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An empirical contribution to development theory: a covariance structure model for development as freedom

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AN EMPIRICAL CONTRIBUTION TO DEVELOPMENT THEORY: A COVARIANCE STRUCTURE MODEL FOR DEVELOPMENT AS FREEDOM

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Dedication

To all the people in the world who suffer from deprivation of freedoms

To my children, Pablo and Mateo, who are privileged with freedoms
To whom I hope to have planted the seed of equality of freedoms,

To my wife, Gloria,
Who I love so much,

To my father, Alfonso,
who has taught me to persevere, and to be disciplined,

To my mother, Hedda,
who taught me the value of unconditional love and humbleness,
and to respect every individual,

And to God,
Who has had the Benevolence of guiding me and
without Whom none of this would have been possible.

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS…… iii

ABSTRACT……. v

CHAPTER 1. INTRODUCTION…….. 1
1.1 Sen's Development Theory: Overview…….. 2
1.2 Research Questions and Relevance …… 4
1.3 Choice of Empirical Model……. 8

CHAPTER 2. SEN'S DEVELOPMENT THEORY……... 11
2.1 Neoclassical Theories of Growth…… 11
2.2 Sen's Critique to Neoclassical Theories of Growth……. 16
2.3 Generalities about Sen's Development Theory…… 19
2.4 Sen's Definition of Development……..……... 27
2.5 Sen's Development Theory……. 30
2.6 A Covariance Structure Model…… 37

CHAPTER 3. RESEARCH DESIGN……. 40
3.1 Research Design……. 40
3.2 Measurement Models……. 47
3.3 Covariance Structure Model..……. 61
3.4 Mathematical Formulation……..... 63
3.5 Dataset and Statistical Treatment…….. 66
3.6 Software Used……..... 73

CHAPTER 4. MODEL RESULTS……. 74
4.1 Measurement Models Results……. 74
4.2 Covariance Structure Models (CSM) Results…….. 79
4.3 Conclusions, Implications, and Recommendations……. 85

REFERENCES…… 90

APPENDIX A: CODEBOOK…… 96
APPENDIX B: DESCRIPTIVE STATISTICS…… 101
APPENDIX C: ANALYSIS OF COVARIANCE STRUCTURE……. 112
APPENDIX D: MATHEMATICAL FORMULATION…….. 123

VITA…….. 144

ABSTRACT

This Thesis work examines the empirical validity of Sen's development theory. In this Thesis, Sen's theoretical conceptualization of development is deconstructed into five core tenets on which his rests. These five pillars, which include the multi-dimensionality aspect and broadening of the informational basis of the concept of development, "freedoms are the primary end of development", the existence of a causal relationship between instrumental freedoms and capabilities, and between the institutional structure and development, and the existence of interlinkages between instrumental freedoms, are translated onto testable hypothesis which are incorporated into a 2nd order recursive Covariance Structure Model (CSM) that allows scientific examination through hypothesis testing. The CSM expands the application of the "capability approach" from a focus on the individual space to that of a society, suggesting the later not only as an appropriate unit of analysis, but also that evaluative assessments of "well-being" may have a potential benefit over the former. In addition, in contrast to the intense emphasis on the substantive freedoms aspect of Sen's theory given by the vast majority of the ongoing scholarly debate on this body of research, this particular work recovers from oblivion the critical relevance and importance of the institutional structure as a crucial building block of development. The CSM is applied over a broad informational basis covering 16 societal capabilities within economic, social, and political instrumental freedoms, and to a sample of 154 countries at all levels of income for the average period between 1990 and 1994. The results provide strong empirical evidence in support of Sen's "development as freedom" theory. The clear implication is that Sen's paradigm shift in development theory calls for a total rethinking on the socio-economic front of policy making and that, once and for all, academics in long-term growth, policy makers, and world financial institutions alike should seriously consider an in-depth review, if not totally abandon, the unidimensional dominant perspective that for far too long now has negatively impacted and slowed down economic growth around the world.

CHAPTER 1

INTRODUCTION

According to Sen (Sen, 2000) development is viewed as an integrated process aimed at the expansion of interconnected freedoms of people "to live the kind of lives they have reason to value"[1], where the expansion of freedoms is both the primary end and the principal means of development. A close analysis and examination of this theoretical conceptualization of development reveals fundamental hypothetical causal relationships between development and different kinds of freedoms that within this body of research still remain untested. The main purpose of this thesis is therefore two-fold. First, to elaborate and derive empirical implications from an in-depth examination of the complexities embedded in Sen's theory of development, as conceptualized in his "Development as Freedom". Second, to provide a firm empirical foundation by a 2nd order recursive covariance structure model (CSM), a proper model to test Sen's theory. The CSM model is utilized to test the major premises and pillars of his theory through the use of confirmatory factor analysis (CFA).

Development has been a major concern of scholarly research in different strands of the social sciences, such as economics, sociology, and political science. The many contributions provided by these different sub-fields of the social sciences and their respective relevance to development theory is fully recognized and a thorough review and analytic comparison of these would be desirable, but presenting an all encompassing synthesis of these goes beyond obvious time and space constraints. Even though it is not a deliberate intention to disregard such important contributions, this work shall circumscribe the discussion to contrasting development models as presented by researchers and analysts in the economics sub-field against the empirical evidence obtained from the work herein presented in support of Sen's theory of development.

[1] (Sen, 2000; p. 10)

1.1 Sen's Development Theory: Overview

Sen's theoretical conceptualization of development, labeled "the capability approach" (CA) (Robeyns, 2005) constitutes a paradigm shift in development theory. Economic theories of growth, which stem from the Harrod-Domar growth model (Harrod, 1939; Domar, 1947) and all of its subsequent derivations, utilize either the aggregate of gross domestic product (or its per capita equivalent) as the means to measure growth, whereas the "fundamental" independent variables used to explain growth in the long run (i.e. development) are "resource or commodity" type variables, i.e. capital, labor, and technology.

In stark contrast with the prominent place enjoyed by economic growth theories as the current dominant "conventional wisdom", Sen's development theory, provides a perspective to explaining and understanding development at a deeper and more foundational level, as it moves away from the utilization of "resource" type variables. Instead, Sen's conceptual approach to development utilizes two types of freedoms: instrumental and constitutive (substantive) freedoms. In Sen's capability approach both constitutive and instrumental "freedoms of individuals are the basic building blocks"[2] of development.

Constitutive freedoms "relate to the importance of substantive freedom in enriching human life."[3] Substantive freedoms (i.e. capabilities) are those that individuals, as agents seeking their overall well being, are able to derive or achieve as a result of the institutional framework in which they operate. In the "development as freedom" perspective, "the success of a society is to be evaluated, [ ] primarily by the substantive freedoms that members of the society enjoy."[4] In this freedom-centered agent-oriented perspective, Sen resorts to a circular epistemology of development:

[2] (Sen, 2000; p. 18).
[3] (Sen, 2000; p. 36).
[4] (Sen, 2000; p. 18).

the "[e]xpansion of freedom[s] is viewed, [ ] both as the primary end and as the principal means of development."[5]

These two dimensions of freedoms, instrumental and substantive, are crucially important to development. In this perspective, both are causally interconnected since "instrumental freedoms directly enhance the capabilities of people."[6] Sen defines capability as "the alternative combinations of functionings that are feasible for [a person] to achieve. Capability is thus a kind of freedom: the substantive freedom to achieve alternative functioning combinations"[7]

Instrumental freedoms are those that represent the institutional structure or arrangements that exist in a given society, since "our opportunities and prospects depend crucially on what institutions exist and how they function"[8]. Broadly conceived, they provide the opportunities for "people to lead the kind of lives they have reason to value."[9]

Another crucial aspect of Sen's conceptualization of development is the hypothesized interlinkages that exist between different kinds of instrumental freedoms: "instrumental freedoms [ ] supplement one another, and can furthermore reinforce one another."[10]

Transparent to the casual observer, is Sen's postulated causal relationship between the institutional structure that exists in a given society, as represented by the instrumental freedoms, and development. The importance of establishing the connection between development, instrumental freedoms, and ultimately the substantive freedoms (i.e. capabilities) that individuals accrue, goes directly to the core of the empirical CSM proposed in this Thesis work. A close examination and analysis of Sen's circular perspective to development reveals the presence of a causal mechanism between development and instrumental freedoms and between instrumental freedoms and substantive freedoms (i.e. capabilities), since "what people can positively achieve is influenced by

5 (Sen 2000; p. xii).
6 (Sen, 2000; p. 40).
7 (Sen, 2000; p. 75).
8 (Sen, 2000; p. 142).
9 (Sen, 2000, p. 10).
10 (Sen, 2000; p. 40).

economic opportunities, political liberties, [and] social powers"[11] all of which represent instrumental freedoms (i.e. institutional structure or arrangement).

In Sen's development perspective, the unit of analysis is clearly established as being the individual. To be sure, particular emphasis is given to the expansion of capabilities of persons and to the agency role of the individual as a [ ] participant in economic, social, and political actions."[12]

Sen' capability approach has been criticized for being to individualistic and for its failure to pay due attention to groups and social structures (Robeyns, 2005). In spite of the high emphasis placed in the theory to the individual as the unit of analysis, in empirical studies (Kuklys, 2005; Krishnakumar, 2007) researchers end up aggregating data and deriving implications about the theory at the individual level, risking "ecological fallacy" as pointed out by Lieberson (Lieberson, 1985), that is the incorrect use of "aggregate data to make inferences about individuals." But given that Sen's theory has general implications rather than "narrowly cast hypothesis"[13] and the above stated risk can be dismissed on such grounds. It might be worth to point out that the work presented in this Thesis suggests that yet another important application of the capability approach lies at the society levels as the unit of analysis. It is hereby submitted that evaluative analysis can be conducted at the societal level as an appropriate space for such analysis.

1.2 Research Questions and Relevance

The main aim of this thesis is to test the postulated core tenants and pillars of Sen's theory of development. A deconstruction of Sen's development theory leads to six core pillars on which this theory rests. These core tenets are translated into testable hypothesis and empirically examined. First, is it true that evaluative assessments of development require a broad perspective on the informational basis? Second, can it be scientifically proven that development is a multidimensional construct that involves economic, social, and political processes or aspects? Third, is the postulated

[11] (Sen, 2000; p. 5).
[12] (Sen, 2000; p. 19).
[13] King, *et. al.* (King, Keohane, Verba; 1994; p. 30).

causal relationship between instrumental freedoms and substantive freedoms (i.e. capabilities) and fourth, between the process of development and instrumental freedoms empirically supported? These two questions require to be addressed in a two-step approach (to be explained later). Fifth, the question of the interlinkages between freedoms of different types is addressed. Are these interlinkaged relationship between freedoms of different kinds supported by empirical data? The CSM model is modified to test the statistical validity of such interdependence.

In order to study, address, and determine the empirical validity of the aforementioned questions a 2nd order covariance structure model (CSM) is built and it incorporates the main aspects of Sen's conceptualization of development, including instrumental freedoms, indicators of capabilities, as well as their postulated causal relationships and interlinkages. The use of a 2nd order covariance structure model (CSM) along with confirmatory factor analysis (CFA) allows statistical significance testing of Sen's development theory core tenets.

The two-step approach referred to above, is as follows. In the first step, a CFA is conducted on a measurement model (MM) in order to test and provide statistical evidence that suggests that there exists a significant causal relationship between instrumental freedoms (i.e. institutional structures) and substantive freedoms (i.e. capabilities). In the second step, a structural equation model (SEM) tests the validity of the hypothesis that posits the existence of a causal relationship between "the expansion of freedoms" and development.

A review of the scholarly literature reveals that there exists no study that has attempted to empirically test the core tenets in which Sen's theory of development is founded. Empirical studies that have attempted to provide either evidence (or counterfactual evidence) in support or otherwise against Sen's development theory reveals the presence of some relevant work (Krishnakumar, 2007; Kuklys, 2005), but none with the scope and reach of the work hereby presented. This thesis work intends to at least partly cover this lacuna in this body of research.

Empirical tests of Sen's theory have been conducted but none have had the comprehensive reach this thesis attempts to attain. The vast majority have focused on measuring functionings (see for example Kuklys, 2005; Klasen, 2000; Chiappero Martinetti, 2000; etc.). Kuklys provides a comprehensive summary table of empirical studies in this area. These studies are limited in their scope not only as it relates to the number of countries covered but also to the number of functionings. For instance, Sen's own (Sen, 1985) includes five countries, and Klasen includes the highest number of functionings (with a total of fourteen functionings) but for one country only (South Africa) (Klasen, 2000).

The one study that closely resembles this Thesis work in its reach is Krishnakumar econometric model (Krishnakumar, 2007). But Krishnakumar's study remains limited to the social and political dimensions of development within a sample of 56 middle and low income countries. In contrast this Thesis expands the application of the "capability approach" to the economic, social, and political dimensions of development while applying it to a sample of 154 countries including high, middle, and low income countries[14]. The use of a larger sample, which includes all levels of income, further enhances the applicability range of the theory, while dismissing up-front any potential issues regarding its applicability to high income level countries, while avoiding selection bias.[15]

If a series of tests generate solid empirical foundation in support of Sen's theoretical conceptualization of development, the direct scientific inference is that his theory provides not only a more fundamental explanation, but also a more in-depth and profound understanding of the process of development than that so far reached by neoclassical and endogenous growth models of economic growth.

[14] A more detailed critique of Krishnakumar empirical study is presented in Chapter 2.
[15] As recommended by King, *et. al.* (King, Keohane, Verba; 1994).

Not discounting the important contributions by the aforementioned empirical studies and those of others related to Sen's "capability approach", this Thesis provides a well rounded and sound empirical contribution among other advantages over previous studies to the advancement of Sen's development theory[16]. On the other hand, it is fully recognized that this is a first and crude attempt to synthesize the many aspects of a complex theory, and that much more empirical research work remains ahead. The model hereby proposed simplifies, to the extent possible, the many complexities of Sen' theory of development. It is hoped that this work will become a stepping stone for future research and that the findings hereby presented will help researchers to elaborate and further develop the required empirical soundness and robustness of Sen's theory of "development as freedom."

The implications of the empirical evidence hereby presented in support of Sen's theoretical conceptualization of development must not be underestimated. Customarily in Comparative Political Economy, the questions researchers address are of "vital interest to the world we live in." (Laitin, 2002). This work hopes to be no exception to this rule. Answering the posited questions at the beginning of this section, accurately and appropriately, is of the up-most importance and the purposes and benefits of such an endeavor are many fold. First, in academia, it will allow gaining a more in-depth and fundamental understanding of the process of development. Current theory which enjoy "conventional wisdom" status may need to be thoroughly reviewed or abandoned. Second, in policy making, because of the short and long term implications a more fundamental understanding of the process of development would have in changing the approach, views, and development policies followed, and implemented not only by developed societies, but most importantly, by international governmental and non-governmental organizations, who at times have forced inadequate structural reform policies to developing countries' governments. Just as theories of economic growth have shifted their focus from national wealth to the efficient allocation of

[16] As recommended by King, *et. al.* (King, Keohane, Verba; 1994).

resources a guided by margins (Peet, 1999), it is expected that Sen's paradigm shift will guide development policy makers in the years to come. Third, the design of new policies that account for this new fundamental understanding of development will not be inconsequential. If Sen's paradigm shift in development theory gains a strength and succeeds in replacing conventional wisdom neoclassical economic growth theories, it will then be expected that this theory will affect "political, social, and economic life, [as well as] shall have profound impact to many peoples lives" as recommende by Shively (Shively, 1990).

1.3 Choice of Empirical Model

Sen's theoretical conceptualization of development entails both theoretical constructs that cannot be directly measured as well as observed variables that are directly measured. For instance, development is a multidimensional theoretical construct which can only be indirectly measured by the societal outcomes we observe. Similarly, instrumental freedoms, which represent the institutional structures that prevail in a given society, are theoretical constructs which cannot be directly measured. In addition, some scholars even regard functionings as being unobserved variables, that is variables that cannot be directly measured (Kuklys, 2005). Theoretical constructs which cannot be directly measured are also called latent variables. Statistical techniques based on regression analysis are not only incapable to dealing with latent variables, but they are also not suited to test the validity of the causal relationship between a set of measured variables and the latent variables that are postulated to explain the (observed) measured variables. Covariance structure analysis (CSA) is a statistical method that can appropriately deal not only with the nature of the variables involved but also the technique that allows a rigorous testing of the causal relationship established in Sen' theoretical conceptualization of development.

Covariance structure modeling (CSM) emerged as an outgrowth of mainly factor analysis and path analysis (Bollen, Kenneth A.; 1989). It is a powerful, generalized, and comprehensive statistically-based tool that allows studying and establishing the existence of causal relationships by

testing the statistical validity and significance of the postulated relationships between measured and latent (non-measurable) variables, through the use of confirmatory factor analysis (CFA). It also extends the more limited approach originally provided by factor analysis and/or path analysis, in that these techniques did not had the ability of hypothesis testing, since they used what is now called exploratory factor analysis (EFA). In short, the CSM provides the ability of hypothesis testing, that is, the capability of establishing statistical significance to the presumed causality linkage between measured and latent (non-measurable) variables.

By latent variables we understand those variables which cannot be directly measured, and which are hypothesized to being casually linked, related, and/or explain the behavior and existing variance and covariance of other directly measured variables. A latent variable may represent an abstract concept, a construct, or a structured organization, of which we know its existence, but which defies being directly measured.

So, which are these latent variables? In order to build the CSM for development several constitutive properties or aspects of Sen's "development as freedom" perspective are utilized. There are at a minimum five seemingly important aspects in Sen's theoretical conceptualization of development as it relates to freedoms which are critical in building the CSM hereby proposed. The details of these aspects shall be saved for a later chapter, but identification of these important aspects in Sen's theoretical conceptualization of development was critical in establishing the proposed model. It is precisely a feature of a CSM, unique among any other statistical techniques, that allows not only to uncover the hypothesized latent variables postulated to being causally related to the measured variables they seek to explain, but also its capability to statistically test the validity of such hypothesized theoretical causational relationship. In this Thesis the measured variables are indicators of societal capabilities. The latent variables are the endogeneous instrumental freedoms, representing the economic, social, political, welfare, and legal / justice institutional arrangements). The exogenous latent variable is development. According to Sen's development theory, there exists

a causal relationship between instrumental freedoms and substantive freedoms (i.e societal capabilities) and between development and instrumental freedoms.

The application of analysis of covariance structure analysis to Sen's conceptualization of development has been very limited. A very small number of empirical studies have used this technique. In addition their breath of scope has been somewhat smaller in their coverage. This Thesis attempts to capture within the CSM the core tenets of Sen' theory while selectively disregarding other aspects covered in previous empirical studies.

This Thesis is organized as follows. Chapter 2 provides a broad overview of neoclassical theories of long-term growth followed by Sen's critique to these models. Next, Sen's definition of development is provided, followed by an in-depth review of Sen's theoretical core tenets of development. This will allow the de-construction of Sen's development theory into testable hypothesis to be included in the CSM. Chapter 3 examines issues regarding research design. How each of the models, the MM and the SEM, were built, along with a justification for the selection of measured indicators of capabilities, and how these two models were combined to yield the CSM. Issues relevant to analysis of covariance structure are also discussed in this chapter along with issues related to the statistical treatment of the dataset. A summarized review of the mathematical formulation of each part of the model is also presented. Finally Chapter 4 discusses the results and an analysis of the implications derived from them. A description of the measured variables used in the MM is presented in the Codebook, included in Appendix A, while Appendix B covers in more detail descriptive statistics. Appendix C provides further historical background and details on factor analysis and analysis of covariance structures. Also, a more detailed presentation of the mathematical equations behind the covariance structure model is presented in Appendix D.

CHAPTER 2

SEN'S DEVELOPMENT THEORY

This Chapter's focus is to provide an in depth review of Sen's theory of development ("development as freedom") as well as an examination of its postulated core tenets, which in turn will allow an opportunity to summarily introduce the major hypothesis the CSM will empirically test. The purpose of such an examination will be undermined if Sen's theory is not contrasted first against neoclassical theories of economic growth.

2.1 Neoclassical Theories of Growth

Economic growth theories have enjoyed a dominant place in the theory of development and their models have been the most influential. Evidence of their influence is really two-fold. First, in the realm of social and economic policy, economic theories of growth have been used not only by governments around the world but also by world financial institutions and organizations. These models have been used to determine the most appropriate and effective strategies, economic policies, and reform programs to both revitalize growth. Their theoretical conceptualization has served as a guidance framework in the decision-making process leading to the provision of economic assistance in the form of multi-billion dollar loans to Third World countries. Based on these economic theories of growth, international organizations' assessments on the effectiveness of such policies and programs have relied, most often if not always, in unidimensional indicators such as real GDP growth or income per capita growth, as the one an only single indicator of a country's progress towards development. Second, in the academic field, many researchers and analysts have based their studies and conclusions on a narrow comparative informational basis, hinged on either income per capita or gross domestic product growth, as dictated by the conventional wisdom advanced by the neocalssical school of thought.

Models of economic growth, as advanced by neoclassical theories, have been concerned with understanding and trying to explain "the way economies actually grow over time" (Hahn and Mathews, 1964), with a major focus on capital accumulation (Helpman, 1992)

A review of the scholarly literature on the determinants of growth and welfare economics reveals that the main concern has been on the supply side (Stern, 1991) as evidenced by the utilization of "resource" type variables as factors of production (i.e. the accumulation of capital, technological advance, and population growth) as the fundamental causal variables that explain long-term growth. Progressively, these factors of production have been the focus of growth theories, starting with the accumulation of capital (Harrod, 1939; Domar, 1947), the inclusion of labor and population growth (Solow, 1956); and finally technological progress (Romer, 1986; Romer, 1989; Romer, 1990; Romer, 1994).

The genesis of modern neoclassical economic models of growth may be traced back to the Harrod-Domar growth model[17] (Hahn and Mathews, 1964). Simply put, in this model, an economy's rate of growth, measured as either real GDP growth or real income per capita growth, is a direct function of the rate of investment in new capital stock and the capital to output ratio. According to this theory's perspective, the greater the savings the greater the rate of growth. The Harrod-Domar model assumed constant returns to scale, no technical progress, and the capital to output ratio to be constant. The latter, a weak assumption at best, opened the door for further refinement.

The refinement came in the form of what is now known as the Solow Growth Model, the seminal contribution to neoclassical economic growth theory (Solow, 1956), who expanded on the Harrod-Domar model. Overarching assumptions used in Solow's growth model were constant returns to scale and the feasibility of only one unique equilibrium point.

[17] Also know as the AK model, where output is a formulated as a function of capital stock K and a constant A (Todaro and Smith, 2009).

Premised in the simple constant returns to scale Cobb-Douglas production function, the formulation of this theory comes in the form of an aggregate production function, where the assumption of constant capital to output ratio is relaxed by including technology, and a third factor is added into the equation, that of labor. Under this framework, Solow's growth model hypothesizes that economic growth stems from increases in capital stock, labor force, and technology. In his analysis, Solow concludes that, under the assumptions of constant returns to scale, no technical progress, and an exogenous labor supply, an increase in savings rate will only increase the rate of growth in the short run, taking the economy to a new equilibrium point after the capital-labor ratio and output-labor ratios are adjusted. According to his model, in the long run, the determinant of growth is labor force growth.

Empirical support for Solow's growth model theory was presented by Solow himself (Solow, 1957) and by Mankiw and Romer (Mankiw and Romer, 1992), but the results were dismal at best. It soon became evident that neoclassical theories of growth had too many limitations and weak assumptions at best.

One such limitation was its explanatory capability. In spite of the popularity the Solow's growth model gained, as it turns out, the non-systematic, residual, unexplained, or exogenously determined rate of historical growth in industrialized nations accounted to roughly 50% of the variation in the rate of growth, the so called "Solow Residual" (Stern, 1991; Todaro and Smith, 2009). Another inadequacy that has clearly emerged after a few decades has been a dismal negligible guarantee at best that, in the long run, destitution and hunger could be eliminated (Dreze and Sen, 1990). Despite the relative progress made so far, the consensus is that neoclassical economic theories of growth had "led to only limited advancement in understanding" the fundamental causes of the rate of growth i.e. development (Stern, 1991). Lastly, another important said limitation hinges on what can be called a "reductionist approach", taken by this school of thought, to the view of what constitutes development.

Indeed, economists have for long portrayed development as a concept of mere growth in aggregate production as their economic growth models main's focus of analysis and emphasis is directed to explaining either gross domestic product or income per capita as the main dependent indicator utilized in their evaluative assessment of long term growth.

It was the lack of explanatory capability the major driving force that may have led economic growth scholars to recognize that a few of the most important assumptions of the neoclassical growth models are hardly ever met. It is this how a new wave of scholars (Romer, 1986; Lucas, 1988) augmented their efforts on developing a new theory, which came to be known as Endogenous Growth Theories.

Endogenous growth theories go beyond the assumptions made in the neoclassical economic development framework. One of the major changes in the assumptions made was the "departure from the usual assumption of diminishing returns" (Romer, 1986, p. 1003) to capital investments. Its main distinction is that economic growth is not the result of external forces; it is internally (endogenously) generated (Romer, 1994) by technology improvements. Scholars in the endogenous growth vein strongly question three of the main tenets of neoclassical economic growth models: the assumption of perfect markets, the treating of externalities as ineffectual, and lastly, the existence of a unique optimal equilibrium as feasible. Based on the existence of an S-shaped privately rational decision function, well thought out government economic coordination policies can potentially improve development outcomes from a less productive to a more productive equilibrium by affecting the expectations of firms. Such strategic coordination trumps markets failures and development traps. Hence, endogenous growth theory suggests that an active participation of public policies to promote growth through coordinated public and private investments in knowledge-intensive sectors. Unfortunately, empirical analysis based on endogenous growth failed to explain growth (Pack, 1994).

Even though Endogenous Growth Theory represents an important departure from mainstream neoclassical economic growth theory, nonetheless it still remains dependent on a number of assumptions and limitations (Todaro and Smith, 2009) that are common to both and that not only impair an effective assessment of growth policies and structural reforms, but often times, continues to incorrectly direct scarce resource and efforts into such ineffective programs and reforms. It is precisely a lack of meaningful and in depth understanding of the process of development, which has ultimately translated into the formulation of models which utilize non-truly fundamental variables to explain growth or development. These moderately poor results in explaining long term development suggest that an in-depth revision at a truly fundamental level is in dire need.

In academia, the implications of neoclassical theories of growth and its reductionist approach to development as proposed by the neoclassical school of thought, viewing it solely as income per capita growth, have not been inconsequential. Long run economic growth theories have transgressed the fuzzy boundaries between different sub-disciplines of other social sciences, severely influencing their analysis and conclusions. For instance, in the field of Political Science, a vast majority of research studies and programs in the sub-field of comparative politics, as applied to political economy, have relied on utilizing a single indicator, such as real GDP growth or income per capita growth, to test their hypothesis and derive their conclusions. A few examples will suffice to illustrate such marked influence.

For instance, Garrett examines the effect of globalization i.e. the integration of national economies into international markets, on macroeconomic performance, based on comparing gross domestic product growth, inflation and unemployment (Garrett, 1998). A second example can be found on Przeworski et al. (Przeworski, et. al., 2000). He examines the relationship between democracy and development based on per capita income. Lastly, in the rather new scholarly debate on varieties of capitalism (Hall and Soskice, 2001), this body of research contends that even though

profound institutional structures differences exist between different types of political economies, i.e. coordinated market economies (CME's) and liberal market economies (LME's), the latter can "secure levels of overall economic performance as high as those of CME's"[18], as assessed in terms of economic growth based on real income per capita growth (Hall and Gingerich, 2004). It is certain that an examination of the analysis of the scholarly literature in this field in light of Sen's development theory will bring about completely different conclusions.

Such limited perspective provides not only a huge opportunity for an in-depth revision of economic theories of growth but also calls for a revision of all those studies in comparative political economy which follow the lineage dictated by the neoclassical school of thought. Sen's development theory not only broadens the informational basis on which evaluative assessments need to be conducted, but also looks deeper into the fundamental determinants that cause development . Let's now proceed to examine Sen's conceptualization of development.

2.2 Sen's Critique to Neoclassical Theories of Growth

The rather dismal outcomes as a result of the application of policies ensued from current theories of economic development may suggest that the issue at hand with these theories may be at a minimum two-fold. The first one relates to the intrinsically flawed breadth of the informational basis contained in welfarist theories of economic growth. The second one, undoubtedly more important at the fundamental level, goes to the core of the philosophy of scientific theory development, and more specifically to scientific realism (Lane, 1996). It relates to the use of questionable fundamental variables to explain development. The current neoclassical school of thought is supported on "resource" type variables, as the independent variables that explain economic growth.

Indeed, the most cogent, structured, broader critique and profound revision to economic models of growth (i.e. development) comes from economist and philosopher Nobel Laureate

[18] Hall and Soskice, 2001, p. 27

Amartya Sen. The main overarching criticism highlighted by Sen in his theoretical conceptualization of development to neoclassical economics and endogenous theories of growth is two fold.

First, Sen (Sen, 2000) contends that the narrowing of the concept of development to a single indicator is one of the main deficiencies of neoclassical economic theories of growth. The issue at hand is one of scope of the informational basis, as aforementioned. Neoclassical economic and endogenous growth theories rely on a very narrow definition of growth, limiting the analysis to studying the effect on only one dependent variable, mainly income per capita or gross national product, as a reliable indicator of growth performance.

It is precisely this criticism the one factor that has hindered theories of (economic) growth, and which accounts for flawed assessments of not only growth (development) performance, but also of a vast array of past and current comparative political economy studies present in the scholarly literature. Broadening the informational basis on which to assess development, by not circumscribing it only to growth as understood by neoclassical economics (i.e. income per capita or GDP), allows for a much more comprehensive assessment as to not only what development strategies work, but also, for a much more fair evaluation of policies and institutional structures needed for advancing development, specially in developing countries. For instance, being unemployed does not only mean loss of income. There are a number of other related negative impacts such as "psychological harm, loss of [ ] motivation, skills, and self confidence, increase in ailments and morbidity, disruption of family relations and social life," etc.[19] Similarly, such broadening of the informational basis from income to Sen's theoretical framework of development enables a far deeper "understanding of inequality and poverty in quite radical ways." [20]

The "conventional wisdom" narrow perspective on development has also severely hampered specifically developing countries and world financial organizations' policies and programs mainly

[19] Sen (2000, p. 94)
[20] Sen (2000, p. 97)

because it mistakenly directs them to the inappropriate utilization of scarce financial and economic resources. In addition, in academia, it has severely biased a huge body of scholarly research work imparting on it a narrow focus which has for decades hampered the true understanding of the mechanisms and effects underlying important processes and phenomena.

The second, and most important criticism from a theoretical stand point of view, is that, even though the proposed neoclassical economic growth theories causal model has been proven to provide some limited explanation and forecasting power, the independent variables used, capital stock, labor force, and technology, are not necessarily fundamental variables.

In Sen's theoretical conceptualization of development, the emphasis is re-directed from a focus on material or "resource" type variables (i.e. capital stock, labor, and technology) to a more fundamental understanding of the determinants of development. In his view, development is seen as "the process of expanding human freedoms" (Sen, 2000; p. 36). It is to be understood that Sen's conceptualization is one of a "freedom-centered understanding … of the process of development" (Sen, 2000; p. 11). The freedoms that Sen refers to include those such as freedom from poverty, freedom from hunger, freedom from lack of shelter and health insurance, freedom to enjoy clean water and sanitary facilities, freedom from poor economic opportunities, freedom from a repressive state, etc.

The above discourse suggests that Sen's theoretical conceptualization of development calls for an in depth re-thinking, a paradigm shift, of what the economic scholarly literature understands of the process of development, based both on the scope of the informational basis and at the theoretical fundamental level, as it seeks to explain the foundational causal relationship between freedoms, as the fundamental variables, their effect on capabilities, and development.

Next, let's proceed to succinctly present a few general issues of Sen's theory of development. This shall certainly provide an introduction to the fundamental bases on which the covariance structure model (CSM) to be presented and explained in detail in Chapter 3, will be premised.

2.3 Generalities about Sen's Development Theory

In the scholarly research literature, Sen's theory is discussed under the rubric of the "capability approach" (CA). The capability approach has been defined as a "broad normative framework for the evaluation and assessment of individual well-being and social arrangement, the design of policies, and proposals about social change in society." (Robeyns, 2005).

Sen's capability approach has undergone a process of evolution and transformation during a period of nearly three decades. Its' origins date back to the early 1980's with a series of publications over nearly twenty years of work (Sen, 1980, 1984, 1985a, 1985b, 1987, 1990b, 1992, 1993). During the early stages, Sen's theory presented an alternative approach "in socio-economic valuation" to those utilized by economists such as the measure of income or expenditure, or to utilitarians, such as satisfaction (Gasper, 2007). Later on, it became an economic theory of development, with the publishing of his seminal work "Development as Freedom" (Sen, 1999).

To be fair, Sen's theory is not only a theory of development, but a theory of social justice, that presents a "philosophical alternative to [ ] utilitarianism, which underpins much of [neoclassical] economic[ ]" (Stewart and Deneulin, 2002) theories, or even to Rawlsian justice theory (Rawls, 1971).

An important aspect of Sen's "capability approach" relies on its philosophical roots, which can be traced back to Aristotle, Adam Smith, and Karl Marx, as reflected in his writings. Such aspect could not be left without further investigation and hence, Sen set out to encompass his theory within a wider framework, thus evolving into a theory of social justice (Sen, 2009), classified within the liberal school of thought in the realm of political philosophy (Robeyns, 2005). This philosophical aspect of Sen's theory has been a major focus of interest and therefore an ongoing

vibrant debate between different schools of thought maps the scholarly literature in this area (Berges, 2007; Dowding, 2006; Kaufman, 2006; Jaggar, 2006; Reader, 2006; Robeyns, 2006)[21].

Leaving aside Sen's social justice theoretical aspects, there are four important aspects of Sen's theory of development, as it is currently being discussed in the scholarly literature, that needs to be brought up to the front of the discussion. The first one relates to the almost negligible attention given to instrumental freedoms. Sen's conceptualization of development considers two types of freedoms as aforementioned: instrumental and substantive. The vast majority of the scholarly literature reflects on either the capability aspects (i.e. as in substantive freedoms) or on the realized functionings; thus the rubric under which it is mostly known and referred to (i.e. as the capability approach). Sen argues that the appropriate space for assessment of well-being is that of substantive freedoms (i.e. capability set) or on the realized functionings. He also invariable refers to his approach as a "freedom-based perspective or approach"[22] or "freedom-centered understanding of economics and of the process of development"[23]. It is therefore not surprising that a vast majority of the scholarly literature discusses and focuses mostly on issues related to capabilities and its' realized or achieved functionings (Robeyns, 2005, 2006; Gasper, 2007; Flauerbaey, 2006; Alkire, 2005, 2008), while none take into consideration the critical relevance of instrumental freedoms that give rise to substantive freedoms and ultimately to realized functionings.

This alleged emphasis by the scholarly literature on capabilities[24] (as in substantive capabilities) and functionings has strangely left, it is argued here, a largely unaddressed void at the forefront of the scholarly literature as it relates to Sen's theory of development, in particular on the aspect of instrumental or process freedoms. So it is one of the goals of this thesis to include in the construction of the CSM relevant instrumental freedoms and test the validity of the causal

[21] In this thesis work, this nonetheless very important aspect of Sen's theory, is totally left aside since it is not the obvious focus of this work.
[22] (Sen, 2000, p. 24, 28, 30, 86).
[23] (Sen, 2000; p. 11).
[24] This bias has also been identified by Alkire (Alkire, 2005)

mechanism between instrumental freedoms and substantive freedoms. Hence, contrary to the large body of scholarly research, in this Thesis it is contended that both (i.e. instrumental and substantive freedoms) are inseparable and equally relevant, since they are core inseparable pillars of Sen's theoretical conceptualization of development. One cannot be without the other since Sen hypothesized the existence of a causal mechanism between these two.

The current label "capability approach" it is hereby suggested, might be a consequence of the lack of attention to instrumental freedoms and maybe therefore to some extent inadequate, as has already been suggested by various analysts elsewhere explicitly (Segal, 1998), and implicitly (Gasper, 2007), as it surreptitiously removes from center stage the critical aspect and role that instrumental freedoms have in development. It would therefore not be inadequate to modestly submit that a more appropriate label, if any is to be applied to Sen's development theory, should rbe the "freedom-capability approach" (freedom as in instrumental freedom). This proposed label would better capture the bi-dimensional nature (the constitutive and the instrumental role of freedoms in this view of development) of the causal mechanism that explains the relationship that exists, as hypothesized by Sen, between these two constructs and development.

The second issue that requires some attention is the issue of underspecification, closely related to the mechanics of valuation assessments. Critics and analysts in this body of research have further elaborated on this underspecification issue (Robeyns, 2005, 2006; Fleurbaey, 2006; Gasper, 2007; Alkire, 2008) and have rightly pointed out that that valuation assessments based on Sen's conceptualization were left underspecified and with a taste of vagueness. Three theoretical specification deficiencies have been identified. Sen did refer to these matters, but refrained from clearly defining them. His discourse emphasized that these were to be defined by democratic discussions and "reasoned consensus".[25] His argument in favor of political freedoms acted as a deterrent against explicitness: "one of the strongest arguments in favor of political freedoms lies

[25] (Sen, 2000, p.78).

precisely in the opportunity it gives citizens to discuss and debate – and to participate in the selection of – values in the choice of priorities." [26] (see also Sen, 1996).

First is the underspecification aspect related to the choice of which is to be measured, capabilities, or functionings, or both a discussed above; secondly, the selection of relevant capabilities, and thirdly, the issue of how relative weights are to be given to functionings for aggregation (Robeyns, 2006). Furthermore, some analysts contend that Sen made "individual freedoms and capabilities (as in substantive freedoms) the one relevant space for evaluation of quality life" (Stewart and Deneulin, 2002) and not that of achieved functionings.

To address the third aspect, related to the relative weights of capabilities, the statistical technique utilized in this thesis work, that of covariance structure analysis, alleviates the researcher responsibility from subjectively having to specify them: the structural regression coefficients of factor loadings will inform not only what their relative weights are but it will also determine the statistical validity of their causal relationship. This is and added advantage which cannot be obtained with exploratory factor analysis. It also addresses the potential misunderstanding that seems to exist (Robeyns, 2006; Alkire, 2005) with respect to exploratory factor analysis and the capability of this statistical technique in helping to elucidate the alluded portrayed underspecification related to the selection of functionings or substantive freedoms in making development assessments. Only confirmatory factor analysis has the capability of hypothesis testing causal relationships between latent (i.e. instrumental freedoms) and observed (measured) variables such as functionings. Exploratory factor analysis does not have the capability of hypothesis testing and therefore cannot validate the existence of a casual relationship between latent variables and measured variables.

The capability approach has been applied in many different ways as discussed in Robeyns (2006). Conducting general assessments of development of a country is one among the nine different themes that the capability approach has covered. The major focus on this area has been

[26] (Sen, 2000, p.30).

the development of a Human Development Index as proposed by Mahbub ul Haq (as pointed out in Krishnakumar, 2007) and its expansions (Ranis, et. al., 2006), inspired on Sen's work and his collaborators. The United Nation Development Program adopted Sen's capability approach and has been issuing a report based on such constructed index since 1990.

The third critical issue that needs discussion is the different interpretation to the type of variables that functionings and capabilities are supposed to represent. In her empirical study, Kuklys (Kuklys, 2005) treats functionings as latent variables while Krishnakumar (Krishnakumar, 2007) treats functionings as directly measured variables. The question is how could such dissimilar interpretation arise? Is one correct and the other mistaken? Could both be correct? Is it Sen's definition of functioning somehow ambiguous or lend to a soft interpretation? Strictly following Sen's own definition of functionings[27], one might think that functionings are observed and therefore directly measured variables. This is merely a simple observation, and this Thesis leaves this question un-answered, rather than attempting to provide an answer. But following the same ambiguous process leads to propose that substantial freedoms (i.e. capability or capability set) might also be treated indifferently. The scholarly literature reviewed indicates that such is the case. In her empirical analysis Kuklys (Kuklys, 2005) treats capability sets as measured variables, while Krishnakumar (Krishnakumar, 2007) treats them as latent variables. In conclusion, it may seem that in the scholarly literature there is a lack of a solid established definition as to the type of variables that both functioning and capabilities (i.e. substantive freedoms) represent, and either can be invariably treated as latent or directly measured variables.

The fourth critical observation is potentially more profound than the previous ones, and it relates to what really a person's capability or capability set is or represents. According to Sen's definition, a person's capability refers to the "alternative combinations of functionings that are

[27] Sen provided the preface to Kuklys published book, whereas Krishnakumar research paper was presented at the 3rd International Conference on the Capability Approach.

feasible for her to achieve."[28] In her empirical study Kuklys (Kuklys, 2005) treats a capability set in accordance with Sen's definition. Krishnakumar treats capabilities as a latent variable devoid of any attachment to "alternative combination of functionings." The same questions as indicated above can be raised. Which of the two approaches is correct? Could both be correct? Is Sen's definition somehow ambiguous? This is merely a simple observation, and this Thesis leaves this question un-answered, rather than attempting to provide a firm answer.

This thesis uses a capability set in the social space as a combination of directly measured achieved functionings (where the selection of the preferred alternative has already taken place).

Before immersing in describing the core pillars in which Sen's development theory rests, the following example (Sen, 1994, Robeyns, 2005) will help put this theory's description and its associated terminology in perspective.[29]

A person wants to ride a bicycle. In order to do so, first there needs to be a bicycle (commodity). Second, he/she needs to either have innate ability or need to have acquired a set of abilities. Some of these abilities are innate or natural[30], meaning that she / he naturally acquired, or were internally developed through life experiences, as the individual was growing-up, or as a naturally occurring process, such as his intelligence, mental ability to concentrate, a coordinated body in addition to healthy senses (i.e. visual, hearing) plus the physical strength pre-disposition and physical ability to balance his / her weight while riding, and finally why not, his / her spiritual awareness about his / her surrounding environment and other beings. These abilities will be referred to as the "innate or personal conversion factors" (Robeyns, 2005).

In regards to acquired individual abilities, for instance, he/she might have attended some formal or informal training. These acquired abilities are referred herein as "external conversion

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[28] (Sen, 2000; p. 75).

[29] This example has been taken from Robeyns (2005), but it has been expanded and somewhat adapted to facilitate the readers' understanding of Sen's main theoretical terminology and concepts.

[30] See also Kuklys (Kuklys, 2005, p. 33), and as implied in Gasper analysis (Gasper, 2007)

factors". The combination of internal (or innate) and external conversion factors constitute what is in generally referred to as an individual's personal conversion factors[31]. Hence, it is hereby suggested that personal conversion factors[32] are constituted from two distinct building blocks: externally occurring or acquired abilities, and internal or innate occurring i.e. internal make-up of the individual.

An individual's personal conversion factors enable the generation of a capability set, which as defined by Sen, is the "alternative combination of functionings that are feasible for her to achieve."[33] The capability set represents an individual's freedoms to achieve "the life one has reason to value."[34]

Now' let's focus on a different aspect of this example. It was mentioned above the formal or informal training to properly being able to ride a bicycle. This formal or informal training may have been facilitated by an institutional educational structure already established by the society to which this individual belongs. There also needs to exist an adequate physical (roads) and (regulatory) infrastructure that would facilitate and enhance bicycle traffic in a safely manner, with regulations, licensing permits, and signage, etc. The overall infrastructure required to be able to support and facilitate bicycle traffic reflects the set of "instrumental freedoms" necessary to facilitate and enable such activity. Without this infrastructure (i.e. instrumental freedoms) bicycle riding would not be feasible.

All together this educational, physical, and regulatory infrastructure required for a safe and efficient bicycle transportation system represents the "instrumental freedoms" (i.e. the institutional structure) that enable such transport system to function.

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[31] In his "Development as Freedom" Sen does not make reference to conversion set(s) and to how it is constituted, even though he acknowledge it existence (see p. 74, where he refer to them as "the personal characteristics"). This may have come about as a further theory refinement from his collaborators.

[32] In addition to personal conversion factor Robeyns (Robeyns, 2005; p. 99) refers to social and environmental conversion factors. These are also important, but are hereby not discussed.

[33] (Sen, 2000, p. 75).

[34] (Sen, 2000, p. 74).

Now let's assume that the individual also has at his disposal the ability to walk, to take a bus, a train, and to drive a car. All three transport systems are also supported by an existing educational, physical, and regulatory institutional infrastructure. When we look at all four transport systems, we can assert that the individual has a transportation capability set from where he can choose the one that he values the most, responding to his agency. This constitutes an individual's capability set or his substantive freedoms, as it relates to a transportaion system.

Say that he/she decides to ride the bicycle. This decision might be based on his /her preference for exercising, considerations for carbon emission footprint, available money for gas, etc. The act of being able to ride the bicycle is a "functioning" or a realized achievement. A functioning is a realized capability. As indicated above, individuals act as their own agent and take decisions based on what they "have reason to value". In hindsight, a functioning is an activity that an individual values and therefore wants to be able to achieve; in Sen's words, functionings "reflect the various things a person may value doing or being." [35] An individual's capability or capability set refers to the "substantive freedom[s]" that allow[s] an "alternative combination of functionings that are feasible [for an individual] to achieve." [36] Hence capabilities are therefore equivalent to substantive freedoms.

The above defines the distinct blocks that constitute the interconnected building blocks, mainly, instrumental freedoms, substantive freedoms or capabilities, and functionings, on which Sen's theory of development rests. The other crucial piece is how these blocks are put together. On this regard, and briefly, in his theoretical conceptualization, Sen established explicitly or implicitly, a serial of causal links between these building blocks of development, as follows.

First, instrumental freedoms "help to advance the general capability of a person."[37] From this statement one may infer that substantive freedoms (i.e. capabilities) are derived, at least partially,

[35] (Sen, 1999, p. 75).
[36] (Sen, 1999; p. 75).
[37] (Sen, 1999; p. 10).

from instrumental freedoms. This is confirmed in Sen's statement: "Individual capabilities crucially depend on, [ ], economic, social, and political arrangements" [38] (i.e. institutional structure). This process may occur through the use of the conversion set aforementioned. The link between functionings and capability set is implicitly embedded in Sen's definition of capability as "the alternative combinations of functionings that are feasible for her to achieve."[39] Simply put, a functioning, which is an achieved outcome (i.e. an achievement), is derived through a person's agency on the set of capabilities at his disposal.

The above example should have clearly defined the framework of Sen's conceptualization of development. Presumably, it also helps to understand why it is being referred to and discussed, in the scholarly literature, as the "capability approach" (Roybens, 2005 and 2006; D'Agata, 2007; Krishnakumar, 2007; Gasper, 2007).

At this point it is pertinent to introduce the reader to Sen's formal definition of development. The next section will focus on the main aspects and foundational elements of Sen's theoretical conceptualization of development.

2.4 Sen's Definition of Development

Before we submerge into the details of Sen's theoretical conceptualization of development it is necessary to provide a full and detailed definition of development as provided by Sen, following the suggested approach by Bollen (Bollen, 1989, p. 180), and as implied by Schumacker and Lomax (Schumacker and Lomax, 2004; p. 252).

Sen clearly stated a definition for development. His definition is provided in two separate statements: The first one is: "[D]evelopment [is seen] as an integrated process of expansion of [ ]

[38] (Sen, 1999; p. 53)
[39] (Sen, 1999; p. 75)

freedoms that connect with one another."[40, 41] Secondly, "In this approach, expansion of freedoms is viewed as both: (1) the primary end and (2) the principal means of development".[42]

A close analysis of this definition is necessary, in order to fully capture its meaning and reach. In addition, an analysis may in turn provide a complimentary clarification.

An Integrated process

Development is a multi-dimensional process which requires the analysis of several aspects, and not just one in particular. Clearly, one of Sen's criticisms to neoclassical theories of development is its narrow focus on a unique indicator (such as gross domestic product or per capita income), since "an adequate conception of development must go beyond the accumulation of wealth and the growth of gross national product." (Sen, 2000; p. 14). In so doing, neoclassical economic theories of development neglect the multidimensional aspect of development. An "integrated process" implies the presence of several co-existing aspects that require divided attention and focused efforts from policy makers, in order to implement complimentary programs, all of which should preferably be carried out in a coordinated, structured manner. The clear implication is that isolated and uncoordinated efforts and programs will most probably be largely inefficient and their efficacy will be negligible or minor at best.

Expansion of freedoms

The above "integrated process" should be aimed at expanding freedoms. The freedoms Sen refers to are of distinct nature. There are the substantive freedoms, also called the "constitutive role" of freedoms, and there are the "instrumental freedoms".

Sen considers five instrumental types of "instrumental freedoms" mainly, economic, social,

[40] (Sen, 2000; p. 8).

[41] The word "substantive" has been omitted here since in other statements, this is not included. The use of the word "substantive" in this particular instance is believed to be misleading. An expansion of substantive freedoms cannot occur without an accompanying expansion of instrumental freedoms, since the former are crucially dependent on the latter according to Sen's own postulate.

[42] (Sen, 2000; p. 36)

political, transparency guarantees, and protective security[43]. We focus next on the first three types of freedoms.

Economic, social, and political freedoms are derived from the institutional arrangements that characterize a given society[44]. Hence, individuals either benefit from these freedoms given the institutional structure that allows substantive freedoms to exist or are disadvantaged given their absence. Realizing the existence of this linkage between freedoms and development Sen wrote: "Individuals live and operate in a world of institutions. Our opportunities and prospects depend crucially on what institutions exist and how they function. Not only do institutions contribute to our freedoms, their roles can be sensibly evaluated in the light of their contributions to our freedom."[45] In this sense, Sen's theoretical conceptualization of development has a decidedly institutional flavor. Ultimately, it is the existence of these freedoms that permit individuals to attain and enhance their capabilities or substantive freedoms. These substantive freedoms refer to the "capability set" or the available set of outcomes at an individual's disposal (i.e. walk, ride a bicycle, drive a car, or take a bus, in the example provide in the previous section).

Interconnectedness between freedoms

Freedoms[46] do not work independently of each other. Freedoms are interconnected and complementary to each other. This also ties understandably with the integrated aspect of development. Sen states that: "freedoms supplement one another, and can furthermore reinforce one another" (p. 40), or more specifically, "freedom of one kind may greatly help in advancing freedom of other types." (p. 37). If this is true, it may be inferred that freedoms of one kind may

[43] This study is limited to building a Covariance Structure Model (CSM) accounting for only three aspects or dimensions of development (i.e. economic freedoms, social freedoms, political freedoms) given data limitations and potential model limitations. This does not necessarily detract from the validity of the results of this study or of the model hereby proposed and tested.

[44] In general, transparency guarantees and protective security are also derived from the institutional structure of a given society.

[45] (Sen, 2000; p. 142).

[46] This applies to instrumental freedoms only.

enhance capabilities of another kind. This hypothesis is also tested in the empirical covariance structure model (CSM) for development hereby proposed.

Primary end and principal means of development

As it relates to the "primary end" development seeks to expand individuals' "substantive freedoms". These are also referred to as the "constitutive role" of freedoms. Substantive freedoms refer to the capabilities individuals enjoy and have reason to value. It must be emphasized here again that the expansion of substantive freedoms cannot occur without an accompanying expansion of instrumental freedoms from where they are derived. The "principal means" refer to the "instrumental freedoms". As has already been pointed out, instrumental freedoms are critical on promoting substantive freedoms. They concern "the way different kinds of rights, opportunities, and entitlements contribute to the expansion of human freedom in general, and thus to promoting development."[47]

2.5 Sen's Development Theory

The previous section has given ample emphasis and focus on various aspects debated in the scholarly literature about Sen's development theory, Sen's definition of development, terminology , etc. This section will concentrate on formulating the core tenets on which Sen's development theory is premised which will help elucidate the set of testable hypothesis on which the covariance structure model will be based.

Sen's formulation of development is predicated upon an idea that commodities production should not be the end of development, and economic, social, and political arrangements should aim to expand people's capabilities, what he calls freedoms, to achieve "the things they have reason to value".

This approach is fundamentally different both from a utilitarian perspective that focuses on utility of commodities and from a main stream growth model in which development is treated as a

[47] (Sen, 2000; p. 37)

measure of outputs. The most important aspect that will clearly evolve from Sen's theory is that it establishes a paradigm shift in development theory, as will be shown below.

A close reading of Sen's theoretical conceptualization of development allows a de-construction or segregation of its constitutive foundational elements. There are at a minimum six foundational pillars on which Sen's development theory rests.

The first foundational pillar is related to the broadening of the informational basis on which an assessment of development can be appropriately performed. Development should not be assessed solely on the basis of one sole indicator, i.e. gross domestic product or per capita gross domestic product). According to Sen, the "success of a society is to be evaluated, [ ] primarily by the substantive freedoms that members of that society enjoy"[48] or alternatively, the evaluative focus can be based on the realized functionings, which are the combination of an individual's actual achievements. In this thesis work the covariance structure model utilizes a number of substantive freedoms (i.e. capabilities) in assessing development.

The second foundational pillar is its fundamental departure from main stream economic growth models in two main aspects. According to Sen, development is seen as the process of expanding freedoms and not that of simply maximizing income or wealth. In effect, in contrast to neoclassical economics growth models, Sen's view of development is a "freedom-centered approach". He defines development as the process of "expanding substantive freedoms"[49]. In this perspective, the "[e]xpansion of freedom[s] is viewed, [ ] both as the primary end and as the principal means of development."[50] This has two major implications. First, it no longer focuses on output as the main variable to use in assessing whether a society is moving in the right direction while broadening the informational scope to that of substantive freedoms. Secondly, it also departs from utilizing "resource" type variables as the determinants of growth, i.e. development.

[48] (Sen, 2000; p. 18).
[49] (Sen, 2000, p. 3)
[50] (Sen 2000; p. xii).

The third foundational element, very closely related to the second, refers to the presence of two different kinds of freedoms, mainly, instrumental freedoms and substantive freedoms. Respectively these are referred to as the "constitutive role" and the "instrumental role" as mentioned in the previous section. The constitutive role is related to the "importance of substantive freedoms in enriching human life" [, which] "include elementary capabilities"[51] like literacy, employment, enjoying political participation, a healthy life, etc. among others. The instrumental role of freedom concerns the means that enable individuals to achieve those substantive freedoms. They refer to the "way different kinds of rights, opportunities, and entitlements contribute to the expansion of [substantive] human freedom in general, and thus to promoting development."[52] Sen considers five different types of instrumental freedoms, mainly economic, social, political, transparency guarantees, and protective security.[53]

Fourth, Sen argues the existence of a causal mechanism between instrumental freedoms and substantive freedoms. The expansion of instrumental freedoms is important because "freedom[s] enhance[ ] the ability of people to help themselves ... [which is] central to the process of development."[54] According to Sen, "[i]ndividual capabilities [or equivalently substantive freedoms] crucially depend on, among other things, economic, social, and political arrangements."[55] It is the institutional structure the crucial building block that allows the expansion of substantive freedoms, i.e. individual capabilities. A lack of freedoms, it is argued, is equivalent to a "capability deprivation". Hence, the expansion of instrumental freedoms is materialized into potential individual capabilities, resulting in higher levels of development.

Essentially, this fundamental theoretical consideration leads to the following causal model between capabilities and instrumental freedoms:

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[51] (Sen, 2000; p. 36)
[52] (Sen, 1999; p. 37)
[53] In this work only the first three of these freedoms will be dealt with.
[54] Sen 2000; p. 18).
[55] (Sen, 1999; p. 53).

Substantive freedoms α Function [instrumental freedoms] **Eq. 2.1**

The fifth foundational element refers to Sen's "freedom-centered" approach, as an institutional approach[56] to development. According to Sen the "expansion of freedoms is viewed as both: (1) the primary end and (2) the principal means of development."[57] In addition, the "instrumental role of freedom concerns the way different kinds of rights, opportunities, and entitlements contribute to the expansion of human freedom [(i.e. substantive freedom)] in general, and thus to promoting development."[58] In addition to expanding the current characterization of Sen's conceptualization as a "capability approach" to one of "freedom-capability approach" this foundational pillar serves two purposes. First, it establishes the institutional arrangement as a crucial building block to development, and secondly, derived and closely related to the first, it establishes a hypothesized causal relationship between development and the institutional structure (i.e. instrumental freedoms). Furthermore, in a somewhat counterintuitive way, it presents freedoms as being the primary end of development, hence, making development the independent fundamental determinant variable that explains freedoms.

We can then write this postulated hypothesis in an equation specified as:

Institutional freedoms α Function [Development] **Eq. 2.2 a**

The above equation can be expanded to:

Political institutions, social institutions, economic institutions, welfare institutions, legal / justice institutions α Function [Development][59] **Eq. 2.2 b**

Conversely, since freedoms are also the principal means of development, this implies a causal relationship between freedoms and development whereby freedoms are the independent

[56] Such a description of development, to some degree, runs along the discourse of "new institutional economics", advanced by Nobel Laureate Douglass C. North, as a robust approach to comparative development, which sought to explain differences in development levels not only between countries, but also between regions of the world (North, 1990).

[57] (Sen, 1999; p. 36)

[58] (Sen, 2000; p. 37)

[59] The empirical model proposed in this thesis work considers only economic, social, and political freedoms.

variables that explain development. This is in sharp contrast with theories of economic growth whereby the determinants of long-term growth are "resource" type variables, such as capital, labor, and technology) as already discussed. The expanded equation establishing this causal relationship is:

Development α Function [Political institutions, social institutions, economic institutions, welfare institutions, legal / justice institutions] [60] **Eq. 2.2 c**

The sixth and last crucial pillar in Sen's development theory is the critical aspect of interconnection and complementarity between instrumental freedoms of different kinds. As indicated above, instrumental freedoms work to directly enhance individuals' capabilities, and "they also supplement one another, and can furthermore reinforce one another."[61] Sen postulates the existence of "remarkable empirical connections" [62] linking freedoms of one kind with freedom of another kind, strengthening one another. For example, social opportunities, such as education facilitate participation in the economic productive system. Furthermore, "different kinds of freedom interrelate with one another, and freedom of one type may greatly help in advancing freedom of other types. The two roles (referring to the instrumental and constitutive role of freedoms) are thus linked by empirical connections, relating freedom of one kind to freedom of other kinds."[63] The clear implication is a hypothesized causal relationship between different kinds of instrumental freedoms, where for instance economic freedoms reinforce social freedoms, or viceversa. According to Sen, "the process of development is crucially influenced by these interconnections." [64] This completes the in-depth review of Sen's development theory core tenets. Figure 2.1 is built based on the above described core pillars of Sen's development theory[65] where some additional refinements by other collaborators were incorporated as well.

[60] Testing both equations 2.2b and 2.2c would require a non-recursive model. Only Eq. 2.2b is empirically tested.
[61] (Sen, 2000; p. 40).
[62] (Sen, 2000; p. 11).
[63] (Sen, 2000; p. 37)
[64] (Sen, 2000; p. 53).
[65] (Robeyns (Robeyns, 2005) presents a similar schematic.

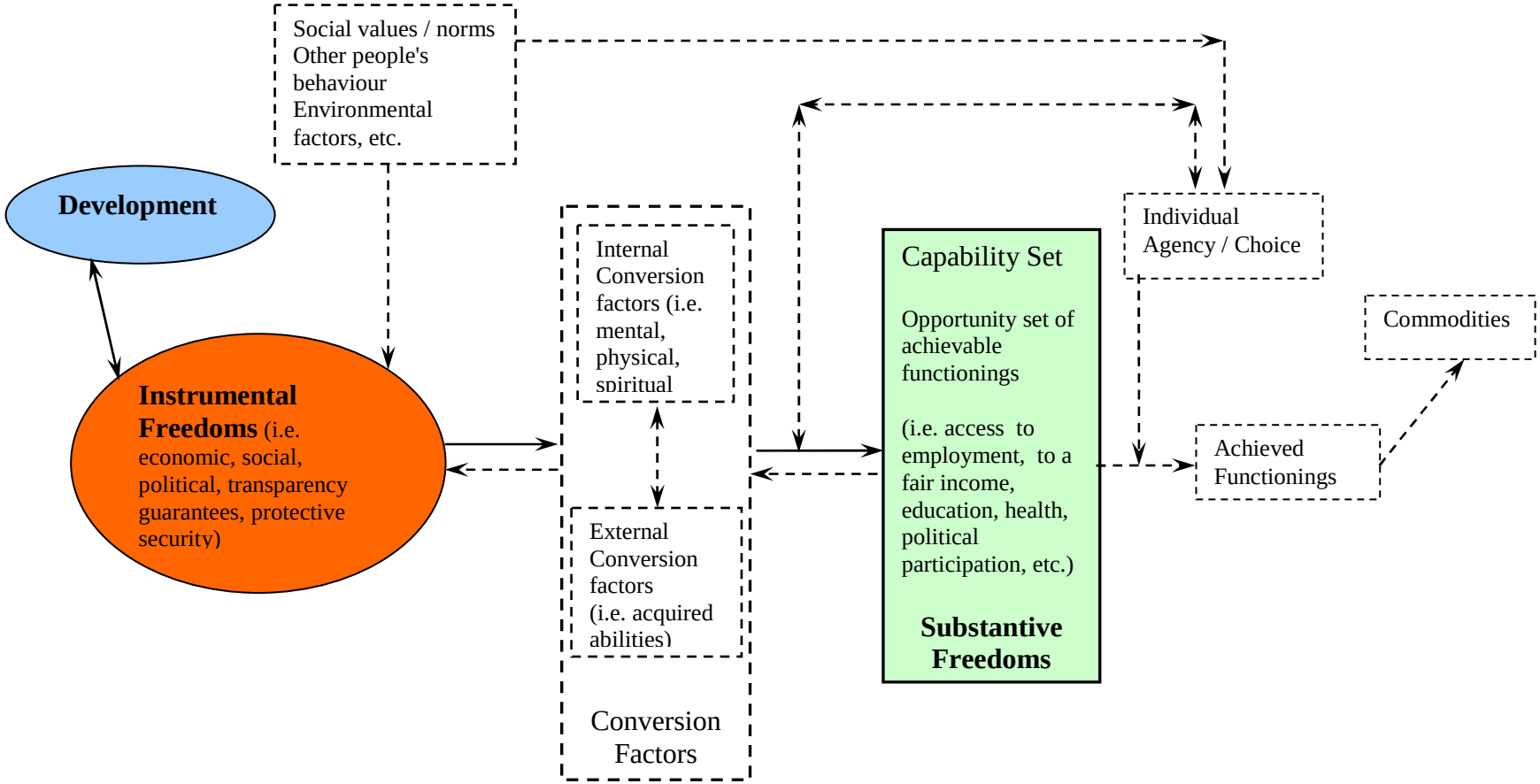

FIGURE 2.1: A Schematic Representation for Sen's Development Theory[66]

[66] As noted in the main text, this schematic representation of Sen's development theory has been somewhat expanded and modified to include the conversion set building block. The dashed-lined blocks and dashed-arrows represent portions of Sen's theoretical framework of development which are not tested in this Thesis. Only the solid colored blocks and their causal links are empirically tested.

The intention here is to not only attempt to synthesize Sen's theory but also to illustratively indicate the scope of coverage of the covariance structure model (CSM) proposed in this thesis work. The following remarks will help define the scope and reach of the CSM as well as tie together all core tenets of Sen's development theory. The following conventions have been adopted in building Figure 2.1:

1. All dashed lines and boxes represent what has been left out of the CSM.

2. Only solid lines and boxes are built into the CSM model.

3. Attention is brought to the two arrows interconnecting instrumental freedoms and substantive freedoms (across the conversion factors). The CSM hereby proposed is a recursive model, and therefore it fails to incorporate Sen's "freedoms are the principal means of development. The proposed CSM only tests "freedoms are the primary end of development"[67].

4. Boxes represent observed or measured variables.

5. Ovals represent theoretical constructs which cannot be directly measured also referred to as latent variables.

6. For the purpose of simplification, all instrumental freedoms have been incorporated in one oval. Rigorously speaking, the figure should have five ovals, one for each of the different types of instrumental freedoms considered in Sen's theoretical conceptualization of development. Therefore in Figure 2.1, the hypothesized interlinkages or interconnections between the different types of instrumental freedoms (the sixth foundational element in Sen' development theory) are not shown, but the reader is reminded that the CSM will empirically tests (albeit indirectly) the statistical significance of such causal relationship.

[67] Testing both directions would require a non-recursive model, which was at the on-set of this thesis work deemed outside the scope.

2.6 A Covariance Structure Model

The above six foundational elements in Sen's development theory permit the construction of an empirical causal model to test Sen's hypothesized relationships.

Such an empirical model cannot be constructed by multivariate regression analysis (OLS). The reader may soon realize that freedoms, and specifically instrumental freedoms, cannot be directly measured or observed, and hence a more sophisticated statistical tool is required. Covariance structure analysis (CSA) allows constructing such an empirical model. CSA allows to test the statistical significance of the postulated causal relationship between latent variables (i.e. instrumental freedoms and development) and between latent variables and measured variables (i.e. indicators of capabilities).

In constructing the empirical CSM hereby proposed, a wide range of measured variables is utilized, thereby allowing to test the first core pillar of Sen's theoretical conceptualization of development (broadening of the informational basis). The proposed CSM decidedly takes a comprehensive approach to development, in light of Amartya Sen's "development as freedom", de-emphasizing the prominent role given by neoclassical economic and endogenous theories of growth to income per capita or GDP as the sole indicator on which to assess economic growth. This accomplishes re-focusing the attention away from a narrow perspective of economic growth to a broader and more encompassing definition of development.

Sen's theoretical conceptualization of development is not necessarily an easy one to disentangle. It would be incorrect to convey the idea that the CSM model hereby proposed strictly covers all aspects of Sen's complex development theory. A quick review of Figure 2.1 reveals the very limited scope of the CSM hereby proposed and a strong research effort is required to complete a full model of Sen's "development of freedom".

One such difficulty that arises in such novel undertaken is that in his "Development as Freedom" Sen did not explicitly specify all the existing relationships between measured variables and

latent variables (non-measurable variables). To be rigorous, the utilization of Confirmatory Factor Analysis (CFA) demands that the relationships have all been based on substantive theoretical considerations, which should have been postulated in the theory the model attempts to represent.

Herein lies though, a little bit of the "trial an error approach" that is recognized by many scholars and is common in the social sciences in theory building. That is to say, that, in so doing some post-ad hoc testing and model adjustments may be necessarily inevitable. Henceforth, the results to be presented show the most parsomonious model that could be fit to the theoretical framework presented by Amartya Sen.

A review of the literature also reveals that to date no attempt has been made to establish an empirical model that incorporates all these six foundational pillars of Sen's development theory. One close exception is Krishnakumar's (Krishnakumar, 2007) econometric model to estimate and explain capabilities. From the theoretical point of view, unquestionably Krishnakumar model is an excellent attempt to provide empirical evidence of some but not all of Sen's theory core tenets. Krishnakumar's econometric model:

1. It is limited to testing the empirical relationship between functioning and capabilities, and the effect of some exogenous variables on functionings. The latter effect is not considered in this thesis model. The econometric model considers functionings as being latent variables istead of measured variables.

2. It does not test the validity of the hypothesized relationship between instrumental freedoms and substantive freedoms (i.e. capabilities).

3. It does not test the hypothesized causal relationship between development and instrumental freedoms.

4. It does not include capabilities in the economic dimension; only capabilities in the social and political dimensions of substantive freedoms are included.

5. It does not test the hypothesized interlinkages between instrumental freedoms of different kinds.

From the stand point of view of statistical soundness and coverage, the model only is successful in including a sample of 56 countries (compared to 154 in this thesis work).[68] Also it is widely accepted that at a minimum, the number of indicators per latent variable used should be three (where in some cases the author used only two indicators).

[68] This thesis work utilized five-year data averaging and imputation to increase the sample size.

CHAPTER 3

RESEARCH DESIGN

This Chapter's focus is on research design. Emphasis is placed first, on how the empirical covariance structure model is conceived and built to test Sen's development theory's core pillars, second in providing a brief overview of the mathematical formulation of the model, and third, on a summary description of the data set, as well as a brief overview on data issues and descriptive statistics. A description of each of the societal capability indicators and data sources is presented in Appendix A (Codebook). A more detailed description of the data set and its descriptive statistics can be found in Appendix B (Descriptive Statistics), while a more detailed mathematical formulation of the model can be found in Appendix D (Mathematical Formulation). Appendix C provides a more comprehensive perspective on analysis of covariance structure, general background and origin, foundational components, and additional information on how a CSM is built.

3.1 Research Design

CSM is the fruitful unification of a set of related lines of research that resulted in the development of statistical techniques and tools, namely path analysis (path diagrams), factor analysis, and general estimation procedures (Bollen, K., 1989). It emerged as a generalized statistical procedure that allows the study and understanding of the causal relationship that exists between observed (measured) variables and latent or factor (non-measurable) variables and the structural relationship that exists among latent variables or factors while confirming the validity of those relationships through the scientific method of hypothesis testing.

A CSM model is composed of two conceptually, but interrelated, distinct models: A confirmatory measurement model (MM) and a confirmatory structural equation model (SEM)

(Joreskog, and Sorbom, D., 1984; Anderson and Gerbing, 1982). Combining these two models together yield what is normally called a CSM[69].

A CSM is composed of two distinct models: A Measurement Model (MM) and a Structural Equation Model (SEM). The direct application of CFA to a set of observed / directly measured variables renders what is called, within the jargon of CSM, the Measurement Model (MM). The MM details the hypothesized causal relationship between the directly measured (observed) variables and the theorized dependent (endogenous) latent variables (or factors) it seeks to uncover. The application of CFA to the MM seeks to provide empirical evidence of the hypothesized causal relationship through hypothesis testing.

The Structural Equation Model (SEM) details the hypothesized causal relationship between the uncovered dependent endogenous latent variables (or factors) from the MM and (a) new hypothesized independent (exogenous) latent variable(s) or factor(s). The structural relationship (between the dependent endogenous latent variables and the independent exogenous latent variable(s) is operationalized through the structural coefficients.

It is important to re-emphasize that a CSM main's aim is that of explaining the existing covariance/variance structure for a set of directly observed and measured variables by a set of latent variables or factors. The first component of a CSM, the Measurement Model, achieves this by finding a set of dependent endogenous latent variables or factors (1st order latent variables) through Confirmatory Factor Analysis, which allows hypothesis testing on each of the resulting factor loadings.

In the second component, the Structural Equation Model (SEM), the resulting covariances/variances for the set of latent dependent endogenous variables, is attempted to be explained by another (set) of independent exogenous latent variable(s) (2n order latent variables or factor(s)).

[69] Long's (Long, 1983) nomenclature is adopted in this thesis work.

The number of latent variables, endogenous and exogenous, which measured (observed) variables load on which endogenous latent variables (factors), and whether measured variables are or not correlated, are all defined by the researcher based on substantive theoretical considerations. The definition of these parameters, based on theoretical considerations, constitutes the major premises under which the hypothesized relationships are translated into mathematical equations, expressed in a matrix form, from which a CSM is built.

Anderson and Gerbing's two-step approach (Anderson and Gerbing, 1988) recommendation is followed. The measurement model is further decomposed in three separate independent measurement models (MM) one for each theoretical construct or latent variable (factor) corresponding to each of the three chosen dimensions of development (i.e. economic freedoms, social freedoms, and political freedoms) expected to be uncovered by the confirmatory factor analysis. That is to say, a measurement model for each of the three different types of instrumental freedoms is built, and then, these three MM are combined together to form one overall MM.

Chapter 2 provided an in depth review of Sen's development theory core tenets. The next sub-section will formulate empirically testable hypothesis based on Sen's theory core tenets.

3.1.1 Hypothesis Formulation

One of the main features of this Thesis work is the structured approach taken in building the empirical 2nd Order Recursive CSM to empirically test Sen' "Development as Freedom" Theory. This structured approach derives from testing on a step-wise fashion the main tenants of Sen's theoretical conceptualization of development. Sen's theoretical conceptualization of development as freedom has been synthesized in Chapter 2 and its core tenets have been decomposed and highlighted. Following are the fundamental "development as freedom" approach main tenants and their accompanying formulated hypothesis:

1. Development cannot be seen merely as an "accumulation of wealth and the growth of gross domestic product (or other related variables)"[70], such as industrialization[71], or technological advance[72]. According to Sen, the "success of a society is to be evaluated, [ ] primarily by the substantive freedoms that members of that society enjoy."[73] Alternatively, the evaluative focus can be based on the realized functionings, the combination of an individual's actual achievements. The proposed CSM utilizes a number of substantive freedoms (i.e. capabilities) in assessing development.

2. Societal instrumental freedoms "help to advance the general capability of a person."[74] From this statement one may infer that [societal] substantive freedoms (i.e. capability set) are derived, at least partially, from societal instrumental freedoms. This is confirmed by Sen: "Individual capabilities crucially depend on, [ ], economic, social, and political arrangements" [75] (i.e. institutional structure).

3. There are mainly five types of societal instrumental freedoms as follows: Economic, social, political, transparency guarantees, and protective securities[76]. The CSM model hereby proposed tests only the existence of the first three (due to lack of data for the last two).

The above three core pillars lead to the formulation of these three interrelated hypothesis which will be tested in the MM portion of the CSM:

Hypothesis 1:

Development cannot be defined solely on the basis of gross domestic product (or income per capita) or on a production function dependent on capital, population growth, or technological progress. 16 societal capability indicators (or functionings indicators) are utilized in CSM.

Hypothesis 2:

There exists a causal relationship between instrumental freedoms and societal substantive freedoms.

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70 (Sen 2000, p. 14).
71 (Sen 2000, p. 5).
72 (Sen, 2000; p. 3).
73 (Sen, 2000; p. 18).
74 (Sen, 1999; p. 10, 40).
75 (Sen, 1999; p. 53)
76 (Sen, 2000; p. 10, 11, 38)

An increase in instrumental freedoms leads to an improvement or an increase in societal substantive freedoms (.i.e. societal capability set). The relationship between societal instrumental freedoms and societal substantive freedoms (i.e. societal capability set) is statistically significant. More specifically, the relationship and sign of this relationship is tabulated (as expected) in Table 3.1 below (see also Hypothesis 3).

TABLE 3.1: Expected basic relationship between societal instrumental freedoms and societal substantive freedoms (i.e. societal capability set).

Variable #	Societal substantive freedom	Variable name	Instrumental Freedoms		
			Economic	Social	Political
1	Income per capita	rgdcppp3	+	None	None
2	Unemployment	unemp	-	None	None
3	Inequality index	ehii1	-	None	None
4	Gross domestic savings	gdsaving	+	None	None
5	Investment	capital1	+	None	None
6	Population growth	popgrowt	None	-	None
7	Life expectancy	lifexp	None	+	None
8	Infant mortality at 5	infmortn	None	-	None
9	Child labor	childlab	None	-	None
10	Literacy	literacy	None	+	None
11	Executive recruitment competitiveness	xrcomp	None	None	+
12	Executive recruitment openess	xropen	None	None	+
13	Executive power constraints	xconst	None	None	+
14	Participation competitiveness	parcomp	None	None	+
15	Political rights index	polright	None	None	+
16	Civil rights index	civlib	None	None	+

Hypothesis 3:

There are three societal institutional freedoms with statistically significant relationships to be uncovered from the selected set of societal substantive freedoms (i.e. societal capability set).

4. The expansion of freedoms is viewed as the primary end of development[77], or development is seen as an "integrated process of expansion of [ ] freedoms." In addition, the "instrumental role of freedom concerns the way different kinds of rights, opportunities, and entitlements contribute to the

[77] (Sen, 2000; p. 36).

expansion of human freedom [(i.e. substantive freedom)] in general, and thus to promoting development" [78], coupled with Sen acknowledgment of the need for "appreciation of the vital roles, in the process of development, of many different institutions"[79]. The combination or triangulation of these statements establishes a causal relationship between societal instrumental freedoms and development, which ultimately constitute one more of Sen's development theory core tenets.

Hypothesis 4:

There is causal relationship between development and societal instrumental freedoms. An increase in development causes and increase in societal instrumental freedoms, in light of the crucial role that instrumental freedoms play in the process of development The relationship between development and institutional freedoms is positive and is statistical significant.

5. Instrumental freedoms are interconnected to one another, and empirical linkages "that tie the distinct types of freedom together"[80] exist, supplementing and reinforcing one another. Freedoms of one kind enhance and reinforce capabilities that mainly originate from freedoms of other kinds[81]. These interlinkages are "central to a fuller understanding of the instrumental role of freedom"[82].

Hypothesis 5:

Institutional freedoms are correlated and this relationship is positive and statistically significant.

The above fundamental tenants in Sen's development theory and their accompanying formulated hypothesis are empirically tested with the CSM.

Lastly, it is worth mentioning that the proposed CSM is a recursive model. Therefore the model does not test the following core pillar of Sen' development theory:

7. Freedoms are the principal means of development[83,84].

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78 (Sen, 2000; p. 37)
79 (Sen, 2000; p. 9)
80 (Sen, 2000; p. 38).
81 (Sen, 2000; p. 37).
82 (Sen, 2000; p. 38)
83 (Sen, 2000; p. 36). The CSM hereby proposed does not test this hypothesized relationship.
84 Including this last fundamental tenant would require building a non-recursive model, which was deemed outside the

As indicated above at the beginning of this section, a path diagram is one of the tools utilized by covariance structure analysis (CSA). The next subsection will cover some general considerations about path diagrams.

3.1.2 Path Diagrams General Considerations

One important feature among the array of constituent components of CSA or in the analysis of covariance structures is the utilization of path diagrams. Path diagrams aid in the visualization of the expected relationships to be confirmed by the confirmatory factor analysis technique. Before introducing the path diagrams representing each of the proposed MM's, the following standard convention is presented, as pertinently applied to the model subject of this study.

Societal Capabilities

These are the independent measurement (observed) variables. They are the selected variables that represent societal capabilities derived from societal institutional freedoms. They are represented by rectangles in the path diagram.

Societal Institutional Freedoms

These are the endogenous (dependent) latent variables representing the institutional structure or arrangements that exist in a society. These are the instrumental freedoms ensued from the institutional arrangement in a given society. These are latent variables because they cannot be directly measured. They are represented by ovals in the path diagram.

Factor Loadings

They are represented by the arrows pointing from the latent variable to the measurement variable. They represent a causal relationship between instrumental freedoms and societal capabilities (or in the case of a CSM) between development and societal instrumental freedoms. Cross linkages between freedoms of one kind and capabilities of another kind are represented by dashed arrows for clarity.

---

reach and scope of this Thesis work.

Error Measurement

Non-systematic error measurement for measure (observed) variables, represented by arrows pointing towards the observed (measured) variable (i.e. societal capability).

Correlated Institutional Freedoms (Interconnections and Complementarity Interlinkages)

These are represented by two-directional arrows between latent endogenous variables to be understood as correlated (latent variables) freedoms. They only represent co-variation or correlation, but not necessarily causation.

Residual Error (disturbance)

This is the non-systematic residual error or disturbance associated with a given latent variable and also represented by a one-directional arrow pointing towards the latent (endogenous) variable.

Based on the theoretical considerations, the hypothesis presented, and the above standard conventions, path diagrams will be depicted for each proposed measurement models (MM) and for the full combined MM.

The next section will cover each of the three MM built, one for each of the institutional freedoms considered in this thesis work.

3.2 Measurement Models

Independent MM sub-models were built one for each of the three institutional freedoms (i.e. economic, social, and political) considered, and then combined into one full MM. The following sub-sections cover the selection of societal capabilities selected for each CFA MM sub-model.

3.2.1 The Economic Institutional Freedoms CFA Measurement Model

The societal economic freedoms MM comprises the utilization of five basic indicators of societal capabilities. The following describes each societal capability indicator and how each is believed to be causally related to economic instrumental freedoms. The Confirmatory Factor Analysis (CFA) of the MM will provide the means to empirically test and confirm the hypothesized causal relationship

and the statistical significance between each societal capability indicator used and the corresponding societal instrumental economic freedom (latent variable).

The selection of societal economic capabilities is based and derived from Sen's considerations as provided below.

Sen defines economic freedoms as those that "individuals [ ] enjoy to utilize economic resources for the purpose of consumption, or production, or exchange." (Sen, 1999; p. 39). These depend on the resources owned by individuals, as well as the availability and easiness to access those resources. Among economics freedoms, Sen's makes references to participation in trade and production (p. 11) as well as the importance of aggregative and distributional considerations (p. 39). The proposed MM fails to include trade as an indicator, but to account for participation in consumption and production the model includes income per capita and the opportunity for employment, and the availability and accessibility to capital. Inequality is an important indicator, since those that are dispossessed, suffer, in one way or another, a form of capability deprivation and ultimately a form of economic un-freedom. Availability and access to finance and capital markets are undoubtedly "a crucial influence on the economic entitlements." (Sen, 1999; p. 39). We therefore include gross domestic savings and gross capital formation (both as a % of GDP). For all indicators of societal capabilities, the sign of the expected relationship is shown in Table 3.1 above.

Gross Domestic Product Per Capita Purchase Power Parity (**gdpcppp3**)

This societal capability indicator is a primary indicator of economic substantive freedoms since it provides a direct measure of the buying / consuming power of a society (citizen). The structure of an economic institutional setting from which societal economic freedoms are derived, endows the society as a whole, among other things, with a higher purchasing power capability. The statistical significance of this causal relationship will be tested in the MM through CFA.

Unemployment (**unemp1**)

This capability is a primary indicator of economic freedom since it provides a direct measure of the ability of the economic institutional structure to provide opportunities for a society to gain and have access to meaningful employment where individuals can effectively utilize their skills, acquired through the societal educational infrastructure and facilities. The structure of an economic institutional setting from which societal economic freedoms are derived, endows either the creation of new businesses or catalyzes growth for existing businesses, further creating new employment opportunities for the society as a whole, which translates in a higher societal capability to gain access to employment. Therefore, a causal relationship between economic institutional freedoms and unemployment is hypothesized. The statistical significance of this causal relationship will be empirically tested in the MM through CFA.

Estimated Household Income Inequality (**ehii1**)

Income inequality is derived mainly from the economic institutional structure that allows higher or lower income differences between different job skills and occupations as well as from the structure of the economy itself. Economic substantive freedoms, mainly derived from the structure of the economic institutions, provide a societal distribution of different job skills and occupations with higher or lower income earning capability setting and defining the income structure and therefore higher or lower inequality differences within the society. It is therefore hypothesized that there exists a causal relationship between societal economic institutional freedoms and income inequality. The statistical significance of this causal relationship will be empirically tested in the MM through CFA.

Gross Domestic Savings (**gdsaving1**)

Gross domestic savings (as a % of GDP) serves as an indicator of societal economic substantive freedoms because it provides an idea of the societal capability to set earnings away from

consumption. Economic freedoms, mainly derived from the structure of societal economic institutions, provide individuals with different income power that sets and define the savings capability of a society as a whole. It is therefore hypothesized that there exists a causal relationship between economic institutional freedoms and savings. The statistical significance of this causal relationship will be empirically tested in the MM through CFA.

Gross Capital Formation (**capital1**)

Gross capital formation (as a % of GDP) serves as an indicator of economic freedoms because it provides an idea of the capability and availability that enterprises, large and small, have in accessing and securing financial resources for growth or whatever purpose they might deem necessary for their business. Economic freedoms, mainly derived from the structure of the economic institutions, provide a source of financial instruments and resources available to firms, individuals, and ultimately to society as a whole, increasing their potential capability for growth and investment to further their business needs and interests, ultimately reflected in gross capital formation. We therefore hypothesize that there is causal relationship between economic institutional freedoms and gross capital formation. The statistical significance of this causal relationship will be empirically tested in the MM through CFA.

Given the above considerations, tha path diagram for the economic institutional freedoms is represented by Figure 3.1 below.

3.2.2 The Social Institutional Freedoms CFA Measurement Model

The social instrumental freedoms MM comprises the utilization of five basic societal indicators (i.e. capability set). The following describes each indicator and how each is believed to be causally related to social instrumental freedoms. The Confirmatory Factor Analysis of the CSM will provide the means to empirically test and confirm the hypothesized causal relationship and it's statistical significance between the indicators used and the corresponding freedom (latent variable).

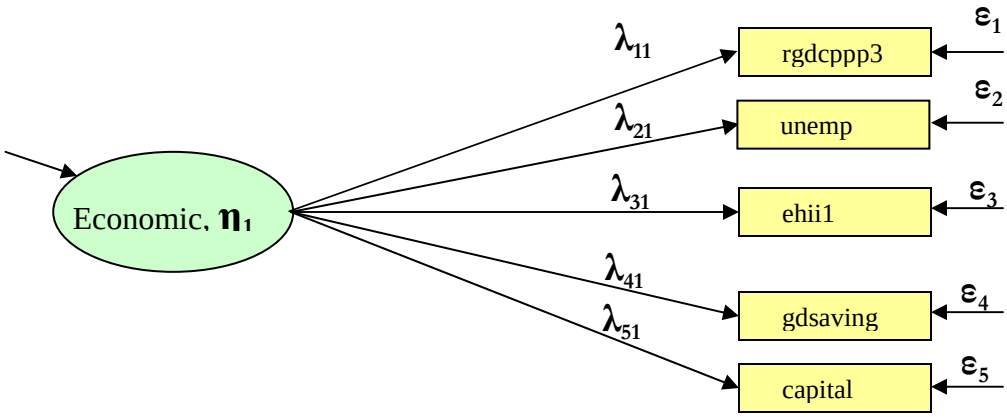

FIGURE 3.1. Proposed Measurement Model for Economic Institutional Freedoms

Sen defines social freedoms as those "arrangements that society makes for education, health care, and so on, which influence the individual's substantive freedom to live better." Social freedoms are important not only because they provide the capability for individuals to live a better life, but also because they provide a means to promote an "effective participation in economic and political activities." (Sen, 1999; p. 39). These depend on the facilities provided by either the government or the private sector for access by individuals and by society as a whole. Among social freedoms, Sen's makes reference, as indicated above, to education and health care facilities (Sen, 1999, p. 11). We therefore include as indicators for social freedoms life expectancy, infant mortality, child labor, and literacy. Population growth rate is also included since this is a resource type variable used in neo-classical economic theories of development, as a means to test within the CSM the relative importance and statistical significance of this indicator. We move our attention to each of these specific indicators.

Population growth rate (**popgrowt1**)

This societal capability is a primary indicator of social instrumental freedoms since it provides a direct measure, albeit not on of by itself, of the potential capability of a society to

produce and consume higher amounts of goods and services. It is therefore hypothesized that the structure of a social institutional setting from which individual social freedoms are derived, endows individuals and the society as a whole, among other things, with a higher or lower potential for population growth rate capability. The statistical significance of this causal relationship will be tested in the MM through CFA.

Life Expectancy (**lifexp1**)

This capability is a primary indicator of social instrumental freedom since it provides a direct measure of the ability of the social institutional structure to provide opportunities for members of a society to live a longer life. The structure of a social institutional setting from which societal social freedoms are derived, endows members of a society with the opportunity and capability to live longer. It is therefore hypothesized that there is causal relationship between social instrumental freedoms and life expectancy as a societal capability indicator of longevity. The statistical significance of this causal relationship will be empirically tested in the MM through CFA.

Child Labor (**childlab1**)

This capability deprivation is a primary indicator of social un-freedoms (in the strict sense) since it provides a direct measure of the lack of societal mechanisms and opportunities for children which end -up being forced, one way or another, to "join" the labor force, while being denied the opportunity to attend school, become literate, and be given the opportunity to become a skilled, or otherwise more productive contributor to society, not only in the economic realm, but in the political as well. It is therefore hypothesized that there exists a causal relationship between social instrumental freedoms and child labor, whereby the structure of a social institutional setting from which social freedoms are derived, denies individuals of young age of the potential opportunity for becoming a more productive element to society and are therefore deprived of opportunities, which would otherwise increase their capabilities. A well conceived social institutional structure would be conducive to social freedoms that would minimize child labor or totally prevent it. It is therefore

hypothesized that there is causal relationship between social instrumental freedoms and child labor. The statistical significance of this causal relationship will be tested in the MM through CFA.

Literacy (**literacy1**)

This societal capability is a primary indicator of social instrumental freedom since it provides a direct measure of the ability of the social institutional structure to provide opportunities for individuals and society as a whole to become literate and to further the societal opportunities for better perspectives and allow its' individuals to "do the thing he/she reasons to value". The structure of a social institutional setting from which societal social freedoms are derived, endows the aggregate sum of individuals, i.e. society, with the opportunity and capability to become literate. It is therefore hypothesized that there is causal relationship between social instrumental freedoms and literacy. The statistical significance of this causal relationship will be empirically tested in the MM through CFA.

Given the above considerations, the path diagram for the social institutional freedoms is represented by Figure 3.2 below.

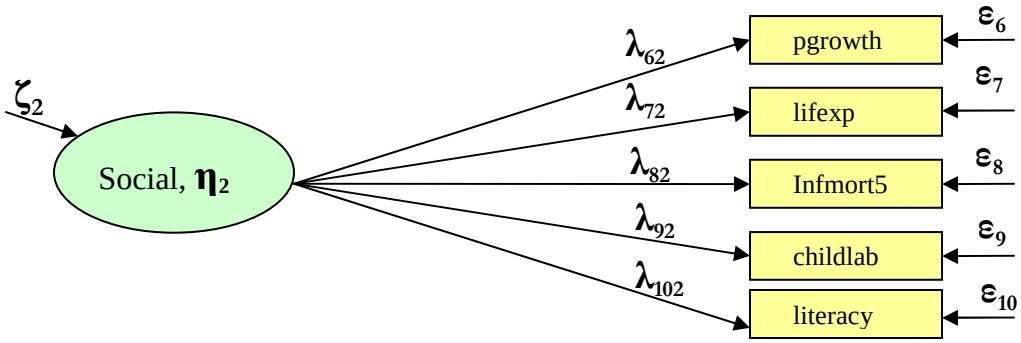

FIGURE 3.2. Proposed Measurement Model for Social Institutional Freedoms

3.2.3 The Political Institutional Freedoms CFA Measurement Model

The political instrumental freedoms MM comprises the utilization of six basic indicators of societal capabilities. The following describes each indicator and how each is hypothesized to be

causally related to political instrumental freedoms. The Confirmatory Factor Analysis of the CSM will provide the means to empirically test and confirm the hypothesized causal relationship and the statistical significance between the indicators used and the corresponding political freedom (latent variable).

Sen defines political freedoms as those "opportunities that people have to determine who should govern and on what principles, […] the possibility to scrutinize and criticize authorities, and to have freedom of political expression and an uncensored press, to enjoy the freedom to choose between different political parties, […] voting rights and participatory selection of legislators and executives". (Sen, 1999; p. 38).

Many researchers have devoted efforts to understanding the relationship between development and political democracy. So, in addition to Sen's perspective, it is necessary to examine recent and past relevant research efforts undertaken to measure political democracy. An examination of the body of research on measuring democracy might be necessary, if nothing else, with an aim at maximizing the nuisances and subtleties that are inherently present in a complex concept such as democracy, with an aim at accomplishing and all encompassing definition and to ensure the validity and inclusion, if at all possible, of suitable indicators to appropriately measure democracy. In what follows, a succinct comparison of different democracy measurement models and their corresponding indicators is provided, with an aim at ensuring that the selected indicators to be used in this study for measuring democracy do not miss important aspects of such a complex concept as democracy.

Bollen (Bollen, 1980) presented a CFA measurement model for democracy based on six indicators. The model was tested for two periods, 1960 and 1965. Three of those were related, as stated, to political liberties (i.e. press freedom, freedom of group opposition, and government sanctions), and the other three were related to popular sovereignty (fairness of elections, executive selection, and legislative selection). Whether the first three indicators are truly or not related to

political liberties and the second three related to popular sovereignty, as hypothesized, was not empirically tested in the proposed measurement model through CFA. Later studies (Bollen and Grandjean, 1981; Bollen, 2009) test the dimensionality of democracy, arriving at the conclusion that democracy is, at least empirically and at the macro level, a uni-dimensional concept. Bollen's conceptualization of democracy is focused on the fairness of the electoral (both executive and legislative) process, and on the general political environment setting (both pre and post election) and the government's response to opposition and criticism.

In his seminal research work on "patterns of democracy" Lijphart (Lijphart, 1999) compares differences in democratic models, mainly the majoritarian and the consensus democratic models. His theoretical conceptualization of democracy is based on 10 measured variables or indicators, which he clusters in two dimensions, the executives-parties dimension (i.e. concentration of executive power, executive vs. legislative balance of power, party system, electoral system, and interest group system) and the federal-unitary dimension (i.e. degree of government centralization, concentration of legislative power, degree of constitutional flexibility, presence of a judicial review, and central bank independence). Resorting to Exploratory Factor Analysis (EFA) technique, his analysis reveals the presence of two dimensions for democracy. But as explained in Appendix C, EFA falls short of providing a statistical significance test for both hypothesis, the first being that each indicator's relationship to the underlying latent variable and that the two uncovered latent variables (i.e. executives parties and the federal-unitary latent variables' relationship to democracy are or not statistically significant). A CFA analysis would be necessary to achieve a rigorous empirical testing of such hypothesized relationship. These set of indicators is undoubtedly the most comprehensive among the three presented in this study. It focuses on the institutional framework that regiments democracy through balance of power, executive power limitations, balance of interest group presence, party and electoral system, degree if constitutional flexibility, the presence of judicial review, and the presence of an independent economic policy body.

Another authoritative research work in democracy is the dataset initiated under Ted Gur's direction. This dataset is unique in that "it examines concomitant qualities of democratic and autocratic authority." Referred to as the POLITY IV dataset, it compiles six indicators grouped on three dimensions of political regime. The first dimension, named the executive recruitment, is based on three indicators (i.e. regulation of chief executive recruitment, the competitiveness of executive recruitment, and the openness of executive recruitment). The second dimension, the independence of executive authority is based on one sole indicator, the executive constraints (or decision rule). Lastly, the third dimension, related to political competition and opposition, is based on two indicators (i.e. regulation of participation, and the competitiveness of participation). It is obvious that POLITY IV dataset focuses on mainly two features of democracy. The first is related to the fairness of the process of selection and participation of the executive, prior to elections. The second one is related to executive power constraints post election.

Table 3.2 below compares each of the indicators used and the presumed or hypothesized dimensions to which they are related for the above three democracy measures.

Undoubtedly, POLITY IV is the most comprehensive dataset in its reach and range of years covered than any other dataset on characteristics of autocratic and democratic authority. From the stand point of view of institutional political regime structure, undoubtedly, the most appropriate selection of indicators would be in favor of Lijphart's indicators as the independent measured variables for the political freedoms measurement model. Unfortunately time limitations for gathering such wide range of variables for the number of countries included in this study was beyond the scope of this work. Similarly, Bollen's dataset is limited in its range of years as well as somewhat limited in the number of countries covered. For the above reasons the obvious selection was to use POLITY IV dataset indicators. The MM for political instrumental freedoms will empirically test the statistical significance of the hypothesized relationship that exists between each

TABLE 3.2: Democracy Indicators

Democracy Index (author)	Bollen		Lijphart		Polity IV	
	Dimensions	Indicators	Dimensions	Indicators	Dimensions	Indicators
	Political liberties	Press freedom	Executive - Party	Concentration of executive power	Executive recruitment	Regulation of chief executive recruitment
		Freedom of group opposition		Executive vs. legislative balance of power		Competitiveness of executive recruitment
		Government sanctions		Party system		Openness of executive recruitment
	Popular sovereignty	Fairness of elections		Electoral system	Independence of executive authority	Executive constraints
		Executive selection		Interest group system	Political competition and opposition	Regulation of participation
		Legislative selection and efficacy	Federal-Unitary	Degree of government centralization		Competitiveness of participation
				Concentration of legislative power		
				Degree of constitutional flexibility		
				Presence of a judicial review		
				Central bank independence		

societal political capability and the societal instrumental political freedoms through CFA in the MM for the POLITY IV dataset.

Given the above considerations, the path diagram for the political institutional freedoms is represented by Figure 3.3 below.

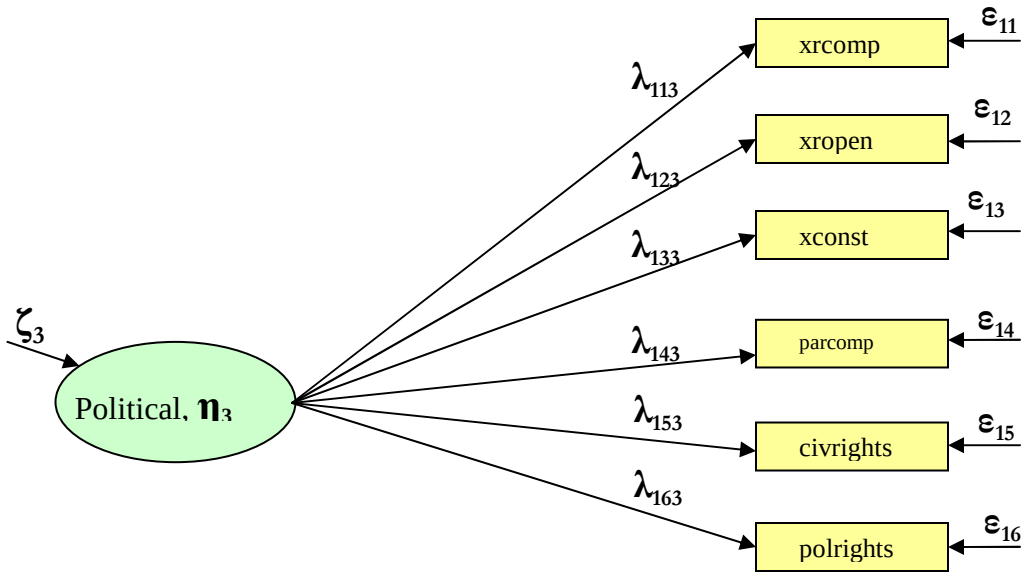

FIGURE 3.3. Proposed Measurement Model for Political Institutional Freedoms

Once the individual MM sub-model for each of the different types of institutional freedoms is empirically tested, the multi-dimensional MM is built by combining all three sub-models. The combined path diagram for the multi-dimensional MM is shown in Figure 3.4 down below.

The purpose of this step is to test two fundamental hypothesis of Sen's conceptualization of development, as it pertains to freedoms.

First, Sen's theoretical consideration that "[f]reedoms of different kinds can strengthen one another." (Sen, 1999; p. 11) is empirically tested. This is done by freeing parameters[85], in this case, factor loadings between freedoms of one kind and capabilities of another kind in the MM.

[85] These were in the originating model set to be equal to zero

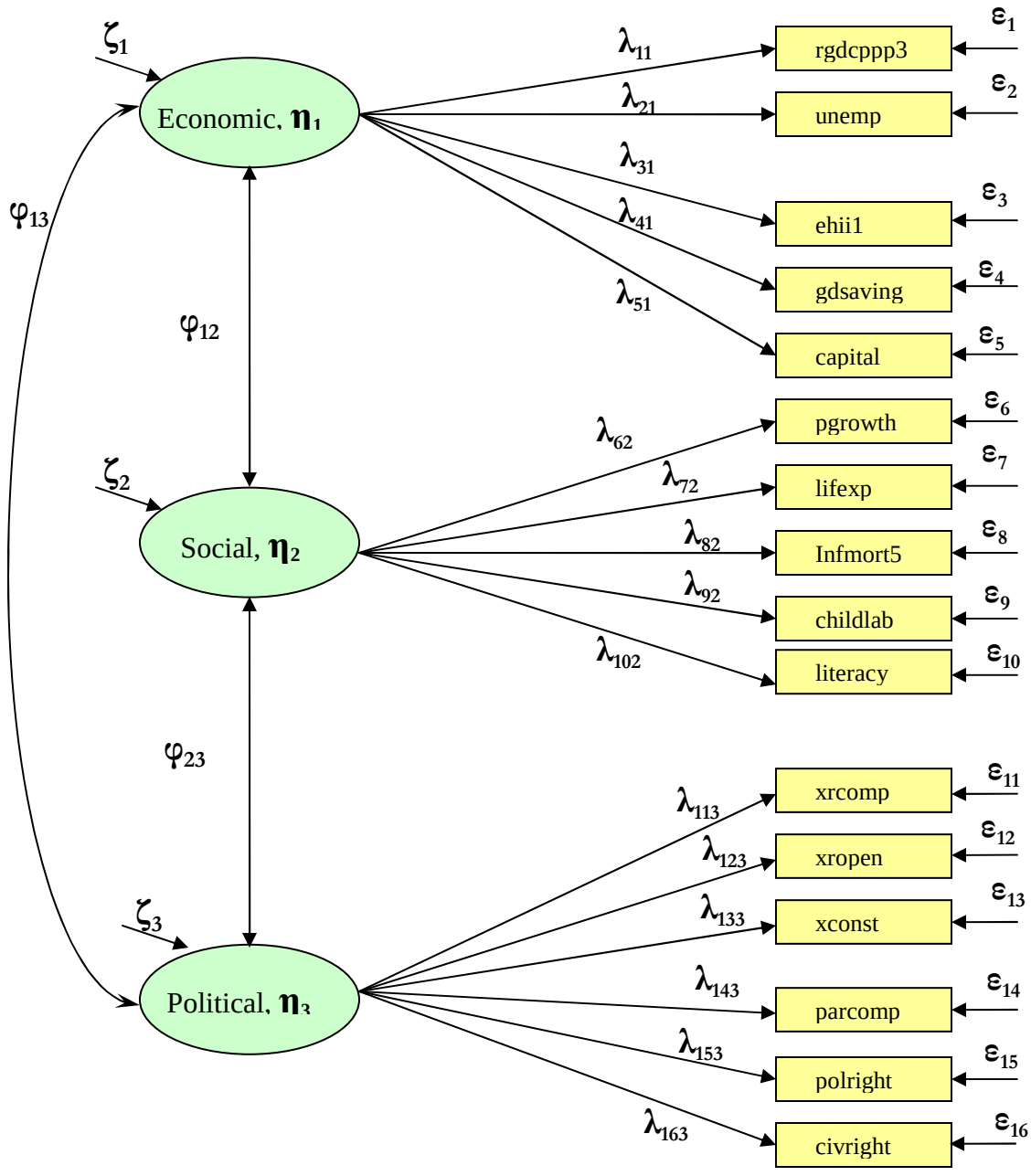

FIGURE 3.4. Proposed Overall Measurement Model

In the model the factor loadings are represented as lamda's $\lambda_{i,j}$ in the Λ matrix. In the initial multi-dimensional measurement model, factor cross-loadings[86] are non-existent. We proceed to modify this multi-dimensional measurement model by hypothesizing that not all factor cross-loadings are equal to zero and thereby free some factor cross-loadings parameters to not being equal to zero. This procedure has to be done in a step-wise fashion, letting one capability to load on a freedom of another kind, one at a time. Allowing several capabilities to load on several freedoms of different kinds in one single move, will most likely lead to non-convergence or to other model related messages and ultimately to falsely rejecting an otherwise theoretically plausibly model.

The selection of which factor cross-loadings are set free is defined by theoretical considerations given by Sen (Sen, 2000) in conjunction with some rationalization of what may seem more obvious. To be sure, Sen's theory, as indicated above, rather specifies, causal effects between freedoms of different kinds. This would require a non-recursive model, which at this time is beyond the scope of this study. Instead, the more simplistic approach of testing empirical causal relationships between capabilities of one kind to load on freedoms of another kind, as explained above, was utilized as an indirect path to empirically test this theoretical aspect.

One clear difficulty that arises in this empirical testing is that we are testing actual data against a theory that for most part is unbeknownst to government policies and presumably unexploited. We therefore proceed cautiously optimistic that any statistically significant finding of this nature will be a definitive resounding proof of the general reach of Sen's theoretical consideration. Clearly, it is not expected to find several non-zero factor cross-loadings. But a statistically significant finding of the existence of factor cross-loadings would provide strong evidence in support of Sen's conceptualization on this regard. Secondly, we test the validity of uncorrelated error measurement between all indicators of one kind and those of different kinds.

[86] Factor cross-loadings express the hypothesized causal relationship between freedom of one kind and capabilities another kind, i.e. a relationship between economic freedoms and say life expectancy and / or literacy.

Societal capabilities of one kind, it is herby hypothesized, are correlated with capabilities of the same kind or another kind, to allow for correlated error measurements. This is done again by freeing (making them different from zero) some non-diagonal parameters in the theta epsilon Θε matrix. On the initial MM for each type of freedom, only the elements of the main diagonal had been free (not equal to zero).

3.3 Covariance Structure Model

This section presents how the final CSM is built. First, the structural equation model (SEM) is built. The main purpose here is to incorporate the causal relationship between development and institutional freedoms. Second, the CSM is put together by combining the overall MM and the SEM.

The SEM basically incorporates the hypothesized casual relationship between development (the latent exogenous variable) and institutional freedoms (the latent endogenous variables).

The expected causal relationship is shown in Table 3.3. For all institutional freedoms (endogenous latent variables) a positive relationship is expected to be found between all three types of freedoms and development. This relationship stems from Sen's theoretical conceptualization that "freedoms are the primary end of development" in conjunction with "[t]he instrumental roles of freedoms include several interrelated components, … [which] have strong interlinkages. The process of development is crucially influenced by these interconnections."[87] Therefore there is a hypothesized causal relationship whereby an increase in development leads to an increase in economic, social, and political freedoms. The general underlying expression that describes this structural causal relationship can be written as:

Freedoms = γ development + residual error

In the above expression:

[87] (Sen, 2000; p. 53).

γ : Structural regression coefficient relating the causal relationship between freedoms (endogenous latent variables) and development (exogenous latent variable).

TABLE 3.3: Expected relationship between development and institutional freedoms

Variable #	Endogenous Latent Variable Name	Endogenous Latent Variable Description	Exogenous Latent Variable Development
1	econ	Economic Freedoms	+
2	social	Social Freedoms	+
3	polit	Political Freedoms	+

The mathematical technique that allows establishing the statistical significance of said causal relationship is confirmatory factor analysis (CFA). This technique does not "discover" the causal relationship, but rather, seeks to explain the variance / covariance matrix obtained from the previous measurement model for the endogenous latent variables in terms of hypothesized number of exogenous latent variables.

The path diagram visually describes the hypothesized causal relationship between the endogenous dependent (first order) latent variables freedoms and the exogenous independent (second order) latent variable development, as shown in Figure 3.5 below:

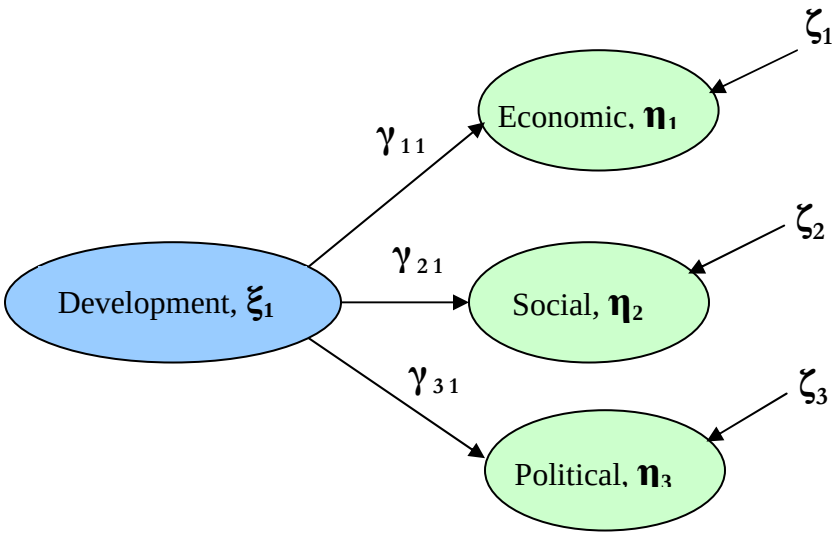

FIGURE 3.5: Path Diagram for the SEM

The CSM hereby proposed, empirically tests the statistical significance of the relationship between development and each of the different types of freedoms, ultimately providing a means to test the aforementioned hypothesis. The final CSM path diagram is shown in Figure 3.6 below.

3.4 Mathematical Formulation

In matrix notation, the set of relations that represent the causal relationship established by the MM based on substantive theoretical conceptualization of development can be expressed as follows:

$$\mathbf{Y} = \Lambda_y \eta + \varepsilon \qquad \textbf{Eq. 3.1}$$

Where:

$\mathbf{Y}$: Vector (16 rows x 1 column) with y_i elements representing the societal capabilities measured (observed) variables.

Λ_y : A 16 x 3 matrix with λ_{ij} factor loadings between the independent measured (observed) variables and the latent variables.

η : A 3 x 1 vector with η_j elements representing the institutional freedoms unobserved (unmeasured) latent variables.

ε : Matrix (16 rows x 1 column) whose elements represent the independent measured (observed) variables' error measurement[88].

Where:

y_i : Independent observed variable i.

λ_{ij} : Structural regression coefficient (loading factor) of independent observed variable i on latent (unobserved) variable j.

η_j : Institutional freedom latent (unobserved) variable j

ε_i : Error measurement related with societal capability observed variable i.

[88] Under un-correlated error measurement assumption, this is a diagonal matrix.

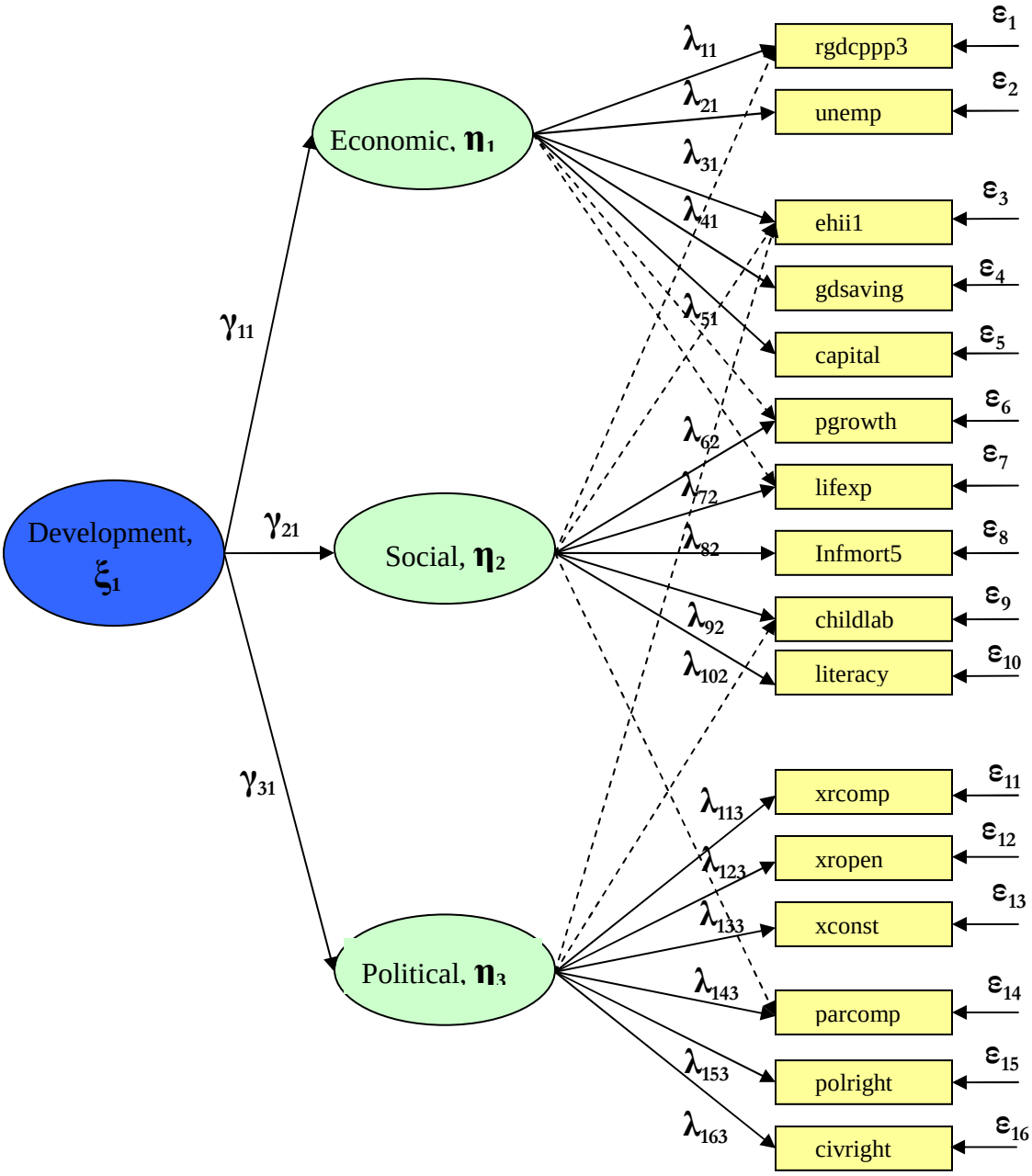

FIGURE 3.6. Proposed Overall CSM with Institutional Interlinkages

Covariance structure analysis' main focus is that of understanding the relationships that exist between the variances and covariances of the observed variables. Hence, the equation above needs to written in terms of variance and covariance matrices. With this in mind, the above equation, written in terms of variances / covariances, becomes:

$$\mathbf{COV[y]} = \Sigma = \Lambda_y \Psi + \Theta = \Sigma(\theta) \qquad \textbf{Eq. 3.2}$$

Where:

COV[y] : Matrix of the variance / covariance between any two societal capability independent measured (observed) variables i

Ψ : Matrix with elements φ_{jk} of the variance / covariance between any two endogenous latent (unmeasurable) variables j.

Θ : Matrix of the variance / covariance between any two error terms associated with the measurement of the independent measured (observed) variables[89].

Σ : Is the population variance / covariance matrix for the measured (observed) variables.

$\Sigma(\theta)$: Is the covariance matrix in terms of the model parameters.

A path diagram that represents the mathematical expressions above is shown in Figure 3 below.

ζ_j : Error in the prediction of latent variable j (or factor)

φ_{jk} : Variance or covariance between latent variables j and k.

The matrix equation that describes the SEM where there exists a causal relationship between endogenous (first order) latent variables and exogenous (second order) latent variables is described by the following equation:

[89] With respect to the elements of the latter matrix it is worth noting that it is a common standard approach to assume error measurements for the independent measured (observed) variables to not be correlated to each other, and therefore this matrix assumes only a diagonal form, whereby only the diagonal elements take a value (different from zero), while all other elements in the matrix are equal to zero (measurement error are not correlated to each other).

$$\eta = B\,\eta + \Gamma\xi + \zeta \qquad \textbf{Eq. 3.3}$$

Where:

η : Matrix of endogenous (dependent first order) latent variables. In this study this matrix is a is a 3 x 1 matrix (vector). Its elements are the economic, social, and political freedoms provided by the institutional structure to individuals in a society.

$\mathbf{B}$: Beta is a 3 x 3 matrix of structural regression coefficients between endogenous latent variables variables (freedoms).

Γ : Gamma is a 3 x 1 matrix (vector) whose elements are the structural regression coefficients γ_{ij} relating the i endogenous (dependent) latent variables to the j exogenous (independent) latent variable (in this study i = 3, j =1).

ξ : Ksi is a 1 x 1 vector of exogenous (independent) latent variable (development).

ζ : Zeta is a 3 x 1 matrix (vector) whose elements are the residual errors in the equation relating the endogenous dependent latent variables to the exogenous independent variable.

In the absence of a causal relationship between endogenous first order latent variables:

$$B = 0$$

And equation XX becomes:

$$\eta = \Gamma\xi + \zeta \qquad \textbf{Eq. 3.4}$$

A more detailed mathematical treatment of covariance structure analysis is provided in Appendix C (Mathematical Formulation).

3.5 Dataset and Statistical Treatment

The original data set compiles measured variables (i.e societal capabilities) data for 207 countries with all level of development (basically all countries in the world) from 1960 through 2007 on 30 variables, 22 of which are continuous and 8 are categorical. The categorical variables correspond only to the political dimension of development. Of the original 207 countries 46

countries had to be dropped from the dataset due to high prevalence of missing data for most variables, rendering a potential dataset of 161 countries. Of the original list of societal capability indicators (measured variables) sixteen 16 were selected strictly based on theoretical considerations (as indicated above) adhering to Sen's conceptualization. A few of these variables were dropped from the analysis attending to covariance structure analysis limitations as will be explained below, given the number of available observations. The final proposed model was built based on sample size of 154 countries and sixteen societal capabilities (measured variables) for an average year corresponding to the period 1990 thru 1994.

An accompanying Codebook has been prepared and is presented in Appendix A of this Thesis. Please refer to it for more detailed information on each societal capability indicator variable.

This section's focus is a summarized overview on how issues regarding outliers, missing data, normality (univariate and multivariate), validity of the assumed linear relationship between variables, etc., was dealt with. A more detailed presentation on this topic is presented in Appendix B.

Data Transformations

Several types of data transformation were performed on the data set, mainly data averaging and scale reduction. These transformations were necessary for several reasons.

Data averaging has two man purposes, mainly to increase data robustness, to increase effective sample size, and to avoid the problem of an "ill-scaled" covariance matrix.

Data averaging allows performing the analysis to a more robust sample set. Data averaging reduces random data fluctuations, which normally occur, but that are not necessarily a reflection of true changes in values. The selection of length of data averaging was anywhere from three to five years. Three years turned out to be not long enough to minimize the effect of missing data. A period of five years was prudent enough to avoid noticeable transient effects, which are nonetheless present in time series datasets. Hence, a period for averaging of five years was chosen. The period

selected[90] was from 1990 thru 1994, that is to say, data worth for five years was averaged for this period. The calculated covariance matrix was based on average data for this period.

In addition averaging data also helped to increase, to a limited extent, the effective sample size. Given the internal structure of the dataset as indicated above, applying a covariance structure analysis to the original dataset would have resulted in a substantially reduced sample size, which have rendered such type analysis implausible or severely limited its reach.

Variable transformations were also necessary in order to avoid the issue of and ill-scaled covariance matrix. The transformations performed to each of the continuous variables are treated down below (see Ill-Scaled Issues). We will present more on the issue of "ill-scaled matrix down below.

Outliers

A large body of research has focused on understanding how outliers affect the true relationship that exists between variables, measured and / or latent (Anderson and Schumacher, 2003; Ho and Naugher, 2000; Huber, 1981; Rousseeuw and Leroy, 1987; Staudte and Sheather, 1990). The presence of univariate outliers contributes to multivariate non-normality (Kline, 2005, p. 49). In addition, most statistical estimation methods in analysis of covariance structure rely on multivariate normality. As a rule of thumb, outliers can be graphically detected by visual inspection of the data. A visual inspection of the dataset, coupled with a histogram for each of the continuous variables indicated the presence of univariate or multivariate outliers. Since removal of univariate outliers contributes to multivariate normality, outliers were removed from the dataset.

Normality

Most statistical methods are based on the underlying assumption of normality. Covariance structure analysis is not an exception. The presence of non-normality can be treated in two ways.

[90] The original intention of this study was to perform the analysis for two periods, the second period being around 2005.

The first one is to obtain normal scores for all variables (since all continuous variables are non-normally distributed. The second option is to utilize estimation methods that have been developed to perform statistical analysis under non-normality.

Missing Data

For statistical analysis of datasets it is customary to handle missing data though either pairwise or listwise deletion. Having used either of these data handling techniques would have rendered a very small effective sample size, such that the type of empirical analysis hereby performed would have not been possible due to sample size requirements inherent to covariance structure analysis (CSM). These requirements will be discussed down below. For this reason, in lieu of the aforementioned data handling techniques, data imputation was utilized.

Data imputation is a statistical technique that allows generating values for missing data cases from data available for other cases with "similar response pattern over a set of matching variables." (Jöreskog and Sörbom, 1996-2002).

An analysis of the data structure by pairwise or listwise deletion yielded an effective sample anywhere from 84 to 97 cases. This number would have rendered any analysis unreliable due to the sample not complying with the minimum requirement of 100 cases (see Sample Size below).

Even though data imputation has the potential disadvantage of adding data that might not necessarily adjust to reality, it nonetheless enables to conform to minimum covariance structure analysis sample size requirements (Jöreskog and Sörbom, 1996-2002). Data imputation raised the effective sample size back to 154 cases. Imputed values were scanned for abnormal generated values.

Sample size

The scholarly literature presents several recommendations on this regard. For instance Guilford (1956) argued that the minimum number of observations to produce reliable factors is 200. On the other hand, Kline (Kline, P., 2005) supports utilizing sample sizes as small as 100 in data

where a clear sample structure exists. He recommends carrying replication with other samples if the number of observation is below 100.

Others (Kline, R, 2005; p. 110) rather than focusing on absolute sample sizes recommend holding the ratio between the number of cases or observations to the number of free parameters to be no smaller than 5:1. This ratio is also the minimum recommended by Bentler and Chou (1987). In this study, depending on the complexity of the model, this ratio varied between 5:1 and 3:1.

Anderson and Gerbing (Anderson and Gerbing, 1984; Gerbin and Anderson; 1985) recommend a minimum of 150 observations to avoid improper solutions, parameter estimate bias, and / or non-convergence issues.

In addition it is recommended to keep the ratio between the number of observations or cases to the number of measured variables to be between 10:1 to, no less than, 2:1. In this study this ratio is 9.6 (154 observations / 16 measured variables). Again, higher ratios are always preferred. Arrindel and van der Ende (Arindel, W. A.; Ende, van der J., 1985) claim that the analysis should rather ensure that the ratio of observations to latent variables (factors) should be kept at no less than 20:1. In this study this ratio is 154 observations / 3 endogenous latent variables (factors) equal to 51.3.

Effective sample size

Jöreskog and Sörbom (Jöreskog and Sörbom, 1996-2002) defined the minimum sample size requirements based on the type of matrix to be analyzed and the number of measured variables. Based on the equation thereby provided the following Table 3.4 was prepared with an aim at defining the maximum number of measured variables the number of available observations (once translated into effective sample size) the CFA would support.

The original database compiled data for 208 countries, but was subsequently reduced to 161 countries. Widespread missing data for 47 countries prevented their inclusion in the study dataset.

TABLE 3.4 Maximum Number of Measured Variables

Type of Matrix	Number of measured variables										
	10	11	12	13	14	15	16	17	18	19	20
For MA = KM	45	55	66	78	91	105	120	136	153	171	190
For MA = CM	55	66	78	91	105	120	136	153	171	190	210
For MA = AM	66	78	91	105	120	136	153	171	190	210	231

Where:

MA: Variance / covariance matrix type to be analyzed.

KM: Pearson correlation matrix.

CM: Covariance matrix.

AM: Asymptotic covariance matrix.

The list of countries that were dropped from the original dataset is presented in Appendix B, Table B.1. In addition, prevalent missing data in 11 countries or outliers required to further drop the sample to 154 countries, thereby making the maximum number of observations available equal to 154. This became the major limitation from the stand point of view of maximum number of observation available for the CFA model.

As indicated above, either pairwise deletion or listwise deletion would have further reduced the number of observation available for the analysis, i.e. the effective sample size. So it was imperative to perform imputation.

Number of measured variables per latent variable

The use of multiple indicators (measured variables) for a given construct lessens the effect of measurement error thereby increasing the accuracy of results. Using two indicators per latent variable or factor is known to give estimation problems. One such estimation problems is the generation of Heywood cases. Heywood cases occur when parameter estimate result in negative variances or correlations with absolute values greater than one. They are known to be caused by the

use of only two indicators per factor. So, as a minimum, it is recommended to use three indicators (measured variables) per latent variable or factor (Kline, R., 2005).

Ill-Scaled Matrix

Analysis of ill-scaled matrices causes estimation problems in analysis of covariance structures. The problem of ill-scaled matrix arises when the observed variables' ratio of relative variances is greater than 10. Estimation methods used in CSM are iterative. The iterative process may fail to produce a stable solution (to converge) because as it makes parameter estimates adjustments, through subsequent cycles of calculations to improve overall model fit, the size of these adjustment may become too small for some variables while too large for others.. This will eventually lead to convergence failure. In order to overcome this problem, it is necessary to re-scale variables by multiplying the raw scores by a suitable constant. Multiplying the raw scores by a constant will modify a variables mean and standard deviation, but it will not modify a variable's correlation with other variables, thereby maintaining the existing covariance structure intact.

Table 3.6 presents the transformations and re-scaling of variables performed to the original raw scores.

Variance - Covariance Matrix vs. Correlation matrix

Analysis of covariance structure is performed, in the majority of cases, based on a variance – covariance matrix instead of on a correlation matrix. It has been found (Boomsma, 1983) that analysis of correlation matrices leads to "imprecise parameter estimates and standard errors of the parameter estimates" (Schumacker and Lomax, 2004; p. 55), and consequently to incorrect interpretation of the statistical significance of the hypothesized causal relationship between measured and latent variables.

TABLE 3.5 Re-Scaling of Measured Variables

Variable Name	Description	Transformation
gdpcppp3	Gross domestic per capita product parity purchase	2*Log(gdpcppp)
unemp1	Unemployment, % of working age population	unemp / 10
ehii1	Inequality household income index	ehii / 10
gdsaving1	Savings as a % of gross domestic product	gdsaving/ 10
capital1	Capital as a % of gross domestic product	capital / 10
popgrowt1	Population growth, %	popgrowt / 2
lifexp1	Life expectancy, years	lifexp / 10
infmort5	Infant mortality up to 5 years	infmort5/5
childlab1	Child labor % of total child population	childlab / 20
literacy1	Literacy as a % of	literacy / 20

3.6 SOFTWARE USED

LInear **S**tructural **REL**ationships (**LISREL**) is by far the best well known software (Long, 1983) utilized by social researchers in studying the causal relationship that exists between a set of measured (observed) variables and a smaller set of latent (unmeasurable) variables in an attempt to understand the causal relationship that exists between them. The causal relationship is explained in terms of the covariance structure between the measured (observed) variables and commonly synthesizes in a (correlation, covariance, or asymptotic covariance) matrix.

LISREL has the capability of providing estimates for the structural regression coefficients between both the latent (un-measurable) variables and the measured (observed) variables and between the latent exogenous and latent endogenous variables. It also has the capability of generating the path diagram. A companion preprocessor program, PRELIS, can perform all sort of variable modifications, generate descriptive statistics, generate the corresponding matrices, among other functionalities.

CHAPTER 4

MODEL RESULTS

This chapter's focus is on examining the results. As stated on previous chapters, one of the main contributions of this Thesis work is to empirically test Sen's theoretical conceptualization of development. The first section will present the results from the MM, and the second section will focus on presenting the results from the CSM. The results are very encouraging.

4.1 Measurement Model Results

In the previous Chapter 3 a proposed 2nd Order Recursive CSM to empirically test the core tenets on which Sen's development theory is premised was presented. Sen's development theory foundational pillars were translated into testable hypothesis and a CSM model based on these foundational pillars was built. The proposed CSM was tested on a sample of 154 countries, utilizing 16 societal capabilities along the multi-dimensional framework of development (i.e. economic, social, and political) utilizing a covariance structure analysis in conjunction with confirmatory factor analysis (CFA). The utilization of CFA allows for testing the statistical significance of the causal relationship between each of the measured variables and the uncovered latent endogenous and exogenous variables.

The MM model was built attending to substantive theoretical considerations describing the hypothesized fundamental relationship that exists between the societal capabilities indicators or substantive freedoms (measured or observed variables) and the hypothesized endogenous instrumental freedoms (latent variables), as well as between the instrumental freedoms and development (exogenous latent variable). Sen's development theory fundamental tenants were converted into specified empirically testable hypothesis and built into a CSM to be analyzed with LISREL.

In this section attention is directed to presenting the MM results. The next section will focus on the results for the CSM. How well a proposed model fits a sample data depends mainly on three major criteria (Byrne, 1998). The first concerns how well the individual parameters fit the sample data and the existing causal relationship it tries to explain. The second concerns the extent to which observed measured variables variance is explained by the latent variables. The third concerns how the model as a whole fits the sample data. All in all these three criteria provide the means to assess the validity of the hypothesized theory in accurately and adequately describing the sample data. The focus will be on examining the results in light of the first two criteria.

4.1.1 Fitness of Individual Parameters in the Model

Determining the adequacy of individual parameters depends mainly on three aspects, mainly the feasibility of parameter estimates, the appropriateness of standard errors, and thirdly on the statistical significance of the parameter estimates (Byrne, 1998). Of these three, the latter is for obvious reasons, the aspect that holds major relevance for determining the empirical validity of a theory. Table 4.1 below summarizes and compares the estimated factor loadings (parameter estimate), standard deviation, and statistical significance of the parameter estimates for two measurement models, MM1 and MM2. Figure 4.1 and Figure 4.2 present the path diagrams for MM1 and MM2 respectively. MM1 represent the overall measurement model with no factor cross-loadings (no interlinkages) and with un-correlated measurement errors. MM2 represents the overall MM with factor cross-loadings and allowing for correlated measurement errors. The presence of statistically significant factor cross-loadings provides empirical evidence of the existence of interrelated institutional freedoms of one kind with societal capabilities of another kind (i.e. interlinkages). An analysis of Table 4.1 reveals the following:

1. For both MM1 and MM2, all societal capabilities factor loadings on the corresponding institutional freedom are statistically significant at the 95% level and with the relationship holding

TABLE 4.1 MM1 and MM2 estimated factor loadings, standard deviations and statistical significance of parameter estimates.

MM1

UNCORRELATED MEASUREMENT ERRORS

	econ	social	polit
gdpcppp3	1.00	- -	- -
unemp	0.1113 (1)	- -	- -
	(0.0583) (2)		
	1.9102 (3)		
ehii1	-0.6648	- -	- -
	(0.0504)		
	-13.1878		
gdsaving	0.7003	- -	- -
	(0.0929)		
	7.5382		
capital1	0.2457	- -	- -
	(0.0676)		
	3.6339		
popgrowt	- -	-0.3551	- -
		(0.0486)	
		-7.3098	
lifexp	- -	0.9943	- -
		(0.0592)	
		16.7967	
infmort5	- -	-1.3890	- -
		(0.0775)	
		-17.9165	
childlab	- -	-0.6287	- -
		(0.0485)	
		-12.9710	
literacy	- -	1.0000	- -
xrcomp	- -	- -	0.1903
			(0.0173)
			11.0147
xropen	- -	- -	1.0000
xconst	- -	- -	0.4776
			(0.0415)
			11.4946
parcomp	- -	- -	0.3481
			(0.0289)
			12.0346
polright	- -	- -	-0.5377
			(0.0442)
			-12.1665
civlib	- -	- -	-0.4904
			(0.0413)
			-11.8831

MM2

CORRELATED MEASUREMENT ERRORS AND FACTOR CROSS-LOADINGS

	econ	social	polit
gdpcppp3	1.0000	- -	- -
unemp	- -	0.0669	- -
		(0.0337)	
		1.9824	
ehii1	-0.1631	-0.4330	0.0461
	(0.0775)	(0.0591)	(0.0180)
	-2.1055	**-7.3254**	**2.5631**
gdsaving	0.0786	0.3655	- -
	(0.0401)	(0.0572)	
	1.9597	**6.3866**	
capital1	0.2164	- -	- -
	(0.0713)		
	3.0350		
popgrowt	- -	-0.2674	- -
		(0.0312)	
		-8.5781	
lifexp	- -	0.6361	0.0296
		(0.0307)	(0.0122)
		20.6941	**2.4313**
infmort5	- -	-1.0000	- -
childlab	- -	-0.6400	0.0704
		(0.0448)	(0.0173)
		-14.2976	**4.0588**
literacy	- -	0.7551	- -
		(0.0410)	
		18.4137	
xrcomp	- -	- -	0.2378
			(0.0180)
			13.1853
xropen	- -	0.9451	1.0000
		(0.1792)	
		5.2735	
xconst	- -	- -	0.5955
			(0.0545)
			10.9350
parcomp	- -	- -	0.4410
			(0.0453)
			9.7328
polright	- -	- -	-0.6814
			(0.0709)
			-9.6067
civlib	- -	- -	-0.6161
			(0.0642)
			-9.6009

Notes:

(1) Factor loading or structural regression coefficient estimate of a given capability represented by the measured (observed) variable onto the respective institutional freedom as represented by the latent (un-measurable) variable.

(2) Standard deviation of parameter estimate.

(3) t-statistic for parameter (structural coefficient) estimate.

the expected sign, with unemp (unemployment) being the only factor loading that was statistically significant at the 90% level but with sign contrary to that as expected. The interpretation of this empirical finding is that the expansion of instrumental freedoms causes an improvement or an increase in societal capabilities (with an exception for unemployment societal capability). For instance, an adequate economic institutional arrangement enhances the capability of a society to lower levels of inequality or to increase levels of capital investment.

2. As hypothesized, there exist three uncovered institutional freedoms (latent variables) that are causally related with societal capabilities. These correspond to economic, social, and political, according to substantive theoretical considerations.

3. In MM2, the effect of social institutions is statistically significant at the 95% level for unemployment societal capability.

4. Results for MM2 provide empirical evidence of the existence of factor cross-loading between institutional freedoms of one kind and capabilities of another kind (i.e. interlinkages). The existence of interinkages between institutional freedoms in the economic, social, and political dimension with societal capabilities of all other different kinds was found to be statistically significant at the 95% level. For example, the social institutional structures help increase societal capability to reduce poverty. The sign has the expected sign. On the other hand, MM2 provides empirical evidence that the political institutional structure has e negative impact in reducing the societal capability to reduce poverty. Similarly, the social institutional arrangement has a statistically significant effect in reducing child labor, but the political institutional structure has a statistically significant impact on increasing child labor societal capability. Also, MM2 provides empirical evidence that both the economic and social institutional arrangement have a statistically significant positive effect on the societal capability to save. Lastly, MM2 provides empirical evidence that suggests that the social institutional arrangement increases the societal capability of executive recruitment openness.

4.1.2 Assessment of the Measurement Models Fitness

The assessment of how well a model can adequately explain the existing variance for each measured variable by the uncovered latent variables is provided by the squared multiple correlation R^2. This information is given below in Table 4.2 which summarizes the R^2 (squared multiple correlations) for each societal capability. This parameter provides the percentage of existing variation that is actually explained by each institutional freedom.

TABLE 4.2 Explained Variation (R^2) by MM1 and MM2 for Societal Capabilities

Societal Capability	MM1	MM2
	% variation explained	
gdpcppp3	83.1	44.6
unemp	2.4	2.3
ehii1	61.1	68.7
gdsaving	29.5	26.6
capital1	8.4	3.5
popgrowt	29.6	31.9
lifexp	90.2	81.1
infmort5	96.1	91.2
childlab	68.1	85.4
literacy	70.4	74.1
xrcomp	80.4	78.6
xropen	49.9	55.7
xconst	87.6	86.8
parcomp	96.1	96.6
polright	98.2	98.8
civlib	93.6	92.6

The R^2 (Squared multiple correlations) shown above indicates that the percentage of explained variance for each of the capabilities (measured variable) is as follows:

High (> than 70% variance explained by the corresponding freedom)

gdpcppp3 , lifexp, infmort5, literacy, xrcomp, xconst, parcomp, polright, civlib.

Moderately good (> than 25% variance explained by the corresponding freedom)

Ehii1, gdsaving, childlab, popgrow, xropen

Low (< than 25% variance explained by the corresponding freedom)

Unemp, capital1.

In summary both CFA measurement models provide empirical evidence that support that each capabilities' (as indicated by the measured variable) regression coefficient (factor loading) is statistically significant (at the 95 % level). The relationship between each capability and its relevant institutional freedom has the expected sign (as shown above in Table 4.1. The only exception is for unemp, which is statistically significant at the 90% level, but with the opposite sign of what was expected. These two CFA measurement models provide statistically significant empirical evidence in support of Hypothesis 1 through Hypothesis 3.

Path Diagrams for both MM1 and MM2 are presented in Figure 4.1 and Figure 4.2 below.

4.2 Covariance Structure Models (CSM) Results

This section presents the results from the two CSM. CSM1 corresponds to the basic model with no interlinkages and un-correlated measurement errors, while CSM2 corresponds to the model which considers the existence of institutional freedoms interlinkages and correlated measurement errors. Results for MM portion of the CSM have already been presented, hence no further reference is made to these. Table 4.3 presents the results related to the structural regression coefficients between development (as the exogenous independent variable) and the instrumental freedoms (representing the economic, social, and political institutional structure), as well as R^2 (the percentage of variation explained by development for each instrumental freedom), for both CSM's. The corresponding path diagrams for CSM1 and CSM2 are presented in Figure 4.3 and Figure 4.4 respectively[91].

[91] Generated by LISREL

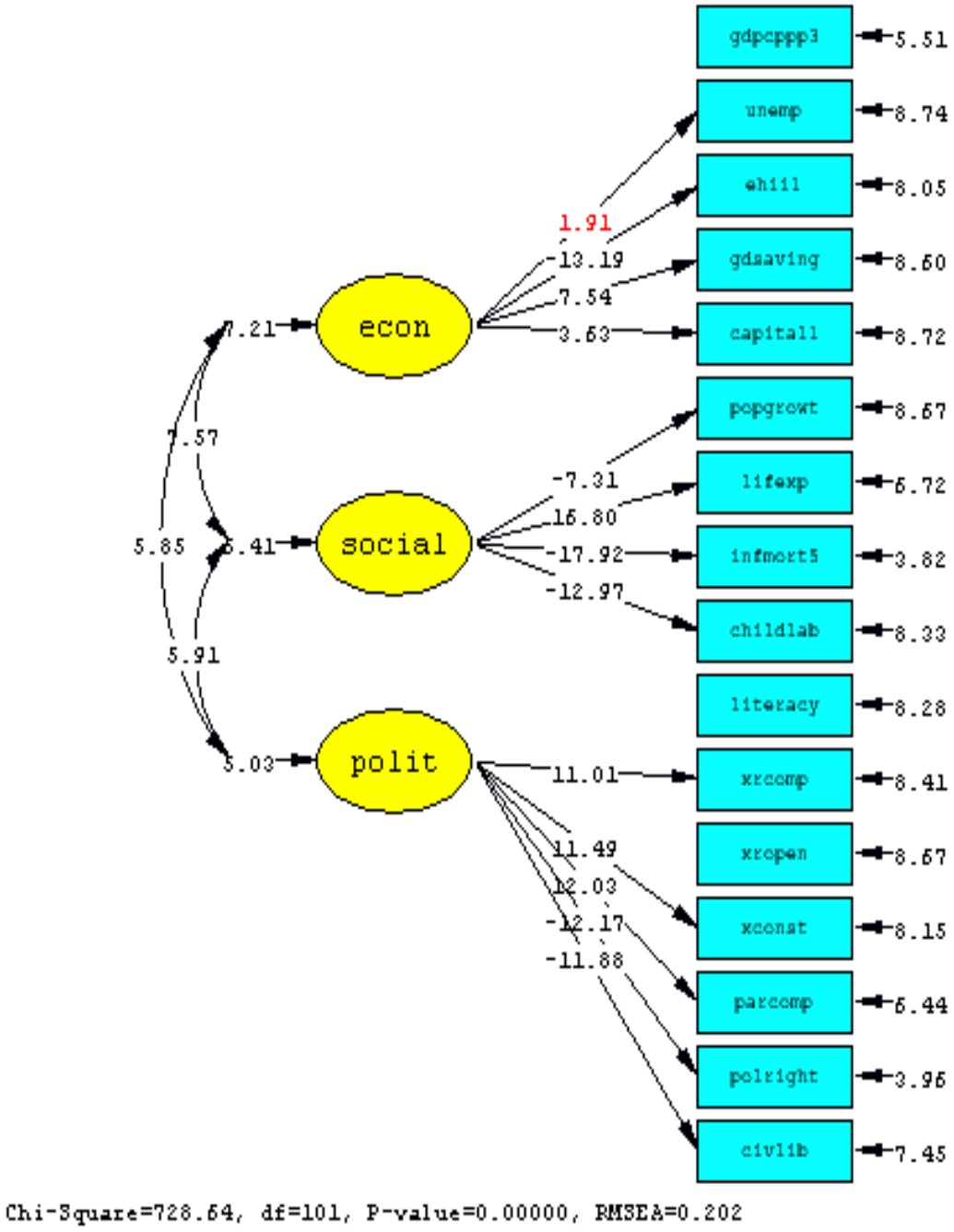

FIGURE 4.1. Path Diagram for MM1.

NOTE:
The number accompanying each arrow is the t-statistic.

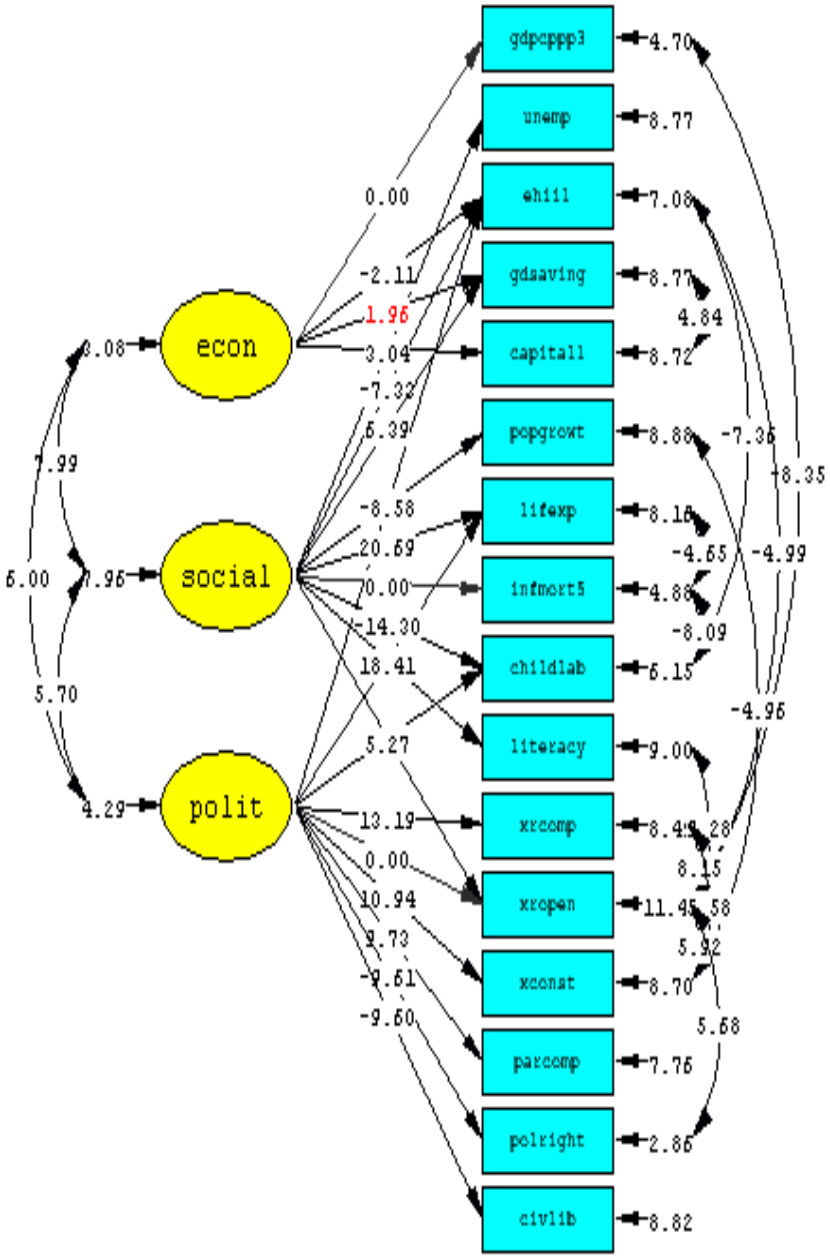

FIGURE 4.2. Path Diagram for MM2.

NOTE:
The number accompanying each arrow is the t-statistic

4.1.1 Fitness of Individual Parameters in the Model

The one important aspect in the CSM model is the one related to the causal relationship between development (as the exogenous 2nd order latent independent variable) and the institutional freedoms (as the endogenous 1st order latent dependent variables) as hypothesized by Sen in his theoretical conceptualization of development (Hypothesis 5 above), incorporated into the CSM. The estimated structural regression coefficients between development and the instrumental freedoms are positively related to development since they all have the expected positive sign and are all statistically significant at the 95% level, as shown in Table 4.3.

This result provides empirical evidence in support of a causal relationship between development and the institutional freedoms or as Sen theorized "the expansion of freedoms is the primary end of development" (Hypothesis 5 in Chapter 2).

TABLE 4.3: Fitness of individual parameters in the CSM model (Gamma Matrix)

Instrumental Freedom	Econ	Social	Polit
Development - Dev	0.83 (1) (0.06) (2) 13.65 (3)	1.4216 (0.09) 16.58	3.16 (0.41) 7.76
R^2	0.95	1.03	0.51

NOTES:
(1) Factor loading or structural regression coefficient estimate for a given institutional freedom.
(2) Standard deviation of parameter estimate.
(3) t-statistic for parameter (structural coefficient) estimate.

The above table provides empirical evidence that supports the existence of a causal relationship between development and instrumental freedoms as provided by the institutional arrangement present in the political economy of a society. This relationship is statistically significant at the 95% level and the relationship is positive for all institutional freedoms, meaning that an increase in development results in a positive effect on the institutional freedoms.

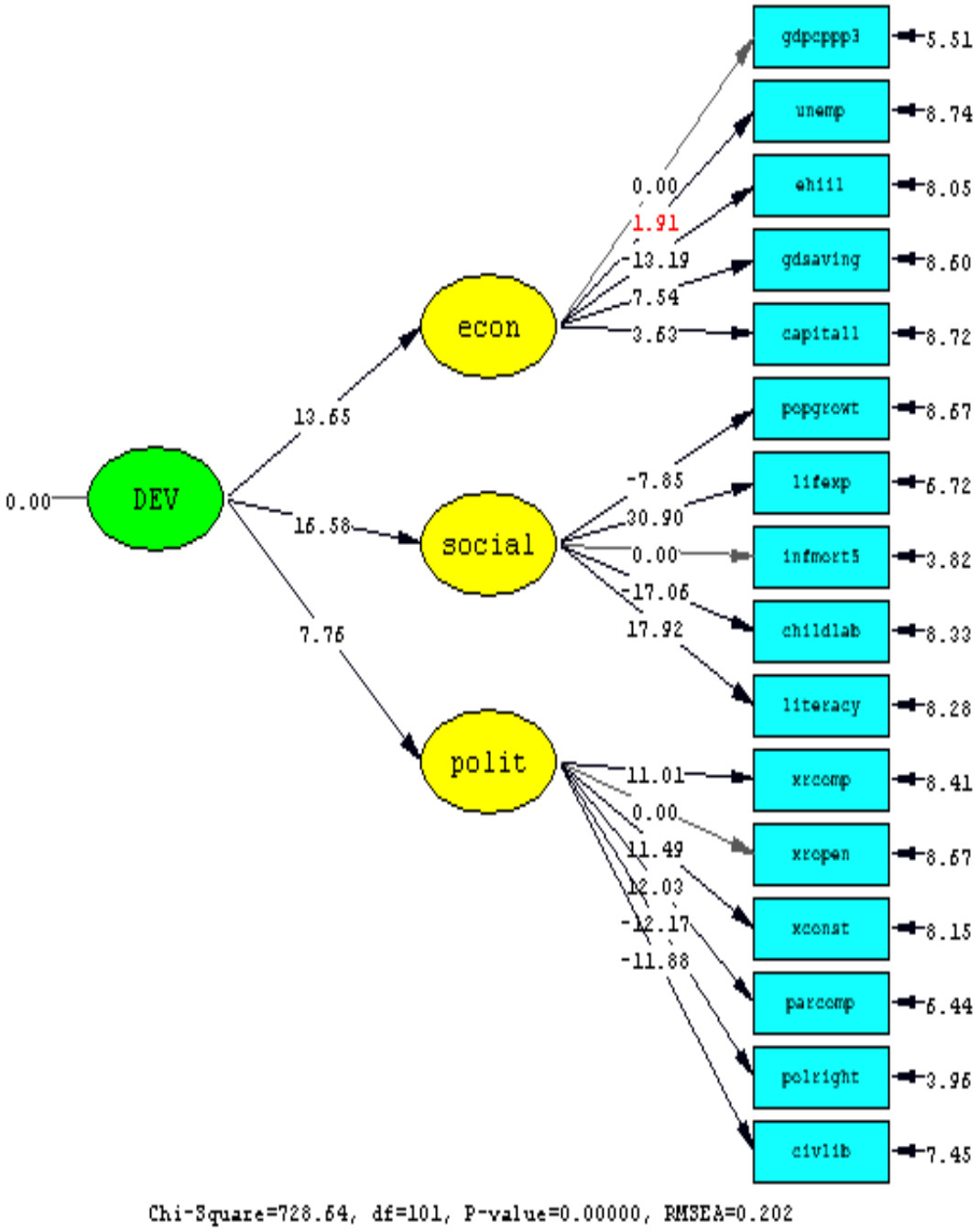

FIGURE 4.3. Path Diagram for CSM1 (Un-Correlated Error Measurement).

NOTE:

The number accompanying each arrow is the t-statistic.

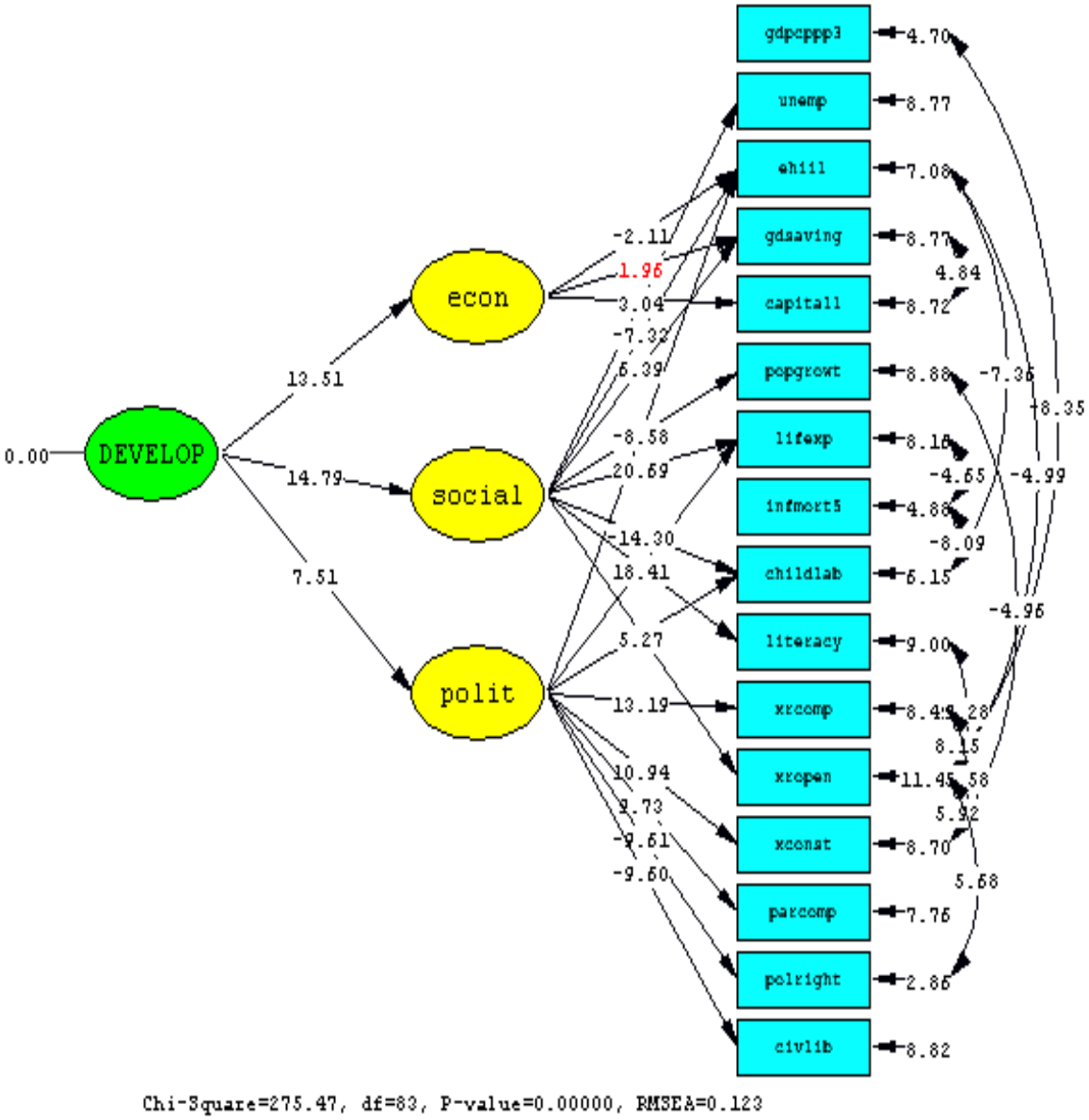

FIGURE 4.4. Path Diagram for Covariance Structure Model (CSM) with Correlated Error Measurement

NOTE:

The number accompanying each arrow is the t-statistic.

4.2.2 Assessment of the Measurement Model fitness

The R^2 shown above indicate the percentage of explained variance for each of the institutional freedoms (1st order latent endogenous variable) by development (the 2nd order latent exogenous variable). The percentage variation explained can be categorized as follows:

High (> than 70% variance explained by development)

Econ and Social.

Medium (> than 25% variance explained by Development)

Polit

4.3 Conclusions, Implications, and Recommendations

A CFA 2nd order recursive covariance structure model (CSM) to test Sen's development theory ("Development as Freedom") empirical validity has been proposed. Sen's postulated theoretical core tenets were translated into testable hypothesis which in turn were incorporated into the CSM model. Sen's theory has been directly applied to societal capabilities, with society as the unit of analysis.

4.3.1 Conclusions

The model results present strong empirical evidence in support of Sen's theoretical conceptualization. All of Sen's hypothesized causal relationships are strongly supported by the proposed CSM model as follows:

1. For the chosen societal capabilities (as represented by the measurement variables) there exist three types of instrumental freedoms, corresponding to economic, social and political institutional structure (as represented by dependent endogenous latent variables).

2. The percentage variation explained by the institutional structure was high to moderate for most societal capabilities, except for unemployment (unemp), population growth (popgrowt) and gross capital formation (capital1), which were low.

3. There exists a strong causal relationship between societal capabilities (i.e. substantive freedoms) and institutional (i.e. instrumental) freedoms. All societal capabilities ensue from the corresponding type of freedom as provided by the institutional arrangement in a society. All relationships were of the expected sign and statistically significant at the 95% level, with the only exception being that for unemployment, which exhibited a positive relationship (negative expected) and statistically significant at the 90% level when associated with economic institutional structure, but was statistically significant at the 95% level when associated with the social institutional structure.

4. The CSM models provide strong empirical evidence that suggests that the postulated existence of crosslinkages between societal capabilities of one kind and institutional freedoms of another kind is valid. These causal relationships are statistically significant at the 95% level. In some cases, the sign of the relationship is contrary to that of the expected sign for the corresponding institutional freedom. Institutional freedoms of one kind reinforce societal capabilities (i.e. substantive freedoms) of another kind.

5. The CSM models provide strong empirical evidence that suggests the existence of a causal relationship between development and the institutional structure (i.e. institutional freedoms). For all three types of institutional freedoms the relationships are positive and statistically significant at the 95% level. Development is a multidimensional process of expanding interconnected freedoms, whereby the expansion of freedoms is the primary end of development.

4.3.2 Implications

There are several implications that can be derived from the findings provided by the proposed CSM. The implications are far reaching and can be viewed as impacting three different realms, first the realm of academia, second, that of development policies, and third, world economic and financial organizations. But before submerging, in them it is important to recognize that Sen's conceptualization of development theory is a very complex theory. The proposed model represents an oversimplication, and it is intended to be taken as a first step, a first approach in the path to

constructing a model that more truly represents Sen's theory of development. There are still several important building blocks that need to be incorporated into the model. The major implications of the findings reported here are as follows:

Academia

1. Sen' conceptualization of development theory provides a scientific paradigm shift in the realm of development theory. Conventional wisdom "resource" type variables are not fundamental variables that can provide and sustain a causal mechanism for long term rate of growth (i.e. development) for a society to achieve. The foundational pillars on which Sen's development theory rests and the perspective of the expansion of freedoms being seen as "the primary end and the principal means of development" provides a deeper and more fundamental understanding of the determinants of development and long term growth.

2. As it pertains to scholars, analysts, and critics of Sen' development theory, the results derived from this thesis work should provide a re-orientation of the current intense focus and emphasis on individual capabilities to a more balance approach, whereby institutional structures and arrangements are given the appropriate space in the analysis. This thesis work attempts to bring to the discussion the important role of the institutional structure in the expansion of freedoms, which seems to have been, for most part, left relegated to a second place, if not totally unattended. Making evaluative assessment of capabilities or functionings without providing adequate consideration and without incorporating into the analysis the effect and impact that the institutional structures and arrangements have on them would not be adequate, because substantive freedoms or functionings are derived from the institutional freedoms provided by the institutional structure, as postulated by Sen's theoretical framework.

3. Given the difficulty in making evaluative assessments at the individual unit of analysis, it maybe worth considering, shifting the emphasis, for the type analysis hereby conducted, from that of the individual to that of the society.

4. In regards to studies in comparative politics, and more specifically, in political economy, scholars will need to start developing their studies, within a larger perspective on the informational basis. It shall no longer be acceptable to make comparative studies, and more importantly, draw valid conclusions, if the focus persists to being on income per capita or gross domestic product.

Development Policies

1. It is no longer adequate to continue to make evaluative assessments of a society's rate of growth based on income per capita or rate of gross domestic product growth. Development is truly a multi-dimensional construct. Development policies need to start paying very close attention to the relevance of the institutional structure and arrangements in the economic, social, political, protective security, and transparency guarantees, and to the importance of creating complementary programs and institutions, that support the interrelated synergies each institutional dimension create on others'.

2. One important aspect is the creation of ample space and an adequate institutional structure and arrangement that allows individuals to become active participants in the process of the expansion of freedoms as a constitutive element of development.

3. Policy makers should start focused efforts in developing an institutional structure that favors the expansion of freedoms and re-orienting resources to emphasizing freedoms while de-emphasizing the importance or relevance given to income per capita.

World Financial Organizations and Institutions

1. World financial organizations and institutions should re-orient the focus of their structural reform policies, multi-billion dollar loans, and aid packages. They should adapt a broader informational basis attending to Sen's development theory first postulated core pillar.

2. Just like neoclassical theories of growth became a constitutive elemental pillar for the development of neo-liberal policies that gave birth to a consensus of policies adopted by international financial institutions (IFI's) and which finally led to a series of failures in the

developing world, IFI's, Sen's development theory should seriously be given consideration as the new platform, the new model of next generation structural reforms.

4.3.3 Recommendations for Further Research

Recommendation for further research work to continue developing a stronger empirical foundation for Sen's development theory should aim at enhancing the comprehensiveness of the empirical CSM to include other aspects not considered in the simple proposed model in this thesis work, as follows:

1. Consider adding exogenous measured variables that affect the instrumental freedoms.
2. Consider adding transparency guarantees and protective security to the instrumental freedoms dimensions of development.
3. Consider building a non-recursive CSM to include the bi-directional causal effects of societal capabilities onto instrumental freedoms.
4. Consider adding aspects of agency theory into the CSM.

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APPENDIX A - CODEBOOK

AN EMPIRICAL CONTRIBUTION TO DEVELOPMENT THEORY: A COVARIANCE STRUCTURE MODEL FOR DEVELOPMENT AS FREEDOM

Carlos A. Rosas

Dataset assembled by Carlos A. Rosas
Louisiana State University
Department of Political Science

Version 1.0
March, 2008

country
Name of country (country identification)

ccode
Country code, arbitrarily assigned.

year
Year for which variable data value is given.

gdpcppp
Gross domestic product per capita purchase power parity at constant 2000 international US $. Data from World Bank (2004). Data available from 1980 thru 2003.

fdinvest
Foreign direct investment, net inflows as a percentage of GDP. Data from World Bank (2004). Data available from 1960 thru 2003.

netsaving
Adjusted net national savings as a percentage of gross national income. Data from World Bank (2004). Data available from 1960 thru 2003.

domcredit
Domestic credit provided by banking sector as a percentage of GDP. Data from World Bank (2004). Data available from 1960 thru 2003.

creditpriv
Domestic credit to private sector as a percentage of GDP. Data from World Bank (2004). Data available from 1960 thru 2003.

gdsaving
Gross domestic savings as a percentage of GDP. Data from World Bank (2004). Data available from 1960 thru 2003.

ehii
Estimated Household Income Inequality Index. Inequality index derived from regressing data from United Nations Industrial Development Organization onto the Deininger & Squire inequality dataset. For more information refer to The Univesity of Texas Inequality Project (UTIP). Data available starting from 1963 until 1999 (http://utip.gov.utexas.edu/data.html).

trade
Total trade as a percentage of GDP. Data from World Bank (2004). Data available from 1960 thru 2003.

marketcap
Market capitalization of listed companies, as a percentage of GDP. Data from World Bank (2004). Data available from 1988 thru 2003.

unemp
Total unemployment as a percentage of total labor force. Data from World Bank (2004). Data available from 1960 thru 2003.

popgrowth
Population growth, annual percentage. Data from World Bank (2004). Data available from 1961 thru 2003.

gini
Measure of inequality of income distribution. High Gini values are an indication of high inequality of income distribution. Values goes from 0 to 1. Data from World Bank (2004).

capital
Gross capital formation, as a % of GDP. Data from World Bank (2004). Data available from 1960 thru 2003.

beds
Hospital beds for 1,000 people. Data from World Bank (2004). Data available from 1960 thru 2003.

childlabor
Children between the age of 10 and 14 years in the labor force as a percentage of the population in that age group. Data from World Bank (2004). Data available from 1960 thru 2003.

lifexp
Life expectancy at birth, total number of years. Data from World Bank (2004). Data available from 1960 thru 2003.

literacy
Literacy rate for the total adult population, ages 15 years old and above. Data from World Bank (2004). Data available from 1960 thru 2003.

infmort
Infant mortality rate per 1,000 live births. Data from World Bank (2004). Data available from 1960 thru 2003.

infmort5
Mortality rate for children under 5 years old. Data from World Bank (2004). Data available from 1960 thru 2003.

literacy
Literacy rate for adult population, ages 15 years old and above, as a percentage of the population within that age group. Data from World Bank (2004). Data available from 1960 thru 2003.

literacy1524
Literacy rate for the youth population, age group between 15 and 24 years old. Data from World Bank (2004). Data available from 1960 thru 2003.

schoolenr
Total school enrollment per capita, all school levels. Data from Cross-National Time-Series Data Archive.

conflict
Weighted conflict index. Data from Cross-National Time-Series Data Archive. Data is derived from *The New York Times*. The eight variable definitions (adopted from Rudolph J. Rummel, "Dimensions of Conflict Behavior Within and Between Nations", *General Systems Yearbook*, VIII [1963], 1-50). It includes, **Assassinations**, defined as politically motivated murder or attempted murder of a high government official or politician; **General Strikes** involving 1,000 or more industrial or service workers that involves more than one employer and that is aimed at national government policies or authority; **Guerrilla Warfare**, any armed activity, sabotage, or bombings carried on by independent bands of citizens or irregular forces and aimed at the overthrow of the present regime; **Major Government Crises**, any rapidly developing situation that threatens to bring the downfall of the present regime - excluding situations of revolt aimed at such overthrow; **Purges**, any systematic elimination by jailing or execution of political opposition within the ranks of the regime or the opposition; **Riots**, any violent demonstration or clash of more than 100 citizens involving the use of physical force; **Revolutions**, any illegal or forced change in the top government elite, any attempt at such a change, or any successful or unsuccessful armed rebellion whose aim is independence from the central government; and **Anti-government Demonstrations**, any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature.
It should be noted that because these data are based on newspaper reports, they are somewhat biased geographically and limited in comprehensiveness. Banks, Arthur S. 2011. Cross-National Time-Series Data Archive. Databanks International. Jerusalem, Israel; see http://www.databanksinternational.com

polity2
A composite measure of the type of political authority pattern of the state regime. It combines measures of institutionalized democracy and autocracy by simply subtracting the constructed annual measures of autocracy AUTOC from that of institutionalized democracy DEMOC. Data from Polity IV Porject. "Political Regime Characteristics and Transitions, 1800-2006."

elect1
Percent voter turnout for Legislature elections, based on registered voters. Data from Cross-National Time-Series Data Archive.

vturnpar
Voter turnout for parliamentary elections. Data from IDEA (International Institute for Democracy and Electoral Assistance). http://www.idea.int

vturnpre
Voter turnout for presidential elections. Data from IDEA (International Institute for Democracy and Electoral Assistance). http://www.idea.int

vpartpar
Voter participation for parliamentary elections. Participation is defined as the percentage of total individuals who voted out of the total voting age population. Data from IDEA (International Institute for Democracy and Electoral Assistance). http://www.idea.int

vpartpre
Voter participation for presidential elections. Participation is defined as the percentage of total individuals who voted out of the total voting age population. Data from IDEA (International Institute for Democracy and Electoral Assistance). http://www.idea.int

polrights
Measure of political rights. Political Rights is measured on a one-to-seven scale, with one representing the highest degree of Freedom and seven the lowest. Data from Freedom House, from 1972 thru 2006.

civlib
Measure of civil liberties. Civil Liberties is measured on a one-to-seven scale, with one representing the highest degree of Freedom and seven the lowest. Data from Freedom House, from 1972 thru 2006.

xrreg: Regulation of Chief Executive Recruitment from POLITY IV dataset. POLITY™ IV PROJECT Political Regime Characteristics and Transitions, 1800-2009, Monty G. Marshall, Ted Robert Gurr, Keith Jaggers. Data available from 1960 thru 2009. For more information refer to Center for Systemic Peace at www.systemicpeace.org/polity/polity4.htm.

xrcomp: Competitiveness of Executive Recruitment from POLITY IV Dataset. POLITY™ IV PROJECT Political Regime Characteristics and Transitions, 1800-2009, Monty G. Marshall, Ted Robert Gurr, Keith Jaggers. Data available from 1960 thru 2009. For more information refer to Center for Systemic Peace at www.systemicpeace.org/polity/polity4.htm.

xropen: Openness of Executive Recruitment from the POLITY IV Dataset. POLITY™ IV PROJECT Political Regime Characteristics and Transitions, 1800-2009, Monty G. Marshall, Ted Robert Gurr, Keith Jaggers. Data available from 1960 thru 2009. For more information refer to Center for Systemic Peace at www.systemicpeace.org/polity/polity4.htm.

xconst: Executive constraints from the POLTY IV Dataset. POLITY™ IV PROJECT Political Regime Characteristics and Transitions, 1800-2009, Monty G. Marshall, Ted Robert Gurr, Keith Jaggers. Data available from 1960 thru 2009. For more information refer to Center for Systemic Peace at www.systemicpeace.org/polity/polity4.htm.

parreg: Regulation of Participation from the POLTY IV Dataset. POLITY™ IV PROJECT Political Regime Characteristics and Transitions, 1800-2009, Monty G. Marshall, Ted Robert Gurr, Keith Jaggers. Data available from 1960 thru 2009. For more information refer to Center for Systemic Peace at www.systemicpeace.org/polity/polity4.htm.

parcomp: Competitiveness of Participation from the POLTY IV Dataset. POLITY™ IV PROJECT Political Regime Characteristics and Transitions, 1800-2009, Monty G. Marshall, Ted Robert Gurr, Keith Jaggers. Data available from 1960 thru 2009. For more information refer to Center for Systemic Peace at www.systemicpeace.org/polity/polity4.htm.

The Dataset exists in an excel spreadsheet. It was compiled by the author of this Thesis work and a copy can be provided upon request.

APPENDIX B

DESCRIPTIVE STATISTICS

This Appendix presents an overview of how issues regarding transformations, outliers, missing data, and normality (univariate and multivariate), etc. were addressed. The aim is mainly two-fold. First, to identify the broad characteristics of the measured variables used in this study and second, to comply as best as possible, with the numerous requirements of a covariance structure analysis.

As indicated in Chapter 3, the analysis if covariance structure was performed over a set of a final sample of 154 countries, with 16 measured variables (representing societal capabilities), and for average data between 1990 and 1994, nominally corresponding to year 1992. Before the analysis could be performed a number of issues had to be dealt with such as transformation, outliers, non-normality, etc. This is how each of these different aspects, inherent to any dataset subject to a statistical analysis, and that will have an effect of the final results of such analysis, were treated. The treatment of each of these aspects was done following recommendations from several scholars (Kline, 2005; Schumacker and Lomax, 2004; Anderson and Gerbing, 1984; Bollen, 1987; Bollen, 1989; Jöreskog and Sörbom, 1996-2002, etc.).

Strictly speaking, of the 16 variables used, 10 are continuous variables and 6 are categorical variables. Table B.1 below presents data descriptive statistics[92] for 10 continuous variables post-transformations. Transformations were performed in order to avoid the problem of ill-scaled covariance matrix. The set of transformations performed on each variable has already been treated on Chapter 3. An inspection of Table B.1 indicates that transformation were successful in making the standard deviations for all continuous variables similar of the same order of magnitude (their ratio is less than 10). This shall avoid the known problem of "ill-scaled matrix" (Kline, 2005).

[92] Data descriptive statistics were obtained with PRELIS, a multivariate data screening and data summarization companion preprocessor software program to LISREL.

TABLE B.1 Univariate Summary Statistics for Continuous Variables Post-Transformation

Variable	Mean	St. Dev.	T-Value	Skewness	Kurtosis	Minimum	Freq.	Maximum	Freq.
gdpcppp3	7.263	0.937	97.137	-0.001	-0.964	5.412	1	9.071	1
unemp1	0.894	0.716	13.629	1.565	4.063	0.033	1	4.350	1
ehii1	4.317	0.766	59.118	-0.224	-0.715	2.222	1	5.817	1
gdsaving	1.565	1.335	14.686	-1.157	3.695	-4.372	1	4.542	1
capital1	2.258	0.803	35.000	1.013	2.251	0.624	1	5.900	1
popgrowt	0.769	1.124	8.681	-5.870	56.171	-10.179	1	2.843	1
lifexp1	6.447	1.071	76.137	-0.745	-0.550	3.488	1	7.921	1
infmort5	1.492	1.421	13.321	1.163	0.596	0.100	1	6.200	1
childlab	0.615	0.778	9.811	1.111	0.140	0.000	60	2.879	1
literacy	3.796	1.210	38.674	-0.800	-0.593	0.612	1	4.990	1

Outliers

A large body of research has focused on understanding how outliers affect the true relationship that exists between measured and/or latent variables (Anderson and Schumacher, 2003; Ho and Naugher, 2000; Huber, 1981; Rousseeuw and Leroy, 1987; Staudte and Sheather, 1990). To start, the presence of univariate outliers contributes to multivariate non-normality (Kline, 2005, p. 49). This may be problematic since most statistical methods are based on the underlying assumption of normality and covariance structure analysis is not an exception. As a rule of thumb, outliers can be graphically detected by visual inspection of the data. A visual inspection of the dataset, coupled with a histogram for each of the continuous variables indicated the presence of univariate outliers. Histograms[93] for each of the continuous variable post-transformation (i.e. re-scaling) are presented down below in Figures B.1a through Figure B.1j. A total of 11 data outliers were visually identified and these are presented in Table B.2. These outliers were related to 9 countries and the decision was made to remove them from the dataset on which the covariance structure analysis was performed, since removal of univariate outliers contributes to multivariate normality, these outliers were removed from the dataset.

[93] Histograms were obtained with PRELIS.

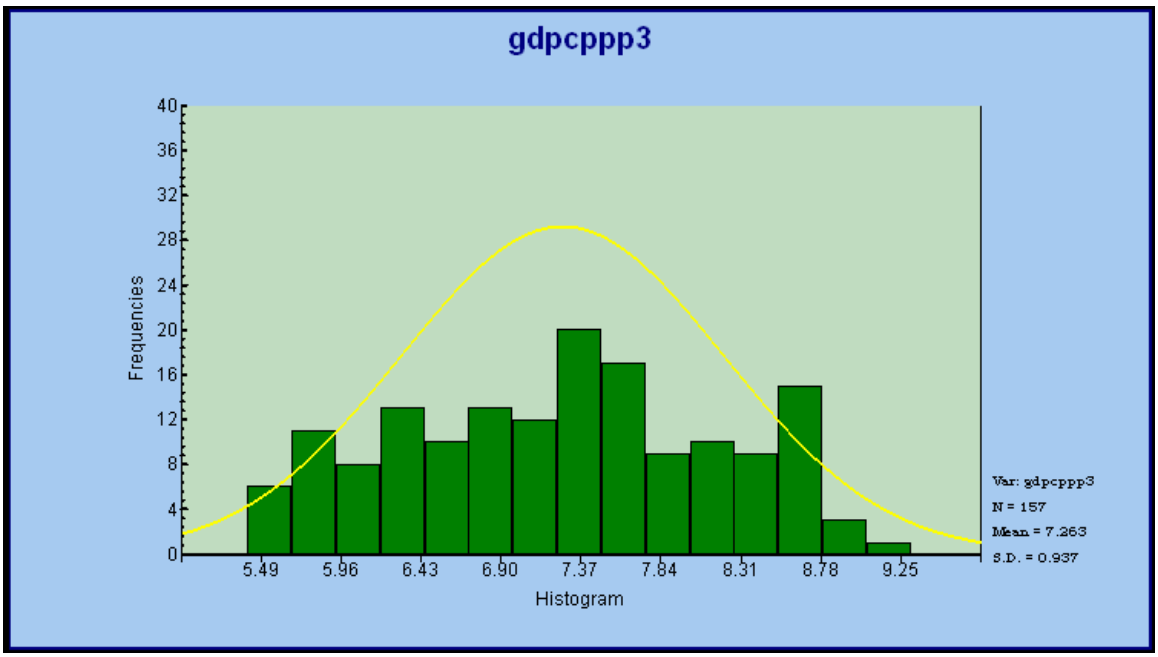

FIGURE B.1a. Histogram for gdpcppp3[94] capability (indicator for economic freedoms).

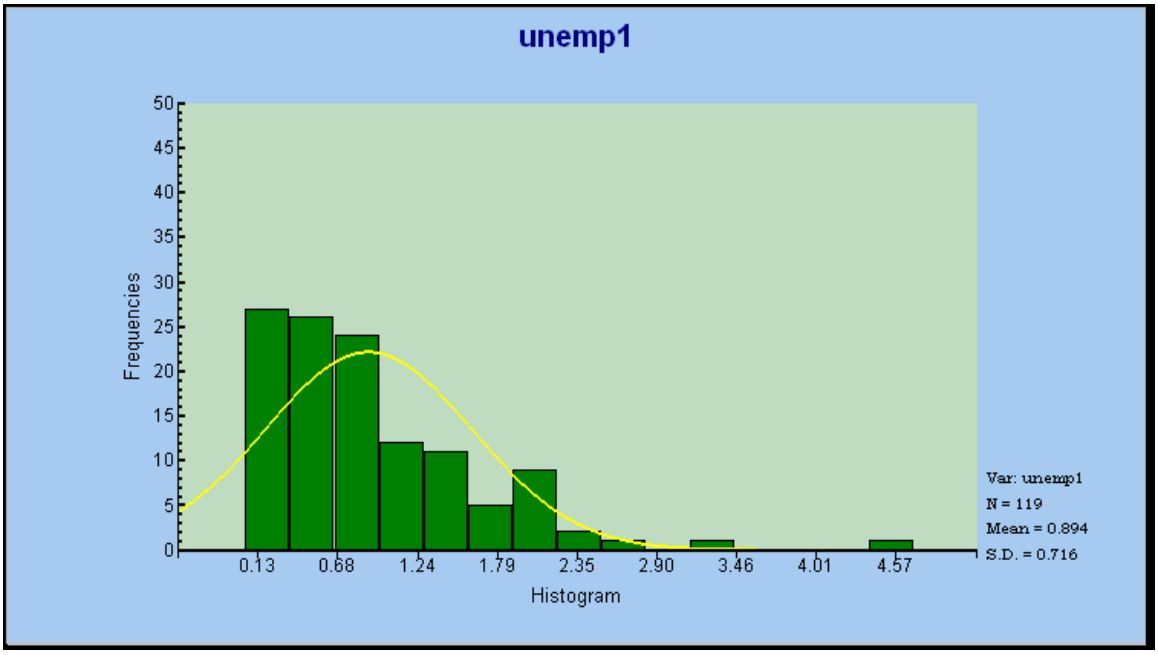

FIGURE B.1b. Histogram for unemp1[95] capability (indicator for economic freedoms).

[94] Per capita Gross Domestic Product, Purchase Power Parity.
[95] Unemployment rate.

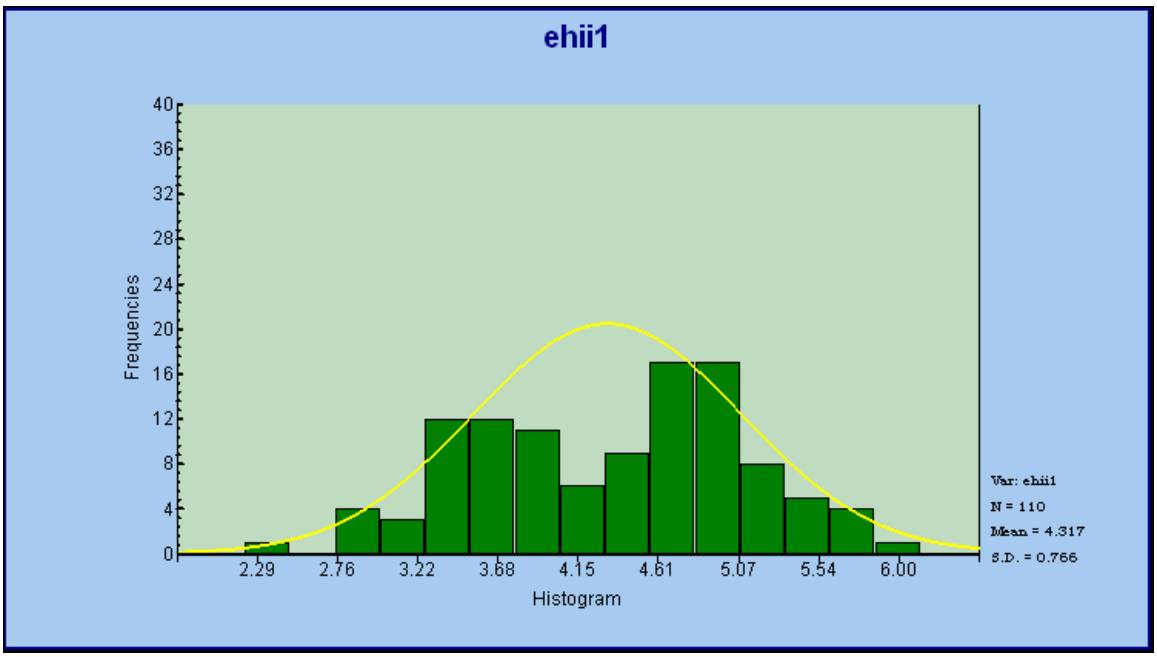

FIGURE B.1c. Histogram for ehii[96] capability (indicator for economic freedoms).

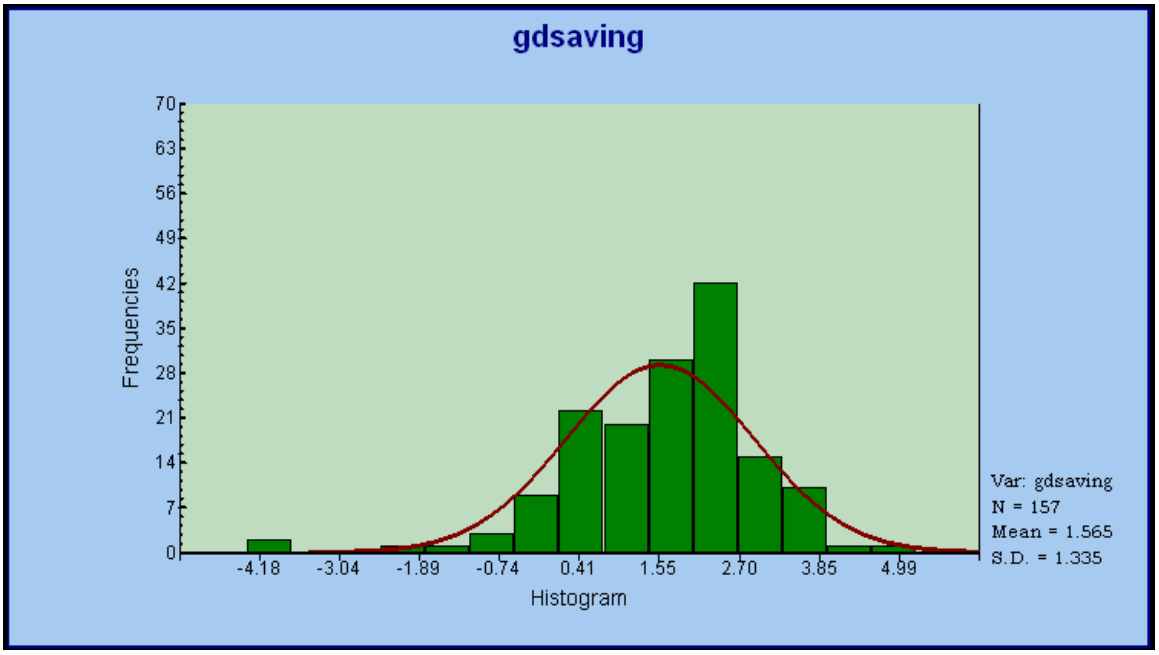

FIGURE B.1d. Histogram for gdsaving[97] capability (indicator for economic freedoms).

[96] Household Income Inequality Index.
[97] Gross Domestic Savings as a % of gross domestic product (GDP).

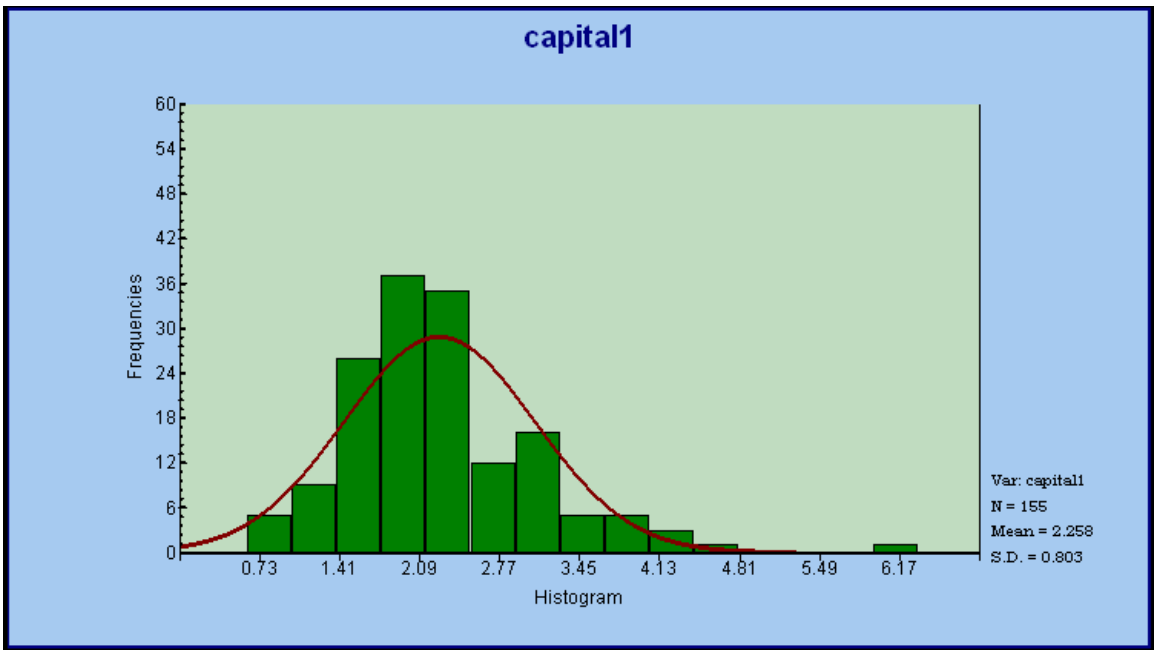

FIGURE B.1e. Histogram for capital1[98] capability (indicator for economic freedoms).

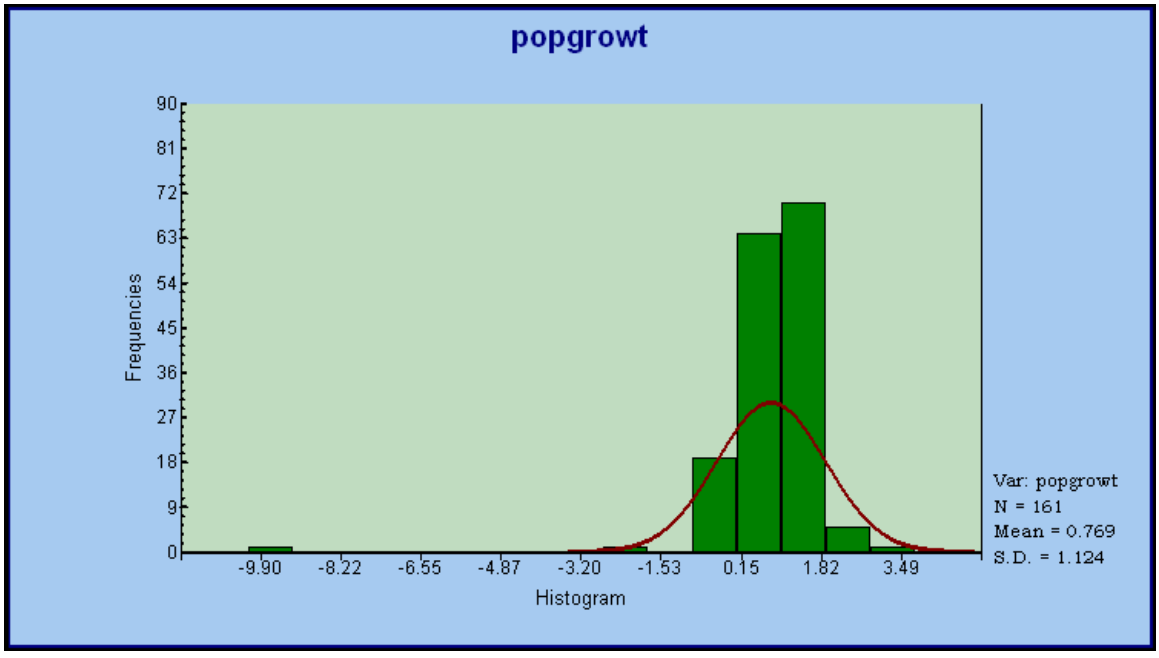

FIGURE B.1f. Histogram for popgrowt[99] capability (indicator for social freedoms).

[98] Gross Capital Formation, as a % of GDP.
[99] Population Growth rate.

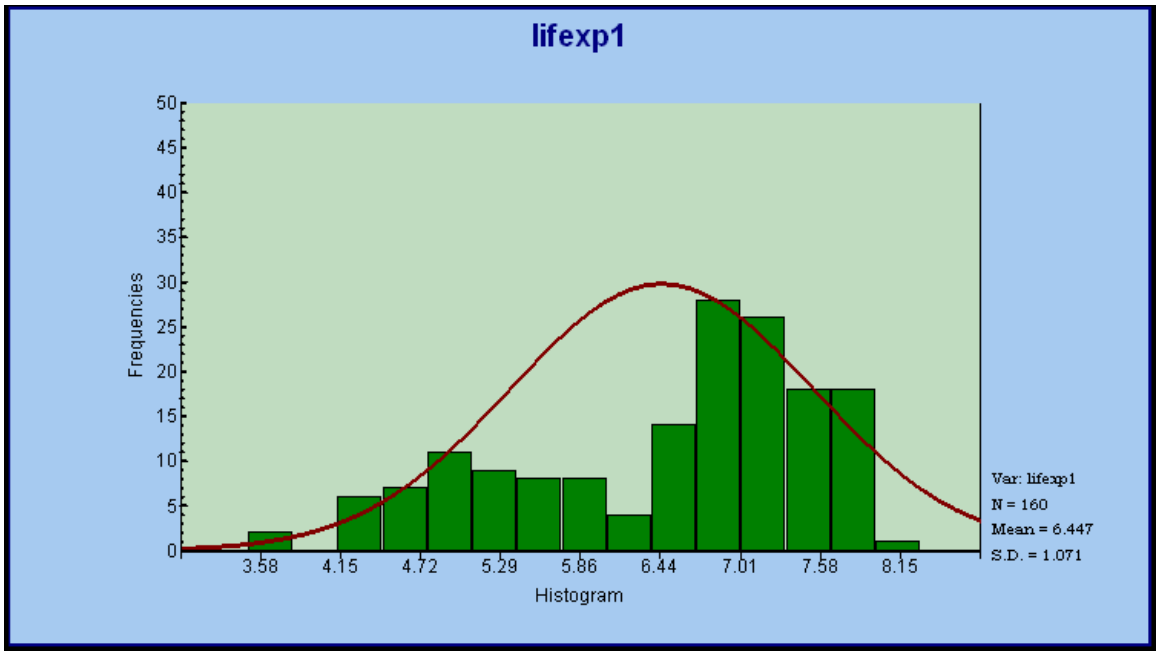

FIGURE B.1g. Histogram for lifexp1[100] capability (indicator for social freedoms).

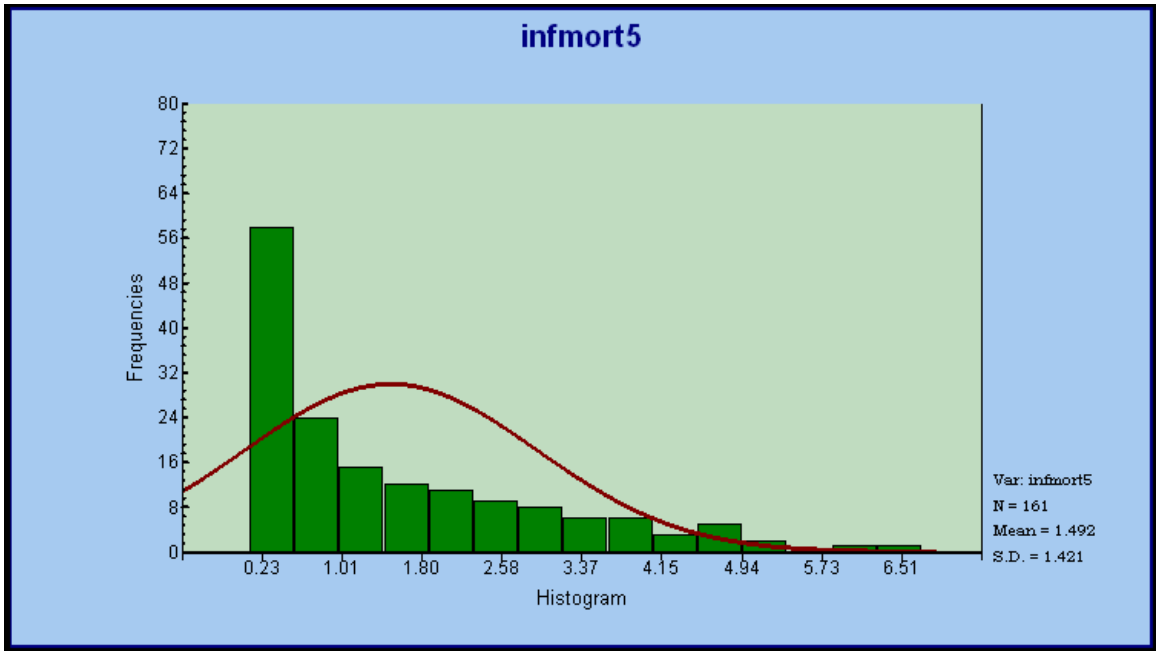

FIGURE B.1h. Histogram for infmort5[101] capability (indicator for social freedoms).

[100] Life expectancy.
[101] Infant mortality at age five years old.

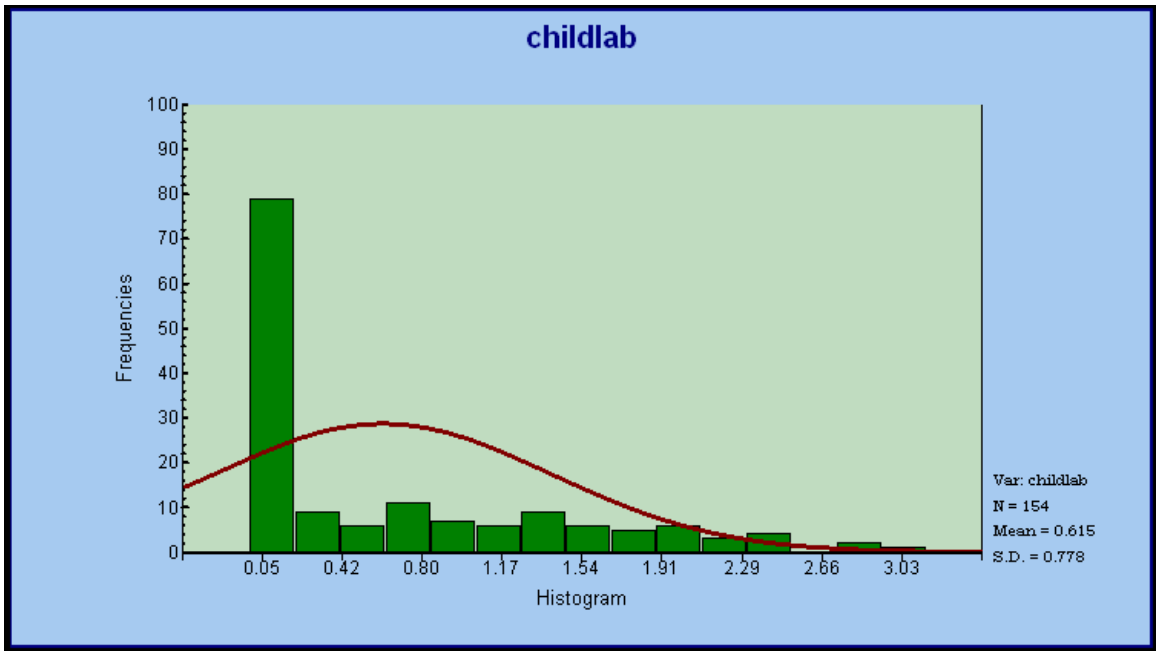

FIGURE B.1i. Histogram for childlab[102] capability (indicator for social freedoms).

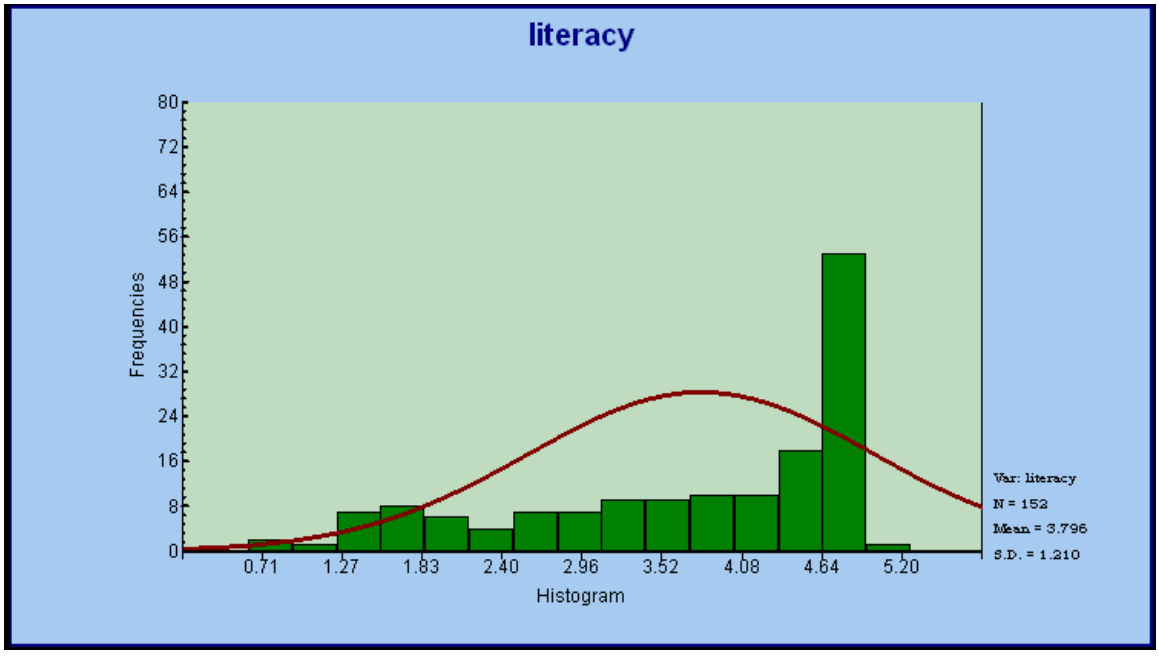

FIGURE B.1j. Histogram for literacy[103] capability (indicator for economic freedoms).

[102] Per capita Gross Domestic Product, Purchase Power Parity.
[103] Per capita Gross Domestic Product, Purchase Power Parity.

TABLE B.2 List of Identified Outliers

Country code	Case #	Country Name	Outlier Variable	Variable value
410	43	Djibouti	unemp1	4.35
690	87	Lesotho	unemp1	3.184
110	1	Albania	gdsaving1	-2.145
688	86	Lebanon	gdsaving1	-4.249
690	87	Lesotho	gdsaving1	-4.372
690	87	Lesotho	capital1	5.9
670	82	Kuwait	popgrowt	-10.179
915	123	Rwanda	popgrowt	-2.53
120	3	Angola	infmort5	5.2
830	109	Niger	infmort5	6.2
935	127	Sierra Leone	infmort5	5.968

Normality

Most statistical methods are based on the underlying assumption of normality. Covariance structure analysis is not an exception. The presence of non-normality can be treated in two ways. The first one is to obtain normal, while the second option is to utilize estimation methods that have been developed to perform statistical analysis under non-normality.

A test of univariate normality[104] was conducted after outliers were removed. Table B.3 below presents a summary test[105] of univariate normality. A test of univariate normality reveals that none of the continuous variables are normally distributed, confirming the visual inspection assessment of the histograms, while rejecting gdpcppp3 as a normally distributed continuous variable. Based on the results from the above test of univariate normality is was decided to obtain normal scores for all continuous variables.

Missing Data

For statistical analysis of datasets it is customary to handle missing data through either pairwise or listwise deletion. Having used either of these data handling techniques would have rendered an effective sample size of about 93 cases or observations, which would have limited the covariance

[104] Performed with PRELIS.
[105] Performed with PRELIS

TABLE B.3 Test of Uni-variate Normality for Continuous Variables

	Skewness		Kurtosis		Skewness and Kurtosis	
Variable	Z-Score	P-Value	Z-Score	P-Value	Chi-Square	P-Value
gdpcppp3	-0.003	0.997	-4.707	0.000	22.156	0.000
unemp1	5.523	0.000	4.103	0.000	47.341	0.000
ehii1	-0.991	0.322	-2.221	0.026	5.915	0.052
gdsaving	-5.060	0.000	4.337	0.000	44.417	0.000
capital1	4.554	0.000	3.381	0.001	32.166	0.000
popgrowt	-12.229	0.000	8.967	0.000	229.956	0.000
lifexp1	-3.607	0.000	-1.842	0.066	16.402	0.000
infmort5	5.137	0.000	1.465	0.143	28.538	0.000
childlab	4.870	0.000	0.516	0.606	23.982	0.000
literacy	-3.738	0.000	-2.003	0.045	17.981	0.000

structure analysis. The absolute minimum recommended sample size that could provide reliable estimates is 100 cases (see Sample Size below).

Data imputation is a recognized data handling technique that allows generating values for missing data cases from data available for other cases with "similar response pattern over a set of matching variables" (Jöreskog and Sörbom, 1996-2002), without substantially affecting the descriptive statistics, while having a positive effect on the effective sample size. Data imputation raised the effective sample size back to 154 cases.

Table B.4 presents the data after outliers were removed, post-imputation, and after normal scores were obtained.

An inspection and comparison of both tables reveals that the effect of removal of outliers and imputation on the means was negligible as expected. Finally, tests of univariate and multivariate normality are performed. Results are shown in Table B.5 and Table B.6 respectively.

Sample size

There is no agreement between researchers with respect to the minimum sample size, but the larger the number of observations the better. For instance Guilford (1956) argued that the minimum number of observations to produce reliable factors is 200. On the other hand, Kline (Kline, P., 2005) (supports sample sizes as small as 100 in data where a clear sample structure exists. He

TABLE B.4 Univariate Summary Statistics for Continuous Variables Post Imputation, and Post Normal Scores

Variable	Mean	St. Dev.	T-Value	Skewness	Kurtosis	Minimum	Freq.	Maximum	Freq.
gdpcppp3	7.265	0.935	96.473	0.000	-0.020	4.647	1	9.883	1
unemp1	0.835	0.609	17.028	0.000	-0.021	-0.870	1	2.541	1
ehii1	4.423	0.725	75.761	0.000	-0.020	2.394	1	6.453	1
gdsaving	1.688	1.098	19.083	0.000	-0.020	-1.387	1	4.763	1
capital1	2.231	0.724	38.245	0.000	-0.020	0.203	1	4.260	1
popgrowt	0.863	0.657	16.295	0.000	-0.020	-0.978	1	2.703	1
lifexp1	6.466	1.054	76.165	0.000	-0.020	3.515	1	9.417	1
infmort5	1.484	1.426	12.917	0.000	-0.020	-2.510	1	5.479	1
childlab	0.600	0.767	9.719	0.491	-0.617	-0.218	58	2.880	1
literacy	3.837	1.199	39.706	-0.007	-0.029	0.475	1	7.199	1

TABLE B.5 Test of Uni-variate Normality for Continuous Variables Post-Normal Scores

	Skewness		Kurtosis		Skewness and Kurtosis	
Variable	Z-Score	P-Value	Z-Score	P-Value	Chi-Square	P-Value
gdpcppp3	0.000	1.000	0.108	0.914	0.012	0.994
unemp1	-0.001	0.999	0.106	0.915	0.011	0.994
ehii1	0.000	1.000	0.108	0.914	0.012	0.994
gdsaving	0.000	1.000	0.108	0.914	0.012	0.994
capital1	0.000	1.000	0.108	0.914	0.012	0.994
popgrowt	0.000	1.000	0.108	0.914	0.012	0.994
lifexp1	0.000	1.000	0.108	0.914	0.012	0.994
infmort5	0.000	1.000	0.108	0.914	0.012	0.994
childlab	2.453	0.014	-2.145	0.032	10.616	0.005
literacy	-0.036	0.971	0.086	0.932	0.009	0.996

TABLE B.6 Test of Multi-variate Normality for Continuous Variables Post-Normal Scores

Relative Multivariate Kurtosis = 1.140

Skewness			Kurtosis			Skewness and Kurtosis	
Value	Z-Score	P-Value	Value	Z-Score	P-Value	Chi-Square	P-Value
18.275	9.065	0.000	136.763	5.228	0.000	109.495	0.000

recommends carrying replication with other samples if the number of observation is below 100.

Others (Kline, R, 2005; p. 110) rather than focusing on absolute sample sizes recommend holding the ratio between the number of cases or observations to the number of free parameters to be no smaller than 5:1. This ratio is also the minimum recommended by Bentler and Chou (1987). In this study, depending on the complexity of the model, this ratio varied between 5:1 and 3:1.

Anderson and Gerbing (Anderson and Gerbing, 1984; Gerbin and Anderson; 1985) performed Monte Carlo study for Maximum Likelihood estimator for normally distributed samples to determine the effect of sample size on both the bias of the estimator and the deviation of the parameter estimates from their respective population values. Samples sizes smaller than 150 were found to present not only large discrepancies in the parameter estimates, but also, problems of non-convergence and improper solutions[106] (i.e. unfeasible variance estimates such as negative values). They therefore recommend 150 observations as a minimum sample size to be considered for an analysis of covariance structure. In addition to providing unrealistic parameter estimates, small sample sizes also present problems of non-convergence and improper solutions.

However, Maximum Likelihood belongs to the family of what is known as "full information methods" and its estimators are asymptotic, that is to say, "they are proven to be true only for large samples." (Anderson and Gerbing, 1988; p. 416). On this basis, some studies suggest samples as small as 400 or 500 observations are believed to be necessary (Tanaka, 1984; Harlow, 1985).

In addition it is recommended to keep the ratio between the number of observations or cases to the number of measured variables to be between 10:1 to, no less than, 2:1. In this study this ratio is 9.6 (154 observations / 16 measured variables). Again, higher ratios are always preferred. Arrindel and van der Ende (Arindel, W. A.; Ende, van der J., 1985) claim that the analysis should rather ensure that the ratio of observations to latent variables (factors) should be kept at no less than 20:1. In this study this ratio is 154 observations / 3 endogenous latent variables (factors) equal to 51.3.

[106] This was found to be valid for confirmatory measurement models with three or more indicators (measured variables) per latent variable (factor).

APPENDIX C

ANALYSIS OF COVARIANCE STRUCTURE

Analysis of covariance structures is a statistical technique which is rather uncommon in Political Science research. This Appendix has mainly three goals. First, it seeks to provide a general background on how and why Covariance Structure Analysis evolved and emerged as an important statistical technique in the social sciences. Secondly, it will provide the reader with an introduction to the foundational elements of Covariance Structure Modeling (CSM), how a CSM model is built, and why this statistical technique can adequately handle the objectives of this study. Thirdly, it provides a general basis and overview of how we apply this technique to building a CSM in seeking to provide statistically significant empirical evidence in support of Sen's theoretical conceptualization of development. Consequently, this appendix should provide a clear picture as to why covariance structure analysis is the only known and adequately equipped statistical technique of choice for the type of analysis required to reaching the goal of this study.

Regression analysis is unquestionably the quantitative statistically-based mathematical modeling technique most widely used for hypothesis testing by researchers in Political Science and other social sciences. Through regression analysis social sciences investigators seek to study and understand the causal relationship that exists between a set of independent variables and a dependent variable.

Multivariate regression analysis allows testing of theories by means of constructing a regression model that links independent variables with a dependent variable. A multivariate regression model is a mathematical construct that represents a theory. Once a regression model has been constructed based on theoretical considerations, researchers in social sciences can test a theory by use of a scientific method called "hypothesis testing".

In multivariate regression models, both types of variables, independent and dependent, are directly observed variables. Perhaps the most important feature of observed variables is the fact that they can be directly measured.

There are, though, many theoretical constructs which cannot be directly measured or directly observed. Multivariate regression analysis is inadequately equipped to handle theoretical constructs which cannot be directly observed or measured. In the sense used by Sen, both development and instrumental freedoms represent such theoretical constructs.

These theoretical constructs are real and do exist because it is known they directly affect existing measured or observed variables; in other words, information about them can be obtained by measuring the effect they have on directly observed (measured) variables. These un-measurable theoretical constructs can also be referred to as latent variables.

Latent variables can be inferred or uncovered from directly observed/measured variables. The mathematical procedure by which a latent variable can be un-covered from a set of directly observed/measured variables is called Factor Analysis. Factor Analysis is one of the constitutive components of a set of related multivariate statistical techniques that have become to be known as Covariance Structure Models.

Covariance Structure Models (CSM), also known as analysis of covariance structure[107] (R. Kline, 2005; K. Bollen, 1989; Long, S. L., 1983) combines two powerful strands of quantitative statistical techniques, mainly the Confirmatory Factor Model used in psychometrics and the Structural Equation Model (SEM) considered in econometrics[108].

CSM is the fruitful unification of a set of related lines of research that resulted in the development of statistical techniques and tools, namely path analysis, factor analysis, and general

[107] Covariance structure analysis (CSA), linear structural relations, and latent variable equation systems in structured linear models are other interchangeable terms utilized to refer to this statistical technique.

[108] This fruitful unification of statistical techniques was greatly facilitated by Goldberger (1971) and by the Conference on Structural Equation Models organized by Goldberger in 1970 (Long, S. L., 1983).

estimation procedures (Bollen, K., 1989). It emerged as a generalized statistical procedure that allows the study and understanding of the causal relationship that exists between observed (measured) variables and latent or factor (non-measurable) variables and the structural relationship that exists among latent variables or factors while confirming the validity of those relationships through the scientific method of hypothesis testing.

In what follows, emphasis will be placed in providing a general broad overview for each of these constitutive elements of Covariance Structure Models (CSM). The next section will provide a broad overview of a Covariance Structure Model, and the following section will explain how analysis of covariance structure can be applied to building a CSM to empirically test Sen's "Development as Freedom".

C.1 The foundations of Covariance Structure Analysis

The first constitutive element, path analysis, was developed by geneticist Sewal Wright (K. Bollen, 1989, R. Kline, 2005; Loehlin, J., 2004). Path analysis encompasses three complimentary techniques. The first is path diagrams, the second technique is represented by equations that express the theorized correlation (or covariances) between the variables shown in the path diagram, and the third is the decomposition of effects, into indirect and direct effects. The latter one is not discussed here.

Path diagrams allow a pictorial representation of the relationships that exist between variables, which in turn facilitates the writing of mathematical equations that represent the proposed existing relationships between the accounted variables.

Factor analysis, the second constitutive element of analysis of covariance structures, was originally developed in the early 1900's by pioneer researchers in the field of psychology, notably Spearman, Thomson, and Thurstone and Burt (Lawley and Maxwell, 1971; Bollen, K. 1989). Their main concern, back then, dealt with explaining an individual's performance on tests based on mental

ability or intelligence. The goal was to explain the relationship between a given number of directly observed variables (tests) in terms of a single latent variable or factor (intelligence).

From a broader perspective, factor analysis deals with resolving linearly the existing correlations (or covariances) between a number of observable, measurable variables into a smaller (although not always) number of un-measurable dimensions called "factors" without the loss of information. The mathematical procedure involved in this type of analysis can be also referred to as "extracting" the underlying dimensions that explain as much as possible, the observed measured variables in terms of their variance/covariance structure. It assumes ex-ante that the relationship between the measurable variables and the un-measurable factors is linear, and that the factors themselves are independent of each other. The resulting "factors" are interpreted as being a theoretical construct that condenses the empirical relationship observed between a given set of dependent variables.

In contrast with regression analysis, factor analysis seeks to study the patterns of relationships among dependent measurable variables with the aim of uncovering the existence of a much smaller number of un-measurable underlying or latent independent variables, also called factors, which largely or entirely explain the pattern of behavior (covariance or correlation) of the dependent measurable variables. At the heart of this technique is its general capability of dealing with directly observed or measurable variables, in terms of, and as a means to uncover, un-measurable theoretical constructs or abstract concepts, such as intelligence or mental ability, personality, leadership, consumer confidence, and in particular in this study, freedoms and development, etc. to provide a few examples.

From the stand-point of view of data management, the chief aim of factor analysis is that of achieving "scientific parsimony or economy of description." (Harman, 1976). From the stand-point of view of theory formulation and / or construct validity/reliability, factor analysis provides the

capability of either allowing the uncovering of underlying latent variables and/or or that of discerning patterns of variation of characteristics within data (Rummel, 1970).

An important feature of the mathematical process of extracting, by factor analysis, the underlying latent variables (factors) is that an infinite number of mathematically equivalent solutions can be obtained. What is important to search for, as the scientific process calls for, is the most parsimonious solution that explains the observed variation between the measured variables. And this process is carried out through what is called "factor rotation".

Hence factor analysis involves basically two steps. First, as described above, the process of extracting the underlying latent factors, and second, a factor rotation with the aim of reducing the solution to the most parsimonious one. This is the criterion of simple structure, as established by Thurnstone (1947). The basic idea is that of having the factor loadings on some measured variables as large as possible, while having the rest of the factor loadings on the remaining measured variables as close as possible to zero.

C.2 Mayor Approaches in Factor Analysis

Factor analysis developed into two major approaches, mainly Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

Exploratory Factor Analysis is the more traditional procedure used and several popular statistical software packages handle this approach to uncovering latent variables from a set of directly observed (measured) variables. The main drawback of this mathematical procedure is that EFA does not allow hypothesis testing. And hence, perhaps one of the most important latest advances in factor analysis is that its capabilities have expanded to include that of hypothesis testing of the presumed existing relationships between the observed variables and the underlying latent factors (Harman, 1976), through the new statistical-technique named Confirmatory Factor Analysis. (CFA)

EFA is the type of analysis applied when the aim is that of determining those latent or underlying factors that account for explaining the existing correlation between a given set of measured variables. In this modality of factor analysis, there is no prior theorization of how the factors to be uncovered load on the measured variables from which the underlying factors are to be uncovered. In EFA, the main objective is that of, as its name suggests, exploring and determining how many dimensions, factors, or construct emerge from a set of directly observed or measured variables. In this approach, the number of latent variables or factors and which measured variables load on which latent variables or factors are not defined a priori. In addition, generally speaking, the measurement errors are assumed to be un-correlated. Therefore, in this approach, no major or substantive a priori theoretical consideration is put to test. As such EFA maybe considered as "an essential step in the investigation of complex" (Kline, 2005, p. 9) fields (i.e. human psychology).

Confirmatory factor analysis (CFA), a later development owned to Jöreskog (1973), on the other hand, allows empirically testing (confirming) the existence of previously hypothesized factors and the sign of the relationships between these and the set of measured or directly observed variables, based on a prior formulated theoretical model. Thus confirmatory factor analysis is by far "a superior method to exploratory factor analysis, because it [allows the testing of hypothesis], which is [a] fundamental [step] to the scientific method." (Kline, 2005, p. 81)

Further developments lead to classifying factor analysis within the growing analytical technique of Structural Equation Modeling (SEM) or Multiple Latent Variable Analysis (Loehlin, 2004). The broad advances and development of factor analysis made possible with the advent of electronic computers has also been a cornerstone to making the use of this quantitative tool technique more widely available for a growing number of scientists within other sub-disciplines of the social sciences, such as those in the area of Political Science, Sociology, Economics, Medicine, and others ((Harman, 1976).

Within confirmatory factor analysis, the method of maximum likelihood is an especially important method because it permits statistically testing the significance of each of the factors extracted. This technique has gained a preponderantly important place for scientists as it permits empirically testing hypothesis related to theoretical models of latent variables representing abstract concepts hard to measure directly but that do have a causal effect on measurable observable variables.

C.3 Components of Covariance Structure Model (CSM)

A full CSM is composed of two models: A Measurement Model (MM) and a Structural Equation Model (SEM). The direct application of CFA to a set of observed / directly measured variables renders what is called, within the jargon of CSM, the Measurement Model (MM). The MM details the hypothesized causal relationship between the directly measured (observed) variables and the theorized dependent (endogenous) latent variables (or factors) it seeks to uncover. The application of CFA to the MM seeks to provide empirical evidence of the hypothesized causal relationship through hypothesis testing.

The Structural Equation Model (SEM) details the hypothesized causal relationship between the uncovered dependent endogenous latent variables (or factors) from the MM and (a) new hypothesized independent (exogenous) latent variable(s) or factor(s). The structural relationship (between the dependent endogenous latent variables and the independent exogenous latent variable(s) is operationalized through the structural coefficients.

It is important to re-emphasize that a CSM main aim is that of explaining, to the largest extent possible, the existing covariance/variance structure for a set of directly observed and measured variables by a set of latent variables or factors. The first component of a CSM, the Measurement Model, achieves this by finding a set of dependent endogenous latent variables or factors (1st order latent variables) through a CFA, which allows hypothesis testing on each of the resulting factor loadings.

In the second component, the Structural Equation Model (SEM), the resulting covariances/variances for the set of latent dependent endogenous variables, is attempted to be explained by another (set of) independent exogenous latent variable(s) (2n order latent variable(s) or factor(s)).

The number of latent variables, endogenous and exogenous, which measured (observed) variables load on which endogenous latent variables (factors), and whether measured variables are or not correlated, are all defined by the researcher based on substantive theoretical considerations. The definition of these parameters, based on theoretical considerations, constitute the major premises under which the hypothesized relationships are translated into mathematical equations, expressed in a matrix form, from which a CSM is built.

C.4 The Application of Covariance Structure Analysis to building a CSM for Development

The above broad overview focused on providing the reader a general background and overview of Covariance Structure Analysis. In this section we will focus on the direct application of this statistical technique to building a CFA CSM for Sen's theoretical conceptualization of development or "Development as Freedom". The CSM is built based upon substantive theoretical considerations, incorporating Sen's development theory's core tenents, which are then tested for statistical significance of the hypothesized causal relationship that presumably exist between the measured, endogenous and exogenous latent variables

The theoretical construct for which we will be building a CSM is “Development”. The departing premise is that, in contrast to neoclassical theories of economic growth, which use a narrow informational basis (i.e income per capita or GDP), development is a multi-dimensional theoretical concept that cannot be directly measured. In addition, according to Sen's theory, development "is the process of expanding freedoms". This effectively establishes a hypothesized direct causal relationship between development and freedoms. Sen differentiates between two different types of freedoms, mainly, instrumental and substantive. Instrumental freedoms cannot be

measured since they represent institutional structures in the realm of economics, social, politics, transparency guarantees, and protective security. The second type of freedoms, called substantive freedoms, represents societal capabilities which are measured variables, such as literacy and life expectancy, etc.

The approach to be followed in this Thesis work does not differ, conceptually speaking, from the one followed by psychologists back in the early 1900's, where they utilized a number of tests (measured variables) to uncover a latent factor called intelligence.

In the Measurement Model (MM) of this study we shall use a number of societal capabilities (measured variables) to uncover the different types of instrumental freedoms (first order latent variables or factors) that explain the existing variance / covariance within the set of measured variables. Again, the measured variables utilized for this purpose are the societal capabilities which are hypothetically derived from those instrumental freedoms it seeks to uncover. The aim is to provide statistically significant empirical evidence that suggests the existence of a causal relationship between instrumental freedoms and societal capabilities.

Following the completion of a MM, the Structural Equation Model (SEM) seeks to provide empirical evidence of the causal relationship that exists between development (as an exogenous, independent, second order latent variable or factor) and the set of instrumental freedoms (first order, endogenous, dependent latent variables or factors) uncovered from the previous MM.

Following Sen's theoretical conceptualization for development, this study builds a CSM model based on the following premises:

1. Development will be treated as an exogenous latent variable in the model.
2. Development is the fundamental variable that causes institutional freedoms. Therefore there exists a hypothesized direct causal relationship between development and instrumental freedoms. These are provided by the institutional structure or institutional arrangement existing in a given society.

3. There are mainly five types of institutional freedoms, mainly, economic freedoms, social freedoms, political freedoms, transparency guarantees, and protective security freedoms[109].
4. Institutional freedoms are treated as dependent endogenous latent variables (factors) in the CSM.
5. Institutional freedoms cannot be directly measured, but their existence is inferred from the effect they cause on societal capabilities. The institutional freedoms enjoyed by any given society, have a causal relationship with the societal capabilities.
6. Societal capabilities are observed variables which can and therefore be directly measured.
7. There exists correlated error measurement between some measured variables societal capabilities.
8. The MM and the SEM model are combine together to form the CSM for development.

C.5 Summary

In this Appendix C main purpose was three-fold. First, it sought to explain why a CSM (as opposed to multivariate regression) is the appropriate statistical technique to be used in this study. A multivariate regression analysis is not feasible when the fundamental variables, hypothesized to explain dependent measured variables (i.e. societal capabilities), are latent (theoretical constructs) variables which cannot be directly measured. These fundamental variables are latent variables or factors because there existence is reflected on the effect they have on directly observed / measured variables.

Secondly, this Appendix sought to explain what a CSM is and how it is conformed. A CSM is made up of two models, mainly a MM and a SEM. The MM contains the measured variables and the first order endogenous latent variables or factors it seeks to uncover. The SEM contains the dependent (first order) latent variables and the independent (exogenous second order) latent variables or factors. A CSM seeks to explain the existing variance/covariance between the measured or directly observed variables.

[109] In this study the latter two will be dropped due to limitations on available information and sample size.

And last but not least, this Appendix explained how analysis of covariance structure is applied to building a CSM to empirically test the statistically significance of the hypothesized causal relationship between development, institutional freedoms, and societal capabilities, as per Sen's theoretical conceptualization of development. Sen's development theory includes both measured as well as latent (theoretical constructs) variables. The proposed CSM seeks to uncover the existence of those latent variables and empirically tests the validity of such hypothesized causal relationships.

APPENDIX D

MATHEMATICAL FORMULATION

This Appendix focuses on providing a detailed formulation of the fundamental mathematical equations underpinning a proposed recursive Covariance Structure Model (CSM) to empirically test Sen's conceptualization of development. In Sen's "Development as Freedom" approach, he hypothesizes that the expansion of freedoms is the primary end and the principal means of development. This study attempts to provide empirical evidence to the former hypothesis only, i.e. the expansion of freedoms is the primary end of development. This entails building a recursive CSM.

As described in Chapter 3, the mathematical foundation of Covariance Structural Analysis (CSA) lays mainly on Factor Analysis. As explained there, factor analysis allows investigating whether a number of observed (measured) variables of interest are linearly related to a smaller number of underlying and unobserved factors or latent variables. Following Sen's conceptualization of development, the measured (observed) variables represent societal capabilities and the underlying unobserved endogenous latent variables or factors represent institutional freedoms. Development, the exogenous dependent latent variable, is then used to explain the pattern or structure of the uncovered covariance matrix for institutional freedoms obtained from the previously postulated MM.

The initial focus is on the measurement model (MM)[110]. The MM seeks to explain the existing covariance structure between a set of measured variables (i.e. societal capabilities) by hypothesizing that a smaller number of endogenous latent variables or factors (i.e. instrumental freedoms) generates said covariance structure. Two different MM are presented. First, a MM with a

[110] This work follows S. Long's (J. S. Long, 1983) nomenclature in describing a CSM as composed of a measurement model (MM) and a structural equation model (SEM).

factor complexity of one where no factor cross-loadings[111] exist is introduced. Second, a MM where limited factor cross-loadings exist is presented. Both MM's consider un-correlated error measurement between the measured variables. This restriction is later relaxed in the CSM to allow for correlated measurement errors.

Secondly, the readers' attention is directed to the structural equation model (SEM). The SEM seeks to explain the latent variables' covariance structure obtained from the previous MM by assuming that it can be explained by an exogenous (second order) independent exogenous latent variable.

Finally, the two above models are combined to produce a recursive covariance structure model for development.

In this study, the chosen observed (measured) variables and their corresponding hypothesized latent variables or factors are[112]:

Measured (observed) Variables or Capabilities

gdpcppp3: Gross domestic per capita product, purchase parity. The variable has been transformed to the logarithmic function.

unemp: Unemployment as a percentage of working age population.

ehii1: Estimated household income inequality index.

gdsaving: gross domestic savings, as a percentage of GDP

capital1: capital formation, as a percentage of GDP

popgrowt: population growth

lifexp: Life expectancy

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[111] A factor cross-loading is the term utilized when a measured (observed) variable loads on more than one latent variable. In general, a measured variable loads on mainly one latent variable or factor. For this relationship, the factor loading carries a heavier weight. If in turn, the same measured variable loads on a second or third latent variable, the factor cross-loadings for these additional relationships is smaller. In this study, some factor-cross loadings are expected, as theorized by Sen.

[112] A Codebook for all variables included in this study has been prepared. In it all pertinent details for each and all variables have been carefully explained. The reader is referred to Appendix A "Database Codebook".

infmortn: Infant mortality at age five years old as a percentage of life births.

childlab: Children under age who perform work

literacy: Percentage of the population who are able to read.

xrcomp: Competitiveness of executive recruitment process

xropen: Openness of the executive recruitment process

xconst: Executive constraints institutionalized to the decision making process of the executive branch.

parcomp: Competiveness of the process of political participation.

polright:: Political rights index

civlib: Civil liberties index

Latent (un-observed) Variables or Factors or Freedoms

Econ: Economic freedoms provided by the economic institutional arrangement, or the economic dimension of development

Social: Social freedoms provided by the social institutional arrangement, or the social dimension of development

Polit: Political freedoms provided by the political institutional arrangement, or the political dimension of development.

D.1 The Measurement Model

The MM defines the expected relationship between the measured (observed) variables and the latent endogenous latent variables (factors) or freedoms. This section concentrates on defining the framework around the MM portion of the full CSM.

A Measurement Model with a Factor complexity of One: Definition of the expected relationship between measured variables and latent variables (factors)

The definition of the causal relationship between the measured (observed) variables or capabilities and the unobserved latent variables (factors) or freedoms for the generalized case where all measured (observed) variables (capabilities) load on all underlying latent variables or factors (freedoms) is summarized in Table D.1 down below. Table D.1 presents the expected relationship

TABLE D.1: Expected relationship (sign) between the measured (observed) variables and the latent underlying unobserved variables (factors).

Variable #	Variable Name	Measured Variable Description	ECONOMIC Freedoms	SOCIAL Freedoms	POLITICAL Freedoms
1	gdpcppp3	Income per capita	+	0	0
2	unemp	Unemployment	-	0	0
3	ehii1	Inequality index	-	0	0
4	gdsaving	Gross domestic savings	+	0	0
5	capital1	Investment	+	0	0
6	popgrowt	Population growth	0	+	0
7	lifexp	Life expectancy	0	+	0
8	infmortn	Infant mortality at 5	0	-	0
9	childlab	Child labor	0	-	0
10	literacy	Literacy	0	+	0
11	xrcomp	Executive recruitment competitiveness	0	0	+
12	xropen	Executive recruitment openess	0	0	+
13	xconst	Executive power constraints	0	0	+
14	parcomp	Participation competitiveness	0	0	+
15	polright	Political rights index	0	0	-
16	civlib	Civil rights index	0	0	-

(sign) between each of the measured (observed) variables or capabilities and each of the latent underlying unobserved variables (factors) or freedoms, in accordance with the hypotheses set forth in Chapter 3.

Factors cross-loadings represent, as hypothesized by Sen, freedoms of one kind that reinforce or complement capabilities of another kind. For example, it is expected that social freedoms (i.e. freedom of access to education) reinforce the capability to increase one's income per capita (an economic capability); similarly, it is expected that economic freedoms enhance or reinforce social capabilities (i.e. economic freedoms enhance an individual's capability to access education or improve one's health or life expectancy).

The proposed empirical CSM for development is composed of two model components: A measurement model (MM) and a structural model (SEM). The first, the measurement model (MM),

represents the causal relationship that exists between the measured (observed) variables or capabilities and the underlying latent (un-measurable) variables (factors) or freedoms. The measurement model rests on the following "a priori assumptions", which shall be confirmed by LISREL once the model is built and tested, as follows:

1. There exist three (3) latent variables (factors) or institutional freedoms that explain the existing variance exhibited by the sixteen (16) measured (observed) variables or capabilities. These three latent variables represent the freedoms provided to a given society by the institutional structure or arrangement resulting from the economic, social, and political dimensions of development.

2. The three latent variables are inter-correlated, that is to say, they complement each other[113].

3. As "a priori" assumption for this case is that there are no interlinkages or complementarity between institutional freedoms of one kind and societal freedoms of another kind. This assumption will be later revised and modified to allow for interlinkages as hypothesized by Sen.

4. Errors of measurement associated with each measured (observed) variable are uncorrelated to each other. In terms of covariance structure analysis, their covariances are zero (see Equation xxxx down below, where the off-diagonal terms of the error measurement matrix Θ, are all equal to zero). This assumption will need to be re-stated later to allow for correlated error measurement between measured variables.

As far as the Measurement Model is concerned, it is expected that the existing variance/covariance of the proposed measured (observed) variables or societal capabilities used in the model can be explained by three underlying (unobserved or unmeasured) latent variable, representing the economic, social, and political freedoms provided by the respective institutional dimensions of development. The proposed covariance structure analysis shall therefore uncover three latent variables or factors (freedoms) and confirm through Confirmatory Factor Analysis

[113] In the path diagram, this inter-correlation between latent variables is shown by two-way arrows between them.

(CFA), not only the expected sign of the relationship (as shown in Table D. 1) but its statistical significance as well.

As a guide for interpreting the signs shown in Table D.1 above, one would expect that high economic freedoms should allow an economic environment where lower levels of unemployment shall exist, while at the same time permitting to achieve higher societal capability of income per capita, and / or also to achieve higher levels of capital investment. Similarly, high levels of social freedoms should allow members of a society to attain higher levels of education and life expectancy.

The path diagram presented below in Figure D.1 further facilitates the understanding and visualization of the expected causal relationships between all measured variables or societal capabilities and the underlying latent variables (factors) or freedoms in the .MM. The CFA MM shall confirm three aspects as follows:

1. There exist three (not less, not more) underlying latent variables that explain the existing variance / covariance between the measured (observed) variables.
2. The expected sign of the relationship.
3. Whether the expected relationship is statistically significant or not.

In path diagrams it is customary to show measured variables in rectangles, while latent variables are shown in ovals. Causal relationships are shown as arrows pointing from the variables causing the effect towards the affected variables. As expected with any measured variable, error measurement is shown as an arrow pointing to the measured variable.

The hypothesized causal relationship[114] that exists between the set of measured (observed) variables or capabilities and the set of latent unmeasured (un-observed) variables (factors) or freedoms can be expressed by the following set of mathematical equations, based on assumptions 1 and 3 of the MM introduced above:

[114] The stochastic relationship that is presumed to exist between a variable and its cause is normally expressed as: $y_1 = \gamma_{11} x_1 + \zeta_1$ (see Bollen, 1989). This is valid for both regression analysis (between observed variables) an in latent variable analysis between an observed variable and a latent variable.

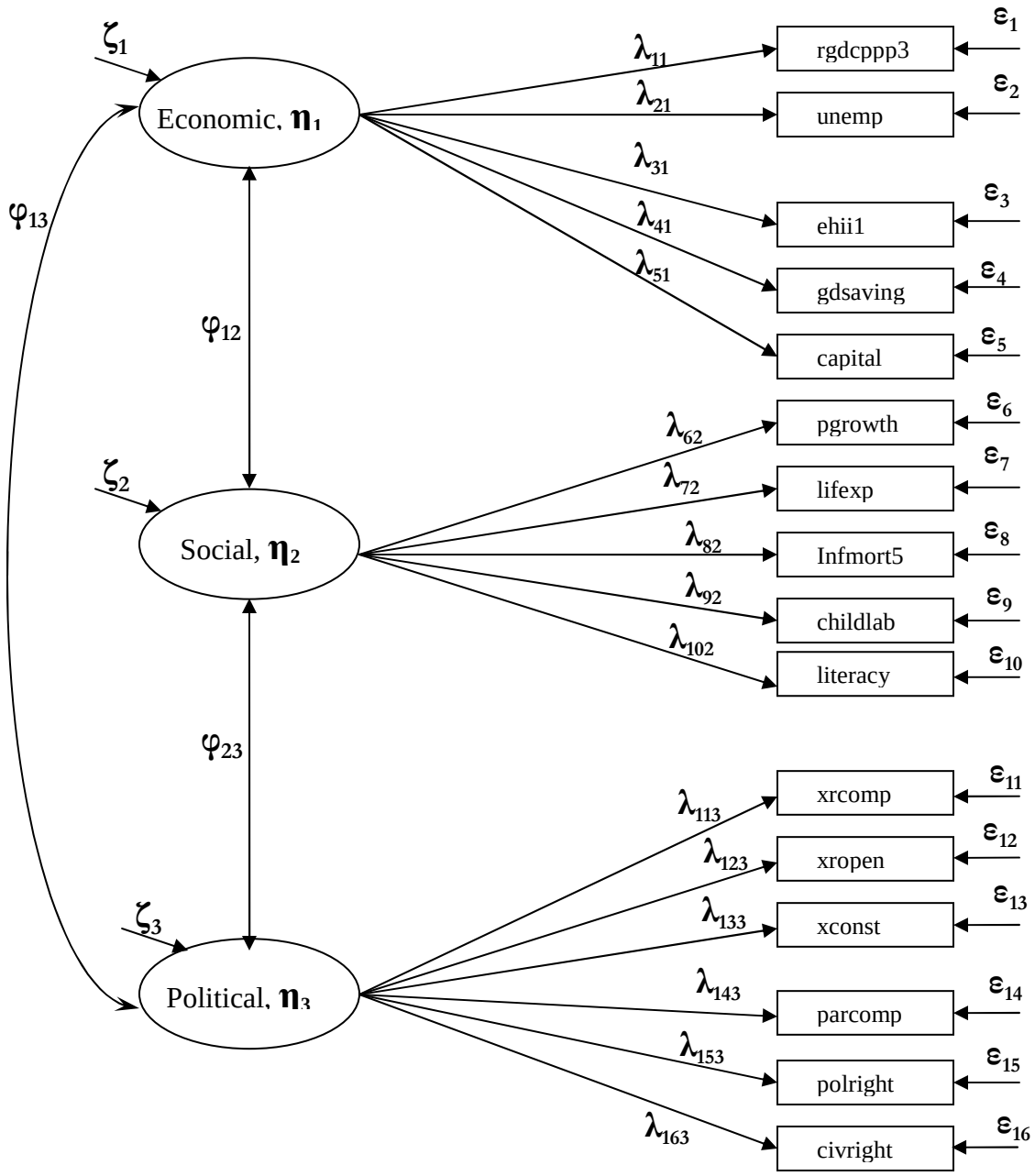

FIGURE D.1 Path Diagram for the MM With a Factor Complexity of One.

$$y_1 = \lambda_{11}\eta_1 + \varepsilon_1$$

$$y_2 = \lambda_{21}\eta_1 + \varepsilon_2$$

$$y_3 = \lambda_{31}\eta_1 + \varepsilon_3$$

$$y_4 = \lambda_{41}\eta_1 + \varepsilon_4$$

$$y_5 = \lambda_{51}\eta_1 + \varepsilon_5$$

$$y_6 = \lambda_{62}\eta_2 + \varepsilon_6$$

$$y_7 = \lambda_{72}\eta_2 + \varepsilon_7$$

$$y_8 = \lambda_{82}\eta_2 + \varepsilon_8$$

$$y_9 = \lambda_{92}\eta_2 + \varepsilon_9$$

$$y_{10} = \lambda_{102}\eta_2 + \varepsilon_{10}$$

$$y_{11} = \lambda_{113}\eta_3 + \varepsilon_{11}$$

$$y_{12} = \lambda_{123}\eta_3 + \varepsilon_{12}$$

$$y_{13} = \lambda_{133}\eta_3 + \varepsilon_{13}$$

$$y_{14} = \lambda_{143}\eta_3 + \varepsilon_{14}$$

$$y_{15} = \lambda_{153}\eta_3 + \varepsilon_{15}$$

$$y_{16} = \lambda_{163}\eta_3 + \varepsilon_{16}$$

Where:

y_i: Independent observed (measurable) variables or societal capabilities, from 1 to k variables.

For the purpose of this study these variables are the ones aforementioned under the economic, social, and political dimensions of development (i.e. income per capita parity purchase, unemployment rate, income inequality, literacy, life expectancy, political rights, civil liberties, etc.)

$\lambda_{i,j}$: Factor loading (to be obtained from the CFA) of variable i onto latent variable (factor) j, which expresses the causal relationship between the measured variable and the underlying latent variable or factor (to be uncovered).

η_1 : Endogenous latent variables (factors) or freedoms, from 1 to j, which express and condense the hidden relationship between the independent measured variables 1 through k and the measured variables or capabilities. The CFA empirical analysis shall yield three latent variables or factors (which shall be named or associated mainly with economic, social, and political freedoms, which stem from the institutional structure or arrangement present (dimensions of development). For the purpose of this study, we expect to uncover (through CFA) three statistically significant latent variables (factors) or freedoms.

$\varepsilon_{k,i}$: The error terms on each measured (observed) variable I, from 1 to *k*, which stem from the latent variable or factors' inability to account for all the variance in the *k-th* variable.

These set of equations can be reduced to matrix notation as follows:

$$\mathbf{Y = \Lambda_y \eta + \varepsilon} \qquad \text{Eq. D.1}$$

Where:

Y : This is the 16 x 1 (rows by columns) matrix (a vector) that contains the measured (observed) variables vector.

$\mathbf{\Lambda_y}$ **:** A 16 x 3 matrix composed of all factor loadings that relate the existing relationship between the latent variable (factors) or freedoms and the measured (observed) variables or capabilities.

$\boldsymbol{\eta}$ **:** A 3 x 1 matrix (vector) composed of the endogenous latent variables (factors) or freedoms.

$\boldsymbol{\varepsilon}$ **:** A 16 x 1 matrix (vector) composed of the error measurements for each measured (observed) variable or capability.

Covariance structure analysis, as mentioned in Chapter 3 deals with variances and covariances. The last step is to convert the above equations into equations relating variance and covariance. Hence the equation above is replaced with matrices that contain the variance / covariance for each and between all variables as follows:

$$\mathbf{Cov[\,Y\,] = \Lambda_y\, cov\,[\,\eta\,] + cov\,[\,\varepsilon\,]} \qquad \text{Eq. D.2}$$

Resulting in;

$$\mathbf{Cov\,[Y] = \Sigma = \Lambda_y \Psi + \Theta = \Sigma\,(\theta)} \qquad \text{Eq. D.3}$$

Where:

$\boldsymbol{\Sigma}$: Is the population variance / covariance matrix for the measured (observed) variables.

$\boldsymbol{\Psi}$: Is the variance / covariance matrix for the exogenous (first order) latent variables (factors)

$\boldsymbol{\Theta\varepsilon}$: Is the variance covariance matrix for the error measurement of the measured (observed) variables.

$\boldsymbol{\theta}$: Vector whose elements are the model parameters.

$\boldsymbol{\Sigma(\theta)}$: Is the covariance matrix in terms of the model parameters.

In the above equation it is worth mentioning that given that a CFA measurement model does not include a causal path between the independent (exogenous) and dependent (endogenous) variables, for the endogenous dependent latent variables there is no residual term to account for, that is to say, the residual term for the endogenous latent variables is zero. Hence, variances and covariances for the endogenous latent (dependent) variables are included in the $\boldsymbol{\Psi}$ matrix.

Expanding the matrix equation above[115] by replacing the measured (observed) variables with their variance / covariance matrix, we get:

$$\begin{vmatrix} \sigma_1 & & & & & & & & \\ \sigma_{2\,1} & \sigma_2 & & & & & & & \\ \sigma_{3\,1} & \sigma_{3\,2} & \sigma_3 & & & & & & \\ . & & & & & & & & \\ . & & & & & & & & \\ \sigma_{8\,1} & \sigma_{8\,2} & \sigma_{8\,3} & . & . & . & \sigma_8 & & \\ . & & & & & & & & \\ \sigma_{16\,1} & \sigma_{16\,2} & \sigma_{16\,3} & . & . & . & . & & \sigma_{16} \end{vmatrix} =$$

[115] It is important to re-emphasize here that in the above factor loading matrix $\boldsymbol{\Lambda}_y$ many of the elements of this matrix are believed to be zero (or very small). Again the equations presented here represent a model where or measured (observed) variables load on all latent variables (factors). This is not the model to be tested with CFA.

$$\begin{vmatrix} \lambda_{1\,1} & 0 & 0 \\ \lambda_{2\,1} & 0 & 0 \\ \lambda_{3\,1} & 0 & 0 \\ . & & \\ . & & \\ 0 & \lambda_{6\,2} & 0 \\ 0 & \lambda_{7\,2} & 0 \\ . & & \\ 0 & \lambda_{10\,2} & 0 \\ . & & \\ 0 & 0 & \lambda_{15\,3} \\ 0 & 0 & \lambda_{16\,3} \end{vmatrix} + \begin{vmatrix} \psi_{1\,1} & & \\ \psi_{2\,1} & \psi_{2\,2} & \\ \psi_{3\,1} & \psi_{3\,2} & \psi_{3\,3} \end{vmatrix} + \begin{vmatrix} \theta_{1\,1} & & & & & \\ 0 & \theta_{2\,2} & & & & \\ 0 & 0 & \theta_{3\,3} & & & \\ 0 & 0 & 0 & \theta_{4\,4} & & \\ . & & & & & \\ . & & & & & \\ . & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ 0 & 0 & 0 & 0 & \ldots 0 & \theta_{16\,16} \end{vmatrix}$$

Eq. D.4

Where:

σ_1 : Variance for measurement variable i.

$\sigma_{i\,j}$: Covariance between measurement variables i and j.

$\psi_{k\,l}$: Covariance between latent variable k and l.

The above set of mathematical relations, path diagram, matrix equations, and expanded matrix equations describe the measurement model where factor cross-loadings are non-existent. In the next section a MM where factor cross-loadings do exist, as hypothesized by Sen, is presented.

A Measurement Model with Freedoms Interlinkages

Let's proceed to adjust the above equations for a second measurement model to be tested in this study where factor-cross loadings do exist to a limited extent. Table D.2 below summarizes the expected causal relationships between measured (observed) variables and latent variables (factors). The corresponding path diagram for the above hypothesized causal relationships is shown below in Figure D.2.

TABLE D.2: Expected Relationship (sign) Between Measured (Observed) Variables and Underlying Latent (Unobserved) Variables (Factors) With Limited Freedoms Interlinkages.

Variable #	Variable Name	Measured Variable Description	ECONOMIC Freedoms	SOCIAL Freedoms	POLITICAL Freedoms
1	gdpcppp3	Income per capita	+	0	0
2	unemp	Unemployment	-	0	0
3	ehii1	Inequality index	-	-	0
4	gdsaving	Gross domestic savings	+	+	0
5	capital1	Investment	+	0	0
6	popgrowt	Population growth	0	+	0
7	lifexp	Life expectancy	0	+	+
8	infmortn	Infant mortality at 5	0	-	0
9	childlab	Child labor	0	-	-
10	literacy	Literacy	0	+	0
11	xrcomp	Executive recruitment competitiveness	0	0	+
12	xropen	Executive recruitment openess	0	+	+
13	xconst	Executive power constraints	0	0	+
14	parcomp	Participation competitiveness	0	0	+
15	polright	Political rights index	0	0	-
16	civlib	Civil rights index	0	0	-

The corresponding mathematical equations that express the hypothesized causal relationship that exists between the societal capabilities and the latent institutional variables can be written as:

$$y_1 = \lambda_{11}\eta_1 + \varepsilon_1$$

$$y_2 = \lambda_{22}\eta_2 + \varepsilon_2$$

$$y_3 = \lambda_{31}\eta_1 + \lambda_{32}\eta_2 + \varepsilon_3$$

$$y_4 = \lambda_{41}\eta_1 + \lambda_{42}\eta_2 + \varepsilon_4$$

$$y_5 = \lambda_{51}\eta_1 + \varepsilon_5$$

$$y_6 = \lambda_{62}\eta_2 + \varepsilon_6$$

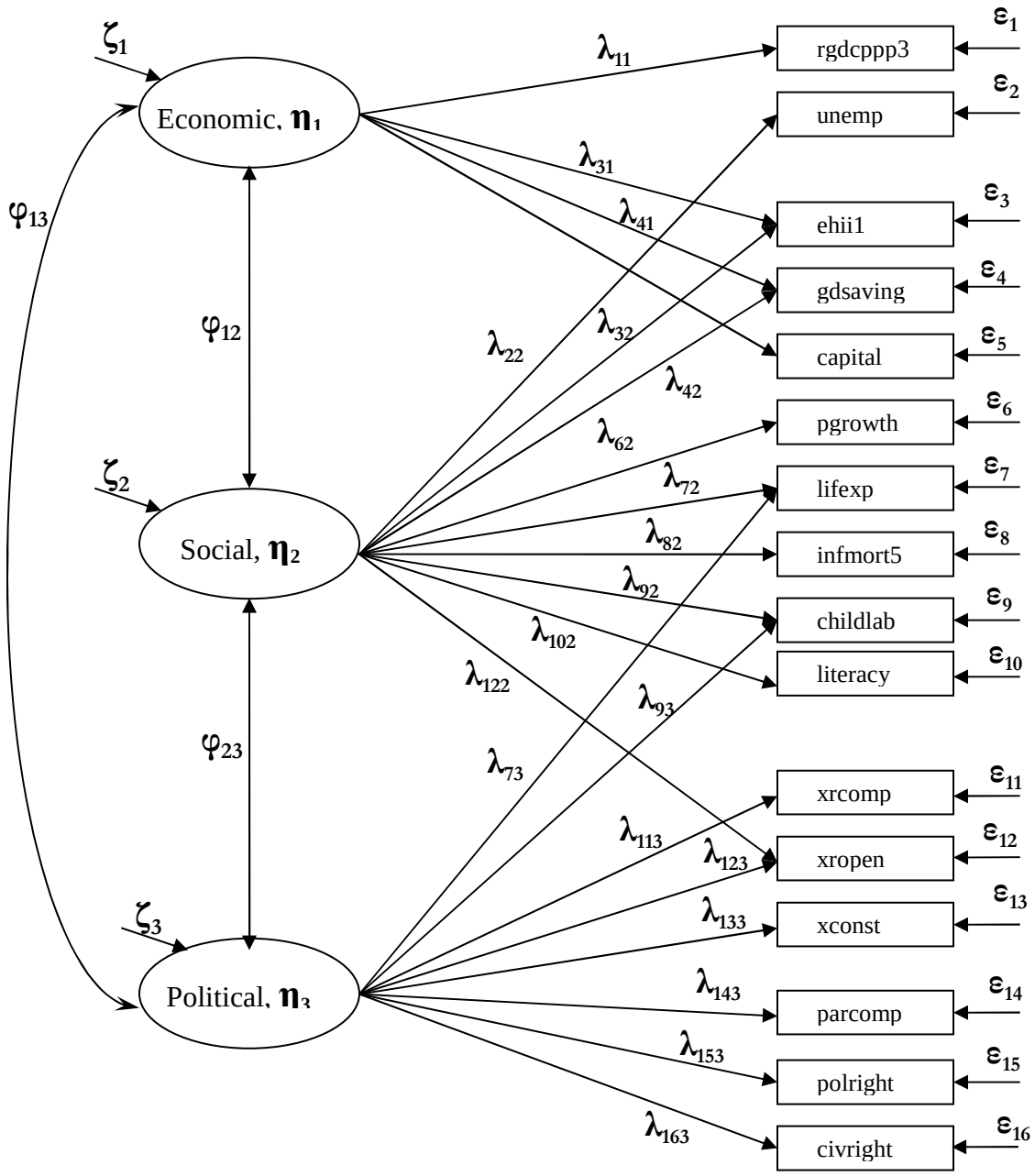

FIGURE D.2. Path Diagram for the MM With Limited Freedoms Interlinkages.

$$y_7 = \lambda_{7\,2}\,\eta_2 + \lambda_{7\,3}\,\eta_3 + \varepsilon_7$$

$$y_8 = \lambda_{8\,2}\,\eta_2 + \varepsilon_8$$

$$y_9 = \lambda_{9\,2}\,\eta_2 + \lambda_{9\,3}\,\eta_3 + \varepsilon_9$$

$$y_{10} = \lambda_{10\,2}\,\eta_2 + \varepsilon_{10}$$

$$y_{11} = \lambda_{11\,3}\,\eta_3 + \varepsilon_{11}$$

$$y_{12} = \lambda_{12\,2}\,\eta_2 + \lambda_{12\,3}\,\eta_3 + \varepsilon_{12}$$

$$y_{13} = \lambda_{133}\,\eta_3 + \varepsilon_{13}$$

$$y_{14} = \lambda_{143}\,\eta_3 + \varepsilon_{14}$$

$$y_{15} = \lambda_{153}\,\eta_3 + \varepsilon_{15}$$

$$y_{16} = \lambda_{163}\,\eta_3 + \varepsilon_{16}$$

The above equations can be written into the following expanded matrix equations:

$$\begin{vmatrix} \sigma_1 & & & & & & & \\ \sigma_{2\,1} & \sigma_2 & & & & & & \\ \sigma_{3\,1} & \sigma_{3\,2} & \sigma_3 & & & & & \\ . & & & & & & & \\ . & & & & & & & \\ \sigma_{8\,1} & \sigma_{8\,2} & \sigma_{8\,3} & . & . & . & \sigma_8 & \\ . & & & & & & & \\ \sigma_{16\,1} & \sigma_{16\,2} & \sigma_{16\,3} & . & . & . & . & \sigma_{16} \end{vmatrix} =$$

$$\begin{vmatrix} \lambda_{1\,1} & 0 & 0 \\ \lambda_{2\,1} & 0 & 0 \\ \lambda_{3\,1} & \lambda_{3\,2} & 0 \\ \lambda_{4\,1} & \lambda_{4\,2} & \\ . & & \\ 0 & \lambda_{6\,2} & 0 \\ 0 & \lambda_{7\,2} & \lambda_{7\,3} \\ . & & \\ 0 & \lambda_{9\,2} & \lambda_{9\,3} \\ 0 & \lambda_{10\,2} & 0 \\ . & & \\ 0 & 0 & \lambda_{11\,3} \\ 0 & \lambda_{12\,2} & \lambda_{12\,3} \\ . & & \\ 0 & 0 & \lambda_{15\,3} \\ 0 & 0 & \lambda_{16\,3} \end{vmatrix} + \begin{vmatrix} \psi_{1\,1} & & \\ \psi_{2\,1} & \psi_{2\,2} & \\ \psi_{3\,1} & \psi_{3\,2} & \psi_{3\,3} \end{vmatrix} + \begin{vmatrix} \theta_{1\,1} & & & & & & & & & & & & & & & \\ 0 & \theta_{2\,2} & & & & & & & & & & & & & & \\ 0 & 0 & \theta_{3\,3} & & & & & & & & & & & & & \\ 0 & 0 & 0 & \theta_{4\,4} & & & & & & & & & & & & \\ . & & & & & & & & & & & & & & & \\ . & & & & & & & & & & & & & & & \\ . & & & & & & & & & & & & & & & \\ 0 & 0 & . & . & . & & \theta_{9\,9} & & & & & & & & & \\ & & & & & & & & & & & & & & & \\ . & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & \\ . & & & & & & & & & & & & & & & \\ & & & & & & & & & & & & & & & \\ . & & & & & & & & & & & & & & & \\ 0 & 0 & 0 & 0 & \ldots & 0 & & \theta_{16\,16} & & & & & & & & \end{vmatrix}$$

Eq. D.5

Lastly, where correlated error measurements exist, the corresponding path diagram shall include two-way arrows between the measured variables and the elements in the Θ matrix become non-zero elements. Representation of correlated error measurements path diagram and the expanded matrix equations is not shown here, but this has been shown in Chapter 4 Model Results.

This section has shown the mathematical formulation, path diagrams, matrix equations, and expanded matrix equations that describe the proposed measurement model with and without interlinakages. The next section will focus on the CSM.

D.2 The Structure Equation Model

This section presents the expected causal relationship, the path diagram, the mathematical equations, in matrix notation and their expanded version, of a structural equation model (SEM) for development.

The expected causal relationship is shown in Table D.3. For all endogenous latent variables it is expected to find a positive relationship between all types of freedoms and development based on theoretical considerations. The anticipated positive relationship stems from the hypothesis that "the instrumental role of freedom concerns the way different kinds of rights, opportunities, and entitlements contribute to the expansion of human freedom in general, and thus to promoting development."[116] It is expected that better institutional freedoms will lead to an increase in economic, social, and/or political freedoms. As hypothesized by Sen, "the expansion of freedoms is the primary end of development". The general underlying expression that describes this structural causal relationship can be written as:

Freedoms = γ development + residual error

TABLE D.3: Expected causal relationship between the exogenous latent variable and the endogenous latent variables

Variable #	Endogenous Latent Variable Name	Endogenous Latent Variable Description	Exogenous Latent Variable Development
1	econ	Economic Freedoms	+
2	social	Social Freedoms	+
3	polit	Political Freedoms	+

In the above expression:

γ : Structural regression coefficient relating the causal relationship between freedoms (endogenous latent variables) and development (exogenous latent variable).

The use of SEM will confirm whether the hypothesized causal relationship between development and the institutional freedoms is statistically significant and if the relationship holds the expected sign. This is done by seeking to explain the variance / covariance matrix obtained from the previous measurement model for the endogenous latent variables in terms of the hypothesized exogenous latent variable.

[116] (Sen, 2000; p. 37).

The path diagram shown below in Figure D.3 visually describes the hypothesized causal relationship between institutional freedoms (endogenous dependent, first order) latent variables and development (exogenous independent, second order) latent variable.

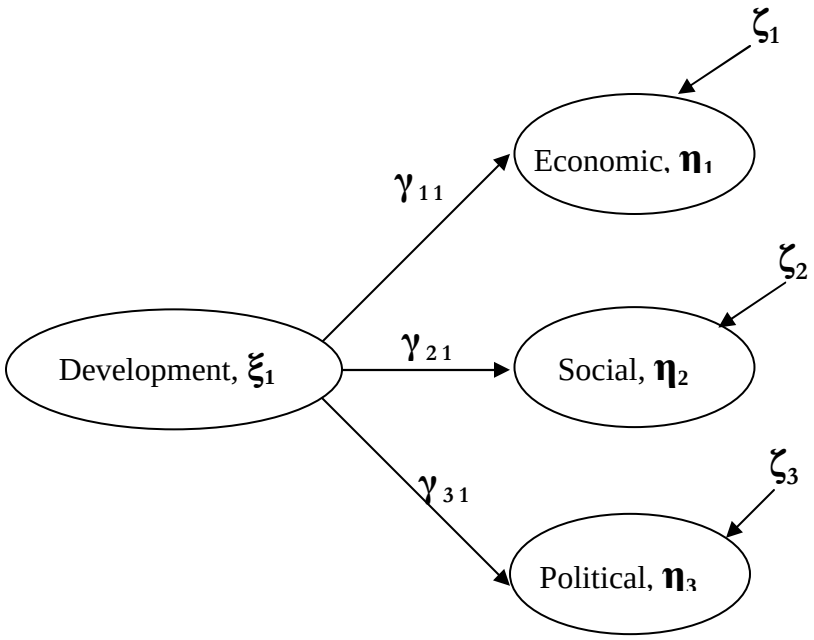

FIGURE D.3: Path Diagram for the SEM.

The matrix equation that describes the above path diagram can be written as:

$$\eta = \mathbf{B}\eta + \Gamma\xi + \zeta \qquad \text{Eq. D.6}$$

Where:

η : Eta is a matrix of endogenous (dependent first order) latent variables. This is a 3 x 1 matrix (vector). Its elements are the economic, social, and political freedoms provided by the institutional structure to a society.

$\mathbf{B}$: Beta is a 3 x 3 matrix of structural regression coefficients between endogenous latent variables (societal freedoms).

Γ : Gamma is a 3 x 1 matrix (vector) whose elements are the structural regression coefficients γ_{ij} relating the i endogenous (dependent) latent variables to the j exogenous (independent) latent variable (in this study i = 3, j =1).

ξ : Ksi is a 1 x 1 vector of exogenous (independent) latent variable (development).

ζ : Zeta is a 3 x 1 matrix (vector) whose elements are the residual errors in the estimation (prediction) of the first order exogenous latent variables from the exogenous independent second order latent variable.

In the absence of a causal relationship between endogenous first order and second order latent variables:

$$\mathbf{B} = \mathbf{0}$$

And equation D.6 becomes:

$$\eta = \Gamma\xi + \zeta \qquad \text{Eq. D.7}$$

Here it is important to note the following. The path diagram shown in Figure D.3 does not include two way arrows (i.e. covariances) between the institutional freedoms (first order endogenous latent variables). This means that their variances and covariances are now accounted for by the higher order (second order) exogenous independent latent variable, i.e. development. Therefore these are no longer parameters to be estimated in the model. Their variation is included in the independent latent variable, i.e. development.

In terms of variance/covariance matrices, this becomes:

$$\eta = \Gamma\, COV[\,\xi\,] + COV\,[\,\zeta\,] \qquad \text{Eq. D.8}$$

Expanding this matrix equation we get:

$$\begin{vmatrix} \eta_1 \\ \eta_1 \\ \eta_1 \end{vmatrix} = \begin{vmatrix} \gamma_{11} \\ \gamma_{21} \\ \gamma_{31} \end{vmatrix} \begin{vmatrix} \xi_1 \end{vmatrix} + \begin{vmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \end{vmatrix}$$

Two additional important points need to be pointed out. First, the elements of matrix ζ (i.e. residual errors) are, by the mathematical procedure involved, normally included in the variances[117] of the endogenous first order latent variables, so the elements of the ζ matrix are replaced with ψ s elements (Byrne, 1998), and therefore:

$$\begin{vmatrix} \eta_1 \\ \eta_1 \\ \eta_1 \end{vmatrix} = \begin{vmatrix} \gamma_{11} \\ \gamma_{21} \\ \gamma_{31} \end{vmatrix} \text{COV} \begin{vmatrix} \xi_1 \end{vmatrix} + \begin{vmatrix} \psi_{1\,1} & & \\ 0 & \psi_{2\,2} & \\ 0 & 0 & \psi_{3\,3} \end{vmatrix}$$

Secondly, it is customary to set the variance of the exogenous independent (second order) latent variable (i.e. development in this thesis work) to be necessarily constrained to be equal to 1.0.

D.3 The Covariance Structure Model

The Covariance Structural Model (CSM) is composed by combining the MM and the SEM models. The full mathematical matrix model that describes the CSM results by substituting Eq. D.7 in D.1, yielding:

$$\mathbf{Y} = \Lambda_y [\Gamma\xi + \zeta] + \varepsilon \qquad \text{Eq. D.9}$$

Converting this equation into an expression of variance/covariance yields:

$$\mathbf{COV\,[\,Y\,]} = \Sigma = \Lambda_y [\Gamma\xi + \zeta] + \Theta \qquad \text{Eq. D.10}$$

Equation D.10 will not be expanded since it will have a form very similar to the expressions already shown for Equation D.5. A simple substitution of those expanded matrices in the above equation will provide the final expanded form of Eq. D.10. It is worth reminding the reader not to lose sight of the fact that the matrix of measured variables is replaced by the variance / covariance matrix , and similarly for the measurement error variance / covariance matrix Θ

[117] These variances have already been calculated in the MM

Finally, the path diagram for the CSM is shown in Figure D.4 below. The case presented here is that for limited cross-factor loadings and with un-correlated error measurements. If error measurements are correlated, then two way arrows between those measured variables where correlation exists should be added. In the final CSM model, correlated error measurements are allowed.

SUMMMARY

This Appendix has presented the mathematical formulations and equations that describe the postulated recursive CSM for development. Special emphasis was placed in presenting these equations both in their matrix and expanded matrix versions. With an aim at complementing the mathematical equations that describe the empirical recursive CSM model, the path diagram for each model was introduced to facilitate visualization of the hypothesized causal relationships. A mayor focus has been placed in providing a step-wise introduction to the models and by segregating the components of the CSM into a measurement model and a structural equation model, while moving from most simple to most complex relationships. Both the MM and the SEM were finally combined into the covariance structural model (CSM).

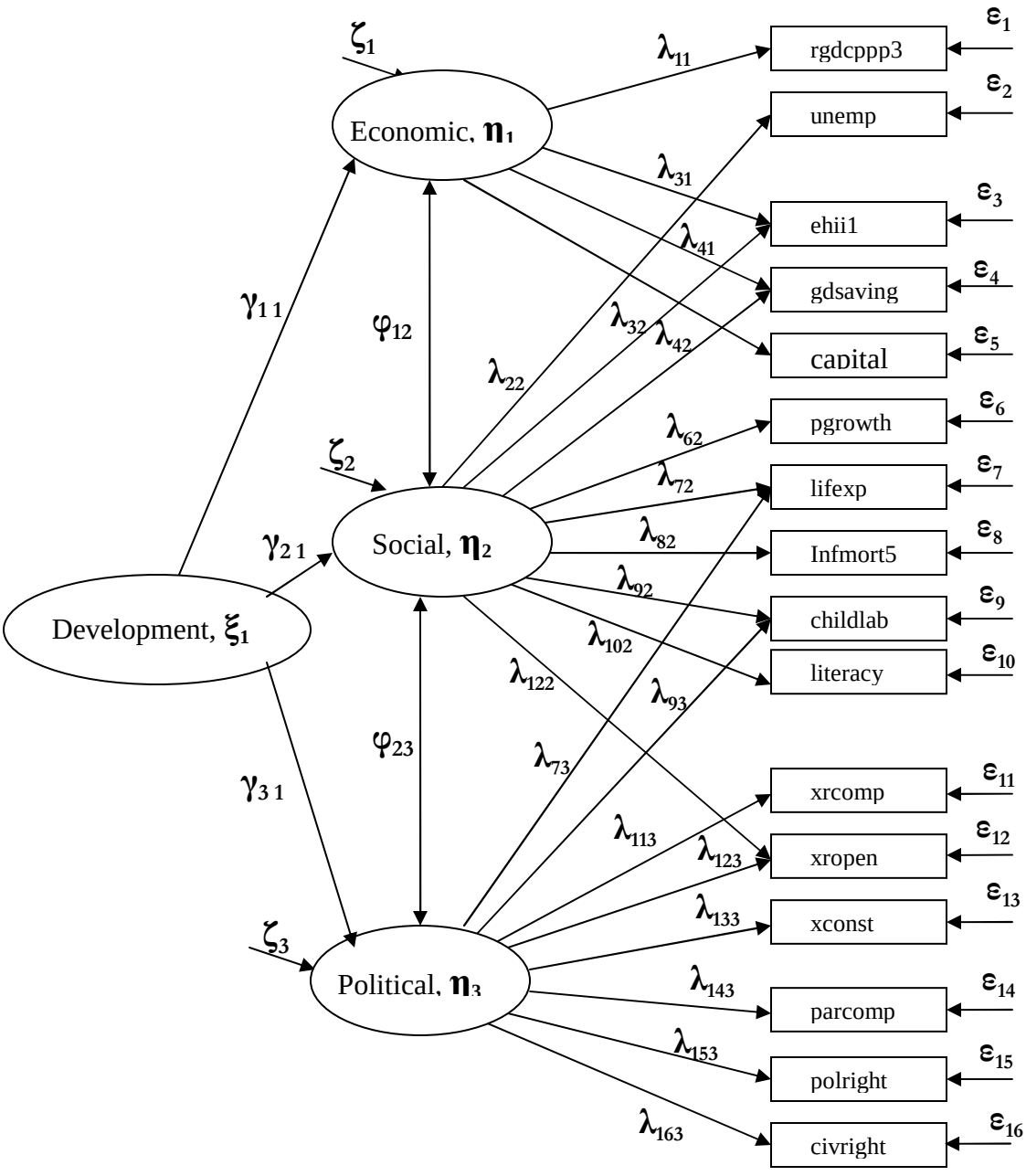

FIGURE D.4. Path Diagram for the CSM with Limited Freedoms Interlinkages and Un-Correlated Measurement Errors

VITA

Carlos was born in Medellin (Colombia), the sixth of nine siblings. During his early childhood, due to his father's obligations as a diplomat representing the government of Colombia, his family moved to Montevideo (Uruguay) where he spent ten years and completed his elementary school. His family moved then to Lima (Peru) where he completed high school in Colegio Santa Maria, a Catholic school. His family moved back to Medellin (Colombia) where he earned a Bachelor of Science in chemical engineering in the Universidad Pontificia Bolivariana in 1985. After working several years at the Ecopetrol Refinery in Barrancabermeja (Colombia) he moved to the private industry and worked for one year at Carboquimica S. A. in Bogota. Carlos' desire to pursue graduate studies led him to a graduate research assistantship in the Department of Chemical Engineering at Louisiana State University in Baton Rouge. He earned a Master of Science in chemical engineering in 1992. Before graduating, he went to Medellin (Colombia) for a short period to get married with Gloria, by this time his 4 year girl friend. In the midst of a recession he was fortunate to receive a job offer and joined Domino Sugar at the Chalmette Refinery where he worked for one year. He moved back to Baton Rouge after receiving a job offer from Bertrand Engineers where he worked for seven years, two of which he spent at the ExxonMobil Baton Rouge Chemical Plant. During this time, his first son, Pablo Andres, was born in Baton Rouge in 1998. Carlos then joined Jacobs Engineering in 2001 in the Baton Rouge office, and in 2002 his second son Mateo Carlos was born. It was also this year when Carlos earned a master's in business administration at Louisiana State University. During the third year as a Jacobs employee he was offered an opportunity for an in-plant assignment again at the ExxonMobil Baton Rouge Chemical Plant which he accepted. He worked at this location for four years at the end of which after receiving an offer he finally joined ExxonMobil as a facilities planner in 2008 where he currently works. Carlos and his family live happy in Baton Rouge where they enjoy the food, the friendly people, soccer, tennis, and their new GSP named Orion.