of the New York Metropolitan Region Project also emphasized the importance of entrepreneurship for the success of New York. Chinitz (1961) compared New York and Pittsburgh, and argued that New York's greater success was linked to a more abundant ''supply schedule of entrepreneurship." Likewise, Hoover and Vernon (1959) depict New York City as an incubator of new business activity, and connects the continuing strength of that city to its constant flow of new businesses. Later business scholars such as Porter (1990) and Saxenian (1994) would echo this message that local success depends on innovative entrepreneurs.

More recently, the connection between entrepreneurship and urban success has been embraced by a number of urban economists. For example, Duranton and Puga (2001) use the term ''nursery cities" to describe places that specialize in creating new firms and succeed through this innovation. In a related vein, Helsley and Strange (2010) adapt Lazear's (2005) model of balanced skills to establish that size is not everything. In order to cultivate entrepreneurship, the entrepreneur's skills and the city's resources must be in a sense complementary. Another theoretical approach to entrepreneurship is taken by Forslid and Ottaviano (2002), who add ''footloose" entrepreneurs to a New Economic Geography model. These agents are in fixed supply, and their human capital is required to form firms. The focus here is not on entrepreneurs *per se*, but instead on how including this sort of mobile and scarce human capital in the NEG model can improve tractability. On the empirical side, Glaeser et al. (1992) documents the connection between small firms and urban success, and interpret these results as reflecting the benefits of competition and entrepreneurship. Miracky (1992), Rosenthal and Strange (2003, 2009), and Glaeser and Kerr (2010) provide similar research along these lines. While it would be hard to imagine a world in which an abundance of entrepreneurs did not strengthen the local economy, the literature documenting this effect is still in its infancy.

Establishing a causal connection between entrepreneurship and local success is difficult because entrepreneurship, in contrast to the proximity to coal or a good harbor, is unlikely to an exogenous local variable determined by nature. Those urban economists who have focused on entrepreneurship, Chinitz and Vernon and Hoover, have seen entrepreneurship as the reflection of other, deeper forces. Broadly, urban economists have offered several hypotheses about why entrepreneurship differs across space: (1) differential returns to entrepreneurship (movement along an entrepreneurial supply curve), (2) differential availability of inputs to entrepreneurship, including entrepreneurial human capital and (3) differential supplies of ideas, and (4) differences in the local culture, political system, or endowments. The first hypothesis refers to a movement along an entrepreneurial supply curve. Hypotheses (2)–(4) refer to a shift in an entrepreneurial supply curve. It is worth remarking that this list is parallel to the well-known list of explanations for the agglomeration of economic activity, a parallel to which we will return later.

Regarding the movement along an entrepreneurial supply curve, Hypothesis (1) above, Smith's famous dictum that the ''division of labor is limited by the extent of the market," suggested that certain entrepreneurial activities could only make financial sense in large communities or places that had ready access to transportation. Smith's description foreshadows the modern description of agglomeration economies, where a larger home market can increase the returns to introducing new products, as in Krugman (1991). Chinitz, as well, argued that New York's scale had some role in its entrepreneurial nature, although he argued that scale alone was not enough to distinguish Gotham from Pittsburgh.

Nearly 50 years ago, Chinitz (1961) argued that economists ignored entrepreneurship because ''the implicit assumption, I suppose, is that the supply schedule of entrepreneurship is identical at all locations". The rest of the ideas in the list relate to factors that would generate different supply curves for entrepreneurship across locations. The second theory of local entrepreneurship emphasizes the importance of inputs into entrepreneurship: some places have more venture capital or the right type of labor or independent input suppliers. For example, if the bulk of the firms in a region are vertically integrated then a lack of independent suppliers may make it difficult for a new firm to sprout. In some industries, skilled labor is vital and as a result a virtuous circle can

[7] See Baumol (1968) for a discussion of this issue. A prominent exception is Lucas (1978).

occur where entrepreneurs come to a place because of the workers and the workers come to the place because of the entrepreneurs. Idiosyncrasies in firm outcome may enhance the gains for entrepreneurs to locate in large cities, since statistical returns to scale essentially help protect workers and lenders (Helsley and Strange, 1990). Workers may be more willing to take on the risks of working for an entrepreneurial start-up in a large city with plenty of alternative employers.

The third hypothesis is that places may differ in the generation and transmission of entrepreneurial ideas. Marshall (1920) emphasized the role of ideas in infrastructure and argued that the flow of ideas from person to person was an external economy that enhanced innovation in cities: "if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas." He described an entrepreneurial chain where "subsidiary trades grow up in the neighborhood, supplying it with implements and materials, organizing its traffic, and in many ways conducing to the economy of its material." One implication of Marshall's logic is that entrepreneurs will congregate next to one another to learn from each other. Another implication is that we should expect to see chains of innovation where one big idea is followed with many others.

Jacobs (1969) is strongly associated with the view that new ideas are the well-spring of entrepreneurship and new businesses make cities grow. Like Chinitz, she admired small firms, which she saw as being conducive to innovation, and density, which helps to speed the flow of ideas. She also emphasized industrial diversity, arguing that some of the biggest innovations are the product of cross-industry fertilization. A modern example of this phenomenon is Michael Bloomberg, who used his financial expertise gained at Salomon Brothers to create an information technology firm that could cater to traders.

It is important to recognize that the inputs, skills, and ideas explanations for the variation in entrepreneurship can arise endogenously. Regarding skills, Chinitz suggested that the children of corporate managers might be less likely to become entrepreneurs than the children of small business owners. In this way, historical industrial specialization in small firm industries, like the garment trade, might lead to an ongoing abundance of entrepreneurs, who then encourage their own spinoffs. Similar stories of positive feedback can be told of inputs and of ideas.

The fourth explanation is that local differences in political system, culture, or in other local endowments have the potential to impact entrepreneurship. Smith notes that, "Order and good government, and along with them the liberty and security of individuals, were … established in cities at a time when the occupiers of land in the country were exposed to every sort of violence." He argues that this security of property led city residents to take on more business risks. Saxenian (1994) has emphasized local difference in culture. Silicon Valley investors, for instance, did not blackball entrepreneurs who had failed previously, a forgiving attitude that is credited with the Valley's entrepreneurial culture. Finally, natural advantage may impact entrepreneurship. Pittsburgh's coal mines made it a center for steel which is inherently less entrepreneurial while New York's port gave it access to the world and attracted an abundance of entrepreneurs.

As noted above, explanations for differences in entrepreneurial activity parallel common explanations for agglomeration. This parallel leads naturally to the conclusion that entrepreneurship can be part of a virtuous circle, where entrepreneurial activity leads to the circumstances that foster further activity. Of course, the flip side of this conclusion is that the absence of entrepreneurship can lead to a vicious circle. This strongly suggests that an improved understanding of entrepreneurship has the potential to help in the understanding of poverty and urban decline.

3. Entrepreneurship in an urban model

This section will present a simple NEG model that incorporates entrepreneurs. The model builds on Abdel-Rahman (1988), Fujita (1988), Rivera-Batiz (1988), and Krugman (1991). None of these paper contains the word entrepreneur, but the NEG analysis that they offer can be extended in a way that captures the connection between entrepreneurship and local success and some of the causes of entrepreneurship.

This extension is meant to accomplish three things. First, the analysis will help us to better understand the equilibrium forces that can explain the spatial variation of entrepreneurial activity and the impact of entrepreneurship on the larger economy. Second, the analysis will provide context for the rest of the papers in this issue. Third, by showing how entrepreneurs can be included in one important urban model, this section suggests a program for introducing entrepreneurs into other lines of urban research, pointing towards an agenda for future spatial research on entrepreneurs.

3.1. Exogenous entrepreneurs

Following Krugman, individual utility is defined over an aggregate of separate manufactured goods, each denoted C_i and land, denoted L. Denoting the elasticity of substitution among the varieties of manufactured goods by σ and adopting Cobb–Douglas utility, we have

$$U = \left(\int C_i^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\mu\sigma}{\sigma-1}} L^{1-\mu}. \tag{1}$$

We will focus on one small city within a large open economy. The city has a fixed total supply of land denoted $\bar{L}$ The renters live in the city and spend their income there.

The basic technological assumption is that to produce X units of a manufactured good, a producer requires $\alpha + \beta X$ units of labor. We assume that some manufactured good varieties are traded, while others are not. We suppose that the price of traded goods is normalized to $\beta\frac{\sigma}{\sigma-1}$ (which implicitly assumes that the price of labor external to this city is normalized to one). The price of non-traded goods will be endogenous.

Krugman critically assumes that there is free entry of firms to the point where profits are zero. This is, implicitly, an assumption about entrepreneurship: the supply schedule of entrepreneurs is everywhere the same, and indeed everywhere horizontal. This assumption essentially takes entrepreneurship out of the model. Instead, we assume that there are a fixed number of entrepreneurs, denoted E_k. These entrepreneurs produce two sorts of goods. We suppose that a share ϕ of the entrepreneurs produce traded goods. The external demand for each traded good produced in the city is assumed to be given by

$$Q * \left(\frac{(\sigma-1)P}{\sigma\beta}\right)^{-\sigma}, \tag{2}$$

where P is the traded good's price. Let E_{-k} denote the number of entrepreneurs in the non-traded sector. The local demand for goods is determined endogenously. These assumptions allow us to look at the city in isolation.

Using this setup, we are able to characterize how entrepreneurship influences market outcomes for a closed city:

Proposition 1 (*Exogenous entrepreneurs in a closed city*). *If the population of the city is fixed:*

(A) *An increase in the number of entrepreneurs will increase wages and worker utility, decrease the number of workers per firm, and will have an ambiguous effect on land values.*

(B) *An increase in the share of entrepreneurs who produce traded goods will increase wages, worker utility, and land prices, and have no impact on the number of workers per firm.*

Proof. See Appendix A. □

Most of the results in Proposition 1 are intuitive. A larger number of entrepreneurs increase wages and the welfare of workers. An increase in the share of entrepreneurs who sell on the global market has similar effects. Places with plenty of entrepreneurs have a smaller average firm size. The ambiguous connection between the number of entrepreneurs and land values is somewhat surprising. It reflects the fact that an increase in the number of entrepreneurs can cause the profitability of firms to decline if the fixed costs involved in each entrepreneurial activity are sufficiently high.

The primary limitation of Proposition 1 is that it takes the population of the city as fixed. The hallmark of urban economics is that population levels respond to changes in parameters. We now, therefore, adopt a specification where, in spatial equilibrium, the welfare of manufacturing workers in the city must equal a reservation utility level, and population adjusts accordingly. If the other parameters in this model are fixed, then worker utility declines with the population level because of competition for land.

In this case, it follows that:

Proposition 2 (*Exogenous entrepreneurs in an open city*). *In an open city:*

(A) *An increase in the number of entrepreneurs will increase city population and land values and have an ambiguous effect on wages, the number of workers per firm, and profits of non-traded good entrepreneurs.*
(B) *An increase in the share of entrepreneurs who produce traded goods will increase wages, city population, land prices and the number of workers per firm and will have an ambiguous effect on profits of non-traded good entrepreneurs.*

Proof. See Appendix A. □

In this case, more entrepreneurship and more traded good entrepreneurship make the city larger and land in the city more expensive. Entrepreneurship may not, however, increase wages, since entrepreneurs are making the city more attractive by creating a wider range of goods that can be bought there.[8] While it is always true that an increase in the share of entrepreneurship in traded goods increases firm size, the impact of entrepreneurship on firm size in this case is ambiguous. It is possible that more entrepreneurship will attract so many new workers that the number of workers per firm will actually increase.

The most interesting results connect the level of entrepreneurship with the return to entrepreneurship. Proposition 2 illustrates that increases in the level of local entrepreneurship have an ambiguous effect the returns to entrepreneurship. This suggests the possibility for a virtuous circle where the presence of entrepreneurs increases the returns for others to be entrepreneurial. The economics behind this ambiguity are straightforward: more entrepreneurs mean higher wages, which increases costs, but more entrepreneurship also means a larger market which increases the benefits to entrepreneurship. Limited land ensures that wages will rise with entrepreneurship, which helps drive wages up and pushes the returns to entrepreneurship down. If μ is sufficiently high, then the land sector is less important, and entrepreneurship is more likely to lead to a virtuous circle where more entrepreneurs increase the returns to entrepreneurship.

The main limitation of Proposition 2 – which applies as well to Proposition 1 – is that we have treated the supply of entrepreneurs as being exogenous. Given the well-documented variation in entrepreneurial activity across locations, we now relax this assumption and extend the model to consider an endogenous supply of entrepreneurs. So far we have asked about the implications of entrepreneurship for urban success. We now turn to the causes of entrepreneurship. The model will show that a range of circumstances can potentially be related to local entrepreneurial activity. These include: density, skills, a tradition of entrepreneurship, human capital, and physical capital.

3.2. Endogenous entrepreneurs

So far, we have treated entrepreneurs as a fixed factor of production that determines the success of the city. Yet a serious treatment of entrepreneurship in urban locations must endogenize the supply of entrepreneurs. The simplest way of endogenizing entrepreneurship is to assume that a city has an upward-sloping supply curve of entrepreneurs, defined by a distribution function so that the share of people whose costs of entrepreneurship are less than X is denoted $F(X)$. As such, the number of entrepreneurs is defined as $F(\pi)$, where π denotes the expected profits from becoming an entrepreneur.[9] To simplify matters, we assume that entrepreneurs do not know whether their product will serve only a local market or will become a traded good when they are choosing whether or not to become active as entrepreneurs. As such expected profits equals ϕ times the profits made by traded goods entrepreneurs plus $(1-\phi)$ times the profits made by non-traded goods entrepreneurs.[10]

The previous section raised the possibility that entrepreneurial profits could be increasing with the number of entrepreneurs. If that is the case, then it is at least possible that there are multiple equilibria in entrepreneurship. In one equilibrium, the number of entrepreneurs is high and so are the returns to entrepreneurship. In the other equilibrium, the number of entrepreneurs is low and so are the returns to entrepreneurship. While we do not wish to rule out the possibility of a global change between these two sorts of equilibrium, in this section we will consider local comparative statics on the number of entrepreneurs taken around a stable equilibria, which is defined so that

$$\frac{1}{F'(\pi)} > \pi'(E_k). \tag{3}$$

Eq. (3) essentially means that an increase in entrepreneurship will not have a destabilizing increase in the profits for each entrepreneur.

With this assumption, the following proposition holds:

Proposition 3 (Endogenous entrepreneurship).

(A) *In a closed city, the level of entrepreneurship is increasing with city population and decreasing with fixed cost (α) and has an ambiguous relationship with the share of traded goods and demand (Q).*

[8] Entrepreneurs are acting as amenities in this setup. For recent work on amenities, see Rappaport (2007), Berger et al. (2008), and Chen and Rosenthal (2008).

[9] This approach has obvious similarities to Lucas (1978). It is worth pointing out that it implicitly assumes that entrepreneurs are risk neutral. In contrast, Kihlstrom and Laffont (1979) build a supply curve of entrepreneurs from differential risk tolerances of economic agents.

[10] An alternate approach to endogenizing entrepreneurial activity in a given city is to adopt the Forslid and Ottaviano (2002) "footloose entrepreneurs" model. In our approach, we have assumed immobile entrepreneurs, an assumption that seems consistent with empirical work on entrepreneurship by Sorenson and Audia (2000), Klepper (2007), Dahl and Sorenson (2010) and others.

(B) *In an open city, the level of entrepreneurship is increasing with demand (Q) and land area ($\bar{L}$), is decreasing with fixed cost (α), and has an ambiguous relationship with the share of traded-goods producers.*

Proof. See Appendix A. □

Many of these results are intuitive. Smaller fixed costs of starting a business always lead the level of entrepreneurship to rise.[11] Higher fixed costs both reduce profits directly and increase the wage. An increase in city population reduces wage and increases demand, both of which make entrepreneurship more attractive. In the open city model, an increase in available land, $\bar{L}$, causes the population to rise which then indirectly increases the amount of labor.

The least intuitive results concern the parameters ϕ and Q. The first of these parameters makes it more likely that the entrepreneur will produce a high-value traded good; the second parameter increases the returns to producing such a traded good. Intuitively, it would seem that either variable should increase the returns to entrepreneurship and the number of entrepreneurs. That is exactly what happens in the case of the open city when Q rises. However, for Q in the closed city case, and for the variable ϕ in either case, the results are ambiguous. These variables cause wages to rise and it is possible that higher values of Q or ϕ can actually drive entrepreneurship down by pushing wages up so much. While this does not seem likely, these results capture perhaps the flavor of Detroit after World War II, when the success of the automobile industry may have crowded out other entrepreneurial activities.

How do these results relate to the core theories about the heterogeneity of entrepreneurship across space? The variable α can be interpreted as reflecting the inputs needed for entrepreneurship. If those inputs are abundant, perhaps because of large numbers of input suppliers or venture capitalists, then entrepreneurship will be more common. The variables N and $\bar{L}$ connect entrepreneurship to the size of the market. In bigger areas, there will be more entrepreneurs, but in this model there is no assurance that the level of entrepreneurship will rise by more than one-to-one. This could be assured by assuming a sufficiently elastic supply of entrepreneurs. The variables of Q or ϕ reflect exogenous factors in the place that increase the potential returns to entrepreneurship. Historically, perhaps, New York's port might have been seen as causing an increase in the value of Q.

This framework illustrates the impact on entrepreneurship of market size, returns to entrepreneurship and input costs. It also illustrates the impact of entrepreneurship on local economic performance. A virtuous circle arises through market size. One could similarly add entrepreneurs to models that emphasize inputs, skills, or ideas to obtain a parallel sort of circularity (see, for instance, Strange et al., 2006).

The framework does not address the Chinitz (1961) intuition that the supply of entrepreneurs might be different across space. To capture this possibility, we can simply assume that the number of entrepreneurs equals $F(\pi) + \epsilon$, where ϵ shifts the supply schedule across space. This would capture the possibility that some places just have more entrepreneurial people. Alternatively, urban density might act as a multiplier so that the supply becomes $F(\pi)^{\upsilon}$, where $\upsilon > 1$, because each entrepreneur spreads ideas to others. Unsurprisingly, then it follows that the level of entrepreneurship is rising with either ϵ or υ (so long as $F(\pi) > 1$). While all of our other comparative statics caused the level of entrepreneurship to increase by increasing the net returns to entrepreneurship, an increase in these variables will cause the net returns to entrepreneurship to fall, at least if the conditions needed for the returns to entrepreneurship to be declining in the level of entrepreneurship hold. However, it is possible, since the returns to entrepreneurship can actually increase with the number of entrepreneurs, that this increase in supply may actually be associated with an increase in the returns to entrepreneurship.

4. The causes and consequences of entrepreneurship

We now turn to the papers in this issue and the literatures from which they emerge. The section will largely be devoted to discussing how both this body of research fits with the causes and consequences of entrepreneurship framework laid out in this paper.

4.1. The impact of entrepreneurship

Both in this issue and more widely, there has been relatively little literature on the broad impacts on entrepreneurship on urban economies.[12] We suspect that this reflects two problems. First, the vast majority of entrepreneurship researchers, and indeed probably most of the academic community, rarely question the positive benefits of entrepreneurship for the local community. After all, real world examples abound of entrepreneurs who have helped their cities economically. Second, the ability to find a causal link between entrepreneurship and urban success would require exogenous variables that increase entrepreneurship but have no other impact on the local economy. As Section 3's model illustrates, most of the candidate variables that explain entrepreneurship, such as market size, could easily have a direct impact on city growth.

The piece of evidence that is most suggestive of the positive benefits of entrepreneurship on city growth is the strong connection between small average firm size and subsequent growth (see Glaeser et al., 1992; Rosenthal and Strange, 2003, 2009; Glaeser et al., 2010). This correlation is certainly suggestive. Small firms are likely to be newer and more entrepreneurial, but after all, this correlation has many interpretations. Small average firm sizes also means more competitive labor markets, or perhaps fewer regulatory barriers to growth.[13,14]

Audretsch and Keilbach (2004) have used an alternative measure of entrepreneurship—the rate of new start-ups. This variable is strongly correlated with the economic output of West German Counties. The start-up rate in the high tech sector is particularly associated with success. Just as in the case of the firm size results, these correlations cannot be conclusively interpreted as causal results showing the benefits of entrepreneurship, since start-up rates are unlikely to be exogenous.

As discussed above, another aspect of entrepreneurship is the independence of entrepreneurs. Rosenthal and Strange (2003) consider this directly by distinguishing between firms that are subsidiaries of another corporate entity from those that are not. No consistent relationship is found between the presence of non-subsidiary firms and growth. This preliminary evidence suggests that in thinking about the impacts of entrepreneurship, the ownership dimension might not be as important as the size dimension.

[11] It is worth observing that the population is mobile, but entrepreneurs are not. Changes in the equilibrium amount of entrepreneurship come from the activation of local entrepreneurs. This seems to us to be consistent with the evidence of entrepreneurial stickiness in Michelacci and Silva (2007) and in Klepper (2010).

[12] There has been a larger body of work on entrepreneurship and economic success at the country level, as in Audretsch and Thurik (2001) and Audretsch et al. (2006).

[13] The self-employment rate also, far more weakly, predicts urban employment growth (Glaeser, 2007).

[14] The result that Wal-Mart has negative impacts on the local economy (Neumark et al., 2008) can be seen as complementary to the small firm effect. See Haltiwanger et al. (2010) for an analysis of big box firms more generally. See Basker (2005) for evidence that Wal-Mart's effects are not necessarily negative.

Economists have thought, at least since Solow (1956), that technological innovation is associated with growth. At the local level, Porter (1990) has argued that the innovativeness of certain clusters accounts for their growth. Moreover, the history of technological innovations, such as the assembly line and software, suggest a significant role for entrepreneurs, such as Henry Ford and Bill Gates. Yet there is surprisingly little formal econometric work at the city level that has quantified the relationship between local innovation and other outcomes. This is presumably explained by the two points raised above: no one doubts such a relationship, and identification is difficult to achieve.

Kolko and Neumark (2010) present an alternative means of assessing the benefits of different forms of entrepreneurship. Instead of looking at economic growth or level of output, they focus on the behavior of firms in response to shocks. Many local leaders would like firms that keep employment steady even during a downturn, and in principle, local entrepreneurship could provide a cushion against recession. Indeed, many communities have specifically tried to protect locally owned businesses from externally owned competitors (such as big-box retailers) with the idea that locally owned businesses are more likely to provide stable employment for local workers.

Kolko and Neumark find mixed evidence for this claim. Company headquarters are more stable than other establishments. Locally owned single establishment firms are actually more sensitive to downward industry shocks, but less sensitive to downward regional shocks. Likewise, among smaller firms there is some tendency of local ownership to mute the response to regional shocks. However, among larger firms, local ownership has no impact in the response to shocks.

4.2. The sources of entrepreneurship

There has been more research that bears on the sources of entrepreneurship than on its impact. The line of research in urban economics that has the most to say regarding the sources of entrepreneurship is the literature on agglomeration. As noted above, this literature has identified inputs, skills, and ideas as being involved in the process generating agglomeration economies.[15] The literature has also looked at political and cultural forces and also natural advantage as explanations for agglomeration.

Many themes in this literature relate to entrepreneurship. Fallick et al. (2006) and Freedman (2008) consider the relationship between agglomeration and job hopping. They show that mobility increases with industrial concentration. This relates to both the self-employment and change dimensions of entrepreneurship. Holmes (1999) shows a relationship between vertical integration and agglomeration in the US Li and Lu (2010) show a similar relationship in China. A large literature has shown a relationship between agglomeration and innovation. Recent contributions include Agrawal et al. (2008), Gerlach et al. (2010), and Simonen and McCann (2008).

In this issue, most of the papers deal with the factors that explain why entrepreneurship might differ across space. One of these factors is differences in the returns to entrepreneurship. The only paper in this volume that directly addresses returns to entrepreneurship is Glaeser et al. (2010). This paper specifically looks at whether the value of shipments per employee, a proxy for the returns to entrepreneurship, are higher in places with abundant small firms where there are lots of entrepreneurs. No correlation is found. This suggests that these clusters of entrepreneurship are not being created by the presence of unusually high returns to entrepreneurial activity. This clearly calls for looking at supply shifters.

Chinitz's (1961) seminal work on entrepreneurship emphasized the importance of inputs to entrepreneurship, which seemed to be far more prevalent in New York than in Pittsburgh. He argued that a competitive economy, made up of small independent firms, would make it much easier for entrepreneurs to find independent suppliers. Certainly, no input is more important for new entrepreneurs than finance itself, so the availability of venture capital should surely be one of those variables that could impact the rate of entrepreneurship.

Chen et al. (2010) look specifically at the geography of the venture capital industry. They find that this industry is overwhelmingly located in three cities: New York, San Francisco and Boston. This might seem to give a great advantage to entrepreneurs working in those locations. However, they also find that these firms frequently invest outside of their cities and actually earn higher returns from spatially distant investments. This may, of course, reflect a selection process. If it were more expensive to invest in distant projects, venture capitalists would tend to invest in only the most promising of such projects, and this would elevate the return on investments outside of the firms' immediate locations, on average. In any case, venture capitalists seem to be capable of making wise investments away from their home towns, which suggests that the availability of capital might not be as geographically concentrated as the venture capitalists.

However, these findings still continue to suggest that the agglomerations of venture capitalists help create agglomerations of entrepreneurs. If investors only bother to invest far away if they can get higher returns by doing so, then firms in Silicon Valley can obtain venture capital for worse projects than firms in Idaho, and the Silicon Valley firms consequently enjoy an advantage. Somewhat paradoxically, the presence of high returns elsewhere actually supports the idea that entrepreneurs enjoy an advantage from being close to the clusters of venture capital.

The paper by Agrawal et al. (2010) takes a different angle in examining the geography of innovation by looking at the advantage of competition vs. monopoly. Just as large vertically integrated firms might not sell goods to new start-ups, such large firms might not provide as many intellectual spillovers if they are more closed to outsiders. This paper looks at the patenting activity of firms in "company towns" that are dominated by a single large enterprise and compares that activity with innovation in more competitive environments.

The main conclusion of Agrawal et al. is that the dominant firms in company towns are, indeed, more inward looking. They are more likely to cite their own patents than comparable firms elsewhere. Yet these large companies do not seem to reduce the tendency of their smaller neighbors to cite broadly. Moreover, the patents invented in these company towns have just as much impact as patents invented elsewhere. These findings could be interpreted as evidence that the creative myopia associated with the presence of large firms in company towns does not necessarily deter productivity and innovation.

The paper by Glaeser et al. (2010) also looks at the connection between local industrial structure and employment growth. They find that an abundance of small firms strongly predicts new establishment births. As noted above, this relationship does not appear to stem from an effect of nearby small firms on the returns to entrepreneurship. Rather, the relationship depends on the supply of entrepreneurs.

A different perspective on the interaction between large and small firms is provided by Haltiwanger et al. (2010). They examine the degree to which big-box stores – both retailers and restaurants – displace employment at local smaller, mom and pop stores. They find that the presence of big-box stores adversely affects employ-

[15] See the recent literature reviews in Duranton and Puga (2004) and Rosenthal and Strange (2004).

ment at smaller firms, primarily by causing smaller firms to exit. Importantly, this effect is concentrated among small firms that are in the same industry as the big-box competitor. In addition, this effect attenuates sharply with distance, and is much less pronounced just a few miles away. The very local geographic nature of the effects of competition from big-box retailers parallels previous research showing that the spillover effects of nearby agglomerations of employment attenuate rapidly with distance (e.g. Rosenthal and Strange, 2003, 2008; Andersson et al., 2009).

Entrepreneurs are often educated, so an increase in the share of educated workers can be seen as an increase in the supply of entrepreneurs. An abundance of educated workers may also increase the returns to entrepreneurship by providing skilled labor, a necessary input into many firms. The paper by Doms et al. (2010) examines the connection between the education level of workers themselves and of the workers' communities and entrepreneurship. It draws on several different surveys, each with its strengths and weaknesses. This includes a new and unique panel of several thousand newly established small businesses that are followed for four years (the Kauffman Firm Survey, or KFS). The paper also utilizes individual-level cross-section data from the voluminous 5% Public Use Micro Sample of the 2000 decennial census.

Based on these and other sources, Doms et al. (2010) first document a strong positive correlation between the average level of education in a metropolitan area and the level of education among the area's community of business owners and self-employed. This is not surprising, but reinforces the importance of distinguishing between the influence of individual versus metropolitan-wide levels of education. Indeed, the paper further shows that while entrepreneurial activity and business turnover, as measured by new business formation and deaths, is more prevalent in educated cities, the relationship appears to be most closely associated with individual rather than city-wide levels of education. Based on the census data, more highly educated individuals are more likely to be self-employed, and conditional on individual education, there is no additional positive association between self-employment and metropolitan area college share.

Are these relationships between education and the propensity for entrepreneurship mirrored in the returns to entrepreneurship? Doms et al. (2010) provide evidence on this point as well. Specifically, in both the KFS and census surveys, they find that entrepreneurs with more education enjoy improved business outcomes, and that this relationship is highly non-linear: there is a strong positive premium for having a college degree. However, conditional on the individual's own level of education, the association between local area education and business outcomes is less clear. In the KFS, this latter relationship is positive, but not distinguishable from zero. In the census data, a clear positive relationship emerges: self-employed individual earn more when operating in more highly educated locations, even after controlling for an extensive array of industry-metro area fixed effects, the individual's own level of education, and many other individual-level controls. Moreover, from both data sources, and especially from the census, there is suggestive evidence that it is primarily high-skilled sectors that benefit from the presence of nearby college educated workers. These findings complement Glaeser et al. (2010) who show that labor-intensive firms are particularly more likely to form in high human capital areas. They are also related to Bacolod et al. (2010) who find that the returns to skills rise with city size. More generally, these findings confirm that education plays a crucial but complicated role in contributing to a successful entrepreneurial environment.

Since the location of skilled workers and technical expertise seems to be so important, it is natural to focus on the mobility of technical workers and innovative activity. Kerr (2010) and Dahl and Sorenson (2010) each shed light here. Kerr examines the speed with which innovative activity migrates across cities in the United States. He demonstrates that development of breakthrough technologies tends to be followed by subsequent intensive research and development that refines the initial innovation. This process attracts additional scientists and engineers to the location where the breakthrough occurs, and contributes to movement of innovative activity across cities. The speed with which such adjustments occur depends in part on the mobility of technical workers. Kerr demonstrates this by focusing on immigrant scientists and engineers, a group thought to be particularly mobile and footloose. Evidence confirms that industries reliant on immigrant technical workers exhibit faster migration of innovative activity towards locations where breakthroughs occur.

Kerr's (2010) work highlights both the dynamics of breakthroughs, as well as the impact of worker mobility on the speed with which innovative activity and technical ability spreads across cities. This relates to prior work on the dynamics of industry migration of across cities. Duranton and Gilles (2007) and Findeisen and Sudekum (2008) show that the size distribution of cities in a given country tends not to change much over time, and that the relative size of individual cities changes only very slowly. However, the industrial composition of employment within individual cities changes at a comparatively rapid pace as industries migrate across locations. Kerr's results highlight factors that contribute to such migration.

The paper by Dahl and Sorenson (2010) also considers the mobility of scientific and technical workers, in this case in Denmark. A key finding is that scientific and technical workers in Denmark are heavily drawn to locations close to family and friends. While economic incentives matter – and especially for older workers – Dahl and Sorenson provide compelling evidence that Danish scientists and technical workers are willing to trade off substantial income for the opportunity to locate closer to their parents, high school friends, and other important social contacts. Such ties tend to create geographic frictions within high-skilled labor markets, and may serve to slow the rate at which innovative activity would migrate across cities. In many respects, these findings complement the evidence offered by Kerr (2010) in which mobile workers accelerate the migration of innovative activity.

The causes of entrepreneurship considered thus far do not come close to forming an exhaustive list. There are many additional factors, many relating to government policies, especially regulations that increase the costs of entrepreneurship. Becker and Henderson (2000) and List et al. (2003) both show that air quality regulations reduce firm birth in the relevant industries. Bertrand and Kramarz (2002) show that French zoning regulation reduces new firm entry in the retail sector. On the other hand, inaction in the face of urban problems such as congestion seems to be negatively associated with growth (Hymel, 2009).

Rosenthal and Ross (2010) consider a different urban problem, the local rate of violent crime. Pope (2008) and Linden and Rockoff (2008) show that the fear of crime can have a large impact on housing prices. Rosenthal and Ross consider the relationship of crime to entrepreneurship. The paper deals with the sorting of sectors of the economy into high- and low-crime neighborhoods depending on a sector's relative sensitivity to crime. The paper illustrates this by comparing retail industries to wholesale sectors and high-end restaurants to low-end eateries. Because retail industries rely on pedestrian shoppers, they will be especially sensitive to violent crime. Because high-end restaurants do a disproportionate amount of their business in the evening, they should be especially sensitive to violent crime over the prime dinner hours. Using data for five US cities, Rosenthal and Ross obtain evidence consistent with these priors: higher levels of violent crime reduce the share of retail trade in an area relative to wholesale trade, and higher local rates of violent crime during peak dining hours reduce the presence of high-end restaurants relative to lower-tier eateries.

Many of the papers in this issue have dealt with the supply of entrepreneurs. Of course, the *local* supply of entrepreneurs only matters if entrepreneurs are tied to a local area. Klepper (2010) offers a further perspective on this topic by examining the history of spinoffs in Detroit – with the auto industry – and in Silicon Valley – with the integrated circuit or semi-conductor industry. Remarkably, the paper draws upon data for the entire history and lineage of modern day auto makers and producers of integrated circuits.

Klepper documents that early in the auto industry's history, several locations were thriving centers of production, as was also the case for integrated circuits. However, spinoffs from unusually successful founding (parent) companies were themselves more likely to be unusually successful, and these spinoffs tended to locate close to their parent firms. Klepper argues that this tendency for overachieving parent companies to spawn nearby overachieving spinoffs accounts for the eventual dominance of Detroit in the auto industry, and the corresponding dominance of Silicon Valley for integrated circuits. The evidence presented by Klepper is compelling and speaks directly to the important role that unusually talented and innovative entrepreneurs may have on an industry, and the role of spinoffs in fostering agglomerations of both innovation and industrial activity.

It is less clear *why* these spinoffs remained in such close proximity to their parent companies. Was it because of the desire to remain close to family and friends, as in Dahl and Sorenson (2010). Was there or some other aspect of the technical labor force that might have deterred migration (which would contrast to the role of immigrant workers as in Kerr, 2010). Or perhaps it was the traditional role of agglomerative spillovers in the form of input sharing, labor pooling, and the opportunity to learn from one's neighbors, as emphasized in the agglomeration literature. These are issues that bear further study, but which do not change the important implication of Klepper (2010) that any assessment of the impact of entrepreneurship on local urban economies must take seriously the role of spinoffs and "organizational reproduction".

5. Conclusion: directions for future research

We believe that the essays in this issue contribute to our understanding of the major questions about entrepreneurship and economic geography. Yet economic research is still just beginning to understand the key topics laid out in this paper. Our ability to model and estimate the creative sparks of Henry Ford and Alfred Sloan remains limited. In conclusion, we will lay out some of the most important open questions. We hope that this may guide future research in this area.

First, and perhaps most importantly, what is the impact of entrepreneurship at the local level? We still lack compelling evidence on the impact of entrepreneurship on cities and regions. The biggest handicap to work in this area is the absence of exogenous variation in entrepreneurship that is independent of other sources of economic success. Both basic research and public policy have a great need for definitive work in this area.

Second, what are the causes of spatial variations in entrepreneurial activity? While there has been much more written about the causes of entrepreneurship than about its effects, there are still many unanswered questions. To what extent are differences in entrepreneurship results of differences in entrepreneurial returns? There is evidence that entrepreneurship increases with the availability of relevant inputs, but we do not know which inputs are most important. For many specific inputs, we still lack well identified estimates of the impact of input availability on entrepreneurship. We know more about how skills and entrepreneurial types impact entrepreneurship. Still, there are many unanswered questions in this area as well. To what extent do social interactions in a place create a local multiplier in entrepreneurship? To what extent does events early in an individual's career influence the propensity to become an entrepreneur? Finally, how do government policies and culture impact entrepreneurial activity. Overall, although we know that the supply curve of entrepreneurs slopes up, we do not understand in a general way the slope of the entrepreneurial supply curve or how it differs across metropolitan areas. This remains a crucial area for future research.

Third, whether one considers the local causes of entrepreneurship or the local effects, it is unclear at what geographic scale the spatial mechanics of entrepreneurship operate. The papers in this issue have all considered the local dimensions of entrepreneurship. In most cases, the spatial issues operate at the city level. In this spirit, several papers consider the city-level conditions that lead to the creation of self-reinforcing entrepreneurial clusters. In other cases, the spatial issues operate at larger (regional) or smaller (neighborhood) levels of geography. The research question that is suggested by these differences in approaches is clear: at what spatial scale do these entrepreneurs operate? Are the effects highly local, or do they impact entire regions?

Fourth, although the papers in this issue have largely focused on business creation and economic growth, it is almost certainly true that entrepreneurship has much broader impacts. Which suggests the fourth question: how does entrepreneurial activity impact key urban issues? For instance, new business creation has taken place disproportionately at the edges of most cities in recent years. This suggests a link between entrepreneurial patterns and spatial decentralization and sprawl. Similarly, some areas within cities have robust business sectors. Some areas do not. How do the factors determining entrepreneurship impact spatial patterns of inequality and ghettoes? Finally, the competition among local governments discussed by Tiebout (1956) is itself a sort of entrepreneurship. How does fiscal entrepreneurship impact cities? Such entrepreneurship has the potential to be particularly important in developing countries (Lichtenberg and Ding, 2009). There are fine examples of research on all these questions, but definitive answers have eluded us.

These four large open questions quite naturally suggest a fifth: what are appropriate policies towards spatial entrepreneurship? Clearly, with only tentative answers to the first four questions, it is difficult to argue for a comprehensive and intrusive program. But given the current evidence that entrepreneurship matters and that there are a range of factors that impact entrepreneurial activity, it would be a grave mistake to simply ignore entrepreneurship.

Entrepreneurship is rooted in a place, even in the industries that are most technologically advanced. Few people would doubt that Silicon Valley or New York or Bangalore have special characteristics that help make them centers for entrepreneurship in different sectors. Few people would also doubt that entrepreneurs have often played a major role in forging local economies. For these reasons, the returns are high to bringing entrepreneurship more squarely into urban economics.

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Appendix A. Proofs

A.1. Proof of Proposition 1

If there are N workers in the city each of whom earns a wage of W, and if total entrepreneurial profits equal π_{Total}, then the price of land will equal $\frac{1-\mu}{\mu\bar{L}}(WN+\pi_{Total})$. The assumption of iso-elastic demand ensures that prices will equal $\frac{\sigma}{\sigma-1}\beta W$, where W denotes the wage. Total labor earnings plus entrepreneurial profits in the city will equal $\frac{\sigma W(N-\alpha E_k)}{\sigma-1}$, so the price of land is $\frac{1-\mu}{\mu\bar{L}}$ times this amount. Total wealth including renter income in city equals $\frac{\sigma W(N-\sigma E_k)}{\mu(\sigma-1)}$. If $\phi > 0$, total welfare for a manufacturing worker in the city equals:

$$\mu\left(\frac{\sigma-1}{\sigma}\right)\beta^{-\mu}(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W^{\mu}(N-\alpha E_k)^{\mu-1}\bar{L}^{1-\mu}. \tag{A1}$$

If $\phi = 0$, the city is a closed economy, wages can be normalized to one, and worker welfare equals

$$\mu\left(\frac{\sigma-1}{\sigma}\right)\beta^{-\mu}E_k^{\frac{\mu}{\sigma-1}}(N-\alpha E_k)^{\mu-1}\bar{L}^{1-\mu}. \tag{A2}$$

Total consumption of each non-traded or non-traded good in the city equals $\frac{\sigma-1}{\sigma\beta}\frac{\mu YW^{-\sigma}}{E_kW^{1-\sigma}+E_{-k}}$, where Y denotes the wealth of the relevant individual. The total consumption of each good in the city is $\frac{1}{\beta}\frac{(N-\alpha E_k)W^{1-\sigma}}{E_kW^{1-\sigma}+E_{-k}}$ and consumption of all domestically produced goods in the city equals $\frac{1}{\beta}\frac{(N-\alpha E_k)E_kW^{1-\sigma}}{E_kW^{1-\sigma}+E_{-k}}$. Demand for each traded good outside the city is $QW^{-\sigma}$, so total exports in this sector equals $\phi E_kQW^{-\sigma}$. Total labor demand equals

$$\alpha E_k+\beta\left(\frac{1}{\beta}\frac{(N-\alpha E_k)E_kW^{1-\sigma}}{E_kW^{1-\sigma}+E_{-k}}+\phi E_kQW^{-\sigma}\right). \tag{A3}$$

Setting this equal to labor supply gives

$$\frac{(N-\alpha E_k)E_{-k}}{\beta\phi E_kQ}=E_kW^{1-2\sigma}+E_{-k}W^{-\sigma}. \tag{A4}$$

The total profits of each non-traded goods entrepreneur equals

$$\frac{\beta\phi E_kQW^{2-2\sigma}}{(\sigma-1)E_{-k}}-\alpha W, \tag{A5}$$

and the total profits of each traded good entrepreneur equal

$$\frac{\beta\phi E_kQW^{2-2\sigma}}{(\sigma-1)E_{-k}}+\frac{\beta}{\sigma-1}QW^{-\sigma}-\alpha W. \tag{A6}$$

From (A4), we have:

$$\frac{NE_{-k}}{\beta\phi Q}=E_k^2W^{1-2\sigma}+E_kE_{-k}W^{-\sigma}+\frac{\alpha E_kE_{-k}}{\beta\phi Q}. \tag{A7}$$

Differentiating (A7) with respect to E_k yields

$$\frac{2W^{1-\sigma}E_k+E_{-k}+\frac{\alpha E_{-k}}{\beta\phi Q}W^{\sigma}}{(2\sigma-1)E_kW^{1-\sigma}+\sigma E_{-k}}=\frac{E_k}{W}\frac{\partial W}{\partial E_k}>0. \tag{A8}$$

Using the notation $\theta=\frac{E_{-k}}{W^{1-\sigma}E_k}$, (A8) can be rewritten

$$\frac{2+\theta+\frac{\alpha\theta}{\beta\phi Q}W^{\sigma}}{(2+\theta)\sigma-1}=\frac{2+\theta+\alpha\frac{E_k+E_{-k}W^{\sigma-1}}{(N-\alpha E_k)}}{(2+\theta)\sigma-1}=\frac{E_k}{W}\frac{\partial W}{\partial E_k}>0. \tag{A9}$$

Differentiating the equation with respect to ϕ yields

$$\frac{E_kW^{1-2\sigma}+E_{-k}W^{-\sigma}}{\phi((2\sigma-1)E_kW^{-2\sigma}+\sigma E_{-k}W^{-1-\sigma})}=\frac{\partial W}{\partial\phi}>0. \tag{A10}$$

The numbers of workers per firm equals $\frac{N}{E_k}$ which is obviously declining with E_k when N is fixed and independent of ϕ. Worker welfare equals

$$\mu\left(\frac{\sigma-1}{\sigma}\right)\beta^{-\mu}L^{-1-\mu}(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W^{\mu}(N-\alpha E_k)^{\mu-1}, \tag{A11}$$

Substituting in

$$W^{\sigma}\frac{(N-\alpha E_k)E_{-k}}{\beta\phi E_kQ}=E_kW^{1-\sigma}+E_{-k}, \tag{A12}$$

we obtain

$$\mu\left(\frac{\sigma-1}{\sigma}\right)\beta^{-\frac{\mu\sigma}{\sigma-1}}L^{-1-\mu}\left(\frac{E_{-k}}{Q}\right)^{\frac{\mu}{\sigma-1}}W^{\frac{\mu(2\sigma-1)}{\sigma-1}}(N-\alpha E_k)^{\frac{\mu\sigma}{\sigma-1}-1}. \tag{A13}$$

The derivative of the logarithm of (A13) with respect to E_k yields

$$\frac{\mu(2\sigma-1)}{\sigma-1}\frac{1}{W}\frac{\partial W}{\partial E_k}-\left(\frac{\mu\sigma}{\sigma-1}-1\right)\frac{\alpha}{N-\alpha E_k}-\frac{\mu}{\sigma-1}\frac{1}{E_k}, \tag{A14}$$

which is positive if

$$\mu(2+\theta)+\mu+(1-\mu)(2\sigma-1)\frac{\alpha E_k}{(N-\alpha E_k)}+(\sigma-\sigma\mu+\mu)\frac{\alpha E_{-k}W^{\sigma-1}}{N-\alpha E_k}>0. \tag{A15}$$

The inequality (A15) always holds.

The derivative of the logarithm of (A13) with respect to ϕ yields:

$$\frac{\mu(2\sigma-1)}{\sigma-1}\frac{1}{W}\frac{\partial W}{\partial\phi}-\frac{\mu}{\sigma-1}\frac{1}{\phi}, \tag{A16}$$

which is positive if and only if

$$\frac{(2\sigma-1)E_kW^{1-\sigma}+(2\sigma-1)E_{-k}}{((2\sigma-1)E_kW^{1-\sigma}+\sigma E_{-k})}>1. \tag{A17}$$

(A17) always holds.

The cost of land equals: $\frac{\sigma W(N-\alpha E_k)}{\sigma-1}\frac{1-\mu}{\mu\bar{L}}$. It is increasing in ϕ since wages are increasing in ϕ . The derivative of the logarithm of land costs with respect to E_k is

$$\frac{1}{E_k}\frac{2+\theta+\alpha\frac{E_k+E_{-k}W^{\sigma-1}}{(N-\alpha E_k)}}{(2+\theta)\sigma-1}-\frac{\alpha}{N-\alpha E_k}, \tag{A18}$$

which is positive if and only if $N > \sigma\alpha E_k$.

A.2. Proof of Proposition 2

The spatial equilibrium requires that worker welfare equals the constant reservation utility. This implies that $(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W^{\mu}(N-\alpha E_k)^{\mu-1}$ or $(\phi E_k)^{\mu-1}W^{\sigma+\mu-\mu\sigma}(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu\sigma}{\sigma-1}-1}$ are constant with respect to changes in the parameters E_k and ϕ.

Standard notions of stability require that welfare be declining with N (taking into account the impact that N has on wages). Differentiating the labor equilibrium equation with respect to N yields:

$$\frac{\partial W}{\partial N}=\frac{-E_{-k}}{\beta\phi E_kQ\left((2\sigma-1)E_kW^{-2\sigma}+\sigma E_{-k}W^{-\sigma-1}\right)}=\frac{-(E_kW^{1-2\sigma}+E_{-k}W^{-\sigma})}{(N-\alpha E_k)\left((2\sigma-1)E_kW^{-2\sigma}+\sigma E_{-k}W^{-\sigma-1}\right)}<0. \tag{A19}$$

Since wages are always declining with population it is sufficient to ascertain that

$$W^{\sigma+\mu-\mu\sigma}(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu\sigma}{\sigma-1}-1}, \tag{A20}$$

is always declining with W. Differentiating the logarithm of (A20) yields:

$$(\sigma+\mu-\mu\sigma)\frac{1}{W}+\left(\frac{\mu\sigma}{\sigma-1}-1\right)\frac{(1-\sigma)E_kW^{-\sigma}}{E_kW^{1-\sigma}+E_{-k}}. \tag{A21}$$

For this quantity to be always positive, it must be that

$$(\sigma+\mu-\mu\sigma)+(\sigma-1-\mu\sigma)\frac{E_kW^{1-\sigma}}{E_kW^{1-\sigma}+E_{-k}}>0. \tag{A22}$$

Rearranging and simplifying, the condition becomes

$$(\sigma+\mu-\mu\sigma)E_{-k}+(2\sigma-1)(1-\mu)E_kW^{1-\sigma}>0. \tag{A23}$$

which must hold.

Differentiating the logarithm of (A23) with respect to E_k yields:

$$(\mu-1)\frac{1}{E_k}+(\sigma+\mu-\mu\sigma)\frac{1}{W}\frac{\partial W}{\partial E_k}+\left(\frac{\mu\sigma}{\sigma-1}-1\right)\times\left(\frac{W^{1-\sigma}}{E_kW^{1-\sigma}+E_{-k}}+\frac{(1-\sigma)E_kW^{-\sigma}}{E_kW^{1-\sigma}+E_{-k}}\frac{\partial W}{\partial E_k}\right)=0. \tag{A24}$$

This implies that:

$$\frac{E_k}{W}\frac{\partial W}{\partial E_k}=\frac{1}{\sigma-1}\times\frac{(2(1-\mu)(\sigma-1)-\mu)E_kW^{1-\sigma}+(1-\mu)(\sigma-1)E_{-k}}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu\sigma)E_{-k}}. \tag{A25}$$

The denominator is positive. The numerator, $(2(1-\mu)(\sigma-1)-\mu)E_kW^{1-\sigma}+(1-\mu)(\sigma-1)E_{-k}$, is obviously positive as long as $2(1-\mu)(\sigma-1)>\mu$. If μ is sufficiently close to one, it will be negative. Note that if $\mu=1$, then $W(E_kW^{1-\sigma}+E_{-k}.)^{\frac{1}{\sigma-1}}$ must be constant with respect to changes in E_k which ensures that wages will fall as entrepreneurship rises.

Differentiating the logarithm of (A23) with respect to ϕ yields:

$$(\mu-1)\frac{1}{\phi}+(\sigma+\mu-\mu\sigma)\frac{1}{W}\frac{\partial W}{\partial\phi}+\left(\frac{\mu\sigma}{\sigma-1}-1\right)\times\left(\frac{(1-\sigma)E_kW^{-\sigma}}{E_kW^{1-\sigma}+E_{-k}}\frac{\partial W}{\partial\phi}\right)=0, \tag{A26}$$

which implies

$$\frac{\phi}{W}\frac{\partial W}{\partial\phi}=\frac{(1-\mu)(E_kW^{1-\sigma}+E_{-k})}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu\sigma)E_{-k}}>0. \tag{A27}$$

The cost of land equals a constant times $W(N-\alpha E_k)$, yet we know that $(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W^{\mu}(N-\alpha E_k)^{\mu-1}$ is constant. This implies that $(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W(W(N-\alpha E_k))^{\mu-1}$ will be constant, and that $W(N-\alpha E_k)$ will rise if and only if

$$(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W, \tag{A28}$$

rises. The derivative of the logarithm of this expression with respect to ϕ yields:

$$\left(\frac{1}{W}-\mu\frac{E_kW^{-\sigma}}{E_kW^{1-\sigma}+E_{-k}}\right)\frac{\partial W}{\partial\phi}=\left(\frac{(1-\mu)E_kW^{1-\sigma}+E_{-k}}{E_kW^{1-\sigma}+E_{-k}}\right)\frac{1}{W}\frac{\partial W}{\partial\phi}, \tag{A29}$$

which is always positive, so land values are always rising with ϕ.

The derivative of the logarithm of $(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W$ with respect to E_K is

$$\frac{\mu}{\sigma-1}\frac{W^{1-\sigma}}{E_kW^{1-\sigma}+E_{-k}}+\left(\frac{(1-\mu)E_kW^{1-\sigma}+E_{-k}}{E_kW^{1-\sigma}+E_{-k}}\right)\frac{1}{W}\frac{\partial W}{\partial E_k}. \tag{A30}$$

(A31) is positive if

$$\mu E_kW^{1-\sigma}+((1-\mu)E_kW^{1-\sigma}+E_{-k})\times\frac{(2(1-\mu)(\sigma-1)-\mu)E_kW^{1-\sigma}+(1-\mu)(\sigma-1)E_{-k}}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu\sigma)E_{-k}}>0. \tag{A31}$$

(A31) can be rewritten as

$$\frac{(1-\mu)(\sigma-1)(2E_kW^{1-\sigma}+E_{-k})(E_kW^{1-\sigma}+E_{-k})}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu\sigma)E_{-k}}, \tag{A32}$$

which is always positive.

To find the effect of ϕ on N, it is enough to note that $(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W^{\mu}(N-\alpha E_k))^{\mu-1}$ must be constant, so N will rise if

$$(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W^{\mu}, \tag{A33}$$

rises. The derivative of the logarithm of this expression with respect to ϕ is

$$\mu\left(\frac{1}{W}-\frac{E_kW^{-\sigma}}{E_kW^{1-\sigma}+E_{-k}}\right)\frac{\partial W}{\partial\phi}, \tag{A34}$$

which is always positive.

To find the effect on N of E_k, we first note that $W(N-\alpha E_k)$ is rising with E_k, so if increases in E_k lower W, it must be that N rises. As such we need only concern ourselves with the cases where increases in E_k increase W. Next differentiating $(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu}{\sigma-1}}W^{\mu}$ with respect to E_k yields:

$$\left(\frac{E_{-k}}{E_kW^{1-\sigma}+E_{-k}}\right)\frac{\mu}{W}\frac{\partial W}{\partial E_k}+\frac{\mu}{\sigma-1}\frac{W^{1-\sigma}}{E_kW^{1-\sigma}+E_{-k}}, \tag{A35}$$

which must be positive if $\frac{\partial W}{\partial E_k}>0$, which means that $N-\alpha E_k$ must increase.

Workers per firm is isomorphic to $(N-\alpha E_k)/E_k$ yet we know that $\phi^{\frac{\mu}{\sigma-1}}(E_k)^{\mu-1}W^{\mu+\frac{\mu\sigma}{\sigma-1}}\left(\frac{N-\alpha E_k}{E_k}\right)^{\frac{\mu\sigma+1-\sigma}{\sigma-1}}$ must be constant when ϕ or E_k changes. Differentiating the logarithm of $\phi^{\frac{-\mu}{\sigma-1}}W^{\mu+\frac{\mu\sigma}{\sigma-1}}$ with respect to ϕ yields:

$$-\frac{\mu}{\sigma-1}\frac{1}{\phi}+\left(\frac{(2\sigma-1)\mu}{\sigma-1}\right)\frac{1}{W}\frac{\partial W}{\partial\phi}=\frac{\mu}{\sigma-1}\frac{1}{\phi}\frac{(\sigma-1-\mu\sigma)E_{-k}}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu\sigma)E_{-k}}, \tag{A36}$$

which is positive if and only if $\sigma-1-\mu\sigma>0$. If $\sigma-1-\mu\sigma>0$, then $(E_k)^{\mu-1}W^{\mu+\frac{\mu\sigma}{\sigma-1}}$ is increasing with ϕ and $\left(\frac{N-\alpha E_k}{E_k}\right)^{\frac{\mu\sigma+1-\sigma}{\sigma-1}}$ is decreasing with $\frac{N-\alpha E_k}{E_k}$ so $\frac{N-\alpha E_k}{E_k}$ must rise as ϕ rises. If $\sigma-1-\mu\sigma>0$, then $(E_k)^{\mu-1}W^{\mu+\frac{\mu\sigma}{\sigma-1}}$ is decreasing with ϕ and $\left(\frac{N-\alpha E_k}{E_k}\right)^{\frac{\mu\sigma+1-\sigma}{\sigma-1}}$ is increasing with $\frac{N-\alpha E_k}{E_k}$ so $\frac{N-\alpha E_k}{E_k}$ must rise as ϕ rises.

Differentiating the logarithm of $(E_k)^{\mu-1}W^{\mu+\frac{\mu\sigma}{\sigma-1}}$ with respect to E_k yields:

$$(\mu-1)\frac{1}{E_k}+\left(\frac{(2\sigma-1)\mu}{(\sigma-1)}\right)\frac{1}{W}\frac{\partial W}{\partial\phi E_k}=\frac{1}{E_k}\frac{-\sigma(1-\mu)(\sigma-1-\mu\sigma)E_k(\sigma-1-\mu\sigma)^2\frac{(2\sigma-1)}{(\sigma-1)}E_kW^{1-\sigma}}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu-\mu\sigma)E_{-k}}. \tag{A37}$$

If $\sigma-1-\mu\sigma>0$, then $(E_k)^{\mu-1}W^{\mu+\frac{\mu\sigma}{\sigma-1}}$ is decreasing with E_k and $\left(\frac{N-\alpha E_k}{E_k}\right)^{\frac{\mu\sigma+1-\sigma}{\sigma-1}}$ is decreasing with $\frac{N-\alpha E_k}{E_k}$, so as E_k rises $\frac{N-\alpha E_k}{E_k}$ must fall. However, if $\sigma-1-\mu\sigma<0$ it is possible that $(E_k)^{\mu-1}W^{\mu+\frac{\mu\sigma}{\sigma-1}}$ may still be decreasing with E_k if $\sigma(\sigma-1)(1-\mu)E_{-k}<$

$(1+\mu\sigma-\sigma)(2\sigma-1)E_kW^{1-\sigma}$, which would hold, for example for high enough levels of μ. In which case, the comparative static would be reversed.

Finally, we turn to the profitability of the non-traded good entrepreneurs which equals $\frac{\beta\phi E_k QW^{2-2\alpha}}{(\sigma-1)E_{-k}} - \alpha W$. The derivative of this with respect to E_k is

$$\frac{\beta\phi QW^{2-2\sigma}}{(\sigma-1)E_{-k}}\left(1-2(\sigma-1)\frac{E_k}{W}\frac{\partial W}{\partial E_k}\right) \quad \alpha\frac{\partial W}{\partial E_k}, \tag{A38}$$

or

$$\frac{\beta\phi QW^{2-2\sigma}}{(\sigma-1)E_{-k}}\left(\frac{(1-(\sigma-1)(1-\mu))E_{-k}+(2-(1-\mu)(2\sigma-1))E_kW^{1-\sigma}}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu-\mu\sigma)E_{-k}}\right) - \alpha\frac{\partial W}{\partial E_k}. \tag{A39}$$

If $\alpha = 0$, this expression is positive if and only if

$$2E_kW^{1-\sigma}+E_{-k} > (\sigma-1)(1-\mu)E_{-k}+(1-\mu)(2\sigma-1)E_kW^{1-\sigma}, \tag{A40}$$

which will always hold if μ is sufficiently close to one. Conversely if μ is distinctly below one, then a large enough value of σ ensures that the inequality will fail.

The derivative of non-traded entrepreneur profit with respect to ϕ is

$$\frac{\beta\phi QW^{2-2\sigma}}{(\sigma-1)E_{-k}}\left(\frac{1}{\sigma-1}-2\frac{\phi}{W}\frac{\partial W}{\partial\phi}\right)-\alpha\frac{\partial W}{\partial\phi}, \tag{A41}$$

which equals:

$$\frac{\beta E_kQW^{2-2\sigma}}{(\sigma-1)E_{-k}}\left(\frac{(1-\mu)E_kW^{1-\sigma}+(1-(\sigma-1)(1-\mu))E_{-k}}{(2\sigma-1)(1-\mu)E_kW^{1-\sigma}+(\sigma+\mu-\mu\sigma)E_{-k})}\right) - \alpha\frac{\partial W}{\partial\phi}. \tag{A42}$$

This expression will be positive if α is small and $(1-\mu)E_kW^{1-\sigma}+E_{-k}>(\sigma-1)(1-\mu)E_{-k}$, which will always hold if μ is sufficiently close to one. However, for large values of σ the derivative must negative everywhere.

A.3. Proof of Proposition 3

The expected profit of each non-traded goods entrepreneur equals $\frac{\beta\phi QE_kW^{2-2\sigma}}{(\sigma-1)E_{-k}}+\frac{\beta\phi Q}{\sigma-1}W^{-\sigma}-\alpha W$, so the equilibrium is that

$$F\left(\frac{\beta\phi E_kQW^{2-2\sigma}}{(\sigma-1)E_{-k}}+\phi\frac{\beta}{\sigma-1}QW^{-\sigma}-\alpha W\right)=E_k. \tag{A43}$$

For any exogenous variable, Z, we can write:

$$F\left(\frac{\beta\phi QE_kW(E_k,Z)^{2-2\sigma}}{(\sigma-1)E_{-k}}+\frac{\phi Q\beta}{\sigma-1}W(E_k,Z)^{-\sigma}-\alpha W(E_k,Z)\right)=E_k, \tag{A44}$$

and totally differentiate the quantity with respect to Z to get:

$$F'(\pi)\left(\frac{\beta\phi QW^{2-2\sigma}}{(\sigma-1)E_{-k}}\frac{dE_k}{dZ}+\frac{\partial}{\partial Z}\left(\frac{\beta\phi E_kQW^{2-2\sigma}}{(\sigma-1)E_{-k}}+\phi\frac{\beta}{\sigma-1}QW^{-\sigma}-\alpha W\right) -\left(2\frac{\beta\phi E_kQW^{1-2\sigma}}{E_{-k}}+\alpha+\frac{\sigma\phi W^{-\sigma-1}\beta}{\sigma-1}Q\right)\left(\frac{\partial W}{\partial E_k}\frac{dE_k}{dz}+\frac{\partial W}{\partial Z}\right)\right)=\frac{dE_k}{dZ}, \tag{A45}$$

where we mean $\frac{\partial}{\partial Z}\left(\frac{\beta\phi E_kQW^{2-2\sigma}}{(\sigma-1)E_{-k}}+\phi\frac{\beta}{\sigma-1}QW^{-\sigma}-\alpha W\right)$ to signify the derivative of the expression with respect to Z, not counting any indirect effects working through W or E_k. Grouping terms together, this yields that $\frac{dE_k}{dZ}$ equals:

$$\frac{F'(\pi)\left(\frac{\partial}{\partial Z}\left(\frac{\beta\phi E_kQW^{2-2\sigma}}{(\sigma-1)E_{-k}}+\phi\frac{\beta}{\sigma-1}QW^{-\sigma}-\alpha W\right)-\left(2\frac{\beta\phi E_kQW^{1-2\sigma}}{E_{-k}}+\alpha+\frac{\sigma\phi W^{-\sigma-1}\beta}{\sigma-1}Q\right)\frac{\partial W}{\partial Z}\right)}{1-F'(\pi)\left(\frac{\beta\phi QW^{2-2\sigma}}{(\sigma-1)E_{-k}}-\left(2\frac{\beta\phi E_kQW^{1-2\sigma}}{(\sigma-1)E_{-k}}+\alpha+\frac{\sigma\phi W^{-\sigma-1}\beta}{\sigma-1}Q\right)\frac{\partial W}{\partial E_k}\right)}. \tag{A46}$$

The expression

$$\left(\frac{\beta\phi QW^{2-2\sigma}}{(\sigma-1)E_{-k}}-\left(2\frac{\beta\phi E_kQW^{1-2\sigma}}{(\sigma-1)E_{-k}}+\alpha+\frac{\sigma\phi W^{-\sigma-1}\beta}{\sigma-1}Q\right)\frac{\partial W}{\partial E_k}\right), \tag{A47}$$

represents the complete impact of E_k on profits and since we have assumed that $1\frac{1}{F'(\pi)}>\pi'(E_k)$, we are assuming that $1>F'(\pi)\pi'(E_k)$ and so the denominator is positive. As such the sign of the derivative is the same as the sign of the numerator, or the sign of the terms in parentheses since $F'(\pi)>0$, which we refer to as M.

A.4. Case 1: closed city

In the closed city case, wages are determined by the equality

$$\frac{(N-\alpha E_k)E_{-k}}{\beta\phi E_kQ}=E_kW^{1-2\sigma}+E_{-k}W^{-\sigma}, \tag{A48}$$

so the variable N, impacts wages but nothing else in the equation. Differentiating gives

$$\frac{\partial W}{\partial N}=\frac{E_{-k}}{\beta\phi E_{-k}Q((1-2\sigma)E_kW^{-2\sigma}-\sigma E_{-k}W^{-\sigma-1})}<0, \tag{A49}$$

so entrepreneurship is rising with city size.

We will also investigate ϕ, α and Q, and it helpful to note that in the closed city case:

$$\begin{aligned}
&\frac{\partial W}{\partial\alpha}=\frac{E_{-k}}{\beta\phi Q(((2\sigma-1)E_kW^{-2\sigma}+\sigma E_{-k}W^{-\sigma-1}))}>0.\\
&\frac{\partial W}{\partial\phi}=\frac{E_kW^{1-2\sigma}+E_{-k}W^{-\sigma}}{\phi((2\sigma-1)E_kW^{-2\sigma}+\sigma E_{-k}W^{-\sigma-1})}>0.\\
&\frac{Q}{W}\frac{\partial W}{\partial Q}=\frac{\phi}{W}\frac{\partial W}{\partial\phi}=\frac{E_kW^{1-\sigma}+E_{-k}}{(2\sigma-1)E_kW^{1-\sigma}+\sigma E_{-k}}>0
\end{aligned} \tag{A50}$$

In the case of α, it is easy to see that the value of M is negative, since the wage effect is positive and the direct effect on wages is also positive.

In the case of ϕ or Q, the value of M equals either $\frac{QW^{-\sigma}\beta}{(\sigma-1)E_{-k}}$ or $\frac{\phi W^{-\sigma}\beta}{(\sigma-1)E_{-k}}$ times $\frac{1}{\phi}$ times $E_kW^{2-\sigma}+E_{-k}$ minus

$$\left(2(\sigma-1)E_kW^{2-\sigma}+\sigma E_{-k}+\frac{\alpha(\sigma-1)W^{1+\sigma}E_{-k}}{\phi\beta Q}\right)\frac{E_kW^{1-\sigma}+E_{-k}}{(2\sigma-1)E_kW^{1-\sigma}+\sigma E_{-k}}.$$

This can be rewritten as

$$\frac{1}{(2\sigma-1)E_kW^{1-\sigma}+\sigma E_{-k}} \; (2-W)(\sigma-1)E_{-k}E_kW^{1-\sigma}+\frac{(N-\alpha\sigma E_k)W^2E_{-k}-\alpha(\sigma-1)W^{1+\sigma}E_{-k}^2}{\phi\beta Q} \tag{A51}$$

If α is small and $W<2$ (which will occur if $N>\alpha E_k+(E_k2^{1-2\alpha}+E_{-k}2^{-\alpha})\frac{\beta Q\phi E_k}{E_{-k}}$, then this will hold. Alternatively, it will hold if σ is close enough to one. If σ is sufficiently large, then wages will explode and all of the terms can be negative.

A.5. Case 2: open city

In the open city case, wages are pinned down by the spatial equilibrium

$$(E_kW^{1-\sigma}+E_{-k})^{\frac{\mu\sigma}{\sigma-1}-1}W^{\mu+\sigma-\sigma\mu}L^{-1-\mu}\left(\frac{\beta\phi E_k}{E_{-k}}\right)^{\mu-1}=constant. \tag{A52}$$

This means that $\frac{\partial W}{\partial \alpha}=0$, so the number of entrepreneurs is again declining with α, and $\frac{\partial W}{\partial Q}=0$, so the number of entrepreneurs is rising with Q. Also:

$$\frac{\partial W}{\partial L}=-\frac{1-\mu}{\bar{L}}\left(\frac{(\mu+\sigma-\sigma\mu)E_{-k}+(2\sigma-1)(1-\mu)E_{-k}W^{1-\sigma}}{W(E_kW^{1-\sigma+E_{-k}})}\right)<0, \tag{A53}$$

so entrepreneurship is rising with $\bar{L}$.

The derivative $\frac{\phi}{W}\frac{\partial W}{\partial \phi}=\frac{(1-\mu)(E_kW^{1-\sigma}+E_{-K})}{(\mu+\sigma-\sigma\mu)E_{-k}+(2\sigma-1)(1-\mu)E_kW^{1-\sigma}}>0$, so the value of M is

$$\frac{QW^{-\sigma}\beta}{(\sigma-1)E_{-k}}E_kW^{2-\sigma}+E_{-k^-}$$
$$\frac{\left(2(\sigma-1)E_kW^{2-\sigma}+\sigma E_{-k}+\frac{\alpha(\sigma-1)E_{-k}W^{1+\sigma}}{\phi\beta Q}\right)(1-\mu)(E_kW^{1-\sigma}+E_{-k})}{(\mu+\sigma-\sigma\mu)E_{-k}+(2\sigma-1)(1-\mu)E_kW^{1-\sigma}} \tag{A54}$$

This becomes:

$$\begin{aligned}&\frac{QW^{-\sigma}\beta}{(\sigma-1)E_{-k}((\mu+\sigma-\sigma\mu)E_{-k}+(2\sigma-1)(1-\mu)E_kW^{1-\sigma})}\\&\quad*\left[\mu\left(E_{-k}^2-E_k^2W^{3-2\sigma}\right)+(\sigma-1)(1-\mu)E_{-k}E_kW^{1-\sigma}(1-W)\right]\\&\quad+\frac{(N-\alpha(\mu+\sigma-\sigma\mu)E_k)\cdot E_{-k}}{\beta\phi Q}W^2\\&\quad-\frac{\alpha(1-\mu)(\sigma-1)E_{-k}^2QW^{1+\sigma}}{\phi\beta Q}.\end{aligned} \tag{A55}$$

As μ approaches one, the value of M approaches $\frac{QW^{-\sigma}\beta(E_kW^{2-\sigma}+E_{-k})}{(\sigma_1)E_{-k}^2}$ which is unambiguously positive. Conversely if σ gets sufficiently high, then wages explode and all of the terms are negative.

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