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Innovation and Migration

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ROBERT SCHUMAN CENTRE FOR ADVANCED STUDIES

MIGRATION POLICY CENTRE (MPC)

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The Migration Policy Centre (MPC)

Mission statement

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.

Rationale

Migration represents both an opportunity and a challenge. While well-managed migration may foster progress and welfare in origin- as well as destination countries, its mismanagement may put social cohesion, security and national sovereignty at risk. Sound policy-making on migration and related matters must be based on knowledge, but the construction of knowledge must in turn address policy priorities. Because migration is rapidly evolving, knowledge thereof needs to be constantly updated. Given that migration links each individual country with the rest of the world, its study requires innovative cooperation between scholars around the world.

The MPC conducts field as well as archival research, both of which are scientifically robust and policy-relevant, not only at European level, but also globally, targeting policy-makers as well as politicians. This research provides tools for addressing migration challenges, by: 1) producing policy-oriented research on aspects of migration, asylum and mobility in Europe and in countries located along migration routes to Europe, that are regarded as priorities; 2) bridging research with action by providing policy-makers and other stakeholders with results required by evidence-based policy-making, as well as necessary methodologies that address migration governance needs; 3) pooling scholars, experts, policy makers, and influential thinkers in order to identify problems, research their causes and consequences, and devise policy solutions.

The MPC's research includes a core programme and several projects, most of them co-financed by the European Union.

Results of the above activities are made available for public consultation through the website of the project: www.migrationpolicycentre.eu

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Introduction

In the European debate the role played by migrants in strengthening the competitiveness seems the last resort to find a positive contribution of migrants in the destination economy. Claims on the larger use of the welfare state by migrants, their potential competitive role in the labour market, the difficult integration which creates the rise of radical political parties have diverted the attention towards policies restricting immigration and of limiting inflows not only to the workers in demand but only to highly skilled which could reduce the negative effect previously mentioned and spur the competition.

This is not the place to contest fears about the role of migrants in the destination economy: we merely refer to the survey papers of Alan Barrett and Andrew Geddes which contrast the negative vision of migrants as welfare users while underlining, instead, their contribution as welfare providers. There is too the paper of Herbert Brücker which shows how little migrants compete with native labour, we just focus on the role of foreign labour in the battle for competitiveness that Europe faces.

The Lisbon strategy of the European Council launched a competitiveness objective for the European Union and the European Commission with the Blue Card Directive inside the Global Migration Approach. This provides an instrument for fostering competitiveness through highly-skilled migration defined as the tertiary educated and Europe 2020 continue down this line..

The focus on competitiveness becomes a focus on innovation because, especially in a period of recession, the race to innovate is a race for survival through costs reduction given the shrinking size of the goods market.

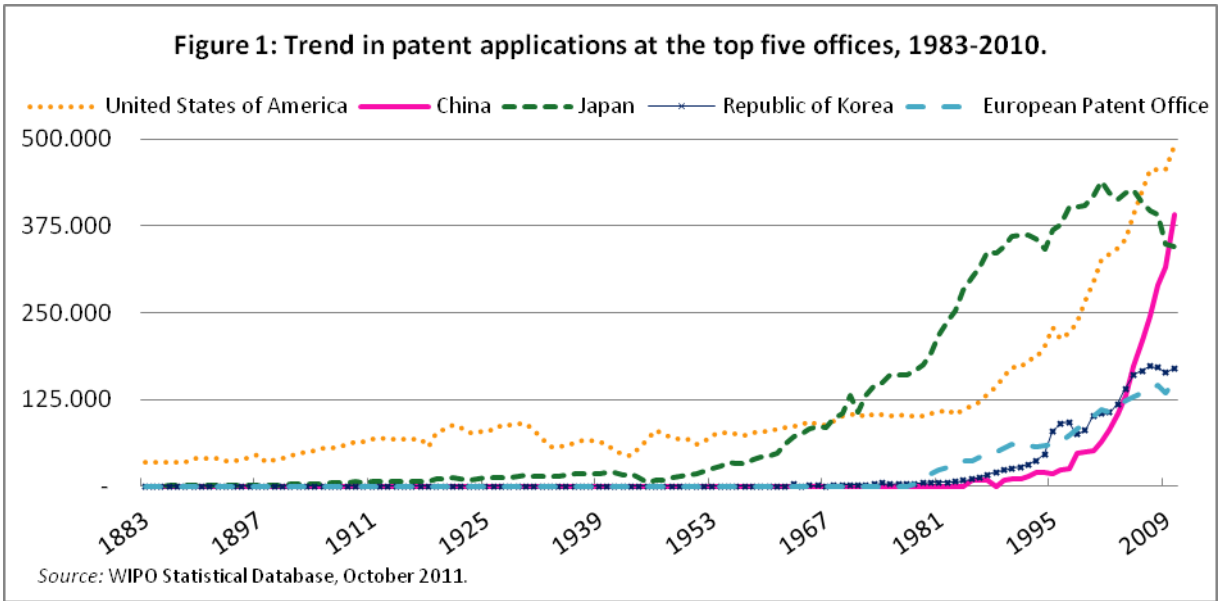
Innovation is a multi-faceted phenomenon. The more popular indicators of innovation are: the number of Patent applications and the Total Factor Productivity

Innovation is a multi-faceted phenomenon which is notoriously difficult to measure. The most popular indicators of innovation are the **number of Patent applications** at the industry or country level (e.g. Furman *et al*. 2002). These provide valuable information on the technological activities of inventors and companies over long time series (Pavitt, 1985; Pavitt, 1988; Grupp, 1990 and Griliches 1990). And they are a good proxy for the technological effort of companies and non-firm organizations aiming to create new products and processes[1].

In recent years, with the global harmonization of intellectual property systems, many countries increased patenting activities, in particular the ones with relatively higher *per capita* growth rates. Even if patenting levels are not directly comparable across national patent offices because of different registration systems and national legislations, Figure 1 gives an interesting snapshot of the relative dynamics of patenting activity in different regions of the world. The leadership of the United States was challenged by Japan in the 1970s. While the rapid growth of patent applications at Chinese and Korean patent offices in the last 20 years are particularly impressive and confirm the role of these

[1] 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) as 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 indicate that, in many sectors, patents are not considered the major source of profit from new products and processes (e.g. Cohen at 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 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.

emerging markets in the global technological arena. At the same time these figures explains why, in Europe, the search of competiveness and innovation is a top priority.

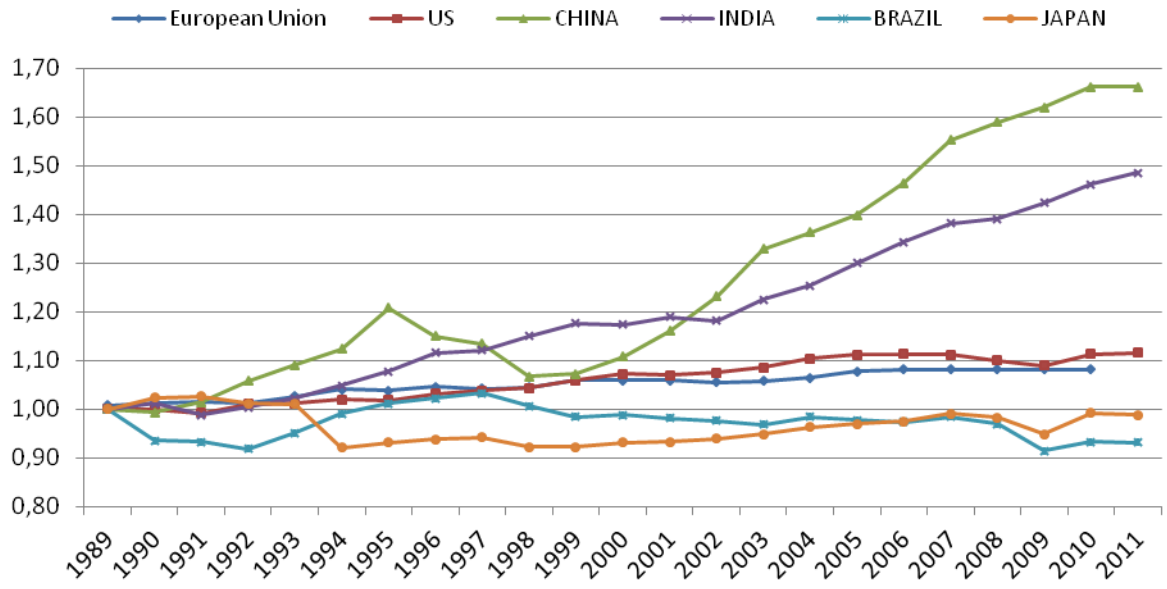


An additional measure of innovation is the growth of **Total Factor Productivity** (TFP). Solow (1957) defined the growth of TFP (ΔA) as "technical progress in its broadest sense" ; Abramovitz (1956) famously named it the "measure of our ignorance"[2], because it is obtained as a residual after subtracting from the value added growth rate the growth rates of capital and labour, weighted by their respective shares in the value added aggregate. Both Solow and Abramovitz also stressed the lack of a specific theory accounting for its dynamics[3]. Indeed, TFP is sensitive to many different improvements in production that can be guided by changes in the quality of labour by age, education, skill and occupation and nationality (Jorgenson and Griliches, 1967). Denison (1985) in his calculation attributes 16% of it to increases 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).

[2] Prskawetz A., Mahlberg B., Skirbekk V., Freund I., Winkler-Dworak M.2006, pag.4.

[3] Other shortcomings from the use of the growth of total factor productivity 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 which is typically associated with innovation.

Figure 2: Total Factor Productivity growth in the largest countries.



Source: The Conference Board Total Economy Database and EU KLEMS Database. 1989 arbitrarily set to 1, the time series are constructed in the following way: $A(t+1) = A(t)\,(1+\Delta A(t)/A(t))$

Figure 2 above shows that the growth rates of TFP vary widely among countries: as in the case of patents, the steep growth of East Asian countries such as China and India from the mid-nineties onward is clearly visible also using this measure. We use Total Factor Productivity to measure not only the innovative investment of a country or a sector (mainly proxied by patents), but also the effectiveness of such an effort in economic terms.

The empirical evidence from Europe is very limited.

Jonke (2011) in his stimulating paper on Immigration and the European Innovation System provides many arguments on the effects of highly-skilled migrants on innovation and growth. He also looks at the most appropriate migration policies which can facilitate growth, but he fails to provide any clear empirical evidence of this for Europe.

The empirical evidence from Europe is very limited.

The two papers that have addressed the issue of the contribution of immigration to European innovation at European level do not find evidence of a positive effect.

On the one hand, Ortega Peri (2011) using a large sample of thirty OECD countries 1980-2007 suggested that migration has a negative or nil effect on TFP (Total Factor Productivity).

On the other hand Ozgen, Nijkamp, Poot (2011) using 170 European regions for 1991-95 and 2001-2005 find that it is not the size of the foreign community but its variety which spurs patent~~'s~~ applications in Europe.

In both cases odd results could be explained by the lack of control of the sector dynamics of innovation which has different sector R&D intensity and which in the first case can produce problems of aggregation while in the second the concentration and specialization of migrants in different sectors, which complement the other in a synergic way.

For these reasons we follow a sectorial approach which was anticipated by the European Competitiveness Report of 2009. And, given the limitations of the European labour force survey in

providing information on migrants at two digits sector level, we chose the three largest European countries: France, the United Kingdom and Germany and we used their national labour force survey and, for Germany, the Microcensus.

Research into the effect of **human capital** on the different measures of innovation does not focus only on **nationality** and **education**. A good deal of attention is also devoted to the role of **age** and research shows delayed timing in innovation and the term "age dividend" is used to underlay the postponement in life of innovative contributions. In fact, there are sectors and workers for which the human capital accumulated prior to work rapidly depreciates and the productivity of workers decline as life goes on. In other cases investment on the job accumulates very specific human capital which increases as life advances and we call this "Old age dividend", while the first is called "Young age dividend". We try in our empirical and theoretical analyses to disentangle all these components of human capital: education, age (depreciation or appreciation) and nationality.

France, the United Kingdom and Germany

The larger European countries present many similarities, but also many differences, we just name the most important for the topic at hand.

In France the agricultural sector still employs 3.8% of the total labour force and this produces 2.8% of added value, while in Germany employment in the manufacturing sector covers 29.3% of added value, while the UK has production concentrated in the services: 75% of added value for Britain.

Human capital in the three countries also differs. France is a young country, the young below 15 years of age are 1.33 times those older than 65, while in Germany the reverse is true, the young are 0.85 of the old and in the UK they are 0.90.

Tertiary enrollment is also different: it is higher in the UK (59%) than in France (54%) and Germany (47%).

The share of foreign natives or foreign-born migrants is quite similar ranging from 11% to 8%. But migration patterns and policies differ. The UK is the only European country which is able to attract highly-skilled migrants for many reasons among them language, educational recruitment, the availability of skilled positions and higher wages and, last but not least, because they have a migrant point system. The share of tertiary-educated migrants varies from 35% in the UK to 18.1 % in France according to the OECD. Germany has tried actively to attract highly-skilled migrations also easing access to the labour market there administratively.

Research project

We have used both measures of innovation: Patents application at the European Patent Office which is limited to the manufacturing sector, and TFP growth in the three countries from 1994 to 2007, which is available for 18 sectors.

*Our model for **Patents draws** on similar models aimed at explaining the innovative capacity of countries or sectors (Jeffrey L. Furman, Michael E. Porter, Scott Stern. 2002). We test, in fact, whether the annual flow of patents (Å) in year t and sector j is explained by the lagged annual investments in fixed capital (K), the lagged yearly expenditures in Research and Development (R&D), a lagged measure of the openness to trade of the specific sector (OT) and lagged human capital characteristics (H) in that specific sector j. The annual number of patents being an annual flow, as in all growth models, we also control for the stock of patents in the previous year (A). A measures the stock of prior ideas and prior research. Note that if the coefficient of A is positive this means that the stock of prior ideas and prior research increases R&D productivity (this is also called the "standing on the shoulders of giants" effect).

Different specifications of this model will be used:

the distinction between tertiary educated and non tertiary educated workers, without and with specification of nationality, native and migrants, in addition the analysis of the accumulation of human capital or depreciation of it, will be controlled by the introduction of the age variable in the analysis. Finally, we will check for the impact of skilled and unskilled workers distinguishing between natives and migrants and also checking for the effect of age among migrants and among natives.

The endogeneity of the Human capital variable is probably less severe in the patent specification and the use of different lags is a solution to inquire into the correlation of the factors which affects innovation. This also controls for a possible reverse causality effect. But an accurate modelling of endogeneity is needed to inquire into the causality between human resources and innovation which for the moment is postponed to a further step.

* We use the EU-KLEMS dataset which provides an accurate measure of the multifactor productivity for all European countries (O'Mahony, Timmer, 2009). Klems TFP growth series are estimated from micro data and aggregated at the sectorial level. For this reason these data are particularly suitable for sectoral level analysis such as that we are attempting here.

Hence our analysis includes all sectors of the economy, including primary sectors, manufacturing and services.

The growth of total factor productivity (Å) in a given sector J at a given time t is considered to be a function of the level of human capital Hj,t and of its growth rate ΔHj,t where time D and sec D are time dummies and sector effects.

The inclusion of both Human capital levels (as in Griffith, Redding, van Reenen, 2004) and of the growth rates of its component allows us to refine the analysis implemented by Peri and Ortega (2011), in which only the growth rates are considered. In our approach we can measure the effect of the growth of H controlling also for the initial levels of human capital in each sector. Assuming, for example, a negative correlation between the levels and the growth rates of human capital, the exclusion of the former might lead to a typical omitted variable problem, which might, in turn, bias the coefficients of the growth rates. Including time dummies should also prevent us from possible country-wide time shocks, such as institutional changes or economic downturns.

We will use a number of different specifications in order to check the impact of human capital variables on the growth of TFP:

First we will test the effect of the growth of migrants on TFP growth, controlling for age which proxy the accumulation or depreciation effect at the human capital level, for the share of migrants and for the share of highly-educated workers in each sector,

Then, we will check the impact of the growth of highly-educated migrants and highly-educated natives, checking also for differentiated age-effects,

Finally, we will test the impact of young educated workers among migrants and among natives, controlling for the skill-intensity, i.e. the share of highly-educated migrants against the total number of migrants and the share of highly educated natives against the total number of native workers.

In the same sector of aggregation we have derived from the national Labour force survey for the UK, France and from the Microcensus in Germany detailed information concerning human capital. We have aggregated the individual information on the persons employed at sector level and thus obtained the following variables:

$Tertiary\ educated$ the number of workers who hold tertiary education (ISCED classification 5 and 6) or 16 years of continued education as is suggested for the UK[4] in the sector j and year t;

$Young\ workers_{j,t}$ the number of workers with age below or equal to 35 years old in France and the UK and below 40 years old in Germany in the sector j and year t;

$A_{j,t}$ the average age of the workers, be they native or foreign, employed in the sector j and year t;

$Highly\ skilled\ occupation_{j,t}$ the number of workers in occupation 1 and 2 or also 3 of the ISCO classification or similar in the sector j and year t;

$Migrants$ as the number of foreign citizen or foreign-born workers in sector j and year t.

The analysis should be extended to the distinction between third-countries nationals and European workers to better catch the effect of different migration policies and specific migration policies adopted in the countries being studied, but in this preliminary version we use only the distinction between native and foreign nationals[5].

Preliminary Results

The results of the preliminary empirical analysis show, as expected, that:

Highly educated workers favour innovation both the *future innovation measured* as number of patent applicants and the *present innovation* measured by TFP.

The impact of highly skilled natives and foreigners is not always the same: highly–skilled natives in France and highly -skilled migrants in the UK and Germany favour the long term innovation capacity measured as patents.

However, contrary to what was expected, not only the highly skilled but also low–skilled workers play a positive role in France and in Germany, while in the UK low skilled natives spur future innovation (patents).

Education is positive but the low skilled matter as well

In addition, the contribution to future innovation is not only in the hands of **young workers**. Of course there is a young dividend for all groups in France. But in the UK the natives accumulate human capital and become more innovative creators in their **old age** (Old Dividend), while young migrants produce more innovation while young. The reverse happens in Germany, old aged migrants and low-skilled and highly- skilled migrants favour long term innovation, while natives favour ~~the~~ innovation when they are young. Thus Europe should not worry too much about the innovative capacity of its old labour force.

Young and also old workers favour future innovation

Also in the short run, looking at the Total Factor Productivity, highly-skilled migrants favour innovation, in particular **young tertiary educated migrants spur innovation in all three countries**.

But again, also in the short run, the growth of low-skilled workers is not reducing proactive innovation in the UK and France while they play a negative role in Germany.

[4] See Manacorda et al. (2012)

[5] The distinction between Western countries and Eastern ones available in statistics is no more appropriate to catch the enlarged Europe.

Migrants and natives patterns are not the same in all three countries but young tertiary educated migrants spur innovation in all cases

Again both an old and young dividend is found persistently in the UK, where the natives hold an age dividend and the foreign nationals a young one and in Germany where old migrants contribute to short run innovation along with young natives. In France a young dividend remains among natives and foreign nationals seem to be more productive in their old age.

The dataset on TFP cover 31 sectors including services and in agriculture we have thus explored the possibility of different coefficients for the high tech sector. In Germany alone the high tech sector seems to catalyze the positive role of migrants, while in the UK and France no significant differential role emerges either for highly- and low-skilled migrants, or indeed, for highly–educated natives.

The results presented are just preliminary but they are consistent in many specifications. . Some caveats apply. In particular, it is worthwhile underlining that our analysis took place at the sectoral level. Accordingly the positive effect of highly-skilled workers – both native and foreign – is limited inside each economic sector. In doing so, we probably underestimate the total positive effect of human capital changes because we do not take into account complementarity between the labor forces employed in different sectors. Productivity growth and innovation at the sectoral level depend upon economic activity in the other sectors of the economy as well, and positive spillovers are not taken into account.

Policies

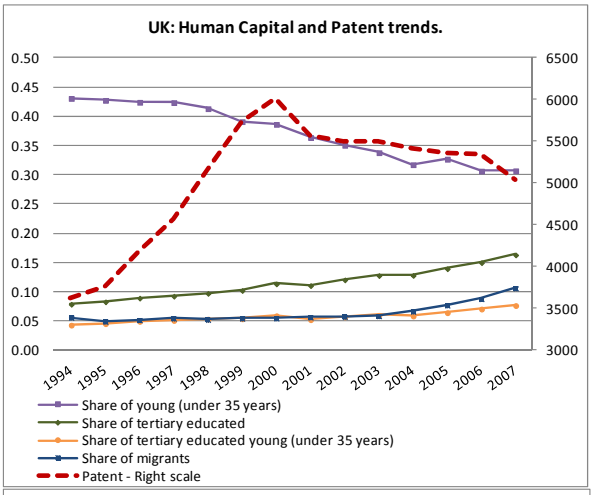
This preliminary empirical analysis suggests that to pursue the objectives of the Lisbon agenda which promotes the competitiveness of the European Economy migration policy is crucial as are the foreign workers in this process.

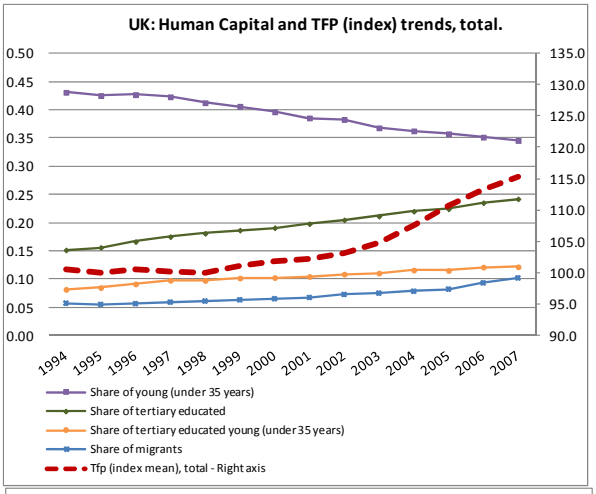
Thinking of the Global Migration Approach migration policies should, of course, focus on the highly-skilled. But it should not be limited to them. It should also include **low-skilled workers** who are important for strengthening innovation.

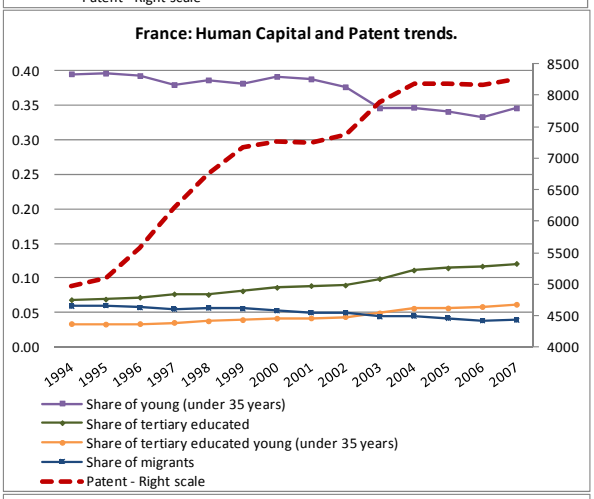
Also **temporary migration schemes** could be the appropriate instrument to cope with the demand of temporary low-skilled workers. But they should be revised to grant full rights such as pension portability or, at least, a reduction in the minimum vesting period to grant old age support when back home. They should also offer temporary but first class jobs.

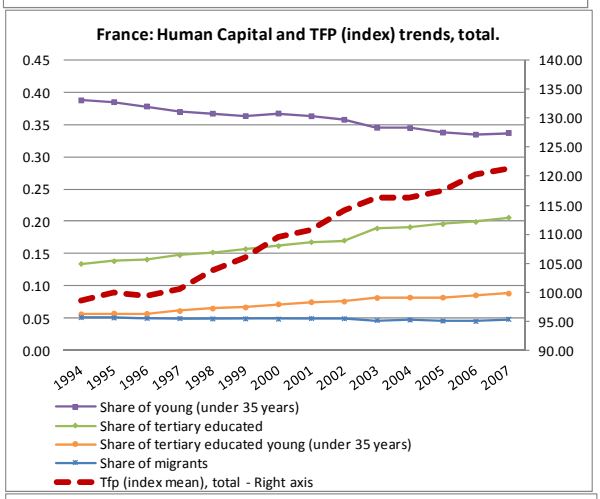
The implementation of migration policies should be left to the Member States because many **national differences** are detected and different priorities need to be respected.

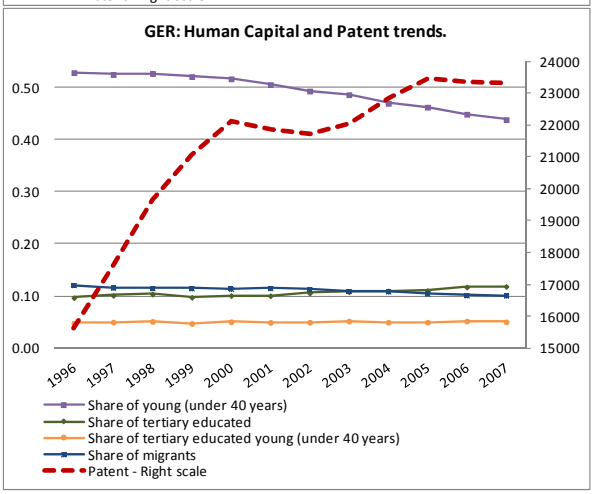
Figure 3. Trends in Human Capital, TFP and Patents in UK, France and Germany

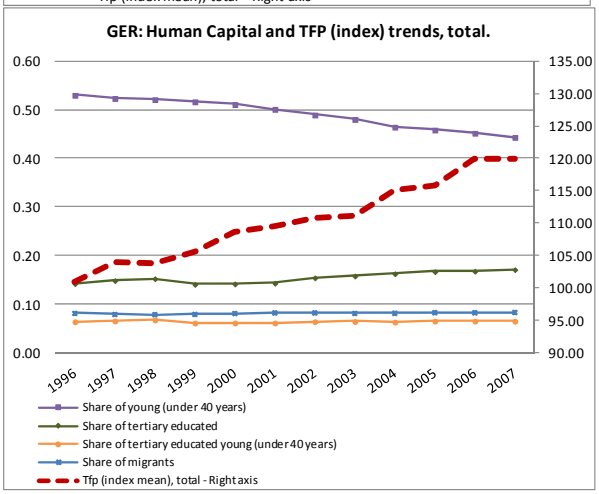












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