DOES "LOCAL INNOVATION POLICY" MAKE SENSE? LESSONS FROM A US-EUROPE COMPARISON

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Universities, R&D and local innovation systems: "état des lieux"

It has been rightly recognized that R&D is an essential input to innovation. R&D alone is insufficient to generate innovation, however; it must be embedded in a set of institutions that allow the knowledge it generates to be known, translated into economically-useful forms, and commercialized. At the same time, successful innovation in many fields requires not that the distinction between applied R&D and basic be eliminated, but that both be vital, and that their differences be respected. Universities and other academic-style research institutions are widely-held to be best at basic R&D, the kind that doesn't necessarily start with a commercial goal in mind. Yet academic research establishments tend to be rather isolated from the world of commerce, and so the problem of how to link the basic R&D to applied R&D and commercialization is at the center of debates about how to sustain high rates of innovation. This is

somewhat less true for certain "traditional" types of innovation, as in the craft- and design-based sectors, but there too, insights from basic science – new materials and new processes, especially – are becoming increasingly important to the maintenance of high quality, innovative looks, and to productivity gains in manufacturing and after-sales service.

The appearance of a number of highly-visible innovative regions in the world – with Silicon Valley as the iconic version of this phenomenon – has injected a geographical element into reasoning about the link between basic research and the downstream innovation process. This is because many accounts of Silicon Valley's rise place the relationship between Stanford and Berkeley and the embryonic micro-electronics industry at the center of Silicon Valley's success. Another superstar region in the USA, Boston, is also the heart of the biggest university complex in North America, and one of its major components, MIT, is particularly well-linked to industry, so it is used to buttress the claim that close local university-industry links are key to innovation and local economic development. From these two key cases, hundreds have been interpreted in the same way: Oxford and Cambridge; Cal Tech-USC-UCLA and Los Angeles; Carnegie-Mellon and Pittsburgh; U. Texas and Austin; and so on. Frequently overlooked is that there are many cases of North American successful economic development where no major technology-based universities are present in the local environment: New York City, Dallas, Denver, Seattle come to mind. Even Washington DC, often cited because of the presence of several major national laboratories, has no "big league" basic R&D facilities organized in a traditional academic fashion. Still, the "trope" of local economic development as driven by the presence of major technology-based universities and labs,

and by close links between them and industry, has become deeply rooted in policy discourse and research.

In Europe, the "lack" of such institutions and local links has become a key element in policy analysis. Thus, European universities are (frequently) said to be less successful at basic technological breakthroughs than their North American counterparts. This is the notion that European researchers are more conservative than their American counterparts, trapped in the post-war logic of "catching up," while American institutions and their researchers are engaged in "pushing the frontier." In part, this is a residue of the missions that were designed for higher education and R&D in the post-war period when Europe's problem was, indeed, to catch up to the Americans. This problem of catch-up is no longer especially relevant to early 21st century Western Europe. But, it is also argued that, having done their job of helping Europe to catch up in general terms, European universities and research establishments have not been reformed so as to help Europe "push the technological frontier:" European universities are hierarchical bureaucracies, with confusing missions (dispensing mass education yet told to do cutting-edge research, told to do cutting edge research but weighed down by ponderous civil service procedures). This not only prevents them from doing as well in basic R&D as American universities – they do not have the internal flexibility, administrative autonomy, or financial autonomy to do so – but in addition, because they are often run by national governments (education and research ministries), and internally are organized by civil service rules, they have little incentive or ability to have strong relationships to industry, and little autonomy with which to privilege the "natural" terrain to do that, i.e. l*ocal* industry, local firms, and local actor-networks.

On both sides of the Atlantic, the less innovative regions have thus turned to the notion that two problems can be resolved at the same time by promoting industry-university linkages at the local level. On the one hand, the local economy will benefit from local R&D, and on the other hand, increasing local university-business linkages will make hide-bound universities more flexible. This will in turn get them involved in the activity of "pushing the frontier" because of the increased incentives to break through in innovations, since the payoffs for doing so will hence be made visible through connections to industry. In both continents, there has been a proliferation of offices to promote university-industry linkages. In America, some of this came as a result of the Bayh-Dole Act, which allows individual researchers and their universities to share the patent revenues from commercialized innovations. In many other cases, it came as a result of local decisions to set up linkage offices, staffs, and procedures for encouraging these relationships.

There is now an extensive literature on the effects of these experiments, and it is – at best – inconclusive as to their effects. It almost invariably finds that university-industry linkages have increased, but this is almost inevitable, given that that is what it is measuring. More difficult is to establish that there has been any measurable effect on the rate of innovation overall, and that local links lead to increases in local innovation in any sustained fashion.

In what follows, I report on research on the geographical (hence, including local) aspects of the EU-USA innovation gap. I use this to consider the question of such university-industry R&D linkages as a potential focus of European innovation policy efforts.

The territorial dynamics of innovation: A US-Europe comparison

In recent research carried out with Riccardo Crescenzi and Andrés Rodriguez-Pose (*Journal of Economic Geography*, 2007), we investigated the reasons for the US-Europe innovation gap. As is well-known, levels of innovation, adjusted for population size, remain stubbornly higher in the USA than in the EU-15, using many different indicators. A major part of the difference has to do with the higher level of inputs to innovation in the USA, including expenditures on R&D, the number of full-time equivalent researchers, and the quality of those researchers. There are also institutional differences, in that the US has a single national system of innovation built during the Cold War period, and involving heavy involvement of the federal government, whereas Europe still has a pastiche of very different national systems, so the US enjoys economies of scale that are not present in Europe. One of the consequences of these differences is that Europe is more specialized in innovations that deepen existing paradigms and products (perfecting their qualities), whilst American innovations are more oriented toward shifting the technological paradigm ("radical" innovation).

Our research seeks to determine whether *geographical behaviors* also contribute to different levels of innovation. The standard approach to this question is via the issue of clustering or agglomeration. Since it is widely believed that certain kinds of innovation depend on geographical proximity in the production system (technological spillovers, trustful relations, face-to-face contacts, diversity and "serendipity" – i.e. Marshallian and Jacobs "externalities"), most of the research on this subject compares

levels of agglomeration of innovators in the US and Europe. It finds, surprisingly, that they do not differ very much.

Rather than deal with this question as a "stock" issue (how much clustering?), however, our research seeks to determine the dynamics – or "flow" processes – of the agents and resources involved in innovation in the two continents. The matching of knowledge resources and the learning of agents depend on the many ways in which such agents move around in territorial spaces and hence how they are able to send signals and generally relate to other agents. Learning and innovating – especial for radical innovations -- depend on how places can "recompose" their "portfolios" of innovative resources as the needs of technologies change. This recomposition is achieved either by moving agents in and out, or by helping existing agents to learn and transform themselves *in situ* as needs change.

Population is more mobile in the USA than in Europe: people move more often. So, this should mean that flows between places are higher and that it is easier to re-arrange the "map of innovation" in the USA than in Europe. On the other hand, in Europe the major metropolitan areas are closer together and population densities are higher, so – in principle – it is easier to have temporary contact between agents in different metropolitan areas than in the USA (less travel time). Europe has an increasingly efficient network structure of inter-agglomeration flows. Against this structural background, what is the role of the "local" in the innovation behavior of the two continents? Is it strong or weak? Is it similar or different?

Our research generated a rather complete statistical analysis of the factors that contribute to different levels of innovation, by using the standard Knowledge Production

Function. We tested the contributions of input levels (investments, R&D workers, and so on), to which we added a detailed set of empirical variables designed to illuminate the possible contribution of territorial factors to innovation. Among these are the different socio-economic conditions of each region (education levels, for example); the level of specialization of the economic base (the Krugman index' notion that more specialization will lead to more local interaction); local population density; migration into and out of the region; and "spatial interaction" variables, which measure the presence of the previous factors in neighboring regions, designed to determine where the geographical "boundary" of such contributing factors lies in relationship to the statistically-defined regions we use. We also had a complete set of national/geographical dummy variables. We used patents as our dependent variable, and recognize that it is a partial measure of innovation (but unavoidable, because it's the highest quality large-scale datum available). The model was estimated for 266 American metro areas, but then re-estimated for only 145 of these because local R&D data were only available for this subset. We also estimated it for NUTS1 and 2 regions in the EU-15.

There are both similarities and differences. One important similarity is that there is convergence in innovation levels between regions in both continents. This more even spread of innovation suggests that both are mature geographies of innovation, offering opportunities in peripheral regions to take over at later stages in the product cycle when the disadvantages of central regions become too great. Interestingly, the convergence is *greater* in the EU than in the USA.

In the USA, there is a greater impact of *local* R&D expenditures on innovation output than in Europe. This is surprising, given that the US has a well-developed system

of national funding for major basic R&D, and this system has been around longer than its European counterparts. Moreover, inter-metropolitan area spillovers are much weaker in the US than in Europe.

There are three potential reasons for these differences. As noted, the distance between innovation centers is greater in the US than in Europe and there are bigger distance decay effects in North America than in Europe (80-110 km in the US, versus 200-300 km is the effective distance in Europe). Thus, it appears that European regions rely to a greater extent on spillovers from other close-by regions than do metro regions in the USA.

Secondly, R&D inputs are more specialized and better targeted than in Europe. This is a legacy of the attempts of many European countries to have presence in many sectors, in spite of smaller size than the USA, so they cannot go as "deep" as the USA in most sectors. This, combined with a more integrated market in the USA, generates more specialized metropolitan regions in terms of R&D efforts.

Third, in the US the high levels of labor mobility allow better ongoing matching of innovative actors in space. Consequently, we can suppose that they interact more strongly on a local basis, relying less on spillovers from other regions than in Europe. This is reflected in the weaker convergence parameter in the USA. In Europe, innovators must rely on neighboring regions' innovation efforts. This hampers matching at the intra-metropolitan level and adjustment of local "portfolios" of activities. It might be that Europeans' greater attachment to place, combined with more uniform incentives to R&D from place to place (national systems of R&D with little local autonomy) reduce the propensity for innovators to move around and match with each other as flexibly and

rapidly in the USA. Perhaps this contributes to the more "conservative" nature of European innovation in general, but also is one reason why American industries tend to abandon their market positions in older technologies, rather than perfecting them and deepening them (less "stickiness").

Critically, in both places, the socio-economic conditions are important to the uptake of innovations, so this suggests that whatever the underlying mobility parameters, it's important that local conditions be conducive to absorbing innovations and allowing innovators to do their work in an appropriate environment.

We did not test directly for the nature of innovation institutions, such as the internal organization of universities and R&D laboratories. But the typical American university or R&D facility has much greater institutional autonomy and independence than its European counterpart. This enables competition for resources between territories as well as local initiatives to relate to industry and other actors, and enables them to raise the funds to implement such initiatives. Even though much of the financing comes from the federal government, it is awarded through a competitive system, rather than through fixed administrative formulae. In this context, the territorial mobility of innovators is a key component to making the whole system work and giving it a distinctive cast – moving rapidly into new areas, possibly abandoning older ones with greater aplomb than in the typical European situation.

So this is the major point of our analysis: in both Europe and America, there are local roles in innovation, but their fundamentals are structured very differently. In Europe, as is well known, there are highly structured local clusters of innovators, involving intricately structured relationships – depending on the sector, of course. The

"national" levels of these systems – usually involving the universities and national research councils – are, paradoxically, structured to *avoid local involvement through autonomy and initiatives,* even though local actors tend to be often highly "rooted" in place. In the USA, the movement and re-arrangement of resources allows for the construction and re-construction of dense, local, "cutting edge" clusters of actors, but at the same time, these do not have the historical stability and "rootedly relational" glue that can be found in their European counterparts. In the USA, they are "here and now," highly fluid but highly local relationships. So, the USA and Europe are *differently localistic.* In the following section, I'd like to argue that each of these types of localism has strengths and limitations.

Some possible lessons for Europe and the USA

As noted above, many European countries have experimented with, or are considering, policies that promote closer local university/R&D/industry relationships. They typically try to do this by establishing liaison offices in universities, who are assigned the task of making contact with industry. Academic research on these experiments has not been able to establish that they contribute to raising the overall rate of innovation in industry, nor that they enhance the productivity of researchers in universities. This is as true for Europe as it is for the USA. This doesn't mean they necessarily have no value, as there are formidable methodological obstacles to detecting discrete influences on innovation, but there is reason for skepticism.

My guess is that such policies are probably of little use in Europe, and are secondary to deeper reforms of both the university/R&D structures and the geography of

innovation. For the USA, they are probably not entirely useless, but they are of secondary importance to deeper structural factors such as those we describe above. The real reasons that universities and industry have deep ties in the USA, and that many of these are local, has to do with the way both research and geography are structured in that country. Universities have substantial academic and financial autonomy; they are set up along the Anglo-Germanic system, which privileges research in the governance system of the university; thus, they compete with one another and need to develop centers of local excellence; and they can offer incentives to individuals to move; and they can re-compose their workforce and student/researcher population according to these priorities and incentives; and there is in addition a cultural and economic propensity toward moving around a lot in the USA. Together, these factors generate – almost naturally – the ties between industry and research, many of them local, in the USA. The liaison offices might make this more efficient, and the Bayh-Dole Act might raise the payoffs, but they are not the fundamental reasons for why it occurs. Our research backs up this perspective with systematic evidence.

This is why creating such offices in Europe is akin to treating the symptoms without dealing with the basic causes of local industry-R&D linkages. The fundamental structures of higher education and research in many European countries militate against such ties, and impede the local autonomy, competition and pursuit of excellence that generates the incentives for these ties to be local.

In Europe the lower rates of population mobility, higher densities, better inter-regional communication and spillovers, deeply structured local political-social systems generate other kinds of "localness" that have some advantages when compared to the

American system. We know already that Europe's "rooted localism" works better in traditional industries and in general in supporting a technological culture that perfects techniques and consolidates market positions: this can be seen in everything from design-based industries to major consumer durables such as cars.

In this light, European countries ideally would undertake basic reforms of their R&D/university systems in order to strengthen their overall innovation-producing capacities *and* as a by-product of that, to strengthen their ability to generate and sustain local connections. This would address the need of Europe to do more on the technological frontier. But Europe needs at the same time to balance this strategy with preserving its current strengths in technology deepening, and to do this, some of the forms of concertation and negotiation and assistance to firms and industries at local level that already exist should be preserved, albeit modernized and made more transparent and dynamic. Innovation policies – including their local component – are a key element in determining how each economy adjusts its sectoral and job mix over time. Europe needs to move more toward the cutting edge. To do so, however, requires fundamental reforms, not just dealing with superficial symptoms or manifestations of the American system.

In the USA, the problem is the mirror image of Europe's. The USA is doing fine at staying at the cutting edge, but needlessly gives up positions in existing industries because the force of mobility and exit is so strong that there are few incentives and structures to "stay the course." We can think of cars, machine tools, steel and many other "old economy" industries in this regard, where the US is a huge importer. And as is well known, these are industries where it's still possible to generate middle-class incomes. The USA is facing a grave problem of worsening inequality, in part because its job

structure is increasingly polarized, between activities on the technological frontier, on the one hand, and to low-wage service jobs on the other.

Concluding Remark

This analysis is meant as a cautionary tale. Policies that attempt to "force" innovation in this manner are merely attempting to treat the most visible symptom of a malady, but they are not getting at its causes. Silicon Valley did not develop because of Stanford and Berkeley, and though they did contribute to Silicon Valley's development, much of this was an outcome rather than a cause. Universities and their relationships to the local economy are structured by deep institutional forces; only by adopting policies that affect the fundamental missions of universities and the geography of innovative agents can the local rate of innovation be raised. Paradoxically, trying to force universities to be more locally involved may entirely miss the point, and by diverting attention from the real problems, may actually do some harm. This is at least what can be said for the American case, and policy reform efforts in Europe need to bear this in mind.