



European
University
Institute



MIGRATION
POLICY CENTRE

ROBERT
SCHUMAN
CENTRE FOR
ADVANCED
STUDIES

October 2013

Innovation and Human Capital: the Role of Migration¹

*By Alessandra Venturini, Migration Policy Center
and University of Turin*

Introduction


Europe is facing three important challenges:

- the aging of the population, something which affects both population size and composition with strong implications for long-term care costs and for pension sustainability;
- the global competition, competition for price and quality of the products, but above all for innovation, where emerging countries are taking the lead;
- the global recession, which, in a period of fiscal imbalances, cannot be solved with larger government expenditure.

The positive role that migrants can play in coping with the drawbacks of an aging society is already known: low-skilled migrants can work as care service providers compensating for their frightened more intensive use of the welfare state. However, less well known is, instead, the role migration plays in the innovation process, something which could, if managed properly, spur the end of global recession. The prevailing idea is that highly-skilled workers bring about innovation, thus highly-skilled migrants can favour innovation competition.

¹ This research is the result of a two-year research project on Human capital and Innovation that I have conducted together with Fabio Montobbio and Claudio Fassio, which produced the MPC DP and the MPC policy brief and the forthcoming paper Innovation and Human Capital: Age, Skill and Ethnicity. I would like to thank Cristiano Antonelli and Francesco Lissoni for illuminating conversations, Ivan Martin and Philippe Fargues for their critical support and Sona Kalataryan for fantastic research assistance.

POLICY
BRIEF



The EU Global Migration Approach, which combines the BLUE Card directive in favouring the access of highly-skilled and Circular migration, which is suited for care givers and agriculture and low-skilled temporary occupations, seems to suit both objectives.

This brief note was written to better understand, first, whether the research results into the link between migration and innovation provide different indications from the prevailing one in designing a migration policy that can spur innovation. It was written, second, to see whether migration can play an important role in enhancing competition. Table 1 sums up the main results of the recent literature here.





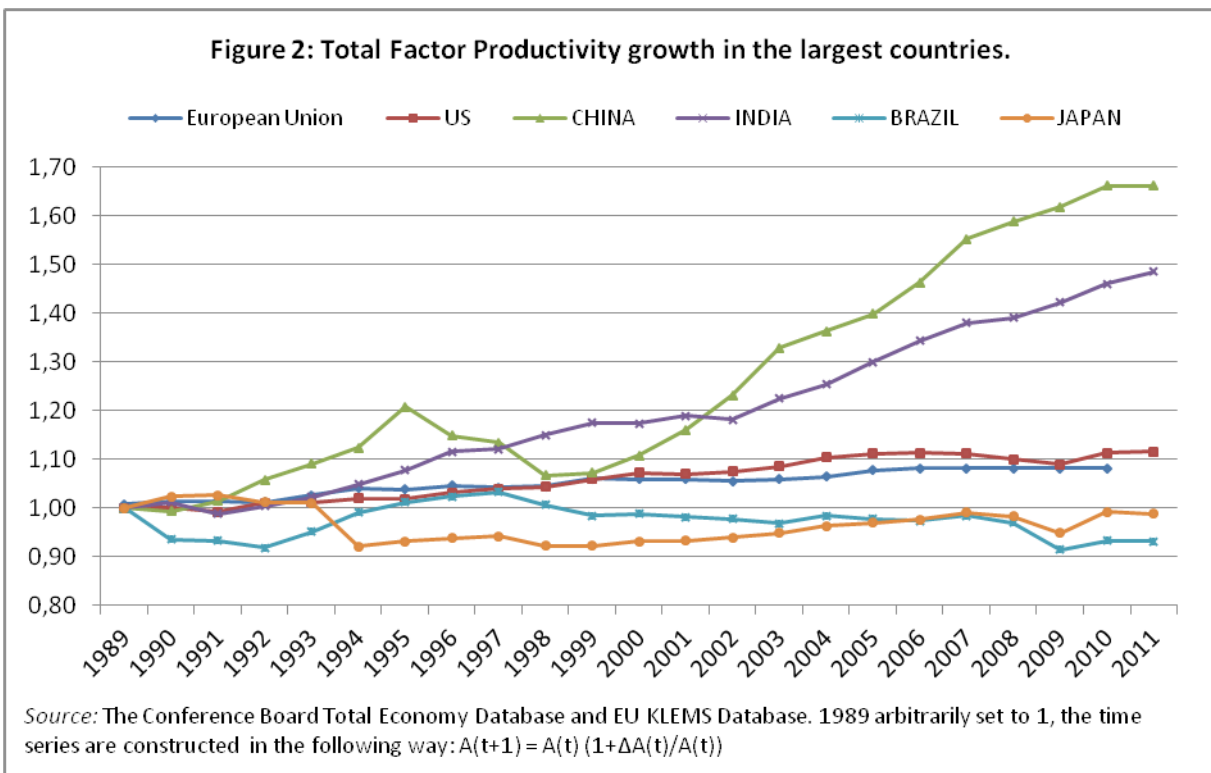
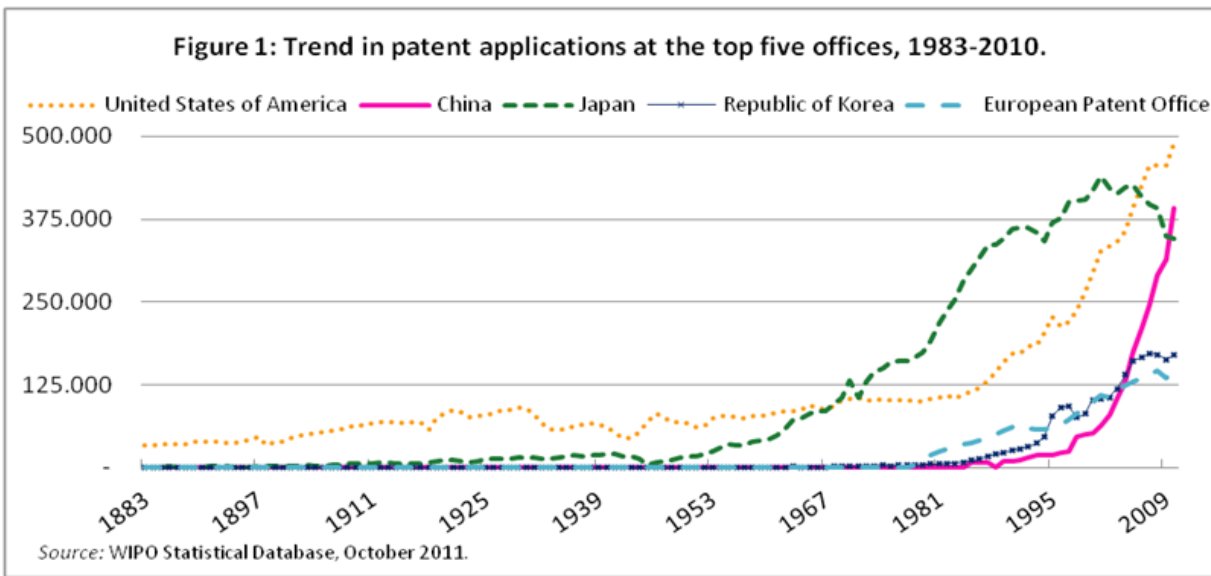
1. Measuring innovation

There are two widely used measures of innovation: patent and Total Factor Productivity, usually termed TFP.

Figure 1 and figure 2 show the same dynamic with a rapid and increasing growth rate in both patent and TFP from new competitors. But if the two measures

are compared they measure different phases of the innovation process: the patent, the inception stage and the TFP, implementation.

The number of **patents** and, in particular, patent applications at the European Patenting Office, given the high cost for registration, identify only inventions in specific technological field that a firm wants





to implement immediately because they have important market potential. The number of patents and, particularly, the citation of patents are both used relevance and their use in innovation. The economic literature has validated the use of patents showing that there is a high level of correlation with R&D activities among firms (Griliches, 1990). The literature also shows that patents are a good proxy for the technological efforts of companies and non-firm organizations aiming to create new products and processes².

An additional measure of innovation is the growth of **Total Factor Productivity** (TFP). Assuming a traditional Cobb-Douglas production function TFP³ is associated with the so-called Solow residual, (Solow (1957). According to Solow the growth of TFP (ΔA) was “technical progress in its broadest sense”; Abramovitz (1956) famously named it the “measure of our ignorance”⁴, because it is obtained as a residual after subtracting from the growth rate of added value the growth rates of capital and labour, weighted by their respective shares in the aggregate added value.

Both Solow and Abramovitz stressed too the lack of a specific theory accounting for its dynamics⁵. Indeed

- 2 The use of patents at the aggregate level has important limitations: (1) the technological and economic value of patents varies considerably (e.g. Shankerman and Pakes, 1986): many patents have low economic and technological value, while a few are extremely valuable; (2) many inventions are not patented: even if patents are increasingly used by companies, the evidence provided by many surveys of R&D managers indicates that, in many sectors, patents are not considered the major source of profit from new products and processes (e.g. Cohen *et al.*, 2000); (3) companies show significantly different propensities to patent across sectors. Finally, like R&D measures, patents tend to be a better proxy for the technological activities of large firms. Small firms tend to have a lower propensity to patent because – all things being equal – the use of intellectual property rights requires high fixed costs of implementation and scale (Bound *et al.* 1984, Patel and Pavitt, 1994). Therefore, the size distribution of firms may have an important effect on the aggregate number of patents at the national level.
- 3 Solow residual: A, which represents the component of the total output, which is not explained by the direct contribution of Labour (L) and Capital (K). (1)
- 4 Prskawetz A., Mahlberg B., Skirbekk V., Freund I., Winkler-Dworak M. 2006, pag. 4.
- 5 Other shortcomings of the use of the growth of total factor pro-

A is sensitive to many different improvements in production that can be guided by the change in the quality of labour: by age, education, skill and occupation and ethnicity (Jorgenson and Griliches, 1967). Denison (1985), in his calculation, attributed 16% of the change to improvements in education, while endogenous growth models underline the role of human capital by changing the focus from the quantity of labour to the quality of labour, highlighting the role of skills within the workforce (Romer, 1990).

The two proxies of innovation refer to two different universes, while TFP is available for all the economy and all sectors of production, patents are only registered in the manufacturing sector. Nevertheless Fig. 1 and 2 show that their dynamic presents similar characteristics with a recent rapid growth in China and India.

2. What role does human capital play in the innovation process?

Research on innovation, even if it asserts the importance of human capital and of highly-skilled workers, do not deserve attention to the question.

Briefly we do not give much space to review the aggregate effect of human capital – namely, age, education and occupation – on both proxies of innovation. We disregard gender differences not because they are unimportant. On the contrary, they are part of our future research projects, because information and research on the issue is particularly limited.

Education Summing up research on TFP stresses the role of the highly-skilled, meaning workers with

ductivity depend on underlying assumptions about the presence of constant returns to scale in the economy and from the adoption of the Euler Theorem according to which the overall compensation of labour equals its marginal productivity. Notwithstanding all these simplifying assumptions TFP growth still remains a good proxy of the share of growth of a firm, country or region which does not depend on the increase of standard productive inputs, and hence is typically associated with innovation.



tertiary education; while research on Patents consider both the highly-skilled and also the “stars”, namely PhDs (or higher) in Science and Technologies (Leiponen, 2005).

Age Very little is said about the effect of age on innovation. The research though tends to find a *young dividend*. This means that age has a negative effect on innovation and that the young innovate more and that a replacement of the old with the young improves the innovation production function. More recently research on Nobel Prize winners and the “big stars” (Stephen, 2001)) shows that the age of patenting has increased, speaking of a postponement in the innovative age. This is more a function of the extension of education, PhD, Post Doc etc than an appreciation of experience. But it, nevertheless, introduces the possibility of an *old dividend*.

Occupation Highly-skilled occupations, namely the smaller ISCO code, play a positive role in the production of patents and favour an increase in TFP. However, these are even less studied. It appears that Technicians (3 ISCO code) have a direct positive effect on the production of patents, while it is much less clear whether managers and high administrative occupations play any positive role in the production of patents. However, they could be crucial in the growth of TFP.

3. What is the role of migrants and of migration policy?

When we move into the role of migrants in the innovation process the distinction between what is measured by patent and TFP becomes even greater. After all, we enter here into the role played by the environment (externalities) in the innovative process (Jackobs 1961, Carter 2003, Florida 2006).

In addition, analyzing the contribution of immigrants in the creation of patents, we have to distinguish between:

Foreigner/immigrant authors of patents or simply foreign inventors who hold a degree in Science and Technology; and , more generally, the **role of foreign workers in the production of patents** inside a team, a firm, a sector or a region, which is also used in the analyses of the effect of foreign nationals on TFP.

While, for the first issue, research has offered clear conclusions, on the second issue, which is broader and more complex, optimal migration policy is probably different from what is considered common knowledge.

3.1 Foreign patenting and migrant legislation

Research which analyses the role of migration policy in the production and registration of patents by foreign nationals has found its main point of reference in the works of Kerr, Lincoln (2010) and Hunt and Gautier-Loiselle (2010). They found the easier entrance of foreigners with a degree in Science and Technology (S&T), a policy introduced in the USA in 1995 with a specific visa (H1-B), had a positive impact on the production of patents by foreign workers⁶.

The migration policy implication for these results are in line with the general wisdom that highly-skilled migration and particularly very highly-skilled migration in S&T specializations should be favoured to encourage innovation.

As is well known the migration policy or better easier entrance for the highly-skilled and for the super highly-skilled is just one and not even the most important attractor of highly-skilled migrants.

⁶ See Yeonij and Walsh 2010.



At least five other components are crucial:

the **availability of highly-skilled jobs**, which is a function of the structure of the industrial system in the country of destination;

and the higher **wage premium**, which was conditioned by the type of industrial relations prevailing in the destination country (the wage dispersion in the US is USA High wage 5 times low wage France and Netherland 2.9, Demark and Switzerland 2.7 Belgium and Sweden 2.4);

the **language** spoken in the country of destination if it is well known or obscure;

and also the “**culture**” both diffused in the society;

and the “**culture**” at firm level.

All these are crucial elements which determine how attractive a country is for migrants and the potential migrant’s chance of integrating into the country of destination and production there. The firm culture plays a very important role, as the chances of a foreign national becoming a “team leader” and of upgrading is much higher in a multinational than in a small local firm. And very highly-skilled foreigners are more easily attracted to these international environments, which are more open and rewarding.

Thus the effectiveness of a change in migration policy does not grant effects in patenting production, if some of the underlying conditions are not met. This explains the greater interest and the more extensive research into the aggregate effect of migrants and migration policy on innovation, measured both by patent, citation of patents and by TFP, where the results present more interactions and more complex answers.

3.2 The prevailing approach: cross country or cross regional analysis

The prevailing approach in the analyses of the effect of foreign labour on innovation, measured both by patents and TFP runs across countries or regions (see Table 1).

The research in this field initially used two variables:

share of migrants (which is, in general, not significant); and the **share of highly-skilled-tertiary educated migrants** (which in general plays a positive role in spurring innovation).

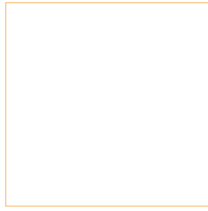
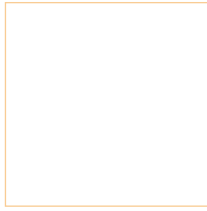
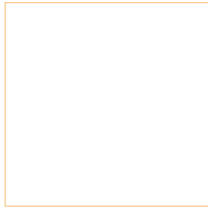
Ortega and Peri (2012, page 113), in their cross-country analyses, find that the share of highly-skilled migrants plays a positive role in enhancing TFP, while Ozgen, Njicamp and Poot (2012) find, instead, that the share of immigrants is not significant in explaining the Patents growth across the EU regions.

To better capture the role of foreign human capital Ozgen, Njicamp and Poot (2012) and Alesina, Har-noss and Rapoport (2012), in explaining respectively the evolution of patenting and the evolution of TFP, use the **diversity index** (the opposite of a concentration index.) This refers fundamentally to the idea that a multiethnic society favours innovation. There are two measures for the diversity index: one which includes the share of natives in the calculation of the index, and which thus combines the rough measure of the share of foreign nationals in a more sophisticated one; and the diversity index calculated only among foreign nationals, which refers to the ethnic composition of the immigrant community.

Table 1A								
	<i>Patent</i>				TFP			
	<i>Est. effect</i>	<i>Study</i>	<i>Unit of analysis</i>	<i>Instrument</i>	<i>Est. effect</i>	<i>Study</i>	<i>Unit of analysis</i>	<i>Instrument</i>
Area approach: Multi-ethnic society								
Share of Migrants	-				+	AHR(2012)	195 countries	Gravity
					no	OP(2006)		
Share of Highly-Skilled Migrants	no	BC(2012)	Italy NUTS3	Antonji&Card (1991)				
	no	ONP(2012)	EU NUTS2 regions	MacDonalds	+	OP(2012)	OECD countries	Gravity
	+	G(2012)	UK, TTWA 7digit post code	Card (2005, 2007)	no	AHR(2012)	195 countries	Gravity
Share of Highly-Skilled Migrants (H-1B visa)	+	KL(2010)	USA city level					
Share of Migrants in Top Occupation	+	BCV(2012)	EU 20 countries	Card (2001)				
Share of Highly-Skilled in High Tech	+	BCV(2012)	EU 20 countries	Card (2001)				
Share of Low-Skilled Migrants	-	BC(2012)	Italy NUTS3	Antonji&Card (1991)				
Diversity Index (without natives)	+	ONP(2011)	EU NUTS2 regions	MacDonalds	+	AHR(2012)	195 countries	Gravity
Diversity Index (with natives)	-	BC(2012)	Italy NUTS3	Antonji&Card (1991)				
	+	N(2011)	Germany NUTS3	5Ylag, space lag /latitude/East-West				
Diversity Index Highly-Skilled (without natives)					+	AHR(2012)	195 countries	Gravity
Diversity Index Low Skilled (without natives)					+/no	AHR(2012)	195 countries	Gravity

Table 1B								
	Patent				TFP			
	Est. effect	Study	Unit of analysis	Inst	Est. effect	Study	Unit of analysis	Inst.
Sector approach: Multi-ethnic production								
Share Migrants								
Share of Highly-Skilled Migrants	+	FMV(2013)	19 Sectors in in UK, DE, FR	GMM				
Diversity Index (without natives)	no	FMV(2013)	19 Sectors in in UK, DE, FR	GMM				
Age	-	FMV(2013)	19 Sectors in in UK, DE, FR	GMM				
Firm approach: Multi ethnic team.								
Share of Migrants					no	TBS(2012)	Germany, plant level	SYSGMM Card(2005)
					-	ONP(2011)	Netherlands, firm level	Alloch. Pop./ foreign rest.
Share of Highly-Skilled Migrants					+	ONP(2011)	Netherlands, firm level	
Diversity index (without natives)					-	PPP(2011)	Denmark, firm level	
					+	ONP(2011)	Netherlands, firm level	
Diversity index at Regional Level (without natives)					+	TBS(2012)	Germany, plant level	SYSGMM Exclusion
Diversity index at Firm Level (without natives)					no	TBS(2012)	Germany, plant level	SYSGMM Exclusion
Immigrants participation in ownership		M(2011)	Germany, firm level					

Note: ONP Ozgen, Nijkan, Poot (EU NUTS2 regions (2012)); ONP Ozgen, Nijkan, Poot (Netherlands, firm level 200-2002 (2011)); BC Bratti Conti (Italy NUTS3 (2012)); BCV Bosetti, Cattaneo, Verdoloni (EU 20 countries 1995-2008 (2012)); G Gagliardi (UK, TTWA 7digit post code, 2002-2007 (2011)); OP Ortega Peri (OECD countries (2012, pag 113)); AHR Alesina, Harnoss, Rapoport (195 countries (2012)); KL Kerr, Lincoln (USA city level 281, 1995-2004 (2010)); PPP Parrotta Pytlikova (Denmark, firm level (2011)); BOPP Bellini Ottaviano Pinelli Prarolo (EU15 NUTS3, 1991-2000 (2008)); TBS Trax Brunow Suedekum (Germany, plant level, 1998-2008(2012)); N Neibuhr (Germany NUTS3, 1995-2000 (2009)); M. Mueller (Germany, firm level (2011)).



These second measures have strong implications for the secular debate in the innovation literature, which started with the seminal paper of Jacobs (1961), inspired by New York after WWII. She suggested that the multi-ethnic quality of the environment at local level was crucial in favouring innovation. But this environment has strong implications for migration policies too. After all, partnership agreements, which favour bilateral flows and neighborhood policies, which favour multilateral agreements in a specific area, are not valued with the same weight if innovation is a policy objective and if the diversity index is at stake.

The Blue Card Directive is theoretically universal and neutral towards the countries of origin of the migrant, lacking geographical and geopolitical limitations. However, its application in Germany, Belgium and now in France employs geographical preferences and seems to counter the objective for which it was created and the very point of its implementation. The universalistic approach of the visa cap (H1-B) in the USA and their success in patent production seems to support this contention.

In addition Jacobs (1961) refers to the role played by the environment in favouring innovation, which probably implies **low- and highly-skilled migrants** and also individuals who are **not part of the labour force**. If this is the deep meaning of externalities, it implies a migration policy less focused on labour demand.

The many papers that followed this approach used the same cross regional grid at the national level: Niebuhr (2009) for the German regions, Bratti and Conti (2012) for the Italian Regions, and Gagliardi (2011) for the British regions (see table 1).

The results of AHR (2012) of the diversity index on TFP seems very plausible and recalls the ideas and the results of Jacobs (1961), and Florida (2003) for,

respectively, NY and Pittsburg on the positive role of a multiethnic society, which is based both on the idea of “soft” skills complementarity and of complementarity between different sectors of production. This last has been verified by Anna Carter (2006) with a Leontief model.

If we ask why migrants should favour innovation we find two different answers:

Labour demand was constrained in the quantity or in the price of highly-skilled human capital not available locally and the migrants, who are similar to the natives, provide the additional labour force demanded;

Alternatively, migrants provide a specific contribution to innovation for their specific human capital, which means soft skills, which cannot be produced by education etc;

The same implication for analyses of patent production is much less convincing. Is the production of patents affected by the “soft” human capital of highly-skilled (or even low-skilled) foreign migrants, or is it complemented by production in other sectors?

The complementarity between employment sectors finds new support in empirical evidence (Cortes, Tessada, 2001, Baroni, Mocetti, 2011, Romiti, Conti, 2011, Ferre’ *et al.* 2009) on the complementary effect of women working in family services on the employment (extensive margin) of highly-skilled native woman: though the results on patent variables is less convincing. This suggests complementarity between workers employed in two different sectors: one low-skilled and the other highly-skilled. If the diversity index also holds for the patent approach, it should be sensitive to the employment of the low-skilled in low tech sectors and in particular in non-manufacturing sectors because the information on patents is limited to the manufacturing sector.



A significant diversity index suggests a migration policy for innovation that foresees not only highly-skilled workers but also low-skilled workers and that is not in line with the tradition of preferential agreement, which favours migrants from a given country. The larger a foreign community, in general, the bigger the integration problems. Migrants from the same ethnic group tend to speak one language, to socialize inside the community, creating an ethnic enclave. If, for integration reasons, mixed communities are preferred, the same results will be extended to the diversity index: the larger a community then the smaller the positive effect on innovation.

3.3 Questioning the regional approach and the diversity index

The effect of the diversity index on innovation is not clear. It might rely on the complementarity between sectors or on complementarity between human capital (soft values).

1-The production of patents is strongly related to specific sectors and to the production function used in those sectors. The employment of migrants is, as well, strongly sector and ethnically concentrated. Migrants arrive in destination countries in subsequent waves. Let us take, for example, Germany after WWII. First, arrived the wave of Italians, then Spaniards, then Yugoslavs, and later Turks. When different waves arrived different sectors were in high demand, thus they distributed themselves in different sectors. Table 2 presents the sector distribution of the main migrant nationality for the UK and France and both graphs show different nationalities specializing in different sectors.

If we add to this the country of origin sector distribution, the ethnic professional “talents” that the diversity index has in mind, this implies that the diversity index capture a wider sector penetration and probably

a complementarity between sectors. If these results seem consistent with the analyses of TFP at regional and national level (AHR, 2012) it is less convincing in explaining patenting, and incremental and sector specific process (ONP, 2011).

2-In addition, there is the use of the diversity index without controlling for the age mix up ethnicity with age components. The new ethnic migrants that enter a country in addition to increasing the ethnic composition also reduce the average age of the foreign labour force, and fundamentally the growth of the diversity index. This is the main way to keep the average age constant in an aging society, which is very different from a multi ethnic society. By not controlling for age the two effects get mixed up.

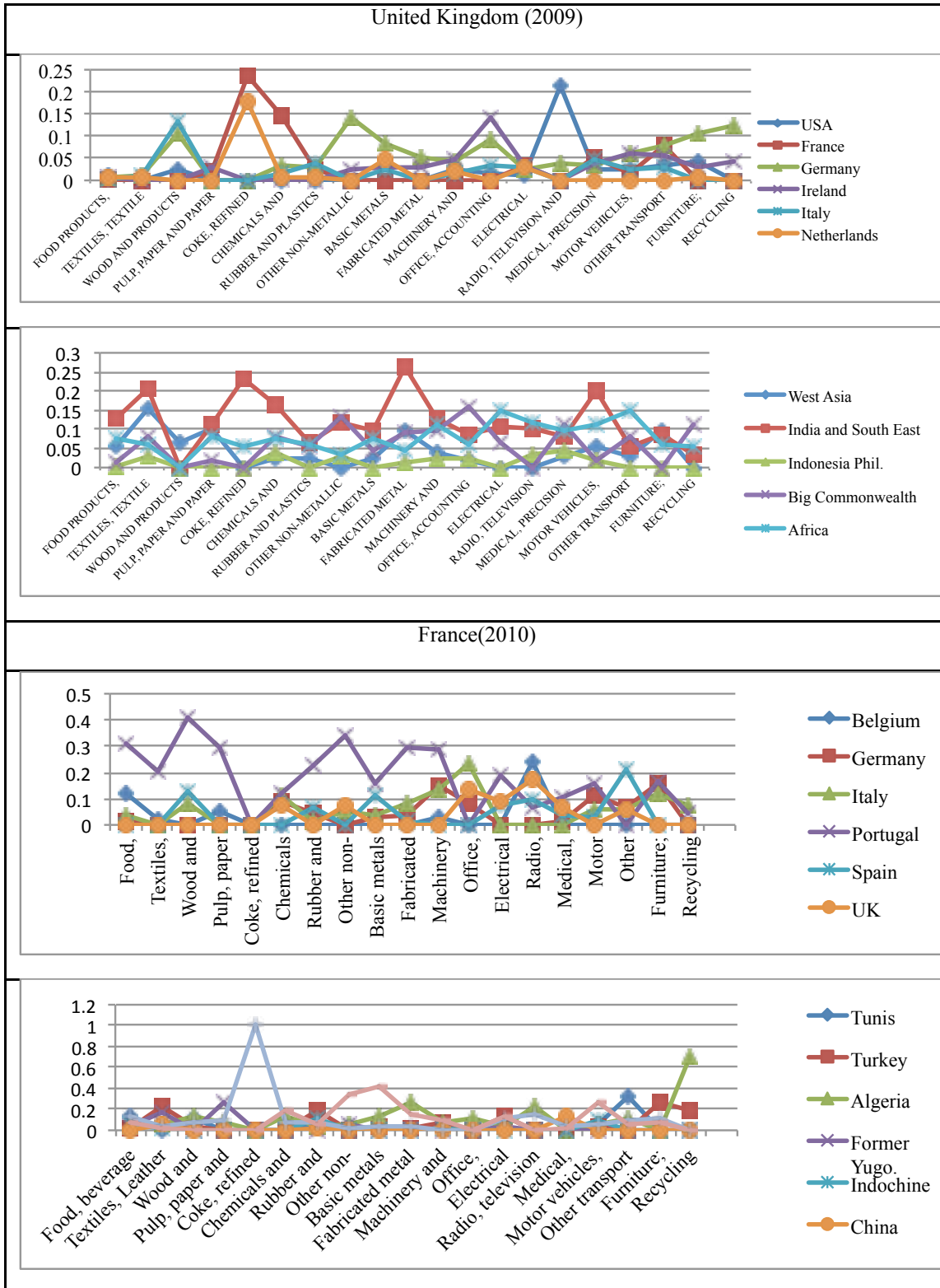
3 Along the same lines, but more difficult to detect is the self selection mechanism, which usually produces a first wave of migrants from a given country of origin of higher quality, which declines in the following waves. The increase in diversity with migrants coming from new countries means that the quality of human capital remains roughly constant (high) as does the average age (young). But this has nothing to do with soft skills, or sector interdependence and a multi-ethnic society.

3.4 Recent approach cross sectors

Not questioning the role of human capital but trying to better capture all the components FMV (2012, 2013) helps disentangle the role of human capital in all its dimension: age, skill (tertiary education and highly-skilled occupations) and ethnicity. However, this is done at sector level in the three largest EU countries: France, the United Kingdom and Germany. In their research on the effects of human capital on the production of patents by sectors the results of highly-skilled migrants are statistically significant with a positive sign, while the diversity index is not significant.



Table 2 The concentration of immigrants from selected countries of origin across sectors ⁷



⁷ The concentration of immigrants from a country of origin *i* across the sectors *j* in the destination country is calculated based on the following formula $\frac{Immigrants_{ij}}{Immigrants_{atj}}$



If highly-skilled migrants play a positive role in the production of patents inside a given sector, then the variety of national foreign workers (the diversity index is not significant) do not spur innovation. The complementarity of firms with different ethnic composition inside a sector or the complementarity between ethnic groups inside the sector – which can exist at territorial level – seems not to produce a positive mix for patents.

In addition, the coefficient of the elasticity of highly-skilled foreign workers for the citation of patents in France, UK and Germany is very small. This suggests that opening to foreign highly-skilled workers does not really spur patent innovation for the well known and diffused phenomenon of “brain waste”, which combined with the “firm culture”, can reduce the potential contribution of foreign nationals in the patent innovation process.

Both phenomena could, instead, be at the root of the positive effect of highly-skilled migrants on the aggregate production, which is captured by TFP.

To sum up, the discussion above indicates that the ethnic variety of migrants does not seem crucial in spurring patent production. Therefore, migration policies should not support low-skilled or different nationalities to increase the chance of patent innovation at sector level.

3.5 Firm level

If, at the regional level, the results are more limited, at the firm level, given the specificity of all the surveys used, the differences increase. But as Table 1 shows we can conclude that, in general, there is little evidence that a multiethnic firm produces more patents while, if any, the positive effect can be produced by the multiethnic environment, which call for a more open migration policy.

4. Which migration policy best suits innovation?

The research briefly presented show that the general wisdom that highly-skilled workers favour innovation both in patent registration and in TFP does not take into account the results of research into the role of foreign human capital.

If, on the one hand, foreign inventors and the contribution of foreign workers in the production of patents is enhanced by the inflow of tertiary-educated migrants, on the other hand, the positive effect of the complementarity of different ethnic groups is occasional and it is not an important or even a general rule.

This result is not so for TFP where complementarity between sectors of different intensity in human capital and the complementarity of soft skills play an important role. This last implies that low-skilled workers contribute to the creation of a synergic environment, which favours an increase in productivity.

Thus if we care about patents the nationality mix of the migrants is not crucial and migrants could, in fact, come from the same ethnic group, which can be selected for the quality of human capital. Therefore, the neighborhood agreement and the partnership agreements could be a way to enhance the positive effect of migration given their area limitation.

If, instead, the production of patents is instrumental to the growth of TFP the research indicators are for a very open migration policy, which should not favour bilateral flows. Rather migration policies should increase the differentiation of source countries and the instruments available, such as the Blue Card directive, should be used as much as possible, with no geopolitical holdback.



References

- Abramovitz, M., 1956, Resource and Output Trends in the United States since 1870, *American Economic Review*, 46(2), pp. 5-23.
- Alesina A., Harnoss J. and H. Rapoport, 2013, Birthplace Diversity and Economic Development. NBER Working Paper No. 18699.
- Altonji, J., Card, D., 1991. The effects of immigration on the labor market outcomes of less skilled natives. In: *Immigration, Trade and the Labor Market*. University of Chicago Press.
- Barone, G. and S. Mocetti, 2010, With a little help from abroad: the effect of low-skilled immigration on the female labor supply, *Temi di Discussione* n. 766. Roma: Banca d'Italia.
- Bosetti V., Cattaneo C. and E. Verdolini, Migration, Cultural Diversity and Innovation: A European Perspective, *Fondazione Eni Enrico Mattei and CMCC*.
- Bound, J., Cummings, C., Griliches, Z., Hall, B. and A Jaffe, 1984, Who does R&D and who patents? in Griliches, Z. (ed.) *R&D, Patent and Productivity*, National Bureau of Economic Research, University of Chicago Press, pp. 21-54.
- Bratti M., and C. Conti, 2012, Immigration, Population Diversity and Innovation of Italian regions.
- Card, D., 2001. Immigrant inflows, native outflows, and the local labor market impacts of higher immigration. *Journal of Labor Economics* 19, 22-64.
- Card, D., 2005. Is the new immigration really so bad? *Economic Journal* 115, F300-F323.
- Carter A.P., 2006, Measurement of the clustering and dispersion of innovation, chapter 2, Polenske K., (ed) *The Economic Geography of Innovation*, CUP.
- Cohen, W. M., Nelson, R. R. and J. P. Walsh, 2000, Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not), NBER Working Paper 7552.
- Cortes P., and J. Tessada, 2011, Low Skilled Immigration and the Labor Supply of Highly Educated Woman, *Applied Economics*.
- Denison, E., 1985, Trends in American Economic Growth, 1929-1982, Brookings Institution.
- Farre' L., Gonzales L, and F. Ortega, 2009, Immigration, family responsibilities and the labour supply of skilled native women, *B.E. Journal of Economic and Policy: Contributions*, 2011, 11 (1), Article 34.
- Fassio C., Montobbio F., Venturini A., 2013, Innovation and human capital, mimeo
- Florida R., 2003, Cities and the Creative Class. *City & Community*, 2,1.
- Gagliardi L., (2011), Does Skilled Migration Foster Innovative Performance? Evidence from British Local Areas, Department of Geography & Environment, London School of Economics SERC Discussion Papers 97.
- Griliches, Z., 1990. Patent statistics as economic indicators: A survey. *Journal of Economic Literature* 28, no. 4:1661-1707.
- Hunt, J., and M. Gauthier-Loiselle, 2010, How much does immigration boost innovation?, *American Economic Journal: Macroeconomics*.
- Jacobs J., 1961, *The Death and Life of the Great American Cities*, Random House, New York (1993 Modern Library Edition).
- Jones B., 2012, Innovation and Human Resources: Migration Policies and employment Protection Policies, Manchester Institute of Innovation



Jorgenson W and Z. Griliches, 1967, The Explanation of Productivity Change, *Review of Economic Studies*, Vol. 34, No. 3, pp. 249-283.

Kerr W., and W.F. Lincoln, 2010, The Supply Side of Innovation: H-1B Visa Reforms and U.S. Ethnic Invention, 28(3), 473-508, *Journal of Labour Economics*.

Leiponene A., 2005, Skills and Innovation, *International Journal of Industrial Organization*, 23, 303-323.

Mueller E., 2011, Entrepreneurs from Low-Skilled Immigrant Groups in Knowledgeintensive Industries – Company Characteristics, Survival and Innovative Performance. ZEW Discussi on Paper No. 11-030.

Niebuhr A., 2010, Migration and innovation: Does cultural diversity matter for regional R&D activity? *Papers in Regional Science*, Volume 89 Number 3 August 2010.

Ortega F. and G. Peri, 2012 The effects of Brain Gain on Growth, Investment, and Employment: Evidence form the OCDE countries, 1980-2005, in Boeri T.,

Brucker H, Docquier F, Rapoport H. (eds) *Brain Drain and Brain Gain*, Oxford University Press, Oxford.

Ozgen, C., Nijkamp, P. and J. Poot, 2011, Immigration and Innovation in European Regions, IZA Discussion Papers 5676, Institute for the Study of Labor (IZA).

Ozgen, C., Nijkamp, P. and J. Poot, The Impact of Cultural Diversity on Innovation: Evidence from Dutch Firm-Level Data, IZA Discussion Papers 6000, Institute for the Study of Labor (IZA).

Parrotta P., Pozzoli D and M. Pytlikova, 2011, Does Labor Diversity affect Firm Productivity? *Norface Migration Discussion paper* 2011-22.

Patel, P. and K. Pavitt, 1994, “The Nature and Economic Importance of National Innovation Systems”, *STI Review*, No. 14, OECD, Paris.

Prskawetz A., and T. Lindh, (eds), 2006, *The Impact of Population Ageing on Innovation and Productivity Growth in Europe*, Research report 28 by Prskawetz A., Mahlberg B., Skirbekk V., Freund I., Winkler-Dworak M., Vienna Institute of Demography, Austrian Academy of Sciences, and Lindh T., Malmberg B., Jans A-C., Nerdstrom O., Andersson F., Institute for Future Studies, Stockholm.

Romer P. M., (1990) Endogenous Technological Change . *The Journal of Political Economy*, Vol. 98, No. 5, Part 2: The Problem of Development: A Conference of the Institute for the Study of Free Enterprise Systems. (Oct., 1990), pp. S71-S102.

Romiti, A. and M. Rossi, (2011), Should we retire earlier in order to look after our parents? The role of immigrants, *CeRP Working papers*.

Schankerman, M. and A. Pakes,, 1986, Estimates of the value of patent rights in European countries during the post-1950 period, *The Economic Journal*, 96 (384). pp. 1052-1076.

Solow R. M., 1957, Technical change and the aggregate production function, *The Review of Economics and Statistics* 39, 312-320.

Stephan P., Levin S., 2001, Exceptional contributions to US science by the foreign-born and foreign-educated, *Population Research and Policy Review*, 20(1), 59-79.

Trax, M., Brunow, S., and J. Suedekum, 2012, Cultural diversity and plant level productivity. IZA Discussion Paper 6845.

Venturini A., Montobbio F. and C. Fassio, 2012, Are migrants spurring innovation, *MPC Research Report* 2012/11



Venturini A., 2012, Innovation and Migration MPC
Analytical and Synthetic Note 2012/05

Yeonji N., Walsh J, 2010, The Importance of Foreign-
Born Talent for US Innovation, Nature Biotech-
nology, 28, 3, 289-291.

Migration Policy Centre

The Migration Policy Centre at the European University Institute, Florence, conducts advanced research on global migration to serve migration governance needs at European level, from developing, implementing and monitoring migration-related policies to assessing their impact on the wider economy and society. The Migration Policy Centre is co-financed by the European Union.

Migration Policy Centre Robert Schuman Centre for Advanced Studies - European University Institute
Via delle Fontanelle 19I-50014 San Domenico di Fiesole (FI) Italy

Tel: (+39) 055 4685 817

Fax: (+39) 055 4685 770

mpc@eui.eu



Complete information on our activities can be found online at: www.migrationpolicycentre.eu/