The effects of economic diversification on human development

By Dominik Hartmann

Abstract:
In this paper we bridge a gap between the human development approach and innovation economics by analyzing positive and negative effects of different types of economic diversification on social welfare. Variety changes with economic development and different types of variety are affected in different ways. This leads to ambiguous effects on the well-being of human agents: on the one hand, an increasing variety enlarge the possibilities to choose. On the other hand, limits in the individuals’ capabilities to make economic decisions can deteriorate their well-being. Strikingly, our empirical analysis -based on export data, human development indicators and diversity measures- reveals that economic diversification is even more crucial for human development than mere economic growth. It becomes clear that human development policy has to go hand in hand with an industrial policy, promoting different types of economic diversification -such as related and unrelated variety - depending on their dynamics. From a better understanding of the co-evolutionary development of economic variety, social choice and well-being a better design of development policies can be expected.

Key Words: innovation, economic diversification, human development

JEL: 010, 054, E11

1 Introduction

The human development approach offers a rich perspective on the expansion of human capabilities and freedom as the means and ends of development (UNDP, 1990, 2010, Sen, 1998, 1999, Alkire, 2010). However, rather little emphasis has been put on the impact of the economic structures and dynamics on the individuals’ capabilities and opportunities. Recently Alice Amsden (2010) drew the attention to the fact that mere expansion of the individuals’ capabilities via social expenditures may not automatically lead within “say law type of mechanism” to an expansion of the economic and decent job opportunities of the poor. Economic development does not necessarily imply human development, but –no doubt- economic opportunities and choices, e.g. for a decent job and consumption continue to be crucial pillars for the life and well-being of the people (ILO, 1976, Sen,
Therefore human development policy has to go hand in hand with economic and innovation policy (Amsden, 2010). However this requires a better understanding on the relations between innovation, economic diversification and human development.

Development economics and especially the Latin American Structuralist School have traditionally emphasized the crucial role of structural change and economic diversification for long-run 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 emphasizes the mechanisms with which innovation lead 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 types and speeds in the direction of structural change and economic diversification, such as related and unrelated variety growth (Frenken et al., 2007; Saviotti and Frenken, 2008), distinguish between disparity, variety and balance of diversity growth (Stirling, 2007) or draw the attention to the productive capabilities and ubiquity of products (Hidalgo et al., 2007; Hidalgo and Hausmann, 2009). However, one question remains widely overlooked and unanswered within the innovation economics and structural change community: What is the impact of economic diversification on human development and well-being? From this missing question follows the implicit underlying assumption 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 arises which type of innovation, structural change and economic diversification they should promote, where and when. But therefore, we need a better understanding about the diverse positive and negative effects innovation-driven economic diversification may have on the choices, capabilities and well-being of people. Obviously, we need to consider that the impacts may not be static but change over time. While initially there might be increasing returns of diversification on the choices and well-being of people, at high levels of complexity (Arthur, 1994; Barker Rosser Jr., 2009) further choices in related varieties might not necessarily increase the well-being of people but indeed contribute to economic growth. The effects of different types of diversification might be different, for instance the effects related and unrelated variety growths have on human and economic development can significantly differ.

To advance in the issues, and to get a better understanding of the complex relations between economic and human development and finally to derive proper policy conclusions, we need to analyze diverse positive, negative and ambiguous effects of economic diversification on human development over time and with respect to the level of economic complexity. To do this, in this paper we synthesize insights from the literature in innovation and development economics. Furthermore, we require new empirical approaches to study the complex relations between human development and economic diversification.

Recently, there is more focus of international and development economics on complexity and diversification (e.g. Hidalgo et al, 2007). But question remains completely open to which degree economic diversification fosters not just long-run economic development but also leads to the well-being, freedom and human development of the development. Furthermore which type of diversification should governments foster not just for productive expansion but also the expansion of
human development. To our best knowledge these questions have not been addressed properly yet neither theoretically nor empirically. There is some work from development economic on the relation between growth and human development, but not on the complexity of economic diversification and diverse effects on growth and human development.

The paper succeeds as follows. Section two reviews the progress of the literature on structural change and economic diversification, but also reveals the shortcoming in analyzing the contribution of diversification for human wealth. Section three resumes the inspiring insights and concepts of the human development and capability approach (UNDP, 1990, Sen, 1999), but also 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 disentangle the complex relations between economic diversification and human development. Section five analyzes diverse positive, negative, ambiguous and dynamic effects of different types of diversification over time. Section six introduces to the great potential of new empirical research entering into the complex relations between human development and economic diversification. By using export data on over 700 product categories and 126 countries we can show for any measure we apply, the effect of diversification is even stronger on human development than mere economic growth. Section seven resumes and derives policy conclusions. 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. 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 change and grow has been in the centre of economic research from the classical authors to the current days. Several lines of research can be traced back to Adam Smith, Karl Marx and Joseph Schumpeter who give different explanations why economies grow and diversify their economic activities over time.

Pasinetti (1981, 1983) shows – in a line with the ideas of Marx - that sustained economic development require constant internal transformations. Mere efficiency growth would lead to unemployment / sub-employment and hence lead to constraints on the demand side. Therefore, the capitalist system needs to constantly innovate and diversify (Saviotti, 1996). Joseph Schumpeter (1912) considered economic development as structural transformation process in which innovation leads to the emergence of new sectors and the obsolescence of some old sectors. Thereby he coined the concept of “creative destruction”.

Adam Smith (1776) identified the division of labour as a driving force of economic development. Noteworthy, increasing division of labour does not necessarily mean that country A produces just product X and country B makes the product Y, but indeed we can find increasing specialization and hence also diversification at all levels of the economic production process.

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 in the most famous industrial clusters such as the Silicon Valley or the Route 128
(Saxenian, 1994) we can find at lower levels of sectoral disaggregation an enormous complexity and variety of related activities and processes. Furthermore, regional specialization does not necessarily mean a reduction of activities on the national or global level, but can even add up to an even 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 a) how development countries can transform from agricultural production into higher value added industrialized activities (Rosenstein-Rodan, 1943; Nurkse, 1953; Lewis, 1954; Hirschman, 1958) and b) 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 the demand for primary products of the dynamic and diversifying centers of development.

Recent empirical research shows that economic diversification and the position in the global productive space clearly matters 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 to 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 highly-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. Depending on the measure and data applied, just at around 7.000 – 11.000 dollar per capita, some specialization is recognizable. However, in the long-run 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 (Tödtling and Trippl, 2005).

To understand the effects of diversification on socioeconomic development we need to define what we mean with the abstract term “diversification” and distinguish between types and dimensions of the terms “diversity” and “economic diversification”. Andy Stirling (2007) argues that variety, disparity and balance consider different aspects of diversity and therefore depending on the measure applied different results are obtained. While variety measures the number of species, balance analyzes how much of each species exist. Disparity indicates how different the species are. Indeed, the evolution and measurement of each aspect may have distinct impacts on economic development. Growth in the variety of species may not necessarily lead to greater balance of the economic value creation, while a higher level of balance does not necessarily imply a “diversified” productive structure with a great variety of competitive sectors.

Regarding the economic variety of countries and regions Saviotti and Frenken (2008) distinguish between related and unrelated variety, where related variety growth indicate to the diversification into related economic activities and unrelated variety growth captures the diversification of economic activities into essentially different activities and knowledge bases. Regarding the (export) product space of countries, Hidalgo et al. (2007) draw the attention of the ubiquity of the products, i.e., if many other countries are able to produce and export specific types of products or not. Hence
also the quality and the value-added of the products matters. In their analysis based on export data (Feenstra, 2005), Hidalgo et al. (2007) come to highly significant results that the combination of the number of products ("diversification") and the ubiquity of the products matter for the past and future economic development of countries, as this indicates their existing and potential future productive capabilities.

But, despite 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 being considered as mere economic growth, but rather “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. Starting in the 1970s perception among development practitioners has grown that the efforts put into industrialisation and economic growth have not led to a significant reduction of poverty and inequalities in development countries. They failed to provide the poor parts of the population with the basic requirements such as water, electricity, health care and basic education. In some areas social indicators have worsened while the overall GDP showed considerable growth rates. Therefore, the basic needs of the people have been set into the focus of interest (ILO 1976; Streeten 1979; Steward 1979; Streeten et al. 1981). The purpose of development was seen in 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 basic needs of people should be the priority of development policy: emphasis on basic education, nutrition, sanitation and health care not only contribute directly to the alleviation of poverty and the reduction of fertility but also improves directly and indirectly productivity and economic growth of countries by efficiently using resources and helping to increase them (Streeten et al., 1981).

Then in 1990, a group of economists around Mahbub ul Haq, Amartya Sen, Paul Streeten and Keith Griffin presented the so-called Human Development Index (UNDP, 1990). They combined GDP per capita with life expectancy and levels of education to trace a more comprehensive and broader picture of development, focussing on the social choices and life quality. Whereas former development approaches concentrated almost exclusively on efficiency and growth, the human

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 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” (Amartya Sen1). The extensions of freedoms that give humans capabilities, opportunities and choices to assist and actively contribute to development are at the time the primary goal and fundamental means of development (Sen, 1999).

Key terms of the human development and capability approach are capabilities, functionings and agency. While functioning refer to the beings and doing that the people realize, the capabilities indicate to 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 decides themselves what is best for them. Thereby, the human capability approach is a main theoretical contributor of a new perspective, which actually believes in the power, intelligence and determination of the poor to help them, when they are just giving the basic opportunities and freedoms to do so (Yunus, 2007). In this vein, Sen (1999) identifies 1) political freedom, 2) economic facilities, 3) social opportunities, 4) transparency guarantees and 5) protective security as instrumental freedoms to make people to agents rather than patients of development.

From this the questions arises what positive and negative effects economic diversification actually has on the agents’ freedom and their choices? To answer this question, we have to go deeper into the complex relations between human and economic development than mere delimitation between growth and people centred development.

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

Due to the focus on 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 important elements of the well-being of individuals. Noteworthy, 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 a passionate topic in the human development community. Amartya Sen (1999) emphasizes the interconnectedness of different dimensions of instrumental freedoms in the social political and economic space. He argues that economic unfreedom can lead also to unfreedom in the social and political freedom. Noteworthy, in 20 years of human development reports of the United Nations, the terms work and employment only appear under the names creativity and productivity and only for five years” (Alkire, 2010:14). ‘Be productive’ and ‘be creative’ are not considered as

1 See cite in http://hdr.undp.org/en/humandev/origins [12.06.2008]
upmost important dimensions of human development. From a human development perspective this is arguably true, as there is series of basic capabilities to be accomplished first, such as education, health, security, agency etc. (Streeten et al, 1981). Nevertheless, it has not to be forgotten that the professional life, being productive and creative, the distribution of labour and specialization, the choice and comparison of professional jobs has always played an important role in any human society, from the first settlers to present days. 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 enough to expand the capabilities of people via health expenditures and better education, but long-run poverty reduction also requires determined investment in the creation of paid employment and self-employment above starvation wages. Development policy and anti-poverty programs 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 not always holds and not automatically contributes to the long-run poverty reduction and development of countries. The people at the bottom quintiles may be forced into self-employment with low potentially 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 brain drain and contribute to further inequalities in the human capital and long-run economic development of countries. Countries need motivated and skilled people to promote the endogenous economic, technological and institutional development. They need motivated, skilled and free 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 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 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 hardly to imagine sustaining regional human development without innovation and well-distributed economic development. This is where innovation and evolutionary economics comes 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 a proxy aggregate measure of this productive as well as innovative capabilities of countries, and hence as a proxy outcome measure of the national production and innovation system.

Several Gobelics researcher emphasize the need of a double focus on basic needs and innovation to promote sustainable systems of innovation and competence building (Johnson et al.) to built up problem-solving capabilities (Arocena and Sutz, 2005) and to overcome negative effects of inequality
on the innovative capabilities of developing countries (Cozenz and Kaplinsky, 2009). However, there has so far not been placed severe emphasis 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 the people affects the direction of technological change. The relations between innovation, economic diversification and human development are not unidirectional positive but are multilayered, 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, we analyze in this paper the positive, negative and changing effects of (different types of innovation driven) economic diversification on human development and well-being. This will provide policy makers 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 the human development and well-being of people depends 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 synthesize them into an integrated framework and derive policy conclusions.

Positive Effects:

First, economic growth based on efficiency growth only implies decreasing demand for labour over time. This tend to foster unemployment and hence unfreedom, assuming that income, social recognition and well-being are correlated with the occupational status of person (Miller et al., 2008.). Furthermore it can provoke an economic system collapse due to constraints on the demand side and rising socioeconomic inequality (Pasinetti, 1981, 1983). Severe economic crisis may also negatively affect human development. Therefore the lack of diversification leads to negative effects on human development.

Second, 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 the people. Hence if development brings with it more choices for the people, diversification and adaption to individual needs, it promotes human development. Economic diversification (in products, services etc.) allows people to choose from a variety of different ideas and possibilities of lifestyle, hence it expands the possible functioning space and is intrinsically valuable for human development. However, as we will
discuss below in the negative effects section, this positive effect may decline and eventually get negative at very high levels of complexity.

Third, in most cases the 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. Noteworthy, all major technological revolutions and waves of fast productive diversification have been strongly connected with innovations in infrastructures (e.g. railways, telecommunication technologies) (Perez, 2002, 2007), allowing the people to be more mobile and access a higher amount of information and choices. Furthermore diversification often requires a varied set of skills, knowledge and educational institutions, hence providing the people in a society with a more varied set of educational choices and capabilities. Thereby, the institutional change going along with the creation of qualitative diversification feedbacks positively on human development.

Fourth, 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 variety of coordination of activities and are not ignorant within specialized, maybe suppressed or under-estimated bits & links of the productive system.

Fifth, diversification in the sense of a better balance between a variety of sectors makes an economy less vulnerable to external shocks (e.g. Tödtling and Tripl, 2005). Economic development alone does not necessarily lead to human development in a country, but certainly economic crisis does negatively feedback to human development. Proper economic diversification reduces the risk for such a crisis. Furthermore, diversification and flexibility of regions and countries can prevent technological lock-in which certainly aggravates structural crises.

Sixth, higher levels of diversification have a positive impact on qualitative 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).

Seventh, diversity breeds diversity mechanism and recombinant growth come 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 lead to further promotion of the effects 1-6.

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

First, during the process of structural change and economic diversification, some sectors win and other 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-run difficult structural adaptation processes have deep negative impacts on parts of the population and sectors and can cause severe frictions. Older sectors decline, many people lose their jobs and are forced to re-orientate themselves or are excluded from the social recognition system of the society.

Second, there are marginal decreasing utilities of further choices at high levels of diversification. The more is not necessarily also the better (Schwartz, 2004). There is little doubt from a human development perspective that several choices are 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 the modern societies often lead to paralysis of people then 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 social insurance companies, plenty of different lifestyles and life planning possibilities, 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 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.

Third, economic diversification can suppress the freedom of the people if they are not able to capture the systemic relations and become ignorant within specialized groups and activities. There is a tendency that people might increasingly be specialized and hence dependent. People become quite inflexible to change activities in the case of structural change. Hence, their capabilities are also 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. From this, people can be easily exploited by coordinating entities.

Fourth, there are potentially negative impacts on ecological sustainability. Noteworthy, diversification can distribute resource exploitation and even be directed towards better ecological solutions. However, in many -if not most- cases diversification can also 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, a minor degree of specialization which potentially leads to a deficit in the realization of economies-of-scale. Doing everything and nothing well not necessarily leads to human development expansion. However, we refer 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 RCAs (Hidalgo et al., 2007).

While analyzing the positive and negative effects of diversification, we recognize that there might also be a changing direction in the effects and that the effect depends on time and the complexity of the economy. Therefore, we analyze first some ambiguous effects supposed to change over time and depending on the type of diversification as well as the institutional set-up of a country.

**Ambiguous and changing effects:**

First, variety evolution and the rising complexity demands 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-run. On the other hand, it triggers further learning processes and evolution of capabilities and choices. Crucial is the degree to which people access information and are able to deal with increasingly complex decision processes at higher level of economic diversification and complexity. At low levels there is a high uncertainty and struggle regarding the basic needs and the survival, at high levels uncertainty raises with respect to the optimal or satisfying choices out of a large quantity of choices. Thereby not just the absolute entitlement with 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.

Second, 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. In 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, an important distinction has to be made between the type of diversification, between related and unrelated variety growth.

**Type of diversification:**

Related versus unrelated variety: While related variety growth is crucial for economic development in the short- to medium-run, qualitative unrelated variety growth is essential for the long-run growth of the economic system. But, unrelated variety growth may be even more important 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 also foster a more democratic regime. In contrast related variety growth tends to favour more hierarchic or centralized systems. Furthermore the value of completely new choices may
be much more important for the people and provide completely new capabilities than the mere expansion of very similar choices (e.g. via product proliferation).

Now how are all these effects interrelated with each other?

**Interplay between the effects**

We outlined a complex set of positive, negative and ambiguous effects of diversification on human development. Diversification has essential impacts on human development and well-being. However, policy makers 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 estimate reliably the net outcome. Nevertheless, some patterns emerge when we resume all effects mentioned above within the table below, distinguishing between the expected effects on low levels diversification as well as on high-levels of diversification.

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<thead>
<tr>
<th>Effects of economic diversification on human development</th>
<th>Low levels of economic complexity</th>
<th>High levels of economic complexity</th>
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<tr>
<td></td>
<td>Absolute effects</td>
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<td><strong>Positive</strong></td>
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<td>Building up productive capabilities</td>
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<td>The tyranny of choice</td>
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<td>Risk of rising levels of ignorance of systemic effects and coordination within specialized groups</td>
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<tr>
<td>Potential negative effects on ecological sustainability</td>
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<td>-</td>
</tr>
<tr>
<td><strong>Ambiguous and changing effects</strong></td>
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</tr>
<tr>
<td>Complexity and the capabilities to deal with complexity</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Business cycles, expansionary and contraction phases, crises</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Type of variety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrelated (qualitative) variety</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Related variety</td>
<td>++</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1: Multiple effects of diversification
The table shows that the expected positive impact of qualitative economic diversification on human development is stronger in the case of low-complexity, in other words in an economy with scarcely diversified and networked economies, than in the case of already highly diversified countries. The difficulty is to trigger a virtuous cycle of qualitative diversification, which is much easier to achieve in countries which already show a considerable set of productive and human capabilities than in countries with low capabilities endowment. 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 has to be achieved before the system starts running.

Contrariwise the negative effects on human development and especially on well-being seem to raise 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 the expectation levels and opportunity costs become higher and higher. The capabilities of human beings to deal with complexity are not unlimited, but 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, hence to increasing relative deprivation.

Now we are able to derive some stylized trends over time as well as according to the level of diversification within an economy.

**Stylized trends over time:**

Naturally the complexity of interrelations does not allow for 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, Hirschmann, 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, we can expect sooner or later decreasing effects of diversification on human development. When the limits of variety processing capabilities are reached, the well being of economic agents gets constrained by increasing the scope of choices to be made.

This allows us to draw the stylized trends outlined in figure 1 and 2:
In the left figure 1 we see 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.

In the right figure 2 we can the divergent evolution of economic variety and human development and well-being in time. Due to network and recombination effects variety increasingly expands over time, sometimes at slow pace or even temporarily declining due to selection processes, but sometimes also rapidly due to the diffusion of radical innovations and by them opened up opportunities for incremental innovations. Whereas human development and well-being grow over-proportionally at low levels of variety, they finally increase only under-proportional 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 does affect negatively 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 follows that policy makers and researchers have to consider potential positive, negative and ambiguous effects. Table 1 and the stylized figures 1 and 2 serve as a major orientation for new empirical research on economic development and human well-being as well as guidance for policy makers to advance the socioeconomic development of their countries, by promoting positive and preventing negative effects of diversification.

6 Empirical Application

This chapter introduces to the promising new field of empirical research on the interrelations between human development and economic diversification. There are plenty of different taxonomies and methodologies to measure well-being and economic diversification of countries. This opens up an enormous range of interesting analysis and in-depth insights into the mutual relations between structural economic change and human welfare. A promising task to advance a better understanding of the black-box between economic and human development.
For simplicity reasons we apply in this first study a cross sectional analysis on the impact of different export diversification measures on the human development versus mere economic growth. This rather simple aggregated method leads already to extremely robust and interesting results. Subsequently we briefly discuss the operationalization of factors, the measures, data and methodologies applied.

6.1 Operationalization of the factors:

Recently, there is increased focus on different taxonomies to measure human capabilities, well-being and social progress. The composed indicators range from rather objective measures of well-being and deprivation such as the human development index (UNDP, 1990) or the multidimensional poverty index (Foster and Alkire, 2007, UNDP, 2010) towards rather subjective measures of well-being, happiness and life satisfaction surveys. New taxonomies tend to be multidimensional and combine several elements of both objective measures such as life expectancy and health as well as rather subjective measures such as community and family life or work-time balance which might vary across cultures (e.g. EIU, 2005; Stiglitz et al., 2009; Hall et al., 2010). Extremely interesting are also individual approaches such as Anand et al. (2009) that deeply enter the level of the single persons, their personality, desires, choices and lives.

In this first application we apply as dependent variable the human development index (HDI), because it the best discussed and most broadly accepted and available indicator for human capabilities and well-being. The HDI is certainly not a comprehensive indicator for all the different elements constituting human well-being and freedom, but at least it considers three basic elements which most people around the world would agree to be important, namely income, health and education (UNDP, 1990). Within a linear regression model we analyze the impact of the explanatory variable economic diversification on human development.

Regarding the measurement of economic diversification great advance has been made in the last decades using export and employment data (e.g. Funke and Ruhwedel, 2001; Hidalgo et al.,2007; Frenken and Saviotti, 2008, Hausmann and Hidalgo, 2010). A varied set of measures for diversity have been explored, considering different dimensions of diversity such as the number, balance and heterogeneity of species (e.g. Stirling, 2007).

In this study we use export data for the year 2000 from a NBER dataset created by Feenstra et al. (2005). The data set contains the exports of virtually all countries of the world to all other countries, distinguishing between 772 product categories at the 4 digit level of the Standard International Trade Classification (SITC-4). We use export data because their broad availability and relatively good comparability for almost all countries in the world. Furthermore export data contains a implicit selection of sectors who show comparative advantages and are able to export, hence supposing a proxy measure for the qualitative diversification of countries. Naturally there might be some bias that larger countries tend to be more diversified (e.g. India in contrast to Lebanon), however we also applied the methodology suggested by Hidalgo et al. (2007) and Hausmann and Hidalgo (2010) to handle the problem by considering Reveal Comparative Advantages above certain thresholds. Furthermore, the results show that larger countries in terms of population, such as China, India, do not necessarily show a higher diversification than smaller countries, such as Belgium, or Switzerland.
We apply different measures, considering different dimensions of economic diversification.

1. **Entropy** measures, putting higher value on smaller sectors, measuring both variety and balance, and allowing to differentiate between unrelated, semi-related and related variety (Frenken et al., 2007, Frenken and Saviotti, 2008)

   The entropy $H$ can be calculated as follows:
   
   $$H = \sum_{i=1}^{n} p_i \log_2 \left( \frac{1}{p_i} \right)$$

   where $p_i$ stands for the share of sector $i$ in total exports of a country. The entropy measure grows with an increase in the number of sectors and with the evenness of the distribution of shares (Frenken and Saviotti, 2008). An essential advantage of the entropy measures is that it can be decomposed on different sectoral digit levels (Frenken, 2007). The entropy values on different digit levels can be introduced into a regression analysis without necessarily leading to collinearity problems (Jacquemin and Berry, 1979). This allows to distinguish between related, semi-related and unrelated variety by measuring the variety on different levels of sectoral aggregations (Frenken et al., 2007b). We define unrelated, semirelated and related variety as the entropies on the 1 digit, 2 digit and 4-digit level, respectively.

2. The **Hirschman-Herfindahl Index**, putting higher weights on larger sectors, basically measuring concentration and balance.

   $$HHI = \sum_i \left( \frac{x_i}{\sum_j x_j} \right)^2$$

   The value of HHI ranges between 0 and 1, where 1 supposes an absolute concentration of the exports $x$ in one product sector $i$. Hence the lower the value the more balanced and less concentrated the sectors are supposed to be.

3. The number of **revealed comparative advantages and the ubiquity of the exports** (Hidalgo et al. 2007, Hidalgo and Hausmann, 2009; Hausmann and Hidalgo, 2010; Balassa, 1965). These indicators measure the number and ubiquity/quality of the export diversification.

   The revealed comparative advantage RCA measures if a country $c$ exports more of product $i$, as share of its total exports, than all countries of the world. It can be computed by:

   $$RCA = \frac{x(c,i)}{\sum_c x(c,i)} / \frac{\sum_c x(c,i)}{\sum_{c,i} x(c,i)}$$

   If RCA is higher 1, country $c$ has a comparative advantage in the export of the product $i$. If it is lower than 1, then the country has a comparative disadvantage.

   Furthermore we calculate the average ubiquity of the products $i$ exported by country $c$ by using the method introduced by Hidalgo and Hausmann (2009).

   $$k_{c,N} = \frac{1}{k_{c,0}} \sum_i M_{c,i} k_{1,N-1}$$
where \( k_c \) stands for the observed level of diversification of the exports of a country and \( k_i \) for the ubiquity of a product, or in other words the number of countries who export product \( i \). \( M_{ci} \) represents a adjacency matrix which measures the RCAs for each country (rows) in the 772 product categories (columns). Further information is available in Hidalgo and Hausmann (2009).

6.2 Results

A set of linear regressions models are used to analyze the impact of different diversification measures on human development and GDP per capita, respectively. The available export, human development and GDP data for the year 2000 allows to analyze a comprehensive set of 121 countries, ranging from countries with very low to very high human development and from highly concentrated to very diversified export portfolios. The dependent variables of the cross-sectional analysis are the human development index and GDP PPP per capita for the year 2000, and explanatory variables are the entropies on the 4, 2 and 1 digit level, the Hirschmann-Herfindahl Index, number of RCAs and average product ubiquity. These results in 16 simple linear regression we can compare and plot. The method is simple but provides very robust and interesting results.

First, economic diversification has a highly significant and positive effect on both GDP and human development, independent of the diversification measure we apply. The effect is so strong that no matter if the measurement focus is on variety, balance, disparity or quality, export diversification always plays a significant role for the overall GDP and human development of a country.

<table>
<thead>
<tr>
<th>Diversification measures</th>
<th>Human Development in 2000</th>
<th>GDP PPP per capita in 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feenstra 2000 data N=121 countries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entropy Constant 4-Digit Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,692</td>
<td>10,459</td>
<td>0,000</td>
</tr>
<tr>
<td>Constant 2-Digit Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,648</td>
<td>9,285</td>
<td>0,000</td>
</tr>
<tr>
<td>Constant 1-Digit Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,531</td>
<td>6,830</td>
<td>0,000</td>
</tr>
<tr>
<td>1- HHI Constant 4-Digit Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,538</td>
<td>6,954</td>
<td>0,000</td>
</tr>
<tr>
<td>Constant 2-Digit Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,543</td>
<td>7,048</td>
<td>0,000</td>
</tr>
<tr>
<td>Constant 1-Digit Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,455</td>
<td>5,571</td>
<td>0,000</td>
</tr>
<tr>
<td>RCAs Constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,637</td>
<td>9,004</td>
<td>0,000</td>
</tr>
<tr>
<td>No. RCA&gt;1 4-D. Constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,584</td>
<td>7,839</td>
<td>0,000</td>
</tr>
</tbody>
</table>

Table 2: Effects of diversification on human development versus GDP
Second, strikingly economic diversification is an even better explanatory variable for human development than mere economic growth (see table 3). For all models, the determination coefficient (R2) is significantly higher for all models explaining human development.

<table>
<thead>
<tr>
<th>Diversification measures</th>
<th>Human Development in 2000</th>
<th>GDP in 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>R</td>
</tr>
<tr>
<td>Entropy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Digit Level</td>
<td>121</td>
<td>0.692</td>
</tr>
<tr>
<td>2-Digit Level</td>
<td>121</td>
<td>0.648</td>
</tr>
<tr>
<td>1-Digit Level</td>
<td>121</td>
<td>0.531</td>
</tr>
<tr>
<td>1- HHI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Digit Level</td>
<td>121</td>
<td>0.538</td>
</tr>
<tr>
<td>2-Digit Level</td>
<td>121</td>
<td>0.543</td>
</tr>
<tr>
<td>1-Digit Level</td>
<td>121</td>
<td>0.455</td>
</tr>
<tr>
<td>RCAs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. RCA &gt; 1 4 Digit</td>
<td>121</td>
<td>0.637</td>
</tr>
<tr>
<td>Average Ubiquity</td>
<td>121</td>
<td>0.584</td>
</tr>
</tbody>
</table>

Table 3: Explanatory power of diversification for human development

Noteworthy this also implies that the significant positive effect of diversification on human development does not result just from the fact that the human development index includes already income. Economic diversification is a better predictor for human development than for mere income. Hence, economic diversification must affect also positively other components of human development, such as education and life expectancy. We outlined several reasons for this in the theoretical section such as a i) a better distribution of power within an economy, b) the requirement of productive capabilities positively affecting human development such as infrastructure, institutions, health and education, c) tackling possibly negative effects of mere efficiency growth freeing up labour.

The implications for human development policy are straightforward: Qualitative economic diversification does not just matters for growth, but is even more important for human development as a whole. Thus proper economic policy can deeply contribute to human development.

Now the question on the impacts of different types of diversification arises and thus which type of diversification should governments promote. Therefore, we contrast the effects of unrelated, semi-related and related variety on economic and human development. The following figures 3-8 plot the unrelated variety of the countries at the 1-digit level (figures 3,4), the semi-related variety at the 2-digit level (figures 5,6) and the related variety at the 4-digit level (figures 7,8), against the human development index and the GDP per capita, respectively.
Figures 3-8: Impact of unrelated, semi-related and related variety on human development and GDP. The two figures on the top show the values of the entropy on the 1-digit level plotted against the values of human development graphs and GDP per cápita on the right graphs. The two graphs in the middle show the semirelated variety measured on the 2-digit level, and the two figures on the bottom the related variety on the 4 digit level.

This leads to a set of further interesting results:
Third, unrelated variety has a more pronounced positive effect on human development, than semi-related and related variety. The slope of the regression line decreases at lower levels of disaggregation. That means that unrelated variety has a stronger impact on HDI/growth than semi-related variety, and semi-related variety has a stronger impact than related variety.

Fourth, the effects of economic diversification on human development shows a clearly decreasing pattern ($f'>0, f''<0$). That means that at higher levels of diversification, the positive effect of further diversification declines. As outlined in the theoretical section, we suggest this is due to several reasons: a) further choices make the decision processes of individuals increasingly complex, b) there are some natural limits in the biological capacity of human beings for well-being, life expectancy and knowledge (years of schooling) and c) declining values of absolute deprivation at higher levels of human development.

Fifth, the effects of economic diversification on income shows a rather increasing pattern ($f'>0, f''>0$). We suggest that this is due to cumulative effects, increasing returns and recombinant growth (Myrdal, 1957, Jacobs, 1969; Romer, 1986; Weitzman, 1998).

Sixth, there is still a plenty of promising possibilities to enter deeper into the black box between human and economic development, by considering the role of economic diversification on the choices and capabilities of people. Such as panel analysis, other data sources e.g. employment data, different measures of well-being and life standards, polynomial functions etc.

7 Policy implications and research outlook

In this paper we analyze the complex effects of economic diversification on human development, which shape critical relations between the direction of economic development and human welfare. Our approach is considered to provide policy makers with new insights and advice how to foster simultaneously the economic and human development in their regions and countries. And finally, it opens up a variety of new possibilities for theoretical and applied research in welfare economics and complexity. It becomes obvious that a future-oriented policy to foster the individuals’ capabilities and choices goes hand and hand with an industrial policy 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. 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 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 due to rising

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2 Noteworthy, in our case the application of polynomial function leads very small changes in the determination coefficient, one reason why apply the common simple linear regression model.
costs in the decision processes. In both countries with higher and lower complexity and productive capabilities, the focus on short and medium run related variety growth should be evaluated against the long-run welfare effects of unrelated variety growth. In our perspective, the emphasis on long-run 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 the people. However, this does not mean to diversify randomly into all possible product areas. Instead the endogenous exploration of local, regional and national productive capabilities has to be emphasized in order to promote competitive diversification.

The results of our theoretical analysis are sustained by the results of our empirical application which leads to the following robust and interesting results.

1. Economic diversification has a strong positive effect on both human and economic development
2. Economic diversification is an even better explanatory factor for human development than for income per capita
3. The positive effects are more pronounced for unrelated variety than for semi-related variety and related variety, subsequently.
4. Diversification has an decreasing positive effect on human development ($f'>0, f''<0$)
5. Diversification has an increasing positive effect on human development ($f'>0, f''<0$)
6. Massive opportunities for promising empirical research on the feedbacks between human and economic development

We hope to awake the interest other researcher to enter into this promising new field of research, entering into the complex relations between economic diversification and human development. There are plenty of opportunities for inspiring and important studies possible, on the national, regional or individual level, on the diverse complex relations outlined in the theoretical part of the paper, using diverse methodologies. This is a research task with enormous potential, as it can contribute to new understanding on socioeconomic development and help policy makers to foster economic and human development simultaneously.

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