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# A PLS PATH MODEL TO INVESTIGATE THE RELATIONS BETWEEN INSTITUTIONS AND HUMAN DEVELOPMENT

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# A PLS Path Model to investigate the relations between institutions and human development

**S. Terzi*, A. Trezzini*, L. Moroni*[1]**

**Abstract**

The paper studies the relations between types of institutions on different components of human development. A role of aggregate demand in determining the material components of human development is assumed. We thus divide institutions into those that create demand and those that are determined by the whole process of development. Similarly we divide human development in its three traditional components (economic development, health, knowledge). Both human development and institutions are assumed as multidimensional constructs; all the main components of these constructs are defined as latent variables, and the relations between them as structural relations. A Partial Least Squares (PLS) path model is developed: it is the aggregation (and simultaneous estimation) of an outer model relating observed or *manifest variables* to their own *latent variable* and of a structural model (inner model) relating some *endogenous* latent variable to other latent variables. From the goodness of fit point of view, our results seem to validate our theoretical assumptions.

**Key words: S**tructural Equations Models, Institutions, Human Development
**Jel codes:** O43, C40, O15

## *1. Introduction*

The influence of institutions on the development of a society seems to imply a multitude of complex relations between social, political and institutional phenomena which for their inner nature cannot be forced in the *traditional* framework of a production function.

In particular, in structuring our model we take distances from three main features of the theoretical traditional framework:

i) the assumed irrelevance of aggregate demand;

ii) the identification of material output with the degree of development;

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iii) the tendency to study economic relations in terms of simple and general quantitative relation between one directly observable endogenous variable, and one or more (directly observable) exogenous variables.

To overcome the difficulties posed by the assumption of irrelevance of aggregate demand in the growth process we distinguish between economic and political institutions. The former are essentially those which directly or indirectly create aggregate demand and positively affect the level of output. The latter are instead a consequence of the existence of Economic Institutions and positively affect the different components of development.

To bypass the rigidities imposed by the identification between development and material output we define human development as a multidimensional phenomenon. This is consistent with UNDP's definition of the Human Development Index (HDI). However – unlike HDI - we define its components (Economic Development, Knowledge, Health) as latent variables (LV), that is variables that cannot be observed and measured directly.

To study the relations between the different institutions and the different components of human development we make use of a Structural Equations Model (SEM), that is a model in which there is more than one endogenous/dependent variable and more than one relation to estimate.

The general features of SEM models seem to overcome some of the limits of the third traditional feature we outlined above (point iii.). The effects of Institutions on Development involve relations in which quantitative phenomena - such as the level of investment, consumption, GDP etc. - and qualitative phenomena - such as the degree of development of political institutions or the level of education or health - are deeply intertwined. Their relations need to be represented – and estimated – as a network of causal relationships. Moreover, the qualitative phenomena – that in statistical language can be defined as latent multidimensional constructs – can be expressed as latent variables, and measured by means of observed indicators. This is precisely what SEM are designed for: to estimate a network of causal relationships, defined according to a theoretical model, linking two or more latent complex concepts, each measured through a number of observable indicators.[2]

[2] Esposito Vinzi, V. et (2010)

These are precisely the key features of our approach. It is original from the point of view of the theoretical relations and principles adopted, as well as from that of the econometric method used in the empirical analysis.

An important feature of our analysis, that needs to be stressed, is that we do not study the effects of Institutions on Human Development (effects that could be studied – and have been studied[3] - by means of a simple regression model of one composite indicator that represents Human Development and one or more composite indicators that represent Institutions ) but instead the causal effects of the different types of institutions on different components of human development. Having defined our multidimensional components of institutions or of human development as latent variables, and being interested in the estimation of more than one causal relation the choice of structural equation modeling (SEM) is a necessary – although original - choice.

The outline of the paper is as follows. In the first part (sections 2-5) we develop critical considerations on the relevant literature. It does not claim to be a complete and detailed critical survey, but merely an attempt to highlight the features of the literature that led us to take up original stances in structuring our analysis. The analysis of the literature leads us also to define (sections 6 and 7) causal relations between the latent variables; then, using a structural equations model (sections 8, 9, 10) we define, estimate and validate the model. As we conclude in section 11, the results of the empirical analysis are consistent with the model which stems from theoretical framework.

## *2. The general conception of productive process in "mainstream" economic theories*

The whole corpus of theoretical analysis of economic growth derives from marginalist or *neoclassical* theories of value and distribution. As such, it is based on the notion of production function and thus on a particular vision of the productive process. In this view, all the material or immaterial, naturally available or produced elements used in production are conceived of as *productive factors* which can be combined in varying proportions in the productive process. These combinations give origin to corresponding levels of output at the individual firm or aggregate level. The production function is thus conceived of as a *simple* and *general functional relation* between the *quantities* of

[3] Basu, 2008, Glaser et al., 2004.

productive factors and the corresponding *quantity* of output realized. This relation is *simple* because it univocally links given quantities of factors and defined quantities of output. It is *general* because it holds in circumstances which in principle may differ for historical, institutional, social and political reasons.

This vision of the productive process lies at the very heart of the "mainstream" theories of prices and distribution. The claim that market economies show an automatic tendency towards full employment equilibria and the irrelevance of aggregate demand in determining the long-term level of output are necessary implications of this vision of the productive process.

### *3. Three key features of the traditional analyses of growth*

The modern theory of growth begins in the 1950s with Solow (1956) and Swan (1956). They studied the determinants of economic growth by elaborating an aggregate production function. Automatic market mechanisms, they argued, would lead the economy on a full-employment steady–state path of growth in which the rate of growth is determined by the rate of growth of population and by the rate of growth of labor productivity determined by technological progress. The influence of any phenomenon on aggregate income is possible only as far as it affects aggregate supply. In recent reformulations many further factors affecting growth have been studied, these analyses did not modify the traditional vision of the productive process: the effects on growth of all different phenomena considered (and institutions between them) have necessarily to pass through changes in the shape or level of the production function.

We focus our attention on *three crucial features* which derive from the marginalist conception of the productive process which underlies the whole corpus of mainstream theories of growth.

The *first* of these features is that the whole approach is based on the implicit assumption that the expansion of aggregate demand does not play any positive role in determining the growth process. The production function can be seen as the centre of the analysis because aggregate supply – it is assumed – always finds its aggregate demand. The only conditions to be studied in order to explain growth are those affecting aggregate supply.

A *second* feature on which our attention will be focused is that in this traditional approach the level of development of an economy, its temporal trend and, more in general, the level of wellbeing of a society, tend to be identified with exclusively quantitative magnitudes: respectively with the level of aggregate GDP, its rate of growth and its per capita level.

Finally a *third* feature is the way in which institutional, political and social phenomena affecting development are studied in the literature. The process of growth is conceived of as essentially determined by technological phenomena (technical innovation or more in general changes in the shape of the aggregate production function) and by the development of the available quantities of productive factors. Its analysis has to be based on the production function a simple and general relation between quantitative observable variables. In this conception it is thus difficult to find any role for the wide set of social, institutional, conventional, political and juridical phenomena which cannot, owing to their intrinsic nature, be represented by means of merely quantitative relations and as such cannot easily be included in an approach based on the notion of "production function".

## *4. The debate on the key features: The role of aggregate demand, development economics as a separate branch of economics and the issue of the adequacy of GDP as a measure of well–being*

The first of these crucial features – the claim of a long-term tendency towards full employment and the irrelevance of aggregate demand expansion in the growth process – is the most fundamental one. It has been questioned since the very beginning of the analysis of growth, and theories in which aggregate demand determines growth have been parallel developed since then. These theories represent a very limited portion of the literature on growth[4] and have not yet been assumed as reference for an analysis of the relation between institutions and development.

[4] Analyses of economic growth in which a decisive role of aggregate demand expansion is explicitly taken into account can be grouped into three different approaches: analyses based on the post-Keynesian models of the 1950s and 1960s (see Kaldor, N. (1956) and (1957) Robinson, J. (1962)); analyses by Neo-Kaleckian

Conversely, the other two features have directly or indirectly generated a wide range of criticisms and elaboration both in theoretical and empirical analyses.

The study of economic development was the field of analysis, in which discomfort for the substantial *irrelevance* of a social, institutional, conventional, political and juridical phenomena on the process of growth appeared. Although at the cost of gross simplification it is actually possible to conceive the whole corpus of *development economics* as an integration of the theory of growth deriving from the attempt to overcome the limitations that this alleged irrelevance imposed on the ability of the theory to interpret reality.

When countries that are not industrially developed are taken into consideration, a multitude of phenomena that are hard to include in the approach based on the production function appear to play an unquestionable role. Development economics has been developed as if these phenomena were relevant in less developed countries, where markets are not complete, information is limited, deep structural changes are still taking place, etc. So, although without questioning the traditional approach, models and theoretical analyses which go beyond the simple use of aggregate production functions are worked out.

In one of the most popular textbooks of development economics, Todaro and Smith (2006) argue that in addition to all the main topics of "traditional economics", development economics "must deal also with the *economic, social, political and institutional* mechanisms, both public and private, necessary to bring about *rapid* ...and *large scale improvements* in levels of living ." (p.9) In development economics, they argue, value premises are relevant; it is necessary to go beyond *simple Economics*, considering 'non economic variables' such as social tradition, religions, attitudes and institutions.

It is thus meaningful that it was within Development Economics that the adequacy of GDP as a measure of the well–being of an economy has been questioned. In this context, the work of the group of UN experts who, in 1954, produced the report

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authors Rowthorn, R. (1981) Marglin, S.A., and A. Bhaduri. 1990. Lavoie, M. (1992) (1995) and the analyses of what may be called a Classical and Keynesian approach, Garegnani, P. (1992), Trezzini, A. (1995), Serrano, F. (1995) Garegnani, P. and Trezzini, A. (2010), Trezzini, A. (2011).

*International Definition and Measurement of Standards and Levels of Living*, defined the notion of human development. This notion tended to combine per capita income, a purely quantitative parameter, with quantities that could take into account different features of the actual economic systems, which could essentially be expressed as four dimensions: health, education, employment and housing.

In the seventies, when Chipman and Moore (1971) and Nordhaus and Tobin (1972) entered this debate, a set of circumstances affecting the well-being of an economy but not registered by the GDP and which we find in the current debate on the issue were already being recorded. The evaluation of non market goods and services, the evaluation of leisure, negative externalities such as pollution, the changes in product quality over time, the evaluation of public goods such as parks, police services, national defense, etc.

Since then, the reflection on a wider measurement of development has offered a rich field of analysis. Morris (1979) opened the way to the study of composite indixes of economic development able to capture not only per capita income but also the fulfillment of basic needs and other possible indicators of well-being. Dasgupta and Weale 1992 included civil and political rights in the definition of the quality of life and development. The work by the Nobel laureate A. Sen radically changed and enhanced the theoretical reflection on this point by defining the notion of capability and the concept of development as a freedom. (See Anand and Sen (1994); Sen (1999)).

This line of critical reasoning finds its most complete expression in the recent *Report by the Commission on the Measurement of Economic Performance and Social Progress* by J. Stiglitz, A. Sen and J.P. Fitoussi (2009). As will be shown in the following, one conclusion of the Report is crucial for our work:

"To define what well-being means a multidimensional definition has to be used….. [T]he Commission has identified the following key dimension that should be taken into account. At least in principle, these dimensions should be considered simultaneously:
i. Material living standards (income, consumption and wealth);
ii. Health;
iii. Education;
iv. Personal activities including work
v. Political voice and governance;
vi. Social connections and relationships;
vii. Environment (present and future conditions);
viii. Insecurity, of an economic as well as a physical nature.
All these dimensions shape people's well-being, and yet many of them are missed by conventional income measures." (p. 27)

*5. The debate on the key features: endogenous growth theories and the analysis of the relations between institutions and growth*

A second line along which the traditional approach to economic growth has been *supplemented* in order to overcome the alleged insignificance of social, political, institutional phenomena can be found in the endogenous growth models (Romer (1986); Lucas (1988); Grossman and Helpman (1991)).

In these analyses, to the traditional notion of capital, labor and natural resources they added other factors different productive factors (e.g. human capital) representing – in general sense - the influence of institutional social and political phenomena. Some quantitative magnitudes univocally representing a specific phenomenon are THUS introduced into the production function. Then a specific rule of accumulation of this particular element is introduced in the growth model. These theories however have continued to make use of the traditional vision of a productive process: a production function actually remains the focus of any reasoning on growth. In this way, although modified, the general conception of productive process is not essentially altered.

A similar reasoning applies to the analyses of the *role of institutions* in determining growth and human development. In recent literature, the role of institutions has generally been treated within the framework of the traditional approach to economic growth based on the production function.[5] Institutions have consequently been considered as affecting growth only through their effects on the production function.

In the corpus of this literature the distinction is made between *economic*, *political* and *social institutions*. Institutions are considered then a multidimensional phenomenon. A meaningful feature of this debate, which we are going to overcome, is that all the possible dimensions are considered together either as conditions which affect economic development or which are determined by it. We thus find a sort of assumed *unitarity* of all the institutions. The debate is focused on whether economic growth determines the

[5] It would be necessary to distinguish between *new* and *old* Institutionalists and thus between the different notions of institutions and conceptions of their role in economic processes. This however lies outside the scope of this paper and it is undeniable that since the beginning of the 1990s the works of North (1990, 1992, 1994) have traced out the lines along which the effects of differences in institutions in determining the performance differentials of different countries have been studied.

development of broad-based and strong institutions or whether the creation of strong and broad-based institutions manages to affect (positively) economic growth.

Since the seminal contribution of North (1981) and (1990), many other authors have argued in favor of a positive effect of institutions on growth. Some of them from a strictly empirical point of view, e.g. Knack and Keefer (1995) or Mauro (1995). Others followed a more general approach: Jones and Hall (1999), Acemoglu (2001) (2002), Mokyr (2002), Easterly and Levine (2003), Dollar and Kraay (2003). They generally claim that 'democracy' is the basic element for securing property rights[6]. In this literature, democracy is conceived of as rules that limit government power. Synthesizing this position, Gleaser et al. (2004) talk about "an intellectual consensus that political institutions of limited government cause economic growth" p. 272.

According to other authors, essentially Lipset (1960), Barro (1997), (1999), Alvarez et al. (2000), Djankov et al. (2003) and Glaeser et al. (2004) the causal relation has to be reversed. When per–capita income, physical and human capital grow, conditions of literacy and education also tend to be created. These conditions lead to the development of democratic institutions. This thesis, although less widespread among economists, tends to be powerful in explaining the processes of development which took place under dictatorships which relatively rapidly evolved towards democracy (e.g. South Korea, Taiwan and even China).

As noted in Glaeser, et al. (2004) these two opposite stances share the assumption that growth is determined by investments in physical and human capital, so it is essential to secure property rights to support investment in physical and human capital. [7]

The difference between the two approaches lies in the fact that, in the first case, this security is determined by the existence of democratic institutions which constrain government power, while in the second instance it could also be determined by political decisions of – generally unconstrained - leaders of developing countries.

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[6] In Mokyr (2002) the role of Institutions is that of encouraging the accumulation of Knowledge and its application to Technology.

[7] The debate is also extended to the kind of institutions allowing a better protection of property rights. Glaeser and Shleifer (2002) and La Porta et al. (1999) claim that evolutions of the English Common Law System generally tend to be more efficient than systems which can be considered evolutions of the French Civil Law system. A similar comparison has been made between different Colonial Origins that gave rise to institutions which work differently. North, Summerhill and Weingast (2000).

From our point of view it is important to stress that the influence of institutions on the process of growth and development is studied assuming the traditional theoretical approach: democratic institutions enforce property rights which are essential in automatically generating investment in physical and human capital or in positively affecting so-called total factor productivity. The production function is again the central focus of argument. Institutions – like all the other circumstances considered in traditional economic analysis – affect either its arguments or its shape.

The fact that the influence of institutions on the process of economic development has been studied in the framework of the traditional theory implies some limitations which we consider to be crucial to the effectiveness of the analysis. This traditional approach to economic growth does not attribute any possible role to aggregate demand expansion. Thus any effect of institutions on growth through the expansion of aggregate demand cannot be envisaged. The existence of institutions which directly or indirectly imply government expenditure is considered as a factor *negatively* affecting growth and development or at most crowding out a corresponding private expenditure. Government size is seen as a negative factor.[8]

The centrality of the notion of production function has also had a methodological implication in the empirical analyses. This feature has favored the use of simple uni-equational models between observed variables. This is true for the first phase of empirical analyses of growth in which the observable variables represented essentially the available quantities of productive factors. The notion of total factor productivity and its empirical counterpart (Solow's residual) represented all the effects of the phenomena which this approach was not able to capture.

The use of simple uni-equational models between observed variables can however be also found in the more recent and articulated formulations of the theory of growth. Both in the endogenous growth theories and in the quoted analyses of the relation between Institutions and human development, all the causal links between phenomena have been treated in terms of *simple* and *general relations* between *quantitative*

[8] It is important to stress the ideological implications of this approach. In the literature, *Democratic* institutions are conceived of as those which limit the political power of Government. An institution that limits market power is not Democratic by definition. Observation of the recent effects of unconstrained financial speculation should give some food for thought.

*variables:* the introduction of the effects of specific phenomena, such as the effects of institutions on growth and then on human development, is generally worked out by introducing in the production function one or more indicators which aggregate different components to obtain a summary measure of the specific phenomenon under consideration.

*6. Our Position and thesis*

All the above critical considerations underpin our position on the relation between institutions and human development. We assume human development to be a multidimensional phenomenon, composed of three key dimensions, to be considered simultaneously: *Economic Development, Knowledge, Health*. These are the same three components of the Human Development Index (HDI) as defined by UNDP. However, in HDI these three components are aggregated to obtain a single summary measure; moreover, some components are themselves multidimensional: in this case they are defined as linear combination of indicators (for example: Knowledge is defined as *access to knowledge* and measured – until 2009 - as a weighted average of adult literacy rate and gross enrolment index; since 2010 as a weighted average of mean years of schooling and expected years of schooling). Here instead we consider the three components of human development as theoretical, not directly observable constructs (in other words we define them as latent variables), and we don't aggregate them in a single summary measure but instead leave them as separate dimensions.

Similarly we don't define institutions as a single variable, but instead as a multidimensional theoretical construct that can be split in three components: *Economic Institutions, Political Institutions, Social Institutions*. We assume these three components to be multidimensional and not directly observable latent variables.

Our analysis consists in the simultaneous definition of two essential elements of the model. On one side we define a set of theoretical relations between the different components (latent variables) involved in the relation between institutions and human development; on the other we define by means of what (manifest) variables we can obtain an aggregate measure of the unobservable components.

As far as the first step is concerned, our assumptions may be represented graphically as in Figure 1, where the arrows represent causal relations between the different components of human development and institutions.

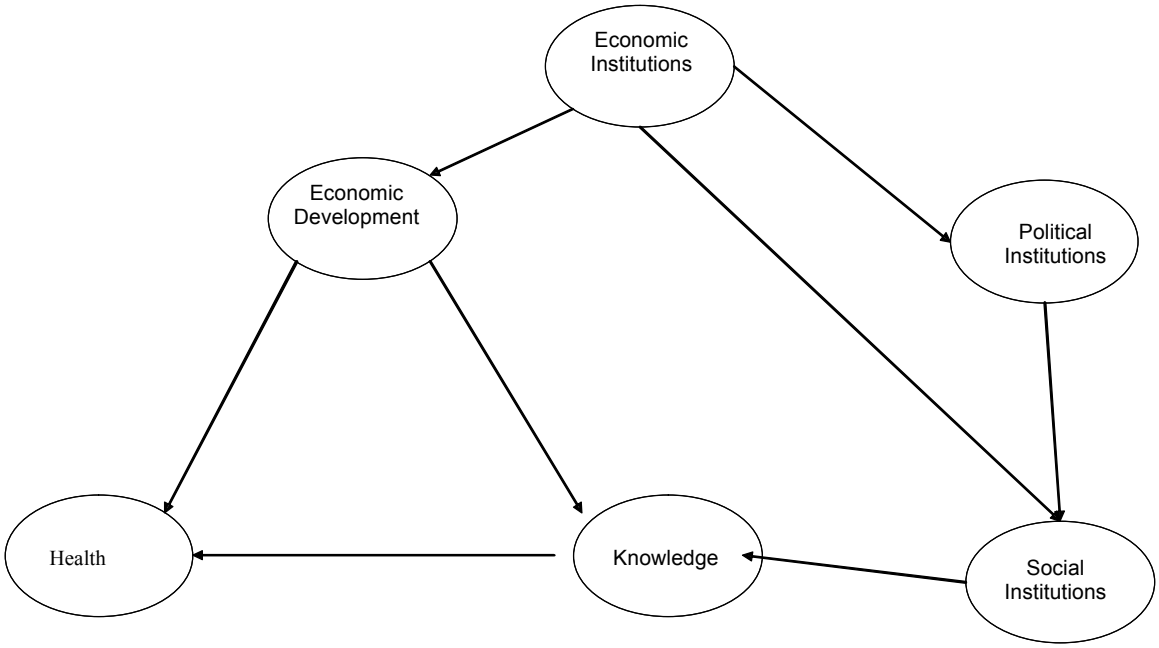


*Figure 1: graphical representation of the relations between latent variables*

We are departing from the traditional framework with regard to some major theoretical and methodological aspects. The most significant theoretical aspect is that, in contrast with what is claimed in the traditional approach, we consider aggregate demand expansion as a significant determinant of growth and accumulation.[9] This leads us to wonder how to assign different roles to different sets of institutions in the development process. We thus break the unitarity in which institutions are dealt with in literature.

Some institutions necessarily imply government expenditure: a well-developed and extensive welfare system or a public health system or the active presence of

[9] The theoretical bases for this position can be found in the Keynesian literature on growth cited in fn. 1.

Government in the economy as a direct producer of goods or services necessarily imply a high level of government expenditure. This implies the existence of levels of aggregate demand which are – in a higher or lower degree – irreversible and that possibly tend to increase in time. Assuming a positive role of aggregate demand in the growth process, the institutions implying government expenditure are considered here as a factor positively determining output level and its trend over time. Moreover, a positive effect on growth and development seems to be exerted by institutions which do not necessarily imply government expenditure but which tend to create positive conditions for the expansion of private investment. This set of institutions can be defined as *Economic Institutions* and must be considered as those directly or indirectly affecting aggregate demand.

Other institutions can be classified, following a distinction we found in the literature, as *Political* or *Social Institutions*. We distinguish these from Economic Institutions because they do not necessarily imply significant government expenditure nor tend to directly affect private investment. In the literature, political institutions represent the set of rules (formal or informal) determining the way in which political decisions are actually taken in a community: the constraints to power of central government and the way in which different social, political or ethnical groups are represented in the process of political decision. Social institutions, instead, are generally conceived as the (formal or informal) rules determining the participation of people to political decisions, civil liberties and women's rights.[10]

The onset and development of both Social and Political Institutions are considered here as consequences of the development of Economic Institutions.[11] The assumption of a positive role of demand expansion in the material growth process leads us to overcome the polarization of the debate: we assume *some* institutions as cause of growth and others (Social and Political) as the result of the development process as a whole. We thus break

[10] We are going to keep these two *similar* sets of institutions separate firstly because in this we follow the literature, but also because we assume an influence of Social Institutions on Knowledge.

[11] In this way we actually follow the general distinction made in the literature between three kinds of institutions: *Economic*, *Political* and *Social Institutions.* As stated in the text Economic Institutions are conceived of and defined in an original way and different connections between the three kinds of institutions are nevertheless assumed.

the unitarity of the institutions in the conception of the process of development, by assuming that other institutions are essentially determined by the existence and the degree of development of Economic Institutions. The latter then becomes crucial both for material development and for further institutional development. We add further relations of causality: we assume that Political Institutions affect the development of Social Institutions; while the latter have a direct effect on Knowledge.

As for the definition of human development, we shall follow the main conclusions of the literature: we limit the empirical analysis to three multidimensional components: Economic Development, Knowledge and Health, and we consider – as stated by J. Stiglitz, A. Sen e J.P. Fitoussi (2009) – a definition of well-being in which the dimensions co-exist. However, unlike the definition of HDI, we do not define a single summary measure.

Moreover we establish a logical causal hierarchy among these components. Following the traditional approach one might be induced to consider the growth of absolute or per-capita GDP as a quantitative aspect of economic growth which does not necessarily generate a simultaneous development of the other dimensions of well–being. The distinction between the quantitative dimension of economic development and the other dimensions derives from the distinction between what is economic (i.e. treatable by means of a production function) and what is non economic and has to be considered as a social phenomenon.

In our view, on the contrary, the process of development and economic growth has to be viewed as a single process in which the quantitative growth of GDP cannot take place without generating a parallel process of improvement of social conditions, determining Knowledge and Health.

On the other hand, in literature, the linkage between Knowledge, Health and Economic Development is generally mediated by the effect of (labor or total factor) productivity being then a supply effect on growth. The assumption of a demand-led growth point of view led us along the other line of reasoning present in the literature which considers these components of well-being as an effect of material development.

Therefore, as already observed, while Economic Development – measured by absolute and per capita GDP - is considered here as directly determined by Economic

Institutions via the almost irreversible direct or indirect contribution to aggregate expenditure, the other two dimensions of human development - Health and Knowledge - are considered here as necessary consequences of Economic Development.

We thus have a network of causal relations. We consider Knowledge (K) directly affected by Economic Development (E.D.) and by Social Institutions (S.I.) although it is also indirectly affected by Economic Institutions (E.I.), which then determine Economic Development (E.D.) and Political Institutions (P.I.).

In this way the relations we are assuming between the latent variables in the model appear to be different from those assumed in the traditional approach: they are not univocal, simple and general quantitative relations between quantity of inputs and the aggregate quantity of outputs.

Limiting assumptions are always necessary for proper identification of the structural model from an econometric perspective. These have led us to assume as a first step the relations now described. As we argue in the conclusions, other options are certainly possible, also keeping using the two crucial contributions of the paper i.e. the leading role of demand expansion and the method based on the definition of latent variables and the development of a PLS path model (PLS-PM).

*7.The formalization of the relations and the PLS model*

Three steps must be taken in order to formalize our model. In the first place, we have to flesh out the theoretical notions utilized. The nature of Economic Institutions, Political Institutions, Social Institutions as well as Economic Development, Health and Knowledge will thus change from that of abstract economic categories (theoretical constructs) to that of quantitative variables which - it is hypothesized - cannot be observed directly. Evidence may be collected on the levels and mutual interactions of these so called *latent* variables by examining their influence on groups of observable variables, thus indirectly describing them by observing one block of *manifest* variables (or indicators) for each latent variable .

The second step consists in the definition of the causal relations between the latent variables using a structural equations model, as in section 6.

Finally, a statistical method is applied to the data in order to validate the model and to estimate its parameters. The statistical procedure does not assess the causality of the relations comprising the model; such an interpretation of the results can derive only from the theoretical framework. Note that this is exactly what happens with any statistical modeling procedure: the model stems from theoretical framework, the results can be consistent with the theoretical model – and thus validate the model – or not.[12]

Having defined the theoretical constructs involved in our reasoning as distinct latent variables that are assumed to be associated with each other, it seems natural to model their interactions by means of a structural equation model. "*Structural equations models (SEM) include a number of statistical methodologies meant to estimate a network of causal relationships, defined according to a theoretical model, linking two or more latent complex concepts, each measured through a number of observable indicators.*" (Esposito Vinzi et. al., (2010)).

In particular, having chosen an exploratory approach, a PLS path model seems to be the most suitable. What led us to PLS soft modeling, as opposed to Maximum Likelihood Structural Equation Models (ML-SEM), is the consideration that ML-SEM, as well as other Lisrel–type methods, requires strong assumptions, many observations and so-called "hard modeling" procedures. Due to the inherent quality of the cross-border data on the topics of institutions and human development, drawn from different sources, in different years and based on the efforts of many public and private organizations operating in a variety of social, political, economic and natural environments all over the world, the indicators are assumed not to carry the level of standardization and accuracy required, nor to fulfill the distributional assumptions and the sample size requirements (for PLS the sample size requirements are much smaller). In fact *covariance- based* SEM typically employ a full information ML estimation process; thus "*a poorly developed construct where some of the item measures are weak or inappropriately measuring some other latent construct or a theoretical model with miss-specified paths can bias other estimates throughout the proposed model. PLS being a limited-information component-based least squares alternative, tends to be less affected.*" (W.W. Chin, 2010) .

[12] M. Friedman wrote: *"Factual evidence can never 'prove' a hypothesis; it can only fail to disprove it, which is what we generally mean when we say, somewhat inexactly, that the hypothesis has been 'confirmed' by experience."* Friedman, M. (1953) (p.9).

PLS is an iterative algorithm that solves out – separately – the blocks of the measurement model and then, in a second step, estimates the path coefficients in the structural model. Therefore it is the aggregation (and simultaneous estimation) of two models:

1) a measurement model (outer model) relating observed or *manifest variables* (MV) to their own *latent variable* (LV);

2) a structural model (inner model) relating some *endogenous* latent variables to *other* latent variables.

The estimation of the parameters of the model is performed by a procedure that computes LV scores using a PLS algorithm, and then performs Ordinary Least Squares (OLS) regressions on them to estimate the structural equations. PLS is prediction oriented: it aims at explaining at best the residual variance of the LV and, potentially, of the MV in any regression run in the model.

Each LV has been defined by means of a reflective measurement model in which each MV ($x_{jh}, j = 1,\ldots J, h = 1,\ldots p_j$) is related to its LV ($\xi_j, j = 1\ldots, J$) by a simple regression:

$$x_{jh} = \pi_{jh0} + \pi_{jh}\xi_j + \varepsilon_{jh} \qquad (1)$$

where $\varepsilon_{jh}$ has mean zero and is uncorrelated with $\xi_j$. The set of MV linked to a LV is called *block* in path model language. A further assumption is the uni-dimensionality of the block; moreover, all the MV are required to be positively correlated.

The reflective specification for the measurement model is consistent with the assumption that each MV reflects its LV, rather than vice-versa, as in the formative specification. It is true that usually complex multidimensional indicators such as Human Development Index, or the Index of Economic Freedom are defined in a formative way, as being generated by their manifest variables as linear combinations of indicators (MV) with fixed weights, but this happens not for theoretical reasons but for estimation requirements. The opportunity to define the outer model by means of the reflective specification is in fact one of the good features of SEM.

On the basis of our theoretical reasoning we define a latent variable Economic Institutions which reflects the extent of government intervention in the economy. From among the available indicators (MV) we select those able to represent direct government intervention in the economy: the levels of general government consumption spending as a percentage of total consumption, transfers and subsidies as a percentage of GDP, government enterprises and investment. We also select a set of indicators measuring different aspects of government activity tending to create the conditions for private investment: protection of property rights, legal enforcement of contracts, taxes on international trade, regulatory trade barriers, credit market regulations, business regulations.

The other latent variables – Political Institutions, Social Institutions, Economic Development, Health and Knowledge – have been built using the set of manifest variables which are generally used in the literature (see in particular Basu (2008)). These are indexes built by International Institutions highly specialized in each specific field associated to our constructs. In literature, we found a general consensus on the ability of these data sets to represent the phenomena under consideration. Although a specific analysis could reveal many limits of these indexes, entering this issue is far beyond the aim of our work. In tables 1, we find the indicators related to each latent variable, their source and year of reference.

In the whole we use 34 indicators for manifest variables. We included in our sample all the countries (belonging to HDI 2006 country list) which had no more than 4 indicators (out of these 34) missing.

The coverage by tertiles of our sample with respect to the HDI 2006 country list is as follows: for the first tertile coverage is of 77.97%; for the second tertile it is of 62.71%; and for the third tertile the coverage is of 52.54%.

**Tables 1: Measurement models**

| Table 1a. Manifest variables for Economic Institutions (E.I.) | | | | |
|---|---|---|---|---|
| **Name** | **Variable** | **Year** | **Source** | **Reversion Formula** |
| Area 1-A | General government consumption spending as a percentage of total consumption | 2006 | FH-EFW | Max(Area 1-A) - Area 1-A |
| Area 1-B | Transfers and subsidies as a percentage of GDP | 2006 | FH- EFW | Max(Area 1-B) - Area 1-B |
| Area 1-C | Government enterprises and investment | 2006 | FH- EFW | |
| Area 2-C | Protection of property rights | 2006 | FH- EFW | |
| Area 2-Fd | Legal enforcement of contracts | 2006 | FH- EFW | |
| Area 4-A | Taxes on international trade | 2006 | FH- EFW | |
| Area 4-B | Regulatory Trade Barriers | 2006 | FH- EFW | |
| Area 4-E | International capital market controls | 2006 | FH- EFW | |
| Area 5-C | Business Regulations | 2006 | FH- EFW | |
| **Description:**<br>There are 9 manifest variables for Economic Institutions. The indicators are a subset of those collected by the Freedom House for the calculation of the EFW index. They are named as in the published FH-EFW dataset.<br>The first two indicators have been reversed as they were inverse indicators of the underlying variables, giving higher scores to countries with lower levels of the variable. i.e. General government consumption spending as a percentage of total consumption. | | | | |

| Table 1b. Manifest variables for Political Institutions (P.I.) | | | | |
|---|---|---|---|---|
| **Name** | **Variable** | **Year** | **Source** | **Reversion Formula** |
| Political Rights | Political rights | 2007 | FH | 8 – PR |
| L1 | Lower legislative | 2004 | POLCON | |
| L2 | Upper legislative | 2004 | POLCON | |
| F | Independent sub-federal units | 2004 | POLCON | |
| ID | Index of democracy | 2000 | PRIO | |
| Polity | Polity score | 2005 | POLITY | |
| Exconst | Executive constraint | 2005 | POLITY | |
| **Description:**<br>There are 7 manifest variables for Political Institutions. The first, Political Rights, comes from the Freedom in the World Annual Report, the Freedom House's flagship publication. We reversed it because it was a inverse indicator.<br>The next three indicators are from the POLCON Henisz Dataset, devoted to the calculation of the Political Constraint Index.<br>The Index of Democracy is part of the Polyarchy dataset , compiled by Tatu Vanhanen (PRIO). | | | | |

The last two indicators are part of the Polity IV project devoted to the evaluation of the political regime characteristics.

**Table 1c. Manifest variables for Social Institutions (S.I.)**

| Name | Variable | Year | Source | Reversion Formula |
|---|---|---|---|---|
| PHYSINT | Physical Integrity Index | 2007 | CIRI | |
| NEW_EMPINX | Empowerment Rights Index | 2007 | CIRI | |
| ASSN | Freedom of association | 2007 | CIRI | |
| WECON | Women's economic rights | 2007 | CIRI | |
| WOPOL | Women's political rights | 2007 | CIRI | |
| WOSOC | Women's social rights | 2007 | CIRI | |
| Press Freedom | Press freedom | 2007 | FH | 100 – PF |
| Civil Liberties | Civil liberties | 2007 | FH | 8 – CL |

**Description:**
There are 8 manifest variables for Social Institutions. The first 6 indicators are contained in the Cingranelli-Richards (CIRI) Human Rights Dataset. It contains standards-based quantitative information on government respect for 15 internationally recognized human rights.
The last two indicators come from the Freedom House Annual Report, (FH), and have been reversed because they were inverse indicators.

**Table 1d. Manifest variables for Economic Development (E.D.)**

| Name | Variable | Year | Source | Reversion Formula |
|---|---|---|---|---|
| GDP | GDP per capita | 2005 | HDR | |
| Radios | Radios per 1000 people | 1997 | WRI- ET | |
| Telephone | Main telephone lines per 1000 people | 2005 | WRI- ET | |
| TV | Television sets per 1000 people | 2003 | WRI- ET | |
| Energy | Total energy consumption per capita | 2005 | WRI- ET | |
| Electricity | Electricity consumption per capita | 2005 | WRI- ET | |

**Description:**
There are 6 manifest variables for Economic Development. The first is from the Human Development Report – United Nations Development Programme (HDP).
The other five are from the World Resource Institute – Earth Trends Searchable Database (WRI-ET)

| Table 1e. Manifest variables for Knowledge (K) | | | | |
|---|---|---|---|---|
| **Name** | **Variable** | **Year** | **Source** | **Reversion Formula** |
| Primary | Primary school gross enrollment ratio | 2004 | WRI- ET | |
| Secondary | Secondary school gross enrollment ratio | 2004 | WRI- ET | |
| Literacy | Adult literacy rate | 2005 | HDR | |
| Tot years | Total school years | 2000 | BL | |
| **Description:**<br>There are 4 manifest variables for Knowledge.<br>The first two are from the World Resource Institute – Earth Trends Searchable Database (WRI- ET)<br>The third is from the Human Development Report – United Nations Development Programme (HDR)<br>The last indicator is from Barro and Lee dataset on school enrollment (BL) | | | | |

| Table 1f. Manifest variables for Health (H) | | | | |
|---|---|---|---|---|
| **Name** | **Variable** | **Year** | **Source** | **Reversion Formula** |
| DPT | Immunization rate for DPT in one-year-olds | 2005 | WRI- ET | |
| Expect. | Life expectancy at birth | 2005 | HDR | |
| Phys. | Physicians | 2004 | HDR | |
| Infant | Infant mortality rate | 2005 | HDR | 1000 – IMR |
| **Description:**<br>There are 4 manifest variables for Health. The first is from the World Resource Institute – Earth Trends Searchable Database (WRI-ET). The other three are from the Human Development Report – United Nations Development Programme (HDR).<br>The last indicator has been reversed in order to obtain a direct indicator of Health. | | | | |

The structural model consists of linear equations relating the latent variables to one another:

$$\xi_j = \beta_{j0} + \sum_{j'} \beta_{jj'} \xi_{j'} + \omega_j \qquad (2)$$

where each $j'$ is such that $\xi_{j'}$ explains $\xi_j$ in the specification of the inner model. The structural model must be a causal chain (recursive model) which means that there is no loop. Being a recursive SEM it is always identified.

The entire model (outer and inner) can be represented as:

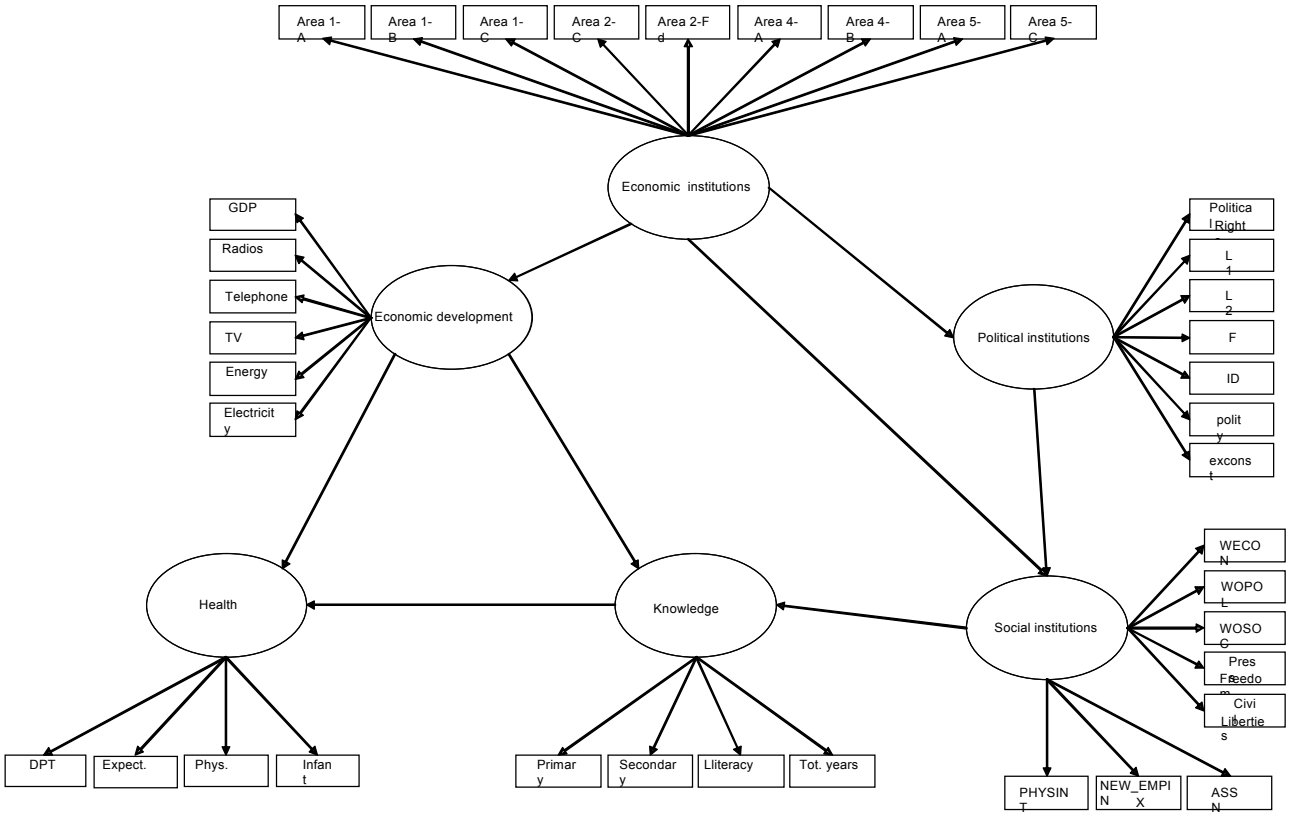


*Figure 2: The PLS-PM model*

*8. PLS-PM algorithm*

It is beyond the scope of this paper to discuss in detail the PLS-PM algorithm and its performance indicators; however, a brief outline will be given of the options required in order to implement the algorithm, as well as of the obtainable output. We suggest that readers interested in gaining a deeper insight refer to Tenenhaus et al. (2005).

We have already illustrated our choices for the outer model and for the structural relations between LV. The PLS algorithm considers three different options for the outer model: reflective (meaning that the LV determine the level of each MV), formative (meaning that each MV contributes to the corresponding LV), and MIMIC (a mixture of the two: some MV follow a reflective path, others a formative one) . Our choice of the reflective model stems from the consideration that – for each block - all the chosen indicators reflect the same underlying construct and have been chosen to be highly correlated: an increase in the latent variable would cause an increase in all its manifest variables.

The chosen estimation procedure for the outer model computes the standardized LV as the weighted linear combination of their standardized MV; as initial weights we chose the elements of the first eigenvector.

The PLS algorithm works by producing in each iteration the estimates $\hat{\pi}_{jh}$ and $\hat{\beta}_{jj'}$ of two key sets of quantities: the outer weights $\pi_{jh}$, namely, the theoretical coefficients of the simple regressions of each standardized MV on its standardized LV, as in equation (1), and the inner weights $\beta_{jj'}$, namely, the theoretical coefficients of the linear equations specifying the relations between the LV, as in (2). The weights estimated in one iteration are used in the subsequent iteration to compute two different estimates of the latent variables: the external estimations $Y_j$, making use of the outer weights:

$$Y_j = \sum_{h=1}^{p_j} \hat{\pi}_{jh} x_{jh} \qquad (3)$$

and the internal estimations $Z_j$, making use of the inner weights:

$$Z_j = \sum_{j'} \hat{\beta}_{jj'} Y_{j'} \qquad (4)$$

The algorithm then makes use of $Y_j$ to compute a new estimate of the inner weights as the estimated regression coefficients obtained by fitting the models:

$$Y_j = b_{j0} + \sum_{j'} b_{jj} Y_{j'} + e_j \qquad (5)$$

and of $Z_j$ to compute a new estimate of the outer weights as the estimated regression coefficients of the models:

$$x_{jh} = p_{jh0} + p_{jh} Z_j + o_j \qquad (6)$$

These estimates are then utilized in the next iteration. The algorithm executes the steps outlined above until the estimates of the outer weights become stable. At this point, the final estimations of the outer weights are used to compute the final estimations of the LV by means of (3); lastly, the structural equations are estimated using individual OLS multiple regressions where the LV are replaced by their estimates, as in (5).

*9. PLS-PM validation*

PLS is a soft modeling procedure, strongly oriented towards prediction. It lacks a specific global optimization criterion; moreover – not being based on distributional assumptions concerning joint multivariate distribution and independence of observations - traditional parametric-based techniques for significance testing/evaluation would not be appropriate. To answer the question: "*to what extent is a PLS model appropriate to describe the interactions between latent constructs?*" we need to assess the quality of both the measurement model and the structural model. Thus the results are usually presented in three steps:

1) quality of measurement model
2) quality of structural model
3) quality of the overall model.

Being PLS a variance-based model, strongly oriented towards prediction, model validation mainly focuses on the model predictive capability. The first step focuses on the reliability and validity of the measures (MV) used. The logic is that if there is not enough confidence that the manifest variables are representing the latent variable, there is little sense in using them to validate the theoretical model. The other two steps concern the evaluation of the structural model, in particular of its predictive power: of each dependent latent variable (of each structural equation) and of the overall performance of the model.

The consistency of the choice of indicators for each block, with the choice of the reflective mode - which requires the uni-dimensionality of the blocks - can be assessed by the level of Cronbach's alpha index which, for the *j*-th block (containing $p_j$ indicators) is defined as:

$$\alpha_j = \frac{p_j}{p_j - 1} \frac{\sum_{h \neq h'} \text{cov}(x_{jh}, x_{jh'})}{\text{var}\left(\sum_h x_{jh}\right)} \qquad (7)$$

This index can be used to check how well a construct is measured by its indicators; it is in fact considered an index of *a construct's reliability*. The rule of thumb is that block *j* and (thus construct $y_j$ ) is essentially uni-dimensional (and reliable) if $\alpha_j > 0.7$ .

The quality of the measurement model can be validated through the communality index (also indicated as AVE) of each block:

$$\text{communality}_j = \frac{1}{p_j} \sum_{h=1}^{p_j} cor^2(x_{jh}, Y_j) \qquad (8)$$

and through the average communality index, where the average is extended to all the measurement blocks and is weighted with the number of MV in each block:

$$\overline{\text{communality}} = \frac{1}{P} \sum_{j=1}^{J} \left(p_j \times \text{communality}_j\right) \quad P = \sum_{j=1}^{J} p_j \qquad (9)$$

The communality explains how much of the MV's variability in the j-th block is explained by their own LV's scores. The rule of the thumb is to consider of good quality any block with AVE ≥0,5.

A more detailed set of information takes into account how each indicator relates to each latent variable. *Indicator reliability* specifies which part of an indicator's variance can be explained by the underlying latent variable. A common threshold criterion is that more than 50% of a MV's variance should be explained by the LV. This in turn implies a factor loading of the LV on the MV ≥0,7. As a rule of the thumb reflective indicators should be eliminated whenever their loadings (correlations) are smaller than 0,4. However, to evaluate the association between each MV and its LV, not only should its indicator be strongly related to its latent construct, but it should not have stronger association with any

other construct. A necessary condition for *discriminant validity* to hold for each MV, is that its correlation with the construct it should reflect is stronger than its correlation with any other construct in the model In other words indicator *loadings* (i.e. correlations between MV and their LV) need to be greater than *cross loadings* (correlations with other LV).

A logical metric for the evaluation of the structural model is endogenous variables' determination index $R^2$.

As for a global goodness of fit (GoF) criterion, unlike maximum likelihood SEM, PLS does not optimize a global scalar function and thus a natural global validation index is not readily available. However, an operational solution can be computed as:

$$\text{GoF} = \sqrt{\overline{\text{communality}} \times \overline{R^2}} \tag{10}$$

where

$$\overline{R^2} = \frac{1}{J}\sum_{j=1}^{J} R^2\left(Y_j, \{Y_{j'}\text{'s explaining } Y_j\}\right) \tag{11}$$

Some authors have proposed comparing the two quantities used to compute the goodness of fit with their theoretical maxima. These maxima are conditioned on the given the model. The maximum of the average communality is obtained by means of a Principal Components Analysis of each block of manifest variables[13]. The maximum of the $\overline{R^2}$ is obtained by means of a Canonical Correlation Analysis of each structural equation.[14]. Of course, if we were to use Principal Component Analysis for the outer model then $\overline{R^2}$ for the inner model would possibly decrease; conversely, if we were to use Canonical Correlation between the MV, thus giving rise to the LV belonging to the same structural equation, the communality of each LV would probably decrease. In other words, it is impossible to maximize the goodness of fit of the outer and of the inner model at the

[13] In particular the maximum communality of a LV is given by the greatest eigenvalue of the variance covariance matrix of its MV. This means that if we define each LV as the first principal component of its MV, the fit for the outer model would be a maximum.

[14] In particular the maximum $R^2\left(Y_j, \{Y_{j'}\text{'s explaining } Y_j\}\right)$ of a structural equation is given by the first canonical correlation coefficient between a canonical variable $\xi_j$ and a canonical variable $\xi_{j'}$; $\xi_j$ is obtained by means of the MV associated with $Y_j$, whereas $\xi_{j'}$ is obtained by merging all the MV variables associated with all the LV explaining $Y_j$.

same time. The ratio of the average communality to its maximum is a relative measure of goodness of ft for the outer model, while the ratio of the $\overline{R^2}$ to its maximum is a relative measure of goodness of fit for the inner model. The product of the two ratios is used as a comprehensive relative measure of goodness of fit , and is called *relative GoF*.

*10. The Results*

Our primary concern has been to define a structural equation model connecting Economic Institutions to other institutions and to the different components of human development. Thus, accordingly, we will first of all discuss the results of the structural model. The main results concerning our path model are represented in this diagram:

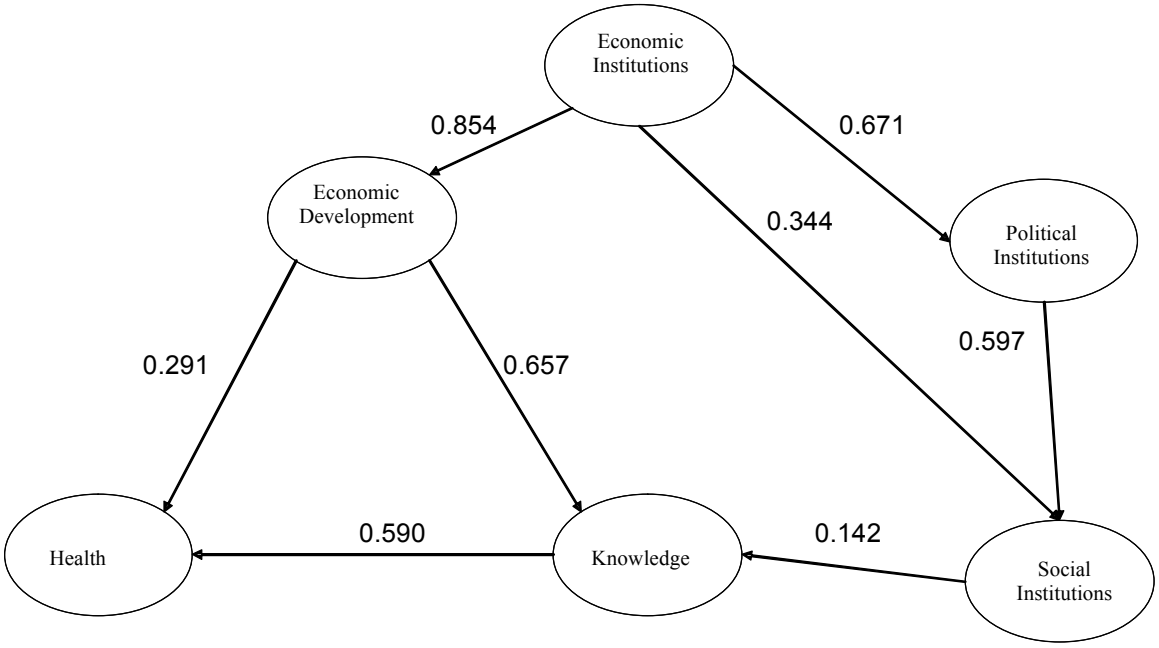


*Figure 3: Estimates of the Path Coefficients*

while the results for model assessment are presented in tables 4, 5, 6.

Figure 3 shows the estimates of the path coefficients, namely the coefficients of the latent variables in the structural equations model (inner model defined by (2)).

Recalling that the latent variables are normalized, the path coefficients are *pure* numbers that quantify the orientation and the strength of the linear structural relations between the variables in the inner model. As expected all the coefficients are positive; the three *institutions* appear to be tightly bounded to each other, as are the three components

of human development (Economic Development, Knowledge, Health). The strong link between these two groups lies in the clear relation that joins Economic Institutions with Economic Development. Conversely the influence of Social Institutions on Knowledge is weaker than we expected.

First of all let us look at the core equation of our model, the relation between Economic Institutions and Economic Development:

E.D.= 0.854 E.I.

with goodness of fit index $R^2$ = 0.729 (see table 2). Economic Institutions have a high impact on Economic Development and the assumed relation between these constructs has very good predictive capability.

This was one of the crucial aspects of our model: that demand determines growth, in particular that institutions that imply government expenditure or that create positive conditions for the expansion of private investment determine economic development. This assumption seems to be very well supported by our data. We will come back to it after having validated the outer model, in particular after having checked for indicator reliability, composite reliability and discriminant validity of the manifest variables in each block.

As for the rest of the inner model, on the institutions side we have:

P.I .= 0.671 E.I .

S.I. = 0.597P.I .+ 0.344E.I.

(with $R^2$= 0.45 and $R^2$ = 0.75 respectively)

whereas on the development side:

K = 0.657E.D .+ 0.142 S.I.

H = 0.590K. + 0.291E.D.

with – respectively – $R^2$ = 0.58 and $R^2$ = 0.692.

The path coefficient connecting Social Institutions to Knowledge is fairly low. It could be worth estimating a different model without this path.

Focusing on the validation of the outer model, from table 3 we see that all Cronbach's alphas are high, ranging from 0.771 to 0.938 thus indicating high reliability for all our latent variables.

Some communalities (see table 2) are just under the threshold value (Economic Institutions and Political Institutions); looking at the manifest variable's loadings (table 4), this is due to one or two low correlations between indicators and latent variable. In particular Area 1-A (*General government consumption spending as a percentage of total consumption* ) and Area 4-A (*Taxes on international trade* ) with Economic Institutions, and F (*Independent sub-federal units*) for Political Institutions. For all three indicators discriminant validity holds. However while the first two indicators are *reliable* (in statistical validation sense) the F indicator instead, is below the threshold of 0.4 and should be eliminated. Another indicator that should be eliminated due to its low reliability is Primary (*Primary school gross enrollment ratio*). However, in this case there are sound reasons in favor of its inclusion in the block (*gross enrollment ratio* – a combination o primary, secondary and tertiary enrolments - is part of the definition of the Education Index as defined by UNDP); moreover the communality for Knowledge is well above the critical threshold.

As for the evaluation of the overall fit (see table 5), having obtained a goodness of fit index of 0.615 our model appears to be well supported by the data. The goodness of fit is slightly better for the outer model (relative index 0.992) than for the inner model (relative $\overline{R^2} = 0.887$).

Concluding our discussion of the results, we can state that the structural model is well supported by the data, and so are all the single blocks. The strongest relation is between Economic Institutions and Economic Development, which is the core relation of our model. It is also worth noticing that Economic Development also has a very high correlations with all its manifest variables, and thus a high communality index. Its definition by means of the PLS model is particularly well supported by the data.

**Table 2: Model assessment**

| Latent variable | Type | $R^2$ | Adjusted $R^2$ | Mean Communalities (AVE) |
|---|---|---|---|---|
| E. I. | Exogenous | | | 0.453 |
| P.I. | Endogenous | 0.450 | 0.450 | 0.435 |
| S.I. | Endogenous | 0.750 | 0.748 | 0.654 |

**Table 3:Composite reliability**

| Latent variable | Dimensions | Cronbach's alpha |
|---|---|---|
| E.I. | 9 | 0.840 |
| P. I. | 7 | 0.771 |
| S. I. | 8 | 0.920 |

| | | | | |
|---|---|---|---|---|
| E.D. | Endogenous | 0.729 | 0.729 | 0.764 |
| K | Endogenous | 0.580 | 0.576 | 0.636 |
| H | Endogenous | 0.692 | 0.689 | 0.747 |
| Mean | | 0.640 | | 0.591 |

| | | |
|---|---|---|
| E. D. | 6 | 0.938 |
| K | 4 | 0.780 |
| H | 4 | 0.885 |
| | | |

**Table 4: Indicator's Loadings and Crossloadings**

| | E.I. | P.I. | S.I. | E.D. | K | H |
|---|---|---|---|---|---|---|
| General government consumption spending as a percentage of total consumption | **0.495** | 0.271 | 0.318 | 0.511 | 0.455 | 0.268 |
| Transfers and subsidies as a percentage of GDP | **0.635** | 0.565 | 0.545 | 0.614 | 0.556 | 0.570 |
| Government enterprises and investment | **0.651** | 0.539 | 0.611 | 0.486 | 0.451 | 0.445 |
| Protection of property rights | **0.799** | 0.376 | 0.493 | 0.707 | 0.469 | 0.462 |
| Legal enforcement of contracts | **0.582** | 0.310 | 0.324 | 0.565 | 0.612 | 0.575 |
| Taxes on international trade | **0.482** | 0.306 | 0.399 | 0.355 | 0.423 | 0.437 |
| Regulatory Trade Barriers | **0.825** | 0.579 | 0.563 | 0.686 | 0.607 | 0.673 |
| International capital market controls | **0.601** | 0.477 | 0.517 | 0.409 | 0.412 | 0.459 |
| Business Regulations | **0.869** | 0.525 | 0.636 | 0.745 | 0.547 | 0.562 |
| Political rights | 0.645 | **0.884** | 0.879 | 0.547 | 0.453 | 0.497 |
| Lower legislative | 0.294 | **0.666** | 0.441 | 0.182 | 0.171 | 0.263 |
| Upper legislative | 0.206 | **0.423** | 0.309 | 0.187 | 0.243 | 0.168 |
| Independent sub-federal units | 0.287 | **0.319** | 0.261 | 0.365 | 0.249 | 0.186 |
| Index of democracy | 0.694 | **0.839** | 0.773 | 0.664 | 0.678 | 0.693 |
| Polity score | 0.353 | **0.723** | 0.435 | 0.270 | 0.266 | 0.405 |
| Executive constraint | 0.276 | **0.562** | 0.266 | 0.213 | 0.202 | 0.361 |
| Physical Integrity Index | 0.643 | 0.488 | **0.745** | 0.583 | 0.415 | 0.438 |
| Empowerment Rights Index | 0.585 | 0.733 | **0.913** | 0.506 | 0.404 | 0.388 |
| Freedom of association | 0.392 | 0.523 | **0.762** | 0.336 | 0.327 | 0.245 |
| Women's economic rights | 0.572 | 0.573 | **0.709** | 0.617 | 0.581 | 0.570 |
| Women's political rights | 0.291 | 0.408 | **0.521** | 0.241 | 0.182 | 0.172 |
| Women's social rights | 0.693 | 0.737 | **0.875** | 0.705 | 0.678 | 0.630 |
| Press freedom | 0.736 | 0.822 | **0.923** | 0.644 | 0.507 | 0.493 |
| Civil liberties | 0.728 | 0.893 | **0.932** | 0.623 | 0.556 | 0.567 |
| GDP per capita | 0.867 | 0.572 | 0.679 | **0.952** | 0.716 | 0.695 |
| Radios per 1000 people | 0.718 | 0.574 | 0.633 | **0.856** | 0.696 | 0.628 |
| Main telephone lines per 1000 people | 0.837 | 0.638 | 0.683 | **0.919** | 0.757 | 0.772 |
| Television sets per 1000 people | 0.751 | 0.524 | 0.589 | **0.832** | 0.714 | 0.701 |
| Total energy consumption per capita | 0.595 | 0.300 | 0.414 | **0.808** | 0.471 | 0.482 |
| Electricity consumption per capita | 0.650 | 0.409 | 0.537 | **0.871** | 0.526 | 0.508 |
| Primary school gross enrollment ratio | 0.018 | 0.033 | 0.004 | -0.036 | **0.210** | 0.037 |
| Secondary school gross enrollment ratio | 0.678 | 0.449 | 0.536 | 0.687 | **0.926** | 0.745 |
| Adult literacy rate | 0.631 | 0.511 | 0.492 | 0.616 | **0.923** | 0.795 |
| Total school years | 0.734 | 0.549 | 0.593 | 0.762 | **0.888** | 0.677 |
| Immunization rate for DPT in one-year-olds | 0.426 | 0.389 | 0.315 | 0.461 | 0.443 | **0.730** |
| Life expectancy at birth | 0.704 | 0.554 | 0.538 | 0.694 | 0.741 | **0.933** |
| Physicians | 0.681 | 0.579 | 0.556 | 0.700 | 0.745 | **0.838** |
| Infant survival rate | 0.703 | 0.572 | 0.519 | 0.649 | 0.799 | **0.939** |

**Table 5 Goodness of fit**

| | GoF |
|---|---|
| Absolute | 0.615 |
| Relative | 0.880 |
| Outer model | 0.992 |
| Inner model | 0.887 |

## *11. Concluding remarks*

This paper introduces a model for the relations between institutions and human development. This subject has been widely treated in the literature on economic growth and development, and there is general agreement around the idea that human development and institutions are multidimensional and need to be defined as composite indicators. We take a further step in this direction and define all the main components of human development (Economic Development; Health, Knowledge) and of institutions (Economic, Political, Social Institutions) as unobservable, theoretical constructs (latent variables). Moreover, we define the relations between the components of human development and of institutions as a system of structural relations instead of defining a single regression model, as in most of the literature. Thus instead of having one single relation between a dependent variable *human development* and one or more independent variables *institutions*, we have a system of relations between several endogenous/dependent variables (the components of human development and some of the components of institutions). In fact we have a causal network (path model) in which only one variable – Economic Institutions – is defined as exogenous/independent.

The aim of our paper however, was to model the relations between different institutions and different components of human development. To do so we suggest the use of SEM – in particular of PLS-PM – and show that the whole procedure provides good results.

In fact having more than one endogenous theoretical latent construct, and more than one structural relation, the only possible statistical instrument is a structural equations model. The next choice that had to be made was between maximum-likelihood based estimation and "soft- modeling". Due to the uneven quality of our data soft

modeling seems a necessary choice; we thus resort to the estimation by means of a PLS path-model.

The estimated path coefficients and the model validation indicators besides showing a good fit for the overall model, clearly support our core assumptions:

i) that aggregate demand creates growth, in particular that what we have defined as Economic Institutions-lead to Economic Development;

ii) Economic Institutions positively affect Political and Social Institutions;

iii) Economic Development generates a parallel process of improvement of social conditions, determining Knowledge and Health.

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