Competition for Foreign Talent and International Labour Mobility

Nicolas Schmitt
and
Antoine Soubeyran

In this essay, we investigate the brain gain phenomenon within a simple two-country model and its links with other forms of international labour mobility as well as with the entry and exit process of firms. Specifically, we analyze how foreign workers and entrepreneurs allocate themselves between two countries both when domestic talents cannot move freely to the other country and when they can do so. We also investigate how this allocation of foreign talent affects each country's market wage as well as the number and the size distribution of firms.

The essay is motivated by two considerations. First, the growth of knowledge-based industries is very much driven by the ability of talented individuals, whether domestic or foreign, to create new firms. The emergence and the growth of the biotechnology industry

in the United States is a fascinating case underlying the critical importance of talented scientists to develop ideas and processes that they then exploit by creating firms (see Zucker, Darby, and Brewer 1998). To capture this idea, we specify a model where talented individuals have a choice between being entrepreneurs or workers. This naturally attenuates the wage effect that exists when individuals' activities are completely specialized, but it also has the advantage of introducing a simple process of entry and exit of domestic firms in response to a brain gain. To capture the idea that these talented individuals are stars, the model exhibits increasing returns to an entrepreneur's ability. Hence, firms with more talented entrepreneurs are larger and earn a higher profit. A brain gain thus has important efficiency gains.

The second motivation is that a country like Canada, although it does attract talented foreigners, may not attract the best of them, who prefer to go to the United States; at the same time, it may also lose some of its best domestic talents to the United States. A two-country model allows us to identify some of the causes of these phenomena; it also allows us to look at the effect of introducing international labour mobility between Canada and the United States on the allocation of talents coming from outside North America. This is an important theme in the European Union, where there is already free mobility of workers, and in North America, where new initiatives aiming at improving labour mobility between Canada and the United States cannot be excluded (see Harris and Schmitt 2004).

We show, first, that the allocation between Canada and the United States of talents coming from outside North America between two countries depends strongly on their relative migration costs, on their relative states of technology, and on variables determining country size and group sizes within each country. In particular, a country that imposes a high cost on those who would migrate to it can attract foreign talents only if it has some compensating advantages, such as better technology. In this case, the foreign talents that are attracted are only the best ones, while the others migrate to the country with lower cost of migration. We then show several effects of this inflow of foreign talents: it increases the equilibrium wage in

each country and it induces the exit of some domestic firms as well as the entry of new ones whose entrepreneurs come from abroad.

Allowing domestic workers to move freely from one country to the other has very different implications depending on the pattern of worker mobility. Naturally, labour migration lowers the cost of labour in the country of immigration relative to the country to which it emigrates. Moreover, when foreign talents are entrepreneurs, they tend to migrate in greater numbers to the country where workers also migrate. International labour mobility, therefore, boosts firm creation in the country of immigration and induces the exit of firms in the country of emigration. Which is the country of immigration turns out to depend essentially on the two countries' relative states of technology. If their technology is similar, the country of immigration tends to receive the lesser-talented foreign individuals; if their technology is significantly different, the country of immigration tends to receive the best foreign talents.

This result is interesting because it shows that, in the first case, international labour mobility is a re-equilibrating force as far as both the allocation of foreign talents and firm creation are concerned. An example of this phenomenon might be the Canadian-U.S. case, where Canada receives individuals from outside North America who are less talented than those going to the United States. It suggests that allowing workers to move freely between the two countries would help Canada by boosting firm creation by both domestic and foreign entrepreneurs. In the second case, however, international labour mobility further tilts the allocation of foreign talents in favour of the country already receiving the best individuals. An example of this case would be international worker mobility between a developed and an underdeveloped country, where the allocation of talents and firm creation would favour the developed country.

When local entrepreneurs, but not workers, are able to move freely between two countries, they have incentives similar to those of the foreign talents: they want to be wherever their earnings are higher. This usually means that, if they move, they go where the best foreign talents also want to go. This implies that a country

quite naturally might lose its best talents, and thus its most productive firms, while not getting the best available talents from outside North America. Still, more foreign talents are being attracted to replace the departing local entrepreneurs and these firms may be more productive than the exiting ones.

Although this essay is essentially devoted to the effect of the arrival of talented individuals (a brain gain), the other side of the coin for the country from which those individuals depart is, of course, a brain drain. Moreover, the loss of skilled labour may also mean the loss of both human capital and returns to investment inherent in the public subsidization of education. We do not, however, look at the link between a brain drain and human capital formation.[1] Instead, we restrict ourselves to a one-sector model in order to investigate how foreign talents allocate themselves between two countries and how this allocation affects the entry and exit process of firms in the two countries in the presence or absence of international labour mobility.

The essay is organized as follows. In the next section, we analyze how foreign talents choose the country to which they will migrate and the effects of this brain gain on the immigrant country. In the following two sections, we contrast the brain gain in Canada and in the United States when international labour mobility (whether by workers or by local entrepreneurs) between these two countries is allowed and when it is not. In the final section, we discuss a few policy implications of our analysis. The main part of the essay is followed by an appendix in which we lay out the basic structure of our two-country model and the general equilibrium implications that are derived from it.

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1   This link is examined in, for example, Bhagwati and Hamada (1974, 1982); Markusen (1988); and Djajic (1989). Here, we deal more with the consequence of the mobility of skilled labour for the creation of new firms and thus for the size of knowledge-based industries. As such, this essay is more closely associated with Rauch (1991). We use the same underlying model of agent's choice of activity as he does. However, he introduces this choice of activity into a two-by-two Heckscher-Ohlin-Samuelson trade model in order to investigate the links between patterns of trade and patterns of migration.

The Economy and Brain Gain

To understand how talents coming from outside North America can influence the Canadian economy, it is important to understand first how this economy functions without them.[2]

We consider that, in a country like Canada or the United States, individuals participating in the labor force are differentiated by talent and that they choose to be either workers or entrepreneurs. Talent is more useful for entrepreneurs than for workers — in other words, workers with different talents may have the same productivity, but entrepreneurs with different talents do not have the same impact on the firm they are leading. An entrepreneur with more talent organizes his or her firm better or takes better advantage of the existing technology, which makes the firm more successful in the market than a firm run by a less-talented entrepreneur. Since entrepreneurs earn their firms' profits, more-talented individuals tend to be entrepreneurs and earn higher profits while less-talented individuals tend to be workers and earn the market wage. Of course, entrepreneurs — and thus firms — need workers, and their wages are determined by the demand for labour (which depends on the number of firms) and the supply of labour (which depends on how many individuals choose to be workers). Since each group needs the other, there are always workers and entrepreneurs in Canada and in the United States.

To find out who is doing what in each country, one can consider individuals who are indifferent between the two activities. Individuals with talent levels below those who are indifferent are workers and those with talent levels above this threshold are entrepreneurs. This approach has several advantages. First, the number of firms in each country is determined by market conditions. Second, firms are differentiated by size and profitability: firms headed by more-talented entrepreneurs tend to be bigger and more profitable than firms headed by less-talented entrepreneurs.

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2 See the appendix for more details.

Why is this framework useful to investigate the effects of brain gain on Canada or on the United States? Below, we assume that the skilled individuals coming from outside North America are sufficiently talented to be entrepreneurs themselves.[3] Hence, when these foreign talents migrate as entrepreneurs, the demand for labour increases in both countries, which, in turn, causes the market wage to increase. The higher wage then causes some existing firms to exit because more domestic individuals want to become workers. In other words, new firms enter (because of the migrant-entrepreneurs) and other (domestic) firms exit. When the migrant-entrepreneurs are more talented than local entrepreneurs, the net effect must be a net decrease in the number of firms in each country since the new firms are more efficient than the exiting ones. Hence the inflow of foreign talents has considerable efficiency gains because it contributes to change in the structure of industries.

We now ask how this pool of talented individuals coming from outside North America allocates itself between Canada and the United States. We continue to assume that these foreign talents become entrepreneurs whether they migrate to Canada or to the United States and that they are differentiated by talent. For the time being, suppose also that this migration of talents is the only possible international migration — that is, there is no movement of entrepreneurs or workers between Canada and the United States (we relax this assumption in the next section). Finally, assume that these foreign talents contemplate earnings in their new country sufficient to cover the costs of migrating — such as the resources incurred to migrate, different tax treatment in the two countries, differences in culture or language, and differences in countries' efforts at integrating new migrants.

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3   This assumption is not as unrealistic as it may first appear. Countries like Canada and the United States already attract a large share of the best talents that wish to move from the rest of the world. The fact that such talents become entrepreneurs "immediately" after migrating comes only from the use of a purely static approach.

Like local entrepreneurs, foreign talents take prices, technology, and wages as given. A foreign individual naturally chooses to migrate to the country where profits are higher. We make the important assumption throughout this essay that the fixed cost of migrating to the United States is higher than that to Canada.[4] One implication of this assumption is that the best among the foreign pool of individuals will migrate to the United States while the others migrate to Canada. It is not difficult to see why. If the cost of migrating to one country is higher than the cost of migrating to another but in all other aspects the two countries are identical, then all foreign migrants will choose to go to the lower-cost country. Hence, to attract a foreign entrepreneur, the higher-entry-cost country must have some advantage, such as better technology or lower workers' wages.[5] But if it is the case that the United States must have a technological or labour-cost advantage to attract migrants from outside North America, a foreign entrepreneur will necessarily earn a higher profit (gross of the cost of migrating) in the United States than in Canada. Since, in addition, profits increase with levels of talent, more-talented individuals will want to migrate to the United States even if the cost of doing so is higher, while less-talented individuals will prefer the cheaper country in terms of migration costs — that is, Canada. The general effects of this inflow of migrant-entrepreneurs are the same as those described above, but, everything else being equal, they are stronger at the margin in the United States than in Canada because of the differences among foreign talents.

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4   In fact, we have no hard evidence that the cost of migrating to the United States is higher than to Canada. However, the cost of migrating may best be associated with the cost of integrating into a new country. If this cost is inversely proportional to the share of individuals born abroad in the total population of that country, then our assumption is consistent with the Canadian-U.S. case.

5   Here, too, the implication about technology is reasonable insofar as the United States is the world leader.

Internationally Mobile Workers

In the previous section, we assumed that the foreign pool of entre-preneurs is the only source of internationally mobile labour. We now assume that local workers are also free to move between Canada and the United States but that local entrepreneurs are not.

Leaving aside migration costs, since complete mobility of labour leads to an equalization of wages in the two countries, the flow of workers is then determined by relative shortages and sur-pluses of workers in the two countries. In which direction will workers migrate? What is the effect of the free movement of work-ers between Canada and the United States on the allocation of entrepreneurs coming from outside North America? Result 1 answers these two questions when the state of technology is not significantly higher in the United States than in Canada; Result 2 does likewise when this difference is significant.

Result 1: When the state of technology is similar in the two countries, internationally mobile workers will tend to move from the United States to Canada. As a result, more entrepreneurs migrate to Canada from out-side North America as compared to the case without worker mobility between Canada and the United States.

The reason for this result is as follows. If the state of technology is not significantly superior in the United States, then the higher cost of migrating to that country faced by talents from the rest of the world must be compensated by some other advantage in order to attract them. In the U.S. case, that advantage is a technological advantage or a lower market wage that these entrepreneurs must pay the workers they employ. But if that is the case, allowing work-ers to migrate between Canada and the United States must lead workers to move from the United States to Canada, not the other way around. The effect of workers' moving from the United States to Canada is to increase wages in the former (ignoring the size effect) and decrease them in the latter. Since wages are then lower in Canada when workers are internationally mobile than when

they are not, those lower labour costs attract foreign entrepreneurs to Canada, who then create jobs that attract more U.S. workers. In this case, introducing the free movement of workers acts to re-equilibrate the distribution between the two countries of talents coming from the rest of the world. Indeed, another implication is that the average quality of foreign talents going to each country is higher with international labour mobility than without it, since the additional talents going to Canada are at the lower end of the range of talents that would otherwise migrate to the United States if labour were not internationally mobile.

Suppose now that the state of technology in the United States is substantially higher than in Canada. What is the effect on internationally mobile workers?

Result 2: When the state of technology is sufficiently superior in the United States so as to induce workers to migrate there from Canada, international worker mobility increases the share of foreign talents migrating to the United States compared to the equilibrium without international worker mobility.

The reason for this result is as follows. If technology is significantly better in the United States and workers are not internationally mobile, wages are higher in the United States than in Canada. If workers are allowed to move freely, however, they are drawn to the United States by the higher wages prevailing there. Mobility then decreases wages in the United States and increases them in Canada until they are equalized. The decrease in wages in the United States then attracts more foreign talented entrepreneurs to that country than would be the case without the free movement of labour. In this case, international labour mobility clearly favours the United States, where the best foreign talents already enjoy better technology.

These results have important implications for Canada. Insofar as it enjoyed the advantage of lower costs of migration than the United States, Canada would benefit from an internationally mobile labour force, on the reasonable assumption that technology in the two countries is not fundamentally different. Indeed, free worker

mobility would attract to Canada not only U.S. workers but additional foreign talents as well. This, in turn, would boost the creation of new firms in Canada by both foreign and domestic entrepreneurs. If the state of technology were significantly different in the two countries, however, the situation would be more like what one sees with developed versus developing countries. The free movement of labour not only attracts workers from developing to developed countries but also induces more-talented individuals from developing countries to take advantage of the significantly better technology in developed countries.

Internationally Mobile Entrepreneurs

The last case we investigate is where local entrepreneurs are internationally mobile but workers are not. This case is particularly relevant for Canada, since the North American Free Trade Agreement already permits some skilled individuals, including entrepreneurs, to move freely between Canada and the United States, but not unskilled workers.

We begin by assuming that domestic entrepreneurs face a migration cost that is equal to or lower than that faced by those coming from outside North America. A domestic entrepreneur then migrates only if earnings, net of the cost of migration, are higher in the new country (say, the United States) than they are at home (say, Canada). In this example, if domestic entrepreneurs are internationally mobile, the demand for labour rises in the United States and falls in Canada, which increases the equilibrium wage in the former and lowers it in the latter (recall that workers do not move between the two countries). This has the following result.

Result 3: If some local entrepreneurs move between the two countries, they necessarily migrate to the United States, as do the best talents from outside North America.

This result can be explained in the following way. When some local entrepreneurs move from one country to the other, there is never a

simultaneous move by local entrepreneurs in the other direction since, given the cost of migrating, a firm's profit is higher in one country than in the other. In our earlier example, we saw how the best foreign talents earn more in the United States than in Canada; the same is true for local entrepreneurs when their cost of migrating is equal to or lower than that faced by foreign talents. Thus, given our assumptions, when local entrepreneurs want to move, they do so from Canada to the United States. Of course, the cost of migrating to the United States does not need to be equal for both Canadian entrepreneurs and foreign talents. In particular, if the cost is lower for Canadian entrepreneurs, then both the best Canadian entrepreneurs and the best foreign talents move to the United States.

Interestingly, this does not mean that Canada necessarily loses from the international mobility of local entrepreneurs. Indeed, in this scenario, more foreign talents from the rest of the world migrate to Canada than would be the case if local entrepreneurs were not internationally mobile. Given our assumptions, this substitution of local entrepreneurs by foreign ones increases the average talent of entrepreneurs in Canada and thus the average size of Canadian firms. Still, it is also true that, of the two countries, only Canada loses local entrepreneurs and also does not get the more able foreign talents. Hence, if anything, the free movement of workers has a greater positive effect on firm creation in Canada than does the free movement of entrepreneurs.

Conclusion

This essay makes two general points about the international mobility of brains. First, a brain gain has general equilibrium effects, not only on wages, but also on the individual agent's choice of activity. This has important implications for the exit and the entry of firms and, thus, for the number and the size distribution of firms. Second, a brain gain cannot be looked at in isolation from other types of international factor mobility. Here, we have concentrated our analysis on two separate types of labour mobility to investigate the

international allocation of foreign talents: the international mobility of workers and that of local entrepreneurs.

Our analysis reveals a number of interesting results. First, the mobility of individuals between two countries like Canada and the United States has nontrivial implications for the allocation of talents coming from outside North America that differ depending on whether the mobility involves workers or local entrepreneurs. Indeed, in the absence of international labour mobility between particular two countries, the best talents coming from elsewhere migrate to the country with the higher entry cost provided it also has the lower wages in terms of efficiency units. The share of the foreign pool that country can attract then depends on both the state of its technology and its labour costs relative to the other country.

Allowing labour to move freely between two countries may either improve or deteriorate the share of the foreign pool of talents each country would obtain in the absence of such labour mobility. In the case of Canada and the United States, however, free worker mobility between the two countries would increase Canada's share of foreign entrepreneurs and thereby boost firm creation in this country. It is the case at least if one accepts the fact that the cost of migrating from outside North America to the United States is higher than it is to Canada and that technology is similar in the two countries.

If local entrepreneurs, rather than workers, are allowed to move freely, the effects are somewhat different since entrepreneurs respond to profits, not wages. Local entrepreneurs who migrate always do so to the same country that attracts the best foreign talents. Hence, if local entrepreneurs move at all, the best Canadian ones migrate to the United States. This is not surprising since the United States has lower wages and/or better technology, so that firms earn higher profits there. At the same time, however, the outflow of Canadian entrepreneurs is offset in part by the ability to attract a greater share of foreign talents.

The analysis suggests two types of public policies that can be used to attract foreign talents. The first type relates to the cost of migrating — examples of such policies are the temporary tax exemption recently adopted by Quebec or those aimed at facilitating

the integration of immigrants. It is not that this parameter is more important than others but simply that any policy affecting the cost of migration is necessarily more direct and thus more efficient than acting on the state of technology or on the supply of local talents. There is no doubt, however, that lowering the cost of migrating to Canada would directly increase not only the number but also the average quality of foreign talents coming to this country.

The second type of policy is that which has only an indirect, or marginal, effect on the attractiveness of a country for foreign talents. An example of such a policy is one aimed at allowing the freer movement of domestic entrepreneurs and workers. Moreover, the effect of such a policy depends crucially on the economic environment in which it is introduced. For instance, a policy aiming at improving the international mobility of workers is useful to attract foreign talents and encourage the entry of new firms when the relative cost of labour is high, but not when it is low. However, a policy that allows freer mobility of local entrepreneurs may be far less useful if entrepreneurs choose not to respond to such an option or if, in responding positively, they induce an imperfect substitution between local and foreign talents. Whether or not such a policy is desirable then depends crucially on the relative economic merits of each group of entrepreneurs.

Appendix

The underlying model used in this paper is based on Lucas (1978) and Murphy et al. (1991). Here, we develop a simplified version in order to understand the main forces at work.[6]

In each country, any firm producing a homogeneous product has an entrepreneur with talent level θ and workers, each of them earning market wage w. We assume that the distribution of abilities is uniform between the lower and the upper limit ($\theta \in [0, \overline{\theta}_i]$, $i = $ U, C for United States and Canada, respectively). Ability measures how much an individual or entrepreneur is able to exploit the technology he

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6   All technical derivations can be found in Schmitt and Soubeyran (2003).

or she operates. Every individual in both countries is fully employed and chooses either to be employed as a worker or to be an entre-preneur. "Ability" is an attribute solely of entrepreneurs, and plays no role for workers; rather, as a worker, an individual simply sup-plies one unit of labour to the market.

A firm producing in country *i* earns profits equal to

$$\pi(\theta) = \chi_i \theta f(l) - w_i l. \tag{1}$$

where χ_i represents a country-specific common state of technology, θ is the entrepreneur's ability, and $f(l)$ is the production function with respect to the number of workers, l, the firm employs (it exhibits decreasing marginal product of labour). The last term of the profit function, $w_i l$, is the firm's total labour cost. The production func-tion is the same for every entrepreneur in both countries, and each entrepreneur takes as given the wage and the state of the technology irrespective of the country in which the firm produces. We also assume that the labour market is competitive in both countries, and that the output market is characterized by free trade between two small countries (in the economic sense).

It must be clear from equation (1) that, although all entrepreneurs use the same technology, those with higher ability earn a higher profit than those with lower ability. This increasing return to ability induces able individuals to become entrepreneurs on two counts: they earn a higher profit for a given firm size and they can spread their ability over a larger firm scale. Indeed, given the above assump-tions, the number of workers hired by an entrepreneur is such that the value marginal product is equal to the marginal cost, and since the value marginal product increases with the entrepreneur's abil-ity, the size of the firm is increasing with the entrepreneur's ability.

Since an individual chooses to become an entrepreneur when profit is higher than salary, or a worker when salary is higher than profit, an individual who is indifferent between one choice and the other in country *i* has ability θ_i^* such that

$$\pi(\theta_i^*) = w_i. \tag{2}$$

Since profit increases with the entrepreneur's ability, any individual with high ability $(\theta > \theta_i^*)$ prefers to be an entrepreneur and any individual with low ability prefers to be a worker.

The critical ability θ_i^* still needs to be determined. Since it splits the domestic agents into two groups, workers and entrepreneurs, it is found simply by equating labour demand and labour supply. In other words, without international mobility,

$$L_i^S (\theta_i^*) = L_i^D (\theta_i^*). \tag{3}$$

Equations (2) and (3) determine, for each country, the market wage w_i and the skill θ_i^* of the individual who is just indifferent between being an entrepreneur or a worker. Hence, these two equations capture how an agent's choice of activity and wage simultaneously adjusts to any exogenous changes. Another way of interpreting equation (2) is that it determines the number of firms in each country, since the number of firms in country *i* is equal to the number of entrepreneurs with ability above θ_i^*.

We now add a foreign pool of talented individuals with a specific distribution of abilities $[\underline{\theta}_0, \bar{\theta}_0]$, which is at least as high as the best abilities of the individuals in the two countries. A foreign entrepreneur moving to one of these two countries expects to earn $\pi_i = \chi_i \theta f(l) - w_i l - \delta_i$, where δ_i is the cost of migrating to country *i*.

When workers are mobile between the two countries, the common international wage and the critical ability, θ_i^*, making an individual indifferent between being a worker and an entrepreneur are determined by

$$w_U(\theta_U^*) = w_C(\theta_C^*)$$

and

$$L_U^D(\theta_U^*) - L_U^S(\theta_U^*) = L_C^S(\theta_C^*) - L_C^D(\theta_C^*).$$

The second equation also indicates the pattern of workers' migration between the United States (*U*) and Canada (*C*).

When entrepreneurs are mobile between the two countries, an entrepreneur migrates when $\pi_i(\theta) - \delta_i \geq \pi_j(\theta)$, where *i* is the country of migration and *j* is the country of origin. Hence, entrepreneurs willing to leave country *j* must have an ability greater than some ability $\tilde{\theta}_j$: only the best entrepreneurs leave a country. The migration of entrepreneurs modifies the supply of labour ($L_i^S(\theta_i^*)$) but equations (2) and (3) are still used to determine the equilibrium in each country.

References

Bhagwati, Jagdish, and Koichi Hamada. 1974. "The Brain Drain, International Integration of Markets for Professionals and Unemployment: A Theoretical Analysis." *Journal of Development Economics* 1 (1): 19–24.

———. 1982. "Tax Policy in the Presence of Emigration." *Journal of Public Economics* 18 (3): 291–317.

Djajic, Slobodan. 1989. "Skills and the Pattern of Migration: The Role of Qualitative and Quantitative Restrictions on International Labor Mobility." *International Economic Review* 30 (4): 795–809.

Harris, Richard G., and Nicolas Schmitt. 2004. "The Consequence of Increased Labour Mobility within an Integrating North America." In *North American Linkages: Opportunities and Challenges for Canada*, Industry Canada Research Series 11, edited by Richard G. Harris. Calgary: University of Calgary Press.

Lucas, Robert E. 1978. "On the Size Distribution of Business Firms." *Rand Journal of Economics* 9 (2): 508–23.

Markusen, James. 1988. "Production, Trade and Migration with Differentiated, Skilled Workers." *Canadian Journal of Economics* 21 (3): 492–506.

Murphy, Kevin M., Andrei Shleifer, and Robert W. Vishny. 1991. "The Allocation of Talent: Implications for Growth." *Quarterly Journal of Economics* 106 (2): 503–30.

Rauch, James E. 1991. "Reconciling the Pattern of Trade with the Pattern of Migration." *American Economic Review* 81 (4): 775–96.

Schmitt, Nicolas, and Antoine Soubeyran. 2003. "International Labor Mobility, Brain Gain and Distribution of Firms." Mimeographed.

Zucker, Lynne, Michael Darby, and Marilynn Brewer. 1998. "Intellectual Human Capital and the Birth of US Biotechnology Entreprises." *American Economic Review* 88 (1): 290–306.