

Asymmetric Information, Entrepreneurial Activity, and the Scope of Fiscal Policy in an Open Regional Economy¹

by

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Abstract

We analyze two hitherto little studied but salient questions concerning the trinity of asymmetric information, entrepreneurial activity, and the scope of fiscal policy in an open regional economy. First, we use a two period model to analyze the contractual relationship between entrepreneurs and venture capitalists when the latter are located outside the region under study. Because there is moral hazard, venture capitalists do *not* offer entrepreneurs the first best investment contract and entrepreneurial activity is *suboptimal*. Second, we analyze a two period model with venture capitalists who are now located inside our regional economy. We show that despite the existence of a credit market imperfection, because the regional authority (RA) does not have an informational advantage over the private sector, it is *not* possible for this RA to use fiscal policy to make a Pareto improving intervention in which some agents are better off and others are no worse off.

Keywords: Asymmetric Information, Entrepreneur, Open Regional Economy, Venture Capitalist

JEL Codes: L26, R11, R58

1. Introduction

In his seminal 1954 book *The Economics of Location*, August Losch, the founding father of modern regional economics, pointed to the importance of open regional economic systems for macroeconomic welfare. With the passage of time, the region has increasingly become a fundamental basis of both economic and social life. This development has led researchers to increasingly focus on the region as an important unit of analysis. With this focus on the region, researchers have now convincingly shown that regional change in general and regional economic development in particular are very closely related to the activities of competing entrepreneurs. In the words of Fischer and Nijkamp (2009, p. 184), “[e]ntrepreneurship...is central to regional economic development.” In addition, contend Fischer and Nijkamp (2009, p. 183), an “entrepreneurial culture is a prerequisite for the wealth of regions...”

Contemporary research on entrepreneurship in the context of regional economic development has stressed three key points.⁴ First, entrepreneurship involves a dynamic process in which new firms are being created, existing firms are growing, and unsuccessful firms are winding down their operations. Second, entrepreneurship involves control of this dynamic process by the entrepreneur/owner who also serves as a manager of risk. Finally, entrepreneurship entails innovation in an uncertain but competitive market environment.

In addition to emphasizing the above three points, the sizeable but mainly empirical and case study based literature on entrepreneurship has addressed a number of other pertinent issues. For instance, Fischer and Nijkamp (1988) and Malecki (1997) have argued that entrepreneurial

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See O’Farrell (1986), Malecki (1997), Verheul *et al.* (2002), Fischer *et al.* (2006), and Fischer and Nijkamp (2009) for a more detailed corroboration of this claim.

development is most likely to be successful in metropolitan regions where innovativeness, an entrepreneurial climate, and business opportunities are plentiful. Pettigrew and Whipp (1991) and Van Geenhuizen (1993) have used a case study approach—sometimes also known as “company life history analysis”—to study the development trajectories of individual firms from a spatio-temporal perspective. Another contribution on urban innovativeness originates from the “urban melting pot” hypothesis—see Jacobs (1993)—in which diversity is seen as a source of creative opportunities. In this vein, Waldinger (1996), Brezis and Temin (1997), and Baycan-Levent and Nijkamp (2009) have all shed light on the extent to which “ethnic entrepreneurship” can be used to better the economic position of minorities in big cities in many parts of the developed world.

Using a data set linking entrepreneurial activity to economic growth in several regions in Germany, Audretsch and Keilbach (2008) have demonstrated that entrepreneurship leads to knowledge spillovers. Glaeser and Kerr (2008) have used United States census data to show that manufacturing startups are most likely to be drawn to areas with many smaller suppliers. Lorentzen (2008) has used network theory and empirical results to argue that firms find knowledge sources on different spatial scales and that global networks and knowledge sources are very beneficial to them.⁵ Finally, Ranga *et al.* (2008) have used what they call a “triple helix perspective”—a network ramification of the business, the knowledge, and the governance sectors—to enhance the innovative capacity of small firms in the northern Netherlands.

The studies discussed in the preceding two paragraphs have certainly enhanced our understanding of the many nexuses between entrepreneurship and regional economic development. This notwithstanding, to the best of our knowledge, there are virtually *no* theoretical studies that are

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A similar proposition was put forward previously by Acs *et al.* (2002).

both dynamic and stochastic in nature and that study the factors that either enhance or impede entrepreneurial activity in open⁶ regional economies. Given this state of affairs, in our paper, we study two hitherto *little studied* but *significant* questions pertaining to the trinity of asymmetric information, entrepreneurial activity, and the scope of fiscal policy in an open regional economy.

More specifically, we first use a two period model of an open regional economy to examine the contractual relationship between entrepreneurs and venture capitalists when these venture capitalists are all located outside the region under study. We show that, *inter alia*, the presence of moral hazard *prevents* venture capitalists from offering entrepreneurs the first best or full information investment contract. As a result, entrepreneurial activity (investment) is *suboptimal*. Second, we once again investigate a two period model but this time the venture capitalists are all located inside the open regional economy under study. In this setting we show that despite the existence of a credit market imperfection, because the regional authority (RA) does not have an informational advantage over the private sector, it is *not* possible for this RA to use fiscal policy to make a Pareto improving intervention in which some agents are better off and others are no worse off.

The rest of this paper is organized as follows. Section 2 first describes a two period model of moral hazard in investment in an open regional economy that is based on Gertler and Rogoff (1990). Then, this section provides a detailed analysis of the contractual relationship between entrepreneurs and venture capitalists when the latter are all located outside the region under study. Section 3 studies a similar two period model but this time the venture capitalists are all located inside the region under study. In this scenario, this section explores whether it is possible for the RA

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By “open” we mean a region that interacts with economic entities outside this region.

to use fiscal policy to make a Pareto improving intervention in which some agents are better off and others are no worse off. Section 4 concludes and then discusses potential extensions of the research delineated in this paper.

2. Entrepreneurs and External Venture Capitalists

2.1. The full information optimum

Consider an open regional economy that faces the world interest rate r and is populated by a large number of entrepreneurs who live for two time periods. These entrepreneurs invest (begin a startup) on date 1 and they consume only on date 2. The representative entrepreneur in this regional economy has a linear utility function given by

$$U_1 = U(C_1, C_2) = C_2. \quad (1)$$

The reader will note that this specification of the utility function implies that consumption in the first period yields no utility to the entrepreneur. On date 1 this representative entrepreneur receives an exogenous endowment of income denoted by Q_1 . This entrepreneur has two options for converting this exogenous income into income in date 2. The first option is to invest Q_1 outside the region under study at the *riskless* rate of return r . The second option is to invest in a *risky* startup within this region. Investment in the startup at level I yields a *random* output Q_2 which is distributed as follows

$$Q_2 = \begin{cases} X & \text{with probability } \varphi(I) \\ 0 & \text{with probability } 1 - \varphi(I) \end{cases}. \quad (2)$$

We assume that $\varphi'(I) > 0$, $\varphi''(I) < 0$, $\varphi(0) = 0$, and that $\varphi'(0)X > 1 + r$. The first two assumptions tell us that higher investment raises expected startup output but at a diminishing rate. The third assumption

says that zero investment yields zero output from the startup. The last assumption tells us that when there is no informational imperfection, i.e., when information is symmetric between the entrepreneurs and the venture capitalists, a positive level of investment is efficient.

Let us denote the first best or the full information level of investment by I^* . Then, it is clear that I^* arises when our entrepreneur's expected profit $\{\Phi(I)X\}/(1+r)-I$ is at a maximum. Therefore, the first order necessary condition that I^* satisfies is

$$\Phi'(I^*)X=1+r. \quad (3)$$

In words, equation (3) is telling us that with the first best level of investment I^* , the expected marginal product of startup investment equals the gross world interest rate. Now, to keep the underlying problem interesting, we suppose that $Q_1 < I^*$. This means that it is impossible for our regional entrepreneurs to finance their startup operations without loans from the venture capitalists who are located outside the region under study.

Let $L \geq 0$ denote the total lending by the region under study to all entities outside this region. Similarly, let $B \geq 0$ denote this region's total borrowing from all the external venture capitalists. Then, on date 1, a regional entrepreneur's financing constraint is

$$Q_1 + B = I + L. \quad (4)$$

Because we are interested in the effects of *asymmetric* information on entrepreneurial activity (investment), we are permitting lending by our region to external entities to allow for the possibility that entrepreneurs *may* invest funds borrowed from the external venture capitalists *outside* and not inside the region under consideration.

The external venture capitalists in our model are competitive and risk neutral. Therefore, any loan they make to an entrepreneur will earn them the expected return r . If the borrowing

entrepreneurs could commit to investing I^* on their startups then they would borrow $B=I^*-Q_1$ and choose $L=0$.⁷ However, it will *not* be possible for these entrepreneurs to repay the borrowed loan in the bad state of nature in which the startup yields no output ($Q_2=0$). This means that all repayments on loans issued against startup output will have to be *state contingent* in nature. In symbols, we denote repayment by $R(Q_2)$ where $R(0)=0$ and $R(X)$ will be determined by the zero profit condition of the external venture capitalists. This zero profit condition also gives us the full information borrowing contract. Mathematically, the zero profit condition of interest is one in which the first best level of investment I^* satisfies

$$\frac{\rho(I^*)R(X)}{1+r}=(I^*-Q_1). \quad (5)$$

With this description of the full information optimum in place, we are now ready to study the effects of asymmetric information on entrepreneurial activity (investment) in the region under study.

2.2. *The asymmetric information optimum*

Events now unfold as follows. The external venture capitalists observe the borrowing entrepreneur's first period exogenous income endowment Q_1 , the total borrowing B , and the second period startup output Q_2 . However, they do *not* observe either the actual entrepreneurial investment I or the actual amount of external assets accumulated by the entrepreneurs as result of lending L to entities outside the region under consideration. In addition, the external venture capitalists first determine the total loan amount B and the repayment terms $R(Q_2)$ and only *then* do entrepreneurs

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Note that the expected return on startup investment in the region under study *exceeds* r until the first best level of investment I^* is reached. In addition, in our model, given the world interest rate r , it does not make sense for an entrepreneur to borrow more than I^*-Q_1 , invest I^* in the startup, and invest the difference outside the region to earn r . This is why $L=0$ in the full information optimum that we are presently studying.

select I and L .

It is important to understand that the external venture capitalists cannot index the loan repayment terms $\{R(Q_2)\}$ to the actual investment in the startup (I) because this investment is *not* observed by them. Hence, as a second best measure, these venture capitalists index the repayment terms to startup output (Q_2) which they can observe. The salient implication of this state of affairs is that if an entrepreneur's investment in a startup turns unprofitable then the external venture capitalists have *no* way of knowing whether this entrepreneur did or did not act in good faith. This implication arises because of the presence of asymmetric or private information.

Let us now study a borrowing entrepreneur's optimization problem. This individual chooses investment I to maximize

$$E[C_2] = \vartheta(I)\{X - R(X)\} - \{1 - \vartheta(I)\}R(0) + (1+r)(Q_1 + B - I), \quad (6)$$

where $E[\cdot]$ is the expectation operator and we have used equation (4) to substitute $L = Q_1 + B - I$ in the last term on the right-hand-side (RHS) of equation (6). For a borrowing entrepreneur, the contractual terms $R(X)$, $R(0)$, and B are given. Using this piece of information and differentiating equation (6) with respect to I , we get

$$\vartheta'(I)[X - \{R(X) - R(0)\}] = 1 + r. \quad (7)$$

A question of considerable interest now is the following. In the asymmetric information scenario of this section, will the external venture capitalists offer an entrepreneur the full information optimum contract? To answer this question, let us proceed in three stages. First, let us compare equations (3) and (7). This comparative exercise tells us that even though a borrowing entrepreneur selects the level of investment I *after* the contractual terms and the borrowing amount $\{R(Q_2), B\}$ have been determined, this entrepreneur will choose $I < I^*$ if he can accept the first best contract.

Second, the external venture capitalists agree to share in the risk of a bad state ($Q_2=0$) as long as the repayment terms stipulate that $R(X)>R(0)$. Knowing this, a borrowing entrepreneur will have less of an incentive to invest in the good outcome for his startup ($Q_2=X$). Instead, this entrepreneur will prefer to covertly invest some of the borrowed funds outside the region under study and earn the riskless return r . When $I=I^*$, this riskless return exceeds the net return given by the left-hand-side (LHS) of equation (7). Third, this moral hazard or hidden action problem on the part of a borrowing entrepreneur tells us that if the external venture capitalists offer the full information optimum contract then they will earn an expected rate of return that is less than r . Therefore, recognizing the incentives facing borrowing entrepreneurs, the external venture capitalists will *not* offer the full information optimum contract to them.

What the venture capitalists will offer entrepreneurs is the next best incentive compatible contract that is optimal in an environment of asymmetric information. In particular, given a borrowing entrepreneur's propensity to underinvest in a successful outcome for his startup, this optimal incentive compatible contract will earn r for the venture capitalists. To see the properties of this optimal contract, note that the contractual terms and the borrowing amount $\{R(X), R(0), B\}$ maximize equation (6) subject to the zero profit condition of the venture capitalists,

$$\varrho(I)R(X) + \{1 - \varrho(I)\}R(0) = (1+r)B, \quad (8)$$

given that investment by our entrepreneur is determined by equation (7). In the remainder of this section, we shall think of equation (7) as an incentive compatibility constraint confronting the external venture capitalists.

Let $R(0)=0$. Now, when $Q_2=0$, an entrepreneur will be able to repay a positive amount to the venture capitalists only by relying on his own assets from outside the region under study.

However, these assets are *unobservable* by the venture capitalists and hence an entrepreneur can always claim that he is bankrupt. This potential behavior means that the incentive compatibility constraint given by equation (7) essentially reduces to

$$R(X) = X - \frac{1+r}{\phi'(I)}. \quad (9)$$

The graph of equation (9) is shown in figure 1 by the curve IC. The LHS of this equation or $R(X)$

Figure 1 about here

is plotted on the vertical axis against investment I on the horizontal axis. This IC curve has a negative slope because when investment I increases, $\phi'(I)$ decreases, $(1+r)/\phi'(I)$ increases and hence $R(X)$ decreases. In addition, the IC curve has a horizontal axis intercept at investment level I^* . This is because when $R(X)=0$, equation (9) reduces to equation (3) which holds when the first best level of investment I^* prevails.

Is the total amount of lending (L) by our regional entrepreneurs to entities outside the region under study zero or positive in the optimal contract under asymmetric information? To answer this question in a rigorous manner, let us write down the Lagrangian function to a borrowing entrepreneur's maximization problem (also see equation (6)). Using $R(0)=0$, we get

$$\begin{aligned} \mathcal{L} = & \phi(I)\{X - R(X)\} + (1+r)(Q_1 + B - I) + \lambda_1\{\phi(I)R(X) - (1+r)B\} + \lambda_2[\phi'(I)\{X - R(X)\} - (1+r)] \\ & - \lambda_3(I - Q_1 - B), \end{aligned} \quad (10)$$

where λ_1 is the Lagrange multiplier on the zero profit condition of the venture capitalists (equation (8)), λ_2 is the multiplier on the incentive compatibility constraint (equation (7)), and λ_3 is the multiplier on the constraint denoted by equation (4).

Using the incentive compatibility constraint (equation (7)) to eliminate the term $X-R(X)$, the Kuhn-Tucker conditions for an optimum are

$$\lambda_1 \varphi'(I)R(X) + \lambda_2 \{(1+r)\varphi''(I)/\varphi'(I)\} - \lambda_3 = 0, \quad (11)$$

$$(1-\lambda_1)(1+r) + \lambda_3 = 0, \quad (12)$$

$$(\lambda_1 - 1)\varphi(I) - \lambda_2 \varphi'(I) = 0, \quad (13)$$

and,

$$\lambda_3(Q_1 + B - I) = 0. \quad (14)$$

Equations (11)-(13) are the first order necessary conditions corresponding to I , B , and $R(X)$, and equation (14) is a complementary slackness condition.

We want to show that in the optimal contract under asymmetric information, $L=0$. To show this we must demonstrate that $\lambda_3 > 0$. Note that if a positive amount B is borrowed by our entrepreneurs then because $R(0)=0$ it must be the case that $R(X)$ is positive. This is the only way that equation (8) can be satisfied. Now suppose $\lambda_3 = 0$. Then equation (12) tells us that $\lambda_1 = 1$. Since $R(X)$ and $\varphi'(I)$ are positive, equation (11), the condition $\lambda_1 = 1$, and $\varphi''(I) < 0$ together tell us that $\lambda_2 > 0$. But if $\lambda_2 > 0$ then equation (13) cannot be satisfied unless $\varphi'(I) = 0$, which is impossible. Therefore, assuming that $\lambda_3 = 0$ leads to a contradiction and $\lambda_3 > 0$ which in turn tells us that $L=0$.

Let us now use the results $R(0)=L=0$ and equation (4) to eliminate B from equation (8). Having done this, the zero profit condition for the venture capitalists can be written as

$$R(X) = \frac{(1+r)(I-Q_1)}{\varphi(I)}. \quad (15)$$

This function is plotted in figure 1 as the upward sloping XR curve. Because Q_1 is fixed, an increase

in investment I increases regional borrowing and this raises $R(X)$. This is why the XR curve in figure 1 is upward sloping. In addition, inspection of equation (15) clearly shows that when $R(X)=0$ the XR curve must have an intercept on the horizontal axis at $I=Q_1$. We now discuss the results we have obtained thus far and conduct some comparative statics exercises.

2.3. Discussion

Figure 1 clearly shows that in the presence of asymmetric information, the optimal level of entrepreneurial investment is strictly *less* than the first best level of investment I^* . To gain additional insight into the working of our model, we now conduct three comparative statics exercises. First, suppose that the date 1 endowment income Q_1 received by our entrepreneurs goes up. Then, inspection of equation (15) and some thought together tell us that a rise in Q_1 will shift the XR curve in figure 1 to the right because any given repayment $R(X)$ is now consistent with a higher level of investment. This means that an increase in Q_1 will *increase* the optimal amount of investment and *lower* the repayment $R(X)$.

Second, suppose that the magnitude of the date 2 startup output in the good state or X increases. Then, inspection of equation (9) and some thought collectively tell us that the IC curve in figure 1 shifts to the right. This *raises* the optimal level of investment I , borrowing B , and the repayment $R(X)$. Finally, suppose that the world interest rate r increases. Inspecting equations (9) and (15) we can tell that an increase in r shifts both the IC and the XR curves leftwards. This leads to a *decrease* in the optimal level of investment in startups by our entrepreneurs.

The results delineated in the previous two paragraphs lead to four clear policy conclusions. First, we see that entrepreneurial activity (investment) in the open regional economy under study will always be *suboptimal*. This is because of the moral hazard problem stemming from the

possession of private information by our regional entrepreneurs and the inability of the external venture capitalists to verify whether the entrepreneurs are or are not acting in good faith. Second, recall that the number of entrepreneurs in our open regional economy is large and that their date 2 output realizations are statistically independent. Therefore, the per capita total entrepreneurial output on date 2 is $\varrho(I)X$. In addition, because investment is less than the first best level, this per capita output $\varrho(I)X$ is also *lower* than the corresponding first best level. Third, the reader should note that relative to other regions, regions with higher date 1 wealth Q_1 will typically benefit from *higher* investment in startups and hence *higher* date 2 startup output. Finally, because investment I is an increasing function of the date 1 income endowment Q_1 , our model suggests that initially richer regional economies will see *higher* entrepreneurial activity in the form of higher investments in startups. This concludes our discussion of the asymmetric information model. We now proceed to analyze the scope of fiscal policy in a two period model in which the venture capitalists are all located inside the open regional economy under study.

3. Entrepreneurs and Internal Venture Capitalists

3.1. Preliminaries

The model of this section is the same as the one used in section 2 but there is one key difference. Specifically, we now suppose that for every entrepreneur in the regional economy under study, there is a venture capitalist also located in this same region. These venture capitalists have the same utility function (see equation (1)) and the same date 1 income endowment (Q_1) as the entrepreneurs but, unlike the entrepreneurs, these venture capitalists do not have any access to startup projects.

The internal venture capitalists of this section have two choices as far as their lending

activities are concerned. They can either lend their money to entrepreneurs in the region under study or they can lend to entities outside this region at rate $1+r$. The reader should note that the mere existence of internal venture capitalists does *not* alter the determination of the equilibrium level of investment by entrepreneurs because these internal venture capitalists do *not* affect the world interest rate. To keep the subsequent discussion interesting, let us assume that the date 1 income endowment Q_1 is sufficiently small so that in a market equilibrium, the optimal level of investment by the entrepreneurs is *below* the first best level of investment.

Suppose that the pertinent regional authority (RA) faces the same informational constraints as the other venture capitalists in our open regional economy. In other words, the RA is unable to directly observe an individual entrepreneur's actual choice of investment I . Instead, this RA observes Q_2 or the date 2 output from a startup. Now, given the assumption that the RA has *no* informational advantage over the private sector in our open regional economy, can she use fiscal policy to address the credit market imperfection discussed in section 2 and thereby achieve a Pareto improvement? Put differently, can she use fiscal policy to make some agents in our regional economy better off without making any others worse off? This is the central question that we now proceed to answer in the next section.

3.2. The scope of fiscal policy

In order to answer the question posed in the preceding section, it will be necessary to impose some more structure on the problem. To this end, let us analyze a tax scheme of the following sort. The RA makes every internal venture capitalist pay a tax of τ_1 in the first period. She then transfers the resulting tax receipts to the entrepreneurs in the region under study. Next, in the second period, the RA imposes a tax of τ_2 on the successful entrepreneurs and then she transfers the ensuing tax

receipts back to the internal venture capitalists.

The reader will note that if the internal venture capitalists are to be made no worse off, then we must have

$$\tau_2 \varrho(I) \geq (1+r)\tau_1. \quad (16)$$

To keep the subsequent mathematics straightforward, we now suppose that our open regional economy is populated with an equal number of entrepreneurs and venture capitalists. Then, in the presence of monetary transfers from the RA, an entrepreneur chooses investment I to maximize

$$E[C_2] = \varrho(I)\{X - R(X) - \tau_2\} - \{1 - \varrho(I)\}R(0) + (1+r)(Q_1 + \tau_1 + B - I). \quad (17)$$

The first order necessary condition for an optimum or the pertinent incentive compatibility constraint in this case—the analog of equation (7) in section 2.2—is

$$\varrho'(I)[X - \{R(X) + \tau_2 - R(0)\}] = 1 + r. \quad (18)$$

In our RA's tax scheme, an unsuccessful entrepreneur does not have to pay the tax. Therefore, $R(0) = 0$. Substituting this last condition in equation (18) reduce this equation to

$$R(X) + \tau_2 = X - \frac{1+r}{\varrho'(I)}. \quad (19)$$

Equation (19) is the analog of equation (9) in section 2.2. The graph of equation (19) with $R(X) + \tau_2$ plotted on the vertical axis against investment I on the horizontal axis gives us a new IC curve. This new IC curve is similar in shape to the IC curve in figure 1. Specifically, this new IC curve is also downward sloping for essentially the same reasons as those given in section 2.2.

In the model of this section, our entrepreneurs borrow $B = I - Q_1 - \tau_1$. Using this information, the zero profit condition for the internal venture capitalists can be written as

$$(1+r)(I-Q_1-\tau_1)=\phi(I)R(X)+\{1-\phi(I)\}R(0). \quad (20)$$

Now, the inequality in (16) will typically hold as an equality because of our stipulation that the RA's tax policy ought not to make the venture capitalists any worse off. Therefore, substituting $\tau_2\phi(I)=(1+r)\tau_1$ in equation (20), this zero profit condition can be re-written as

$$R(X)+\tau_2=\frac{(1+r)(I-Q_1)}{\phi(I)}. \quad (21)$$

Equation (21) is the analog of equation (15) in section 2.2. The graph of equation (21) with $R(X)+\tau_2$ on the vertical axis and investment I on the horizontal axis gives us a new XR curve. Like the XR curve in figure 1, this new XR curve is also upward sloping because of reasons that are similar to those given in section 2.2 for the figure 1 XR curve. Let us now discuss our findings thus far in greater detail.

3.3. Discussion

The new IC and the XR curves referred to in section 3.2 are graphed together in figure 2.

Figure 2 about here

Comparing the new and the old IC and XR curves in figures 1 and 2 along with equations (9), (15), (19), and (21), it is clear that the two sets of IC and XR curves are unchanged except that $R(X)+\tau_2$ has replaced $R(X)$ on the vertical axis in figure 2. What this means is that each entrepreneur now borrows τ_1 less from the venture capitalists and the successful ones pay $(1+r)\tau_1/\phi(I)=\tau_2$ less to these same venture capitalists. Therefore, the RA's fiscal policy intervention has *no* effect on investment by the entrepreneurs.

To see why the above result holds, note the following. Each entrepreneur's first period

income rises by τ_1 . However, the RA must raise second period taxes on successful entrepreneurs by an amount that is sufficient to raise tax revenue of $(1+r)\tau_1$. This “overhang effect” exactly offsets the gain from granting the subsidy to entrepreneurs in the first period. Therefore, the RA is *unable* to use fiscal policy to make some agents in our open regional economy better off without making any others worse off. In comprehending this negative result, it is salient to grasp the role played by the existence of private information in our regional economy. Specifically, in this decentralized regional economy, the RA is unable to achieve a Pareto improvement because she has no informational advantage over the private sector. More generally, we can say that despite the presence of a credit market imperfection, there is *no* scope for using fiscal policy by the RA to bring about a Pareto improving intervention. This concludes our discussion of the trinity of asymmetric information, entrepreneurial activity, and the scope of fiscal policy in an open regional economy.

4. Conclusions

In this paper, we analyzed entrepreneurial activity in an open regional economy in the presence of asymmetrically held information. Specifically, we first used a two period model to examine the contractual relationship between entrepreneurs and venture capitalists when the latter are all located outside the region under study. We showed that in the presence of moral hazard, the external venture capitalists do *not* offer entrepreneurs in the region under study the first best investment contract and entrepreneurial activity is *suboptimal*. Next, we studied a two period model of entrepreneurs and venture capitalists who are all located inside our regional economy. We demonstrated that despite the existence of a credit market imperfection, because the regional authority (RA) does not have an informational advantage over the private sector, it is *not* possible for her to use fiscal policy to make a Pareto improving intervention in which some agents are better

off and others are no worse off.

We would like to reiterate that the existence of moral hazard is central to our analysis in this paper. In some ways, the existence of this condition in the context of regional economic development brings us back to foundational issues in economics and regional science and raises issues concerning trust, social capital, and fairness among market actors. Although a complete analysis of these issues is beyond the scope of this paper, we note that some of these issues have been lucidly discussed in the fascinating new book titled *Animal Spirits* by Akerlof and Shiller (2009).

The analysis in this paper can be extended in a number of directions. Here are two suggestions for extending the research delineated in this paper. First, it would be useful to analyze the entrepreneur/venture capitalist interaction when, in addition to the first period income endowment, entrepreneurs also receive a second period income endowment that can be used either for second period consumption or to pay off any existing loans. Second, one could introduce debt into the model and then examine the entrepreneur/venture capitalist interaction when the pertinent regional authority must pay off a per capita debt. Studies of the contractual relationship between entrepreneurs and venture capitalists that incorporate these features of the problem into the analysis will provide additional insights into an important mechanism that drives regional economic development.

Repayment by Entrepreneurs $\{R(X)\}$

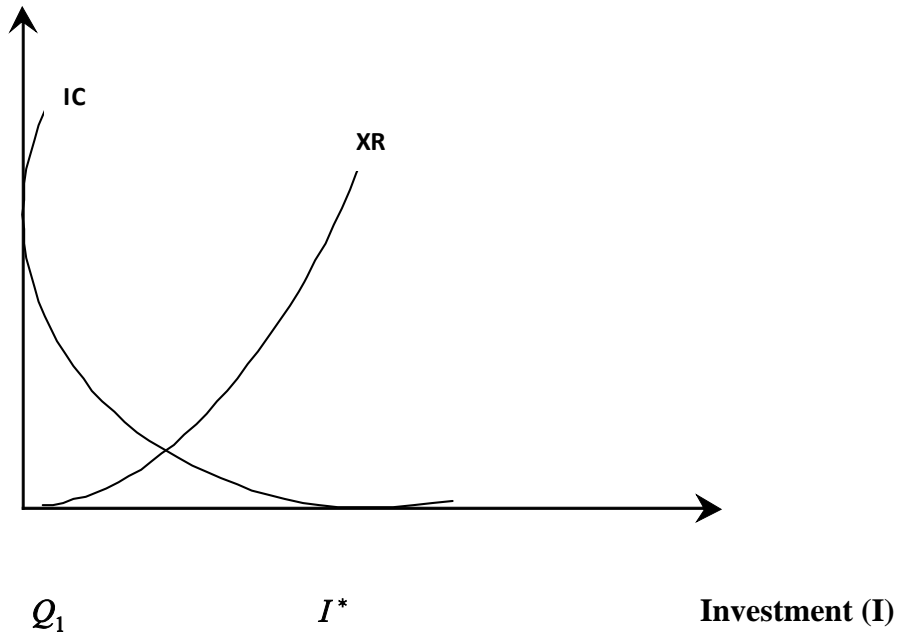


Figure 1

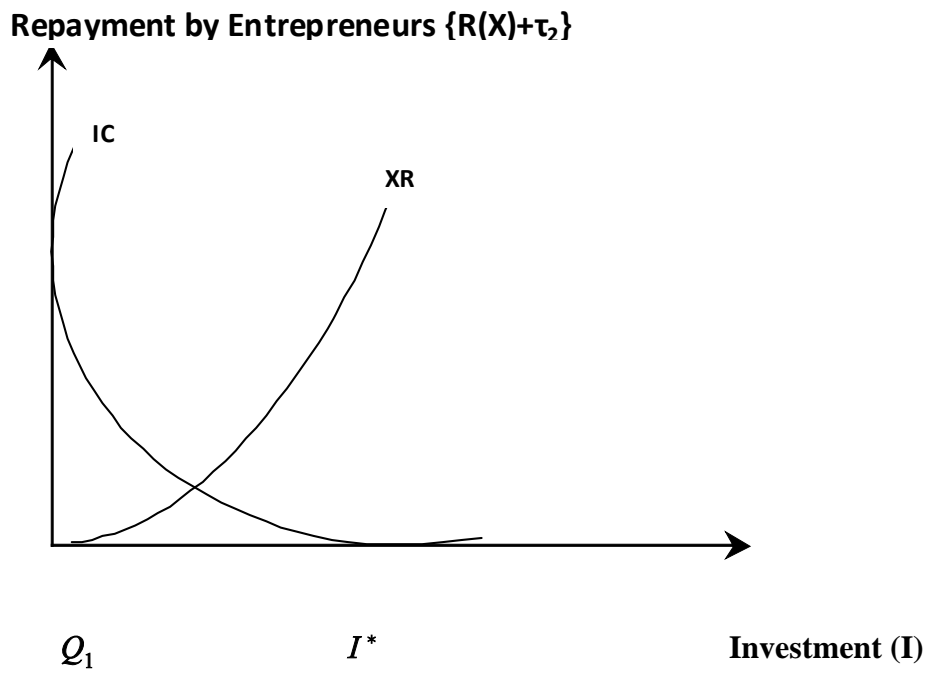


Figure 2

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