Relatedness, Diversification and Institutions in the EU-27

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Abstract

In this empirical study, we propose to bridge two separate streams of literature on economic growth, that is, the literature on industrial diversification and the literature on institutions. Starting from the assumption of diversification as a path-dependent process driven by product relatedness, we claim that the constraints of path-dependence are not equally binding for all countries: while some capabilities are important only for specific products or groups of products, there are also general-purpose capabilities that are relevant for all products, that are country specific, and that make it easier to jump for countries to any new product, reducing the importance of product relatedness as driver of diversification. Institutions may be regarded as important general-purpose capabilities of a country: they shape and constraint the behavior of individuals at all levels and in all sectors. In our empirical study on diversification of many countries worldwide, we consider a wide range of institutions, like economic and political institutions, rules governing the educational system, the technological environment, and the relations between social and economic actors, and norms and values. Our preliminary empirical results show that different types of institutions have indeed an impact on the diversification process. Institutions either reinforce path-dependency, or they provide countries with more degrees of freedom in their evolution within the product space.

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Introduction

Understanding the nature and causes of economic prosperity and growth has been an important objective of the modern economic science since its inception (Smith, 1776). Several explanations have been advanced over time for the existence and persistence of big differences in per-capita incomes across countries, including the accumulation of physical (Solow, 1956) and human capital (Lucas, 1988), endogenous technical change (Romer, 1990), openness to international trade (Frankel and Romer,1999), geography (Diamond, 1997; Sachs, 2001), religion (Weber, 1930) and social capital (Knack and Keefer, 1997).

Although all these factors might play some role in the process of growth, two different theories have gained a growing consensus about the deep determinants of sustained economic growth. The first of these theories claims that institutions, and in particular economic institutions, are the fundamental cause of long run growth (Acemoglu et al., 2005). Institutions, in this perspective, are conceived as "rules of the game" that shape and constraint human behavior, by encouraging or dampening their efforts to work, to invest, and to innovate (North, 1990). The basic argument can be summarized as follows: economic institutions can be either inclusive or exclusive. Inclusive institutions, that guarantee property rights, ensure the enforcement of contracts, and sustain the rule of law, allow people to freely choose their occupation and to efficiently allocate their talents. Extractive institutions benefit only a restricted set of people that exploit the remaining part of the population. Economic institutions are determined by the distribution of political power, that is by political institutions: inclusive political institutions, such as democracy and pluralism, favor the emergence and persistence of inclusive economic institutions, while extractive economic institutions are typically the rule under absolutism and dictatorship (Acemoglu and Robinson, 2012).

The second theory, instead, focuses on the productive structure of countries. There is a strong heterogeneity in what countries produce, and this heterogeneity is relevant because it determines the potential income that nations may obtain. In fact, the product space has a core-periphery structure:

countries specializing in products that are very close to each other and offer important opportunities for exploiting the advantages of the division of the labor will have better growth opportunities (Hidalgo et al., 2007). Moving from the periphery to the core of the product space is very difficult: the evolution of the productive structure of countries exhibits a strong path-dependence, since products require specific capabilities and these are not easily transferred across countries. If a country does not have most of the capabilities needed to produce a new good, it can be very difficult to start producing it (Hidalgo and Hausmann, 2009). Countries that already produce related products – that is, products that require similar capabilities – will have a clear advantage in the diversification process (Hausmann and Klinger, 2007).

Both theories provide reasonable explanations for the inequalities in countries income and are supported by sound empirical analyses; however, they provide no explicit link with each other.

In this working paper, we propose some ideas to bridge these two streams of literature. Our starting point is the relatedness and diversification literature. Our main claim is that the constraints of path-dependence are not equally binding for all countries: while some capabilities are important only for specific products or groups of products (e.g. specific technological knowledge), there are also general-purpose capabilities that are relevant for all products, and are also country specific. Countries characterized by stronger general-purpose capabilities could find it easier to jump to any new product: therefore, the importance of product relatedness would be much lower in this case. On the contrary, countries characterized by weaker general-purpose capabilities would rely much more strongly on the links between products in order to jump into new industries. Institutions are the most evident form of general-purpose capabilities of a country: they shape and constraint the behavior of individuals at all levels and in all sectors. This role is not limited to economic or political institutions: the discovery of new products is also affected by the rules governing the educational system, the technological environment, or the relations between social and economic actors. Moreover, we also consider elements that are not formally or legally expressed, such as norms or values, that also differ across nations and are very stable over time.

In the next section, we present the basic theoretical framework. Then we specify our hypotheses about the effects of specific institutions. In the subsequent section, we illustrate the methodology and the data. In the results section, we first discuss the outcomes of our empirical analysis. We conclude by discussing the policy and theoretical implications. A simulation model supporting our theoretical arguments can be found in the appendix.

The structure of the product space, diversification and relatedness

The idea that the product space has a complex structure has important implications for our understanding of the diversification process that characterizes world countries, since it implies that the achievement of a comparative advantage in a new product can be subject to many constraints and limitations (Hausmann and Klinger, 2007). The evolution of the productive structure of a country is driven by its own history, because countries develop products that are not too far from what they are currently doing. This argument relies strongly on the concept of capabilities. Capabilities might refer to different levels of analysis. At the firm level they identify complex routines or collection of routines that give an organization a set of options for producing specific outputs (Winter, 2003). They provide firms competitive advantage because they cannot be easily imitated (Dosi, Nelson and Winter, 2000). At the country level, they refer to specific infrastructure, skills, knowledge, institutions or norms, and provide advantage for countries because they are not internationally tradable (Hausmann and Hidalgo, 2010). If a country is specialized in a certain product, it clearly has the capabilities to produce it, as well as most of the capabilities necessary to produce similar products. Therefore, countries specialized in products located in the dense part of the product space will have more opportunities to redeploy their capabilities in new products and will have higher growth rates. Recent empirical evidence indirectly confirms the role played by capabilities in the diversification process. Industry case studies show that the most successful firms in new industries are founded by entrepreneurs with experience in related industries: many carriage-makers were able to redeploy their experience in complex assembly in the newly born automobile

industry (Klepper, 2002), and the dominant firms in the radio industry were also able to dominate the television receiver industry (Klepper and Simons, 2000). Boschma et al. (2012) show that the diversification process is much stronger at the regional rather than country level, which is compatible with the concept of non-tradable and localized capabilities.

As we just mentioned, at the country level capabilities might refer also to institutions or norms. However, institutions and norms do not necessarily pertain to specific products: they can affect different groups of products and even all sectors in a country. Therefore, they might be considered as general-purpose capabilities, that are country specific rather than product specific. The diversification process in countries with strong general-purpose capabilities will be less affected by the existence of product specific capabilities. However, in countries with weak general-purpose capabilities the only way to move to new industries would be to exploit the existing product specific capabilities. So, the path-dependent process driving the diversification into new industries might offer different degrees of freedom in different countries. In countries where general purpose capabilities are stronger, we will observe a weaker role for relatedness between products; in countries with weaker capabilities we will observe the opposite pattern.

Institutions as general-purpose capabilities

As we mentioned before, institutions might be considered as an example of capabilities at the country level, since they affect the behavior of individuals and organizations, and cannot be traded internationally. As the term "institutions" has been used in different contexts, we need to specify what we have in mind. We follow North (1991) definition of institutions as "the humanly devised constraints that structure political, economic and social interaction". They can be either formal or informal rules, and are distinct from actors that follow them. As our analysis is at the level of the economic system, we consider organizations as actors rather than institutions, although we are aware that the internal rules of organizations can also be considered as institutions (Hodgson, 2006). Actors generally follow the rules of the game for different motives, that can be cognitive, normative

or explicitly self-interested, and they can also actively operate to change these rules, although usually this process is quite slow. As it may be expected, the work in the economic field has focused mostly on the importance of economic or political institutions for the performance of economic systems. However, the rules governing other aspects of social life, such as the educational system or innovation systems, can also have important implications for the diversification process of a country, and therefore we will consider a broader set of institutions that goes beyond the purely economic and political realm.

Economic Institutions

Economic institutions refer to the rules that directly affect the economic system. Although this definition can be very inclusive, the current literature has focused mostly on two variables: property right institutions, that protect common citizens against expropriation by the government and by other powerful citizens, and contracting institutions, that allow and favor the enforcement of contracts (Acemglu and Johnson, 2005). Although generally are considered separately, we can include within the set of economic institutions also the rules governing international trade, and determining the degree of trade openness of a country. All these institutions share a strong and direct impact on the emergence of markets, either domestic or international. There is now a broad consensus on the role that economic institutions play in the process of economic growth (Acemoglu et al., 2001), with a specific preeminence of property rights and rule of law over contract rules (Acemoglu and Johnson, 2005) and trade integration (Rodrik et al., 2004). Moreover, it is also quite clear to understand that in presence of good economic institutions individuals and organizations have strong incentives to innovate in order to gain profits from their activities. However, here we claim that in presence of these institutions the diversification process will be less constrained by the existing productive structure. There are at least two rationales for this proposition: first, an economy with good economic institutions favors the entry and the investments by foreign firms that may possess capabilities that are far from the current set available in a country. Second, the search for

new capabilities is costly, and the more so the farther the capabilities are from what is currently known (Hausmann et al., 2007): good economic institutions provide a strong incentive to incur these costs, since they also guarantee secure profits in case of success.

Political Institutions

Political institutions are the rules that shape and constraint actors in the political sphere. The most important element of political institutions is the form of government (democracy versus autocracy), but there are several important aspects to consider, such as the constraints on the executive action, the level of corruption, or the presence of general freedoms, such as the freedom of press and association. There is no conclusive evidence of a link between political institutions and economic outcomes: democracy could even have a negative direct effect on economic growth (Barro, 1996), but transition to less democratic form of government can also impact negatively income (Persson and Tabellini, 2007). There is more consensus on the indirect effects of political institutions via economic institutions: democratic forms of government and ample freedoms for citizens provide ample guarantees on the persistence of good economic institutions (Acemoglu and Robinson, 2012). The link with diversification is also weaker than in the case of economic institutions. However, there is recent evidence that political rights have a selective positive effect on the growth of sectors that are close to the technological frontier (Aghion et al., 2007). This effect is due to the lower barriers to entry associated with democracy because of a weaker protection of vested interests: therefore, it should also lead to the discovery of new products that are far from the current productive structure of a country.

Coordination Institutions

If it is true that economic institutions supporting property rights and contract enforcement are positive for growth, it must also be recognized that these objectives can be pursued through different institutional arrangements that are equally effective (Rodrik, 2008). The stream of

literature that goes under the label of "Varieties of Capitalism" has its focus exactly on the institutional differences within the group of advanced countries (Hall and Soskice, 2001). The basic discrimination element is given by the rules governing the firms coordination problems in with their working force, with the investors, and with the other firms. Although these coordination problems arise in different realms, the solutions adopted by firms tend to be similar because of institutional complementarities, and determine two types of political economies: in liberal market economies (LME) firms coordinate their activities through hierarchies and market arrangements, while in coordinated market economies (CME) firms rely on non-market relations and strategic interactions. The main prediction of this theory is that coordinated market economies are better at supporting incremental innovation: workers are more secure of their job and can reach higher levels of industry-specific technical skills; the coordinated system of corporate governance reduces the importance of getting immediate profits from breakthrough innovations to avoid hostile takeovers. Liberal market economies, however, are better at supporting radical innovations: firms can easily find on the market both workers (or even companies) with the necessary skills and financial resources to pursue riskier projects.

Although the distinction between the two groups of countries has been challenged (Geffen and Kenyon, 2006), also because institutional arrangements underwent major changes in many developed countries (Schneider and Paunescu, 2012), empirical findings support the idea of institutional complementarities (Hall and Gingerich, 2009). However, the prediction about the link between institutions and innovation is strongly debated: some case studies suggest that the mechanisms advanced by the varieties of capitalism position are actually at work (Hall and Soskice, 2001), but large scale empirical works do not support its claims (Taylor, 2004; Akkermans et al., 2009).

Our work provides an alternative setting in which the varieties of capitalism hypothesis can be tested. Rather than drawing a distinction between radical and incremental innovations, we consider the possibility that CME tend to diversify mostly in related sectors while LME have higher

probability to engage and succeed in less related diversification. The mechanisms at work are very similar to what described by Hall and Soskice (2001). However, CME might also be successful in radical innovations, if these take place in related sectors: this is very much in line with the evidence by Akkermans et al. (2009).

Educational Institutions

An institutional domain that can be relevant for the development of new products is the educational system of a country (Lundvall, 1992): the presence of people with strong skills and advanced competences (as signaled by the completion of higher education) is important, as well as the existence of a majority of the population that has at least a basic formal education (Crescenzi and Rodriguez-Pose, 2011). There is now a quite supportive evidence that the quality of education is more important for growth than the simple number of years spent at school (Barro, 2013; Hanushek and Woessmann, 2010); however, even an imperfect measure of education as the level of education attainment shows important results (Krueger and Lindahl, 2001).

Suggesting an impact of educational variables on the patterns of diversification is not an easy task. Higher levels of education should have a positive impact on diversification, especially in knowledge-demanding fields: some form of knowledge is necessary to move towards both related fields and unrelated fields. However, since secondary education is often concerned with practical knowledge, it is possible that countries with a relatively high share of secondary education will have stronger propensity to related diversification, while countries with a higher share of tertiary education will diversify also in less related products.

Technology and Innovation Institutions

The literature on markets for technologies (Arora et al., 2001) and more generally on markets for inventions (Conti et al., 2013) has pointed out the importance of allowing the innovation process to take place also outside the organizational boundary of a firm. In presence of well-developed

markets for technologies specialization and division of labor are enhanced, supporting the diversification process of a country (Arora and Gambardella, 1994). However, the development of markets for technologies is the outcome of the interaction of formal and informal institutions, including effective intellectual property rights, appropriate contracts, and social norms. Countries with well developed markets for technologies should be less constrained in their diversification process: firms might pursue innovative projects without needing downstream capabilities for the commercialization. Moreover, the presence of markets for technologies determines an easier access to knowledge favoring the recombination of existing skills to produce novelty (Chesbrough, 2003).

Culture

In the economic literature about institutions and growth, culture is typically considered as an unconvincing explanation for the observed patterns. The culture variable is often operationalized through very specific variables, such as common language, religion, or juridical system (Acemoglu et al., 2001). However, if include in the concept of institutions also informal rules and social norms, then we cannot exclude the idea of culture as "the collective programming of the mind distinguishing the members of one group or category of people from another" (Hofstede, 1980). The research stream developed by Geert Hofstede has shown that it is possible to identify cultural traits at the national level that affect the values and the behavior of the majority of the population. Over time, Hofstede et al. (2010) identified 6 dimensions of national culture: four of them are certainly relevant in our context.

First, the Uncertainty Avoidance dimension reflects the preference and the tolerance of a society for uncertainty and ambiguity. A quite direct link might be suggested: since engaging in the development of products that are not so related to the current activities is a very uncertain process, we can expect that countries avoiding uncertainties might be more strongly constrained by the current productive structure in the process of industrial diversification.

Second, the Individualism dimension reflects the expectation of a society that an individual is able to look after himself and is not strongly integrated in his origin group. Here considerations similar to what were developed in the case of coordinated and liberal market economies can be applied: more collectivistic countries should be more constrained in their innovation activities.

There is suggestive evidence that these two dimensions are correlated with more radical and creative innovations (Acemoglu et al., 2014).

Third, the Masculinity dimension reflects the importance in society played by competition and assertiveness: people can therefore pursue their projects without caring about consensus and expecting to be rewarded for their achievements.

Finally, the Long-Term Orientation dimension reflects the propensity of people to save and invest for the future, and to be persistent in their endeavours, characteristics that can be very important when trying to develop ideas and products that are not very related with the current activities. On the contrary, short term oriented cultures have a weaker propensity to abandon traditions and to open to diversity.

Methodology and Data

In order to represent the product space we follow quite closely the approach outlined by Hidalgo et al. (2007) and Hidalgo and Hausmann (2009). Our starting point is the concept of revealed comparative advantage developed by Balassa (1965). A country has a comparative advantage in a product *i* when the share of this product in its exports is larger than the share of the product in the world exports.

The next step is to provide a measure of the proximity between industries. The proximity (ϕ) between two products (*i* and *j*) in a given year *t* can be formally expressed as:

$$\varphi_{ijt} = min\{P(x_{i,t}|x_{j,t}), P(x_{j,t}|x_{i,t})\} \qquad (1)$$

that is, the proximity between product *i* and *j* in year *t* is the minimum between the conditional probability of having a comparative advantage in product *i* given a comparative advantage in

product *j*, and the conditional probability of having a comparative advantage in product *j* given a comparative advantage in product *i*. The rationale behind the proximity measure is that if two products are related because they require similar institutions, infrastructure, productive inputs, organizational routines and capabilities, and technology, then they will be probably produced together. Conditional probabilities rather than joint probabilities must be used, so that the measure is not affected by the relevance of the products in the world trade. The minimum between conditional probabilities is used in order to ensure a symmetric and conservative measure.

Proximity is a property referring to the link between two products. In order to analyze countries we need to place them in this space. This can be done by using a density indicator, that measures how close a product is to the current productive structure of a country or a region. Formally, density can be expressed as follows:

$$d_{i,c,t} = \frac{\sum_k x_{k,c,t} \cdot \varphi_{i,k,t}}{\sum_k \varphi_{i,k,t}} \qquad (2)$$

where ϕ represents proximity (between product *i* and product *k*) and *x* takes the value of 1 if country *c* has a comparative advantage in product *k* at time *t*, and zero otherwise. So, density around a product will be high if a country has a comparative advantage in most of the products related to the focal one; at the very extreme, it will be equal to 1, if a country has a comparative advantage in all products with a non-zero proximity to the focal product. Conversely, density around a product will be low (zero) if a country does not have a comparative advantage in most (any) of the products related to the focal one.

In order to calculate the density indicator, we use country-level world trade data from the BACI database for the period 1995-2010 (Gaulier and Zignago, 2010). This database is based on the UN Comtrade data, and is developed using a procedure that reconciles the declarations of the exporter and the importer, allowing to extend considerably the number of countries with available trade data. Moreover, data are available at an high level of product disaggregation (6-digit Harmozized

System), although for the current analysis we use a 4-digit level, which includes 1241 different products[1].

We estimate the following econometric model:

$$\begin{aligned} x_{i,c,t+5} = \; & \alpha + \beta x_{i,c,t} + \beta^{o}\left(x_{i,c,t}\right) \cdot d_{i,c,t} + \beta^{n}\left(1 - x_{i,c,t}\right) \cdot d_{i,c,t} + \\ & + \gamma^{o}\left(x_{i,c,t}\right) \cdot d_{i,c,t}^{2} + \; \gamma^{n}\left(1 - x_{i,c,t}\right) \cdot d_{i,c,t}^{2} + \\ & + \delta^{o} Inst \cdot \left(x_{i,c,t}\right) \cdot d_{i,c,t} + \delta^{n} Inst \cdot \left(1 - x_{i,c,t}\right) \cdot d_{i,c,t} + \\ & + \pi X + \varepsilon_{i,c,t} \quad (3) \end{aligned}$$

where the dependent variable takes value 1 if country *c* has a comparative advantage in product *i* at time *t* + 5 and zero otherwise, $d_{i,c,t}$ denotes the density around product i in country c at time t, *Inst* is the institutional indicator measured in the specific context, and *X* is a vector of country-year and product-year dummy variables, which control for any time-varying country or product characteristics. The coefficient $\delta^{o}$and δ^{n}capture any eventual difference in the impact of density on having a comparative advantage in current and new products depending on the level of the institutional indicator. Density is normalized by subtracting the mean and dividing by the standard deviation. All results are obtained from OLS estimation with standard errors clustered at the country level.

Results

In this section we present the results of our analysis. For each group of institutions identified in the theory section, we will consider different indicators, in order to provide robust results. When possible, we will use a continuous indicator (Cts), and we will also dichotomize it around the median (Med) and the third quartile (3Qt) in order to ease the interpretation and to capture possible non-linear effects.

[1] We use 4-digit data rather than 6-digit because the computation of conditional probabilities is highly demanding for memory. However, even as it is, our analysis is more fine-grained than what can be found in previous studies: Hausmann and Klinger (2007) use a specification with 1006 products, while Boschma et al. (2012) have 775 products.

Economic Institutions

We start our analysis from economic institutions. In the first three columns of Table 1 we use the Average Protection against Expropriation Risk, as a measure of the property rights enforcement in a country that is taken from Political Risk Services and used by Acemoglu et al. (2001). In columns 4 to 6, we use the index of government's anti-diversion policies, which is a weighted average of five indicators (law and order, bureaucratic quality, corruption, risk of expropriation, and government repudiation of contracts. The measure has been developed by Hall and Jones (1999) and used by Persson and Tabellini (2009). We use also a different combination of this variable employed by Tabellini (2008) in columns 7 to 9. In all cases, there is no interaction between our institutional indicators and density: economic institutions, and especially those related to property rights enforcement, are not correlated with strength of the path dependence process of industrial diversification. In the last three columns of Table 1 we consider a different dimension of economic institutions: trade openness, which is simply the ratio of Imports and Exports over GDP (Castellacci and Natera, 2011). Countries open to international trade are able to keep producing products even if these are not perfectly related to their industrial structure, confirming the findings by Boschma and Capone (2014) about the role of trade partners. However, the impact on the development of new products is quite limited.

Overall, although economic institutions have a well-known effect on economic growth, they do not seem to affect the process of industrial diversification of countries.

Political Institutions

In Table 2 we analyze the effect of political institutions on the process of industrial diversification. As in the case of economic institutions, we use different measures of political institutions. First, we employ an average measure of the constraints on the executive: governments with a limited amount of power do not have many possibilities to expropriate the citizens and therefore might favor

diversification in less related areas. Our second measure is the well known Democracy and Autocracy Index developed within the Polity IV Project: this is a measure of the current political conditions in a country. To take into account also the political history of countries, and the fact that there is lower uncertainty when democracy is established since long, we use the concept of democratic capital developed by Persson and Tabellini (2009): countries will accumulate this capital when democracy is the rule, and will depreciate it when there is an autocratic government. Whatever the measure, we find a quite relevant effect: countries with political institutions above the median tend to be less constrained by their current productive structure when developing new products.

A more surprising finding emerges from the last three columns (10 to 12). Here we consider the political transitions (from autocracy to democracy or viceversa) occurring in the previous 5 years, and we find a very strong effect of moving from democracy to autocracy on the development of new products in more distant fields, although we would have expected a more positive role of democracy. This result might be due to the limited number of transitions in our sample, and therefore further robustness checks are necessary. It is also possible that trade data around period of transitions might not be perfectly reliable, and therefore sectors that were already present in a country are considered as new.

Educational Institutions

A third group of institutions we consider refer to the educational system. In the literature about education and economic growth, there are two different set of variables. Measures of the quantity of education are easy to obtain and quite reliable, but they do not take into account the differences in the contents of education. Measures of the quality of education address exactly this issue, but they are less precise and not easily comparable across countries.

Our measures for quantity (Gross Enrolment Ratio for Primary, Secondary and Tertiary Level, and Public Expenditure) show only a limited impact on industrial diversification (Table 3). Countries

with higher secondary and tertiary education, however, tend to be less constrained by density in keeping their production in sectors less related to the current productive structure. Our measures of quality of education (Table 4) confirm and reinforce this result: average school attainment is a more precise measure of the current stock of knowledge available in the country, while the ratio between pupils and teacher is a general proxy for the quality of the school. They both show significant effects. The impact of cognitive skills, as measured by international tests, is quite similar, although statistically less significant. Finally, we also employ the concept of social filter, which refers to the conditions that favor learning and innovations and includes education achievement, the productive employment of human capital, and the demographic structure of a region or a country (Rodriguez-Pose and Crescenzi, 2008). The three dimensions are merged in a single indicator by employing principal component analysis. As can be seen in columns 10 to 12 of Table 4, the social filter[2] has a stronger effect in the third quartile column: countries with very low educational levels and a bad allocation of human capital tend to lock into products that are already strongly related to what they produce.

Coordination Institutions

In Table 5 we analyze the role of coordination institutions. The generic distinction between liberal market economies , coordinated market economies and mixed market economies does not produce any significant interaction with the effect of density (column 1 to 3). However, if we use measures of the specific dimensions of coordination, such as labor relations and corporate governance, we find results in the direction we would have expected. It is particularly relevant the role of labor markets: since in coordinated economies they are less fluid, firms have higher costs in jumping into new products, and therefore will tend to diversify into more related fields. The effect is weaker in the case of corporate governance, and also when considering both indicators together, although the

[2] The principal component indicator takes higher values for worse educational performance and allocation of human capital.

last case is probably due to a problem of collinearity given the very high correlation between the two indicators.

Finally, it is import to remark that this analysis is heavily limited by data availability, since the information about labor relations and corporate governance coordination are available only for 20 countries.

Technological Institutions

In Table 6 we analyze the role that markets for technology play in the diversification process. As a proxy for the development of markets for technology, we employ the amount of royalty and license fees payments, although this measure does not consider other channels through which technology might be traded. Our results are quite in line with our expectations: markets for technology matter mostly for the development of new products, and this is particularly relevant in the case of countries with highly developed markets (column 3 of Table 6).

Culture

In Table 7 we consider four different dimensions of culture identified by Hofstede et al. (2010): uncertainty avoidance, individualism, masculinity and long-term orientation. Quite surprisingly, uncertainty avoidance and individualism do not show any interaction with density. The impact of masculinity is limited to countries with very high values (column 9 of Table 7). However, long term orientation is associated to a lower impact of density for both the development of new products and the retention of current products. These results are confirmed also in a model that consider all cultural dimensions together (Table 8).

Conclusions

In this paper we investigated the role of institutions in the process of industrial diversification. In the theoretical section, we proposed to consider institutions as general-purpose capabilities that are

relevant not for specific sectors, but for whole regions and countries. We then identified the potential effect of different sets of institutions pertaining to different dimensions (economic, political, coordination, educational, technological, cultural). With notable exceptions for economic institutions and some cultural traits, our empirical results confirm the theoretical expectations:

they show that different institutions pertaining to different domains may have an impact on the diversification process, and can either reinforce the path-dependency or provide the countries with more degrees of freedom in their evolution within the product space.

Quite surprisingly, economic institutions, that are recognized as fundamental elements to start and foster the growth process (Acemoglu et al., 2005), are the less relevant dimension for the diversification process. Trade openness is the only element that plays a role, and it confirms that the entry in new areas of the product space that are far from the current productive structure of a country may be easier if the country is well embedded in the network of international trade (Boschma and Capone, 2014).

Political institutions, instead, play a very important role: democracy, especially if established since long, favors the diversification in distant products. Within the restricted set of developed countries, coordination in labor relations strengthen the path-dependence, while coordination in the corporate governance domain is less important.

Educational institutions reduce the importance of the current productive structure only for products that have been already established in the past: they reflect the education of the majority of the population rather than the frontier of the knowledge. Markets for technology work in the expected direction, since they favor the diversification into less related products. Finally, among the cultural dimensions we consider, only long term orientation affects in a relevant and consistent way the process of diversification.

Our work contributes to the studies about the determinants of economic growth by providing a bridge between two different streams of literature that have emerged in this field, that focus on institutions (Acemoglu et al., 2005) and industrial diversification (Hidalgo et al., 2007). Institutions

have an important impact on the diversification process, but a major role is played by political, educational, and technological dimensions, and not by the immediate characteristics of the economic environment. This result is consistent with the idea that institutions less directly related to the economic system can have an important indirect effect on the economic performance of countries: the speed and the direction of industrial diversification would represent an important mechanism through which their action takes actually place.

Our results on the institutions governing the coordination problems of the firms provide an interesting contribution to the literature about the Varieties of Capitalism (Hall and Soskice, 2001). Rather than focusing on the characteristics of the innovation output (radical versus incremental), we show that more coordinated economies, especially in the labor relations, tend to be more constrained in the diversification process jumping to more related sectors. Although we did not investigate this aspect, our result is agnostic about the type of innovation that could emerge within these sectors.

Third, we also contribute to the evolutionary economic geography research program by explicitly introducing institutional differences in the evolutionary process through which countries develop new products and industries. The role of institutions within evolutionary economic geography has been at the center of the recent debate (Frenken and Boschma, 2009; MacKinnon et al., 2009). Our work support the idea that at the regional and national level institutions can play an important role to generate, reinforce and select the path-dependent routines behind the behavior of firms (Essletzbichler and Rigby, 2007) and provides an example of how institutions can be included in an evolutionary framework, alongside the attention to institutional proximity as a driver of evolution (Balland et al., 2014).

Drawing policy implications is a very delicate exercise with respect to the analysis conducted so far. Our study, in fact, confirms the strong path-dependence in the diversification process of countries emerging from previous work (Hausmann and Klinger, 2007; Boschma et al., 2013): the productive structure of the past keeps exerting its influence many years later, and the position of countries in

the product space is very stable over the whole period under analysis. Therefore, policy interventions should take into account that effects might display only over a long time period.

Policy aimed at improving and speeding up the diversification process should consider that in countries with low institutional quality, this could be obtained mostly by favoring the development of nearby sectors. Directly favoring the creation of very distant industries might result in severe failures, since the lack of necessary supporting infrastructure and institutions may doom these initiatives before positive diffusion effects may occur. Such policies might actually have a positive effect only in presence of a good education system, that enables countries to keep producing also in sectors less related to its current productive structure.

Together with these interventions focused on nearby industries, policy makers might also consider actions aimed at improving the quality of the supporting institutions. Creating an environment where firms can emerge and grow more easily or returns from innovation can be better appropriated, might provide stronger incentives and opportunities for diversification even in very far products and therefore boost the future growth of countries. A particular relevance must be placed on the role of political institutions: reforms of the political system aimed at increasing the degree of democracy could have a very important impact on the development of new products.

There are obviously some aspects that we did not consider in this work and ore open to further research. First, it would be important to study the extent to which some institutions might be relevant only for some specific sectors, distinguishing high-tech from low-tech, as suggested by the literature on sectoral systems of innovation (Malerba, 2004). The presence of sectoral institutions could actually be a fundamental driver for the emergence and success of some sectors, because of their institutional proximity (Balland et al., 2014).

Another interesting aspect to investigate is the existence of institutional complementarities, with some sets of institutions that become relevant only when also other elements are present (Lipsey, 2009). A first step in this direction was our analysis of coordination mechanisms. Finally, an important issue to consider is institutional change: although institutions change slowly, there are

also historical cases of abrupt change that can have long-lasting consequences on the process of industrial diversification and on the economic performance of countries.

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Table 1

Determinants of Having a Comparative Advantage in the Future: Economic Institutions

Institutions Indicator	Average Protection against Expropriation Risk (Acemoglu et al., 2001)			Government Anti Diversion Policies (GADP) (Persson and Tabellini, 2009)			GADP + Bureaucratic Quality (Tabellini, 2008)			Trade Openness Indicator (Castellacci and Natera, 2011)		
Indicator Measurement	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.529**	0.53**	0.529**	0.527**	0.527**	0.528**	0.534**	0.537**	0.535**	0.51**	0.511**	0.511**
	(0.0106)	(0.0107)	(0.0107)	(0.0109)	(0.0109)	0.0108)	(0.0103)	(0.0104)	(0.0103)	(0.0107)	(0.0107)	(0.0106)
Density on Current	0.308**	0.319**	0.303**	0.282**	0.304**	0.299**	0.302**	0.322**	0.299**	0.333**	0.329**	0.323**
	(0.0284)	(0.0169)	(0.0144)	(0.0331)	(0.0162)	0.0134)	(0.0135)	(0.0185)	(0.0142)	(0.0146)	(0.0135)	(0.0129)
Density on New	0.228**	0.213**	0.205**	0.203**	0.218**	0.212**	0.206**	0.206**	0.205**	0.227**	0.225**	0.219**
	(0.033)	(0.0106)	(0.0102)	(0.031)	(0.0107)	0.0102)	(0.01)	(0.011)	(0.0109)	(0.0133)	(0.0109)	(0.0099)
Squared Density on Current	-0.038**	-0.034**	-0.039**	-0.037**	-0.036**	-0.037**	-0.039**	-0.034**	-0.039**	-0.04**	-0.04**	-0.04**
	(0.0052)	(0.0052)	(0.0049)	(0.0042)	(0.0041)	0.0041)	(0.0044)	(0.0043)	(0.0043)	(0.004)	(0.0041)	(0.0039)
Squared Density on New	-0.021**	-0.02**	-0.024**	-0.025**	-0.023**	-0.025**	-0.021**	-0.023**	-0.022**	-0.027**	-0.027**	-0.027**
	(0.0054)	(0.005)	(0.0049)	(0.0053)	(0.0048)	0.0054)	(0.0054)	(0.0055)	(0.005)	(0.0043)	(0.0042)	(0.0042)
Indicator *Density on Curr.	-0.0005	-0.031+	0.008	0.0003	-0.002	0.012	0.002	-0.033+	0.014	-0.027*	-0.023**	-0.025*
	(0.0033)	(0.0162)	(0.0113)	(0.0004)	(0.0157)	0.0122)	(0.0035)	(0.0193)	(0.012)	(0.0121)	(0.0076)	(0.0097)
Indicator *Density on New	-0.003	-0.019	0.008	0.0001	-0.008	0.008	-0.003	-0.003	0.004	-0.016	-0.016+	-0.009
	(0.0046)	(0.014)	(0.016)	(0.0004)	(0.012)	0.0165)	(0.0053)	(0.0152)	(0.0167)	(0.0148)	(0.0094)	(0.0114)
Observations	413253	413253	413253	424422	424422	424422	394638	394638	394638	469098	469098	469098
Number of Clusters	111	111	111	114	114	114	106	106	106	126	126	126
Adjusted R-squared	0.528	0.528	0.528	0.5269	0.5269	0.5269	0.5359	0.536	0.5359	0.5094	0.5095	0.5095

Country-clustered standard errors in parentheses.

All models include country-year and product-year dummy variables.

**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Table 2

Determinants of Having a Comparative Advantage in the Future: Political Institutions

Institutions Indicator	Constraints on Executive (Tabellini, 2008)			Democracy and Autocracy Index (Marshall and Jagger, 2003)			Democratic Capital (Persson and Tabellini, 2009)			Political Transitions (Persson and Tabellini, 2009)		
Indicator Measurement	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt	All	To Dem	To Aut
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.492**	0.492**	0.493**	0.502**	0.502**	0.504**	0.492**	0.491**	0.494**	0.493**	0.493**	0.493**
	(0.011)	(0.0111)	(0.0109)	(0.0106)	(0.0106)	(0.0105)	(0.0107)	(0.0108)	(0.0107)	(0.0109)	(0.0109)	(0.0109)
Density on Current	0.328**	0.333**	0.322**	0.322**	0.321**	0.317**	0.318**	0.317**	0.318**	0.326**	0.325**	0.323**
	(0.0176)	(0.0142)	(0.0127)	(0.0132)	(0.0146)	(0.0128)	(0.0138)	(0.014)	(0.0126)	(0.0126)	(0.0126)	(0.0123)
Density on New	0.25**	0.236**	0.226**	0.223**	0.233**	0.218**	0.235**	0.235**	0.224**	0.224**	0.222**	0.224**
	(0.0152)	(0.0103)	(0.0095)	(0.0094)	(0.0108)	(0.0095)	(0.0094)	(0.01)	(0.0091)	(0.0094)	(0.0094)	(0.0095)
Squared Density on Current	-0.039**	-0.038**	-0.039**	-0.039**	-0.039**	-0.04**	-0.041**	-0.04**	-0.042**	-0.039**	-0.039**	-0.038**
	(0.004)	(0.0038)	(0.0039)	(0.0039)	(0.004)	(0.0039)	(0.0044)	(0.004)	(0.0042)	(0.004)	(0.0039)	(0.0038)
Squared Density on New	-0.023**	-0.025**	-0.025**	-0.022**	-0.023**	-0.024**	-0.022**	-0.024**	-0.024**	-0.028**	-0.027**	-0.028**
	(0.0046)	(0.0043)	(0.0044)	(0.0044)	(0.0042)	(0.0044)	(0.0042)	(0.0041)	(0.0042)	(0.0042)	(0.0042)	(0.0042)
Indicator *Density on Curr.	-0.001	-0.016	0.002	-0.0004	-0.001	0.007	0.013	0.012	0.017+	-0.027+	-0.023	-0.015
	(0.0027)	(0.0098)	(0.0091)	(0.0009)	(0.0115)	(0.0101)	(0.0145)	(0.0115)	(0.0098)	(0.0153)	(0.0166)	(0.0215)
Indicator *Density on New	-0.007*	-0.025*	-0.016	-0.002*	-0.027*	-0.008	-0.035**	-0.024**	-0.016	-0.01	-0.004	-0.042**
	(0.0031)	(0.0105)	(0.0114)	(0.0009)	(0.0107)	(0.0144)	(0.0123)	(0.009)	(0.0102)	(0.0134)	(0.0146)	(0.0154)
Observations	532389	532389	532389	500123	500123	500123	532389	532389	532389	532389	532389	532389
Number of Clusters	143	143	143	142	142	142	143	143	143	143	143	143
Adjusted R-squared	0.4995	0.4994	0.4994	0.5116	0.5116	0.5116	0.4997	0.4996	0.4996	0.4994	0.4994	0.4994

Country-clustered standard errors in parentheses.

All models include country-year and product-year dummy variables.

**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Table 3

Determinants of Having a Comparative Advantage in the Future: Educational Institutions

Institutions Indicator	Gross Enrolment Ratio Primary Level (Castellacci and Natera, 2011)			Gross Enrolment Ratio Secondary Level (Castellacci and Natera, 2011)			Gross Enrolment Ratio Tertiary Level (Castellacci and Natera, 2011)			Public Expenditure on Education (Castellacci and Natera, 2011)		
Indicator Measurement	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.509**	0.51**	0.509**	0.51**	0.511**	0.51**	0.51**	0.511**	0.51**	0.51**	0.51**	0.509**
	(0.0113)	(0.0107)	(0.0108)	(0.0107)	(0.0106)	(0.0108)	(0.0107)	(0.0106)	(0.0108)	(0.0108)	(0.0108)	(0.0108)
Density on Current	0.343**	0.319**	0.315**	0.334**	0.325**	0.312**	0.322**	0.328**	0.315**	0.311**	0.315**	0.312**
	(0.0437)	(0.0128)	(0.0126)	(0.0181)	(0.0138)	(0.0129)	(0.0141)	(0.0135)	(0.0127)	(0.0186)	(0.0134)	(0.0129)
Density on New	0.278**	0.225**	0.221**	0.232**	0.22**	0.216**	0.225**	0.219**	0.218**	0.22**	0.217**	0.218**
	(0.038)	(0.01)	(0.01)	(0.0165)	(0.0103)	(0.01)	(0.0124)	(0.0104)	(0.0102)	(0.0168)	(0.0109)	(0.01)
Squared Density on Current	-0.038**	-0.039**	-0.039**	-0.037**	-0.038**	-0.04**	-0.038**	-0.037**	-0.039**	-0.039**	-0.039**	-0.038**
	(0.004)	(0.004)	(0.0041)	(0.0041)	(0.0042)	(0.0042)	(0.004)	(0.0042)	(0.0041)	(0.004)	(0.004)	(0.0042)
Squared Density on New	-0.026**	-0.026**	-0.028**	-0.025**	-0.027**	-0.027**	-0.025**	-0.028**	-0.026**	-0.026**	-0.027**	-0.026**
	(0.0043)	(0.0042)	(0.0044)	(0.0048)	(0.0049)	(0.0049)	(0.0046)	(0.0046)	(0.0045)	(0.0044)	(0.0044)	(0.0042)
Indicator *Density on Curr.	-0.0003	-0.004	0.007	-0.0003	-0.018*	0.013	-0.0002	-0.022**	0.001	0.001	0.0002	0.008
	(0.0004)	(0.0071)	(0.009)	(0.0002)	(0.0089)	(0.0105)	(0.0002)	(0.0084)	(0.0089)	(0.0028)	(0.0081)	(0.0078)
Indicator *Density on New	-0.0006	-0.011	-0.009	-0.0002	-0.005	0.005	-0.0003	-0.003	-0.002	-0.001	0.001	-0.0001
	(0.0004)	(0.0084)	(0.0107)	(0.0002)	(0.011)	(0.0149)	(0.0002)	(0.0104)	(0.0119)	(0.0033)	(0.0095)	(0.0103)
Observations	469098	469098	469098	469098	469098	469098	469098	469098	469098	469098	469098	469098
Number of Clusters	126	126	126	126	126	126	126	126	126	126	126	126
Adjusted R-squared	0.5094	0.5094	0.5094	0.5094	0.5094	0.5094	0.5094	0.5094	0.5094	0.5094	0.5094	0.5094

Country-clustered standard errors in parentheses.

All models include country-year and product-year dummy variables.

**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Table 4

Determinants of Having a Comparative Advantage in the Future: Quality of Education

Institutions Indicator	Average School Attainment (Persson and Tabellini, 2009)			Pupil-Teacher Ratio Primary Level (Castellacci and Natera, 2011)			Cognitive Skills (Hanushek and Woessman, 2012)			Social Filter (Rodriguez-Pose and Crescenzi, 2008)		
Indicator Measurement	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.534**	0.534**	0.533**	0.512**	0.511**	0.51**	0.575**	0.576**	0.574**	0.525**	0.526**	0.527**
	(0.0104)	(0.0105)	(0.0106)	(0.0106)	(0.0106)	(0.0107)	(0.0131)	(0.0131)	(0.0131)	(0.0106)	(0.0107)	(0.0106)
Density on Current	0.36**	0.323**	0.315**	0.281**	0.333**	0.315**	0.307**	0.241**	0.237**	0.304**	0.294**	0.293**
	(0.0238)	(0.0148)	(0.0146)	(0.0179)	(0.0139)	(0.0129)	(0.0694)	(0.0155)	(0.0152)	(0.0127)	(0.0134)	(0.0126)
Density on New	0.236**	0.214**	0.216**	0.209**	0.221**	0.217**	0.251**	0.175**	0.185**	0.215**	0.211**	0.211**
	(0.023)	(0.011)	(0.0099)	(0.0161)	(0.0099)	(0.0099)	(0.0521)	(0.0122)	(0.0098)	(0.0096)	(0.0121)	(0.0104)
Squared Density on Current	-0.037**	-0.038**	-0.039**	-0.035**	-0.035**	-0.039**	-0.022**	-0.021**	-0.024**	-0.035**	-0.036**	-0.035**
	(0.005)	(0.0049)	(0.0051)	(0.0039)	(0.0041)	(0.004)	(0.0052)	(0.0046)	(0.0046)	(0.0042)	(0.0043)	(0.004)
Squared Density on New	-0.024**	-0.026**	-0.023**	-0.027**	-0.026**	-0.027**	-0.017**	-0.02**	-0.019**	-0.026**	-0.027**	-0.026**
	(0.0053)	(0.0049)	(0.0049)	(0.0049)	(0.0048)	(0.0048)	(0.0054)	(0.0053)	(0.0048)	(0.0052)	(0.0051)	(0.0045)
Indicator *Density on Curr.	-0.024**	-0.026**	-0.02+	-0.001*	-0.032**	0.001	-0.017	-0.02+	-0.013	0.005+	0.02*	0.042*
	(0.0087)	(0.0092)	(0.0102)	(0.0006)	(0.011)	(0.0087)	(0.0148)	(0.0114)	(0.0115)	(0.0027)	(0.0092)	(0.0199)
Indicator *Density on New	-0.012	-0.006	-0.015	-0.0003	-0.01	0.003	-0.016	0.002	-0.026+	0.004	0.006	0.013
	(0.0105)	(0.0117)	(0.0134)	(0.0005)	(0.011)	(0.0127)	(0.0113)	(0.0137)	(0.0139)	(0.0038)	(0.0117)	(0.0131)
Observations	382228	382228	382228	469098	469098	469098	245718	245718	245718	416976	416976	416976
Number of Clusters	108	108	108	126	126	126	66	66	66	112	112	112
Adjusted R-squared	0.5278	0.5279	0.5278	0.5095	0.5095	0.5094	0.5395	0.5396	0.5395	0.5166	0.5166	0.5167

Country-clustered standard errors in parentheses.

All models include country-year and product-year dummy variables.

**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Table 5

Determinants of Having a Comparative Advantage in the Future: Coordination Institutions

Institutions Indicator	Original Dummy (Hall and Soskice, 2001)			Coordination in Labor Relations (Hall and Gingerich, 2009)			Coordination in Corporate Governance (Hall and Gingerich, 2009)			Coordination in Labor Relations and Corporate Governance (Hall and Gingerich, 2009)		
Indicator Measurement	LME	CME	MME	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.661**	0.661**	0.66**	0.669**	0.67**	0.671**	0.669**	0.669**	0.669**	0.668**	0.67**	0.67**
	(0.0123)	(0.0122)	(0.0123)	(0.012)	(0.0119)	(0.0123)	(0.0118)	(0.0123)	(0.0114)	(0.0119)	(0.0124)	(0.0122)
Density on Current	0.164**	0.159**	0.163**	0.141**	0.144**	0.15**	0.138**	0.15**	0.156**	0.138**	0.144**	0.153**
	(0.0106)	(0.0124)	(0.0118)	(0.015)	(0.0131)	(0.0132)	(0.0157)	(0.015)	(0.0118)	(0.0152)	(0.0145)	(0.0126)
Density on New	0.147**	0.138**	0.15**	0.129**	0.13**	0.138**	0.132**	0.137**	0.154**	0.142**	0.129**	0.147**
	(0.0086)	(0.0084)	(0.0072)	(0.0114)	(0.0109)	(0.0092)	(0.0126)	(0.01)	(0.0104)	(0.0135)	(0.0103)	(0.0113)
Squared Density on Current	-0.011*	-0.011*	-0.011*	-0.014*	-0.013*	-0.016*	-0.015*	-0.014*	-0.017*	-0.013*	-0.014*	-0.018**
	(0.0053)	(0.0052)	(0.0053)	(0.0062)	(0.0057)	(0.0063)	(0.0064)	(0.0057)	(0.0065)	(0.0059)	(0.0054)	(0.0065)
Squared Density on New	0.003	0.004	0.005	0.006	0.006	0.006	0.006	0.005	0.011*	0.008	0.006	0.011+
	(0.0042)	(0.0044)	(0.0041)	(0.0042)	(0.0047)	(0.0047)	(0.0038)	(0.0035)	(0.0055)	(0.005)	(0.0043)	(0.0065)
Dummy*Density on Curr.	-0.012	0.006	0.001									
	(0.0158)	(0.0119)	(0.0147)									
Dummy*Density on New	-0.01	0.016	-0.012									
	(0.0142)	(0.0128)	(0.0171)									
Labor*Density on Curr.				0.031+	0.024*	0.027*				-0.014	0.023*	0.018
				(0.0168)	(0.0113)	(0.0131)				(0.05)	(0.0104)	(0.0153)
Labor*Density on New				0.03+	0.027*	0.023+				0.062	0.026	0.026*
				(0.0161)	(0.0121)	(0.0127)				(0.0404)	(0.0163)	(0.0109)
Corp.Gov.*Density on Curr.							0.034+	0.014	0.014	0.043	0.001	0.006
							(0.0195)	(0.0138)	(0.0126)	(0.055)	(0.0129)	(0.0156)
Corp.Gov.*Density on New							0.023	0.016	-0.017	-0.044	0.002	-0.026
							(0.0188)	(0.0122)	(0.016)	(0.0484)	(0.0154)	(0.0178)
Observations	85629	85629	85629	74460	74460	74460	74460	74460	74460	74460	74460	74460
Number of Clusters	23	23	23	20	20	20	20	20	20	20	20	20
Adjusted R-squared	0.6243	0.6243	0.6243	0.6334	0.6335	0.6335	0.6335	0.6334	0.6335	0.6335	0.6335	0.6335

Country-clustered standard errors in parentheses.
All models include country-year and product-year dummy variables.
**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Table 6

Determinants of Having a Comparative Advantage in the Future: Markets for Technology

Institutions Indicator	Royalty and License Fees Payments (Castellacci and Natera, 2011)		
Indicator Measurement	Cts	Med	3Qt
	(1)	(2)	(3)
Model	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.509**	0.509**	0.508**
	(0.0109)	(0.0109)	(0.0107)
Density on Current	0.312**	0.332**	0.318**
	(0.0128)	(0.0135)	(0.0128)
Density on New	0.216**	0.236**	0.226**
	(0.01)	(0.0105)	(0.0097)
Squared Density on Current	-0.038**	-0.038**	-0.039**
	(0.004)	(0.0041)	(0.0039)
Squared Density on New	-0.027**	-0.024**	-0.026**
	(0.0042)	(0.0043)	(0.0042)
Indicator*Density on Curr.	1.034	-0.023*	-0.003
	(1.0719)	(0.0102)	(0.0085)
Indicator*Density on New	0.506	-0.031**	-0.026**
	(1.0981)	(0.0097)	(0.0099)
Observations	469098	469098	469098
Number of Clusters	126	126	126
Adjusted R-squared	0.5094	0.5094	0.5095

Country-clustered standard errors in parentheses.
All models include country-year and product-year dummy variables.
**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Table 7

Determinants of Having a Comparative Advantage in the Future: Cultural Indicators

Cultural Indicator	Uncertainty Avoidance Index (UAI) (Hofstede et al., 2010)			Individualism (IDV) (Hofstede et al., 2010)			Masculinity (MAS) (Hofstede et al., 2010)			Long Term Orientation (LTO) (Hofstede et al., 2010)		
Indicator Measurement	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt	Cts	Med	3Qt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.59**	0.59**	0.59**	0.59**	0.59**	0.59**	0.59**	0.59**	0.59**	0.535**	0.535**	0.536**
	(0.0116)	(0.0117)	(0.0118)	(0.0117)	(0.0117)	(0.0116)	(0.0119)	(0.0119)	(0.0117)	(0.013)	(0.0131)	(0.013)
Density on Current	0.217**	0.209**	0.206**	0.215**	0.212**	0.207**	0.226**	0.209**	0.212**	0.307**	0.301**	0.291**
	(0.0184)	(0.0129)	(0.0121)	(0.0153)	(0.0129)	(0.0117)	(0.0174)	(0.0118)	(0.0107)	(0.0183)	(0.0178)	(0.0153)
Density on New	0.164**	0.163**	0.165**	0.175**	0.166**	0.169**	0.173**	0.164**	0.172**	0.238**	0.219**	0.209**
	(0.0135)	(0.0092)	(0.0088)	(0.0148)	(0.0102)	(0.0089)	(0.017)	(0.0096)	(0.0089)	(0.0177)	(0.0147)	(0.0102)
Squared Density on Current	-0.019**	-0.019**	-0.018**	-0.018**	-0.018**	-0.019**	-0.018**	-0.019**	-0.017**	-0.036**	-0.035**	-0.035**
	(0.004)	(0.0042)	(0.0041)	(0.0041)	(0.0041)	(0.0038)	(0.0042)	(0.0042)	(0.0042)	(0.0053)	(0.0049)	(0.0054)
Squared Density on New	-0.015**	-0.015**	-0.015**	-0.013**	-0.015**	-0.013**	-0.014**	-0.015**	-0.012**	-0.021**	-0.022**	-0.023**
	(0.004)	(0.004)	(0.0039)	(0.0044)	(0.0041)	(0.004)	(0.0042)	(0.0041)	(0.0042)	(0.0053)	(0.0051)	(0.0053)
Indicator*Density on Curr.	-0.0001	-0.002	0.008	-0.0002	-0.007	0.002	-0.0004	-0.001	-0.02+	-0.0004+	-0.022+	-0.017+
	(0.0002)	(0.0094)	(0.0102)	(0.0002)	(0.0111)	(0.012)	(0.0003)	(0.0099)	(0.0103)	(0.0002)	(0.0118)	(0.0095)
Indicator*Density on New	< 0.0001	0.004	0.001	-0.0003	-0.002	-0.017	-0.0002	0.002	-0.029**	-0.001**	-0.034*	-0.026*
	(0.0002)	(0.0102)	(0.0118)	(0.0003)	(0.0114)	(0.0149)	(0.0003)	(0.0106)	(0.011)	(0.0003)	(0.0133)	(0.0116)
Observations	235790	235790	235790	235790	235790	235790	235790	235790	235790	317696	317696	317696
Number of Clusters	64	64	64	64	64	64	64	64	64	86	86	86
Adjusted R-squared	0.5497	0.5497	0.5497	0.5497	0.5497	0.5497	0.5497	0.5497	0.5497	0.5214	0.5214	0.5213

Country-clustered standard errors in parentheses.
All models include country-year and product-year dummy variables.
**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Table 8

Determinants of Having a Comparative Advantage in the Future: Culture Full Model

Cultural Indicator	Hofstede Cultural Indicators (Hofstede et al., 2010)		
Indicator Measurement	Cts	Med	3Qt
	(1)	(2)	(3)
Model	LPM	LPM	LPM
D.V.	CA_{t+5}	CA_{t+5}	CA_{t+5}
CA_t	0.593**	0.593**	0.594**
	(0.0123)	(0.0125)	(0.0123)
Density on Current	0.261**	0.219**	0.207**
	(0.0382)	(0.0231)	(0.0133)
Density on New	0.235**	0.181**	0.185**
	(0.0404)	(0.0248)	(0.012)
Squared Density on Current	-0.019**	-0.02**	-0.017**
	(0.0058)	(0.0049)	(0.0051)
Squared Density on New	-0.008	-0.012*	-0.007
	(0.0055)	(0.0055)	(0.0047)
UAI*Density on Curr.	-0.0002	-0.005	0.006
	(0.0002)	(0.0113)	(0.0117)
UAI*Density on New	-0.0001	0.006	-0.003
	(0.0002)	(0.0128)	(0.0125)
IDV*Density on Curr.	-0.0002	-0.007	0.003
	(0.0003)	(0.0114)	(0.0122)
IDV*Density on New	-0.0004	-0.004	-0.019
	(0.0003)	(0.0148)	(0.0141)
MAS*Density on Curr.	-0.0004	-0.002	-0.012
	(0.0003)	(0.0116)	(0.0127)
MAS*Density on New	-0.0003	-0.003	-0.029**
	(0.0003)	(0.013)	(0.0107)
LTO*Density on Curr.	-0.0002	-0.007	-0.015
	(0.0002)	(0.0123)	(0.0101)
LTO*Density on New	-0.001**	-0.029+	-0.034**
	(0.0003)	(0.0155)	(0.0099)
Observations	217175	217175	217175
Number of Clusters	59	59	59
Adjusted R-squared	0.5529	0.5529	0.553

Country-clustered standard errors in parentheses.
All models include country-year and product-year dummy variables.
**,*,+ statistically significant at .01, .05 and .10 percent respectively.

Appendix: Simulation Model

We can provide a more precise account of our theoretical argument by building a simulation model of product dynamics, that simplifies and extends the work by Hausmann and Hidalgo (2011) and by Klimek, Hausmann, and Thurner (2012). The basic elements of our model are products and capabilities: products are the elements that can be observed in the empirical studies; capabilities are unobservable characteristics that determine the evolution of the observable products. The state of the economy of a country is represented at each point in time by two binary vectors: an element of the vector of products (of length N_p) takes value 1 if a country has a comparative advantage in the production of that product, and 0 otherwise; analogously, an element of the vector of capabilities (of length N_a) takes value 1 if a country has that specific capability, and 0 otherwise.

The transition from a state to next one is governed by two separate processes for the evolution of capabilities and products. Capabilities are subject to both production and destruction rules. In a Schumpeterian fashion, new capabilities are created through the recombination of existing capabilities. For each capability, there are on average $\overline{R_+}$ combinations of existing capabilities that can generate it. For the sake of simplicity, we assume that each combination requires only two capabilities. All these relations are summarized in a binary matrix of dimensions N_a x R_+ for each capability: in each column two elements take value 1 (corresponding to the production combination) and all other elements take value 0. Capabilities can also be lost, because they are not used anymore due to the obsolescence of corresponding products. For each capability, there are on average $\overline{R_-}$ different capabilities leading to obsolescence.

The dynamics of products is determined by the presence or lack of the required capabilities. Each product requires a set of specific capabilities (on average N_{ap}) that a country has to be endowed with in order to produce it. While previous models assumed this relation between capabilities and products to be deterministic (a country needed all required capabilities for a product in order to produce it), here we relax this assumption by allowing countries to produce a product even if they do not have all required capabilities. However, the more the required capabilities a country is

endowed with, the higher the probability to start producing a product. This probability is modeled through a beta cumulative distribution function, where the parameter β always takes the value 1. We use variations in the parameter α to distinguish between countries with strong and weak general-purpose capabilities: countries with strong general-purpose capabilities will have a lower value of α (α_s), while countries with weak general-purpose capabilities will have a higher value of α (α_w).

In each period, we first update the vector of capability for each country, and then we update the corresponding vector of products. Initial conditions in terms of products and capabilities are estimated from the empirical dataset.

Our model represents, in a simple and parsimonious way, the mechanisms that we tried to highlight in the theoretical section. Therefore, the analysis of the data generated by our simulation model follows the same methodology employed for the empirical analysis. Since initial conditions are estimated from the empirical data, we also use fixed effects and clustered standard errors. We present the preliminary results in Table A1: the results presented are the outcome of a single simulation run, although a similar pattern emerges from multiple simulation runs.

As can be seen in columns 1 and 2, the model successfully replicates the findings on density. However, columns 3 and 4 show that the effect of density is valid only in the case of countries with weak general-purpose capabilities, whereas countries with strong general-purpose capabilities are not constrained at all by density in the evolution of their productive structure. Although rather extreme, these results support our main theoretical argument. However, further calibration of the parameters of the model and several robustness checks will be needed in order to validate our results.

Table A1

Determinants of Having a Comparative Advantage in the Future:
Results from the Simulation Model

	(1)	(2)	(3)	(4)
Model	LPM	LPM	LPM	LPM
D.V.	CA_{t+1}	CA_{t+1}	CA_{t+1}	CA_{t+1}
CA_t	0.32**	0.321**	0.327**	0.335**
	(0.0069)	(0.0069)	(0.0071)	(0.009)
Density	0.159**		-0.016	
	(0.0458)		(0.0556)	
Density on Current		0.165**		-0.052
		(0.044)		(0.0672)
Density on New		0.17**		-0. 04
		(0.0438)		(0.0691)
WeakGPC*Density			0.2**	
			(0.0206)	
WeakGPC*Density on Curr.				0.216**
				(0.0293)
WeakGPC*Density on New				0.174**
				(0.0285)
Observations	967200	967200	967200	967200
Adjusted R-squared	0.276	0.276	0.2768	0.2771

Country-clustered standard errors in parentheses.
All models include country-year and product-year dummy variables.
** statistically significant at .01 percent.