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# Informality, Infrastructure Investments and New Firms' Creation: The Location Strategy

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**Abstract**: This paper examines how government investments in infrastructure affect new firms' creation and location. We analyze two scenarios. With an optimizing government, optimal location is a function of government expenditures in infrastructure. With a passive government, optimal location is independent of government expenditures in infrastructure. Productivity effects in the formal sector, as contrasted with informal sector, yield a greater impact on the formation of capital stock, and shadow price of location. The impact of fees on informal firms and taxes of formal firms affect output and welfare. With an optimizing government, entrepreneurs in the formal sector will have higher output and welfare; with a passive government, it is likely that the welfare of informal entrepreneurs is smaller than the one of formal entrepreneurs.

**Keywords**: Firms' creation; Location choices; Location strategy; Government expenditures.

## 1. Introduction

There is a substantial body of theoretical models and empirical work showing the importance of government investments in infrastructure for productivity growth. For instance, in endogenous growth models, it is well-known that government choices about public services can change the level of baseline technology and thereby affect the economy's long-run growth rate (e.g., Barro, 1990; Barro and Sala-i-Martin, 1992, 2004). This is particularly important for Europe since investment is not catching up very fast since the Great Recession. The issue gains greater importance taking into account that Europe is human capital rich, which combined with strategic public services can boost entrepreneurship (e.g., Faria et al., 2021). The economy benefits from government expenditures because they are assumed to be pure public goods, i.e., non-rival and non-excludable. However, some of these government public goods such as roads, water systems, and police services are subject to congestion. Lump sum taxes in the case of congestion lead to suboptimal decentralized equilibrium, optimality only ensues if output is taxed proportionally at the optimal rate of government expenditures relative to aggregate output.

Using the cost-function framework, Morrison and Schwartz (1996) include public capital into the variable cost function. They capture its returns by computing its shadow value, which is the cost savings from a decline in variable inputs (and thus costs) required to produce a given amount of output when infrastructure investment occurs. Empirical results for the USA show that the return to

infrastructure investment is positive and significant. In the same vein, Aschauer (1989) finds that nonmilitary public capital stock is determining productivity and that water systems and transportation infrastructure (roads, airports, mass transit) have most explanatory power for productivity. Canning and Pedroni (2008) show that infrastructure causes long-run economic growth; however, there is substantial variation across countries.

Only recently the impact of infrastructure on entrepreneurship in the form of startup activity has begun to be studied. Woolley (2013) points out that infrastructure can be a catalyst of entrepreneurial opportunities along with the ability of nascent entrepreneurs to act upon those opportunities in the form of starting a new firm. Audretsch et al. (2015) hypothesize that infrastructure is positively related to new firm startup activity although it has a heterogeneous impact on it, which is specific to the particular industry context. They test their model for Germany and find that broadband infrastructure is conducive to the startup of new firms in high technology manufacturing, technology oriented services, consumer-related services, and retail trade but not in low technology manufacturing. By contrast, railway infrastructure is most conducive to new firm startups in technology oriented services, consumer-related services, and retail trade, but not in either high technology or low technology manufacturing. Thurik and Wennekers (2004) argue that in the new entrepreneurial economy, the government policy targets skills supply through education, promote knowledge transfer, and facilitate worker mobility and ability to start new firms.

Mendicino and Prado (2014) show that benefits of formality (in the shape of public investments in infrastructure) are key for the decision of firms to

operate. Moreover, they find that when public infrastructure investments are high, maximizing welfare is associated with the maximization of formality.

Location strategy is an important potential research area and combines different perspectives as economic geography, international business, business competitiveness, regional economics, innovation, and others (Ferreira et al., 2017; Ferreira & Ratten, 2018).

Bougna and Nguimkeu (2018) develop and estimate a location model of entrepreneurship to analyze the impact on formality of local infrastructure investment. Using data for Cameroon, they find that investments in infrastructure have substantial positive impact on entrepreneurship and formality.

This paper fills a void in the literature. It provides a much needed theoretical approach that puts together these strains of literatures to analyze the impact of infrastructure investments on business creation. In a growth theory framework, it models entrepreneurs' location decisions taking into account the creative destruction associated with government expenditures in infrastructure. In addition, it considers that the impact of government investments in infrastructure differs between formal and informal sectors. The results help with empirical issues of identification, causality, and expected impacts of several variables commonly ignored.

In the next section, we provide some theoretical background, in "The Model" we present the model, which we solve both for the cases without government intervention (Tobin equilibrium) and with a government (both rational and passive cases). Finally, in "Conclusions, Limitations, and Future Research" we conclude

and mention, in one hand, some potential limitation, and in the other hand, some avenues for future research

## 2. Theoretical background

It is no surprise that the local impact of provision of infrastructure associated with brand new technologies may boost and concentrate locally firms in the new knowledge economy. In these industries, entrepreneurial success requires knowledge acquisition, transfer, and learning (e.g., Audretsch & Keilbach, 2008). Technological proximity indicates the localization of knowledge. Physical or spatial proximity reduces costs of knowledge acquisition (Audretsch & Feldman, 1996; Jaffe et al., 1993) and facilitates knowledge transfer (Freeman & Audia, 2006). Subsequently, spatial proximity increases new firm foundings (e.g., Agarwal et al., 2007; Carroll & Wade, 1991; Lomi, 1995; Sorenson & Audia, 2000) and industrial clustering (e.g., Krugman, 1991), the best example is the Silicon Valley (Saxenian, 1994).

Theories of location have long since drawn specific attention from the academia (Arauzo & Viladecans, 2006; Ferreira et al., 2017; Hayter, 1997). There are three approaches to analyze location of economic activities: (i) neoclassical, (ii) institutional, and (iii) behavioural (e.g., Hayter, 1997). The neoclassical approach (Grimes, 2000; Ouwersloot & Rietveld, 2000; Holl, 2004; Faria, 2016) focuses on strategies for maximizing profits and minimizing costs. The institutional approach (Galbraith, 1985; Felsenstein, 1996; Arauzo & Viladecans, 2006) considers how companies seek out locations appropriate to the institutional surroundings for meetings (clients, suppliers, commercial associations, regional systems, the

government, and other companies). The behavioural approach takes into account informational issues and uncertainty.

In their study, Ferreira et al. (2017) showed a chronological evolution of theories on location and identifies the landmark studies in the literature. Through a cross-section study, they addressed some critical aspects of the location's impact on innovation capabilities of firms and on their financial performance. According to Arauzo and Manjón (2004), the factors of location are not uniform and hence diverge between different geographic areas. Non-economic factors and entrepreneur's own personality characteristics play a role. This location decision making process is more common to small- and medium-sized companies which fundamentally decide on their location in keeping with the origins and experience of entrepreneurs in their respective sectors or the company financial positions.

Entrepreneur location decisions depend on the sector of activity, type of area (urban vs. rural), and the characteristics of the entrepreneur (Carayannis et al. 2016). Ferreira et al. (2016) analyzed if entrepreneur location decisions differ across industries and if the choice of location is different between rural and urban locations. These authors find that companies engaged in knowledge intensive business services prefer to locate in urban areas. From an institutional point of view, firms prefer to locate in rural areas.

Using a behavioural-experimental economics approach, Alventosa et al. (2016) show that the location of a potential innovator has an impact on innovation attitude and innovation optimism. They argue that a behavioural economic approach helps to explain innovation behaviours and attitudes that are beyond

of the scope of the conventional non-behavioural models. In turn, Vivas-López et al. (2016) adopted an historical perspective and analyzed the intersection of the geographical location of different startups and concluded that level of agglomeration influences the performance of new ventures.

Faria (2016) analyzes a model of local entrepreneurs' choices and shown that the location costs and preferences of local entrepreneurs affect their location and consumption. He argues some policies that influence entrepreneur location and suggests as future research the measurement of individual impact of some important policies as provision of logistical infrastructure, creation and nurturing of pro-market institutions, non-discretionary policies, reduction of statutory tax rate, and incentives to universities and research centres.

According to Jiang et al. (2014), the company's experiences reduce barriers to investment resulting from formal and informal institutional environments in host countries. Their results indicate that previous experiences of other companies in a host country mitigate the negative effect of formal and informal institutional distance on entry decisions. They also found that the effect of distance from the experiences of other companies in different industries is less significant when there is a larger body of experiences from companies in the same industry in a country.

Bennett (2019a, b) proposes an insightful hypothesis—akin of Schumpeter's (1934) creative destruction—conjecturing that infrastructure investments may not only create new businesses but also destroy old ones; i.e., it may create new jobs that did not previously exist, and lead to permanent loss of jobs by closing

incumbent establishments (Chattopadhyay, 2014). Bennett (2019a) finds that public infrastructure investments are associated with the destruction of businesses and jobs, and private infrastructure investment is positively associated with the creation of businesses and jobs. Bennett (2019b) shows that economic freedom is positively associated with firm and job creation, but it has no effect on firm and job destruction.

## 3. The Model

### Market (Tobin) Equilibrium

Assume that the government is investing in infrastructure *G* in one region (roads, water, electricity, etc), properties in that location are denoted *L*, and can represent buildings, structures, lots, etc. The main characteristic of the model is the creative destruction of infrastructure investments represented by the difference between business creation *C(G)* and business destruction *D(G)*:

$$s_t = C(G_t) - D(G_t) \quad (1)$$

Entrepreneurs pay attention to these infrastructure investments, as long as they create business value they try to locate in this region, so their location strategy is driven the creative destruction of infrastructure investments, as in Bennett (2019a, b), given by $s_t$ :

$$L_{t+1} - L_t = \varphi L_t s_t - \aleph(s_t) \quad (2)$$

where $\varphi$ is a positive parameter. The term $\aleph(s_t)$ is zero if $s_t = 0, i.e., \aleph(0) = 0$ .[1]

Firms invest $I$ in location (properties) and capital, $K$. As a consequence, the accumulation equation for capital is given by the difference between investment and expenditures in location, $K_{t+1} - K_t$:

$$K_{t+1} - K_t = I_t - pL_t \quad (3)$$

On the right-hand side, $p$ is the property price in a given location L. Eq. (3) says that capital accumulation is made with resources that are not spent in properties. Note that the purchase price of capital is constant equal to 1 and the depreciation rate of capital is assumed to be zero.

The production function $F(K_t, L_t, G_t)$ is defined in line with Mendicino and Prado (2014):

$$F(K_t, L_t, G_t) = (1 + \alpha_j L_t x {G_t}^{1/x}) K_t^a \quad (4)$$

where 0<$a$<1, and j indexes formal (f) or informal (i) sector, $j = \{i,f\}$.

The impact of government investments in infrastructure differs between the two sectors. On this regard, we assume it is higher on firms operating in the formal sector:

$$\alpha_f + \alpha_i = 1 \quad (5)$$

$$\alpha_f > 0.5$$

[1] Long run stability of equilibrium is warranted by solving for *s* the following restriction [not considered in the paper]: $L_t s_t - \aleph(s_t) = zL_t(1 - L_t/Q)$. Note that on the sigmoid on the left-hand side, *Q* is the carrying capacity of the environment in sustain the expansion of *L*.

Firms face adjustment costs associated with new investments in capital and location. These are impacted by informality as well. Firms in the formal sector pay a tax $\tau$, while firms in the informal sector, when get caught, pay a fine, $e$. Thus, adjustment costs are $c(e, \tau, I_t)$

The representative entrepreneur in each sector (formal or informal) maximizes the present value of profits net of adjustment costs:

$$\max U = \sum \beta^t [F(K_t, L_t, G_t) - I_t - c(e, \tau,\ I_t)] \quad (6)$$

where $\beta$ is the discount factor. This maximization is subject to Eqs. (2)-(4).

The Lagrangian corresponding to the representative entrepreneur problem is:

$$\sum \beta^t \{(1 + \alpha_j\, L_t x {G_t}^{1/x}) K_t^a - I_t - c(e, \tau,\ I_t) + \mu_t [I_t - pL_t + K_t - K_{t+1}] + \vartheta_t [\varphi L_t s_t - \aleph(s_t) - L_{t+1} + L_t]\} \quad (7)$$

where $\vartheta_t$ and $\mu_t$ are the Lagrange multipliers corresponding to constraints (2) and (3), respectively. The first order conditions with respect to I, K and L are:

$$-1 - c_I(e, \tau,\ I_t) + \mu_t = 0 \quad (8)$$

$$-\beta^t \mu_t + \beta^{t+1} \left\{ \left(1 + \alpha_f L_{t+1} x {G_{t+1}}^{\frac{1}{x}}\right) a K_{t+1}^{a-1} + \mu_{t+1} \right\} = 0 \quad (9)$$

$$\beta^{t+1} \alpha_j\, x {G_{t+1}}^{\frac{1}{x}} K_{t+1}^a - \beta^{t+1} \mu_{t+1} p - \beta^t \vartheta_t + \beta^{t+1} \vartheta_{t+1} [\varphi s_{t+1} + 1] = 0 \quad (10)$$

Note that Eq.(8) is similar to Tobin's $q$ result,[2] since the cost of acquiring a unit of capital $\mu_t$, equals the purchase price of capital, fixed at 1, plus the marginal adjustment

[2] More on the Tobin's $q$ and Tobin's equilibrium can be found in Kaldor (1966) and Tobin and Brainard (1977).

cost $c_I(e, \tau,\ I_t)$. This suggests that a Tobin's like equilibrium may hold in the steady-state equilibrium [$X_{t+1} = X_t$] in which case, μ=1. The steady-state solutions of the model are found solving the following system of equations:

$$c_I(e, \tau,\ I) = 0 \quad (11)$$

$$I = pL \quad (12)$$

$$\left(1 + \alpha_j L x G^{\frac{1}{x}}\right) aK^{a-1} = r \quad (13)$$

$$\vartheta = \frac{\alpha_j\, x G^{\frac{1}{x}} K^a - p}{r - \varphi s} \quad (14)$$

$$\varphi L s = \aleph(s) \quad (15)$$

The system of Equations (11)-(15) is fully determined since there are 5 unknowns [$I$, $L$, $K$, $\vartheta$ and $G$] to 5 equations. The system is block-recursive: Note that Eq. (11) determines the equilibrium value of $I^*$, then Eq. (12) determines equilibrium $L^*$. Given $I^*$, and $L^*$, Equations (13)-(15) determine simultaneously the optimal values of $K^*$, $G^*$ and the shadow price of location $\vartheta^*$ .

It is important to stress that in this Tobin Equilibrium, there is no place for government policies since optimal $G$ is determined endogenously solely by firms. This makes this equilibrium a pure market outcome less likely to happen. Of special interest is that in this equilibrium differences between the formal and informal sectors disappear, but their final outcome in terms of welfare may be worse than in cases where the government plays a role. Since the productivity of firms depend on $G$ and $L$ and they in turn are likely to be smaller as well when compared with case with government is active.

**The Role of the Government**

In general, the above Tobin's like equilibrium defined by μ=1, may not hold, in which case Eq. (11) must be replaced by the following Equation (16):

$$c_I(e, \tau, \ I) = \mu - 1 \ \ (16)$$

where $\mu \neq 1$. Equation (13), the steady state version of Eq. (9), is replaced by:

$$\beta \left[ \left( 1 + \alpha_j L x G^{\frac{1}{x}} \right) a K^{a-1} + \mu \right] = \mu \ \ (17)$$

And equation (14) is replaced by:

$$\vartheta = \frac{\beta(\alpha_f \, x G^{\frac{1}{x}} K^a - \mu p)}{1 - \beta(\varphi s + 1)} \ (18)$$

And to guarantee that $\vartheta$ is positive, we must assume that $\alpha_f \, x G^{\frac{1}{x}} K^a > \mu p$ and $\beta(\varphi s + 1) < 1$.

Note, however, that in this case, we now have only 5 equations [Eqs. (12), (15), (16), (17), and (18)] for 6 unknowns: *I*, *L*, *K*, $\vartheta$, $\mu$ and *G*.

In order to fully solve this model, we need to analyze the role of the government in the model, since it is the government who determines infrastructure investments *G*.

We consider two scenarios for the government:

(1) The government is rational and maximizes the impact of infrastructure investments, in which case it sets the marginal benefits of infrastructure equal to its marginal costs which yields positive creative destruction:

$$C_G(G_t) = D_G(G_t) \rightarrow s_t > 0 \quad (19)$$

(2) The government is passive, and set infrastructure investments at the level that equals business creation to business destruction:

$$s_t = C(G_t) - D(G_t) = 0 \quad (20)$$

One can compare Eqs. (19) and (20) and notice that the only difference between them is whether the creative destruction of infrastructure investments [its net effect] is positive or nil: s>0 or s=0.

The scenario (1) with an optimizing government [denoted by ’] is block recursive. Eq. (19) determines optimal government infrastructure investments G’. Given G’, then Eq. (15) determines optimal location, L’. Given G’ and L’, Eq. (12) determines I’, and the Eq. (17) K’. With I’ given, then Eq. (16) determines μ’, and given K’, Eq. (18) υ’.

Therefore, the most important result steaming from an optimizing government is that optimal location is a function of government expenditures in infrastructure.

In the scenario (2) with a passive government, the equilibrium is undetermined. This happens because with s=0, Eq.(15) vanishes, so the complete system has 6 unknowns for only 5 equations. One could argue that in this case a passive government just follows what the private sector dictates, which is in line with the Tobin’s location equilibrium considered above. In this case, the equilibrium with passive government [denoted by ”] has μ”=1, and the model is fully determined with 5 unknowns for 5 equations.

With this provision the system works as follows: Simultaneously and independently, Eq (20) determines G", and Eq. (16) determines I". Given I", Eq. (12) determines L". Given L", Eq.(13) determines K". Given K", Eq.(14) determines υ".

Therefore, the important result steaming from a passive government consistent with Tobin's equilibrium is that optimal location is independent of government expenditures in infrastructure.

As per the status of the representative entrepreneurs in the formal or in the informal sector, we can study the effects of $\alpha_j$. It affects Equations (17) and (18) which determine K and the shadow price of location υ. In both cases the impact of $\alpha_j$ is positive on K and υ:

$$\frac{dK}{d\alpha_j} = \frac{LxG^{\frac{1}{\bar{x}}}K}{\left(1+\alpha_j LxG^{\frac{1}{\bar{x}}}\right)(1-a)} > 0 \quad (21)$$

$$\frac{d\vartheta}{d\alpha_j} = \frac{\beta xG^{\frac{1}{\bar{x}}}K^a}{1-\beta(\varphi s+1)} \quad (22)$$

This result is important because it says that the formal sector, through $\alpha_f > 0.5$, yields a greater impact on the formation of capital stock K than the informal sector does. And that greater impact in K in turn yields a greater impact on the shadow price of location υ in the formal sector compared to the informal one.

In sum, we find that the results for the Tobin equilibrium and passive government are the same for the formal and informal entrepreneurs in terms of their location, investment, and capital accumulation. In terms of welfare, e and τ will be determinant to

differentiating those sectors. If $e > \tau$, as for example in Prado (2011), then it is likely that the welfare of informal entrepreneurs is smaller than the one of formal entrepreneurs.

For the optimizing government case, then capital accumulation is different for the two sectors. Entrepreneurs in the formal sector will therefore have higher output and welfare.

## 4. Conclusions, Limitations, and Future Research

This paper examined, in a theoretical macroeconomic framework, how government investments in infrastructure affect new firms' creation and location. The main hypothesis is that these investments destroy old businesses and create new businesses. It provides a much needed theoretical approach since the results help with empirical issues of identification, causality, and expected impacts of several variables commonly ignored in the current literature of the area.

Two scenarios are analyzed, one with an optimizing government and alternative scenario with passive government. With an optimizing government optimal location is a function of government expenditures in infrastructure. With a passive government, which is consistent with Tobin's equilibrium, optimal location is independent of government expenditures in infrastructure.

Taking into consideration formal or informal status of firms, the paper shows that productivity effects in the formal sector yield a greater impact on the formation of capital stock, and shadow price of location. While in the scenario with market [Tobin's] equilibrium and passive government, we do not observe any difference of capital accumulation and location between sectors. The only difference is on the welfare of the

entrepreneurs. One policy implication there is that the tax rates should be smaller than enforcement rates if one would like to provide incentives for formalization.

A more general policy implication is that an active government may be associated to an equilibrium with higher welfare (when compared with the passive government/ Tobin equilibrium case). Since the productivity of firms depend on G and L, an active government that can guarantee higher G and L would increase the productivity of firms. That in turn would lead to higher output and welfare than the passive government case.

The current model only analyzes this economy in the steady-state. Future research should explore the dynamics towards the steady-state. The transitional dynamics could provide some more nuanced results in terms of welfare. Moreover, one could allow entrepreneurs to have different innate productivities to choose optimally in the each sector they want to operate, rather than the current scenario where firms are a sector as a given. That can potentially provide more interesting dynamics as shocks may lead firms on the margin to switch between sectors.

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