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Innovation, economic diversification and human development

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Abstract:

In this paper we bridge a gap between innovation economics and the human development approach by analyzing positive and negative effects of different types of economic diversification on social welfare. Economic variety is a driver and outcome of economic development. However, diversification leads to ambiguous effects on the well-being of human agents: on the one hand, increasing variety augments the freedom of human agents to choose. On the other hand, it can overburden their capabilities to make economic decisions and can deteriorate their well-being. It becomes clear that human development policy has to go hand in hand with an industrial policy that promotes qualitative economic diversification. Depending on its dynamics, this diversification can be achieved via related and unrelated variety. We can expect a better design of development policies from a better understanding of the co-evolutionary development of variety, freedom of choice and well-being.

Key Words: innovation, economic diversification, human development

JEL: 010, 054, E11

1 Introduction

The *superior* goal of economics is to understand and promote economic development in order to contribute to social welfare. Focusing on the mechanisms and drivers of development, however, economists sometimes lose sight of the economic agents and their well-being. For instance, innovation is a core driver of economic development (Schumpeter, 1912, 1939, 1943), but does not automatically lead to improved well-being and distributive justice. The Globelics community has made important contributions to answering some crucial questions about the interplay between learning, innovation and welfare creation by drawing attention to the need for a better understanding of the mutual relation between human capabilities and systems of innovation (Johnson et al., 2003; Arocena and Sutz, 2005; Srinivas and Sutz, 2008; Cozzen and Kaplinsky, 2009). For this purpose they suggest to integrate insights from Amartya Sen's capability approach (Sen, 1992, 1996, 1998, 1999) and the systems of innovation literature (Freeman, 1987, Lundvall, 1988, 1992).

Development economics, and especially the Latin American Structuralist School, have traditionally emphasized the role of structural change and economic diversification for long-term economic development (Rosenstein-Rodan, 1943; Nurkse, 1953; Prebisch, 1949; Furtado, 1961; Fajnzylber, 1990; Rodrik, 2004; Klinger and Lederman, 2006; Hidalgo et al, 2007; ECLAC, 2008). Evolutionary economics, on the other hand, emphasizes the mechanisms with which innovation leads to creative destruction and changes the composition of the economic system (Dosi et al, 1988; Saviotti, 1996; Dopfer et al, 2004; Saviotti and Pyka, 2004, Frenken and Boschma, 2007; Hanusch and Pyka, 2007). They disentangle different, often conflicting ways in which to address how structural change and economic diversification can be achieved, such as increasing related versus unrelated variety (Frenken et al., 2007; Saviotti and Frenken, 2008), distinguishing between disparity, variety and balance of diversity growth (Stirling, 2007) and focusing on productive capabilities and ubiquity of products (Hidalgo et al., 2007; Hidalgo and Hausmann, 2009).

Despite all this body of work within the innovation and development economics communities, one question stills remains widely overlooked and unanswered: What is the impact of economic diversification on human development and well-being?

We argue that this question has remained largely unaddressed because there is an implicit assumption in the community that progress, innovation and diversification are positive *per se*.

Innovation is certainly a main driver of human development (UNDP, 2001), but innovation can also have negative effects such as the destruction of workplaces and competences and the creation of polarization and structural inequality (Myrdal, 1957). For policy makers, the essential question shall be what type of innovation, structural change and economic diversification they should promote, where and when. In order to address this question we need a better understanding of the positive and negative effects that innovation-driven economic diversification may have on the freedom of choice, capabilities and well-being of people, taking into account that these factors are not static can change over time.

Increasing returns may be achieved initially through a higher diversification that leads to increased complexity levels in the economic system, variety of choices and well-being (Arthur, 1994; Barker Rosser Jr., 2009). Furthermore, choices in related varieties might not necessarily increase the well-being of people but still contribute to economic growth. The effects of different types of diversification, for example the effects that related and unrelated variety can have on human and economic development, might also be different.

We need to gain a better understanding of the complex relations between economic and human development in order to generate proper public policy. To gain such understanding, we need to analyze diverse positive, negative and ambiguous effects of economic diversification on human development over time and study economic systems of increasing complexity. In order to achieve this goal, we draw on previous work in the areas of innovation and development economics.

Section two reviews the progress made in the areas of structural change and economic diversification, outlining some of the shortcomings arising from an analysis of the contributions of diversification to human wealth. Section three summarizes the inspiring insights and concepts of the human development and capability approach (UNDP, 1990, Sen, 1999) and highlights the increasing neglect of the productive and economic side of human development (Amsden, 2010). Section four shows why it is important and valuable to understand the complex interplay between economic diversification and human development. Section five analyzes diverse positive, negative, ambiguous and dynamic effects of different types of diversification over time. This allows us to derive a matrix of effects and to synthesize the results within a simple model. The model allows for a varied set of further applications and extensions. Finally, section six provides a summary and conclusions for policy making. From our analysis it becomes clear that industrial and human development policy have to go hand in hand in order to promote the social welfare of the people and that at

different levels of complexity different policy measures are necessary to foster both economic and human development.

2 Economic diversification as a key driver and result of economic development

How economic systems grow and diversify has been a central theme of economic research from the classical authors to the present. Several lines of research can be traced back to Adam Smith, Karl Marx and Joseph Schumpeter, giving different explanations for why economies grow and diversify their economic activities over time.

Adam Smith (1776) identified the division of labour as a driving force of economic development. It is noteworthy that increasing division of labour does not necessarily mean that country *A* only produces product *X* and country *B* only produces product *Y*. Instead, increasing levels of specialization, but also diversification, can be found at all levels of the economic production process. Specialization on a lower level of aggregation often means diversification of activities and outcome on a higher level of aggregation. The division of labour led to an enormous amount of new professions, skills, timesavings, more output and technical progress.

Joseph Schumpeter (1912) considered economic development as a structural transformation process in which innovation leads to the emergence of new sectors and the obsolescence of some old sectors, a phenomenon that he termed 'creative destruction'. Pasinetti (1981, 1983) showed, much in line with the ideas of Marx, that sustained economic development requires constant internal transformations. Mere efficiency growth would lead to unemployment and to constraints on the demand side. Therefore, the capitalist system needs to constantly innovate and diversify (Saviotti, 1996).

With regard to the growth in cities, Jane Jacobs (1969) identified the variety of activities, ideas and resources as a source of creativity, recombination, innovation and growth. Work from economic geography also highlights the crucial role of proactive specialization and geographic agglomeration of related activities and companies (Becattini, 1979; Pyke et al., 1990; Porter, 1990, 1998; Glaeser et al., 1992). But even the most famous industrial clusters such as Silicon Valley or Route 128 (Saxenian, 1994) are not as homogenous as might be imagined; at lower levels of sectoral disaggregation there is an enormous complexity and variety of related activities and processes. Furthermore, regional specialization does not

necessarily mean a reduction of activities at the national or global level, but can even add up to a larger number of activities and complex interactions between them.

Development economics has traditionally put strong emphasis on structural change and economic diversification. Early approaches focus on (i) how development countries can transform from agricultural production into higher value-added industrialized activities (Rosenstein-Rodan, 1943; Nurkse, 1953; Lewis, 1954; Hirschman, 1958) and (ii) how the embeddedness of development countries in the global production system can produce structural dependency and underdevelopment due to specific types of productive specialization and diversification (Prebisch, 1949, 1959; Furtado, 1961). The periphery of the world economy was considered to attend to the demand for primary products of the dynamic and diversifying centres of development.

Recent empirical research shows that economic diversification and the position in the global productive space clearly matter for the economic performance of countries (Hidalgo et al., 2007; Funke and Ruhwedel, 2001; Saviotti and Frenken, 2008) and regions (Frenken et al., 2007). With the exception of some oil-rich Arab countries, most rich countries can draw upon highly diversified economic structures. Diversification also indicates a large variety of productive capabilities such as infrastructure, knowledge, institutions etc., within these countries (Hidalgo et al., 2007; Hidalgo and Hausmann, 2009). The productive capabilities allow countries to produce high value-added and complex products, recombine capabilities and further diversify and grow. By using employment and aggregated export data, Imbs and Wacziarg (2003) showed that countries diversify until very high levels of income. Just at around 7,000 to 11,000 dollars per capita, depending on the measure and data applied, a tendency towards more specialization is observable. However, in the long-term and at lower levels of disaggregation the economic system has to constantly diversify into more and better products, processes and services in order to maintain economic development (Pasinetti, 1981, 1983; Saviotti, 1996). This is valid for the global economy but also for countries and regions to maintain flexibility and economic competitiveness (Tödting and Tripl, 2005).

But, in spite of the advances in the analysis of economic diversification and its role for economic development, one question remains unanswered: What are the effects of economic diversification on human development and well-being?

To answer this question we have to define what we mean with the terms “human development and well-being” (section 3) and explain why it is important to analyze the distinct feedbacks between diversification and human development (section 4).

3 Human development and well-being

People are the Real Wealth of Nations. The basic objective of development is to create an enabling environment for people to live long, healthy and creative lives. This may appear to be a simple truth but it is often forgotten in the immediate concern with the accumulation of commodities and financial wealth. (UNDP, 1990).

The human development and capability approach (HDCA) is a people-centered development approach. It views development as a process *by* the people, *of* the people and *for* the people (UNDP, 1991; Alkire, 2010). Therefore, development is not considered as mere economic growth, but rather as ‘a process of enlarging the people’s choices and the level of their achieved well-being’ (UNDP, 1990).

The human development approach developed out of the critique to view development as mere expansion of aggregated economic growth. Since the ‘70s, the perception among development practitioners has grown that the efforts put into industrialization and economic growth have not led to a significant reduction of poverty and inequalities in development countries. They have failed to provide the poor parts of the population with basic requirements such as water, electricity, health care and basic education. In some areas, social indicators have worsened while the overall GDP has shown considerable growth rates. Therefore, the basic needs of the people have become the focus of interest (ILO, 1976; Steward, 1979; Streeten, 1979; Streeten et al, 1981). The purpose of development was seen as reducing mass deprivation and giving all individuals the opportunity to live a *full life* (Streeten, 1979). The concentration of development policy on economic growth was considered insufficient. Meeting the people’s basic needs should be the priority of development policy: an emphasis on basic education, nutrition, sanitation and health care not only contributes directly to the alleviation of poverty and the reduction of fertility but also improves directly and indirectly the productivity and economic growth of countries by using resources efficiently and helping to increase them (Streeten et al, 1981).

Then, in 1990, a group of economists involving Mahbub ul Haq, Amartya Sen, Paul Streeten and Keith Griffin presented the so-called Human Development Index (UNDP, 1990). They combined the GDP per capita with life expectancy and levels of education to trace a broader and more comprehensive picture of development, focusing on social choices and life quality. Whereas the former development approaches concentrated almost exclusively on efficiency and growth, the human development concept proposes a switch towards an agent-based perspective, distributive justice, well-being, freedom and quality of life (UNDP, 1990; Nussbaum and Sen, 1993; Sen, 1999; Nussbaum and Sen, 2000; Alkire, 2010; UNDP, 2010).

Human development is defined as a process of enlarging people's choices and enhancing human capabilities (the range of things people can do) and freedoms, enabling them to live a long and healthy life, have access to knowledge and a decent standard of living and participate in the life of their community and the decisions affecting their life (UNDP, 1990). This encompasses a focus of development policies on 'advancing the richness of human life, rather than the richness of the economy in which human beings live, which is only part of it.'¹ The extensions of the freedoms that give humans the capabilities, opportunities and choices to assist and contribute actively to development are at the same time the primary goal and the fundamental means of development (Sen, 1999).

The key terms of the human development and capability approach are capabilities, functionings and agency. While functionings refer to the being and doing that the people realize, capabilities indicate the basic freedoms and capabilities of the people to achieve these functionings. Hence, capabilities refer to the freedoms of people to be agents of their lives and decide themselves what is best for them. Thereby, the human capability approach is a main theoretical contributor to a new perspective, which actually believes in the power, intelligence and determination of the poor to help themselves, when they are just given the basic opportunities and freedoms to do so (Yunus, 2007). In this vein, Sen (1999) identifies (i) political freedom, (ii) economic facilities, (iii) social opportunities, (iv) transparency guarantees and (v) protective security as instrumental freedoms to make people agents rather than patients of development.

From the above discussion the question arises as to what positive and negative effects economic diversification has on the freedom of the economic agents and their choices? To answer this question, we have to depart from a mere delimitation between growth and people

¹ Amartya Sen; see citation in <http://hdr.undp.org/en/humandev/origins> [Accessed 12 June 2008]

centred development and delve deeper into the complex relationships between human and economic development.

4 Why should we analyze the relations between human development, innovation and economic development?

Due to the focus on the well-being and human rights of people, economic topics such as technological innovation, structural change and economic diversification have not been in the core focus of the human development community. This does not mean that knowledge, consumption and production are not considered as elements of the well-being of individuals. For example, income and knowledge are two of the three constitutional pillars of the human development index (UNDP, 1990, 2010). The relation and especially the differentiation between economic growth and human development is one of the central research topics in the human development community. Amartya Sen (1999) emphasizes the interconnectedness of different dimensions of instrumental freedoms in the socio-political and economic space. He argues that the lack of economic freedom can also lead to lack of freedom in the social and political dimensions. However, topics such as production, trade and economic structures are not core topics of interest in the human development debate. From a human development perspective, this is arguably true because a series of basic needs and capabilities such as education and health have to be accomplished first (Streeten et al., 1981). But it should not be forgotten that economic dimensions such as employment, occupational and consumption choices, income, being productive and creative, and the distribution of labour continue to be crucial elements for the life, self-esteem and happiness of people. Especially for the ‘poor and deprived’, some materialistic and economic issues such as money, trade, income and a decent job continue to be core dimensions of daily life, desires, preoccupations, basic needs, social recognition and well-being. Amsden (2010) recently argued that grass-roots methods of poverty alleviation and human development policies will fail until jobs are created. It is not sufficient to expand the capabilities of people via health expenditure and better education, but long-term poverty reduction also requires determined investment in the creation of paid employment and self-employment above starvation wages. Development policy and anti-poverty programmes often neglect the crucial employment dimension, supposing in a ‘Say’s law’ type of relation that supply of capabilities implies also the economic demand for these capabilities. But this does not always hold; supply of capabilities does not automatically

contribute to long-term poverty reduction and development of countries. The people in the bottom quintiles may be forced into self-employment with low potential economic gains or into paid employment at starvation wages. If the people do not find proper occupational choices at home, they may try to emigrate. This can lead to a brain drain and contribute to further inequalities in the human capital and long-term economic development of countries. Countries need motivated and skilled people to promote the endogenous economic, technological and institutional development. They need free and capable people to build up innovative and competitive companies able to transform and diversify the productive structure of their countries. But without the initial set of economic opportunities and systemic interrelations between institutions, knowledge, production and demand, the virtuous circles of recombinant growth, evolutionary learning and innovation cannot start. Therefore, the productive structure and economic diversification of the countries matters. One cannot assume that the mere expansion of capabilities (education, health, democracy and infrastructure) is enough to enable the emergence of prolific innovation systems and recombinant growth and development. Industrial and employment policies are necessary to create the incentives, institutional environment and economies of scale to allow enterprises in developing countries to grow, to innovate and to be competitive on the global markets (Rodrik, 2004). It is true that economic development alone does not automatically translate into (well-distributed) human development, but within a globalized economy, it is hard to imagine sustainable regional human development without innovation and well-distributed economic development. This is where innovation and evolutionary economics come into play. The development of countries is dependent on former technological and productive capabilities as well as on the historically and spatially evolved interrelations between all parts of the socioeconomic system affecting the creation, diffusion and application of knowledge and new technologies. The economic diversification (variety, quality and balance of the products) of countries can be considered as an aggregate measure to proxy these productive as well as innovative capabilities of countries. Hence, economic diversification can serve as an outcome measure to proxy the national production and innovation system.

Several Globelics researchers emphasise the need for a double focus on basic needs and innovation to promote sustainable systems of innovation and competence building (Johnson et al.), to build up problem-solving capabilities (Arocena and Sutz, 2005) and to overcome negative effects of inequality in the innovative capabilities of developing countries (Cozzen and Kaplinsky, 2009). However, significant emphasis has not yet been placed on the effect of innovation-driven economic diversification on human development and well-being. This is an

essential shortcoming, as innovation, economic diversification and human development are mutually interconnected and reinforcing drivers and outcomes of development (Hartmann et al., 2010). For example, innovation in health and agriculture can directly affect human well-being and social welfare (e.g. think about Penicillin or the welfare advance through innovation in agriculture). Furthermore, innovation leads to the emergence and decline of different companies, competences and sectors, implying different types of occupational and consumption choices as well as skill requirements for the people. To phrase it differently, the learning capabilities, occupational and consumption choices of people affect the direction of technological change. The relations between innovation, economic diversification and human development are not unidirectional positive but are multi-layered, sometimes positive, sometimes negative, and often ambiguous. Think, for example, about military technologies or product proliferation in supermarkets.

To contribute to the disentanglement between innovation and human development, this section analyses the positive, negative and changing effects of (different types of innovation-driven) economic diversification on human development and well-being. This will provide policymakers with insights on which types of innovative activities and economic diversification they should promote, at which point in time and at which level of complexity achieved.

5 Relations between economic diversification and human development

The effects of economic diversification on human development and the well-being of people depend on the type of diversification, point of time and complexity of the economy and choices already available. Some effects are positive, others are negative and some change over time and according to the achieved complexity level. In the following paragraphs we explain these diverse effects before we synthesise them into an integrated framework and derive policy conclusions.

Positive Effects:

We now proceed to enumerate the positive effects of economic diversification on human development and the well-being of people:

1. Economic diversification, in the sense of a growth in the variety of products and services an economy produces, leads to more occupational and consumption choices for people. More choices mean also more possible functionings and capabilities and a better adaptation to individual needs. Therefore, diversification promotes human development. Economic diversification (in products, services, etc.) allows people to choose from a variety of different ideas and lifestyle possibilities; hence, it expands the possible functioning space and is intrinsically valuable for human development. However, due to the negative effects discussed in section 4.5.2, this positive effect can decline and eventually become negative at very high levels of complexity.

In most cases productive diversification goes hand in hand with co-evolutionary institutional progress and the recombination or expansion of productive capabilities by building up infrastructure, institutions, education, etc. It is noteworthy that all major technological revolutions and waves of fast productive diversification have been strongly connected with innovations in infrastructure (e.g. railways, telecommunication technologies) (Perez, 2002, 2007), allowing people to be more mobile and access a higher amount of information and choices. Furthermore, diversification often requires varied skill sets, knowledge and educational institutions, which in turn provides people in a society with a more varied set of educational choices and capabilities. Through this process, the institutional change that goes along with the creation of qualitative diversification has a positive feedback on human development.

2. Diversification tends to distribute the economic, political and social power within an economy, especially in the case of unrelated variety growth. The distribution of power fosters a more democratic regime. However, this may just be the case if the people within the society have equal access to the information and knowledge upon the coordination of the variety of activities and are not ignorant within specialized, maybe suppressed or underestimated bits and links of the productive system.
3. Higher levels of diversification have a positive impact on opportunity-based entrepreneurship. If economies lack a diversity of choices, many people may be forced into necessity and subsistence-level entrepreneurship. In contrast, if there are many different job possibilities available, entrepreneurs tend to be based on free will, hence promoting entrepreneurship as functioning (Gries and Naude, 2010) (see also section 6.2).

4. Diversity breeds diversity mechanisms and recombinant growth comes into play. Diversity allows for the recombination of former capabilities and a virtuous circle of productive and human capability expansion. A varied strand of literature theoretically supports this type of economic *Matthew effect* (e.g. Myrdal, 1957; Jacobs, 1969; Hidalgo et al., 2007). However, the diversification of one centre can also lead to structural dependence, underdevelopment and rising disparity of other regions. But at least within the diversifying regions, the *Matthew effect* leads to further cumulative positive feedback loops.
5. Economic growth based on mere efficiency growth only implies decreasing demand for labour over time. This tends to foster unemployment and hence lack of freedom, assuming that income, social recognition and well-being are correlated with the occupational status of persons (Miller et al., 2008). Lack of diversification can provoke an economic system collapse due to constraints on the demand side and rising socioeconomic inequality (Pasinetti, 1981, 1983).
6. Diversification in the sense of a better balance between a variety of sectors makes an economy less vulnerable to external shocks (e.g. Tödting and Trippl, 2005). Economic development alone does not necessarily lead to human development in a country, but certainly economic crisis does have a negative feedback on human development. Proper economic diversification reduces the risk of such a crisis. Furthermore, diversification and flexibility of regions and countries can prevent technological lock-in.

But while there are plenty of reasons why diversification has positive effects on human development, we should not forget to take the potential negative effects into account and how they evolve over time and according to the level of diversification an economy has already achieved.

We now proceed to enumerate the negative effects of economic diversification on human development and the well-being of people:

Negative effects:

1. During the process of structural change and economic diversification, some sectors win and others lose. In some instances whole sectors, workplaces and capabilities can even

become obsolete. In the long run, when the economic system is diversifying, a number of diverse and increasingly well-paid jobs have become available. This is at least true in the last 200 years, where we experienced a massive expansion in the variety of activities, products, jobs and life planning. Nevertheless, in the short- to medium-term difficult structural adaptation processes have negative impacts on parts of the population and sectors and can cause severe frictions. Older sectors decline and many people lose their jobs and are forced to re-orientate themselves or are excluded from the social recognition system of the society.

2. There are marginal decreasing utilities of further choices at high levels of diversification. More is not necessarily also better (Schwartz, 2004). There is little doubt from a human development perspective that a varied set of choices is better for the human freedom of the people than just one compulsory choice to survive. But the same cannot be said at high levels of economic diversification, where further choices can even lead to paralysis of the individuals. The paradigm of individual freedom suggests that the more choices the better because each individual can choose the optimal one for himself (Schwartz, 2004). Barry Schwartz (2004) shows that abundant choices in modern societies often lead to paralysis of people, and not to further well-being. Decision processes between different types of choices in all areas of human life have become very complex, time-consuming and uncertain. Think, for example, about the choice between 50 different Internet providers or social insurance companies, the large variety of lifestyles and life planning possibilities, the massive amount of extremely diversified consumption possibilities, plenty of different occupations. Rising complexity of decision processes together with rising expectations (to get the optimal choice) and rising opportunity costs (of not having chosen other choices) can lead to pre-regret and stress. Instead of getting an optimal or at least satisfactory choice, many people postpone their decision or do not even decide at all. Therefore, at a very high level of diversification the effects of further choices could even become negatively correlated with human agency and well-being. This is especially true in the case of related variety growth, e.g. in massive product proliferation. In contrast, unrelated variety growth may open up completely new choices with a new value. However, the effect of unrelated variety growth depends on its characteristics and value for the well-being and freedom of the people.

3. Economic diversification can suppress the freedom of the people if they are not able to capture the systemic relations because they become so specialized in their groups and activities. There is a tendency that people become increasingly specialized and hence dependent. People become quite inflexible and unwilling to change activities in the case of structural change. Hence, their capabilities can become very concentrated in specific areas, which make the people a highly productive labour force, but can also make them very vulnerable and weak in other fields of socioeconomic life. Due to this, people can be easily exploited by coordinating entities.
4. There are potentially negative impacts on ecological sustainability. It is true that diversification can distribute resource exploitation and even be directed towards better ecological solutions. However, in many -if not most- cases, diversification tends to increase the demand for products and hence lead to more consumption, production and resource exploitation.

A fifth potentially negative effect is the loss of focus as a low degree of specialization can potentially lead to a deficit in the realization of *economies of scale*. Doing a bit of everything but nothing well does not necessarily lead to human development expansion. However, the term ‘diversification’ refers in this article to ‘qualitative diversification’, meaning that the countries and regions are competitive in the sector they are diversifying into. Proxy measures for this are, for instance, the diversification and ubiquity of exports based on Revealed Comparative Advantages (Hidalgo et al., 2007; Hausmann and Hidalgo, 2010).

The analysis of the positive and negative effects of diversification also reveals that there can be a change in the direction of the effects and that the effect depends upon time and the complexity of the economy.

In what follows, subsequently ambiguous effects, that is, effects that change over time and depend on the type of diversification, the institutional set-up and the economic complexity of a country, are outlined.

Ambiguous and changing effects:

1. Variety evolution and the rising complexity demand growing and changing capabilities of the agents to be free. On the one hand, this can have negative effects on human well-being, especially in the short to medium term. On the other hand, it triggers further learning

processes and evolution of capabilities and choices. The degree to which people access information and are able to deal with increasingly complex decision processes at a higher level of economic diversification and complexity also matters. At low levels there is a high uncertainty and struggle regarding basic needs and survival. At high levels uncertainty increases with respect to the optimal or satisfying choices out of a large quantity of choices. Therefore, not only the absolute entitlement to capabilities and functioning choices matters, but also the relative capacity of individuals to make a certain selection with their capabilities. An individual with comparatively high capabilities may perceive a high level of relative deprivation when the potential functioning is very large. Not just absolute but also relative deprivation matters.

2. Business cycles may have complex impacts on economic diversification and human development. In expansionary phases, related economic variety, job opportunities and also social expenditures may rise, having a positive impact on human development. By contrast, in phases of contraction or crises, the social expenditures tend to shrink, companies go bankrupt and unemployment and uncertainty rises. However, it is known that crises can also be a seedbed for new ideas, radical changes and the demand for social and economic innovation. Hence crises have a negative direct impact on human development in the immediate stage but can even have positive effects in the long run.

Furthermore, a distinction has to be made between the type of diversification, that is, between related and unrelated variety growth. While related variety growth is crucial for economic development in the short to medium term, qualitative unrelated variety growth is essential for the long-term growth of the economic system. But, unrelated variety growth may be even more decisive for human development compared to economic growth. The main reason for this is that unrelated variety growth provides completely new choices and tends to distribute the economic, social and political power; hence a higher level of unrelated variety diversification may facilitate a more democratic regime. By contrast, related variety growth tends to favour more hierarchic or centralized systems. Furthermore, the value of completely new choices tends to be more valuable for the people than the mere expansion of very similar choices (e.g. via product proliferation).

But how are all these effects interrelated with each other?

Interplay between the effects

We have revealed a set of positive, negative and ambiguous effects of diversification on human development. No doubt, diversification has fundamental impacts on human development and well-being. However, policymakers and researchers need to know what might be the net effects of (specific types of) diversification over time and with respect to the productive structures of their countries. Naturally, it is not possible to reliably estimate the net outcome. Nevertheless, some patterns emerge when all the effects mentioned above are illustrated in the Table 1, distinguishing between the expected effects on low levels of diversification as well as on high levels of diversification.

Table 1 shows that the expected positive impact of qualitative economic diversification on human development is stronger in the case of low complexity; in other words economic diversification in scarcely diversified and networked economy has a more profound positive effect than in the case of an already highly diversified economy. The difficulty is to trigger a virtuous cycle of qualitative diversification, which is much easier to achieve in countries that already show a considerable set of productive and human capabilities than in countries with a low endowment of capabilities. This is closely related to the ideas of the early development pioneers, such as Nurkse, Hirschman or Myrdal, that first a certain amount of systemic effects between demand, supply and productive capabilities have to be achieved before the system starts running. Conversely, the negative effects on human development and especially on well-being seem to increase at higher levels of diversification, where the people are confronted with difficulties in their decisions among the enormous quantity of choices, regarding all dimensions of life (e.g. consumption, life planning), with the consequence that expectation levels and opportunity costs become higher and higher. The capabilities of human beings to deal with complexity are limited; the biological constraints of human beings (e.g. for information processing) have to be taken into account (Simon, 1957). This can lead to an increasing mismatch between the theoretical capabilities and the true functioning space of people, and hence to increasing relative deprivation.

Now we can derive some stylized trends both considering their evolution over time as well as the level of diversification within an economy.

Effects of economic diversification on human development				
	Low levels of economic complexity		High levels of economic complexity	
	Absolute effects	Marginal effects	Absolute effects	Marginal effects
Positive				
Variety of choices	++	++	+/-	-
Building up productive capabilities	++	+	+	○
Distribution of power	++	++	+/-	○
Fosters qualitative entrepreneurship	++	+	+	-
Success breeds success, variety breeds variety	+	+	++	++
Opposing the negative effect of mere efficiency growth on employment	+		+	
Less vulnerability to external shocks, better risk portfolio (less threat of technological lock-in, structural problems)	++	-	+	-
Negative				
The tyranny of choice	-		--	
Destructive part of creative destruction processes, obsolescence and changing values of capabilities and competences	-		-	
Risk of rising levels of ignorance of systemic effects and coordination within specialized groups	-		--	
Potential negative effects on ecological sustainability	-		-	

Ambiguous and changing effects				
Complexity and the capabilities to deal with complexity	+	+	+/-	-
Business cycles, expansionary and contraction phases, crises	-	-	+	-
Type of variety				
Unrelated (qualitative) variety	++	-	+	-
Related variety	++	-	+/-	-

Table 1: Multiple effects of diversification

Stylized trends over time

Naturally, the complexity of interrelations does not allow for completely reliable predictions, however, there seem to be underlying trends in the direction and impact of diversification on human development over time, which are strongly confirmed by theoretical and empirical analysis (Myrdal, 1957; Hirschman, 1958; Hidalgo, 2007, 2010; Schwartz, 2004).

- At low levels of diversification there are cumulative effects and increasing returns of new varieties on human development (due to systemic interaction effects, Nurkse, 1953; Myrdal, 1957; Jacobs, 1969). An increasing variety strongly correlates to an improved basis for sound decisions allowing for further development.
- At higher levels of diversification, decreasing positive effects of diversification on human development can be expected. When the limits of variety processing capabilities are reached, the well-being of economic agents becomes constrained by increasing the scope of choices to be made.

These stylized trends are illustrated in Figure 1 and Figure 2.

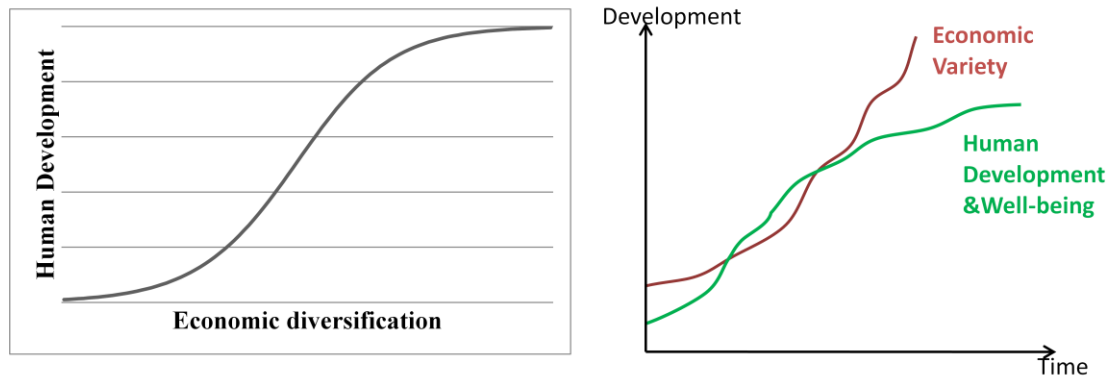


Figure 1: S-shaped relation between economic diversification and human development
 Figure 2: Different evolution of economic variety and human development over time

In Figure 1 (left) increasing returns of diversification on human development at low levels of diversification and then decreasing returns of diversification on human development at higher levels of diversification and complexity can be observed.

In Figure 2 (right) the divergent evolution of economic variety and human development and well-being in time is illustrated. Due to network and recombination effects, variety increasingly expands over time, sometimes at a slow pace or even temporarily declining due to selection processes, but sometimes rapidly due to the diffusion of radical innovations and the related opportunities for incremental innovations. Whereas human development and well-being grow over-proportionally at low levels of variety, they finally increase only under-proportionally due to the biological limits of information processing and constraints in the learning of single agents. Some studies from psychology even argue that the massive explosion of choices in the most highly industrialized countries negatively affects the well-being of people.

Without doubt, the exact shape of the curves depends on the interplay and dominance of the varied effects of diversification over time and the level of the underlying complexity. From this, it follows that policymakers and researchers have to consider potential positive, negative and ambiguous effects. Table 1 as well as Figure 1 and Figure 2 serve as a major orientation for new empirical research on economic development and human well-being as well as guidance for policymakers to advance the socioeconomic development of their countries, by promoting positive and preventing negative effects of diversification.

6 Policy implications and research outlook

In this the article, we analyze the complex effects of economic diversification on human development that shape critical relations between the direction of economic development and human welfare. Our approach provides policymakers with new insights and advice on how to foster simultaneously the economic and human development in their regions and countries. Our work opens up a variety of new possibilities for theoretical and applied research in welfare economics and complexity. Furthermore, it becomes obvious that future-oriented policies that foster the individuals' capabilities and choices go hand and hand with an industrial policies promoting adequate economic diversification. Government should foster different types of diversification, for instance related or unrelated variety growth, according to their productive structure at the point of time. In order to design proper innovation and development policies a fruitful mix of selection and variation processes has to be found.

At lower complexity levels countries need to foster endogenous capability upgrading and diversification evolution, which will allow for systemic feedbacks. This is close to the idea of the development of push strategies (e.g. Rosenstein-Rodan, 1943; Nurkse, 1953; Hirschman, 1958). At higher levels of complexity the emphasis of policy design should shift towards a proper selection processes, fostering less the quantity of further consumption and employment choices, but instead focus on the quality of choices and their impact on the well-being of people. Too much choice does not necessarily lead to more freedom and well-being but can even have negative effects on them due to rising costs in the decision processes.

In countries with both higher and lower complexity and productive capabilities, the focus on short- and medium-term related variety growth should be evaluated against the long-term welfare effects of unrelated variety growth.

In our perspective, the emphasis on long-term unrelated variety growth deserves major attention because it distributes the economic and political power within countries and leads to more democratic regimes with more choices for people. However, this does not mean to diversify randomly into all possible product areas. Instead exploration of local, regional and national productive capabilities has to be emphasized following a more strategic future-oriented approach that takes into account both endogenous and exogenous inputs in order to promote competitive diversification.

Our agenda for future research consists in empirically analysing the relation between diversification and human development by using export diversification data and the human development index. From this we expect to shed light on how the different components of economic diversification differ, but also how they interplay, in driving economic growth and human development. A preliminary result is that diversification is even more important for human development than for mere economic growth.

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