



Applying Comprehensive Neo-Schumpeterian Economics to Latin American Economies

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Abstract:

The dichotomy of development economics between market-driven and state-led development approaches has recently been complemented by a third strand which focus on knowledge and capabilities-based development models. Our paper aims to make a first step towards a Comprehensive Neo-Schumpeterian theory of Development (CNSD) allowing synthesizing the three mentioned development approaches and putting the agents into the centre of interest. The theoretical part of this paper identifies (i) freedom of the actors and social welfare (ii) the capacity to create, implement, diffuse and imitate knowledge and innovations and (iii) an open, efficient and future oriented economic structure as mutual interconnected and reinforcing objective classes of development. In the empirical part we apply multivariate statistics to a data set with 44 indicators representing the future orientation of 20 Latin American countries in the three objective classes of CNSD. The results show that indeed different patterns and structural bottlenecks for development can be identified. While in some countries knowledge is the main bottleneck for future oriented development, other countries suffer from inefficient economic structures or the exclusion of large parts of the

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population from participating in development and innovation processes. It becomes obvious that just an appropriate combination of the interconnected and mutually reinforcing factors knowledge, freedom and future-oriented economic structure may lead to qualitative change and sustainable economic development in the long run.

Key words: comprehensive Neo-Schumpeterian development, freedom, knowledge, economic structure, cluster analysis, Latin America

JEL: O10, O30, O31, O54, C33, B52, D63

1 Introduction:

In previous work the so-called Comprehensive Neo-Schumpeterian Economics (CNSE) developed by Hanusch and Pyka (2007a) is empirically applied to European and OECD countries in order to detect specific patterns in the future orientation of industrialized countries (Hanusch and Pyka, 2007b). CNSE is transferring the ideas of innovation going hand in hand with true uncertainty from industry dynamics to the financial markets as well as to the public sector. For balanced growth and development potential the missing future orientation in only one of these economic areas can be the decisive bottleneck hampering all dynamic development processes. The empirical application of this approach to industrialized European and OECD countries has shown that not an optimal design exists, but specific patterns can be found. These different designs (e.g. the Scandinavian model, the Mediterranean model or the Central European Model) co-exist and also change with time, e.g. showing more recently a strong size orientation and no longer any geographical determination (Hanusch and Pyka, 2007c).

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This paper will apply the CNSE-approach to the specific conditions in the developing and emerging countries of Latin America. The perspective of CNSE obviously allows new insights in the role of technological change in development and growth not only in the North but also in the South of the world; allowing a better understanding of internal obstacles for qualitative change driven by entrepreneurship and the introduction of novelties in their various and multifaceted forms and the related co-evolutionary processes (Hanusch and Pyka 2007a). However, for an application of CNSE (e.g. based upon the precondition of a capitalistic economic structure) to the South, the particularities and path-dependencies of development countries have to be considered. In particular, Amartya Sen's capability approach (Sen, 1999), as well as some insights from the global competitiveness research (Lopez-Claros et al., 2006a,b) and the Global Network for Economics of Learning, Innovation and Competence Building Systems (Johnson et al. 2003; Arocena and Sutz, 2005) inspired us to transform the three pillars of Comprehensive Neo-Schumpeterian Economics, namely industry, financial markets and the public sector to three objective classes of economic development, namely (i) freedom of actors and social welfare, (ii) the capacity to create, implement, diffuse and imitate knowledge, and (iii) a future-oriented economic structure. With these three major objective classes of economic development we are able to cover the most important prerequisites for prosperous and prolific development relevant in Latin American economies. We choose this angle of perspective to provide new insights into the structural socioeconomic setup of Latin American countries by considering the impact of mass deprivation and social imbalances, weaknesses of the institutional setups and (low) future orientation of the economic structures on the ability of an economy to reach the Schumpeterian Development corridor where prolific development takes place (Hanusch and Pyka, 2007a). The former pillars industry, finance and public sector of Comprehensive Neo-Schumpeterian are still substantial elements of the overall system,

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but distributed adequately between the three objective classes of development. Accordingly, the underlying rationale behind CNSE is maintained, but the angle of perspective is adapted, in order to supply new insights in the structural dissimilarities, strengths and bottlenecks for entrepreneurship, innovation and future-oriented economic development in Latin America.

The paper proceeds as follows: In order to receive a better understanding of structural obstacles for enabling creative destruction processes in developing countries, section 2 discusses the cross-fertilisation potentials between Neo-Schumpeterian Economics, global competitiveness research and agent-based approaches of Development Economics. The combination of these overlapping and complementary approaches leads to the identification of (i) freedom of the actors, (ii) knowledge and (iii) a future oriented economic structure as objective classes and key pillars of Comprehensive Neo-Schumpeterian Development (CNSD), able to facilitate qualitative change for the people in developing countries.

In the empirical part of the paper (section 3) we will introduce a data set describing 20 countries and some 97% of the population of Latin America with a comprehensive set of 44 indicators representing the future orientation of the three objective classes of CNSD. For this data set we perform multivariate data analysis in order to control empirically the reliability and interconnectedness of objective classes and detect specific patterns for the developmental potential on the Latin American continent. The results show that indeed different patterns can be identified and underline the applicability of CNSE to the thrilling research questions of development economics. While in some countries knowledge is the main bottleneck for future oriented development, other countries suffer from inefficient economic structures, lack of

learning by solving opportunities or the exclusion of large parts of the population from participating actively to the development and innovation processes that are hampering competence improvement and qualitative change. It becomes obvious that just an appropriate combination of the interconnected and mutually reinforcing factors knowledge, freedom and future-oriented economic structure may lead to qualitative change and sustainable economic development in the long run.

Section 4 provides an outlook for further research and indicates that interactive learning between Neo-Schumpeterian Economics and complementary research approaches should be fostered in order to receive a deeper understanding about the problems for entrepreneurship, innovation and qualitative change in developing and transition countries.

2 Developmental Economics in a Modern Schumpeterian Perspective

Joseph Alois Schumpeter's Theory of Economic Development (1912) revealed the role of entrepreneurs and the implementation of new combinations as core mechanism of capitalistic development dynamics. Neo-Schumpeterian approaches concentrate mainly on the role these new combinations play for competitiveness, growth dynamics and structural change in industrialized countries.

Some researchers have also applied Neo-Schumpeterian approaches to the southern hemisphere and have revealed important obstacles for structural change and knowledge-based development in less developed countries such as the lack of learning by solving opportunities, technological asymmetries and the weak policy orientation towards innovation (e.g. Arocena and Sutz, 2005; Cassiolato et al, 2003; Cimoli, 2005; Katz,

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2007). However, in order to create a consistent theory of Comprehensive Neo-Schumpeterian Development for less developed countries, there is still much more theoretical and empirical discussion necessary.

Development Economics and Global Competitiveness Research can help to provide insights into the specific conditions and range of problems in less developed countries. Several authors indicated to the high cross-fertilisation potentials between innovation economics and agents-oriented development approaches (e.g. Johnson et al., 2003, Arocena and Sutz, 2005). It is important to note that the dichotomy of Development Economics between the market-driven and the state-led development models are beginning to be complemented by a rising third strand of literature and public policy measures which focus on knowledge-based development models (e.g. World Bank, 1999, Juma et al. 2001). A comprehensive Neo-Schumpeterian development approach, able to combine the understandings of all three approaches and putting the actor into the centre of interests, is still missing.

2.1 Comprehensive Neo-Schumpeterian Economics

When we developed the CNSE-approach we were guided by the question “Why is modern Schumpeterian Economics less visible, despite its important contributions in economic dynamics and growth, compared to the mainstream approaches in economics?” An answer can be seen in the restriction of the research programme focussing mainly on innovation driven industry development. While the neoclassical theories are offering a comprehensive approach which encompasses besides market transactions also the monetary realm and the public sector, modern Schumpeterian

Economics so far has not applied its major principles of innovation and uncertainty to other economics realms besides industry.

In Hanusch and Pyka (2007a) we show that the innovation principle can be seen as the Schumpeterian complement of the price mechanism. Focussing on innovation in all economic realms challenges the short run orientation in modern capital markets approaches as well in the market-failure based approaches for an economic theory of the welfare state. With an innovation- or future-orientation, complexity issues combined with strong uncertainty enter economic theory and demands for a new methodology. The crucial prerequisites of long run prolific economic development and growth decisively depend not only on entrepreneurship but also on the long run orientation on capital markets facing strong uncertainty and a public sector willing to cope with the strong uncertainties and increasing complexities modern economies are confronted with.

Of course the CNSE approach developed for industrialized countries cannot be overtaken one-to-one to the context of development countries. However, we find strong evidence in the modern literature on economic development on the importance of innovation in a developmental context and therefore transform the CNSE approach in the following sections to an approach applicable to the economies of Latin America.

2.2 Agent-based development approaches

Starting in the 1970s there has been a growing perception 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, and to provide the people with the capabilities and opportunities to contribute

actively to the development process. In some areas the social indicators have worsened, while the overall GDP presented considerable growth rates. This discussion was triggered in the late 1970s and early 1980s, putting the basic needs of the people in developing countries into the focus of interest (ILO 1976, Streeten 1979, Steward 1979, Streeten et al. 1981). The purpose of development was identified as reducing mass deprivation and giving everyone the opportunity to live a *full life* (Streeten, 1979). The concentration of development policy on economic growth and unemployment was considered to be insufficient. Meeting the basic needs of the people should be the first priority of development policy, because 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 improve directly and indirectly the productivity and economic growth of countries by economizing the resources required and increasing the available resources (Streeten et al., 1981). The basic need-approach was supposed to increase the available resources by facilitating a healthier, better educated and motivated labour force and mobilizing previously underutilized labour. (Streeten, 1979).

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) which combined GDP per capita with life expectancy and levels of education in order to trace a more comprehensive and broader picture of development and putting the social choice and life quality of the people into the centre of interest. Whereas former development approaches focused almost exclusively on economic efficiency and growth, the human development concept proposes a switch towards a more agent-based point of view. According to the Website of the United Nations, human development can be 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 analysis and “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 Sen³).

Further elaborations of the human development approach and the role of capabilities for development by Amartya Sen, introduce the concept of *development as freedom*. In Sen's agent oriented view on development, underdevelopment is seen as unfreedom, while development appears as an integrated process of profound changes (Sen, 1999). The extensions of the freedoms that give the people capabilities, opportunities and choice to assist and actively contribute to the development are at the time the primary goal and fundamental means of development (Sen, 1999). Sen distinguishes between five instrumental freedoms: 1) political freedoms, 2) economic facilities, 3) social opportunities, 4) transparency guarantees and 5) protective security. These rights and opportunities are different but also linked, fostering the capabilities of persons and their possibilities of being agents rather than patients (Sen, 1999)

Sen's capability and development as freedom-approach has received a lot of interest from Neo-Schumpeterian economists, as it puts the capabilities of the actors in the centre of interest. Sen's capability approach provides a good theoretical bridge to connect, adapt and apply Neo-Schumpeterian approaches to underdeveloped countries and development policy, especially in a *glocalized* knowledge based economy in which human capital, entrepreneurship and innovation are increasingly becoming the key elements for development.

³ See cite in <http://hdr.undp.org/en/humandev/origins> [12.06.2008]

2.3 Integral approaches for development and competitiveness

Nevertheless the ethic responsibility (as well as the positive economic and entrepreneurial impacts) of putting the capabilities and opportunities of human beings into the focus of development policies, traditional economic key concepts such as market efficiency, macroeconomic stability, capital accumulation and economic growth persist to be essential factors for economic development. Economic growth does not necessarily imply poverty reduction (or higher levels of freedom), but without economic growth poverty reduction and qualitative change seem impossible.

Many modern development and competitiveness approaches are switching from mono-causal analysis on development and competitiveness to a more integral and complex type of analysis (see World Bank 2003, Lopez-Claros et al. 2006b). Growth generally is identified as a necessary but not as a sufficient element for sustainable development (UNDP 1990, World Bank 2003). For example economists of the World Bank argue in the World Development Report 2003, that “ensuring sustainable development requires attention not just to economic growth but also to environmental and social issues. Unless the transformation of society and the management of the environment are addressed integrally along with economic growth, growth itself will be jeopardized over the longer term.”

The Global Competitiveness Index (GCI), developed by Sala-i-Martin is a measurement (concept) for the competitiveness of countries which inspired our work on the application of the CNSE approach to development countries. The GCI considers (i) the fulfilment of basic requirements (e.g. infrastructure, macroeconomic stability, health and primary education) (ii) efficiency enhancer (e.g. higher education and training, technological readiness) and (iii) innovation and sophistication indicators as key

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indicators for competitiveness (e.g. in Lopez-Claros et al. 2006b). Despite the fact that Neo-Schumpeterian Economics substantially differs from the neoclassical approach behind the GCI-index, the necessity to achieve good values for these indicators to foster competitiveness and development is common sense.

2.4 Towards a theory of Comprehensive Neo-Schumpeterian development for less developed countries

Johnson et al, 2003 and Arocena and Sutz, 2005 contributed substantially to the cross-fertilisation potentials between development and innovation economics. Inter alia, the former authors (Johnson et al, 2003) proposed that in developing countries a double focus on fostering the systems of innovation and competence building as well as attending to the basic needs is necessary. Arocena and Sutz (2005) identified the fertile intersection between Sen's capability approach and the innovation system approach and pointed to the fact that learning by solving require a steady flow of opportunities to solve non-trivial problems. In a similar vein, Evers et al. (2006) pointed to the knowledge trap which emerges from the fact that the mere import of knowledge and technology does not foster endogenous learning processes and the creation of important *non-knowledge*. Each problem-solving process and research activity leads intrinsically to the creation of knowledge about what we do not know and what still has to be improved or further analysed. The lack of non-trivial technological problem solving-opportunities hampers decisively the capacity for endogenous capability upgrading and innovation (Arocena and Sutz, 2005).

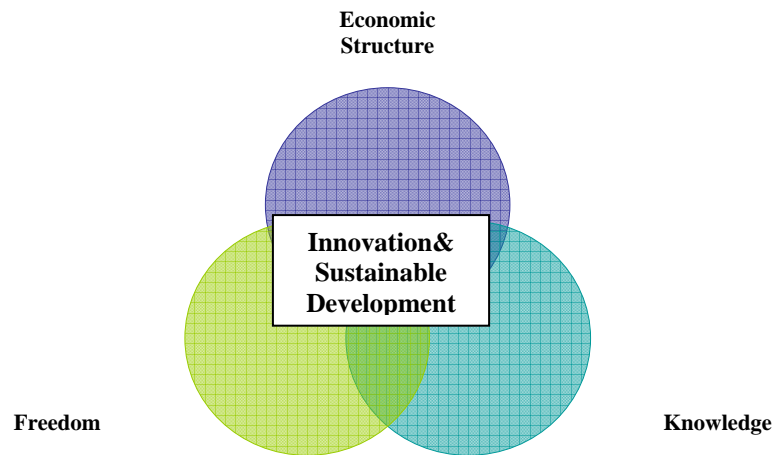
From a human development and basic needs point of view, the social choice of the actors to assist in the development process has to be fostered and the basic needs to be

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attended. Social imbalances and poverty tends to hamper overall economic performance. From a neoclassical perspective, Sala-i-Martin (in Lopez-Claros et al., 2006b) divides between factor endowment, efficiency and innovation as main pillars for global competitiveness.

Discussing these different but complementary approaches shows that the adaptation of Comprehensive Neo-Schumpeterian Economics (CNSE) to the specific conditions and challenges in developing countries has to consider on the one hand the inability of a large percentage of the population in development countries to participate pro-actively in the innovation and development process. On the other hand, the serious structural problems with respect to economic efficiency and providing the economic opportunities for learning by solving processes (see also Arocena and Sutz, 2005) have to be analysed.

Thus, when applying CNSE to development countries a much stronger focus must be made on the efficiency of the economic structure and the enlarging the capabilities of all actors to contribute to the innovation and development process of their countries and regions. We argue that the actors have to be free and that they absolutely need the cognitive capabilities and economic opportunities to participate in the economic life of their countries. A fertile combination between the mutual reinforcing factors: (i) freedom and social welfare (ii) the capacity to create, implement, diffuse and imitate knowledge and innovations and (iii) an efficient and future oriented economic structure has to be made, in order to achieve socially sustainable Comprehensive Neo-Schumpeterian Development.



Another significant and relevant fact is that none of these elements alone are able to facilitate Comprehensive Neo-Schumpeterian Development with sustained capacity to cooperate and compete, innovate and create social welfare. An efficient and appropriately liberalized economy is necessary for economic growth, but does not deal sufficiently with market failures nor provide the economy with strategic investment in knowledge. Freedom of the actors may be the primordial objective class of development, but without a future-oriented economic structure as well as appropriate scientific and technological capabilities, cannot lead to the economic growth and competitiveness necessary in the long run. Knowledge is a main ingredient for innovation and economic development, but without an efficient economic structure and a supportive institutional setup, that allows for capitalization of knowledge, fosters entrepreneurship and evolutionary learning activities, tackles market failures and facilitate equilibrated growth, it will not lead to innovation, competitiveness and qualitative change in the long run. Thus, the three objective classes of Comprehensive Neo-Schumpeterian Development, freedom, economic structure and knowledge are mutually reinforcing and interconnected.

3 Patterns in Latin American Countries

We applied this new development approach to analyse patterns of development performance in the Latin American countries. Therefore we raised a comprehensive data set with some 44 indicators for the objective classes of comprehensive Neo-Schumpeterian development. The main purposes of the empirical study have been (i) the operationalization of the objective classes with a adequate measurement instrument, (ii) the control of intra-factorial measurement reliability, (iii) the study of mutual interdependencies between the objective classes and (iv) the structural (dis-)similarities of the developing and transition countries of Latin America with regard to the objective classes. In order to measure the intra-and inter-factor consistency we applied a confirmative factor analysis. The structural (dis-)similarities were analysed by applying an average-linkage cluster algorithm to the data, which origins and preparation we have presented subsequently.

3.1 Data

Despite some persistent problems, data availability for developing and transition countries has substantially improved over the last 10 to 20 years. Therefore for the period from 2000 to 2005 we could raise a comprehensive and broad set of data comprising 44 indicators for the factors of knowledge, freedom and economic structure in 20 Latin American countries. Because of missing data, inter alia due to information policy as well as small size of the correspondent institutions, Cuba and some smaller countries such as Guyana, Haiti and Belize are excluded from our analysis. Considering its particular economic system and historical importance Cuba would have been an interesting case. However, in the 20 countries analysed approximately 97% of the Latin American population are represented. Considering the quantity and complexity of

collected indicators and the dispersed level of development of the analysed countries, a percentage of 1,9% missing data in the overall data set of 44 indicators and 20 countries has to be considered satisfying. Missing data has been estimated by comparator variables as well as adequate interpolation methods (see appendix 2).

In order to achieve the highest possible level of data comparability and to prevent severe perturbations caused by differing measurement methods and/or politically influenced estimation methods, only data of international leading research institutions such as the United Nations, The World Bank Group and the World Economic Forum are used.

3.2 Factors operationalization

In order to operationalize the *factor freedom* we used both, indicators showing the levels of freedom of the actors (e.g. health and primary education, human development index) as well as indicators provoking unfreedom of actors (such as poverty, corruption and unemployment, infrastructure, macroeconomic (in-)stability and quality of institutions). Detailed information about indicators used, data sources, analysed years and the contents of the aggregated indicators Human Development Index, Health and Primary Education, Infrastructure, Institutions and Macroeconomic stability can be found in the appendix 1.

The collection of indicators concerning the *factor knowledge* has been inspired and in concordance with previous taxonomies to measure national innovation systems (e.g. Godinho et al., 2004; Balzat and Pyka, 2006; Fagerberg and Shrolec, 2006; MERIT and EC-JRC, 2007) and were adapted to the specific conditions in the developing countries

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of Latin America. Despite the limited data availability in developing countries, we could compile a comprehensive data set with some 20 indicators describing the knowledge base, innovative efforts, knowledge-output and diffusion capacity in Latin American countries (see appendix 1).

In order to analyse the efficiency and future-orientation of the *economic structure* we collect a data set of 17 indicators concerning the dimensions market efficiency (commodities, labour and financial markets), degree of informal work (e.g. urban informal sector), enterprises performance (e.g. ISI-certificates and business sophistication), sectoral setup (e.g. I,II,III sectors) and qualitative internationalisation (e.g. foreign direct investment, manufactured exports).

Detailed information about the indicators, their data sources, analysed years, estimated data and the contents of aggregated indicators can be found in the appendix.

3.3 Measuring the internal consistency of factors and model

In order to prove the reliability of the factor operationalization as well as to reveal the correlation of the objective classes, a confirmative factor analysis with Cronbach's Alpha is applied. The main purpose is to examine whether or not the hypothesis that factors freedom, knowledge and economic structure are mutual reinforcing and interconnected building blocks of a common dimension (that we call socially sustainable Comprehensive Neo-Schumpeterian development) has to be rejected.

Reliability is a measure of the internal consistency of a collection of indicators (e.g. literacy rate, gross secondary and tertiary enrolment, R&D expenditures, publications,

patents), showing the degree to which they indicate a common latent construct (e.g. knowledge) (Hair et al. 1995). Cronbach's alpha is constructed by computing the mean of all possible Split-Half-coefficients which are estimated by dividing the test into two shares with random distribution of the items and measuring the correlation between both shares with the Spearman-Brown-method (Schnell et al., 2005). Cronbach's alpha can be formalized as follows (in equation 1):

$$\alpha = \frac{n}{n-1} \left(1 - \frac{\sum \sigma_i^2}{\sigma_x^2} \right)$$

n = Number of items
 σ_i^2 = Variance of item i
 σ_x^2 = Total test variance

Alpha can take values between 0 and 1, a commonly used threshold value for an acceptable reliability (i.e. alpha value) is 0,7 or larger (Hair et al 1995). Values should also not be too close to 1 because this would indicate to total inter-item correlation or insufficient heterogeneity of selected items.

Reliability of the factors

The operationalization of the factors shows a high degree of intra-factorial

Cronbach's alpha	
Freedom	0,809
Knowledge	0,952
Economic Structure	0,883
Table 1: Intra-factorial consistency	

intercorrelatedness, and hence a high statistically reliability. The alpha value of the factor knowledge is very high (0,952), but still significantly below 1. Regarding the factors of freedom and economic structure, the alpha-values 0,809 and 0,883 suppose a high reliability of the empirical implementation. While a series of heterogeneous indicators are taken into account (see appendix 1), the necessary intra-factorial homogeneity is maintained. Thus, an appropriate trade-off between the

complexity of the real world and the explanatory power of the empirical model is

realized. Especially in the case of the abstract factor freedom, the good alpha value of 0,809 is recognizable, as from a qualitative perspective rather heterogeneous but apparently interconnected indicators have been considered.

Intercorrelatedness of the factors

(Inter-)correlatedness of the objective classes

Item-Number	Constructs	Alpha, when construct deleted	Cronbach's Alpha
1	Freedom	0,845	
2	Economic Structure	0,894	
3	Knowledge	0,904	
			0,918

Table 2: (Inter-)correlatedness of the objective classes

In order to prevent distortions in the reliability results by the large number of total-system-items and casual inter-correlations of items from different constructs, the reliability of the global system has been calculated over the three aggregated constructs including freedom, knowledge and economic structure. The aggregation has been implemented by the sum of the values of the standardized items corresponding to the respective constructs. The results of the reliability analysis show a high (inter-)

correlatedness between the factors of the system, with a high alpha value of 0,918. The respective elimination of one of the factors would lead to lower, but still good, alpha values. Each factor (objective class) is highly correlated with each of the other two factors (objective classes). The high correlations between the factors freedom and knowledge (alpha 0,894), between the factors freedom and economic structure (0,904)

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and also between the factors knowledge and economic structure (0,845) have to be highlighted.

Accordingly, in our case of Latin America, the theoretical finding that freedom, knowledge and economic structure are highly (inter-)correlated factors is empirically confirmed. The hypothesis that knowledge, freedom and economic structure are interconnected and mutual reinforcing building blocks of a common latent dimension (we call socially sustainable Comprehensive Neo-Schumpeterian Development) cannot be dismissed.

3.4 Segmentation procedure

Based on the theoretical and empirical foundations of connectedness and reliability of the objective classes, we proceed with the analysis of the cross-national (dis-) similarities between Latin American countries and their relative strengths and weaknesses with respect to each object class as well as the overall system performance. To meet these objectives, cluster analysis techniques are applied to the data (Jobson, 1992; Hair et al. 1995, Backhaus et al. 2006). The general rationale behind this analytical tool is to test a sample for the degree of structural commonalities between the units of analysis. Its outcome is a categorisation of the analysed units, so that the coherence of each group (or cluster) as well as the heterogeneity among different clusters is to be maximized (Jobson, 1992). For this purpose distance values between the countries are determined on the basis of the characteristics of each entity. In particular we used the squared Euclidean distance measure. This a frequently applied distance measure of metric data that indicates the direct distance between two entities.

The distance between the indicators of two countries i and j are calculated as follows (equation 2):

$$d(i, j) = \sum_{k=1}^m (a_{ik} - a_{jk})^2$$

Here a_{ik} represents the parameter values of characteristic $k= 1, \dots, m$ for country $i = 1, \dots, n$. Thus the entire quantitative data matrix is $A = (a_{ik})_{n \times m}$.

The determination of distances between entities is a crucial but at the time preliminary step in the entire cluster analysis. It needs to be completed by the application of a classification algorithm. Depending on the quality of the underlying data and on the research target, various classification procedures exist.

The data are characterised by a relatively small number of units of analysis (20 countries in total) and at the same time by a relatively large number of variables (44 variables in total) and by a metric data level. Considering the extremely diverse geographic conditions, ethnical compositions and different historical and political development process in Latin America, there are clear mavericks to be expected, which form their own single cluster. Given these specifics of the underlying data and country sample, a hierarchical average-linkage cluster-algorithm is applied to the sample. The average-linkage method is applied because on the one hand this cluster algorithm is not extremely influenced by single cases and neighbours, and on the other hand is not that susceptible to distortions in case of mavericks, such as the Ward-method (see Backhaus et al. 2006).

The determination of the inter-cluster diversity is calculated as follows (equation 3):

$$v(K, L) = \frac{1}{|K| \cdot |L|} \sum_{\substack{i \in K \\ j \in L}} d(i, j)$$

with both distinctive classes K and L (i.e. $K \neq L$) belonging to the entire classification K . Since it is not intended to analyse a given, ex ante predetermined, classification of countries, an agglomerative classification is utilised which starts with single-country clusters and entails a step-wise concentration of countries according to their degree of structural similarities. Given that it is intended to attach all countries in the sample to a certain cluster (also 1-case clusters are possible) and that cases in which a certain country belongs to several clusters shall be ruled out, the selected clustering method yields an exhaustive as well as disjunctive classification. That means that every country is assigned to one cluster ($\bigcup_{K \in \mathcal{K}} K = N$, with N being the total amount of analysed objects) and no country can be part of two different classes ($K, L \in \mathcal{K}, K \neq L$, so that $K \cap L = \emptyset$).

3.4.1 Identification of outliers

The first step of the segmentation procedure of the data is the identification and exclusion of possible outlier cases which could lead to distortions of the cluster results, suboptimal determination of the optimal cluster numbers and fundamentally less information on the structural (dis-)similarities. The analysis of the cluster dendrograms and evolution of the heterogeneity coefficients led to identification of Chile as significant outlier in the factors freedom and overall system, Jamaica in the factor knowledge and Uruguay in the factor freedom. After the specific interpretation of these cases and their exclusion from the data set, the cluster algorithms have been applied

once again in order to provide better insights in the structural (dis-)similarities within the other countries.

What distinguishes Jamaica and Uruguay and makes them outlier in the respective objective classes are the facts that Uruguay can show the lowest poverty rates in Latin America (according to UN-data, 3,9% between 1990-2003) and that Jamaica has remarkable high values concerning the use of information and telecommunication technologies. Nevertheless, both countries are lacking greatly in a series of other indicators. In the objective class freedom and the overall system, Chile can show such significant higher average values that it agglomerate just at the last cluster step with the other countries/clusters. According to the data from 2001 to 2005, Chile is by far the best performing country in all three objective classes: freedom, knowledge and economic structure. It is important to mention here, that the outstanding performance of Chile does not suppose that everything is going well in Chile (e.g. the poverty level between 1990 and 2003 has been close to 10%) but simply that the relative average performance is much better than in the other Latin American countries. Concerning the factor economic structure a high heterogeneity between the countries has been identified, but there was not one decisively different case that would have made it necessary to exclude it from the data.

3.4.2 Optimal cluster number and classification results

In order to find out the optimal cluster number (for the remaining cases), the so-called elbow-criterion is applied. This measure in cluster analysis can be identified by analysing the change of the heterogeneity index in the different agglomeration steps of the hierarchical cluster algorithm. The elbow-criteria increases, when further merging

steps lead to a sharp rise of the heterogeneity coefficient, i.e. a strong loss in the coherence of the different clusters and thus in a strong quality reduction of the entire classification. The idea of the elbow-criteria is to find the optimal cluster number, which can provide the best trade-off between intra-cluster-homogeneity and at the same time inter-cluster heterogeneity.

As could be expected, the high level of diversity and heterogeneity of Latin American countries leads to elevated optimal cluster numbers. The following graphics show the change of the inter-cluster heterogeneity coefficients within the objective classes and overall system in dependence of the number of clusters.

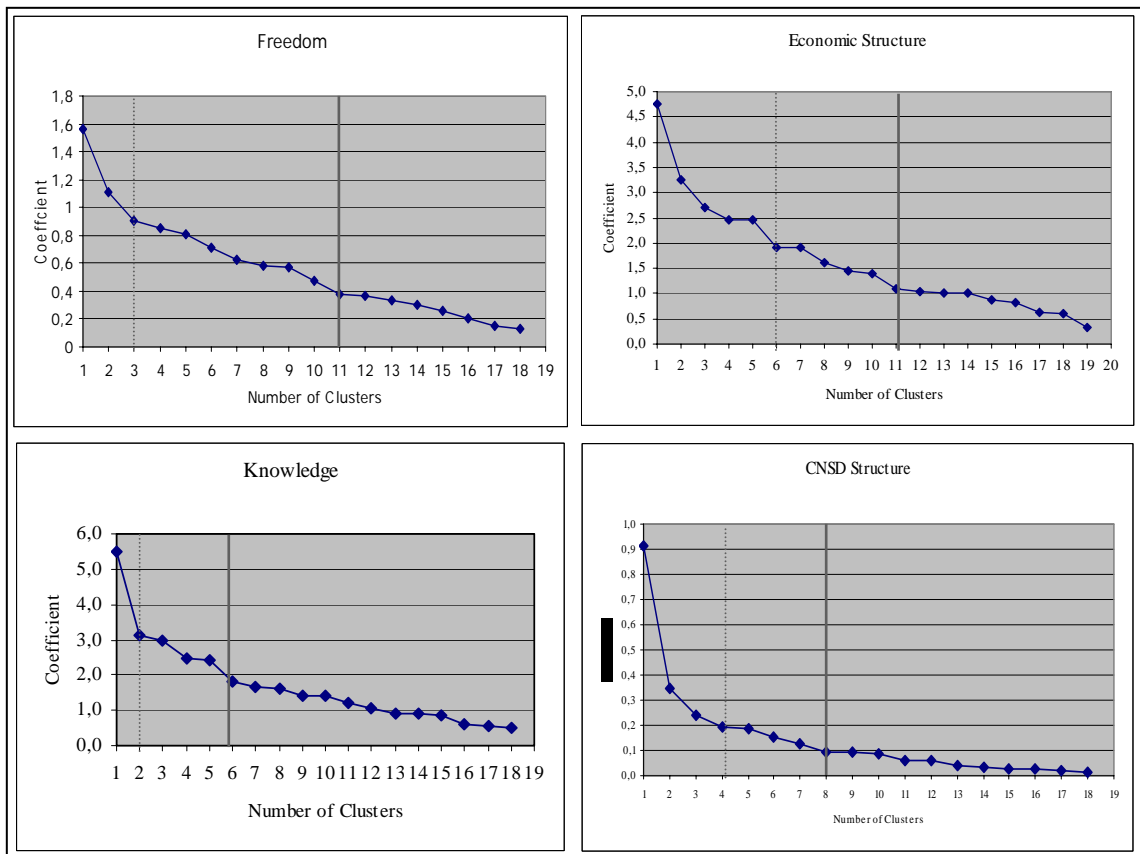


Figure 1: Elbow-Criteria

Generally, the agglomerative nature of the different Average-Linkage Cluster analysis allows the interpretation of different steps of the cluster algorithm. Thus, the present analysis made possible a wide range of different insights into the (dis-)similarities between the Latin American countries on different levels of aggregation. Several sharp rises of the heterogeneity indexes can be observed. Because of space constraints we concentrate on the cluster steps/elbows leading to the classification we considered to have the best trade off between structural homogeneity within groups and structural heterogeneity between groups and to provide the most interesting insights of structural (dis-)similarities. For us, the most interesting classification results can be obtained for the 2+1+1 cluster solution (= 2 Cluster solution + outlier Chile + outlier Uruguay) in the factor freedom, the 6+1 (1 = outlier Jamaica) cluster solution in the factor knowledge, the eleven cluster solution in the factor economic structure and the 8+1 (1=outlier Chile) cluster solution in the overall system. Table 3 shows the identified classification within the objective classes and the overall system. In the columns we find the acronyms of the analysed countries, on the lines we find freedom (F), knowledge (K), economic structure (E) and overall system (S).

	C L	C R	M X	T T	A R	B R	U Y	P A	J M	C O	S V	V E	P E	E C	D	H N	P Y	B O	G U	N I
F 3	1	3	3	3	3	3	2	3	3	3	3	4	3	4	4	4	4	4	4	4
K 6	1	3	5	5	2	4	2	6	2	5	6	5	6	6	6	6	6	6	6	6
E 1 1	1	2	4	3	5	5	5	8	9	7	4	1 0	7	1 0	9	1 1	1 1	1 1	1 1	1 1
S 9	1	2	3	3	4	4	5	3	4	6	6	7	7	8	8	9	9	9	9	9

Table 3: Classification results

3.4.3 Patterns within the three factors freedom, knowledge and economic structure

To facilitate a better interpretation of the respective classification results, cluster profiles have been computed by calculating the mean squares values of the -previously N (0,1) standardized- items of the correspondent clusters. In this paper we concentrate on providing the statistical cluster results and analysing the overall aggregated system (dis-)similarities. Nevertheless, to understand the cluster results of the overall system it is important to get a brief glimpse and qualitative understanding of the single factor classification.

Freedom

Concerning the factor freedom, there are significant intra-cluster similarities as well as inter-cluster dissimilarities measurable between the relatively better performing clusters/outliers Chile and Uruguay, a medium performing cluster (encompassing Argentina, Brazil, Costa Rica, El Salvador, Jamaica, Colombia, Mexico, Panama, Peru, Trinidad & Tobago), and a weak performing cluster (including Bolivia, Dom. Republic, Ecuador, Guatemala, Honduras, Nicaragua, Paraguay, Venezuela).

Whereas Chile and Uruguay allow for comparatively higher average levels of freedom (in the case of Chile especially with respect economic freedom and in the case of Uruguay with respect to poverty), there are serious limitations for the freedom of the people in the weak as well as the medium performing cluster.

In the weak performing cluster the levels of poverty, corruption, crime are so pronounced and/or the social institutions and macroeconomic conditions are so unbalanced, that apart from the high levels of unfreedom for the poorer quintiles of the population, even the freedom of the richest quintile maybe negatively affected. The “average actor” in these countries cannot be considered free, in terms of having condign social choice and the capability to assist and contribute actively to the innovation and development process.

The cluster of countries we considered as (comparatively) medium performing countries encloses the typical Latin American two class society, where the richest quintiles of population can live a rather good life, similar to standards in some Northern countries, whereas the poorest quintile(s) are socially and economically excluded and are not able to contribute actively to the innovation and development process of their countries. The

statistical results are medium average values. This cluster embraces some 80% of the Latin American population.

Economic Structure

The evolution of the heterogeneity-coefficients with respect to the economic structure of the countries shows two marked elbows at the 6 and 11 cluster-solution. Substantial (dis-)similarities with respect to openness, efficiency and structural setup (I, II, II) of the countries are revealed.

In the 11-cluster solution, several countries build their own one-country cluster (Chile, Costa Rica, Brazil, Panama, Trinidad Tobago), other countries show similar patterns to one other, geographically neighboured countries (Argentina and Uruguay; the service based Dominican Republic and Jamaica; the rather neoliberal countries Mexico and El Salvador, and the oil-based Ecuador and Venezuela) and the least developed countries of Latin America (Bolivia, Guatemala, Honduras, Nicaragua and Paraguay) cluster in one group with low values in business sophistication and market efficiency, high importance of agriculture and informal sectors as well as a high merchandise trade.

Concerning the factor economic structure also the aggregation from the 11 to the 6 cluster solution is revealing:

1. Panama aggregates with Dom. Rep. and Jamaica into one cluster with strongly service sector based countries.
2. Ecuador and Venezuela aggregate with the structural weakest countries into one cluster.
3. Brazil, Argentina, Mexico, Uruguay, El Salvador, Colombia and Peru aggregate into one large cluster embracing some 75 % of the Latin American population and

showing in average a rather low trade values and a -relative to developed countries- very high importance of the informal economy.

4. Chile, Costa Rica and Trinidad Tobago maintain their status as one country-cluster.

Knowledge

Regarding the capability to create, implement, diffuse and imitate knowledge, seven clusters are identified. Jamaica, Chile, Costa Rica and Brazil build their own one-country clusters with significant average dissimilarities to all other investigated countries. Argentina aggregates with Uruguay into two-country-cluster with a comparatively good knowledge base. Colombia, Mexico, Panama, Trinidad & Tobago, Venezuela are building a medium to weak performing cluster and the rest of the countries (Bolivia, Dom. Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay, Peru) are clustering in one group with low average values.

Chile (Cluster K1) can present the best average values. There are some other countries able to show higher values in specific indicators (e.g. Costa Rica in main telephone lines, Argentina in number of researchers per 100.000 inhabitant, Brazil with respect to R&D expenditures), but no other country in Latin America is able to present such sound values in all twenty analysed indicators for the dimensions knowledge base, innovative efforts, innovation and knowledge diffusion. Nevertheless, from a global perspective Chile has to bundle its efforts and resources towards knowledge-based activities and innovation in order to facilitate vertical and horizontal diversification and overcome primary-resource dependence, especially on copper.

The countries of cluster K2 Argentina and Uruguay can traditionally rely upon a good knowledge infrastructure, but the limited amount of techno-economic opportunities –

partly due to a certain *resource curse* in these countries- hampers evolutionary learning and learning by solving processes in technological activities. The well developed education systems of these countries provide a comparatively high or at least acceptable educational standard for virtually all of its inhabitants, but the policy change in the 1990s towards more market-oriented strategies may have hampered nascent, albeit sometimes inefficient, endogenous technology upgrading processes and reinforced the dependency of the strong cattle-breeding sector (e.g. Katz, 2007).

The single-country cluster Brazil is clear frontrunner of Latin America in some specific technological indicators, e.g. in R&D expenditures (e.g. according to RICYT 0,99% between 1998-2003) and number of patents per 100.000 habitants (4,07 between 2000-2002), but performs rather moderate in other indicators indicating the general knowledge base, e.g. adult literacy rate (88,4% in 2002, UNESCO) or internet users per 100 inhabitants (12,4 in 2004; ITU). The deep technological gaps within social classes and spatial areas in Brazil have their impact on the statistical average data and hinder Brazil to enable a much broader and sounder performance in the factors knowledge and innovation. Brazil can present some very advanced and technology-intensive sectors (e.g. aerospace), but still has to find a way for better integration of the social classes and spatial areas who are excluded from good quality education, knowledge flows, technological catch-up processes and endogenous capability upgrading. Not doing so supposes a great loss of human capital and tightens the structural inequalities which hamper economic, institutional and technological development.

The single country cluster Costa Rica is by far the best performing country in Central America and reaches in some indicators the levels of countries like Chile, Brazil or Argentina. Costa Rica made some significant initial steps in the transformation from a

primary resource exporting country towards a modern service economy, but of course there is still a long way to go and the internal gaps are very high. On the one hand, Costa Rica has high quality research institutions, a comparatively high number of researchers and a production facility of Intel (dominating the technology-intensive production and rocketing the high-technology exports data). On the other hand, almost one third of the population aged over 18 has not attended secondary education (UNESCO, 2003).

The countries in the medium to weak performing countries (Colombia, Mexico, Panama, Trinidad Tobago) show some advanced sectors and high-quality researchers, but the great amount of technologically excluded inhabitants leads to significant lower average values in technological readiness and knowledge infrastructure than in the previously analysed countries. Nevertheless, the average performance is still significantly better than in the cluster with the weakest performing countries and some significant internal knowledge hubs e.g. some well recognized universities in Mexico and Colombia must be mentioned. Another interesting note is that (according to data from 2003) adult literacy in the countries of this cluster is better than those of Brazil.

The cluster with Bolivia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Paraguay and Peru is characterized by weak values concerning all indicators. Large parts of their populations are excluded from good-quality education. In average (between 1998-2003) just 0.10% of GDP is spent on R&D and approximately one third of the population is unable to read and write. The weak performance in education, knowledge and innovation suppose a severe constraint for technological and economic catch-up (compare also empirical findings of Fagerberg and Shrolec, 2006). Considering the tremendous poverty rates and low average-income indicators, there are

more urgent problems in these countries than those of improving the low average values in indicators such as scientific publications in Pascal or Sci-Search. However, a sustainable strategy for development has to consider possibilities of closing the tremendous scientific and technological gaps.

3.4.4 Patterns of the overall structure

After a short glimpse on the intra-factor (dis-)similarities, we now turn to the analysis of the overall performance in the aggregated objective classes, knowledge, freedom and economic structure. No doubt, each of the analysed countries has its own specifics, historical path dependencies, institutional setups, technological capabilities, social interaction patterns and economic opportunities. Nevertheless, also at the aggregated level of the objective classes of development it is possible to reveal interesting common patterns, structural (dis-)similarities, strength and weaknesses of the investigated countries.

In the first run of the cluster algorithm, Chile has been revealed as clear outlier presenting significantly higher average values in all three objective classes than any other country of the region. In order to prevent distortions and providing better insights into the structural (dis-)similarities between the other countries, Chile has been excluded from the data before running the cluster algorithm again. The resulting heterogeneity index shows the sharpest rises from the 2 to the 1, 4 to the 3 and 8 to the 7 cluster solution (see Figure 1 on page 13). While the agglomerative nature of the cluster allows interpreting each of the cluster steps, we concentrate here only on the 8-cluster solution, which provides the best trade-off between intra-cluster homogeneity and inter-cluster heterogeneity.

To facilitate an interpretation of the 8-Cluster solution, the mean square values of the different country clusters concerning the aggregated factors have been calculated (over the (previously N (0,1) standardized items). Table 4 shows the cluster profiles for the 8 cluster solution.

Cluster Profiles	Freedom	Knowledge	Economy
A: Chile	1,83	1,44	1,13
B: Costa Rica	0,58	0,81	0,68
C: Uruguay	0,74	0,54	-0,12
D: Argentina, Brazil	0,14	0,81	0,18
E: Mexico, Panama, Trinidad&Tobago	0,36	0,18	0,69
F: Colombia, El Salvador	0,17	-0,29	0,03
G: Peru, Venezuela	-0,31	-0,11	-0,37
H: Dom. Republic, Ecuador	-0,46	-0,61	-0,21
I: Bolivia, Guatemala, Honduras, Nicaragua, Paraguay	-0,69	-0,75	-0,64

Table 4: Cluster profiles Comprehensive Neo-Schumpeterian Development

Several important observations concerning the strength and weaknesses can be made both within and between the resultant clusters.

Chile is by far the best performing country/cluster. Especially regarding the factors of freedom and knowledge there is a significant gap between Chile and all other countries of Latin America. For the factor economy, *Chile* is also clear frontrunner, but the

distance to the other countries is not as marked as in the factors of freedom and knowledge. Chile benefits from a macroeconomic, institutional and political stability in the last 2-3 decades that no other Latin American country can demonstrate. Policy focus should be on diversification and knowledge intensification of the product portfolio.

In the last decades, (cluster B) *Costa Rica* has made large steps forward in the transition from an agricultural towards a modern service economy. Nevertheless, some (serious) bottlenecks persist in (i) the freedom it can provide to its citizens and (ii) the fact that the comparatively good values in the factor economy are strongly dependent on a handful of foreign investors and the strong tourism sector. According to our indicators, the policy focus should address the high socioeconomic imbalances.

Uruguay (cluster C) is also an interesting case, which provides far above average values in the factor freedom and -with some constraints- also in the factor knowledge, but performs poorly in regards to the openness, efficiency and macroeconomic stability of the economy. A clear policy focus should be made on the promotion of an open, efficient and future-oriented economic structure.

The two-country cluster D *Argentina and Brazil* show good average values in the factor knowledge, but rather medium values in the factors freedom and economic structure. There are serious constraints in the freedom of the actors and weaknesses concerning the efficiency and internationalization of the economy. According to Arocena and Sutz (2005) it is the combination of both, capabilities and opportunities that opens the way for sustained learning. They indicated to the fact that the steady flow of opportunities to solve non-trivial problems is essential for accumulative evolutionary learning, building up problem-solving routines and foster innovation. Many people in Argentina and

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Brazil are highly educated, but are lacking of learning by doing and learning by solving opportunities, especially in the secondary and tertiary sectors. The governments of these countries should place strategic emphasis on knowledge-intensive sectors, which correspond to the endogenous capabilities and economic opportunities. Furthermore, constraints for freedom, e.g. corruption and poverty, have to be tackled in order to make the economic systems more efficient and the development path broader and sustainable.

In the country cluster E with *Mexico*, *Panama* and *Trinidad Tobago*, the major bottleneck is knowledge. The countries of this cluster show a high degree of internationalization in some efficient sectors, but the factors of knowledge and freedom hamper the potential of these countries for improved technological and economic performance. Policy should place stronger focus on knowledge and innovation and tackling the socioeconomic imbalances. If these countries would be able to introduce better conditions for knowledge improvements and innovation in their economic systems and could achieve a better inclusion of the two poorest quintiles of population into a more diversified knowledge based economy, a fertile Neo-Schumpeterian development corridor is possible. The rising incomes of these economies in the last years should be used to promote sectoral alignment towards future-oriented knowledge-intensive sectors not forgetting to provide the necessary skills through adequate education and professional formation.

While (inter-)national media puts strong emphasis on security issues and thus constraints for freedom of the actors, another decisive bottleneck for economic development of the two country cluster (F) *Colombia and El Salvador* is often forgotten in media and public policy: the weak average performance in the factor knowledge. The present analysis reveals that knowledge is a significant relative disadvantage of this

country cluster. The way out of crime and narcotraffic is not possible without a much stronger focus of public policy on the factor knowledge paired with strategic alignment towards future-oriented sectors and competence building, based upon endogenous technological capabilities and opportunities.

While the cluster G with *Peru and Venezuela* is not performing well in the factor knowledge, the performance in the objective classes freedom and economic structure is even worse. Both countries may have the potential to translate current positive developments in GDP growth based upon primary resource richness into the promotion of pro-poor infrastructure, fostering education and most importantly diversification and knowledge intensification. The enormous richness in natural resources together with rent-seeking tendency and a series of institutional problems hamper significant vertical and horizontal diversification of the economy, strategic alignment towards industrial activities or knowledge-based activities in the service sector and an improvement of the freedom for the actors.

The main weaknesses in the rather poor performing cluster (H) with *Dom. Republic and Ecuador* consist in low average values in the factor knowledge as well as the exclusion of large parts of the population from assisting and contributing actively to the economic and technological development, thus low values in the factor freedom. Both countries have to put a much stronger focus on education and knowledge in order to make qualitative change possible. The reason why these countries do not fall into the even weaker cluster can be seen in the comparatively strong tourism sector in the Dominican Republic as well as the oil sector in Ecuador. However, these single sectors are not enough to promote future oriented sustainable development. Key challenges are the

promotion of knowledge as well as a sectoral diversification providing more and higher qualified employment.

The cluster (I) embracing the poorest countries of Latin America (Bolivia, Guatemala, Honduras, Nicaragua, Paraguay), shows serious constraints and weaknesses with regard to the average performance in all three factors. Before making Neo-Schumpeterian development possible, a first step is a profound institutional change, efficiency upgrading of the economy and strong investment in infrastructure and education is needed. Due to global competition and comparatively small sizes of these countries and their governmental budgets, this requires not just significant changes within the internal socioeconomic structure, but also considerable injection of external resources. Attracting the necessary external resources (e.g. FDI) is possible by upgrading the trust of possible investors and government into the property rights, socioeconomic stability, institutional support and security situation in these countries. Emphasis in education can be seen as essential step for both the promotion of institutional change and the attraction of higher value added investment.

The following table 5 resumes the main strengths and weaknesses of the Latin American countries concerning the objective classes of Comprehensive Neo-Schumpeterian Development, supposing triple plus the best score and triple minus the worst.

Cluster Profiles	Freedom	Knowledge	Economy
A: Chile	+++	+++	+++
B: Costa Rica	+	++	++
C: Uruguay	++	++	-
D: Argentina, Brazil	-+	++	-+
E: Mexico, Panama, Trinidad&Tobago	+-	-+	++
F: Colombia, El Salvador	-+	--	-
G: Peru, Venezuela	--	-	--
H: Dom. Republic, Ecuador	--	---	-
I: Bolivia, Guatemala, Honduras, Nicaragua, Paraguay	---	---	---

Table 5: Comparative strengths and weaknesses of the Latin American economies

4 Conclusions

The theoretical part identified (i) freedom of the actors and social welfare (ii) the capacity to create, implement, diffuse and imitate knowledge and innovations and (iii) an open, efficient and future oriented economic structure as mutual interconnected and reinforcing objective classes of socially sustainable Neo-Schumpeterian development. The actors have to be free, need the cognitive capabilities and economic opportunities to be able to unfold themselves and promote qualitative entrepreneurship and innovation. Socioeconomic imbalances not just suppose a significant intervention into the freedom of the actors, but also hamper economic development by creating institutional problems and fixing economic structures. Knowledge and innovation are key factors to enable economic development and institutional change. But innovation and endogenous

capability upgrading require not just knowledge, but also an efficient and future-oriented economic structure which supplies a steady flow of opportunities to apply, adapt and modify knowledge to the endogenous opportunities and demands. Thus, only an adequate combination of freedom, knowledge and a future-oriented structure can lead to a fertile (and socially sustainable) Comprehensive Neo-Schumpeterian development corridor. Policy measures have to be adapted to the specific national capabilities, opportunities and requirements and provide the actors with a fruitful combination of cognitive capabilities and economic opportunities in order to enable innovation and qualitative change. There is no archetype bundle of policy measures able to promote development in all Latin American economies, but policy has to adapt and focus on the specific bottlenecks for development in the respective countries.

Despite the fact of extreme levels of structural heterogeneity of the Latin American Economies, some structural (dis-)similarities between the Latin American countries concerning the objective classes of Neo-Schumpeterian development can be revealed in the empirical analysis.

In some countries, a stronger policy focus has to be placed on knowledge (e.g. in Mexico, Colombia, Ecuador), in other countries on the economic structure and efficiency (e.g. Uruguay and Argentina) and in a series of countries socioeconomic imbalances suppose important constraints for a broader and sounder development path which should be consequently tackled (e.g. Brazil, Costa Rica). The least developed countries (Bolivia, Guatemala, Honduras, Nicaragua, and Paraguay) show comparative disadvantages in all factors. Nevertheless, the authors suggest that without stronger emphasis on education and knowledge, institutional change, endogenous development, technological catch up, significant improvements in the other two objective classes freedom and economic structure will not be possible. Common receipts for development, e.g. the Washington consensus, may be adequate in the one or other case,

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but will not be able to overcome the specific internal obstacles for development in cases requiring stronger state intervention, e.g. in order to overcome socioeconomic imbalances or promoting strategic alignment towards future-oriented sectors.

No doubt, this paper is just a first step to developing a Comprehensive Neo-Schumpeterian development theory for developing and transition countries, which still requires a profound theoretical and empirical discussion, detailed consideration of aspects such as obstacles for qualitative entrepreneurship, impact of social disparities and migration flows, demand side factors for innovation, institutional setup, governance and public policy, (cyclical) (dis-) connection between finance and production, global knowledge and trade flows, geographic concentration of production etc. Nevertheless a decisive conclusion of this paper is that in order to develop a Comprehensive Neo-Schumpeterian development theory, we have to include (as essential parts!) also other branches in economics such as development and institutional economics. We do not want to foster blind eclecticism, but aim to promote the search and acceptance of complementary insights of compatible research lines in order to prevent theoretical lock-ins, foster interactive learning and facilitate new combinations.

References

- Arocena, R.; Sutz, J. (2005):** 'Evolutionary Learning in Underdevelopment', International Journal of Technology and Globalisation, Vol. 1, Nr. 2, 2005, S.209-224
- Backhaus, K.; Erichson, B.; Plinke, W.; Weiber, R. (2006):** Multivariate Analysemethoden –Eine anwendungsorientierte Einführung, 11. Aufl., Springer-Verlag: Berlin; Heidelberg; New York
- Balzat, M.; Pyka, A. (2006):** 'Mapping National Innovation Systems in the OECD Area', International Journal of Technology and Globalisation', Vol.2, Nos.1/2 2006, S.158-176
- Cassiolato, J.; Lastres, H.; Maciel, M. (2003, Eds):** Systems of Innovation and Development: Evidence from Brazil, Edward Elgar Publishing, London;
- Cimoli, M. (2005): Structural heterogeneity, technological asymmetries and growth in Latin America,** MPRA Paper 3832, University Library of Munich, Germany

- Evers, H.D.; Gerke, S.; Menkhoff, T. (2006):** Little-understood knowledge trap, in D+C Magazine for Development and Cooperation 2006 (6), InWent, Bonn; Frankfurt am Main
- Fagerberg, J.; Srholec, M. (2006):** ‘The role of “capabilities“ in development: Why some countries develop (while other stay poor)’, 11th ISS Conference on “Innovation, Competition and Growth: Schumpeterian Perspectives”, Nice/Sophia-Antipolis, France, June 21-24
- Godinho, M.M.; Mendonça, S.F.; Pereira, T.S. (2004):** Towards a taxonomy of innovation systems, Institute for Economics and Business Administration (ISEG), Technical University of Lisbon
- Hair, J.F.; Anderson, R.E.; Tatham, R.L.; Black, W.C. (1995):** Multivariate Data Analysis with Readings, 4th edition, Prentice-Hall International, New Jersey
- Hanusch, H. and Pyka, A. (2007a),** The Principles of Neo-Schumpeterian Economics, Cambridge Journal of Economics, Vol. 31(2), 275-289, 2007
- _____ (2007b), The Troika of Economic Growth and Development, in EU Economic Development and Employment in the Context of the Lisbon Strategy", Editing Company of the F. Skarbek Graduate School of Business Economics, Warsaw (Eds.)
- _____ (2007c), Applying a Comprehensive Neo-Schumpeterian Approach to Europe and its Lisbon Agenda, in: Tilly, R., Welfens, P. und Heise, M. (eds.), 50 years of EU Dynamics, Integration - Financial Markets and Innovations, Springer, Berlin, Heidelberg, New York, 275 – 300
- International Labour Organisation (1976):** Employment, Growth, and Basic Needs: A One World Problem Geneva: ILO
- Jobson, J. D. (1992):** Applied Multivariate Data Analysis – Vol. II: Categorical and Multivariate Methods, Springer-Verlag, Berlin; Heidelberg; New York; Tokyo
- Johnson, B.; Edquist, C.; Lundvall, B.-A (2003):** ‘Economic Development and the National System of Innovation Approach’, First Globelics Conference, Rio de Janeiro, 3-6. November 2003
- Juma, C.; Fang, K.; Honca, D.; Huete-Perez, J.; Konde, V.; Lee, S.H.; Ivinson, A.; Robinson, H.; Singh, S. (2001):** ‘Global Governance of technology: meeting the needs of developing countries’, in: International Journal of Technology Management, Vol. 22, Nos. 7/8, 2001, 629-655
- Katz, J (2007):** Cambios estructurales y ciclos de destrucción y creación de capacidades productivas y tecnológicas en America Latina, Globelics Working Paper Series, No.2007-06
- López-Claros, Altinger, L.; Blanke, J., Drezeniek, M.; Mia, I. (2006a):** ‘Assessing Latin American Competitiveness: Challenges and Opportunities’, in: World Economic Forum (2006): The Latin America Competitiveness Review 2006 – Paving the Way for Regional Prosperity, World Economic Forum, Geneva, p.1-36
- Lopez-Claros, A.; Porter, M.E., Sala-i-Martin, X.; Schwab, K. (2006a):** The Global Competitiveness Report 2006-2007, World Economic Forum, Geneva
- MERIT and the EC-JRC (2007):** European Innovation Scoreboard 2006. Comparative analysis of innovation performance, Pro Inno Europe, Innometrics, [www.proinno-europe.eu/innometrics.html]
- Schumpeter, J.A. (1912):** Theorie der wirtschaftlichen Entwicklung, Duncker&Humblodt, Berlin
- Sen, A. (1999):** Development as Freedom, Oxford: Oxford University Press
- Schnell, R; Hill, P.B.; Esser, E. (2005):** Methoden der empirischen Sozialforschung, 7th edition, Oldenbourg-Verlag: München; Wien
- Steward, F. (1979):** Country experience in providing for basic needs, Finance and Development, 1979 16(4): 23-26

Paper presented in the VI Globelics Conference at Mexico City, September 22-24 2008

Streeten, P. (1979): From growth to basic needs, *Finance and Development*, 1979 16(3): 28-31

Streeten, P.; Burki, S.J.; Ul Haq, M.; Hicks, N.; Stewart, F. (1981): First things first: Meeting Basic Human Needs in Developing Countries, Oxford: Oxford University Press for the World Bank

United Nations Development Programme (1990): Human Development Report 1990, New York, Oxford: Oxford University Press

World Bank (1999): World Development Report 1998-1999: Knowledge for Development, Oxford University Press, New York

_____ **(2003):** World Development Report 2003: Sustainable Development in a Dynamic Economy, Oxford University Press, New York

Indicator & Definition	Scaling	Source	Average over Period/Year	% of data estimated
<u>Objective Class Freedom</u>				
Human Development Index (GDP per capita (PPP in US\$), life expectancy, adult literacy rate)	Index 0 - 1	United Nations Development Program - Human Development Report 2005	2003	0
Population below income POVERTY line	< 2\$ per day	United Nations Development Program - Human Development Report 2005	1990-2003	5
Unemployment (Urban Unemployment was applied, because for some country, e.g. Argentina, there was no country data available)	percent of total labour force	Economic Commission for Latin America and the Caribbean (ECLAC) - Badestat	2002-2005	0
Corruption Perception Index	Index 0 - 10	Transparency International - Corruption Perception Index 2005	2003-2005	0
Health and Primary Education (Medium-term business impact of malaria, medium-term business impact of tuberculosis, medium-term business impact of HIV/AIDS, infant mortality, life expectancy, tuberculosis prevalence, malaria prevalence, HIV prevalence, primary enrolment)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2003	0
Infrastructure (Overall infrastructure quality, railroad infrastructure development, port infrastructure quality, air transport infrastructure quality, quality of electricity supply, telephone lines)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2005	0
Institutions (property rights, diversion of public funds, public trust of politicians, judicial independence, favouritism in decisions of government officials, wastefulness of government spending, burden of government regulation, business costs of terrorism, reliability of police services, business costs of crime and violence, organized crime, ethical behaviour of firms, efficacy of corporate boards, protection of minority shareholders' interests, strength of auditing and accounting standards)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2005	0

Indicator & Definition	Scaling	Source	Average over Period/Year	% of data estimated
Objective class: Efficient and Future-Oriented Economic Structure				
Macroeconomics - Finance (Government surplus/deficit spending, national saving rate, inflation, interest spread rate, government debt, real effective exchange rate)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2004	0
Market Efficiency (Agricultural policy costs, efficiency of legal framework, extent and effect of taxation, number of procedures required to start a business, time required to start a business, entry barriers, intensity of local competition, effectiveness of antitrust policy, GDP-exports & imports, exports, (hiring and firing) employment practices, flexibility of wage determination, cooperation in labor-employer relations, reliance on professional management, pay and productivity, brain drain, private sector employment of women, financial market sophistication, ease of access to loans, venture capital availability, soundness of banks, local equity market access)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2005	0
Business Sophistication (Local supplier quantity, local supplier quality, production process sophistication, extent of marketing, control of international distribution, willingness to delegate authority, nature of competitive advantage, value chain presence)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2005	0
ISO9001:2000 Quality Management Systems - Certifications	per million inhabitants	International Standards Organization (ISO) - The ISO Survey 2004	2004	0
ISO14001:2004 Environmental Management Systems - Certifications	per million inhabitants	International Standards Organization (ISO) - The ISO Survey 2004	2004	0
Agriculture, value added (% of GDP)	% of GDP	World Bank - Development Indicators	Average 2001-2004	0

Indicator & Definition	Scaling	Source	Average over Period/Year	% of data estimated
Industry, value added (% of GDP)	% of GDP	World Bank - Development Indicators	Average 2001-2004	0
Services, etc., value added (% of GDP)	% of GDP	World Bank - Development Indicators	2001-2004	0
Urban occupied population in sectors of low productivity (Total informal sector)	% of total urban population	Economic Commission for Latin America and the Caribbean (ECLAC) - Statistical Yearbook 2004	2000-2002	15
Urban occupied population in sectors of low productivity (independent, not qualified, informal working)	% of total urban population	Economic Commission for Latin America and the Caribbean (ECLAC) - Statistical Yearbook 2005	2000-2002	10
Merchandise Trade (% of GDP) Merchandise trade as a share of GDP is the sum of merchandise exports and imports divided by the value of GDP, all in current U.S. dollars.	% of GDP	World Bank - Development Indicators	2001-2004	0
Exports of goods and services (% of GDP)	% of GDP	World Bank - Development Indicators	2001-2004	0
Manufactured Exports (primary exports are aprox 1-manufactured exports)	% of merchandise exports	United Nations Development Program - Human Development Report 2005	2003	0
High-Technology Exports (% of manufactured exports)	(% of manufactured exports)	World Bank - Development Indicators	2001-2004	0
Imports of goods and services	% of GDP	World Bank - Development Indicators	2001-2004	0
Foreign direct investment, net inflows (BoP, current US\$) / GDP (current US\$)	% of GDP	World Bank - Development Indicators; IMF	2001-2004	0
Foreign direct investment, net inflows (BoP, current US\$) / Population 2005	per capita	World Bank - Development Indicators; IMF	2001-2004	0

Indicator & Definition	Scaling	Source	Average over Period/Year	% of data estimated
Objective Class: Knowledge				
Expenditure on R&D	% of GDP	Red de Indicadores de Ciencia y Tecnología -Iberoamericana e Interamericana- (RICYT) - Indicadores comparativos	1998-2003	10
Expenditure on STA (Science and Technology Activities)	% of GDP	Red de Indicadores de Ciencia y Tecnología -Iberoamericana e Interamericana- (RICYT) - Indicadores comparativos	1998-2003	15
Public Expenditure on Education	% of GDP	Economic Commission for Latin America and the Caribbean (ECLAC) - Statistical Yearbook 2004	2000-2004	0
Public Expenditure on Education	as % of total government expenditure	United Nations Development Program - Human Development Report 2005	2000-2002	15
Researchers in R&D	per million people	United Nations Development Program - Human Development Report 2005	1990-2003	15
Publications in SCI SEARCH	publications / 100 000 population	Red de Indicadores de Ciencia y Tecnología -Iberoamericana e Interamericana- (RICYT) - Indicadores comparativos	2001-2003	0
Publications in PASCAL	publications / 100 000 population	Red de Indicadores de Ciencia y Tecnología -Iberoamericana e Interamericana- (RICYT) - Indicadores comparativos	2001-2003	0
Adult literacy rate	(percent of population aged 15 and above)	UNESCO - Educational Database	2002	0
Gross Secondary Enrollment	gross ratio	UNESCO - Educational Database	2003	0
Gross Tertiary Enrollment	gross ratio	UNESCO - Educational Database	2003	0

Indicator & Definition	Scaling	Source	Average over Period/Year	% of data estimated
Total Telephone Subscribers per 100 inhabitants	per 100 inhabitants	International Telecommunication Union - Statistics	2004	0
Mobile Subscribers per 100 inhabitants	per 100 inhabitants	International Telecommunication Union - Statistics	2004	0
Main Telephone line per 100 inhabitants	per 100 inhabitants	International Telecommunication Union - Statistics	2004	0
Internet: Hosts	per 10000 inhabitants	International Telecommunication Union - Statistics	2004	0
Internet: Users	per 100 inhabitants	International Telecommunication Union - Statistics	2004	0

Indicator & Definition	Scaling	Source	Average over Period/Year	% of data estimated
PCs	per 100 inhabitants	International Telecommunication Union - Statistics	2004	5
Higher Education and Training (Quality of the educational system, quality of math and science education, quality of management schools, local availability of specialized research and training services, secondary school enrollment, tertiary school enrollment, extent of staff training)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review	2005	0
Technological Readiness (Technological readiness, firm-level technology absorption, laws relating to ICT, FDI and technological transfer, cellular telephones, internet users, personal computers)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2005	0
Innovation (Quality of scientific research institutions, company spending on research and development, university/industry research collaboration, government procurement of advanced technology products, intellectual property protection, availability of scientists and engineers, capacity for innovation, utility patents)	Index 1 - 8	World Economic Forum (WEF) - The Latin America Competitiveness Review 2006	2005	0
Invention coefficient (patents applied by residents per 100 000 population)	per 100,000 residents	Red de Indicadores de Ciencia y Tecnología -Iberoamericana e Interamericana- (RICYT) - Indicadores comparativos; United Nations Development Program – Human Development Report 2005	1999-2003	5

Appendix 2: Missing Data

Indicators	missing data %	Cases	Method of estimation
Population below income POVERTY line (<2\$)	5	Dominican Republic	Estimation of the Dominican poverty value by comparison of poverty values with the GDP per Capita Poverty-value Dominican Republic estimated = Poverty all countries * (GDP per Capita Dominican Republic / GDP per Capita all countries)
Urban occupied population in sectors of low productivity (Total informal sector)	15	Jamaica, Trinidad& Tobago, Colombia	Colombia estimated by relation to data of Urban occupied population independent, not qualified, informal working Jamaica, Trinidad & Tobago based on the comparison of their labor market data and sectoral specifics
Urban occupied population in sectors of low productivity (independent, not qualified, informal working)	10	Jamaica, Trinidad& Tobago	Jamaica, Trinidad & Tobago values estimated based on the comparison of their labor market data and sectoral specifics
Expenditure on R&D	10	Dominican Republic, Guatemala	Dominican Republic and Guatemala estimated by comparing the relations of their Invention coefficients, their Public Expenditure on R&D, and Innovation-values
Expenditure on STA (Science and Technology Activities)	15	Dominican Republic, Guatemala, Chile	Chile estimated by comparison with Expenditure on R&D-Data; Dominican Republic and Guatemala estimated by comparison with relations in Estimated Expenditure on R&D-Data
Public Expenditure on Education	15	Guatemala, Honduras, Venezuela	Guatemala, Honduras, Venezuela estimated by value of Public Expenditure on Education (% of GDP) in relation to the other analyzed countries
Researchers in R&D	15	Dominican Republic, Guatemala, Jamaica	Values estimated by comparing their Higher Education & Training values as well as their publications in Sci Search and Pascal
PCs per 100 inhabitants	5	Dominican Republic	Value estimated by the amount of Internet users
Invention coefficient (patents applied by residents per 100 000 population)	5	Costa Rica	Value estimated by comparing the relations of Researchers in R&D - and Higher Education & Training-Data