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Editorial: Geography, Skills and Technological Change

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One of the components of the original Marshallian analysis that has not yet assumed an established role in studies of the interdependence of geographical space, innovation and technology is skills. This is particularly true in geographic studies, but also in economics, which has tended to assume a degree of mobility, substitutability and homogeneity that may not be empirically warranted. The role of skills as an influence on the location of economic activities – as well as the attraction exerted by specific places towards certain kinds of skills – needs further theoretical development and empirical evidence, particularly to understand the changing patterns of linkages among (sub-national) regions across and within national borders. The capacity to generate skills and attract those with skills is influenced by the changing division of labour accompanying globalization and by the accelerating pace of technological and organizational innovation. These alter the demand for skills, their combinations and categorization, their social perception and recognition, and their distribution across space.

This special issue is based on a selection of papers from a workshop on Technology, Skills and Geography organized jointly by Science and Technology Policy Research (SPRU) at the University of Sussex and the Faculty of Geosciences of Utrecht University, and sponsored by the Dynamics of Institutions & Markets in Europe (DIME) Network of Excellence. The papers herein develop the conceptual linkages and explore the empirical foundations of issues at the intersection of geography, skills and technological change. The contributions are from both early career researchers and established scholars interested in understanding the spatial dimension of education, experience and learning processes that provide the skills and capabilities necessary for socio-economic growth and development.

The first part of this issue includes four papers offering new insights into larger patterns of human capital stocks and flows within and across countries. Elisabetta Marinelli examines interregional knowledge flows carried by mobile university graduates, distinguishing between those who leave the region of study to work in another location from those who move back to their home region after graduation. She finds that because graduates who remain away from their home region are more frequently able to find employment matching their skills, the regions receiving them are advantaged relative to the home regions of students who return and find employment less well matched with their skills. These findings confirm the existence of a threshold level of local techno-economic development necessary to benefit fully from high skills. They are all the more worrying as the empirical context is the relatively recent migration of Italian graduates from the poorer and less innovative south to the richer and more innovative centre-north, a development that risks further strengthening the severe territorial imbalances of the country.

In the same vein, Davide Consoli, Francesco Vona and Toni Saarivirta investigate the extent of earning distribution inequalities in the graduate labour market, focusing particularly on the role of spatial agglomeration and job-skill matching. Based on micro-data on Finnish individuals collected in two steps by Statistics Finland across the decade 1995–2005, the study shows that highly skilled labour (both graduate and postgraduate) tends to congregate in specific geographical regions, especially during periods of rapid technological change, as recently experienced by Finland. Concentrations of human capital benefit highly skilled individuals, but remarkably even more so those with lower

qualifications. However, postgraduate wage premiums differ considerably across regions, explained here in part as the result of dispersion of industrial activity and also by differences in the share of professionals working in the Finnish public sector.

The paper by Michaela Trippel focuses on the knowledge transferred by top scientists who, with their high propensity for geographical mobility, create knowledge networks at different spatial levels, that is, both inter-regional and intra-regional, thereby contributing to the innovation capabilities of the regions at both ends of the migration process. Trippel proposes a conceptual model of knowledge circulation that aptly illustrates the dynamics and complexity of such flows. Her results demonstrate that such transfers are not an unmitigated loss to their former region of employment and highlight unique features of 'returnees' (scientists who have worked abroad and return to their home country). Drawing on data from an original web-based survey of 'star' scientists, the results show that international migration connects the region of current employment to other regions in different countries and that highly skilled individuals diffuse their cutting-edge knowledge in a variety of ways to local actors at the receiving location. Rather than being isolated in their new location, little distinction is found between immigrant scientists' contributions to local knowledge transfer activities and those of home grown 'star' scientists, suggesting that acquisition of such migrants works as a direct substitute for their domestic creation.

Ernest Miguélez and Rosina Moreno turn to another typology of highly skilled workers, that of inventors. They discuss the importance of two different types of knowledge flows, namely, the spatial mobility of inventors and their involvement in co-inventorships on regional innovative output. Empirically, a novel method for measuring mobility is to examine the number of assignees for patents by each inventor in a region. The relative impact of the two mechanisms of knowledge transmission on the innovation intensity of regions is analysed within a knowledge (patent) production framework for a number of European countries. While a strong positive impact is found for 'mobile' labour as defined by changes in patent assignments, knowledge networks are found to be more conducive to innovation when links are looser, supporting Granovetter's interpretation of 'weak ties'. This finding has the important policy implication that regions may benefit more from creating a greater number of distant linkages than from attempting to deepen or reinforce intra-regional cooperation in the production of patentable knowledge.

The second part of the special issue includes four papers that examine, both conceptually and empirically, the central Marshallian issue of the local accumulation of production-related capabilities at different levels of analysis, that is, the firm, the industry and the region. The paper by Cristiano Antonelli and Francesco

Quatraro looks at the impacts of regional labour market rigidity on the direction of technological change and whether this affects regional productivity growth. The authors challenge the Hicks–Ruttan hypothesis that changes in relative factor prices will induce a switch away from the employed technology toward one that reduces the use of the more expensive factor. Instead, they argue that localized inflexibilities in the ability to substitute capital for labour induce firms to innovate in ways that will make more intensive use of expensive labour. The result is not only a non-neutral pattern of technological change, but also a reinforcing mechanism. Employment levels continue to rise placing further pressure on firms to adapt the technology and exploit localized learning to achieve marginal productivity consistent with the (rising) wage rate. The converse process is that areas with greater flexibility, for example, where trade unions are less effective in blocking substitution of capital for labour, will be better able to adopt capital-intensive technologies. The paradoxical result is that regions where lower wages are prevalent are likely to become relatively more capital intensive. These theoretical claims are supported by an empirical study of regions in Continental Europe over 1995–2004.

David Grandadam, Patrick Cohendet and Laurent Simon discuss the nature of externalities in creative cities. They argue that it is not sufficient to have proximity between private firms or between creative individuals to capture fully the impact of knowledge externalities in creative settings. Their claim is that the creative potential of a city can only be exploited when the creative skills in the local environment are enhanced and nurtured collectively by a rich and active middle-ground level where creative externalities are generated and where the informal underground (embodied in creative individuals) is connected and integrated with the formal 'upper ground', represented by commercial firms. The middle ground consists of communities that form repositories of creative skills which are not fully controlled by private firms and where places play a crucial role. These claims are illustrated by an in-depth case study of the video game cluster in Montreal, Canada. In this vibrant cluster, communities at the middle-ground level provide structure and shape creativity, such that market forces interpret, understand and take up this creativity commercially.

Based on survey data collection, Heike Mayer investigates the labour mobility stemming from spinoffs in the Seattle (Washington) high-technology cluster. Her study shows clearly how relevant knowledge, skills and business practices are transferred from parents to offspring and that spinoffs lead the cluster to diversify into new, but closely related, activities. Spinoffs founded by Microsoft appear to play a crucial role, though these are not significantly different from other types of spinoff firms in terms of the nature of their relationship to parent firms. Mayer sheds light on the specific role

hub firms play in hub-and-spoke clusters showing how spinoffs build on the former parent and induce economic renewal in a region. Mayer also notes the accumulation of agglomeration diseconomies in the Seattle area which encourages firms to consider engaging in outsourcing or relocation of their businesses outside the region.

The paper by Matias Ramirez, Xibao Li and Weifeng Chen concentrates on the mobility of skilled employees working in information and communication technology firms located in a Chinese science park in Beijing. The authors note the potential trade-off between the advantages available from hiring individuals with local institutional and tacit-knowledge skills and the advantages stemming from diversity in more distant recruitment. Based on a survey of research and development (R&D) employees at a leading Beijing science park, recruiting of employees from within the region is shown to have a positive effect in contributing to the problem-solving capacity of R&D employees engaged in R&D projects, while inter-regional transfer has a negative effect. The authors note that this effect may be related to the current state of local development in which still developing absorptive capacities may constrain the ability to utilize skills fully from the more distant recruits.

Mobility is a common theme throughout this issue. What is most apparent is that the advantages and opportunities of mobility rely upon the structure and development of locality. The processes of the labour market and regional development are difficult to reconcile with the common economic dichotomy between general and specific human capital. Locality adds a further dimension to human capital transfer and it is not a dimension of

regular proportion or structure but, instead, resembles a jigsaw puzzle in which pieces may appear similar but do not fit. The papers reveal the complexity of the simple term 'skills-matching' and indicate that policies aimed at regional development face major challenges in building absorptive and adaptive capacities to facilitate and utilize the potential advantages of mobility. Moreover, several of the contributions make clear that the localized processes of technological change and institutional development produce cumulateness and perhaps even path dependence. These features contest theories and policies in which markets for skills and human capital are thought to operate without reference to locality. At the same time, however, several of the papers indicate that when skills are transferred from more distant locales, there are potential advantages. The reaping of these advantages, however, relies upon the richness and quality of localized institutional development without which the potential remains untapped. Finally, it appears that 'weak ties', particularly those that link a locality to more distant sources of technological knowledge, also convey advantage. Thus, although localized development appears to be of primary importance, it should not be pursued without attention to the potential for more distant linkages and connections. The papers in this issue offer a valuable guide to how further research may better illuminate the dynamic interaction between skills and regional development. The contributions here presented take important steps toward addressing the role of skills and knowledge as complements to other features whose localization increasingly has been recognized as essential for understanding patterns of regional development and advantage.