The Interdependence of Economic Growth, Human Development and Political Institutions
A General Equilibrium Framework

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Abstract

Since about the turn of the millennium, a vibrant literature in development economics has begun empirical work to identify the root-causes of international wealth disparities using instrumental variables. Although this literature has provided valuable insights, its disregard for general-equilibrium effects and theoretical mechanisms calls the empirical results and debates produced by it into question. As a response, this thesis formally introduces, and subsequently empirically estimates a simple general equilibrium model describing the long-run development process. Estimations involve 4 different cross-sectional and panel-data specifications. The model is found empirically viable, and findings implicate that both economic growth and human development, but also human development and institutional change strongly depend on each other in the long run. This is a wake-up call for more structural- and theoretically founded general equilibrium modeling in the macro-development literature.

1 Introduction

Since the early beginnings in growth econometrics in the 1950's and 60's, cross-country growth regressions with GDP growth in different forms as the dependent variable have been economists tools of choice to study economic development. From the concerns about robustness, model selection and endogeneity, which were always present in the literature but became especially strong in the 1980's and 1990's, research went into different directions. One strand of research was the endogenous growth literature following the ideas of Paul Romer in the early 90's (Romer, 1994; Pack, 1994; Cortright, 2001). Another strand became the robustness literature following Edward Leamer's extreme bounds analysis and Levine and Renelt (1992), succeeded by bayesian model averaging and Sala-i-Martin (1997) and later more sophisticated model selection approaches such as the general-to-specific approach by Hoover and Perez (2004) (Deijl, n.d.; Levine & Renelt, 1992; Sala-i Martin, 1997; Hoover & Perez, 2004). Further developments followed that have characterized the growth and development economics literature since roughly the turn of the century. Notable among these are the Randomized Control Trials (RCT) literature building upon the work of Esther Duflo and Abhijit Banerjee from the early 2000's, the microeconometric work examining household surveys and other micro-data inspired by Angus Deaton and others, and the cross-country instrumental variables (IV) development literature that was largely inaugurated through a seminal paper by Daron Acemoglu, Simon Johnson and James Robinson (Henceforth AJR) in 2001 (Banerjee & Duflo, 2005; A. Deaton, 2010b,a, 1997; Duflo et al., 2008; Acemoglu et al., 2001, 2014; Bigsten, 2016). These tree literatures distinguish themselves from earlier works especially through their rigorous focus on learning about development by measuring causal effects. In the RCT literature this entails measuring the effects of treatments, policy experiments and natural experiments on development outcomes, whereas the microdata literature focuses more on capturing the effects of policies and learning about consumption and saving behavior (A. S. Deaton, 2009; A. Deaton, 1997, 2010b). The cross-country IV literature on the other hand focuses on measuring the causal effects of single determinants on economic growth using instrumental variables estimation. The emphasis in this literature has been on estimating the effects of institutions, human capital, trade and geographic factors and their relative importance for economic development (Acemoglu et al., 2001, 2014; Dollar & Kraay, 2003; Dias & Tebaldi, 2012a; Bhattacharyya, 2009c; J. D. Sachs, 2003; Rodrik et al., 2004).

The field of development economics has seen a lot of progress and become one of the most vibrant and dynamic fields in economics in recent years, largely because of the impact of these three literatures (Bigsten, 2016). But despite these rapid positive developments and innovations in empirical method, common criticisms have been raised and become louder. These criticisms run along the lines of concerns about the lack of formal economic theory ubiquitous throughout the literature, and more importantly of doubts about the generalizability and usefulness of the estimated (causal) coefficients given a limited representativeness of samples (particularly in micro-work), and the general-equilibrium nature of the economy (a criticism pertaining to both micro and macro work) (Rodrik, 2012; A. Deaton, 2010a,b; A. S. Deaton, 2009; Acemoglu, 2010). Acemoglu (2010) and Deaton (2010b) illustrate the problems associated with disregarding theory, general equilibrium and political economy effects when estimating and interpreting causal coefficients from IV's or RCT's. Both assert that economic theory is crucial since it focuses on the most important mechanisms and provides a framework withing which to interpret empirical estimates and their external validity. They contend that estimates themselves are of little use without an understanding of the mechanisms that have produced them (Acemoglu, 2010; A. Deaton, 2010a). Acemoglu (2010) goes further and elucidates that partial equilibrium estimates obtained under the maxim of *ceteris paribus* (all other factors held fixed), are misleading in terms of external validity in contexts where a large scale change in the variable concerned will trigger either endogenous policy responses or endogenous changes in other factors (such as prices or technology) (Acemoglu, 2010). As an example he gives the omitted effects of imperfect substitution and diminishing returns when estimating the returns to schooling ceteris paribus. The problem here is that the estimate is taken under the implicit assumption that a change in schooling will not alter the market return to education. This assumption is correct if the estimate is used to evaluate individual decisions to acquire education, but it becomes biased if it is employed to evaluate the returns to a government program which would improve schooling in a large fraction of the population. Such a program would be followed by a market shift in the supply of high-skilled workers, which in turn would lower the skill premium and thus reduce the returns to education (Acemoglu, 2010). Another striking example in the literature concerns the effect of health (proxied by life-expectancy) on income. In the micro-literature, it has been empirically established that greater health improves income. Acemoglu and Johnson (2007), however, using a cross-country regression framework of income on life expectancy instrumented by predicted mortality rate (a variable based on health breakthroughs with differing implications for different countries, which they argue accounts for a source of exogenous variation in health in different counties) find a negative coefficient on life expectancy on income (Acemoglu & Johnson, 2007; Acemoglu, 2010). They explain this digression by the increase in population triggered by nationwide improvements in life expectancy, which then through diminishing returns to capital and land decreased labor productivity and led to a net-reduction in income per capita (Acemoglu, 2010; Acemoglu & Johnson, 2007). These examples (of which more may be consulted in Acemoglu (2010) and Deaton (2010b)) illustrate that general equilibrium estimates can be quite different in magnitude, and even reversed in sign from partial equilibrium estimates (Acemoglu, 2010; A. Deaton, 2010a). Unfortunately, development economists are typically interested in estimating responses to policies which would result in economy-wide changes in certain factor endowments, and thus entail endogenous responses and general equilibrium effects that may not be captured in a partial equilibrium regression model. Acemoglu (2010) therefore concludes by advocating for more structural economic modeling in development economics. This type of modeling, if it is firmly based on theory, will incorporate endogenous responses in terms of changing factors, policy responses or externalities, and provides a general equilibrium framework within which it is possible to identify and estimate causal policy parameters (Acemoglu, 2010).

This paper aims to present some progress in this direction by theoretically justifying and empirically estimating a simple structural simultaneous-equation model to capture the mutual interdependence of income/growth, political institutions and human development in what will be termed a "long run development equilibrium". In this attempt it may be considered an addition to the cross-country IV development literature[1], which differs from the existing literature insofar that it takes feedback loops between income, human capital and institutions and interaction effects between these three factors into account. This model thus operates from the fundamental assumption of a cyclical and dynamic rather than a linear development process. It also differs from most of the existing literature in considering human development and good political institutions as development ends in themselves rather than just inputs to a development function where wealth serves as the ultimate measure of development success (as it is common in the literature).

The remainder of this paper is be structured as follows: Section 2 briefly summarizes the cross-country IV development literature to date, mentioning its most important results and identification strategies, which serve as inspiration for the identification strategies followed in this paper. Section 3 introduces the theoretical model employed in this paper and provides a detailed discussion of the models different chains. Section 4 introduces the data used in this study and documents the construction of empirical proxies for institutions and human development. In section 5 an empirical model selection exercise is conducted to demonstrate the empirical relevance of the theoretical process identified in section 3 vis-a vis competing theories. In section 6 the the model is estimated using a cross-section of countries and instruments from the literature. Section 7 presents a panel data specification with decadal changes and an identification strategy utilizing a set of time-varying external instruments. Section 8 presents medium- and long-term panel estimations with data reaching down to 1820 and identification using lagged values as instruments. Section 9 concludes. The appendix includes supplementary materials that will allow the reader to fully reproduce the empirical estiamtions and plots presented here[2]. It also includes a set of extra plots presenting the cross-sectional and time-series data used for this study.

1.1 Paper Outline

1. Introduction
2. Literature Review
3. Theoretical Model
4. Data and Indexes
5. Model Selection Exercise
6. Cross-Sectional Model
7. Panel-Data Model with Time-Varying Instruments
8. Long-Term Panel with Lags as Instruments
9. Conculsion
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[1] Which has largely concerned itself with identifying the effects of institutions and human capital (& some other factors) on income/growth using instrumental variables, and which has been characterized by an ongoing debate on which of these factors is more important or fundamental (e.g. see the confrontations between Acemoglu et al. (2014) and Glaeser et al. (2004), or between Sachs (2003) and Rodrik et al. (2004)).

[2] The estimations are conducted (mostly) in STATA and the plots are made in R. The supplementary materials provide datasets and code files to reproduce the results and plots using these two programs.

2 Literature Review

Taking inspiration from the genealogy of Vieira et al. (2012), the existing literature on institutions, human development[3] and growth, can be partitioned into four separate groups. The first of these groups is the *geographic determinist* or endowment camp associated with studies such as Sachs and Warner (1995, 1997), Bloom and Sachs (1998) and Sachs (2003). These studies assert that geographic factors such as tropics, germs, and crops have a direct and fundamental effect on economic development and can explain a good part of the international development divide (Vieira et al., 2012; B. J. D. Sachs & Warner, 1997; J. D. Sachs, 2003). Bloom et al. (1998) for example hold that diseases such as malaria have a fatal and debilitating effect on the African population. The high disease burden negatively impacts productivity, investment and saving, and therefore impairs African economic performance. They empirically find that the high incidence of malaria reduces the annual growth rate of the continent by 1,3%, and that an eradication of malaria in the 1950's would have yielded a doubling of income per capita on the continent today (Bloom et al., 1998). This camp has been attacked by the institutionalists (more on them later), who have claimed that geography only proximately impacts development because of its effect on early political institutions. J. D. Sachs (2003) presents a response to these critics by estimating a regression of per-capita income on malaria risk (instrumented by malaria ecology, a geographically computed index of the conductivity of the environment to malaria) and institutions (rule of law by the world bank world governance indicators) to show that malaria has a direct effect on productivity next to the effect of institutions. The debates between these two camps have been quite intense and carried out in a series of papers. I therefore continue with introducing the institutionalists.

The second camp are *the institutionalists*, which believe that early (colonial) institutions and subsequent institutional developments lie at the heart of the development divide (Vieira et al., 2012). These authors affirm the effects of geography, the disease burden and human development (human capital) on economic development, but rather assert that these factors (high disease burden, low education levels etc.) have as their root cause extractive and ineffective institutions which were put in place by unfavorable political conditions and the activities of European settlers during the colonial era (Acemoglu et al., 2001, 2014; Dollar & Kraay, 2003; Vieira et al., 2012; Dias & Tebaldi, 2012b). Early studies in this literature are the one by Hall & Jones (1999) who demonstrate that their measure of institutional quality (social infrastructure), instrumented with distance from the equator and European languages spoken in the population, is crucial to explaining cross-national differences in productivity (Vieira et al., 2012). Another landmark study supporting the institutionalist view is the one of Acemoglu, Robinson and Johnson (AJR) (2001), who use data on the mortality rates of European settlers in different parts of the world (based on the work of the historian Philip D. Curtin) to instrument for their measure of institutions (protection against "risk of expropriation" index from political risk services), and show a robust positive effect of institutions on growth (Acemoglu et al., 2001). The paper triggered great interest from all over the economics community due to the revolutionary instrumentation strategy employed, and because the estimate may be interpreted as causal if their story is to be believed (which has however become contested in the literature). The story, in short, goes as follows:

Europeans followed different types of colonization policies which created different sets of political institutions: At one extreme, European powers set up "extractive states," exemplified by the Belgian colonization of the Congo, which did not introduce much protection for private property or checks and balances against government expropriation, but had the main purpose to transfer as much of the resources of the colony to the colonizer as possible (Acemoglu et al., 2001). On the other hand, many Europeans migrated and settled in a number of colonies, creating what the historian Alfred Crosby (1986) calls "Neo-Europes" (Australia, New Zealand, Canada, and the United States) (Acemoglu et al., 2001). According to AJR (2001), the type of colonization strategy followed was determined by the feasibility of settlements, which in turn was determined by climate and the disease environment (Acemoglu et al., 2001). Finally, AJR (2001) assert that institutions are highly persistent structures, and thus contemporary institutions in the third world are to a certain extent still under the influence of their colonial predecessors. All this leads to the

[3] the literature actually focuses more on human capital (proxied by education)

following mechanism:

$$\text{Settler Mortality} \Rightarrow \text{Settlements or Extractive State} \Rightarrow \text{Early Institutions} \Rightarrow$$
$$\text{Current Institutions} \Rightarrow \text{Current Economic Performance}$$

If settler mortality is established to influence economic performance only via the institutional mechanism and not via other channels (such as human capital like it is claimed by Porta, Glaeser et al (2004)), then it is a valid instrument and AJR (2001) have succeeded in capturing the causal effects of early institutions on todays economic performance (Glaeser et al., 2004). Acemoglu et al. (2014) confirm the findings of AJR 2001 and defend them against the attack from Glaeser et al. (2004) (discussed below). They regress GDP per capita on institutions (rule of law index) and human capital (years of schooling) while instrumenting institutions with log settler mortality and log population density in 1500, and human capital with primary enrollment in 1900 and protestant missionary activity in the early 20th century. The reasoning for the population density instrument is that next to the disease environment, colonialists sought out densely populated areas (back in 1500) to set up an extractive state, because of the slave labor readily available. The protestant missionary activity instrument for human capital is based on the premises that protestant missionaries both educated people (e.g. by learning them to read scripture) and did not conduct their missionary efforts systematically (for example by seeking out more educated people first), for both of which Acemoglu et al. (2014) argue at length. Acemoglu et al. (2014) find that when institutions and human capital are instrumented using these historical sources of variation, institutions appear to have a fairly robust effect of on current prosperity and the effect of human capital is much more limited. They take this as evidence that institutions are a fundamental determinant of long-run development and human capital only a proximate cause. They also estimate a semi-structural regression where they regress the instrumented human capital measure on growth and control for the historical instruments for institutions. They find that the coefficient on years of schooling becomes insignificant and take this as evidence that both institutions are fundamental, and that there is no causal impact of human capital on institutions (Acemoglu et al., 2014). They conclude that this also shows that the view that differences in the human capital endowments of early European colonists have been a major factor in the subsequent institutional development of former colonies is false. A final influential study in this camp is that by Rodrik et al. (2004), who compare the effects of institutions, geography and trade on income. They instrument institutions with log settler mortality and trade with the amount of trade predicted by a gravity model (The geographically predicted (natural) amount of trade so to say) following Frankel & Romer (1999). They also estimate a second specification where they use fraction of the population speaking English and fraction of the population speaking other European languages (following Hall & Jones (1999)) as instruments for institutions, to allow for a greater sample size[4]. They find that in both the small and the large sample specification the quality of institutions "trumps" everything else (e.g. once institutions are controlled for, measures of geography have at best weak direct effects on incomes and trade is insignificant). Both geography and trade however are found to have a strong indirect effect on income by influencing the quality of institutions (Rodrik et al., 2004).

The third group of studies in this literature express the so called *policy view*. These authors hold that good macroeconomic policies (fiscal and monetary), openness to international trade, and financial integration into capital markets are the fundamental drivers of long-run economic success (Vieira et al., 2012). Representative studies are the ones by Frankel and Romer (1999) and Dollar and Kraay (2003) (Dollar & Kraay, 2003; Frankel & Romer, 1999). These studies have tried to identify the effects of trade on income by exploiting deep geographical determinants of trade – countries that are landlocked and/or remote from major markets tend to trade less than those that are not (Dollar & Kraay, 2003). Using a cross-section of 134 countries, Dollar & Kraay (2003) show that in explaining growth in the long run, good institutions and trade go together and can be traced back to common geographical and historical factors. However their instrumentations strategy (instrumenting institutions with the population fractions speaking English and other European[5] following Hall & Jones (1999), and current trade with the geographically predicted trade using a gravity model following Frankel & Romer (1999)) does not allow them to disentangle the

[4]beyond former colonies to which the settler mortality instrument would restrict the sample

[5]These instruments are intended to capture the influences of colonial origin on current institutional quality, and allow for a large sample size.

partial effects of institutions and trade[6]. They attempt to remedy this by regressing changes in decadal growth rates on decadal changes in institutions and trade (using lagged initial values as instruments). Their findings implicate that there is substantial variation in growth rates, institutional quality and trade shares over time, but that trade has a larger effect on growth than institutions over these shorter time-horizons. They conclude by suggesting that both institutions and trade are important in the very long run, but that trade has a larger impact on growth in the short run.

A final set of studies is in support of the *human development* (human capital) view. These authors affirm that human capital accumulation is fundamental to the growth process and that during the colonial experience settlers brought not primarily their institutions, but themselves and their human capital. They thus contest the validity of settler mortality as a valid instrument for the effect of institutions on growth[7]. These authors hold the modernization view (a la Lipset (1960)) that human capital is a more basic source of growth than institutions, and that poor countries get out of poverty through good policies, often pursued by dictators, which lead to an accumulation of human and physical capital, and subsequently to improvement of political institutions (Glaeser et al., 2004). They theoretically support their view by pointing to the experiences of Asian nations such as South Korea, Taiwan, and Singapore, which first grew rapidly under one-party dictatorships and eventually became democratic. They contrast the historical trajectories of North- and South Korea. The two countries had very similar dictatorships and income levels in 1950, but diverged starkly in income because of the differing economic system choices of both regimes, which from 1980 onwards was followed by democratic reforms in South Korea (Glaeser et al., 2004). Glaeser et al. (2004) go on to point at the near universality of dictatorships in poor countries during the 1960's, and the great dispersion in growth rates and property rights regimes that followed, which they attribute predominantly to dictatorial choices. They also criticize the set of institutional proxies used by the new institutionalists (e.g. Rodrik et al. (2004) and Acemoglu et al. (2001) (see Table 2)) in that these measure short-term governance outcomes and not deep institutional characteristics. (Glaeser et al., 2004) contend that these indexes rise with income and are highly volatile, and thus reflect dictatorial choices in addition to the political environment. They demonstrate this point by showing that dictatorships like Singapore and the USSR scored highly on these indexes in the mid 1980's. Glaeser et al. (2004) also provide empirical support for their theory by regressing growth of per capita income between 1960 and 2000 on initial income per capita, initial education, the share of a country's population in temperate zones, and eight institutional variables[8] entering into the regression one at a time. Of these 8 proxies, 4 relate to governance outcome measures and 4 relate to constitutional measures. They find there to be a strong effect of governance outcome measures on growth, and no effect of the constitutional variables. They also find that initial human capital is a strong predictor of subsequent growth whereas initial institutions are not. Finally, they also find (using dynamic panel data with country fixed effects (no time fixed effects though)) that lagged education predicts subsequent institutional improvements (but not lagged income), whereas lagged institutions do not predict subsequent changes in human development (but lagged income does). Glaeser et al. (2004) conclude that their evidence supports the Lipset (1960) view that human capital takes primacy for both economic growth and democratization. From a policy point of view the argue that the historical experience shows that focusing on establishing democracies in countries with low human capital might not be viable strategy, and that development efforts should be directed towards improving human capital.

Beyond these distinct camps, there are studies that try to unify theories or that take a different perspective such as the studies by Bhattacharyya (2009b) and Bhattacharyya (2009a). Bhattacharyya (2009b) contrasts three competing narratives in explaining African underdevelopment. The first of which is the disease view promoted by Bloom et al. (1998), the second the institutionalist view of Acemoglu et al. (2001), and the third is the slave trade view by Nunn (2004). The latter holds that African slave trade caused massive depopulation of the continent over two centuries, and also had a detrimental impact on the development of domestic institutions. Nunn

[6] Due to very large correlations in the two first stage predicted values.

[7] They attempt to show this by demonstrating that the settler mortality instrument is correlated with human capital (years of schooling) today even higher than with contemporary institutions.

[8] The 4 governance outcome measures are: constraints on the executive, risk of expropriation, government effectiveness, and autocracy, and the 4 constitutional measures of institutions are: judicial independence, constitutional review, plurality, and proportional representation.

(2004) explains that the frequent slave raids created a culture of violence and instability which spawned a persistent state of lawlessness in society and impaired the development of effective political institutions. Bhattacharyya (2009b) investigates the relative contributions of these mechanisms using a cross-sectional growth regression on malaria incidence, institutional quality, slave trade and various controls. He instruments malaria incidence with malaria ecology[9], institutions with log settler mortality and log population density in 1500 and slave exports with mean distance from the coast. He demonstrates that malaria dominates over institutions and slave exports when it comes to explaining long-run economic performance of Africa. His findings suggest that it explains as much as 26.3% of the variation in log per capita income. He goes on to show that high malaria incidence adversely affects growth by increasing both mortality and morbidity. Increased mortality from malaria induces households to increase current consumption and save less for the future, while increased morbidity adversely affects labor productivity (Bhattacharyya, 2009b). The combined impact of these two effects is a slowdown of capital accumulation and economic growth. Since the continent seems to be trapped in a low-level equilibrium, Bhattacharyya (2009b) asserts that the only way out of it may be large scale public health investments, which he claims have to a certain extent taken place in Asian and Latin American countries with originally similar disease environments. It is thus the ineffectiveness and thin fiscal resources of African governments that are responsible for a continued vicious cycle. Bhattacharyya (2009b) thus reinforces ineffective (and financially poor) institutions as a proximate cause of African underdevelopment and calls for increased large scale internationally funded efforts to combat diseases in Africa.

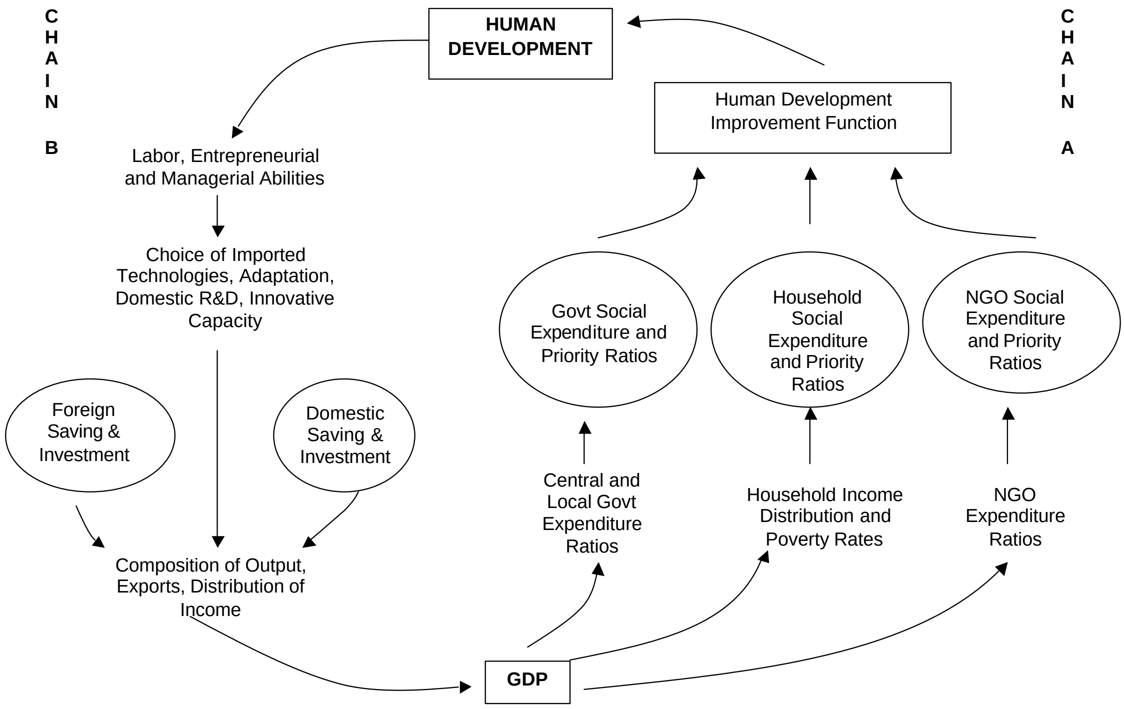
Bhattacharyya (2009a) takes these ideas further and develops a framework to marry the institutionalist view (=underdevelopment and high disease burden today are a consequence of bad governance) with the disease view (=high disease burdens have a causal negative impact on development). This framework stipulates that overcoming diseases is of prime importance in early stages in the development process whereas institutions become more important later on. Bhattacharyya (2009a) shows that Western Europe managed to overcome an initial Malthusian type bottleneck through better food production driven by superior technology, which in turn led to a better organizational structure in society. Improving institutions then started a virtuous cycle of sustained technological progress, institutional innovations, trade, and long-term economic growth (Bhattacharyya, 2009a). He finds this framework to carry explanatory power for the developing world as well. China, as the leader in old-world technology, passed the disease bottleneck very early in history. The collapse of the Ming Dynasty into the hands of the Manchu-led Qings in the 1430's however altered the governance of China towards a more absolutist regime which did not allow private initiatives and destroyed all institutional incentives for technological research (Bhattacharyya, 2009a). China therefore fell behind the west in the middle ages. In India, the institutional environment was good, but the British colonizers replaced these institutions by extractive institutions and destroyed the local Indian cotton industry for reasons of economic competition. This so induced institutional reversal prevented India from developing an efficient capitalist system (Bhattacharyya, 2009a). The story of Latin America (as told by Bhattacharyya (2009a)) is very similar; initially suitable institutions in prosperous societies were replaced with extractive colonial institutions in the 17th century. The latter persisted until the 19th century and impaired economic development (Bhattacharyya, 2009a). He goes on to argue that the history of Africa is distinct from other continents as unfavorable climactic conditions (droughts and heavy rains) combined with a high disease burden precluded Africa from producing more than a subsistence level of grains and evolving towards more complex societal structures. The long history of slave trade and colonial institutions have fed into this as well, and left the continent stuck at stage 1 in the development process (Bhattacharyya, 2009a). He concludes by suggesting that instead of arguing for "root causes", stage theories of development should be taken more serious, ideas should be formalized and the mechanisms explained. He further suggests that the inherent causality problems in some of the empirical results in this literature might only be resolved through appropriate general equilibrium modeling, and that such efforts should be complemented by country case-studies to allow for heterogeneity in development trajectories.

The literature has also seen attempts of providing and estimating a dynamic framework describing the development process. An early attempt is given by Ranis et al. (2000), who develop and test a framework describing the two-way interaction between human development and eco-

[9]Malaria Ecology is a geographically computed index from J. D. Sachs (2003)

nomic growth. Using cross-country regressions[10] they demonstrate a significant relationship in both directions, with (public) expenditures on health and education being the main drivers from growth to human development, and investment and income distribution the main drivers from human development to economic growth (Ranis et al., 2000). They also investigate the development paths of countries over time which they categorize into "virtuous" and "vicious" cycles[11], and establish that in terms of sequencing human development appears to be more fundamental than growth (Ranis et al., 2000). Their model is taken up and developed further by Suri et al. (2011), who develop an empirical strategy to investigate the strength of the chains from economic growth (EG) to human development (HD) and vice versa[12] and find that both chains are empirically very strong. For Chain A (from EG to HD), inequality and public expenditure ratio's are significant in explaining how effectively EG translates to HD (Suri et al., 2011).

Figure 1: The HD-EG Model of Ranis et al. (2000) and Suri et al. (2011)
Source: Suri et al. (2011)



For Chain B (from HD to EG), they find that levels and changes in HD and investment ratios are important determinants of chain strength, and that there seems to be a HD threshold needed for countries to embark on a growth path (Suri et al., 2011). They give credence to threshold-externality models a la Azariadis & Drazen (1990) in explaining this finding. They also confirm the findings of Ranis et al. (2000), that the chain from HD to EG is stronger, and that virtually no country entered the virtuous cycle by improving growth but not human development, whereas the

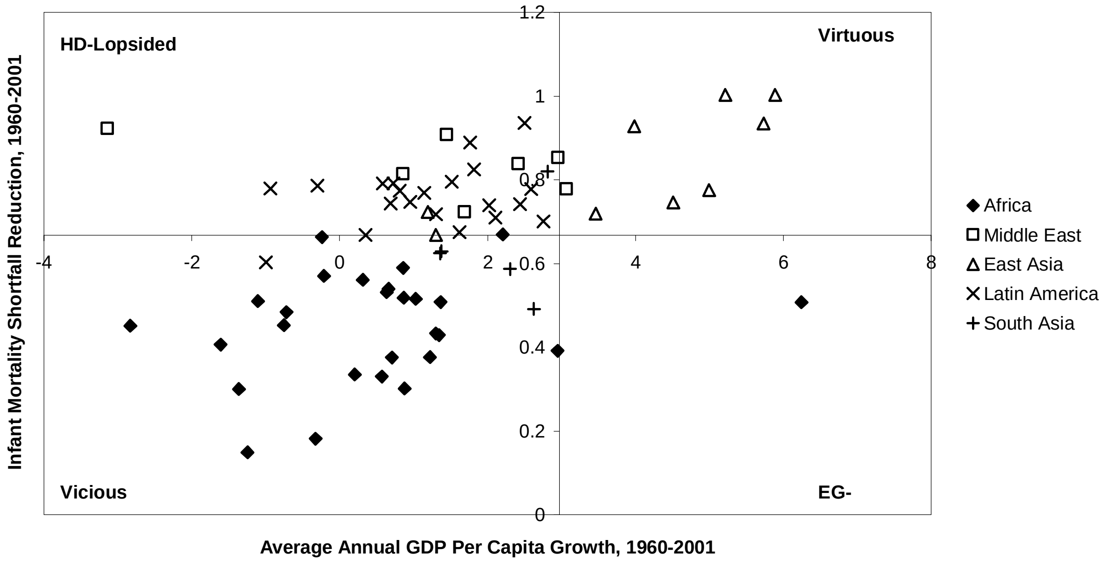
[10]They regress their indicator of Human Development (life-expectancy shortfall reduction 1970-92) on initial growth (GDP/Capita growth 1960-70) and various mediators in their chain from EG to HD, and some regional dummies and control variables. Similarly they also regress their measure of growth (Average real GDP/Capital growth 1970-92) on initial growth and life expectancy, various mediators identified in their HD to EG chain, regional dummies and control variables. In all that they use lags as instruments to curb reverse causality.

[11]They broadly distinguish between "virtuous", "vicious", "HD-loopsided" (strong human development weak growth) and "EG-loopsided" (strong growth but weak human development) cycles and classify each country into one category by comparing its performance from 1960-92 in terms of HD and EG to the average performance of all countries over this time period. Their observation that almost all countries who entered the EG-loopsided quadrant (above average growth performance but below average HD improvements) fell back into the vicious quadrant after a while, whereas almost all countries entering the HD-loopsided quadrant remained there or entered a virtuous cycle, led them to the conclusion that human development is more fundamental than growth (Ranis et al., 2000)

[12]In particular Suri et al. (2011) develop and index of the relative strength of the chains (for example for Chain A they calculate the country-specific fitted residual from a regression of late (1980-2000) HD growth on early (1960-1980) EG as a measure of how successful a country was in translating EG to HD). They then regress this measure of chain strength on some policy variables (like social expenditure ratios), to investigate the causes of the differing chain strength's.

other way around there is abundant evidence (Suri et al., 2011). The theoretical model of Ranis et al. (2000) and Suri et al. (2011) is shown in Figure 1, and the cycle-decomposition of Ranis et al. (2000) is shown in Figure 2.

Figure 2: Virtuous and Vicious HD-EG Cycles by Ranis et al. (2000) and Suri et al. (2011)
Source: Suri et al. (2011)



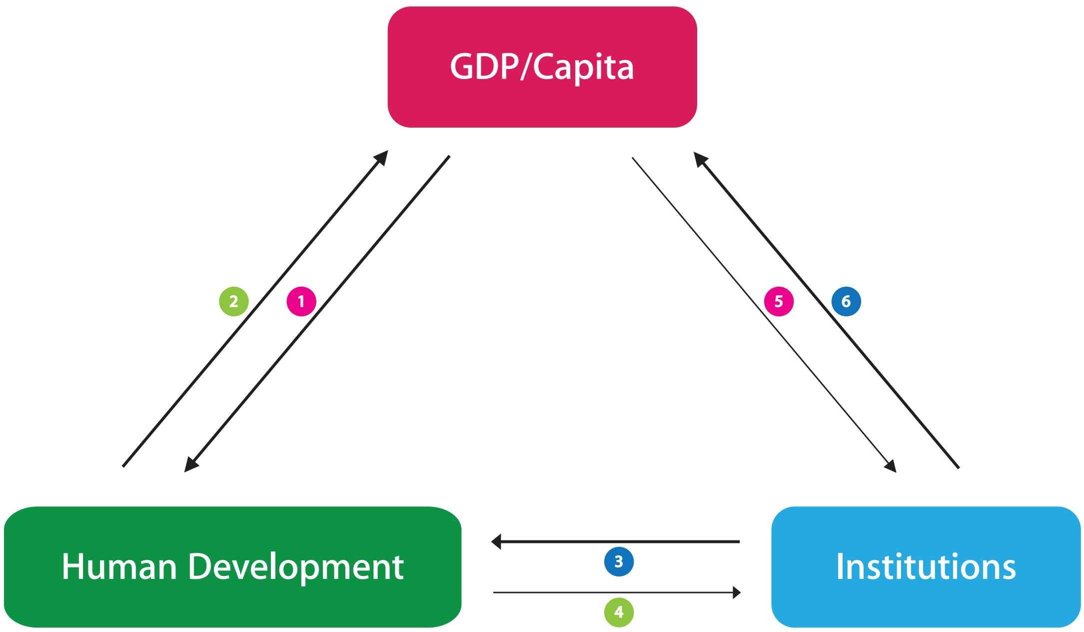
These studies constitute important progress in the field in providing a strong theoretical framework that succeeds in making sence of most macro data, and by exposing and taking serious the general-equilibrium nature of the development process. The studies are however limited in scope and method. In particular the framework delivered by Ranis et al. (2000) contracts political institutions with economic growth and thus is unable to explain the differing human development trajectories of countries with similar income levels but very different institutional environments. Starting with Acemoglu et al. (2001), the accumulating evidence from the cross-country IV literature has suggested that institutions are both quite persistent over time and fundamental to the development process, and should thus be given separate consideration in any theoretical model aspiring to capture fundamental development dynamics (Acemoglu et al., 2001; Rodrik et al., 2004; Acemoglu et al., 2014). The limitation in method of these studies relying on simple OLS cross-country regressions is also evident when contrasted with the emerging cross-country IV literature and the general methodological shift of development economics towards rigorous detection of causal effects and high concern with the problems of endogeneity and omitted variable bias in empirical results (Banerjee & Duflo, 2005; Bazzi & Clemens, 2013; Bigsten, 2016; A. Deaton, 2010b).

The research presented in this paper addresses both of these issues by developing an extended version of Ranis et al. (2000) model which includes institutions as a separate dimension, and by taking rigorous efforts to empirically test the model using instrumental variables strategies and both cross-sectional and time-series data. In addition, an effort is made to show that among a variety of possible theoretical models this model appears capable of explaining the bulk of variation in cross-country development data and might thus be considered capable of describing the long-run development process.

3 Theoretical Model

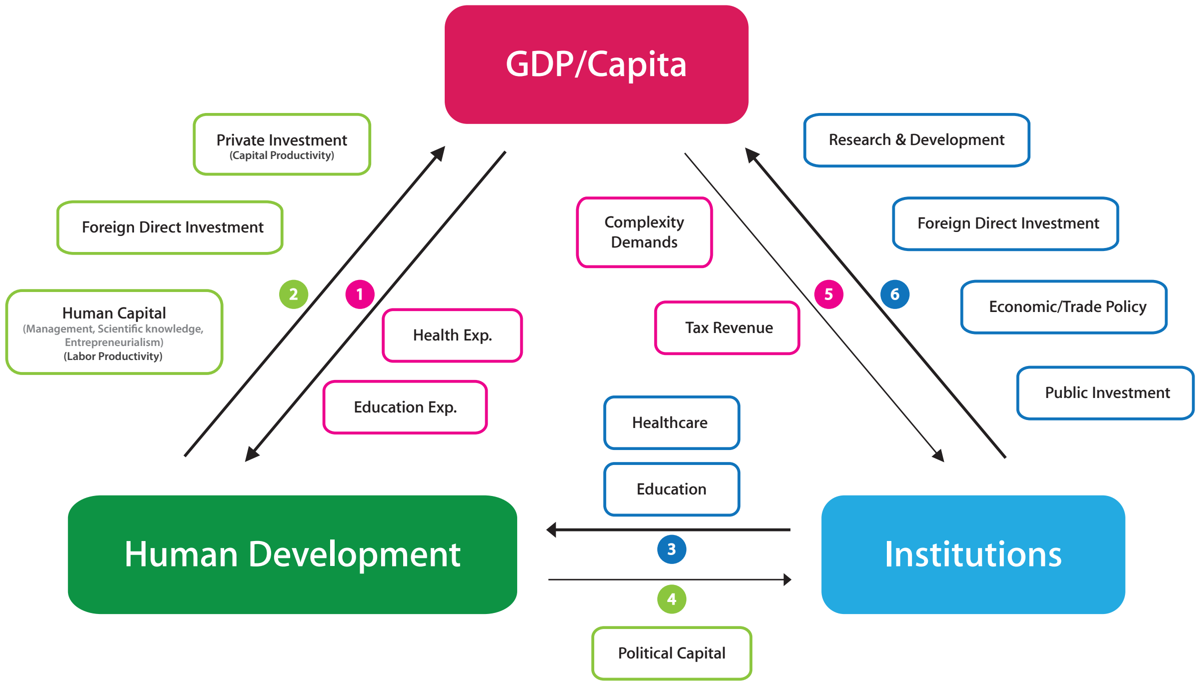
The theoretical model to be tested in this paper is drawn shematically in Figure 3. The basic considerations behind this model are to maintain the well established two-way relationship between economic growth and human development from Ranis et al. (2000) (as shown in Figure 1), but to disentangle the model and do justice to the growing empirical institutionalist literature by adding institutions as a third fundamental node and source of heterogeneity in the development process. This step complicates the model vis a vis the model of Ranis et al. (2000) in that the number of fundamental chains rises from 2 to 6. On the other hand this adjustment is also a simplification since there remain less mediators that allow for heterogeneity but are fundamentally unexplained by the model. For example the model of Ranis et al. (2000) includes government social expenditure and priority ratios as a mediator between income and human development, and the authors empirically confirm its significance (Ranis et al., 2000; Suri et al., 2011). Government expenditure ratio's are however not explained in their model (except for the component determined by tax income) and must therefore be treated as an exogenous source of variation in the strength of "Chain A". The model of this paper retains this mediator, but is able to explain it in terms of institutional quality, which is itself endogenously determined within the model (e.g. in this model one would reason: Similar levels of income growth yield different human development responses in different countries because countries with better institutions have higher government social expenditure ratio's and are therefore more effective in translating income growth into human development).

Figure 3: The simple Development Model
Arrow thickness represents the expected relative magnitude of the coefficients



In the remainder of this section the six different chains of the new model will be explored theoretically, starting with the two way relationship between income and human development where Ranis et al. (2000); Suri et al. (2011) and Ranis (2004) are being followed very closely. Afterwards the two way relationships between institutions and income and between human development and institutions will be explored in detail after clarifying the concept of institutions. Figure 4 serves as visual support for this analysis and shows the most important mediating channels drawn next to the arrows that represent the respective relationships. The section will conclude by setting some priors on the relative chain strengths of the 6 chains, which are then to be subsequently tested in the empirical analysis that follows.

Figure 4: Transition channels
Arrow thickness represents the expected relative chain strength,
the light boxes contain (independent) mediators



3.1 Economic Growth and Human Development

Whereas the literature and major international institutions such as UNDP used to focus on advancing GNP as the ultimate measure of development and success, thought on development has changed quite dramatically in the decades roughly following Amartya Sen's promotion of development as freedom and other influential voices of the early 1980's. Building on Sen, development shifted towards advancing human development as the ultimate outcome measure and goal of the development process (Ranis, 2004; Sen, 1980, 1985; Ranis et al., 2000). There is however a clear relationship between these two to the extent that greater freedom and capabilities improve economic performance and increased income broadens the range of choices and capabilities enjoyed by individuals and households (Ranis, 2004). The step from the normative capabilities approach of Sen to a quantitative assessment of capabilities and freedom has been a difficult one, and the Human Development Index[13] introduced by UNDP in 1990 remains disputed among scholars (Ranis, 2004). In order to distinguish human development from income as prescribed by the theoretical model, and to synthesize the findings of this paper with the cross-county IV literature which has focused itself more on human capital[14] (generally proxied by education), this paper will subscribe to a reductionistic view of human development as the combined health and education outcome in a given society at a given moment in time.

Income directly influences human development by advancing the economy's command over resources and therefore the individuals ability to undertake private health and education expenditures (Ranis, 2004; Sen, 2000; Ranis et al., 2000). Central mediators for how effective income translates into human development via private expenditure are the income distribution and cultural factors such as gender equality (Ranis, 2004; Ranis et al., 2000). The income distribution mediates between income and human development insofar that poorer households spend a larger proportion of their income on primary goods promoting health and education, and therefore an income shock that is equally distributed across society will entail a larger human development response than one that concentrates income in the hands of few (Ranis, 2004). A study by Birdsall et al. (1995) found that that if the distribution of income in Brazil were as equal as that of Malaysia,

[13]The HDI is computed as the geometric mean of health, education and income per capita indexes (UNDP, n.d.)
[14]See: Acemoglu et al. (2014); Rodrik et al. (2004); Bhattacharyya (2009c); Dias & Tebaldi (2012a)

school enrollments among poor Brazilian children would be 40% higher (Birdsall et al., 1995; Ranis, 2004). The income distribution itself naturally depends on the effectiveness of redistribution mechanisms within society and therefore on the quality of institutions. In measuring the impacts of gender inequality, abundant empirical research such as that by Von Braun (1988) on Gambian households, by Garcia (1990) in the Philippines and by Hoddinott et al. (1991) (multiple countries) has confirmed that health and educational outcomes are higher if women contribute more to the family income and have a greater influence on household spending (Ranis et al., 2000; Ranis, 2004). The central elements of Chain (1) (as shown in Figure 4) are thus private expenditure ratio's on health and educations and their determinants (omitted in Fig. 4 for simplicity), some if which are implicitly contained within institutions[15]. It must at this point be noted that the effectiveness by which growth is translated into human development depends on many more factors than can be covered in this review. Yet unmentioned are the structure of the economy, the distribution of assets, policy choices, levels of public morality, freedom in economic activity and the structure of social/religious/cultural systems (Ranis et al., 2000).

Human development, in turn, affects income and income growth through a variety of channels, the most elementary of which, using Sen's terminology, is that healthier, more educated and therefore more capable people can choose from a broader variety of possibe functionings and therefore are more likely to find an occupation which they enjoy and in which they are most productive (Ranis, 2004; Sen, 1985; Ranis et al., 2000). Furthermore, both the health and the education component of human development enter the production function directly by their contribution to what the literature has termed "human capital". Education for its part is strongly related to both labor productivity and scientific progress, which through technological change translates into growth (Ranis, 2004). This has been the central idea behind the new growth theories and their proponents such as Paul Romer and Robert Lucas (Romer, 1994; Lucas, 1988). Lucas (1988) in particular was one of the first to stipulate that as levels of education increase, also the productivity of capital increases, because more educated people are more likely to innovate and positively impact the productivity of the economy as a whole (Lucas, 1988; Ranis et al., 2000). These theoretical assumptions have subsequently been confirmed by an abundant body of research: Duflo (2004) measured an increase in wages of 1.5 to 2.7% for each additional school built per 1,000 children in a study carried out in Indonesia. In a study in India, Foster & Rosenzweig (1995) demonstrated that higher education is associated with faster technology adoption among farmers (Foster & Rosenzweig, 1995; Ranis, 2004). Deraniyagala (1995) shows that higher skill and education levels among workers were associated with higher rates of technological change in Sri-Lankan companies (Deraniyagala, 1995; Ranis, 2004; Ranis et al., 2000). Furthermore education also determines the quality and level of investment and economic management, whether carried out by private individuals heading companies and making investment decisions, or by public servants making economic policies and allocating government budgets (Ranis, 2004; Ranis et al., 2000). Some studies have also associated higher average education levels with more equal income distributions (which in turn positively affect growth), and argued that overall higher education levels enable poor people to better seek out economic opportunities (Ranis, 2004; Ranis et al., 2000). Education, in particular women's education, is also related to decreased fertility and population growth rates, which in turn translates into higher per capita income levels since family resources are distributed over a fewer number of children, allowing them to reach higher levels of human development and subsequently live more productive lives (Birdsall et al., 1995; Behrman & Wolfe, 1987). Taking into account investment decisions and endogenous growth theory, human development is then strongly associated with both "labor productivity" and "capital productivity", as the main mediators for chain (2). A third mediator is foreign direct investment, which amongst other factors is triggered by a productive environment with a well-educated labor force.

Health also has income effects, though in magnitude they are secondary to the effects of education. Height and strength, being derivatives of good nutrition and a healthy lifestyle, are positively associated with income, as empirically confirmed by numerous studies such as Schultz (2001), Strauss (1986), Immink & Viteri (1981) and Wolgemuth et al. (1982), to just name a few (Ranis, 2004). Studies carried out in Cote d'Ivoire and Ghana have also documented the negative effects in terms of employment and wages for men suffering from chronic illness (Ranis et al., 2000).

[15] For example income growth influences human development through institutions by their effectivity in leveling the income distribution

Education and health also influence each other, as more educated people tend to live healthier lives and health (including parental health), is a prerequisite for any child to follow an education. Behrman & Wolfe (1987), to give just one example, empirically confirm the positive impact of womens education on family health and nutrition (Ranis, 2004).

Similarly as for chain (1), there many more factors that influence how effectively human development translates into growth. Simply creating a larger pool of educated people will not be enough since these people also need to be employed (Ranis et al., 2000). Next to the usual cultural factors, particularly the quality of public management, political stability, inequality, institutions, saving and investment rates and technology choice seem important factors influencing the strength of chain (2) (Ranis et al., 2000).

3.2 Institutions and Human Development

The concept of institutions is a difficult one, and finding an all-encompassing definition is probably just as elusive an endeavor as trying to define what "the state" exactly is. What is meant however by the term institutions as employed in this research is the governing fabric of a society as consisting of a particular set of political and social organizations, a set of formal rules constraining and regulating individual action, and a particular set of people pursuing particular policies. This definition acknowledges the structural aspects of institutions as being the (by)product of historical processes and cumulative political evolution, which as such might be devoid of any strict unity or intentionality. It however also acknowledges the contested nature of the political space, where institutional outcomes are very well subject to the individual agency of particular people as well as collective political will, and are thus ever changing and constantly in the making. The questions of what constitutes institutional quality and how to empirically proxy for it are big debates of their own and a large part of these debates is beyond the scope of this paper. The empirical question will be given further (limited) consideration in section 4. For simplicity, and to remain firmly within the framework of this model, good institutional outcomes are defined at outcomes that increase the freedom, capabilities and possible functionings of all individuals in society to live lives that they value (in line with Sen). Empirically this will mean that desirable institutional outcomes increase both human development (health and education) and income, or either of the two, without having adverse effects on the other or on the distribution of these goods within society.

Institutions and human development are also linked by a number of channels. Institutions impact human development through government expenditures on health and education, social services and family-support, pension systems and more generally their success in leveling the income-distribution and creating an equal-opportunities environment. The effectiveness of government social expenditures in advancing human development, depends on the quality of government expenditure targeting and delivery (Ranis, 2004). An effective government succeeds in identifying priority sectors (such as primary education, gender equality and health) that have the highest potential for HD improvement (Suri et al., 2011). In order to have a high marginal impact, HD expenditures must also be distributed properly (that is predominantly to low income groups and women). Studies, such as the one by Swaroop & Rajkumar (2002) have demonstrated that the effectiveness of public expenditure is conditional on the quality of governance, with government accountability likely to play an important role. Theory also suggests that the structure of government is a crucial factor for its conductivity to HD. A decentralized, locally accountable government system may be most effective in resource allocation and service delivery Ranis et al. (2000). According to Ranis (2004), the HD allocation ratio's of government also depend on factors other than the inherent capacity of the government. These other factors are: (1) the tax capacity of the system; (2) the strength of the demand for military expenditure and for other non-HD priorities of the government and (3) the varying interplay between bureaucratic forces, vested interests and popular pressures (Ranis, 2004). According to Ranis (2004), these factors in turn are also impacted by the extent of decentralization of the government, and cross-country evidence suggest that decentralization increases the total tax revenue available and almost always increases the HD priority ratio.

Governments, via their effect on the income distribution, also have a crucial mediating impact on how effectively growth translates into human development. The study of Birdsall et al. (1995) briefly discussed in the previous part testifies most strongly to this.

The capabilities approach of Sen also analyzes the role of the social environment on human choice and agency: It stipulates that an individual in an open, free society would enjoy a larger set of potential functionings than one in a closed, oppressive society (Clark, 2005; Ranis, 2004). This functioning, if supported by the government, often takes the form of heightened NGO and civil society activity which is often very HD oriented and helps to strengthen the social fabric of society (Ranis, 2004). Finally, governments, by their investment in health and education, and support for civil society organizations, contribute to HD by ensuring that future governance will be (or remain) of a high quality and promote further HD improvements.

On that note, government must also have the institutional capacity to efficiently allocate these expenditures, and that capacity, for the most part, is found in the education of its public servants. The idea that human development leads to institutional improvement is in fact very old. An early treatment is provided by Lipset (1960), who however himself gives credit to Aristotle. Lipset (1960) holds that educated people are more likely to resolve their differences through negotiation and voting than through violent conflict (Glaeser et al., 2004). Education is also fundamental to running government institutions such as courts or parliaments, and for ordinary citizens to engage with government and the polity. Literacy and public press were characteristic of early modern societies and help spread information about the government and its activities, and increase the general public attention to, and interest in, political matters (Glaeser et al., 2004). This encouraged democratic sentiment in society and was often followed by institutional improvements. The view promoted by Lipset (1960) suggests that the political system is a key externality of human capital, next to technology. This view is confirmed by Bhattacharyya (2009a) in his discussion of Taiwan, Singapore and South Korea, Asian countries in which significant economic growth and human capital accumulation was followed by institutional improvements. In an interesting paper by Djankov et al. (2003) on the politics of institutional choice, the authors stipulate that each community faces a set of institutional opportunities, determined largely by the human and social capital of its population. The greater the human and social capital of a community, the more attractive its institutional opportunities. Institutions, in this framework, are points on this opportunity set, determined by efficiency, history, and politics Djankov et al. (2003); Glaeser et al. (2004).

Empirical evidence on both the micro and the macro scale supports the fact that secondary and tertiary education represent critical elements in the development of key institutions, of government, the law, the financial system, all of which are essential for HD and economic growth (Ranis et al., 2000). The knowledge of policy makers about issues such as education, water and sanitation, diseases, family planning, macroeconomics, technological opportunities, appropriate combinations of inputs and the complex relationships between all these are crucial to the quality of governance applied, and its effect on HD and EG. The level of development policy education in society, in short will determine the quality of the development policy applied.

3.3 Institutions and Economic Growth

The relationship between institutions and growth is similarly complex as the relationship between human development and growth. Beginning with the channel from institutions to growth, the most elementary manor in which good institutions are conductive to growth is just by existing. Countries with better quality institutions characterized by better enforcement of property rights and contracts and are comparatively more prosperous because better institutions encourage investment in machinery, human capital, and technology which promotes growth (Bhattacharyya, 2009a; Glaeser et al., 2004). Part of this investment is done by the own population, and its quality thus depends on the level of human capital in society (e.g. its impact is mediated via the human development channel). Another part however is foreign direct investment, which to a large extent depends on a secure and conductive institutional environment. Beyond these externalities, a good set of institutions will also actively pursue capital intensive investments with high returns, e.g. investments in public infrastructure. The quality of these investments thereby depends as much on the institutional environment as on the quality of public servants (thus another interaction with human development). Other important channels are public and private research and development expenditure. Private research and development expenditure will occur whenever the legal framework in place safeguards intellectual property rights, allowing private actors to reap the benefits of their investment. Its public equivalent is dependent on a provident institutional setting and a foresighted set of public servants committed to long-run technologically driven growth. Technological progress, which is treated as an exogenous and fundamental driver of long-run growth in the classical Solow growth model is thus endogenized in terms of institutions and human development in this endogenous theory. Finally, as noted by Dollar & Kraay (2003), in the very long run, one can view macroeconomic and trade policies as endogenous and reflective of the underlying quality of institutions, although in the short run fluctuations in such policies might not be traceable directly to the quality of institutions. Rodrik et al. (2000) advance the consideration that improvements in institutional quality make countries more attractive as trading partners, and Dollar & Kraay (2003) pick up this effect as they include changes in institutional quality into their first stage regression for changes in trade in their dynamic framework. Their results however not to suggest that trade volumes solely depend on institutional quality, as this would deny the existence of deeper geographic and historical causes of affecting trade and also institutions. This paper nevertheless assumes that beyond the underlying historical and geographical causes, for which controls are entered into the estimations that follow, trade volumes are largely a political choice and therefore endogenous to institutions and human development.

For the reverse chain from income to institutional quality, it is evident that increased income enhances the possibilities of governments (in terms of expenditure, investment and taxation), which in turn may translate further into HD outcomes (Ranis, 2004). A telltale example is provided by Ranis et al. (2000), who compare the development trajectories of Sudan in Botswana. Whereas in 1970 public expenditures on health and education per person were similar in both countries ($96 in 1987 prices in Sudan, and $65 in Botswana), per capita expenditures increased more than seven times in Botswana during 1970-92 while remaining practically unchanged in Sudan (Ranis et al., 2000). By 1992, Sudanese expenditure was less than a quarter of that in Botswana ($114 versus $466). The authors attribute this difference not to the public expenditure ratio, which was higher in Sudan during the 1970s and equal to Botswana's during the 1980s, but rather to the much faster income growth in Botswana that caused real expenditures to rise. A second channel by which growth influences institutions, is that rising and changing levels of economic activity naturally pose a demand for different forms of social organization and regulation. This effect is termed "complexity demands" in Figure 4, and very much goes back to Walter Rostow's stages of economic development and the experience of countries during the industrial revolution (and the social effects that it had on the political system, e.g. in England). Such effect are also invoked by Bhattacharyya (2009a) and Bhattacharyya (2009b). Bhattacharyya (2009b) in particular talks about the impact of moving past subsistence levels of production, and the impact this has on social organization and institutions. Empirically this effect is hard to pin down and has not found much coverage in recent studies. Hope in nevertheless placed in the possibility that the instrumentation strategies of this paper will be able to pick up the feedback from income to institutions.

4 Data and Indexes

The Data used for this study is taken from 11 different sources. For the cross-sectional model of section 6, data is taken from (1) The dataset from Acemoglu, Gallego and Robinson (2014)[16], (2) the malaria ecology data from J. D. Sachs (2003)[17], (3) the standard dataset from the Quality of Government institute combining various political datasets and covering the 1946-2016 period[18], (4) the dataset from Dollar & Kraay (2003)[19], (5) selected series from the World Bank Development Indicators[20], and (6) data from the UNDP Human Development Reports[21]. For the model selection exercise in section 5 additional data is taken from (7) Sala-i Martin (1997)[22].

For the panel data models of sections 7 and 8, additional data is taken in the form of (8) the educational attainment database by Barro and Lee (2013)[23], (9) epidemics (and other biological disaster data) from the Centre for Research on the Epidemiology of Disasters (CRED)[24], (10) long-term data on institutions from the Cross-National Time-Series Data Archive (CNTS)[25], and (11) long term GDP per capita PPP and life-expectancy data from the Gapminder Foundation[26]. The challenge of this section is to find variables e.g. compute indexes that accurately reflect the central constructs of interest (income, human development and institutions), and in a manor that is of theoretical interest.

4.1 Income

To represent income, the logarithm of a standard gross domestic product (GDP) per capita series is taken. For the cross-sectional analysis of section 6, a GDP per capita 2011 PPP $ series is taken from UNDP (6) for 184 countries in 2005 (in order to have the data exactly match the human development report of 2005). For the time-series models of sections 7 and 8, an equivalent series (GDP per capita 2011 PPP $ inflation-adjusted) is taken from the Gapminder Foundation (11). This series (which used to be a piece of pride for Hans Rosling in his fantastic presentations), is compiled from various international sources and stretches down to the year 1800. It furthermore has the remarkable property of recording income data for 201 countries and regional aggregates as they exist today down to 1800, giving it an incredible data-coverage of 43.612 observations. For all practical purposes it is qualitatively equivalent to the UNDP series (the correlation coefficient between the two over the available years from 1990-2015 is >0.999). Since the Gapminder series has a slightly higher country coverage for 2005, the 2005 incomes for 9 countries are taken from Gapminder and added to the UNDP series, yielding income data for 193 countries in the cross-section. Both indicators are summarized in their levels and log transformations in Table 1. In the estimations of sections 6, 7 and 8, only the log transformed variable will be employed, in order to curb heteroskedasticity and ease the interpretation of coefficients.

[16] (Acemoglu et al., 2014) Data: https://economics.mit.edu/faculty/acemoglu/data/hcapital

[17] J. D. Sachs (2003) Institutions Don't Rule: https://academiccommons.columbia.edu/catalog/ac%3A131145, Dataset: https://academiccommons.columbia.edu/download/fedora_content/download/ac:131146/CONTENT/institutions_NBER2003_updated.zip

[18] QGU Standard Dataset: http://qog.pol.gu.se/data/datadownloads/qogstandarddata, The Time-Series version in STATA format: www.qogdata.pol.gu.se/data/qog_std_ts_jan17.dta

[19] (Dollar & Kraay, 2003) Institutions, Trade and Growth Data: siteresources.worldbank.org/DEC/Resources/DollarKraayITGDataset.xls

[20] WDI Database: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators

[21] UNDP Data Page: http://hdr.undp.org/en/data, from there, take the dimension "Education" and download the "Expected years of schooling (years)" and "Mean years of schooling (years)" series. Then take the "Health" dimension and download "Life expectancy at birth (years)". Finally, navigate to the "Income/composition of resources" dimension and download "Gross domestic product (GDP) per capita (2011 PPP $)".

[22] Sala-i Martin (1997) Dataset: www.columbia.edu/~xs23/data/millions.XLS, Variable Labels: http://www.csus.edu/indiv/p/perezs/data/smdatades.pdf

[23] Normal BL2013 Dataset: barrolee.com/data/BL_v2.1/BL2013_MF1599_v2.1.dta
Long-term BL dataset (1820-2010): barrolee.com/data/Lee_Lee_v1.0/LeeLee_v1.dta

[24] All Biological disasters (epidemics etc.) from 1900 to present, taken from the Emergency Events Database (EM-DAT) at CRED: http://www.emdat.be/advanced_search/index.html

[25] CNTS Website: http://www.cntsdata.com/ the version with data through 2008 used in this paper is taken from: https://www.databanksinternational.com/Trial/

[26] Gapminder website: http://www.gapminder.org/data/, GDP per Capita 1800-2016 PPP, inflation-adjusted: spreadsheets.google.com/pub?key=phAwcNAVuyj1jiMAkmq1iMg&output=xls, Life-Expectancy at birth 1800-2016: spreadsheets.google.com/pub?key=phAwcNAVuyj2tPLxKvvnNPA&output=xls

Table 1: GDP per Capita Series

Variable	*Source*	*N*	*Mean*	*SD*	*Min*	*Max*
GDP per capita in 2005 (2011 PPP $)	UNDP/Gapm.	193	16,116	19,751	535	114,840
Log GDP per capita in 2005 (2011 PPP $)	UNDP/Gapm.	193	8.97	1.28	6.28	11.65
GDP per capita 1800-2016 (2011 PPP $ Inf-Adj)	Gapminder	43,612	4,671	10,268	142	182,668
Log GDP per capita 1800-2016 (2011 PPP $ Inf-Adj)	Gapminder	43,612	7.59	1.12	4.96	12.12

For human development and institutions there are no straightforward proxies which has led to diverse practice and a considerable amount of debate in the literature.

4.2 Institutions

Representation of institutions in particular has been very diverse with most proxies falling in the categories of either political system variables or various governance outcome measures, as the following table summarizes:

Table 2: Institutional Proxies used in the Literature

Type of Measure	*Variable Name*	*Source*	*Employed by*
Political System	- Adjusted-combined index of democracy and autocracy	Polit IV	Dias & Tebaldi (2012a)
	- Democracy	Polit IV	Bhattacharyya (2009c)
	- Constraints on the executive	Polit IV	Bhattacharyya (2009b) Acemoglu et al. (2001) Acemoglu et al. (2005)
	- Political Freedom	Freedom House	Dollar & Kraay (2003)
	- Democracy	Jaggers & Marshall (2000)	Glaeser et al. (2004)
	- Judicial Independence	La Porta et al. (2004)	Glaeser et al. (2004)
	- Strength and impartiality of the legal system	ICRG	Vieira et al. (2012)
Governance Outcome	- Government Effectiveness	Kaufman et al. (2003)	Glaeser et al. (2004)
	- Rule of Law	World Bank WGI / ICRG	Acemoglu et al. (2014) Dollar & Kraay (2003) Bhattacharyya (2009c) Rodrik et al. (2004)
	- Expropriation risk	ICRG	Glaeser et al. (2004) Bhattacharyya (2009c)
	- Institutional strength and quality of the bureaucracy	ICRG	Vieira et al. (2012)
	- Contract-intensive money[a]	Clague et al. (1999)	Dollar & Kraay (2003)
	- Average number of revolutions per decade since the 1960's	??	Dollar & Kraay (2003)
	- Fraction of the population killed in wars	Clague et al. (1999)	Dollar & Kraay (2003)
	- Regulation of Credit, Labour and Business	Gwartney & Lawson (2005)	Bhattacharyya (2009c)
	- Sound Money Index	Gwartney & Lawson (2005)	Bhattacharyya (2009c)

[a] According to D&K 2003, this variable measures the extent to which property rights are sufficiently secure that individuals are willing to hold liquid assets via financial intermediaries

Table 2, which by far is not a comprehensive summary of the diverse practice in the literature, shows that several authors (like Dollar & Kraay (2003), Glaeser et al. (2004) and Bhattacharyya (2009c)) follow a diversification strategy.

Bhattacharyya (2009c) for example unbundles institutions into *market creating institutions* (proxied by the ICRG Law and Order rating), *market regulating institutions* (proxied by an index of Regulation of Credit, Labour, Business taken from Gwartney and Lawson (2005)), *market* *stabilising institutions* (proxied by a Sound Money Index also from Gwartney and Lawson (2005)) and *market legitimising institutions* (proxied by the Democracy Index from the PolityIV dataset) using a theoretical framework laid out by Rodrik (2005). He finds that strong market creating institutions and market stabilising institutions are good for growth whereas market legitimising institutions does not seem to matter. His findings also implicate that there seems to exist exists a growth maximizing level of market regulation (captured by inclusion of a quadratic term on 'regulating institutions') (Bhattacharyya, 2009c).

Glaeser et al. (2004) go further than this and criticize the existing literature on using unsuitable proxies to establish relations between institutions and growth (Glaeser et al., 2004). They contend that dictatorships are very well capable of putting into place secure property rights and growth promoting policies, thus political system variables do not capture the part of institutions relevant to growth. They support this view with by referencing the dispersion of growth rates among poor countries in 1960 which at the time were almost all ruled by dictatorships, and they point towards Singapore and South Korea as countries that started with dictatorships and only later (when growth had embarked and people became more educated) moved towards more equitable political representation (Glaeser et al., 2004).

The efforts of Bhattacharyya (2009c) and the criticism of Glaeser et al. (2004) are insightful in terms of taking a differential perspective on institutions, but also deeply troubling for any effort to empirically proxy for the effect of institutions. In the theoretical framework laid out for this study it is apparent that measureable outcomes of governance (captured e.g. by rule of law ratings) are necessary to capture the effects of institutions on growth (e.g. through foreign investors). But also variables capturing the structure of the political system (e.g. constraints on the executive) are needed, since these variables are able to capture the feedback from human capital towards the political system which modernization theory stipulates (and which Glaeser et al. (2004) also affirm in their discussion of Singapore and South Korea). A political dimension is also warranted in this framework because equitable and representative institutions are treated as a desirable development outcome in their own right.

To deal with these concerns, instead of following a diversification strategy like Dollar & Kraay (2003), Glaeser et al. (2004) or Bhattacharyya (2009b) (which would inevitably lead to estimating a multitude of models using different institutional proxies), this paper adopts a unificantion approach. The kind of institutional measure needed is a holistic or deep index that aims to capture institutional quality in its entirety and is therefore able to interact with both income and human development variables. Such a holistic measure may be obtained by treating institutional quality as a latent variable in a structural equation modeling framework, which in statistical language means performing factor analysis. The rationale behind this idea is not that there exists a true objective state of institutional quality which has to be captured from a set of noisy proxies (just as psychologist think of latent character traits when they perform factor analysis on a set of questions). It is rather that a factor analysis may be able to produce an institutional index that captures various institutional characteristics in a single measure, and may thus be thought of as an overall average measure of institutional quality.

Below I hope to demonstrate that for the most part measures of institutional quality are indeed highly factorable. Table 3 shows 10 institutional variables that were selected to construct the institutional measure employed in the cross-sectional regressions in section 6. Of the 10 variables the 4 Freedom House variables are what I termed political system variables, and represent the political dimension of institutions. The other 6 measures (with the exception of "Voice and Accountability" perhaps), are governance outcome measures taken from the World Bank Worldwide Governance Indicators.

Table 3: Selected Institutional Variables

Variables (in years)	*Source*	*N*	*Mean*	*SD*	*Min*	*Max*
Civil Liberties	Freedom House	7,557	3.7	2	1	7
Level of Democracy	Freedom House/Imputed Polity	7,557	5.7	3.5	0	10
Political Rights	Freedom House	7,557	3.8	2.2	1	7
Freedom Status	Freedom House	7,557	1.9	0.8	1	3
Control of Corruption	Worldbank World. Govern. Ind.	3,010	-0.1	1	-2.1	2.6
Government Effectiveness	Worldbank World. Govern. Ind.	3,010	-0.1	1	-2.5	2.4
Political Stability	Worldbank World. Govern. Ind.	3,027	-0.06	1	-3.3	1.7
Rule of Law	Worldbank World. Govern. Ind.	3,069	-0.07	1	-2.7	2.1
Regulatory Quality	Worldbank World. Govern. Ind.	3,011	-0.07	1	-2.7	2.2
Voice and Accountability	Worldbank World. Govern. Ind.	3,071	-0.05	1	-2.3	1.8

An exploratory Principal Components Analysis (PCA)[27] on both sets or variables reveals that they indeed represent slightly different dimensions. A PCA on the 4 Freedom House variables yields a first component with eigenvalue of 3.8, which explains 95% of the variance of the underlying variables (Kaiser-Meyer-Olkin measure of sampling adequacy (henceforth KMO) is 0.82). A PCA on the 6 Worldwide Governance Indicators yields a first component with eigenvalue 5.1, which explains 85% of the variance of the underlying variables[28] (KMO = 0.89). Performing PCA on the joint set of 10 variables yields a first component with eigenvalue 7.9, explaining 79% of the underlying variance, but also a second component with eigenvalue 1.3, explaining 13% of the variance (KMO = 0.92). Moving to the actual Factor Analysis[29] (method: principal factors) on the full set of variables yields very similar results to the PCA:

Table 4: Factor Analysis on 10 Institutional Indicators
Method: principal factors | Unrotated | NObs: 2990

Factor	*Eigenvalue*	*Difference*	*Proportion*	*Cumulative*
Factor1	7.77	6.55	0.85	0.85
Factor2	1.22	1.04	0.1344	0.99
Factor3	0.18	0.15	0.02	1.01

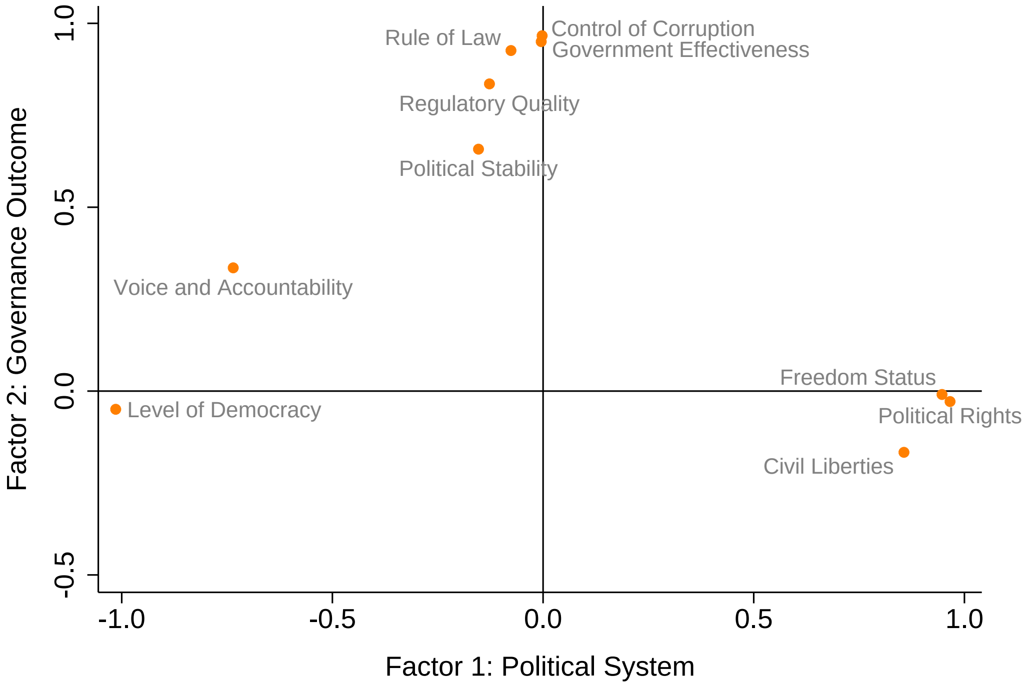
Again (as with PCA), there are two factors with eigenvalues greater than 1 of which the first one takes most of the variance (KMO = 0.92). Repeating the factor analysis while retaining 2 factors under the use of oblique promax 3 rotation and computing a loadingplot, reveals that the institutional indices indeed cluster along two (correlated) dimensions in the expected way:

[27] Yes indeed exploratory PCA and not exploratory factor analysis, because PCA splits up the variance exactly and is therefore much easier to interpret for exploratory purposes in this context

[28] In contrast to the Freedom House variables where the first component explained around 95% of every variable, in the Worldbank WGI variables, 34% of the Political Stability indicator remain unexplained by Component 1

[29] I prefer Factor Analysis over PCA in this situation since the purpose of this exercise is not just in dimensionality reduction but also detecting and capturing some deep institutional dimensions from the data

Figure 5: Factor Loadings Plot for 2 Factors
Rotation: oblique promax(3) | Method: principal factors



The final indicator is retained by again performing the initial (unrotated) factor analysis on the 10 indices and retaining the first factor as a variable using the regression scoring method. Table 5 shows the factor loadings[30] of the 10 variables with the computed institutions index, together with the regression scoring coefficients used to obtain it factor from the 10 variables. The table shows that the index correlates highly with all variables from both underlying institutional dimensions, and thus indeed represents the kind of "multidimensional institutions index" that this analysis sought to produce.

Table 5: Factor Loadings (Pattern Matrix) and Unique Variances
Method: principal factors | Unrotated | Nobs: 2990 | Scoring: Regression

Variable	Factor1	Uniqueness	Scoring Coefficients
Control of Corruption	0.86	0.26	0.06
Government Effectiveness	0.87	0.24	0.15
Political Stability	0.73	0.46	0.01
Rule of Law	0.90	0.18	0.20
Regulatory Quality	0.87	0.25	0.04
Voice and Accountability	0.97	0.06	0.20
Freedom Status	-0.87	0.24	-0.05
Level of Democracy	0.88	0.23	0.06
Political Rights	-0.91	0.18	-0.17
Civil Liberties	-0.93	0.13	-0.15

To obtain the final "Multidimensional Institutions Index" that will be employed in the 2005 cross-country regressions in Section 6, the just computed index is linearly transformed so that it takes a minimum value of 0 and a maximum value of 10 over the complete available data range from 1996-2015 (this is done solely for interpretational purposes). Furthermore the average value of the index over a 5-year period between 2003 and 2007 is computed for each country. The latter adjustment is done because the literature (such as Dollar and Kraay (2003)) has noted a remarkable variability in most institutional indicators, and for the cross-sectional regression framework we are interested in an indicator that represents a "final state" of institutional development to date

[30] Factor loadings are the correlations (pearsons r) of the original variables with the computed factor

(2005). Taking a five-year average of the indicator will thus hopefully smoothen out any undesirable year-to-year fluctuations (caused by an election or coup etc. or by measurement error). Table 6 summarizes the computed Multidimensional Institutions Index (henceforth MII) for the year 2005 together with selected 4 of the 10 indexes above.

Table 6: Multidimensional Institutions Index in 2005

Variables (2005, in years)	*N*	*Mean*	*SD*	*Min*	*Max*
Multidimensional Institutions Index	188	5.89	2.16	1.42	9.90
Level of Democracy	192	6.70	3.15	0	10
Freedom Status	192	1.77	0.81	1	3
Government Effectiveness	187	-0.073	1.00	-2.17	2.16
Rule of Law	191	-0.069	1.00	-2.21	1.97

According to the MII, the 5 countries with the best institutions in 2005 were Denmark, Finland, Iceland, Sweden and Norway, and the 5 countries with the worst institutions were Sudan, Turkmenistan, North Korea, Myanmar and Somalia.

Table 7: Multidimensional Institutions Index in 2005 by Region

	Africa		Americas		Asia		Europe		Oceania	
Variables (2005, in years)	*N*	*mean*	*N*	*mean*	*N*	*mean*	*N*	*mean*	*N*	*mean*
Multidimensional Institutions Index	53	4.6	35	6.6	47	4.7	40	8.0	13	7.0
Level of Democracy	53	5.2	35	8.4	47	4.2	41	9.2	14	8.9
Freedom Status	53	2.1	35	1.4	47	2.3	41	1.2	14	1.3
Government Effectiveness	53	-0.8	35	0.06	47	-0.2	39	0.9	12	-0.04
Rule of Law	53	-0.7	35	-0.09	47	-0.3	41	0.8	14	0.6

For the panel data models of sections 7 and 8, different institutions indexes need to be calculated since the Worldwide Governance Indicators have only been recorded from 1996 onwards. A balance between maximal data coverage and data quality is sought here, and two solutions have been found: For section 7 I chose to factor 19 variables taken from the Varieties of Democracy (V-Dem) Project which are contained in the QGS standard dataset (3). These items have a data coverage from 1946-2015 on more that 100 countries. The results of the factor analysis are very similar to the one using the Freedom-House and WGI items. They are reported in Table 8, the KMO is 0.86.

Table 8: Factor Analysis on 19 Institutional Indicators from the V-Dem Project
Method: principal factors | Unrotated | NObs: 2990

Factor	*Eigenvalue*	*Difference*	*Proportion*	*Cumulative*
Factor1	14.14	11.56	0.77	0.77
Factor2	2.58	2.19	0.14	0.91
Factor3	0.38	0.07	0.02	0.93

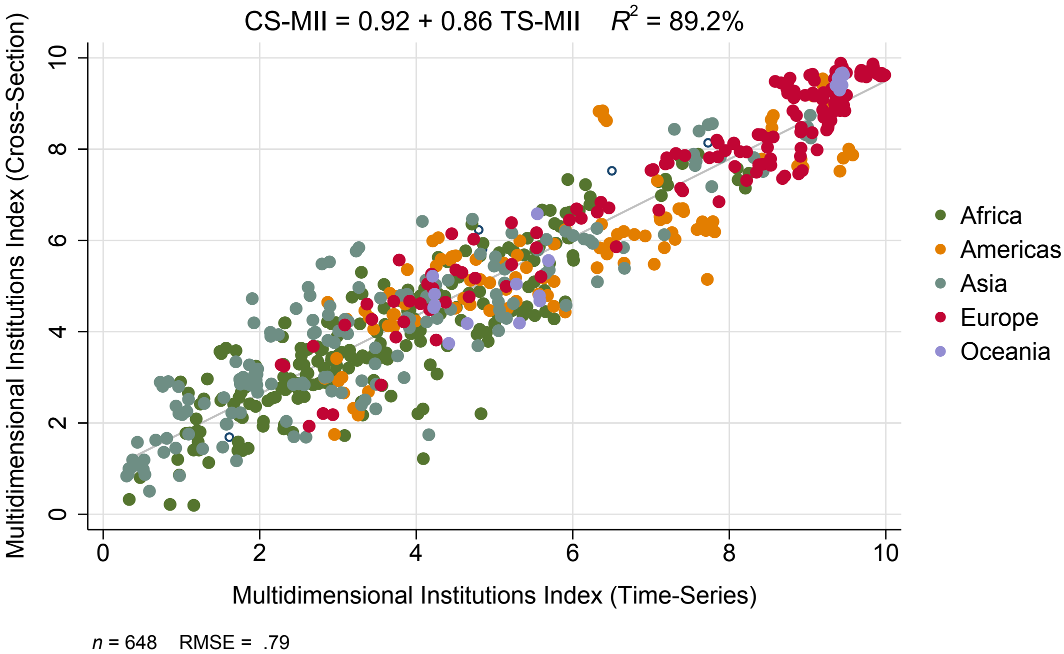
Just like before with the other items, the bulk of the variance is taken by a single factor with a very large eigenvalue of 14 in this case. There remains however a second factor with an eigenvalue larger than 1. Investigating the factor loadings on two factors using again oblique promax 3 rotation reveals that the two factors again correspond to two different aspects of institutions, where the first may again be roughly considered measuring aspects of the political system and the second measures governance outcomes. The factor loadings, together with summary statistics of the 19 items are shown in Table 9. A loadingplot is omitted to save space.

Table 9: Summary and rotated factor loadings of 19 V-Dem Project Items
Method: Principal Factors | Rotation: Oblique Promax 3 | FL=Factor Loading; UN=Uniqueness

Variable	*N*	*Mean*	*SD*	*Min*	*Max*	*FL*	*UN*
Items loading onto Factor 1: Political system							
Deliberative democracy index	8,604	0.31	0.29	0.00	0.93	.93	.03
Deliberative component index	8,626	0.55	0.30	0.01	0.99	.92	.17
Electoral component index	8,637	0.50	0.29	0.00	0.97	.97	.08
Egalitarian democracy index	8,637	0.34	0.26	0.01	0.92	.80	.06
Liberal democracy index	8,637	0.34	0.28	0.01	0.93	.88	.03
Liberal component index	8,660	0.54	0.28	0.03	0.98	.82	.10
Media corrupt	8,660	2.10	1.26	0.03	3.98	.84	.26
Participatory component index	8,660	0.42	0.20	0.00	0.87	.96	.19
Participatory democracy index	8,637	0.28	0.22	0.00	0.84	.94	.04
Electoral democracy index	8,637	0.44	0.29	0.01	0.96	.98	.03
Items loading evenly on Factors 1 and 2 (loading on Factor 1 shown)							
Egalitarian component index	8,660	0.57	0.25	0.03	0.99	.47	.31
Items loading onto Factor 2: Governance Outcome							
Political corruption	8,660	0.48	0.28	0.01	0.95	-.99	.04
Executive bribery and corrupt exchanges	8,660	1.94	1.11	0.08	3.94	.94	.14
Public sector corrupt exchanges	8,660	1.93	1.01	0.13	3.93	.91	.11
Executive corruption index	8,660	0.49	0.30	0.01	0.98	-.91	.07
Executive embezzlement and theft	8,660	2.13	1.15	0.05	3.95	.84	.12
Public sector theft	8,660	0.12	1.50	-3.27	3.84	.90	.11
Judicial corruption decision	8,660	2.31	0.96	0.23	3.90	.81	.31
Public sector corruption index	8,660	0.48	0.30	0.00	0.97	-.95	.07

The final indicator is retained by again performing the initial (unrotated) factor analysis on the 19 indices and retaining the first factor as a variable using the regression scoring method. Just as with the MII employed for the cross-sectional framework, also this new time-series MII is linearly transformed to yield a minimum of 0 and a maximum of 10, and 5-year averages are computed to smoothen out fluctuations. Figure 6 shows the new MII index just calculated for use in section 7 plotted against the cross-sectional index computed before over all available 5-year intervals of the latter (2000, 2005, 2010, 2015). The plot shows that aside from what appears to be statistical variation with a RMSE of .79, both indexes are surprisingly congruent to one another (as the R-squared of 89.2% testifies). This finding is very affirmative of the methodology employed and suggests that not only can institutional indicators be factored and yield similar underlying dimensions using different sets if indicators, but that the empirical results of sections 6 and 7 will be comparable due to the similarity of the indexes employed.

Figure 6: Cross-Sectional & Time-Series MII, 5-Year Averages since 1996



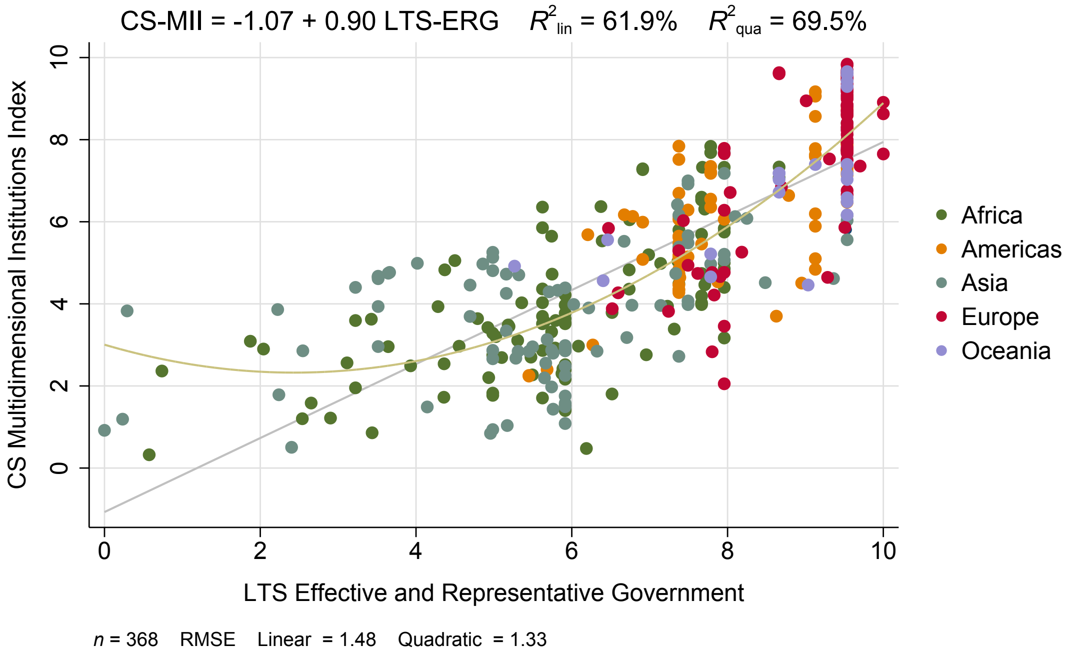
At last, for the long-term panel data model of section 8, an institutional index with large historical data coverage is needed. This index, due to lack of better data, is computed from 4 ordinal items in the Cross-National Time-Series Data Archive (CNTS) (*Version:* 2008). These items are *1.* effective executive (selection) which records how the effective executive power is elected [(1) Direct Election; (2) Indirect Election; (3) Nonelective]; *2.* the degree of parliamentary responsibility, which refers to the degree to which a premier must depend on the support of a majority in the lower house of a legislature to remain in office [(0) Irrelevant; (1) Absent; (2) Incomplete; (3) Complete]; *3.* legislative effectiveness [(0) No legislature exists; (1) Ineffective; (2) Partially Effective; (3) Effective]; and *4.* legislative selection [(0) No legislature exists; (1) Nonelective; (2) Elective]. These 4 items are jointly available on a continuous basis from 1815 to 2006 exempting the years of the world wars (1914-1918) and (1940-1945) for which no data is available. Geographical coverage starts off with 15 countries in 1815, reaches 43 countries in 1900, 101 countries in 1960 and 194 countries from 1994 onwards. Factor analysis on these variables yields a single eigenvalue of 1.73 (that meets Kaisers's criterion (>1)) which explains about 55% of the underlying variance. The KMO is 0.59 which means that these variables are only marginally suitable for factor analysis. The computed factor is nevertheless retained and employed because it loads highly on legislative effectiveness (as Table 10 shows), the only governance outcome measure among these 4 variables.

Table 10: Summary and rotated factor loadings of 4 CNTS items
Method: principal factors | FL=Factor loading; UN=Uniqueness

Variable	*N*	*Mean*	*SD*	*Min*	*Max*	*FL*	*UN*
Effective Executive (Selection)	13542	2.11	0.77	1.00	3.00	-0.44	0.80
Degree of Parliamentary Responsibility	13454	1.16	1.20	0.00	3.00	0.49	0.76
Legislative Effectiveness	13333	1.71	1.03	0.00	3.00	0.85	0.28
Legislative Selection	13431	1.69	0.69	0.00	2.00	0.75	0.43

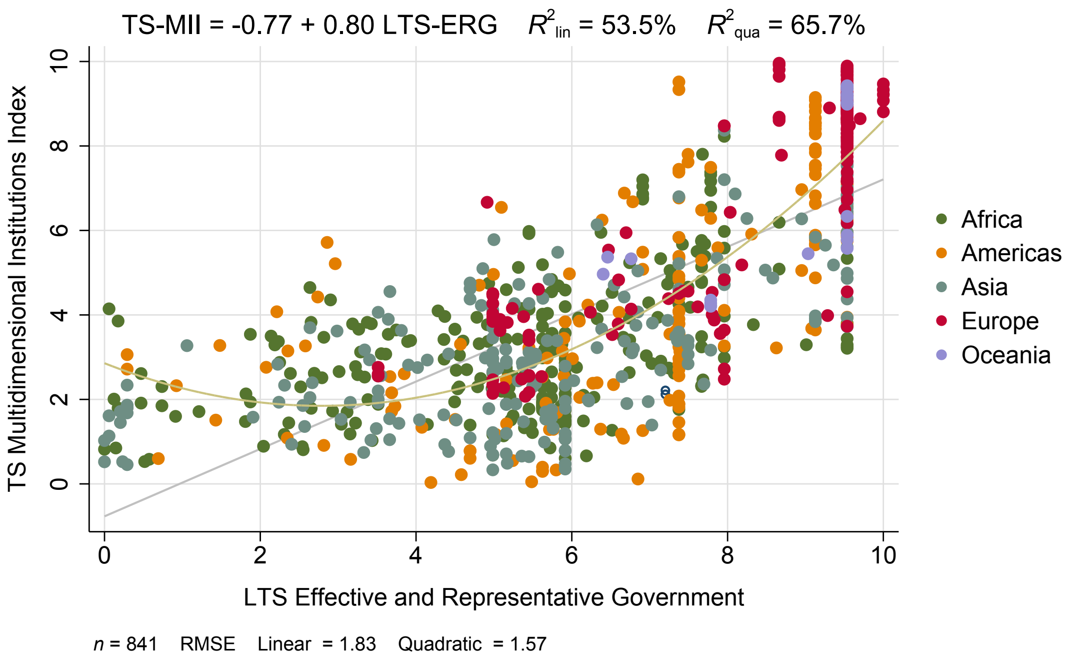
The computed factor is again linearly transformed to take on a minimum value of 0 and a maximum value of 10, and 5 year averages are taken in order to smoothen out fluctuations. Considering its underlying variables, the final factor is termed "Effective and Representative Government" (ERG). Figures 7 and 8 (using decadal averages as the ERG index will be employed in a panel-data estimation with Δt= 1 Decade), show that the new index still loads reasonably well

Figure 7: Cross-Sectional MII & Long-term ERG, 10-Year Averages since 1996



onto the cross-sectional and time-series MII's computed before. Since the World Bank Worldwide Governance Indicators start in 1996 and the ERG data coverage ends in 2006, the overlap between the cross-sectional MII and the ERG consists effectively of two half-decades. The time-series MII and the ERG on the other hand share an overlap of 5 and 2-half decades (from 1946-2006). Strange enough there appears to be a significant quadratic relationship between the ERG and the two MII indexes for which there does not seem to be a palpable explanation.

Figure 8: Time-Series MII & Long-term ERG, 10-Year Averages since 1946



4.3 Human Development

For the cross-section, the non-income Human Development Index (henceforth NIHDI) shall serve as the measure for human development. This index depends only on the health and education dimension indexes, but is otherwise equivalent to the HDI. The index is calculated below using UNDP's post-2010 HDI formula, taken from the technical notes of UNDP's Human Development Report 2016[31] (UNDP, n.d.). The first step is to calculate dimensional indexes on a scale of 0 to 1 for the two dimensions of education (proxied by means years of schooling and expected years of schooling) and health (proxied by life-expectancy at birth). To do this, minimum and maximum values (so called goal-posts) for all indicators are set:

Table 11: Goalposts for non-income HDI (source: UNDP (2016))

Dimension	*Indicator*	*Min*	*Max*
Health	Life expectancy at birth (years)	20	85
Education	Expected years of schooling (years)	0	18
	Mean years of schooling (years)	0	15

The dimension-indices are then calculated as follows:

$$\text{Dimension index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \tag{1}$$

finally, the non-income HDI is calculated as the geometric mean of the two dimension indices, so that the final index will have a value of 1 if a country reaches the max on all goalposts and a value of 0 if it is at min on all goalposts:

$$\text{NIHDI} = \sqrt{I_{\text{Health}} * I_{\text{Education}}} \tag{2}$$

The NIHDI index is calculated using data from UNDP's Human Development Report 2005.

Table 12: UNDP Human Development Indicators and NIHDI

Variables (2005, in years)	*N*	*Mean*	*SD*	*Min*	*Max*
Expected years of schooling	187	12.03	3.12	3.700	20.30
Life expectancy at birth	188	68.11	9.81	41.80	82.30
Mean years of schooling	181	7.44	3.11	1.30	13.10
Non-Income HDI	181	0.653	0.164	0.276	0.952

The best NIHDI performers in 2005 were Australia, New Zealand, Norway, Denmark and Ireland, and the worst were Sierra Leone, the Central African Republic, Burkina Faso, Chad and Niger.

Table 13: Human Development in 2005 by Region

	Africa		Americas		Asia		Europe		Oceania	
Variables (2005, in years)	*N*	*mean*	*N*	*mean*	*N*	*mean*	*N*	*mean*	*N*	*mean*
Expected years of schooling	52	9.0	35	13.0	48	11.8	40	15.1	12	12.9
Life expectancy at birth	53	56.2	35	72.6	49	70.8	40	76.2	11	69.9
Mean years of schooling	52	4.4	33	8.0	46	7.5	39	10.6	11	8.6
Non-Income HDI	52	0.47	33	0.71	46	0.67	39	0.82	11	0.70

For the panel data models, the non-income HDI cannot be calculated in the classical way, since no data on the expected years of schooling is available far down into history. The long-term educational attainment dataset of Barro and Lee (8) provides an estimate of the total years of schooling recorded in 5-year intervals. But the variable is "only" available from 1870 onwards.

[31] UNDP Technical Notes: http://dev-hdr.pantheonsite.io/sites/default/files/hdr2016_technical_notes_0.pdf

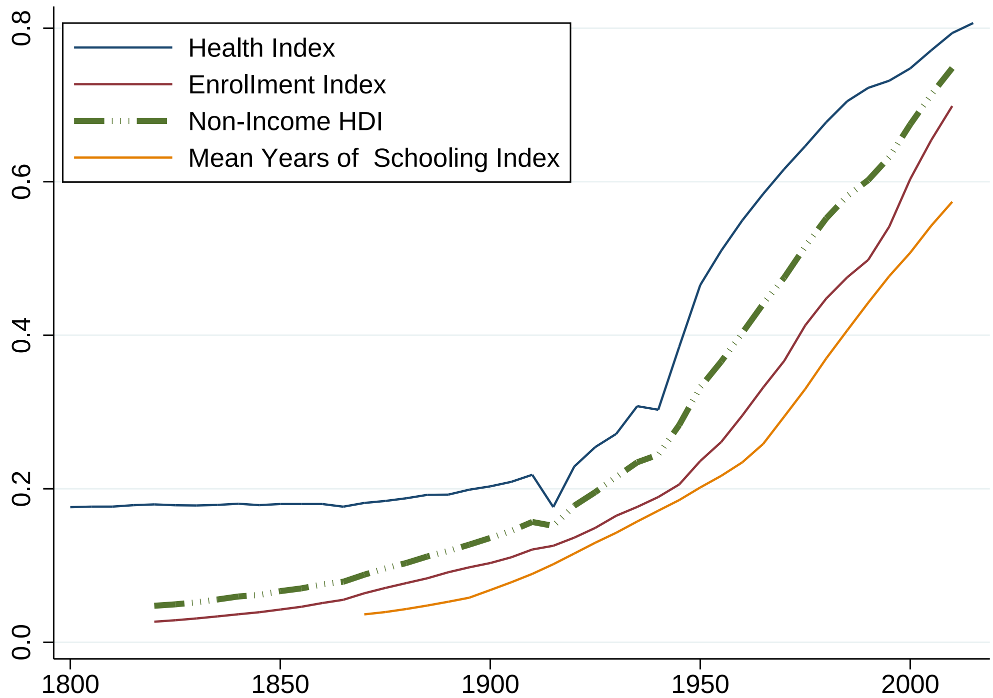
The dataset however also contains three variables recording the primary, secondary and tertiary adjusted enrollment ratio's (in %), and these are jointly available since 1820. It turns out that the simple sum if these three indicators is correlated with the total year of schooling variable with a coefficient of 0.95 (R^2=89.8%). For reasons of data coverage, and with comparability of results in mind, this simple sum of the three enrollment indicators will be used to represent the education dimension of the NIHDI in all panel-data specifications. The Goalposts for the new education dimensionality index are set at 0% (no school enrollment at all) and 300% (full primary, secondary and tertiary enrollment) respectively. The dimensionality index is calculated following (1). For the health dimension a life expectancy series from the gapminder foundation is employed which is similarly remarkable to the GDP per capita series discussed earlier on. It records the average life expectancies of 201 contemporary countries and regional entities down to 1800, yielding a total of 43,846 observations. The goalposts for the health series remain the same as in the cross-section. The time-series NIHDI is calculated following (2), and the variables are summarized in Table 14.

Table 14: Time-Series Human Development Indicators and NIHDI (Δt=5-years | 1820-2010)

Variables (only joint observations)	*N*	*Mean*	*SD*	*Min*	*Max*
Sum of Pri. Sec. Ter. Enrollment	4328	62.95	69.64	0	297
Life expectancy at birth	4328	44.41	16.78	20.06	83.20
Non-Income HDI	4328	0.26	0.26	0	0.96

Figure 9 shows the new time-series NIHDI with the associated dimensionality indexes (including the mean years of schooling index which was not used due to data coverage issues). The plot shows that the enrollment index is overall very similar to the mean years of schooling index, but appears to be larger by a fixed amount. This suggests that the NIHDI employed here will be upwards biased vis a vis the original NIHDI. The mean of the index for 2005 is 0.71, which is higher than the mean of the original index of 0.65 (see table 12). This bias however seems to be constant (as Figure 9 suggests) and will thus not affect the empirical results, where correlations and differences rather than levels matter.

Figure 9: Time-Series NIHDI and Dimensionality Indexes, (Δt=5-years | 1800-2015)



5 Model Selection Exercise

Having introduced the theoretical model on which the empirical research in sections 6-8 is based, it is now the purpose of this section to show that the identified model parameters (proxied by their respective indicators) are indeed central to the development process and stand out among a plethora of other parameters and competing theories. In other words this subsection aims to support the theoretical model built in this paper by conducting empirical model selection exercises similar to the ones abundant in the empirical growth literature in the 90's and early 2000's (e.g. see (Deijl, n.d.; Levine & Renelt, 1992; Sala-i Martin, 1997; Hoover & Perez, 2004)). The aim of this exercize is to show that income, human development and institutions are indeed mutually constitutive of each other and do not lend much to variables from other competing theories. Following the empirical growth literature, these exercises are done only for a cross-section of countries (since many variables of theoretical interest (e.g. geography) are time-invariant).

The theoretical model itself is operationalized in form of a 3-equation simultaneous equation system (SEM) as follows:

$$\begin{aligned} \text{Income} &= \beta_o + \beta_1 * \text{Institutions} + \beta_2 * \text{Human Development} + controls + \epsilon \\ \text{Human Development} &= \beta_3 + \beta_4 * \text{Income} + \beta_5 * \text{Institutions} + controls + \epsilon \\ \text{Institutions} &= \beta_6 + \beta_7 * \text{Human Development} + \beta_8 * \text{Income} + controls + \epsilon \end{aligned} \tag{3}$$

Graphically this system implies the existence of an long-run equilibrium point between income, human development and institutional quality to be found in three dimensions. An optimal outcome for the model selection exercize would thus be to establish all three equations in 3 as empirically very significant.

Two empirical approaches for model selection will be followed: first, a variation of Sala-i-Martin's 1997 averaging of classical estimates and Levene and Renelts 1992 extreme bounds analysis will be implemented using the data of Sala-i-Martin (1997). Afterwards, a random forest ensemble machine learning algorithm[32] will be applied to a separate but similar dataset[33], since this algorithm has proven itself a powerful tool for detecting complex and nonlinear relationships between a large number of predictors and assessing variable importance in out-of sample predictions[34]. Results are reported separately for each of the three variables. For the first method the dataset of Sala-i-Martin (1997) containing 61 predictors of growth (and also of human development and institutions for the purpose of this exercise) is taken. From this dataset 17 variables that function as direct proxies for income, human development or institutions (e.g. several measures of health and schooling and several institutional proxies are dropped from the dataset), leaving 44 predictors over 134 countries to be tested against the model predictors.

The methodology employed to find the most robust predictors is inspired by Sala-i-Martin (1997) in his seminal work on predictors of growth. According to Sala-i-Martin, robustness of a predictor can be tested by running regressions of the form:

$$\gamma = \beta_o + \beta_k y^k + \beta_z z + \beta_j x^j + u \tag{4}$$

where z is the predictor of interest, y^k is a vector of predictors always included in the model and x^j, is a vector of fixed length l of tuples of predictors taken at random from a pool of X predictors identified by the empirical literature. In this research the term y^k is left out since prior knowledge of true model variables is not assumed. Thus regressions including the predictor of interest z are run for all possible ${}^{X-1}C_l$ combinations of covariates in x^j, yielding regressions of the form

$$y = \beta_o + \beta_1 z + \beta_j x^j + u. \tag{5}$$

[32] More on the algorithm and machine-learning itself can be read under: (Friedman et al., 2001) and (Liaw & Wiener, 2002). A further excellent resource on the application of machine-learning methods to economic problems is (Varian, 2014).

[33] An own Dataset is created because the data of Sala-i-Martin 1997 contains missing values on several variables which makes it difficult to apply machine-learning methods to this data.

[34] A paper that applies a random forest algorithm to the growth problem for variable selection: (Bang et al., 2015).

For $X = 44 + 2(\text{Model}) = 46$ predictors, taking a vector of length l=2 would require ${}^{46-1}C_2$=990 regressions to check the robustness of one predictor z using this method, which yields ${}^{46}C_3$=15180 regressions to conduct the robustness test for all 46 predictors on one model variable. The results are reported below:

Table 15: Averaged 3-Tuple Regressions of 46 Predictors on Log GDP/Capita 2005 PPP
Number of Regression: 15180 (990 per predictor) | Countries: 134 | Robust error matrix

Variable	*b*	*se*	*t*	*p*	*sig*	*signpos*	*N*	*r2*
Non-Income HDI	6.58	.34	**20.54**	0	1	1	102	**.84**
Number of Years Open Economy	2.15	.27	7.87	0	1	1	100	.6
Equipment Investment	23.92	3.24	7.39	0	1	1	79	.66
Non-Equipment Investment	11.13	2.18	5.06	0	1	1	79	.55
Public Consumption Share (fraction of GDP)	-8.59	1.43	-5.94	0	1	0	89	.52
Fraction of population living in cities (1960)	3.57	.36	10.25	0	.97	1	100	.66
Absolute Lattitude	.04	.01	7.71	0	.97	1	102	.56
Multidimensional Institutions Index	.38	.04	**9.73**	.01	.96	1	102	**.62**
Sub-Sahara African Dummy	-1.64	.22	-7.7	.02	.96	0	102	.58

Table 15 shows that the non-income HDI is by far the best predictor of GDP/capita according to this method, with an average t-statistic of more than twice the magnitude of the next closest t-statistic. The variable is significant in 100% of specifications and would thus also survive Edward Leamers extreme-bounds analysis. With an average R^2 of .84, simple three-variable models involving it are by an order of magnitude more predictive than other models. The MII is also a significant predictor of growth, albeit only significant in 96% of models and with an average t-statistic of around 10. The reason it might be more difficult for the MII to reach the top of the list is because the dataset includes many variables that impact growth but are to a certain extent endogenous to the quality of institutions (e.g. public investment, which is a mediator from institutions to growth in this theoretical framework). Next to the aforementioned variables, open economy ($\approx$ trade) and geographic variables (latitude, sub-saharan Africa) show up as very significant predictors of income. This is confirmatory of the theoretical debates in the literature. In this reasearch geography is only controlled for (because it is exogenous and time-invariant and presumably impacts all thee theory variables), and the part of trade undetermined by geography and colonial history is theoretically treated as to a certain degree endogenous to institutional quality (but it will also be controlled for in several specifications).

Table 16: Averaged 3-Tuple Regressions of 46 Pred. on the Multidimensional Institutions Index
Number of Regression: 15180 (990 per predictor) | Countries: 134 | Robust error matrix

Variable	*b*	*se*	*t*	*p*	*sig*	*signpos*	*N*	*r2*
Non-Income HDI	9.6	.87	**11.71**	0	1	1	102	**.69**
Number of Years Open Economy	3.58	.51	7.22	0	1	1	100	.56
Fraction of Protestant	2.97	.58	5.23	0	1	1	102	.37
Growth Rate of Population (1960-1990)	-106.36	20.3	-5.88	0	1	0	102	.54
Absolute Lattitude	.07	.01	8.37	0	.99	1	102	.53
Fraction of Muslim	-2.31	.44	-5.33	0	.99	0	102	.41
Fraction of primary exports in tot. exp. in 1970	-3.69	.6	-6.51	0	.99	0	98	.47
Ratio of liquid liabilities to GDP	4.69	1.36	3.5	.01	.98	1	65	.52
Equipment Investment	34.17	6.57	5.25	0	.97	1	79	.56
Log GDP/Capita 2005 PPP	1.08	.14	**8.47**	.01	.96	1	102	**.6**
Fraction of Population Able to Speak English	2.12	.55	3.94	.01	.96	1	102	.34
Degree of Capitalism	.46	.12	3.7	.01	.96	1	102	.37
Revolutions and Coups	-3.25	.77	-4.26	0	.96	0	102	.4
Fraction of population living in cities (1960)	4.88	.71	7.2	.01	.95	1	100	.53
War Dummy (war between 1960 and 1990)	-1.19	.36	-3.26	.01	.95	0	99	.35

Table 16 shows that HD and GDP are also both very significant predictors of institutional quality. The non-incme HDI is the best predictor of the MII (both in terms of t-statistic and R^2), and significant at the 5% level in 100% of cases. In terms of both average t-statistic and average R^2, log GDP per capita is the second strongest predictor of institutional quality, but it is only significant in 96% of specifications. Other variables that are important in predicting institutions are trade, population fraction speaking english (≈ colonial origin according to Dollar & Kraay (2003)), geography and religion variables. The of these, only religion variables are yet unconsidered in the theoretical section, but the effect of worldviews on the organization of society has been documented extensively in several literatures, and religious controls will be added to the estimations in section 6.

Table 17: Averaged 3-Tuple Regressions of 46 Predictors on the Non-Income HDI
Number of Regression: 15180 (990 per predictor) | Countries: 134 | Robust error matrix

Variable	*b*	*se*	*t*	*p*	*sig*	*signpos*	*N*	*r2*
Log GDP/Capita 2005 PPP	.12	.01	**18.03**	0	1	1	102	**.85**
Multidimensional Institutions Index	.06	0	**13.19**	0	1	1	102	**.71**
Fraction of population living in cities (1960)	.5	.05	10.78	0	1	1	100	.7
Ethnolinguistic Fractionalization	-.26	.05	-5.59	0	1	0	96	.5
Sub-Sahara African Dummy	-.26	.02	-10.8	0	1	0	102	.68
Absolute Lattitude	.01	0	8.64	0	.99	1	102	.58
Number of Years Open Economy	.29	.04	7.72	0	.98	1	100	.6
Fraction of Population Able to Speak English	.17	.04	4.12	0	.98	1	102	.37
French Colony (dummy)	-.15	.03	-4.16	.01	.97	0	102	.41
Exchange Rate Distortions	0	0	-5.29	.01	.96	0	98	.47
Non-Equipment Investment	1.37	.31	4.38	.02	.95	1	79	.52
Public Consumption Share (fraction of GDP)	-1.08	.21	-5.18	.02	.95	0	89	.5

Table 17 finally also confirms the empirical relevance of income and institutional quality in predicting human development. This time the results are unequivocal, log GDP/Capita and the MII are the best predictors if HD, both in terms of the R^2, and the average t-statistic. Both variables are also significant in 100% of model specifications. Other variables of importance to HD according to these results are the urban population fraction, ethnolinguistic fractionalization, geography, colonial history and openness.

The results from the random forrest are almost identical to the results using Sala-i-Martin's method reported here. Because these results are harder and time-consuming to interpret, they are not reported, but can be consulted in the supplementary materials to this paper (see also Appendix).

Overall This exercize has been very confirmatory of the theoretical model. For each of the three model equations, the theory variables have ended up in the top 10 predictors (out of 46), are significant in more than 95% of models and are highly predictive in terms of average t-statistic and R^2. Amongst the (counfounding) predictors in the regressions on oncome and institutional quality, most highly significant variables are either time-invariant, or to a certain degree endogenous (mediators) in the thearetical process identified in section 3, or will be used as instruments in the cross-sectional estimations that follow. For most of these variables controls are available in the estimations of section 6, which are being introduced now.

6 Cross-sectional Model

In this section the theoretical framework built and found empirically viable in the previous section will be tested using a cross-sectional framework with 2005 as the reference year (following Acemoglu et al. (2014)) and instrumental variables estimation. Table 18 summarizes the 3 main theoretical variables and all of the instruments used in the estimations that follow. The instruments used are primary enrollment rate in 1900 and protestant missionary activity in 1920 for the education dimension of human development following Acemoglu et al. (2014). Additionally malaria ecology, an index constructed on geographical conditions, is employed for the health dimension of human development (following J. D. Sachs (2003)). Institutions are instrumented by capped log settler mortality following Acemoglu et al. (2001) and Acemoglu et al. (2014), and by log population density in 1500 following Acemoglu et al. (2014). Since the settler mortality instrument has become a point of dispute in the literature, legal origin by La Porta et al. (1999) is also used. In addition, the shares of population speaking English or another major European language are used by Dollar & Kraay (2003) as an instrument for rule of law on growth, under the assumption that they proxy for the impact of colonial origin on institutions. These instruments are employed in a small subset of models due to their high availability across countries. This is however done with great skepticism since it seems reasonable to assume that they are correlated with education as well and therefore not valid instruments.

Table 18: Main Variables and Instruments

Variable	*Source*	*N*	*Mean*	*SD*	*Min*	*Max*
GDP per capita (2011 PPP $)	UNDP/Gapminder	193	16,116	19,751	535	114,840
Log GDP per capita (2011 PPP $)	UNDP/Gapminder	193	8.97	1.28	6.28	11.7
Non-Income Human Development Index	Authors Calculations	181	0.65	0.16	0.28	0.95
Multidimensional Institutions Index (03-07 mean)	Authors Calculations	188	5.89	2.16	1.42	9.90
All Instruments						
Primary enrollment in 1900	Acemoglu et al. (2014)	63	17.5	23.9	0.20	95
Protestant missionaries per 10,000 people in the 1920s	Acemoglu et al. (2014)	63	0.58	1.21	0	9.05
Dummy=1 if protmiss computed from Dennis et al.	Acemoglu et al. (2014)	63	0.095	0.30	0	1
Malaria Ecology, pop-weighted	J. D. Sachs (2003)	168	3.66	6.47	0	31.5
Log settler mortality, mortality capped at 250	Acemoglu et al. (2014)	63	4.45	0.95	2.15	5.52
Log population density 1500 (baseline)	Acemoglu et al. (2014)	63	0.56	1.72	-3.83	4.61
Share of the population that speaks English	Dollar & Kraay (2003)	177	0.073	0.24	0	1
Share of Pop. that speaks a major European language	Dollar & Kraay (2003)	180	0.22	0.38	0	1.00
Legal Origin	La Porta et al. (1999)	154	1.91	0.94	1	5
(Avg<2005) FDI % of GDP undet. by H.C. & Inst.	Worldbank WDI	155	0.20	2.64	-8.94	17.2
(Avg<2005) Net oil export value/capita, const. 2000 $	Worldbank WDI	169	197	1,155	-3,303	8,058

The greatest challenge of this section has been to identify valid instruments for income. I argue that the two instruments identified, oil exports and the part of foreign direct investment undetermined by institutional quality and human capital, are valid instruments in this framework. The argument for using oil-exports as an instrument for income is simply that oil-wealth has provided an opportunity for a group of countries to become very rich without the necessity of equivalent gains in human capital or institutional quality. The feedback from income to human development and institutions is thus well investigated in comparing the development paths of oil-rich nations with the those of other nations. Empirically it indeed holds true that oil-exports are almost unrelated to institutional quality and human development: A regression of the measure of oil exports per capita (which is computed as an average over all available years up-to and including 2005) on the NIHDI and MII indexes and their squared terms yields an r-squared of merely 6%. To avoid the problem of weak-identification, and also to broaden the set of countries affected by the instruments employed, a second instrument is computed as the residuals from a regression of foreign direct investment (in % of GDP) (FDI) on NIHDI, MII, their quadratic terms and all indicators that have been used in the computation of these indexes separately. The reason for this is that foreign direct investment into the economy is surely related to institutional quality and the human development of the labor force, but also driven my many factors that are exogenous to this. It is those exogenous factors driving FDI that this instrument hopes to capture. Empirically a regression of FDI on NIHDI, MII and their respective quadratic terms also gives an r-squared of around 7%. When the individual indicators used to compute NIHDI and MII in section 3 are added to this (giving 17 predictors in total), the r-squared rises to 17%, suggesting that around 80% of FDI flows are neither linearly nor non-linearly related to the human development or institutional quality of their recipient countries.

Table 19 shows the pairwise correlations of the variables and instruments. It is interesting to observe that the log of income is substantially higher correlated with NIHDI and MII than its level. The correlations of the instruments with the three theory variables are of the expected sign and overall quite large (which suggests that there might be a multicollinearity problem in the cross-sectional results as it was experienced among others by Dollar & Kraay (2003) and Bhattacharyya (2009c)).

Table 19: Correlation Matrix of Main Variables and Instruments
Pairwise Correlations

# *Variable*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) GDP per capita (2011 PPP $)	1													
(2) Log GDP per capita (2011 PPP $)	.83	1												
(3) Non-Income Human Development Index	.60	.85	1											
(4) Multidimensional Institutions Index (03-07 mean)	.48	.62	.70	1										
All Instruments														
(5) Primary enrollment in 1900	.63	.62	.68	.75	1									
(6) Protestant missionaries per 10,000 people in the 1920s	.20	.24	.16	.26	.28	1								
(7) Dummy=1 if protmiss computed from Dennis et al.	.69	.53	.54	.61	.69	-.14	1							
(8) Malaria Ecology, pop-weighted	-.31	-.52	-.68	-.30	-.41	-.15	-.19	1						
(9) Log settler mortality, mortality capped at 250	-.71	-.69	-.70	-.61	-.59	-.03	-.65	.58	1					
(10) Log population density 1500 (baseline)	-.58	-.49	-.47	-.51	-.50	-.11	-.40	.21	.38	1				
(11) Share of the population that speaks English	.15	.23	.27	.34	.85	.41	.50	-.14	-.43	-.40	1			
(12) Share of Pop. that speaks a major European language	.12	.30	.37	.44	.65	.19	.21	-.26	-.34	-.55	.57	1		
(13) Legal Origin	.24	.26	.29	.20	-.37	-.28	-.26	-.17	.34	.07	-.30	-.11	1	
(14) (Avg<2005) FDI % of GDP undet. by H.C. & Inst.	-.05	-.04	-.03	-.01	-.06	.12	-.20	.05	.05	.03	.01	.01	-.09	1
(15) (Avg<2005) Net oil export value/capita, const. 2000 $	.55	.27	.03	-.12	-.07	-.10	-.06	-.06	.31	.16	-.06	-.11	.04	-.06

The only slightly disturbing feature of this correlation matrix are the very low and surprisingly negative loadings of the computed FDI instrument on the theory variables. This suggests that the instrument itself will not be of much use, and it is evident that most of the variance in income will be explained by the oil-exports instrument.

The empirical appraisal of the model is conducted equation by equation. Although a system-estimator like 3SLS would be more efficient in this case, equation-by equation estimation is preferred because it allows for the careful investigation of different specifications, and prevents the possible invalidity of an instrument for one the of the equations to adversely impact all other equations. Each equation is estimated in three sequences, and each sequence is estimated with 12 different sets of control variables. The first sequence (OLS) is simply a series of OLS models. The second sequence (IV1) is estimated using 2SLS involving the instruments of Acemoglu et al. (2014)[35], which limit the sample size to a subset of around 60 ex-colonies. The third Sequence (IV2) is also a series of 2SLS models, but this time with instruments other than those of Acemoglu et al. (2014) (see Table 18), which allows for a greater sample size of typically around 130 countries.

In order to save space, all three sequences of models for a given equation are put together in a single table, with the respective choice of controls indicated at the bottom. These control variables apply to the models of all three sequences in a given column unless specified otherwise by sub-or superscripts.

6.1 Empirical Results

Table 20 shows the cross sectional results for the equation with the non-income HDI times 10[36] as the dependent variable. The first sequence with OLS models indicates that both institutions and income are very significant predictors of human development. The coefficients on institutions, which are on average around 0.2, appear to be a bit smaller than those on income, with an average value if about 0.7. That the coefficient on income would be larger has already been suggested by

[35] In particular: Log settler mortality and log population density in 1500 for Institutions and protestant missionary activity and primary enrollment in 1900 for human development

[36] The Non-Income HDI is multiplied times 10 in all empirical results of this paper to make the scales of the variables (MII: 0-10, logGDP/capita: 6-12 (approx.), and 10*NIHDI: 0-10) more comparable and ease the interpretation of the coefficients

the correlation matrix (19), but in interpreting these results it must be taken into account that institutions are coded on a scale ranging from 1.42 to 9.90, yielding an effective range of 8.48 (see Table 18), whereas the log GDP per capita scale only ranges from 6.28 to 11.7, yielding a slightly lower range of 5.42.

The second sequence (IV1), where log settler mortality and log population density are taken as instruments for institutions (following Acemoglu et al. (2014)), and the net oil export value per capita and the computed exogenous component of FDI are taken as instruments for log GDP per capita, largely confirms the message from the OLS models. In the simple specification without control variables (3) (where all instruments are used), the first stage regression for log GDP per capita has an R^2 of 0.58, and the first stage for the MII has an R^2 of 0.56. The correlation coefficient between the predicted values from both first stages is 0.77 ($R^2 = 0.59$). Although this correlation is not small, unambiguous identification of the impact of both variables in the specification should remain possible. The coefficient on income is significant across all 12 specifications, and varies in magnitude between 0.44 and 1. Its average value is around 0.65. The coefficient on institutions is only significant in half of the specifications, in particular adding geographic controls such as continent dummies and absolute latitude to the specification appear to render institutions insignificant. The latter observation could be interpreted as a confirmation of J. D. Sachs (2003) that geography is indeed a more fundamental factor than institutions, but taking into consideration that the settler mortality instrument is itself geographically determined, it seems more reasonable to assume that there just is a high collinearity between the instrument for institutions and the geographic controls. However whenever the institutions coefficient is significant, it appears to be larger than in the OLS regressions and closer the the effect of income, with an average magnitude of 0.4.

In the third sequence of models (IV2) reported in Table 20, legal origin from La Porta et al. (1999) is used as an instrument for institutions. But in specifications (1), (3) and (4) the fractions of the population speaking English or another European language from Dollar & Kraay (2003) are used instead of legal origin[37]. The first stage R^2's are 0.19 for log GDP per capita and 0.10 for 10*NIHDI, and the correlation between their predicted values is 0.47 ($R^2 = 0.22$), allowing for a strong identification of both effects. The results of IV2 are very similar to those of IVI. This time they lend more evidence to the hypothesis of J. D. Sachs (2003) because in all models where geographic variables or variables capturing the disease environment (such as Sachs malaria ecology variable) are introduced as controls, the coefficient on institutions becomes insignificant and close to zero. This happens inspite of the fact that the legal origin instrument used for institutions is unrelated to geography. In terms of coefficients, the average coefficient on institutions whenever it is significant is about 0.45. The coefficient on log income remains on average 0.65 but it is interesting to note here that it is insignificant in two cases: One involving continent dummies, Sachs malaria ecology measure and temperature and humidity levels, and the other one controlling for urban population fraction, the arable land fraction and population density. The identification statistics for IV1 and IV2 indicate that for the most part the models are well identified (which means that the underidentification test by Kleinbergen and Paap is rejected at the 5% level and the overidentification test by Hansen is not rejected at any conventional significance level).

[37] The linguistic instruments of Dollar & Kraay (2003) are only employed sparsely here due to the elucidated doubts about their validity (In this particular case the population fractions speaking English or another major European language are likely to also affect human development directly. They could even be considered alternative indicators of human development)

Table 20: Cross Sectional Regressions, Dependent Variable: **10*Non-Income HDI**, Year: 2005
Estimation Method: Limited-Information Maximum Likelihood (LIML) | Error Matrix: Robust

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
OLS												
Multidimensional Institutions Index (03-07 mean)	0.23***	0.08	0.17**	0.22***	0.21***	0.16***	0.17***	0.21***	0.13***	0.21***	0.16***	0.19***
	(0.04)	(0.05)	(0.07)	(0.03)	(0.05)	(0.03)	(0.03)	(0.06)	(0.03)	(0.04)	(0.03)	(0.04)
Log GDP per capita (2011 PPP $) (UNDP)	0.86***	0.82***	1.07***	0.67***	0.91***	0.58***	0.59***	0.76***	0.51***	0.77***	0.57***	0.55***
	(0.07)	(0.10)	(0.10)	(0.07)	(0.08)	(0.07)	(0.10)	(0.08)	(0.09)	(0.09)	(0.07)	(0.07)
Observations	178	149	62	160	158	173	160	136	140	177	173	125
R^2	0.77	0.80	0.85	0.85	0.77	0.88	0.89	0.87	0.91	0.78	0.89	0.93
IV1: SetMort, LPD1500, ExogFDI, OilExpPC[a]												
Multidimensional Institutions Index (03-07 mean)	0.49***	0.43***	0.41***	0.47	0.33***	0.12	0.11	0.28*	0.15	0.37***	0.05	0.29*
	(0.12)	(0.09)	(0.12)	(0.28)	(0.08)	(0.21)	(0.13)	(0.16)	(0.15)	(0.12)	(0.12)	(0.16)
Log GDP per capita (2011 PPP $) (UNDP)	0.86***	0.68***	0.89***	1.00***	0.60***	0.59***	0.55***	0.75***	0.45**	0.80***	0.65***	0.44**
	(0.16)	(0.19)	(0.18)	(0.17)	(0.12)	(0.17)	(0.13)	(0.10)	(0.21)	(0.21)	(0.11)	(0.18)
Observations	58	58	58	58	58	58	59	57	59	59	59	57
R^2	0.76	0.76	0.79	0.80	0.86	0.88	0.89	0.89	0.92	0.82	0.87	0.95
Instruments for Institutions:	SetMo.	LPD15	Both	Both	Both	Both	Both	Both	Both	Both	Both	Both
Kleibergen-Paap rk LM statistic[b]	6.73	9.30	9.70	7.80	6.43	6.74	8.81	7.32	5.69	11.87	11.31	7.76
Kleibergen-Paap P-Value	0.03	0.01	0.02	0.05	0.09	0.08	0.03	0.06	0.13	0.01	0.01	0.05
Hansen J statistic[c]	0.26	0.29	3.27	2.49	0.75	1.48	2.92	2.62	1.23	4.36	0.08	1.88
Hansen J P-Value	0.61	0.59	0.20	0.29	0.69	0.48	0.23	0.27	0.54	0.11	0.96	0.39
IV2: LegOr, EngFrac, EurFrac, ExogFDI, OilExpPC[a]												
Multidimensional Institutions Index (03-07 mean)	0.37***	0.45***	0.54***	0.30***	0.48***	0.41***	-0.10	0.40	0.02	0.49**	-0.07	-0.07
	(0.05)	(0.10)	(0.20)	(0.05)	(0.12)	(0.10)	(0.41)	(0.83)	(0.38)	(0.23)	(0.34)	(0.24)
Log GDP per capita (2011 PPP $) (UNDP)	0.69***	0.79***	0.85***	0.51***	0.81***	0.67***	0.34*	0.75***	0.57	0.86	0.40**	0.56***
	(0.10)	(0.12)	(0.19)	(0.09)	(0.13)	(0.13)	(0.18)	(0.11)	(0.37)	(0.66)	(0.16)	(0.10)
Observations	149	125	59	147	122	121	121	120	110	125	123	117
R^2	0.76	0.81	0.77	0.84	0.80	0.86	0.82	0.86	0.91	0.78	0.84	0.91
Instruments for Institutions:	EngEur	LegOr	EngEur	EngEur	LegOr	LegOr	LegOr	LegOr	LegOrn	LegOr	LegOr	LegOr
Kleibergen-Paap rk LM statistic[b]	23.83	5.98	11.07	18.75	5.20	5.22	2.14	0.78	3.12	0.98	1.54	4.05
Kleibergen-Paap P-Value	0.00	0.05	0.01	0.00	0.07	0.07	0.34	0.68	0.21	0.61	0.46	0.13
Hansen J statistic[c]	0.03	0.01	0.05	2.29	0.16	0.13	0.13	0.11	0.57	0.00	0.00	0.26
Hansen J P-Value	0.98	0.93	0.98	0.32	0.69	0.71	0.71	0.75	0.45	0.97	0.96	0.61
Control Variables												
Continent Dummies						YES^{OLS}_{IV2}	YES		YES		YES	YES
Latitude						YES^{OLS}_{IV2}	YES				YES	YES
Landlocked Dummy						YES^{OLS}_{IV2}	YES				YES	YES
Colonial Origin											YES	YES
Malaria Ecology [Sachs 2003]				YES^{OLS}_{IV2}	YES^{IV1}	YES^{IV1}	YES		YES			YES
Fractionalization Variables |Rel.|Ethn.|Lan.								YES				YES
Religious Affiliation in 1980								YES				YES
Urban Population [% of Total]										YES		
Arable Land [% of land Area]										YES		
Population density [Per km^2]										YES		
Temperatures and Humidity Levels									YES			YES^{IV1}
Falciparum Malaria Index 1994									YES			YES^{IV1}
% GDP in Agriculture/Hunting/Forestry/Fishing							YES^{OLS}					
Ethnic/Civil/International Warfare Variables					YES^{OLS}_{IV2}							
Protestant Missionary Activity			YES^{OLS}_{IV2}	YES^{IV1}		YES^{IV1}						
Primary Enrollment in 1900			YES^{OLS}_{IV2}	YES^{IV1}		YES^{IV1}						

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOTE: Sub-and/or superscript on the control variables indicate to which specification (OLS, IV1 or IV2) they are added. A simple "YES" implies that this control applies to all three.
[a] Instruments IVI: Log settler mortality and log population density in 1500 for institutions, and the exogenous component of FDI and the average oil export value per capita up to 2005 for income. Instruments IV2: Legal origin or the population fractions speaking english and other major european languages for institutions, and exogenous FDI and average oil exports per capita for income.
[b] Underidentification Test by Kleinbergen and Paap, H0: Equation Underidentified
[c] Overidentification Test by Hansen, H0: Equation Exactly Identified

The main message from Table 20 is that both institutions and income have a significant and large impact on human development. Their impact in fact seems to be similar. An increase in institutional quality by one point (on a 10 point scale) is associated with a rise of 0.045 in the (untransformed) non-income HDI, and a doubling in income (e.g. a 100% increase) relates to change of 0.065 in the non-income HDI. The effect of institutions can however be rendered insignificant by controlling for geography and the disease environment, which lends partial credit to J. D. Sachs (2003) in seeing institutions not as fundamental to the human development divide but as partly determined by geography and other factors (which in turn is compatible with the mechanism stipulated by Acemoglu et al. (2001)).

Table 21 is constructed analogous to Table 20 with log GDP per capita as the dependent variable.

Table 21: Cross Sectional Regressions, Dep. Variable: **Log GDP/Capita PPP $**, Year: 2005
Estimation Method: Limited-Information Maximum Likelihood (LIML) | Error Matrix: Robust

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
OLS												
10*Non-Income Human Development Index	0.63***	0.66***	0.75***	0.73***	0.73***	0.73***	0.57***	0.55***	0.62***	0.62***	0.62***	0.64***
	(0.04)	(0.05)	(0.06)	(0.06)	(0.06)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
Multidimensional Institutions Index (03-07 mean)	0.02	-0.04	-0.02	-0.04	-0.04	0.02	0.07*	0.11***	0.02	0.02	0.02	0.04
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Observations	178	144	144	141	141	136	150	151	122	122	121	122
R^2	0.72	0.76	0.78	0.79	0.79	0.79	0.79	0.83	0.88	0.88	0.88	0.88
IV1: ME, ProtMis, PriEnr, SetMort, LPD1500[a]												
10*Non-Income Human Development Index	0.34**	0.36***	0.50*	0.34	0.38	0.54**	0.40***	0.47***	0.36**	0.39**	0.56*	0.45***
	(0.16)	(0.14)	(0.26)	(0.38)	(0.36)	(0.22)	(0.10)	(0.08)	(0.17)	(0.16)	(0.33)	(0.17)
Multidimensional Institutions Index (03-07 mean)	0.34*	0.33**	0.32**	0.38**	0.42**	0.46**	0.23**	0.17	0.27**	0.24*	0.56	0.44**
	(0.18)	(0.16)	(0.15)	(0.17)	(0.18)	(0.20)	(0.11)	(0.14)	(0.12)	(0.13)	(0.47)	(0.21)
Dummy=1 if protmiss computed from Dennis et al.	-0.45	-0.32	-0.10	-0.07	-0.14	-0.83**	-0.12	0.07	-0.05	-0.09	-0.73	-0.26
	(0.38)	(0.36)	(0.34)	(0.47)	(0.51)	(0.38)	(0.34)	(0.43)	(0.50)	(0.51)	(0.95)	(0.57)
Observations	61	61	61	61	61	59	60	58	58	58	57	58
R^2	0.67	0.68	0.71	0.68	0.66	0.65	0.75	0.84	0.85	0.86	0.60	0.78
Kleibergen-Paap rk LM statistic[b]	9.21	9.43	6.52	10.28	8.40	7.52	10.43	11.67	9.92	9.00	9.30	10.31
Kleibergen-Paap P-Value	0.06	0.05	0.16	0.04	0.08	0.11	0.03	0.02	0.04	0.06	0.05	0.04
Hansen J statistic[c]	3.59	3.97	4.17	4.04	3.94	2.36	4.35	1.14	2.08	1.78	3.23	3.73
Hansen J P-Value	0.31	0.27	0.24	0.26	0.27	0.50	0.23	0.77	0.56	0.62	0.36	0.29
IV2: LegOr, ME, EngFrac, EurFrac[a]												
10*Non-Income Human Development Index	0.67***	0.56***	0.56***	0.52***	0.51***	0.71***	0.59***	0.58***	0.57***	0.56***	0.56***	0.61***
	(0.10)	(0.07)	(0.15)	(0.17)	(0.16)	(0.12)	(0.09)	(0.07)	(0.13)	(0.13)	(0.14)	(0.13)
Multidimensional Institutions Index (03-07 mean)	-0.06	-0.00	0.15	0.21*	0.20**	-0.07	0.04	0.07	0.17*	0.18**	0.19**	0.18***
	(0.11)	(0.08)	(0.10)	(0.11)	(0.10)	(0.11)	(0.09)	(0.08)	(0.09)	(0.09)	(0.09)	(0.07)
Observations	131	131	131	131	131	125	120	120	120	120	119	120
R^2	0.76	0.76	0.75	0.75	0.75	0.79	0.82	0.86	0.86	0.85	0.85	0.87
Kleibergen-Paap rk LM statistic[b]	14.54	22.42	15.33	16.50	16.90	12.62	14.66	15.94	18.69	19.12	19.15	18.01
Kleibergen-Paap P-Value	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Hansen J statistic[c]	1.23	1.18	0.99	1.56	1.53	0.30	0.20	0.13	1.77	1.88	1.80	1.11
Hansen J P-Value	0.54	0.56	0.61	0.46	0.47	0.86	0.91	0.94	0.41	0.39	0.41	0.57
Control Variables												
Latitude		YES	YES	YES	YES				YES	YES	YES	YES
Exog FDI & Net PC Oil Export value								YES	YES	YES	YES	YES
Continent Dummies			YES	YES	YES				YES	YES	YES	YES
Landlocked Dummy				YES	YES				YES	YES	YES	YES
Log Population				YES	YES				YES	YES	YES	YES
Former Colonies Dummies					YES					YES	YES	YES
Religious Affiliation in 1900/1980						YES						YES
Trade as % of GDP							YES				YES	
Fractionalization Variables |Rel.|Ethn.|Lan.						YES						

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Instruments IV1: Malaria ecology, protestant missionary activity and primary enrollment for human development, and log settler mortality and log population density in 1500 for institutions. Instruments IV2: Malaria ecology for human development, legal origin for institutions, and the population fractions speaking english and other major european languages for both.
[b] Underidentification Test by Kleinbergen and Paap, H0: Equation Underidentified
[c] Overidentification Test by Hansen, H0: Equation Exactly Identified

In the OLS sequence institutions appear to have no impact on income, whereas human development has a significant impact with a large average coefficient of about 0.65. This picture is altered in IV1 and IV2. In IV1, log settler mortality and log population density in 1500 are used as instruments for institutions, and the number of protestant missionaries per 10,000 in the 1920's and the primary enrollment rate in 1900 are used as instruments for human development following Acemoglu et al. (2014). Because the non-income HDI also includes a life expectancy component, the geographically computed malaria ecology variable of J. D. Sachs (2003) is added as an additional instrument for human development to properly instrument for both the health and the education dimension.

In IV1, the first stage regressions for the specification without controls (1) yield R^2's of 0.74 for NIHDI and 0.64 for the MII respectively. The correlation coefficient between the predicted values is 0.86 ($R^2 = 0.74$). This correlation is high but not prohibitive to identification. The identification statistics show that 80% of the models in this sequence are well identified. Both variables are significant in 10 out of 12 specifications, and the coefficient on human development, with a significant average of 0.45, is slightly larger than the coefficient on institutions, with a significant average of 0.35. This difference may however be regarded negligible after considering that the NIHDI for the year 2005 has a slightly lower range (0.28-0.95) than the MII (1.42-9.90) (see Table 18).

In IV2, legal origin by La Porta et al. (1999) is used as an instrument for institutions, and only malaria ecology is retained as an instrument for human development[38]. In addition, the population fractions speaking English and a major European language taken from Dollar & Kraay (2003) are added as instruments for both variables[39]. The first stage regressions for human development and institutions have R^2's of 0.62 and 0.33, and the correlation coefficient of their first stage predicted values is 0.91 ($R^2 = 0.83$). This is a case of high multicollinearity between the instrumented predictors, but considering that the sample size more than doubled when moving from IV1 to IV2, the situation is not much worse than in IV1, and the 17% unshared variance should allow for identification of the effects of both factors. As to affirm this, the identification statistics show that all 12 models of IV2 are exactly identified. Concerning their impact, this sequence of models suggests that human development is more important than institutions in fostering growth. the NIHDI (*10) is significant in all 12 models with an average coefficient of 0.6, whereas institutions are only significant in 6 models with an average coefficient of 0.2. This in and of itself would be considered a strong finding, but there is reason to be skeptical considering the divergent first stage R^2's and the strong correlation between the instrumented variables.

Considering both IV1 and IV2, the message from Table 21 is that both human development and institutions have a significant positive impact on income. The human development channel appears to be stronger though, with an increase of 0.1 in the (untransformed) non-income human development index associated with an approx. 50% increase in GDP per capita, and a 1 unit increase in the multidimensional institutions index yielding an approx. 25% increase in income. This lends empirical support to Glaeser et al. (2004) who also demonstrated a stronger human development channel vis a vis institutions.

Last but not least, Table 22 reports the estimation of the equation predicting institutional quality, and hence completes the cross-sectional estimation of the theoretical model promoted in this paper. In the OLS sequence, human development has a large and highly significant impact on institutional quality. The coefficient size varies between 0.54 and 1.04, but takes a very large average value of about 0.85. Income, in contrast, is not significant at all except in model (3), where temperatures and humidity levels and the incidence of malaria in 1994 are controlled for. This conclusion is hardly altered by IV1 or IV2.

In IV1, the scaled non-income human development index is instrumented by the number of protestant missionaries per 10,000 in the 1920's, the primary enrollment rate in 1900 (taken from Acemoglu et al. (2014)), and by malaria ecology (taken from J. D. Sachs (2003)). Log GDP per capita is instrumented using again the net oil export value per capita and the computed exogenous component of foreign direct investment. The first stage regression for the NIHDI in model (1) has an R^2 of 0.76 and the first stage on log GDP per capita has an R^2 of 0.76. This time there is a very significant multicollinearity problem in the first stage predicted values, which share a correlation coefficient of 0.96 (R^2 =0.91). The identification statistics testify to this, only a single model out of 12 is well identified. In the results, human development is significant in 5 of 12 models with an

[38] Because the data coverage on protestant missionary activity is limited to around 60 countries, as elaborated before..

[39] As elaborated earlier Dollar & Kraay (2003) use these as instruments for institutions in a regression on log GDP/Capita under the justification that they capture the colonial origin component of institutions. The validity of this instrument may however be called into question when considering that these measures can proxy for education and therefore also work through human development. They nevertheless remain valid instruments for both institutions and human development together, which is exploited here by adding them to the instrument matrix. In the first stages these instruments indeed significantly (at the 1% level) predict both the NIHDI and the MII.

extremely large average coefficient of about 1.4. Income is however also significant in 3 cases where it takes a very large negative coefficient of -1.4 on average. The symptoms of multicollinearity are evident in these results, and the large negative coefficient on income is disturbing. An explanation for it may be taken from the correlation matrix (Table 19), which indicates that the correlation between the MII and the net oil export value per capita in 2005 is negative with a correlation coefficient of -0.12. Oil rich nations thus appear to have worse institutions than the average in a cross-section of countries. Since the exogenous FDI instrument loads very low on log income, the first stage predicted values for income turn out to capture only the quantity of oil exports, which relate negatively to institutions.

Table 22: Cross Sectional Reg., Dep.Var.: **Multidimensional Institutions Index**, Year: 2005
Estimation Method: Limited-Information Maximum Likelihood (LIML) | Error Matrix: Robust

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
OLS												
10*Non-Income Human Development Index	0.82***	0.83***	0.28	0.86***	1.04***	0.94***	0.81***	0.54***	0.72***	0.89***	1.04***	0.93***
	(0.14)	(0.15)	(0.21)	(0.16)	(0.17)	(0.18)	(0.15)	(0.19)	(0.14)	(0.15)	(0.17)	(0.18)
logGDPCapita	0.12	0.10	0.76***	0.13	-0.23	-0.07	0.13	-0.02	0.12	-0.14	-0.23	-0.09
	(0.19)	(0.20)	(0.22)	(0.17)	(0.16)	(0.18)	(0.20)	(0.27)	(0.19)	(0.18)	(0.16)	(0.18)
Observations	178	174	142	173	141	133	171	62	167	137	141	133
R^2	0.49	0.49	0.62	0.60	0.67	0.73	0.49	0.58	0.52	0.56	0.67	0.74
IV1: ME, ProtMis, PriEnr, ExogFDI, OilExpPC[a]												
10*Non-Income Human Development Index	1.58**	1.45**	1.12	1.94	-0.19	0.93	1.31**	0.96*	0.73	0.68	-0.06	1.73*
	(0.72)	(0.69)	(1.23)	(3.77)	(0.88)	(1.10)	(0.57)	(0.52)	(0.60)	(1.07)	(0.71)	(1.04)
Log GDP per capita (2011 PPP $) (UNDP)	-2.01	-1.78	-1.07*	-2.10	0.12	-1.17	-1.67	-1.54*	-1.42	-1.27	-0.18	-1.37**
	(1.24)	(1.13)	(0.61)	(3.17)	(0.80)	(0.85)	(1.07)	(0.89)	(0.97)	(0.93)	(0.63)	(0.68)
Dummy=1 if protmiss computed from Dennis et al.	3.19***	3.01***	2.90	3.08**	1.20	1.31	3.30***	1.62**	3.24***	1.83*	-0.12	0.04
	(0.83)	(0.82)	(2.35)	(1.22)	(0.93)	(1.79)	(0.85)	(0.78)	(0.87)	(1.00)	(0.90)	(2.51)
Observations	58	58	58	58	57	56	57	58	58	58	57	58
R^2	0.26	0.33	0.62	0.25	0.59	0.57	0.35	0.45	0.46	0.48	0.63	0.64
Kleibergen-Paap rk LM statistic[b]	4.57	5.60	12.93	7.08	8.51	6.53	5.48	4.60	4.80	7.37	8.11	7.28
Kleibergen-Paap P-Value	0.33	0.23	0.01	0.13	0.07	0.16	0.24	0.33	0.31	0.12	0.09	0.12
Hansen J statistic[c]	5.36	6.35	6.90	4.64	5.62	5.63	5.79	4.81	4.02	5.81	4.54	2.75
Hansen J P-Value	0.15	0.10	0.08	0.20	0.13	0.13	0.12	0.19	0.26	0.12	0.21	0.43
IV2: ME, ExogFDI, OilExpPC[a]												
10*Non-Income Human Development Index	1.33***	0.67*	0.08	-0.11	-0.15	-1.51	1.34***	0.53	0.97**	1.05**	-0.15	-2.44
	(0.42)	(0.40)	(0.66)	(0.77)	(0.69)	(2.58)	(0.42)	(0.43)	(0.44)	(0.43)	(0.69)	(3.17)
logGDPCapita	-1.31*	-0.99*	-0.81	-0.45	-0.48	0.81	-1.31*	-1.26**	-0.97	-1.13*	-0.48	1.40
	(0.67)	(0.59)	(1.28)	(0.61)	(0.61)	(1.64)	(0.67)	(0.64)	(0.71)	(0.60)	(0.61)	(1.96)
Observations	146	146	135	146	120	116	144	58	146	120	120	116
R^2	0.20	0.15	0.25	0.29	0.41	0.29	0.20	0.37	0.31	0.42	0.41	-0.04
Kleibergen-Paap rk LM statistic[b]	2.61	2.70	4.18	8.15	12.72	4.24	2.59	3.93	2.72	2.95	12.72	4.51
Kleibergen-Paap P-Value	0.27	0.26	0.12	0.02	0.00	0.12	0.27	0.14	0.26	0.23	0.00	0.10
Hansen J statistic[c]	0.04	0.13	0.80	0.04	0.99	2.06	0.01	0.03	0.13	0.23	0.99	1.82
Hansen J P-Value	0.84	0.72	0.37	0.85	0.32	0.15	0.93	0.86	0.72	0.63	0.32	0.18
Control Variables												
Latitude		YES		YES	YES	YES				YES^{IV1}	YES	YES
Continent Dummies				YES	YES	YES				YES^{IV1}	YES	YES
Landlocked Dummy				YES	YES	YES				YES^{IV1}	YES	YES
Legal Origin										YES^{IV2}_{OLS}		YES
Fractionalization Variables |Rel.|Ethn.|Lan.						YES						YES^{IV2}_{OLS}
Religious Affiliation in $1900^{IV1}/1980^{IV2}_{OLS}$						YES						YES^{IV2}_{OLS}
Log Population					YES						YES	
Colonial & Legal Origin Variables					YES						YES	
Population Share speaking English 2003									YES	YES^{IV2}_{OLS}		
Population Share speaking another EL									YES	YES^{IV2}_{OLS}		
AJR Capped Log Settler Mortality								YES		YES^{IV1}	YES^{IV1}	YES^{IV1}
Log Population Density in 1500								YES		YES^{IV1}	YES^{IV1}	YES^{IV1}
Trade as % of GDP							YES					
Temperatures and Humidity Levels			YES									YES^{IV1}
Falciparum Malaria Index 1994			YES									YES^{IV1}

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

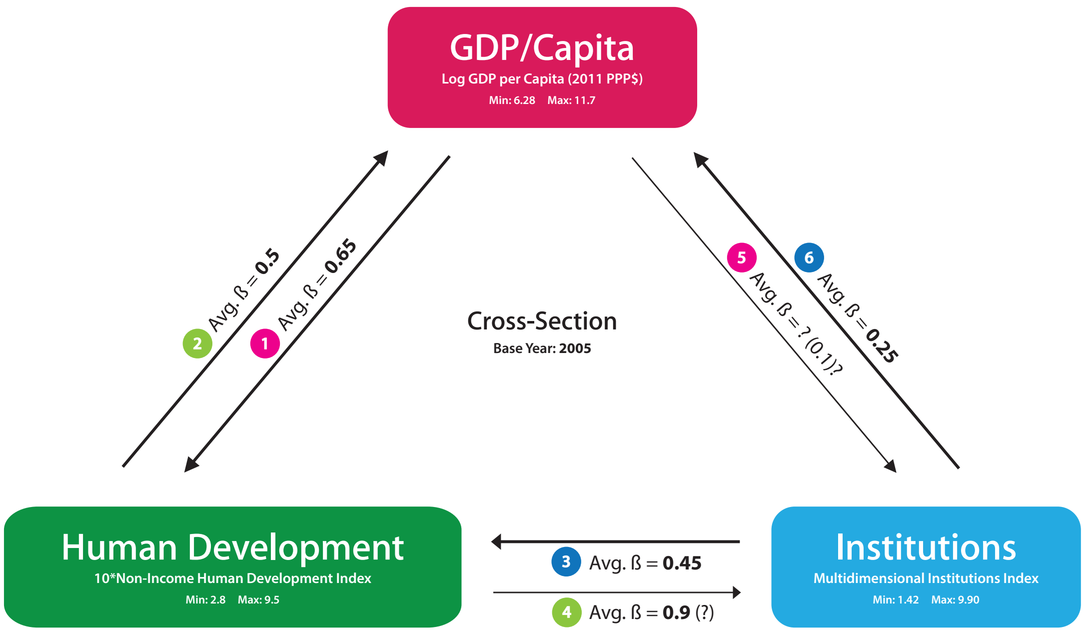
NOTE: Sub-and/or superscript on the control variables indicate to which specification (OLS, IV1 or IV2) they are added. A simple "YES" implies that this control applies to all three.
[a] Instruments IV1: Malaria ecology, protestant missionary activity and primary enrollment for human development, and exogenous FDI and the average oil export value per capita for income.
Instruments IV2: Malaria ecology for human development, and the exogenous component of FDI and the average oil export value per capita up to 2005 for income.
[b] Underidentification Test by Kleibergen and Paap, H0: Equation Underidentified
[c] Overidentification Test by Hansen, H0: Equation Exactly Identified

All of this suggests that the identification strategy pursued for income is not a very successful one, at least one that is unable to properly capture the feedback from growth to Institutions. The results of IV2 do not look any more pleasant. In IV2 only malaria ecology is used to instrument human development and income is again instrumented using the net oil export value per capita and the computed exogenous component of FDI. The first stage on log GDP per capita has a R^2 of 0.36 and the first stage NIHDI has an R^2 of 0.46. Despite these reduced loadings (which are due to the smaller instrument matrix), the first stage correlation coefficient remains very high at 0.95 ($R^2 = 0.91$), and the problem of multicollinearity persists. The identification statistics are similarly poor as in IV1, with merely 3 models exactly identified at the 5% level. The results are also the same as in IV1 and carry the trademark of multicollinearity and underidentification. For NIHDI (*10), five models are significant with a very large average coefficient of 1.1. For log GDP per capita, also five models are significant (albeit less significant than the NIHDI), with a large average negative coefficient of -1.1.

The conclusion from Table 22, considering especially the OLS models, is that human development seems to have a large positive impact in institutions, with an average coefficient on the untransformed NIHDI of approx. 9 (that is an increase of 0.1 in the non-income HDI would be followed by a 0.9 point increase in the MII). The instrumentation strategy employed failed to capture the impact of income on institutions, but the OLS sequence suggests that this channel is likely to be very weak (with an average coefficient of perhaps around 0.1).

The overall conclusion on this cross-sectional analysis is that it allowed for the successful estimation of two of the tree equations in the theoretical model, and provided estimations of chain strength that were to a large degree in line with the prior assumptions set in the theoretical section. Figure 10 summarizes the findings of this cross-sectional analysis. Question marks are placed behind coefficients that could either not be properly estimated, or who's magnitude is questionable.

Figure 10: Cross-Sectional Results Summary
Note: Coefficients apply to NIHDI scaled by 10



7 Panel-Data Model with Time-Varying Instruments

In this section, the model will be estimated using a panel of decadal averages from 1960 to 2010. An identification strategy using time-varying external instruments is followed. This is done in contrast to the literature which has relied on lagged initial values as instruments in a first-difference equation (under the assumption that lagged initial values of the edogenous predictors are uncorrelated with future error terms). Before this instrumentation strategy is further introduced though, this section will begin by taking a close look at the data to be used in this and the following section.

Figure 11 shows the main variables plotted over time. It is interesting to observe the divergence in income levels across the 5 continents starting roughly in 1940. This divergence stands in contrast to the plot for human development, where initial human development levels were further apart, but improved quite significantly on all continents. The two bottom plots of Figure 11 show world institutional development according to the effective and representative government index (ERG) (left) and the time series multidimensional institutions index (TS-MII) (right). The ERG plot shows a significant institutional development on all continents except for Africa. It also shows that the data for the ERG is not of very high quality, as some continent averages appear to be invariant over extended periods of time. This plot (and in the other plots as well) suffers from aggregation effects induced by data coverage increasing over time. For Oceania the plot shows an initially very high level of institutional development, which then begins to drop following 1960. This drop is explained by the fact that before 1960 the series only carried data for Australia and New Zealand, but following 1960 data coverage for all the other small Oceanic island states like Fiji begins, which pulls down the average. The plot for the TS-MII shows this same aggregation phenomenon for Oceania. It also shows a very high level of institutional persistence across the five continents, with substantial improvements (at the continent level) visible only in the Americas.

Figure 11: **World Development since 1800**
5-Year Intervals | By Continent

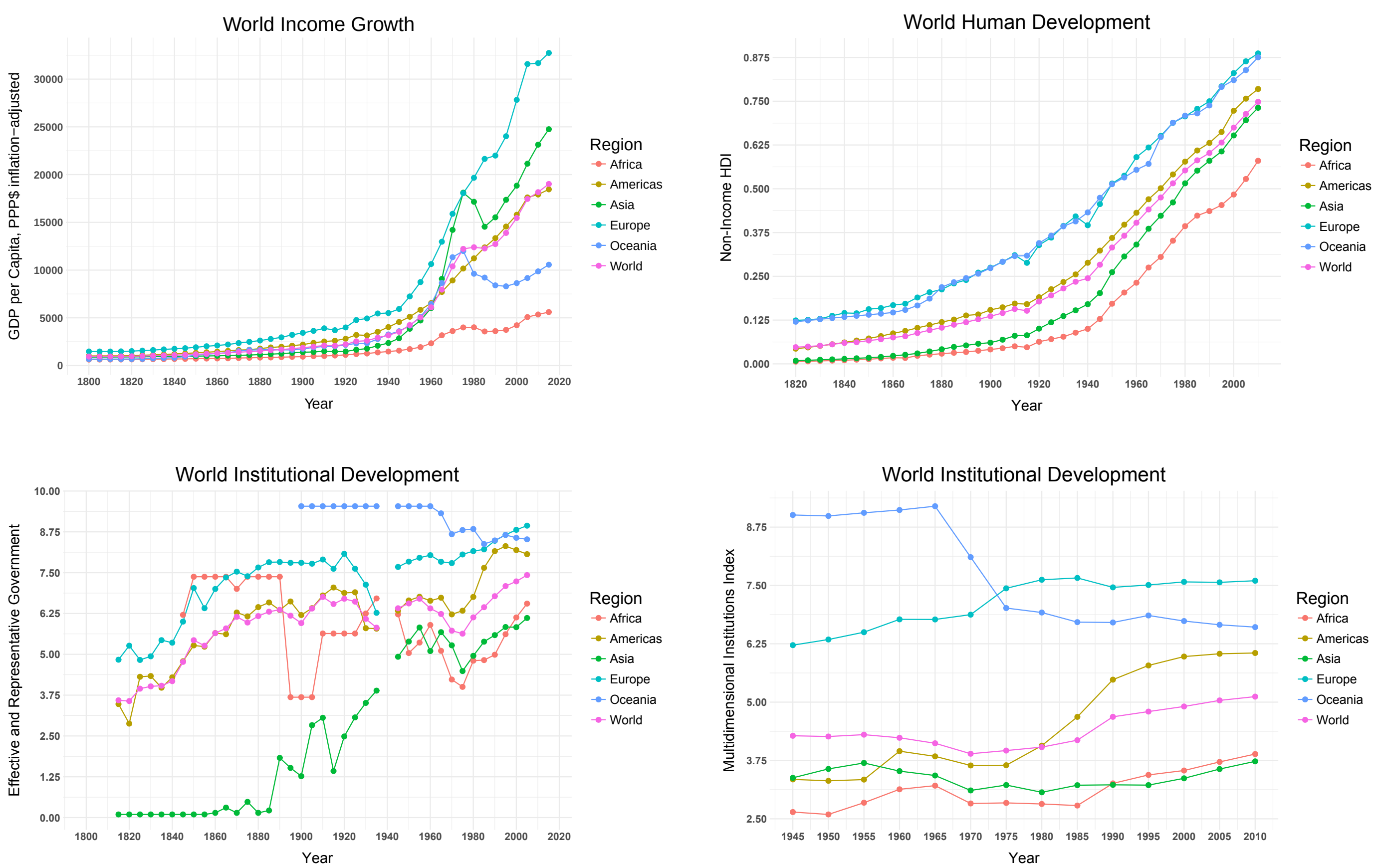


Figure 12: Wealth and Human Development over 200 years of History by Continent

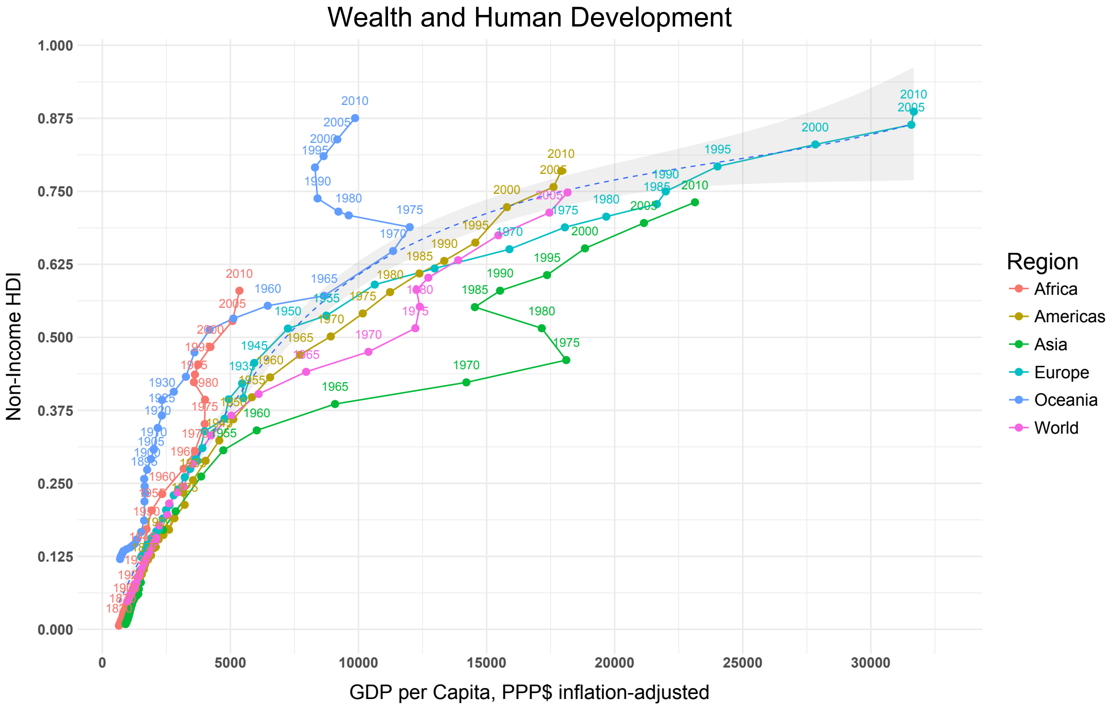


Figure 12 shows wealth plotted against human development over all available years. The figure is well known from the presentations of Hans Rosling, and suggests that human development takes primacy over income in driving the long-run development process. The plot again shows nasty aggregation effects, but these effects disappear when the data is further disaggregated, yielding a smooth funnel-shape as it is indicated by the lowess-smoother.

Figure 13: Average Weath and Human Development Growth 1950-2015

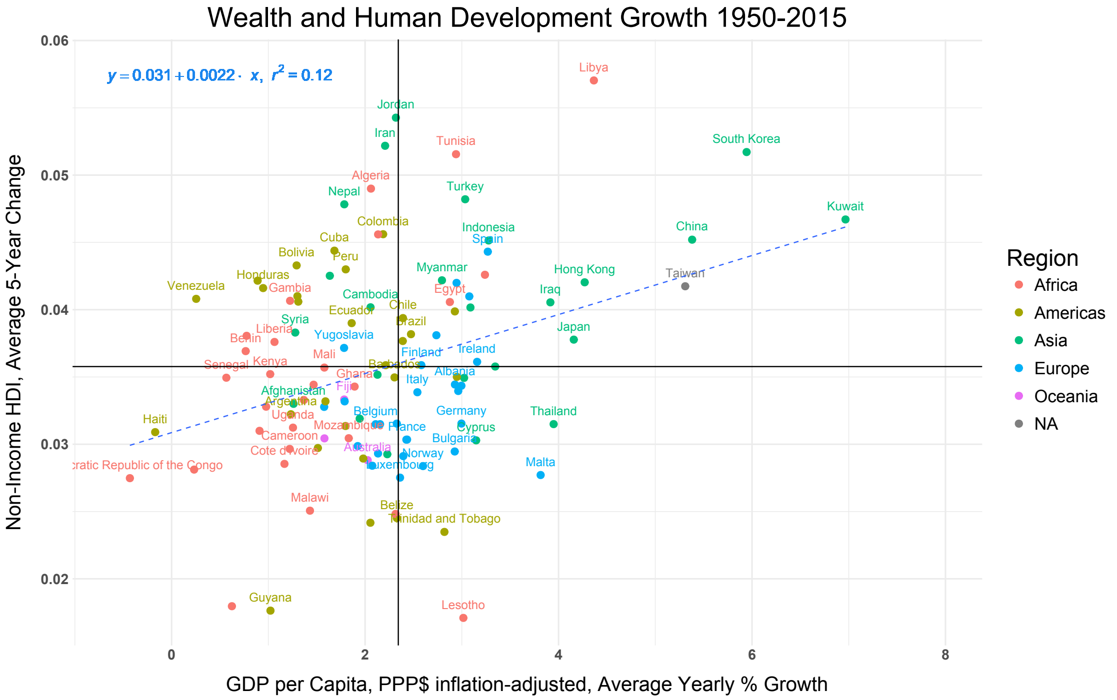
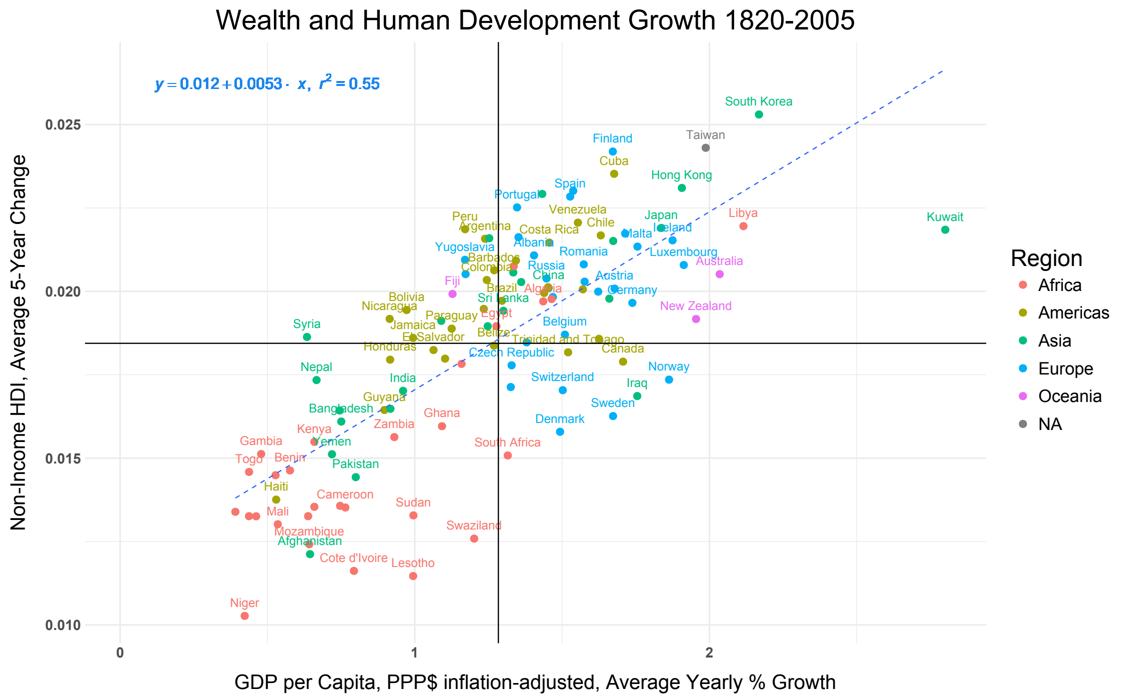


Figure 13 is inspired by Ranis et al. (2000), and shows the average yearly growth rate for each country over the period 1950-2015, plotted against the average 5-year change in the non-income HDI over the same period[40]. The black vertical line represents the world average growth rate over this period (computed as the average of all individual country average growth rates), and the black horizontal line represents the average 5-year NIHDI change (computed in the same manor). Figure 13 shows a very significant (though noisy) relationship between income growth and human development improvement. It also confirms the findings of Ranis et al. (2000) and Suri et al. (2011) that hardly any developing country experienced above-average income growth but below-average human development improvement. The bulk of developing countries seems to be caught up either in a vicious cycle (Africa), a HD-loopsided cycle with above-average human development (HD) improvement and below average growth (Latin-America), or a virtuous cycle with growth and HD reinforcing each other (East-Asia). This picture is consolidated in Figure 14, where the long term average growth rates over the 1820 to 2005 period are computed. Here the relationship between EG and HD is stronger than in Figure 13, and the only developing country which really seems to have experienced and EG driven development process is Iraq, an oil producer.

Figure 14: Average Wealth and Human Development Growth 1820-2005

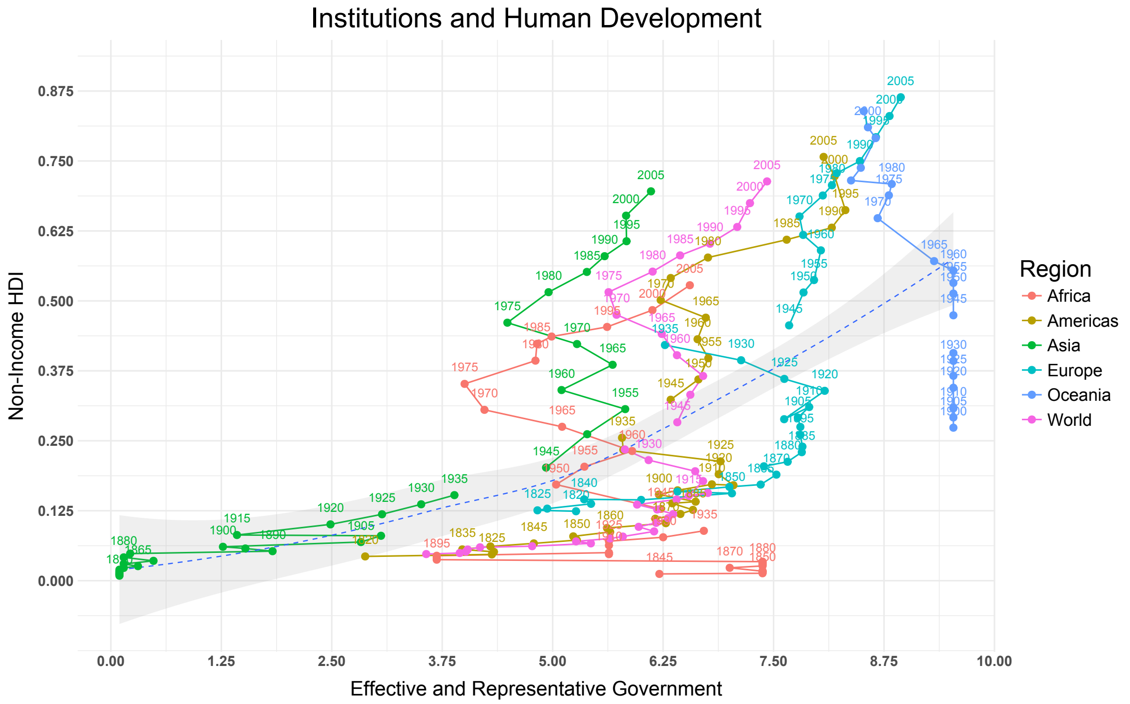


Figures 15, 16 and 17 tell the analog story for institutions and HD improvement. Figure 15 shows that institutions and HD have also been increasing together over the course of history. The shape of the lowess smoother might suggest that institutional improvements take a slight primacy over HD improvements. Overall this relationship is very noisy though, and it seems that exempting Europe, a strong positive relationship between HD and institutions only developed from the 1970's onwards. Going back to Figure 11 and comparing the EG and HD plots (where real growth only kicked in following the 1950's) with the Institutions graph (where institutional improvement is visible from the beginning), suggests that there might have been something like an institutional threshold that was passed after the second world war and allowed for very rapid institutional improvement and human development in subsequent decades. The idea of an institutional threshold remains speculative though and will not be further explored in this paper.

Figure 16 shows the world average 5-year HD and institutional improvement over the 1950-2015 period, analogous to Figure 13. In contrast to Figure 13 however the relationship seems to be very weak, and no systematic patterns (for example institutional improvement preceding HD

[40] 5-year intervals are employed here because the enrollment data of Barro and Lee used to compute the NIHDI is only available in 5-year intervals

Figure 15: Institutions and Human Development over 200 years of History by Continent



improvement) can be detected. Over the long-term (shown in Figure 17), the relationship between HD improvement and Institutional improvement collapses entirely, suggesting that the curved shape of the smoother in Figure 15 is misleading. Perhaps the strong linear relationship following the 1970's (in Figure 15) is indeed due to an institutional threshold having been passed.

Figure 16: Average Institutions and Human Development Improvement 1950-2015

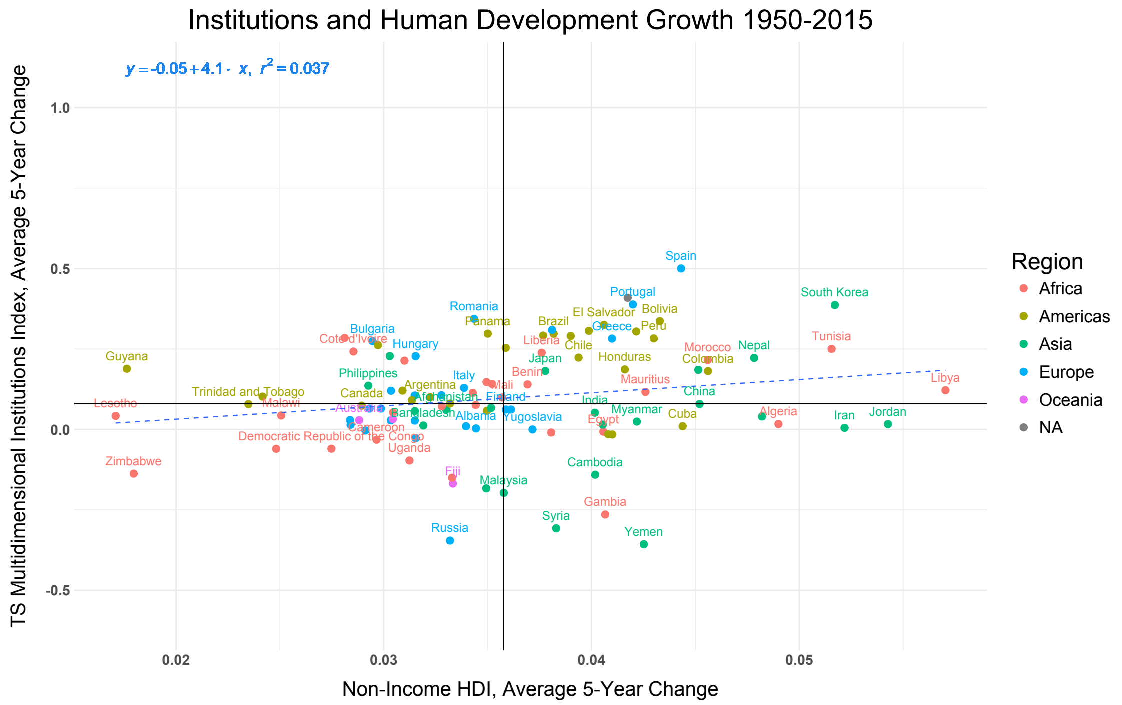
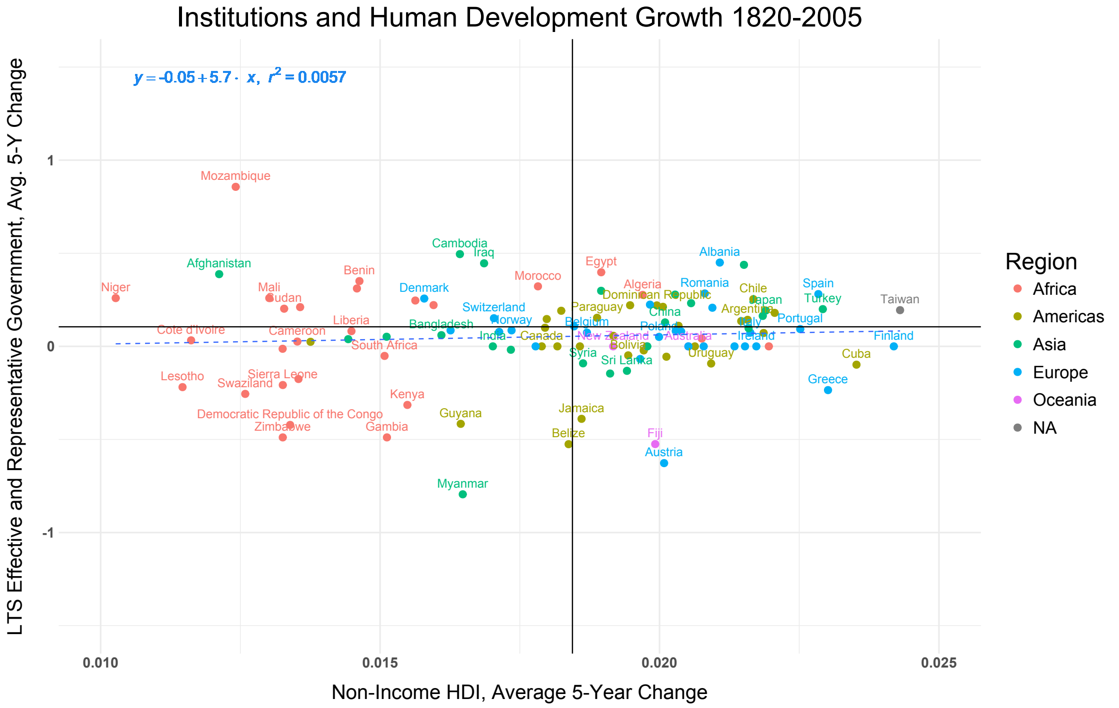


Figure 17: Average Institutions and Human Development Improvement 1820-2005



Figures 18, 19 and 20 document the relationship between income and institutions over time. Figure 18 shows a similar picture as Figure 15, but here the relationship seems almost nonexistent. A slight positive relationship between EG and institutional improvement appears to exist from 1950 to 2015, as Figure 19 shows. This relationship however collapses over the long-run, (see Figure 20), just as it was the case with institutions and human development.

Figure 18: Wealth and Institutions over 200 years of History by Continent

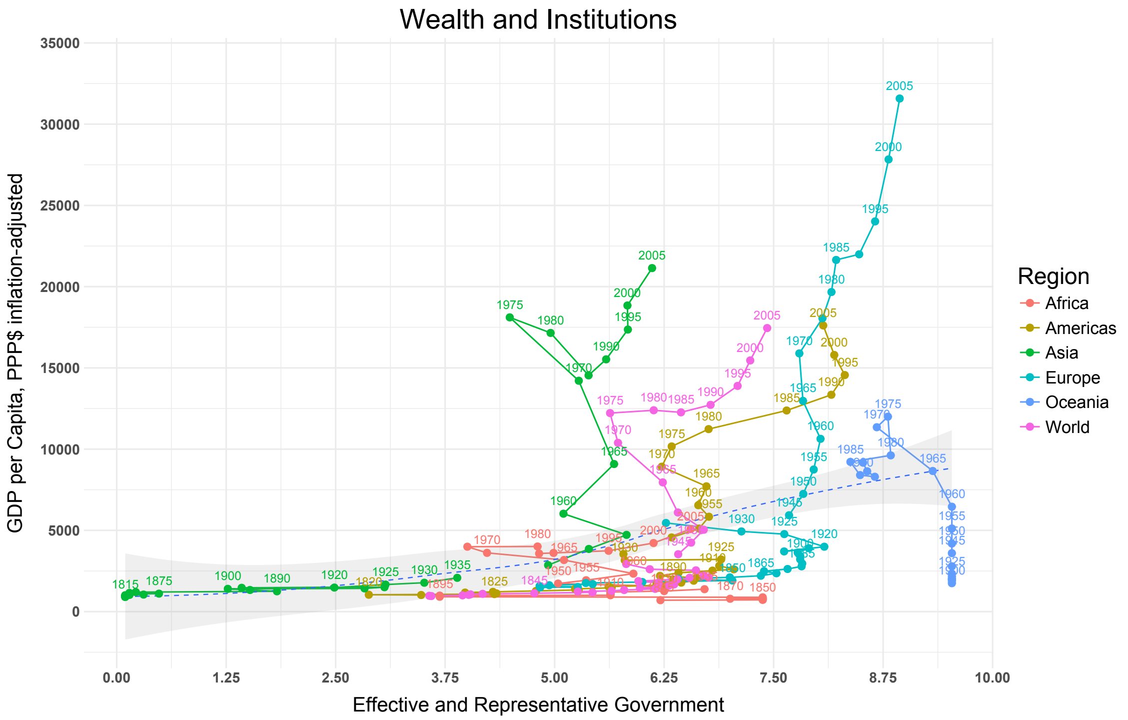
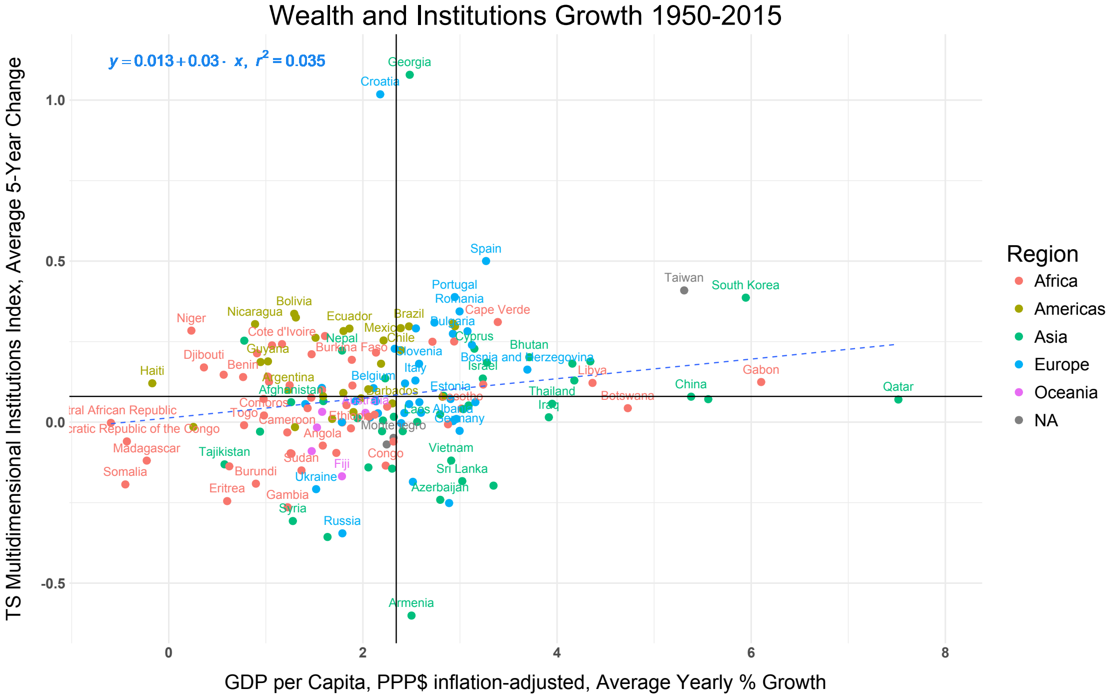


Figure 19: Average Wealth and Institutions Growth 1950-2015



This might again speak for the idea of an institutional threshold following WWII, after which joint institutional development and economic growth became possible. It might also simply suggest that the institutional data is too noisy (and too persistent), and growth to weak in earlier years to make their relationship visible (the same could be argued for institutions and human development improvement in order to evade threshold theories).

Figure 20: Average Wealth and Institutions Growth 1820-2005

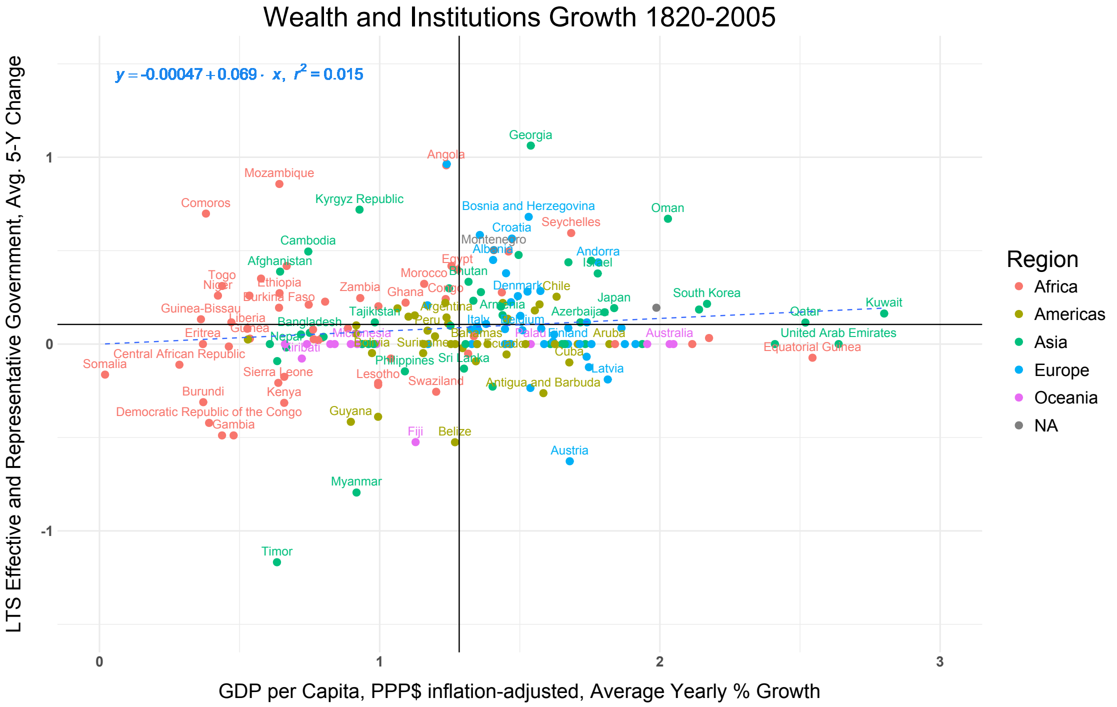


Table 23 provides a summary of the main variables and instruments employed in this section in decadal averages. This instrumentation strategy utilizes plausibly exogenous shocks to identify the model. For GDP per capita /GDP p.c. growth, the average oil and gas prices over each decade are taken as instruments. This is done under the assumptions that these prices are determined by exogenous market fluctuations, and that oil and gas prices impact the economic performance of nations producing these resources. In addition, the average oil production per capita per decade is computed as an additional instrument, under the assumption that resource endowments are exogenous and their exploitation due mainly to market demand and other exogenous factors. Finally, a dummy for financial crisis (computed from a nominal GDP growth series in the WDI) is taken as an additional instrument for GDP (and also for institutions) in the human development equation. The assumption here is that crisis are also due to exogenous and unpredictable events, and that they impact both income and the institutional environment (and are thus not a valid instrument for income in the institutions equation).

Table 23: Main Variables and Instruments, Decadal Averages 1960-2010

Variable	*Source*	*N*	*Mean*	*SD*	*Min*	*Max*
GDP per capita (2011 PPP $)	Gapminder	737	10619	11519	291	63,491
Log GDP per capita (2011 PPP $)	Gapminder	737	8.70	1.12	5.67	11.06
Non-Income Human Development Index	Authors Calculations	737	0.55	0.21	0.02	0.96
TS Multidimensional Institutions Index	Authors Calculations	737	4.84	2.77	0	10
All Instruments						
Constant price of oil in 2000 $/brl	Worldbank WDI	737	33.49	21.67	8.35	76.80
Constant price of gas in 2000 $/mboe	Worldbank WDI	737	1.69e+07	8.10e+06	0	2.94e+07
Financial Crisis Dummy (1=Crisis)	Authors Calc. (WDI)	562	0.14	0.17	0	1
Oil production in metric tons per Capita	Authors Calc. (WDI)	603	0.81	3.28	0	41.73
Biological Disaster (Epidemic etc.) Occurrence	EM-DAT at CRED	737	0.12	0.23	0	2
Biological Disaster (Epidemic etc.) Total Deaths	EM-DAT at CRED	737	18.44	85.05	0	1028
Biological Disaster (Epidemic etc.) Total Affected	EM-DAT at CRED	737	3084	28249	0	6.81e+05
Number of Revolutions	CNTS	619	0.21	0.36	0	2.30
Number of Coups d'Etat	CNTS	626	0.04	0.09	0	1
Number of Major Constitutional Changes	CNTS	626	0.09	0.14	0	1

Human development is instrumented with data on biological disasters (9) such as epidemics, plagues (locusts, severe animal diseases etc.) and others, taken from the Emergency Events Database at the Centre for Research on the Epidemiology of Disasters (CRED). The assumption here is that these events impact productivity and institutions only via human development. From this database the decadal averages of three series on occurrence (how many such events occurred per country per year), total deaths, and the total people affected are taken as instruments for HD. Finally, institutions are instrumented using data on the number of revolutions, the number of coups d'etat, and the number of major constitutional changes (10) from the Cross-National Time Series Data Archive (CNTS). This strategy is not without weaknesses as the instruments could be argued to be internal to institutional quality itself, and previous research has already employed similar data to proxy for institutions (for example Dollar & Kraay (2003) used the average number of revolutions per decade since 1960 as an alternative empirical proxy for institutional quality). The reasoning applied to still justify their use in this context, is that although revolutions and coups are to a certain extent endogenous to institutional quality, they are very often triggered by exogenous political events (e.g. scandals around politicians, invasions of external forces etc.). When a government is suddenly overthrown due to such an exogenous event and replaced by a new government, or sometimes by an entirely new political system, then this represents an exogenous shock to institutional quality and provides opportunities to identify the effect of institutions on HD and EG.

Table 24 shows the pairwise correlations matrix of all variables used in levels. The theory variables load highly onto each other, with correlation coefficients very similar to the cross-sectional ones (compare Table 19). Income and HD are highly correlated, whereas institutions loads a bit higher onto human development than income. The loadings of the instruments on the three theory variables are intuitive for the most part. Noteworthy are the negative loading of oil production per capita on institutions (which was already noted in the cross-section), the surprisingly positive loadings of disaster occurrence and total affected on HD, and the very high loadings of the oil and gas prices on HD.

Table 24: Correlation Matrix of Main Variables and Instruments

Pairwise Correlations in Levels (Decadal Averages)

# *Variable*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Log GDP per capita (2011 PPP $)	1											
(2) Non-Income Human Development Index	.87	1										
(3) TS Multidimensional Institutions Index	.60	.64	1									
All Instruments												
(4) Constant price of oil in 2000 $/brl	.22	.54	.10	1								
(5) Constant price of gas in 2000 $/mboe	.13	.40	.03	.39	1							
(6) Financial Crisis Dummy (1=Crisis)	-.04	-.06	-.10	-.10	-.01	1						
(7) Oil production in metric tons per Capita	.30	.01	-.08	-.04	-.02	.02	1					
(8) Biological Disaster (Epidemic etc.) Occurrence	-.09	.13	-.17	.14	.25	.03	-.08	1				
(9) Biological Disaster (Epidemic etc.) Total Deaths	-.04	-.07	-.10	.04	.03	.02	-.04	.12	1			
(10) Biological Disaster (Epidemic etc.) Total Affected	-.01	.04	-.03	.02	.00	-.02	-.02	.12	-.00	1		
(11) Number of Revolutions	-.25	-.24	-.30	-.07	-.12	.15	-.04	.14	-.01	-.01	1	
(12) Number of Coups d'Etat	-.20	-.26	-.26	-.13	-.16	.09	-.03	-.03	-.01	-.01	.40	1
(13) Number of Major Constitutional Changes	-.23	-.16	-.27	-.17	-.17	.21	-.02	.03	-.02	-.01	.33	.33

To take a second closer look at these correlations, Table 25 reports the same correlation matrix, but with the main variables in decadal changes (except for income, where the decadal change in log GDP/capita is replaced by the decadal average growth rate). Table 25 accommodates some surprises as well. Whereas changes in HD still load quite high onto changes in EG, changes in institutional quality appear to be unrelated to either. Furthermore changes in oil production are now unrelated to changes in institutions, whereas the price of oil has a substantial negative correlation with institutions. The biological disaster variables now load onto HD in the opposite way as in the levels matrix. Occurrence and total affected load slightly negative onto HD whereas total death loads slightly positive. At last, the financial crisis dummy now loads highly onto EG, and does not correlate with HD and institutions. A final unforeseen idiosyncrasy of this matrix is that the difference in the number of major constitutional changes loads negatively on growth but does not load onto institutions.

Table 25: Correlation Matrix of Main Variables and Instruments

Pairwise Correlations in First-Differences (Decadal Averages)

# *Variable*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) GDP per capita Growth (2011 PPP $)	1											
(2) Non-Income Human Development Index	.36	1										
(3) TS Multidimensional Institutions Index	.03	-.01	1									
All Instruments												
(4) Constant price of oil in 2000 $/brl	.05	.05	-.17	1								
(5) Constant price of gas in 2000 $/mboe	.03	.26	-.09	.09	1							
(6) Financial Crisis Dummy (1=Crisis)	-.38	.01	-.02	.05	-.03	1						
(7) Oil production in metric tons per Capita	.18	-.09	-0	-.02	-.04	-.11	1					
(8) Biological Disaster (Epidemic etc.) Occurrence	-.10	-.05	.05	-.29	.19	.04	.01	1				
(9) Biological Disaster (Epidemic etc.) Total Deaths	.01	.02	-.01	-.11	-.07	-0	0	.02	1			
(10) Biological Disaster (Epidemic etc.) Total Affected	-.02	-.04	-.01	-.06	-.08	0	0	.01	-.98	1		
(11) Number of Revolutions	-.12	-.14	-.06	-.10	-.17	.16	.03	.04	-.15	0	1	
(12) Number of Coups d'Etat	-.08	-.06	-.07	-.01	-0	.12	0	.02	-.05	-0	.38	1
(13) Number of Major Constitutional Changes	-.14	-.15	.01	-.22	-.22	.18	.04	.03	-.04	-.01	.31	.28

In the following part the model is estimated using different panel data estimators. For each equation 6 basic specifications are estimated, and this is then repeated with a set of control variables. The basic specifications are: *1.* A first-difference 2-stage lease squared (FD-2sls) estimator where the difference in the dependent variable is regressed on the differences in the independent variables (For GDP the decadal average growth rate is employed), which in turn are instrumented using differences of the instruments; *2.* A classical fixed-effect (FE) estimator instrumenting the endogenous theory variables with levels of the instruments; *3.* A one-step difference generalized methods of moments estimator (1s D-GMM) where a first-difference equation is instrumented using the external instruments in first differences in addition to gmm-style instruments (lagged levels 2 and onwards of the endogenous variables); *4.* The same 1s D-GMM estimator but without the GMM-style instruments; *5.* A two-step system GMM estimator (2s S-GMM) including gmm-style instruments, where the levels equation is instrumented using lagged differences of the endogenous predictors and levels of the external instruments, and the first difference equation is instrumented using twice lagged levels of the endogenous variables and differences of the external instruments; *6.* The same 2s S-GMM but without the gmm-style instruments. All specifications include time-fixed effects (in the form of decadal dummies added to the equation).

A particularity perhaps is that no lagged dependent variable is employed in any of these specifications. The reason for this is that the theoretical model does not stipulate such dynamic adjustment effects (although they might plausible exist in reality, for example in the form of persistent institutions). The focus of interest in this paper however is the contemporaneous effect of institutions, human development and income on each other, and to which extent these three are moving in equilibrium. Properly instrumenting for endogenous variables should allow for the identification of contemporaneous causal effects, and dynamic adjustment effects are to be investigated in another paper. Other reasons for not including the lagged dependent variable were that doing so would bias the fixed-effects estimator, and that the current specification renders the results more directly comparable to the cross-section.

In a second step these 6 specifications are re-estimated under the addition of 11 control variables. These include 3 variables measuring the magnitude of violence (international, ethnic or civil) (taken from the QOG dataset), 5 items documenting properties of the population (% working age, % urban, density, total, and annual % growth), 2 agricultural indicators (arable land fraction and average precipitation per year), and the trade share as % of GDP. The latter 8 are all taken from the WDI. The trade share was included as a control variables despite trade policy being plausibly endogenous to institutional quality (as argued in the introduction), because it was empirically found that differences in the trade share correlate only minimally with changes in institutions (r=0.05), but have quite large effects on changes in income (r=0.25) and HD (r=0.13). The controls are included in levels or in first differences depending on the form of the main equation. An exception to this is the FD-2sls estimator, in which population size and urban population fraction are added in levels to account for 'market-size' effects.

7.1 Empirical Results

For convenience the results for all three equations are reported in a single great table (Table 26), in which the estimator is specified at the top and the choice of control variables indicated at the bottom. Just as for the cross-section, under-and overidentification statistics are reported, and for the GMM estimators, the Arellano-Bond test for second-order autocorrelation (in differences) is reported[41].

For the first equation with log GDP per capita as the dependent variable, Table 26 presents a large impact of HD on income, and no effect of institutions. The impact of HD appears to be very large at around 0.5 in magnitude (as taken from the final 2s S-GMM with controls (12), which is probably the most reliable estimator in this ensemble). This can be interpreted as that a change in the non-income HDI of 0.1 would yield an approximately 50% increase in income over that decade[42]. The FD-2sls estimator with the decadal average growth rate as the dependent variable therewhile suggests that 0.1 point increase in the non-income HDI would result in an 4.1% increase of the average growth rate over that decade. This is very congruent to the message from the system-GMM estimator since $100\% * (1+0.041)^{10} = 149,5\% \approx 150\%$, or a 50% increase in income. The identification statistics on this series are rather unsatisfactory and suggest that most models are slightly underidentified. Adding control variables causes the coefficients of all models to drop by around 30-40% and generally improves identification. The results for the second equation with the MII as the dependent variable are generally rather disappointing since only few specifications pick up a significant effect. The Table shows that income does not appear to have a significant effect on institutional quality, whereas the 1s D-GMM (including lagged levels as instruments) picks up a potentially large effect of HD on institutions of around 0.6 in size. This effect is ostensibly robust to the inclusion of control variables, and would imply that a 0.1 point increase in the non-income

[41] This test checks for AR(2) in differences in order to test for AR(1) in levels and, if significant, would indicate the presence of first-order serial correlation in the levels equation, suggesting that some of the lags or external instruments are in fact endogenous, and thus bad instruments.

[42] Technically, the proper interpretation of log-linear models is $\%\Delta y = 100 * (e^{\beta x} - 1)$, which in this case would result in a $\%\Delta y = 100 * (e^{0.5} - 1) = 65\%$ change in income.

HDI over the course of a decade triggers a response of 0.6 points in terms of institutional quality. This effect is certainly of questionable magnitude, but it seems to fit well with the cross-section, which also displayed a potentially large feedback from HD to the quality of governance.

Table 26: Time-Varying External Instruments, Decadal Averages 1960-2010
Error Matrix: Cluster Robust

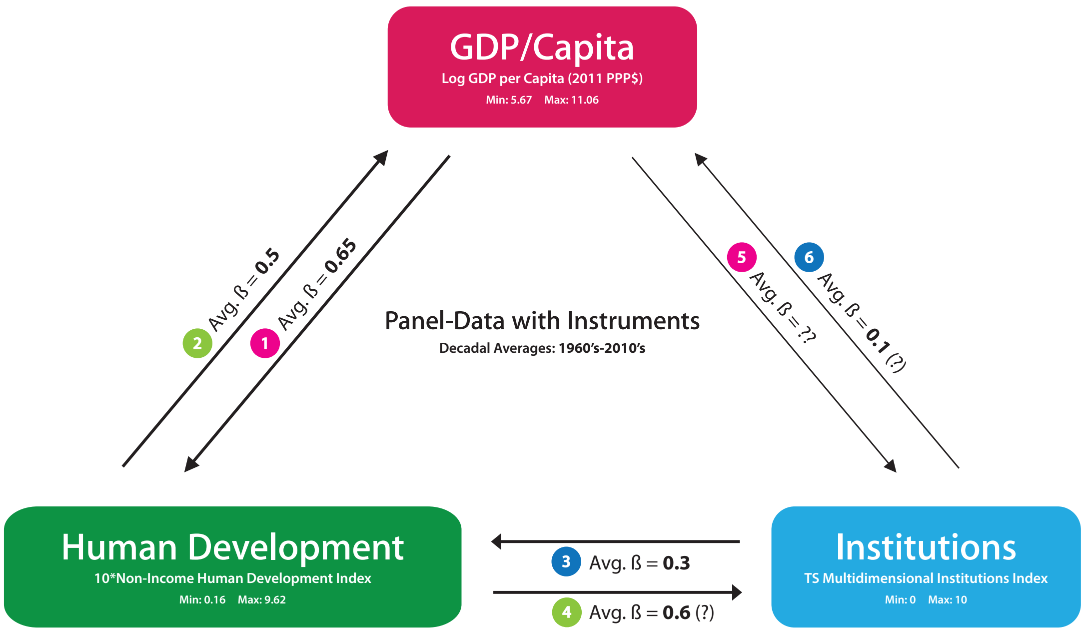
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Estimator	FD-2sls	FE	1s D-GMM	1s D-GMM	2s S-GMM	2s S-GMM	FD-2sls	FE	1s D-GMM	1s D-GMM	2s S-GMM	2s S-GMM
Instruments	FD	levels	levels +Lags 2 - .	levels	levels +Lags 2 - .	levels	FD	levels	levels +Lags 2 - .	levels	levels +Lags 2 - .	levels
Dependent Variable: **Log GDP per Capita, PPP$ inflation−adjusted**												
Multidimensional Institutions Index	-1.93	-0.01	0.09**	-0.19	0.07*	-0.10*	0.10	-0.13*	0.00	-0.03	0.04	-0.02
	(1.88)	(0.18)	(0.04)	(0.17)	(0.04)	(0.06)	(0.64)	(0.07)	(0.02)	(0.06)	(0.03)	(0.04)
10*Non-Income HDI	7.60**	0.79**	-0.26**	0.62**	0.50***	0.77***	4.10***	0.43***	-0.03	0.34***	0.20***	0.47***
	(3.00)	(0.36)	(0.10)	(0.26)	(0.05)	(0.08)	(1.20)	(0.16)	(0.11)	(0.10)	(0.06)	(0.10)
Observations	512	616	512	512	617	617	340	443	340	340	445	445
R^2	-1.43	0.32					0.19	0.48				
Number of Countries		104	104	104	105	105		100	100	100	102	102
Number of Instruments	6	6	114	12	127	13	6	6	97	21	108	22
Kleibergen-Paap rk LM statistic (Underid. test)	4.26	3.97					7.70	9.64				
Kleibergen-Paap P-Value (H0: Underidentified)	0.51	0.55					0.17	0.09				
Hansen J statistic (Overidentification test)	1.72	10.01					3.51	3.65				
Hansen J P-Value (H0: Equation Identified)	0.79	0.04					0.48	0.46				
Arellano-Bond test for AR(2) in first differences			1.56	1.29	1.88	1.54			1.91	1.31	3.20	1.89
Arellano-Bond P-Value (H0: No AR(2))			0.12	0.20	0.06	0.12			0.06	0.19	0.00	0.06
Hansen overidentification test for GMM			94.54	NA	101.23	NA			84.89	NA	86.73	NA
Hansen GMM P-Value (H0: Equation Identified)			0.35	NA	0.50	NA			0.03	NA	0.11	NA
Dependent Variable: **Multidimensional Institutions Index**												
Log GDP per Capita, PPP$ inflation−adjusted	-0.12	-0.18	0.52	-1.13*	0.82*	-0.84	0.24	-0.78	0.36	-1.00	0.81*	0.16
	(0.08)	(0.45)	(0.41)	(0.61)	(0.46)	(0.59)	(0.29)	(1.00)	(0.56)	(1.01)	(0.45)	(1.16)
10*Non-Income HDI	0.78	0.46	0.59***	0.73	0.49*	1.52***	0.96	0.18	0.65***	0.56	-0.01	-0.63
	(0.80)	(0.71)	(0.22)	(0.64)	(0.27)	(0.42)	(1.31)	(0.96)	(0.22)	(0.66)	(0.29)	(0.99)
Observations	499	603	499	499	603	603	442	547	442	442	547	547
R^2	-0.05	0.29					-0.16	0.29				
Number of Countries		104	104	104	104	104		102	102	102	102	102
Number of Instruments	6	6	181	11	194	12	6	6	192	22	205	23
Kleibergen-Paap rk LM statistic (Underid. test)	13.55	12.57					3.43	12.83				
Kleibergen-Paap P-Value (H0: Underidentified)	0.02	0.03					0.63	0.02				
Hansen J statistic (Overidentification test)	1.12	6.87					3.45	5.52				
Hansen J P-Value (H0: Equation Identified)	0.89	0.14					0.49	0.24				
Arellano-Bond test for AR(2) in first differences			-1.78	-1.68	-1.71	-1.63			-1.83	-1.89	-0.70	-0.91
Arellano-Bond P-Value (H0: No AR(2))			0.07	0.09	0.09	0.10			0.07	0.06	0.49	0.36
Hansen overidentification test for GMM			94.08	NA	99.43	NA			86.14	NA	90.07	NA
Hansen GMM P-Value (H0: Equation Identified)			1	NA	1	NA			1	NA	1	NA
Dependent Variable: **10*Non-Income HDI**												
Multidimensional Institutions Index	0.48**	0.46***	0.14***	0.46**	0.15***	0.35***	0.31**	0.34***	0.11***	0.30**	0.08*	0.16
	(0.21)	(0.13)	(0.04)	(0.20)	(0.05)	(0.11)	(0.15)	(0.11)	(0.04)	(0.15)	(0.05)	(0.14)
Log GDP per Capita, PPP$ inflation−adjusted	0.03	0.39	0.22	0.54	0.98***	0.62**	0.03	0.19	0.12	0.53	0.67***	0.62**
	(0.03)	(0.42)	(0.15)	(0.39)	(0.10)	(0.26)	(0.03)	(0.34)	(0.19)	(0.36)	(0.11)	(0.25)
Observations	351	452	351	351	455	455	334	432	334	334	436	436
R^2	-1.07	0.77					-0.29	0.84				
Number of Countries		101	101	101	104	104		98	98	98	102	102
Number of Instruments	7	7	95	11	106	12	7	7	106	22	117	23
Kleibergen-Paap rk LM statistic (Underid. test)	5.42	8.89					6.23	8.87				
Kleibergen-Paap P-Value (H0: Underidentified)	0.49	0.18					0.40	0.18				
Hansen J statistic (Overidentification test)	4.14	1.51					6.39	2.01				
Hansen J P-Value (H0: Equation Identified)	0.53	0.91					0.27	0.85				
Arellano-Bond test for AR(2) in first differences			-1.10	-1.60	-0.31	-1.45			-1.38	-2.03	-1.17	-1.53
Arellano-Bond P-Value (H0: No AR(2))			0.27	0.11	0.76	0.15			0.17	0.04	0.24	0.13
Hansen overidentification test for GMM			90.29	NA	88.75	NA			84.70	NA	81.99	NA
Hansen GMM P-Value (H0: Equation Identified)			0.06	NA	0.26	NA			0.13	NA	0.45	NA
Control Variables												
Magnitude International Warfare							YES	YES	YES	YES	YES	YES
Magnitude Ethnic Violence							YES	YES	YES	YES	YES	YES
Magnitude Civil War							YES	YES	YES	YES	YES	YES
Population ages 15-64 [% of total]							YES	YES	YES	YES	YES	YES
Urban population [% of total]							YES	YES	YES	YES	YES	YES
Population density [per sq. km]							YES	YES	YES	YES	YES	YES
Population [total]							YES	YES	YES	YES	YES	YES
Population growth [annual %]							YES	YES	YES	YES	YES	YES
Arable land [% of land area]							YES	YES	YES	YES	YES	YES
Average precipitation [mm per year]							YES	YES	YES	YES	YES	YES
Trade [% of GDP]							YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A conspicuous peculiarity in these results is the very large coefficient of 1.52 on the uncontrolled 2s S-GMM estimator. Since this effect however disappears when the controls are added, no further attention is devoted to it. The identification statistics for this equation are better than for the previous equation and signify that most models are well-identified.

In the equation predicting human development, both institutions and income show significant effect, although more models pick up the effect of institutions than the effect of income. The impact of institutions varies quite a bit, with significant coefficients ranging from 0.11 to 0.48. Considering only the models with added controls, 0.3 surfaces as the proper coefficient, and it is certainly not too far off from the cross-sectional coefficient of around 0.45. A coefficient of 0.3 would mean that a 1 point increase in the overall quality of governance (on a scale from 0 to 10), would have a response of 0.03 in the non-income HDI over the course of a decade. This does not seem implausible. The average effect of income on HD, considering the 4 significant system-GMM estimators, emerges as around 0.65. This coefficient matches the cross sectional coefficient exactly, and purports that at 100% increase in income has a human development return of 0.065 in the non-income HDI over the course of a decade. The identification statistics for this equation indicate that the FD-2sls and FE models are slightly underidentified, whereas the GMM estimators seem to be well identified. Figure 21 provides a compact summary of the results of this section. Besides the unfortunate inability of these specifications to properly capture the relationship between institutions and income, the results using decadal changes and time-varying instruments are very similar to those of the cross section. Noteworthy is in particular the two-way relationship between income and HD, which emerges to be empirically rock-solid.

Figure 21: Panel with Time-Varying Instruments Results Summary
Note: Coefficients apply to NIHDI scaled by 10



8 Long-Term Panel with Lags as Instruments

In this section the focus shall be on the evolution of income, human development and institutions in the medium and the very long run, as far as data are available. The section starts with an estimation of the model where exactly the same variables as in the previous section are employed, but this time computed as 5-year averages over the whole available data range from 1945 to 2010. Identification is achieved using only lagged values as instruments. This will be followed by an estimation of the model in decadal averages over the period 1820-2010 using the effective and representative government index and identification via lagged values.

The central idea behind using lagged values to empirically identify a model like this one, is the assumption that past values of the endogenous predictors are unrelated to future error terms, and that thus past values can serve as valid instruments to identify the model. This assumption is questionable in this context, since in a fully endogenous model like the present one, past values of one variable affect past values of the other variables as well, which in turn impact the present values of that variable. Worse even, they might impact variables that cause the dependent variable but are omitted from the model. It can thus not be assumed that past values of an endogenous predictor in this context only affect the dependent variable via their future values. The lagged values are thus neither really exogenous to the model nor strictly valid instruments in terms of only working through the future values of that same variable. Proper identification can nevertheless be achieved in assuming that past values are correlated with their own future values more strongly than with the future values of any other variable, and that all essential endogenous variables (that are both effected by the variable under consideration and also cause the dependent variable) are already included in the model. Under this assumption then the impact of the lagged values on other endogenous variables (which themselves are also instrumented by their own lagged values), is partialled out in the regression and the model can be identified (e.g. what remains inside the error term is then unrelated to the instruments). To identify the model using this strategy, it must therefore be assumed that no major endogenous variables that are both determined by income, HD or institutions and also cause either income, HD or institutions are omitted from the model. Of the variables considered in the literature, only geography and trade come to mind as potential other such variables of significant magnitude. Of these two, geography is clearly exogenous, and trade appears to be much less related to institutions than originally assumed (as a brief discussion in the previous section showed). Furthermore the trade share is also available as a control. Under these considerations the conclusion may be drawn that no major endogenous confounders matching the above criteria are omitted from this model, and thus a strategy using lagged values as instruments will permit the model to be identified.

Table 27 shows again a brief summary of the variables used, in their new form as 5-year averages.

Table 27: Main Variables and Instruments, 5-Year Averages 1945-2010

Variable	*Source*	*N*	*Mean*	*SD*	*Min*	*Max*
GDP per capita (2011 PPP $)	Gapminder	1293	10,484	11,297	265	64,499
Log GDP per capita (2011 PPP $)	Gapminder	1293	8.69	1.12	5.58	11.07
Non-Income Human Development Index	Authors Calculations	1293	0.54	0.21	0.01	0.96
TS Multidimensional Institutions Index	Authors Calculations	1293	4.81	2.79	0	9.99

Table 28 displays the pairwise correlations of the three variables both in levels (left) and differences (right), where for income the 5-year difference was replace by the average annual growth rate over the 5-year period. The top left of Table 28 shows again that the levels of the three theory variables load high onto each other in much the same manor as Table 24 already showed. It however also reveals that the average growth rate of GDP correlates positively with both the level of institutional quality and the level of human development, whereby the level of human development appears to be about three times as important. The 5-year difference in HD on the other hand also relates to levels of income, but not (or surprisingly slightly negatively) to levels in institutional quality. Changes in institutional quality finally present themselves as weekly related to levels of income and HD. The right lower side of Table 28 also confirms the message from Table 25 that growth and changes in HD are strongly related whereas changes in institutions appear unrelated to either. It also shows that the level of GDP relates to differences in HD and to a weak extent also to differences in institutional quality.

Table 28: Correlation Matrix of Main Variables and Instruments
Pairwise Correlations in Levels and Differences (5-Year Averages)

#	*Variable*	(1)	(2)	(3)	(G.1)	(D.2)	(D.3)
(1)	Log GDP per capita (2011 PPP $)	1					
(2)	Non-Income Human Development Index	.87	1				
(3)	TS Multidimensional Institutions Index	.59	.64	1			
(G.1)	GDP per capita Growth (2011 PPP $)	.27	.26	.07	1		
(D.2)	Non-Income Human Development Index	.33	.44	-.05	.28	1	
(D.3)	TS Multidimensional Institutions Index	.06	.08	.17	.004	-.02	1

The empirical estimation of the model is conducted using 4 different panel-data estimators. For each of these a basic specification is estimated, and then a specification with added controls. The basic specifications are: *1.* A FD-2sls estimator using lagged levels 1 through 5 as instruments; *2.* a FE estimator also using lagged levels 1 through 5 as instruments; *3.* A 1s D-GMM estimator using lagged levels 2 through 6 as instruments and *4.* a 2s S-GMM using lagged levels 2 through 6 as instruments for the first-difference equation, and first differences 1 through 5 as instruments for the levels equation. All of these specifications include time-fixed effects. In addition to these main specifications, 4 exploratory estimators are added which treat the independent variables as exogenous. These are: *1.* A simple FD estimator with time-fixed effects included; *2.* A FE estimator (+ time fixed effects); *3.* OLS with time fixed effects and *4.* normal OLS. For the main specifications, under-and overidentification statistics are reported as in the previous section.

8.1 Empirical Results 5-Year Panel, 1945-2010

Table 29 shows the medium-term results. It is constructed differently than Table 26 insofar that now 4 columns are devoted to each dependent variable and the choice of estimators is indicated at the top of each horizontal section. Moving strait to interpretation, the first 4 columns of Table 29 suggest that human development has a large effect on income whereas institutional changes do not seem to matter. The effect of HD varies between 0.11 and 0.54. The 2s S-GMM estimator with control variables is most likely the most reliable estimator in this context, thus the effect may be assumed to be around 0.35 in magnitude (slightly smaller than in the previous section). The identification statistics demonstrate that all models are well-identified. The next 4 columns report the results for the equation predicting HD. The results here exhibit a significant effect of both institutions and income on HD. The effect of income is quite large, judging from the two highly significant 2s S-GMM coefficients. Picking the latter one with control variables as result of choice, yields a coefficient of 0.73 for the impact of GDP on human development. This is overall in line with the cross section and the results of the previous section. Concerning the effect of institutions on HD, the significant coefficients vary between 0.09 and 0.16, where the models with controls added produce distinctly smaller and partly insignificant coefficients. Taking into account that some of the controls (magnitude of international, civil or ethnic warfare and the trade share) might be endogenous to institutional quality, the result of choice is a coefficient of 0.1 for the effect of institutions on HD. This coefficient is 3 times smaller than the coefficient of 0.3 found in the previous section. The models for this equation are not as well identified as in the previous equation.

Finally, columns 8 through 12 display the results for the equation predicting institutional quality. For the effect of HD, 2 significant coefficients are available. The 2s S-GMM without controls yields a coefficient of 0.63, and the FD-2sls with controls presents a coefficient of 0.72. Of these two 0.63 seems to be the more reasonable magnitude, also considering that it is very closely in line with the cross-section and the time-varying instruments section. Moving towards the effect of income, the only coefficient significant at the 5% level is given by the FD-2sls estimator without controls. With 0.05 it is very small, which is congruent with the failures in the previous sections to identify this effect. The identification statistics for this equation are overall not charming, but represent a slight improvement over the previous equation.

Table 29: Medium-Term Panel Estimations, 5-year Averages, 1945-2010
Error Matrix: Cluster Robust

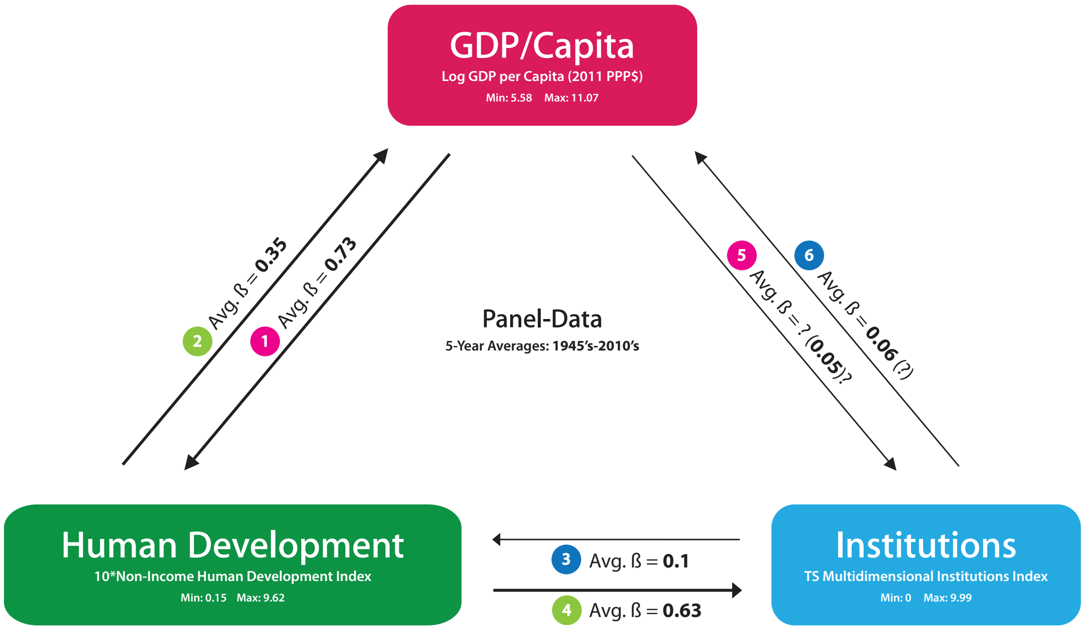
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable:	GDP/C Gr	logGDP/C	logGDP/C	logGDP/C	D.10*NIHDI	10*NIHDI	10*NIHDI	10*NIHDI	D.MII	MII	MII	MII
OLS and other Exploratory Estimators												
tFE=Time-Fixed-Effects, FE=Fixed Effects (C+t)												
Estimator	FD+tFE	FE	OLS+tFE	OLS	FD+tFE	FE	OLS+tFE	OLS	FD+tFE	FE	OLS+tFE	OLS
Multidimensional Institutions Index	0.19	0.034	0.054***	0.099***	0.0021	0.033	0.14***	0.14***				
	(0.14)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)				
10*Non-Income HDI	1.12***	0.14***	0.49***	0.35***					0.01	0.19	0.76***	0.40***
	(0.32)	(0.04)	(0.03)	(0.02)					(0.07)	(0.16)	(0.17)	(0.10)
Log GDP per Capita, PPP$ inflation−adjusted					0.013***	0.30***	1.08***	1.28***	0.0098	0.43	0.66**	1.06***
					(0.0047)	(0.086)	(0.082)	(0.083)	(0.0068)	(0.28)	(0.26)	(0.24)
Observations	1,188	1,293	1,293	1,293	1,188	1,293	1,293	1,293	1,188	1,293	1,293	1,293
R^2	0.11	0.63	0.76	0.70	0.05	0.91	0.84	0.68	0.06	0.27	0.52	0.48
Number of Countries		105				105				105		
IV-Models using Lags as Instruments (all models with time-fixed-effects)												
Estimator	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM
Instruments	Lag1-5	Lag1-5	Lag2-5	L2-6/LD1-6	Lag1-5	Lag1-5	Lag2-6	L2-6/LD1-6	Lag1-5	Lag1-5	Lag2-6	L2-6/LD1-6
Multidimensional Institutions Index	0.68	-0.01	0.05	0.05	0.10***	0.09***	0.11**	0.16***				
	(0.54)	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.05)	(0.04)				
10*Non-Income HDI	-1.98	0.19***	-0.37***	0.54***					0.42	0.09	0.29	0.63***
	(1.47)	(0.07)	(0.10)	(0.07)					(0.32)	(0.20)	(0.24)	(0.25)
Log GDP per Capita, PPP$ inflation−adjusted					0.02	0.21*	0.24*	1.02***	0.05**	0.51*	0.64*	0.64*
					(0.02)	(0.12)	(0.14)	(0.10)	(0.03)	(0.31)	(0.37)	(0.35)
Observations	771	771	1,188	1,293	771	771	1,188	1,293	1,188	1,293	1,188	1,293
R^2	-0.01	0.47			-0.01	0.86			-0.01	0.27		
Number of Countries		100	105	105		100	105	105		105	105	105
Number of Instruments			128	155			128	155			143	172
Kleibergen-Paap rk LM statistic (Underid. test)	34.67	44.80			21.50	47.75			24.24	53.27		
Kleibergen-Paap P-Value (H0: Underidentified)	<0.01	<0.01			0.01	<0.01			<0.01	<0.01		
Hansen J statistic (overidentification test)	9.25	10.76			15.64	20.99			7.54	16.56		
Hansen J P-Value (H0: Equation Identified)	0.32	0.22			0.05	0.01			0.48	0.04		
Arellano-Bond test for AR(2) in first differences			1.70	-0.65			-2.08	-1.46			-2.12	-2.19
Arellano-Bond P-Value (H0: No AR(2))			0.09	0.51			0.04	0.14			0.03	0.03
Hansen Overidentification for GMM			90.05	100.67			94.42	91.59			97.88	93.41
Hansen GMM P-Value (H0: Equation Identified)			0.25	0.68			0.16	0.87			0.46	0.98
OLS and other Exploratory Estimators + Control Variables												
Estimator	FD+tFE	FE	OLS+tFE	OLS	FD+tFE	FE	OLS+tFE	OLS	FD+tFE	FE	OLS+tFE	OLS
Multidimensional Institutions Index	0.13	0.00	0.03*	0.06***	0.02	0.05**	0.06**	0.03				
	(0.14)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)				
10*Non-Income HDI	0.95**	0.09**	0.32***	0.20***					0.11	0.39**	0.45***	0.18
	(0.38)	(0.04)	(0.04)	(0.04)					(0.08)	(0.16)	(0.17)	(0.13)
Log GDP per Capita, PPP$ inflation−adjusted					0.01**	0.24**	0.73***	0.53***	0.01	0.05	0.48*	0.79***
					(0.01)	(0.11)	(0.08)	(0.09)	(0.01)	(0.35)	(0.27)	(0.25)
Observations	863	969	969	969	863	969	969	969	863	969	969	969
R^2	0.28	0.65	0.86	0.82	0.09	0.90	0.89	0.84	0.09	0.30	0.58	0.57
Number of Countries		102				102				102		
IV-Models using Lags as Instruments + Control Variables (all models with time-fixed-effects)												
Estimator	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM
Instruments	Lag1-5	Lag1-5	Lag2-6	L2-6/LD1-6	Lag1-5	Lag1-5	Lag2-6	L2-6/LD1-6	Lag1-5	Lag1-5	Lag2-6	L2-6/LD1-6
Multidimensional Institutions Index	0.21	-0.00	-0.01	0.06*	0.08*	0.09***	0.10***	0.05				
	(0.41)	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)				
10*Non-Income HDI	0.26	0.11**	-0.04	0.35***					0.72***	0.32	0.43*	0.20
	(1.22)	(0.06)	(0.06)	(0.08)					(0.25)	(0.24)	(0.24)	(0.24)
Log GDP per Capita, PPP$ inflation−adjusted					0.05**	0.25*	0.26*	0.73***	0.05	0.12	0.44	0.39
					(0.02)	(0.14)	(0.16)	(0.12)	(0.03)	(0.35)	(0.52)	(0.38)
Observations	681	699	863	969	681	699	863	969	863	969	863	969
R^2	0.29	0.64			0.02	0.88			0.01	0.30		
Number of Countries		97	102	102		97	102	102		102	102	102
Number of Instruments			118	141			118	141			121	144
Kleibergen-Paap rk LM statistic (Underid. test)	38.75	39.48			27.76	38.50			48.48	40.95		
Kleibergen-Paap P-Value (H0: Underidentified)	<0.01	<0.01			<0.01	<0.01			<0.01	<0.01		
Hansen J statistic (overidentification test)	9.76	7.50			16.82	22.67			10.42	11.20		
Hansen J P-Value (H0: Equation Identified)	0.28	0.48			0.03	<0.01			0.32	0.19		
Arellano-Bond test for AR(2) in first differences			2.01	0.51			-2.64	-2.12			-1.59	-2.18
Arellano-Bond P-Value (H0: No AR(2))			0.04	0.61			0.01	0.03			0.11	0.03
Hansen Overidentification for GMM			88.70	93.55			87.78	82.79			84.93	84.61
Hansen GMM P-Value (H0: Equation Identified)			0.01	0.20			0.01	0.49			0.04	0.52

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Control Variables: Magnitude International Warfare | Magnitude Ethnic Violence | Magnitude Civil War | Population ages 15-64 [% of total] | Urban population [% of total] | Population density [per sq. km] | Population [total] | Population growth [annual %] | Arable land [% of land area] | Average precipitation [mm per year] | Trade [% of GDP]

Figure 22 presents again a small summary of the results estimated from this 5-Year panel.

Figure 22: 5-Year Panel 1945-2010 Results Summary
Note: Coefficients apply to NIHDI scaled by 10



Without further ado, the variables and results for the long-term decadal averages panel are introduced. Beyond the different institutions variable and the different aggregation choice, the methods and estimators employed are exactly the same as for the 5-year panel just discussed. The only differences are that the number of lags employed as instruments is reduced by 1, and there are no control variables employed (due to data-issues in finding controls over this very long time-frame).

Table 30 again briefly summarizes the main variables used in the long-term panel. Table 31 shows a cross-correlation matrix of levels and differences analogous to the matrix for the 5-year panel.

Table 30: Main Variables and Instruments, Decadal Averages 1820-2010

Variable	*Source*	*N*	*Mean*	*SD*	*Min*	*Max*
GDP per capita (2011 PPP $)	Gapminder	1145	7,212	9,999	291	87,824
Log GDP per capita (2011 PPP $)	Gapminder	1145	8.28	1.05	5.67	11.38
Non-Income Human Development Index	Authors Calculations	1145	0.38	0.24	0	0.93
LTS Effective and Representative Government	Authors Calculations	1145	6.46	2.64	0	10

The picture presented by Table 31 is very similar to the one of Table 28. The levels all together load highly onto each other, and the GDP growth rate is positively related to levels of HD and institutional quality. Furthermore differences in HD are also positively correlated with the levels of both income and institutional quality. Changes in institutional quality however appear unrelated the levels of income and HD. The right side of Table 31 shows that changes in institutions are also only very softly correlated which changes in HD and growth, whereas changes in HD and growth load highly onto on another.

Table 31: Correlation Matrix of Main Variables and Instruments
Pairwise Correlations in Levels and Differences (Decadal Averages)

# *Variable*	(1)	(2)	(3)	(G.1)	(D.2)	(D.3)
(1) Log GDP per capita (2011 PPP $)	1					
(2) Non-Income Human Development Index	.87	1				
(3) LTS Effective and Representative Government	.46	.51	1			
(G.1) GDP per capita Growth (2011 PPP $)	.33	.33	.12	1		
(D.2) Non-Income Human Development Index	.44	.57	.12	.36	1	
(D.3) LTS Effective and Representative Government	-.01	-.001	.23	.02	.02	1

8.2 Empirical Results Decadal Panel, 1820-2010

Table 32 finally presents the estimates from the long term panel. They are overall very similar the 5-year panel and the results of the previous sections. This is noteworthy considering that the ERG institutions index is quite different from the MII indexes previously employed. The first 4 columns again exhibit a large effect of HD on income with a magnitude of 0.45 (taken from the 2s S-GMM). The impact of institutions is again very small, the FE-2sls estimator delivers a significant coefficient of 0.08. This is both in line with the previous results. The identification statistics suggests that some of the models are overidentified, and there seems to be significant first-order autocorrelation in the levels equation, which also hints at some identification problems.

Table 32: Long-term Panel Estimations, 10-year Averages, 1820's-2000's
Error Matrix: Cluster Robust

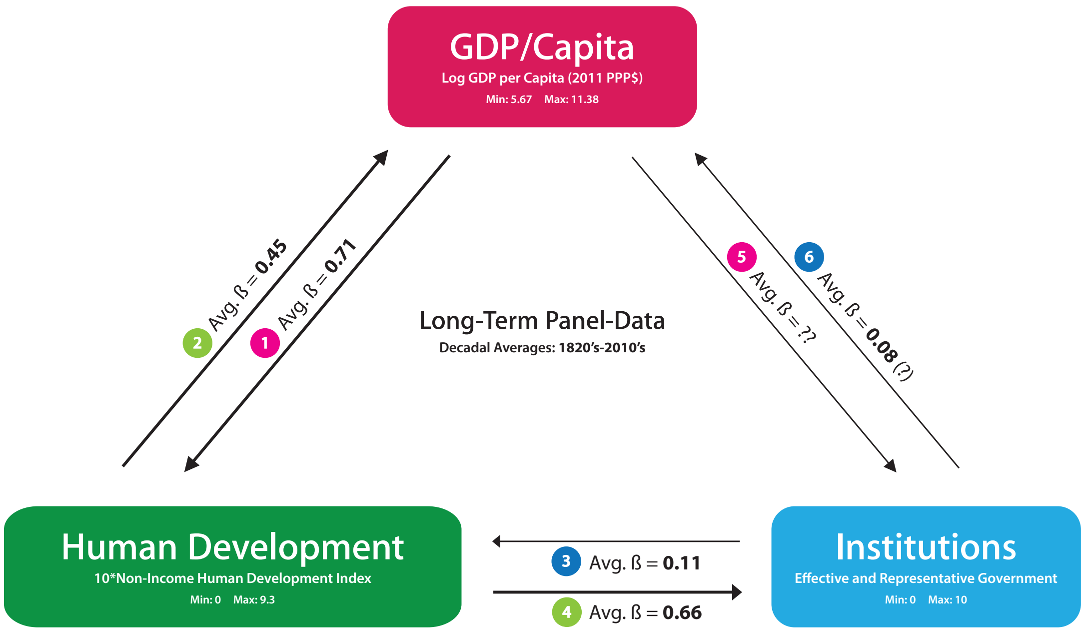
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable:	GDP/C Gr	logGDP/C	logGDP/C	logGDP/C	D.10*NIHDI	10*NIHDI	10*NIHDI	10*NIHDI	D.EffResGov	EffResGov	EffResGov	EffResGov
OLS and other Exploratory Estimators												
tFE=Time-Fixed-Effects, FE=Fixed Effects (C+t)												
Estimator	FD+tFE	FE	OLS+tFE	OLS	FD+tFE	FE	OLS+tFE	OLS	FD+tFE	FE	OLS+tFE	OLS
Effective and Representative Government	0.048	0.027**	0.028	0.072***	0.017***	0.043***	0.13***	0.072**				
	(0.045)	(0.012)	(0.018)	(0.016)	(0.0057)	(0.014)	(0.024)	(0.035)				
10*Non-Income HDI	1.04***	0.18***	0.46***	0.32***					0.35***	0.56***	0.78***	0.18*
	(0.27)	(0.048)	(0.029)	(0.015)					(0.13)	(0.18)	(0.15)	(0.093)
Log GDP per Capita, PPP$ inflation−adjusted					0.027***	0.38***	1.16***	1.80***	0.026	0.74**	0.42	1.04***
					(0.0081)	(0.096)	(0.069)	(0.097)	(0.024)	(0.32)	(0.27)	(0.24)
Observations	1,023	1,145	1,145	1,145	1,023	1,145	1,145	1,145	1,023	1,145	1,145	1,145
R^2	0.179	0.830	0.751	0.700	0.401	0.954	0.884	0.680	0.081	0.303	0.417	0.313
Number of countryid		109				109				109		
IV-Models using Lags as Instruments (all models with time-fixed-effects)												
Estimator	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM	FD-2sls	FE-2sls	1s D-GMM	2s S-GMM
Instruments	Lag1-4	Lag1-4	Lag2-5	L2-5/LD1-5	Lag1-4	Lag1-4	Lag2-5	L2-5/LD1-5	Lag1-4	Lag1-4	Lag2-5	L2-5/LD1-5
Effective and Representative Government	-0.23	0.08**	-0.00	-0.02	-0.00	0.07**	0.01	0.11***				
	(0.16)	(0.04)	(0.01)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)				
10*Non-Income HDI	-2.36	0.07	-0.16**	0.45***					-0.33	0.56**	-0.10	0.76***
	(1.96)	(0.10)	(0.07)	(0.04)					(0.63)	(0.24)	(0.33)	(0.22)
Log GDP per Capita, PPP$ inflation−adjusted					-0.02	0.08	0.71***	1.09***	-0.04	0.42	-0.04	0.20
					(0.05)	(0.12)	(0.17)	(0.08)	(0.08)	(0.34)	(0.43)	(0.32)
Observations	687	662	1,023	1,145	704	679	1,023	1,145	952	1,041	1,023	1,145
R^2	-0.11	0.80			0.34	0.96			0.04	0.19		
Number of Countries		77	109	109		77	109	109		109	109	109
Number of Instruments			146	182			153	191			149	186
Kleibergen-Paap rk LM statistic (Underid. test)	11.25	25.40			17.91	26.84			10.69	56.56		
Kleibergen-Paap P-Value (H0: Underidentified)	0.13	0.00			0.01	0.00			0.15	0.00		
Hansen J statistic (Overidentification test)	6.78	15.58			5.64	10.94			5.41	4.55		
Hansen J P-Value (H0: Equation Identified)	0.34	0.02			0.46	0.09			0.49	0.60		
Arellano-Bond test for AR(2) in first differences			2.04	3.04			0.88	0.27			-3.07	-3.10
Arellano-Bond P-Value (H0: No AR(2))			0.04	0.00			0.38	0.79			0.00	0.00
Hansen overidentification test for GMM			96.36	94.89			90.68	99.53			91.96	98.50
Hansen GMM P-Value (H0: Equation Identified)			0.96	1			1	1			0.99	1

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The second equation predicting HD is also broadly in line with the results examined thus far. Income is again shown to have a very large effect in HD, whereas the coefficient of 1.09 presented by the 2s S-GMM seems to be a bit too large to hold in reality. The 1s D-GMM coefficient of 0.71 in a more reasonable result in this case, and very much in line with previous estimations. The effect of institutions on HD of about 0.11 as proposed by the 2s S-GMM on the other hand emerges as reasonably sized, and congruent to the 5-year panel. The identification statistics present themselves as better than for the previous equation, in fact all models show up as well identified at the 5% level. Columns 8 through 12 of Table 32 represent the third equation predicting institutions. The results - and this is a very welcome surprize - are also in line with the 5-year panel and the time-varying instruments. The estimators show no significant effect of income on institutions, but well a significant impact of HD. Averaging the two significant HD coefficients captured by the FE-2sls and the 2s S-GMM estimator results in a coefficient of 0.66, which is almost identical to the 0.63 measured in the 5-year panel. The identification statistics for this equation are better than those for the GDP equation, but the presence of AR(1) serial correlation in the levels equation (=AR(2) in differences) suggests that some of the lags used as instruments might be endogenous.

Figure 23 again presents a short summary of the results from the long-term decadal panel.

Figure 23: Decadal Panel 1820-2010 Results Summary
Note: Coefficients apply to NIHDI scaled by 10



9 Conclusion

This brings the long theoretical and empirical exploration into the interdependence of economic growth, human development and political institutions conducted in this thesis to an end. It becomes time to take a resume: What has been learned, and what remains to be investigated? I believe a great deal has been learned in this research. The greatest conclusion that can be drawn from the results produced here is that applying this kind of general equilibrium modeling to the development context is reasonable. The results of all specifications reveal the presence of significant feedback loops and interactions between income, human development and institutional quality, and the magnitude of the estimated coefficients signifies that these relationships are formative, rather than secondary, to the long-term development process. This I believe has ramifications for the entire literature that focuses itself on identifying the root causes of wealth differences across nations using instrumental variables and single equations. On the one hand this research has been affirmative of this literature as regarding the presence of deep geographical, historical and cultural factors explaining the persistence of institutional quality in many parts of the world as well as basic levels trade and economic activity. On the other hand however the findings produced here implicate that this focus on root causes is a bit misplaced, and the development process far more dynamic and far less deterministic that this literature (e.g. the findings of Acemoglu et al. (2001) and others) implies.

The focus of this literature should therefore shift towards trying to understand how the process of development unfolds. What are the most important mechanisms and chains in this process? How can we explain the different trajectories of countries starting off from similar historical and geographical vantage points? (e.g. contrasting the Asian tigers with other Asian nations, Nigeria, Kenya and Botswana with other African countries, Chile with its neighboring countries etc.). The actuality that we will not be able to change historical or geographical factors should drive us towards gaining a better understanding of the process of development itself, and different development trajectories, and to then focus macro-development policy towards the crucial nodes in that process that are variant, and investment in which will yield the greatest general-equilibrium social return. The tenor of this paper is thus a call for more structural and dynamic modeling in the development economics literature. Continuing to estimate single equations will continue to be uninformative in terms of learning about the development process, continue to yield partial equilibrium estimates of very little policy relevance, and continue to hold the field trapped up in unfruitful root-cause debates. Development economists should take inspiration from macro and other fields where structural modeling is and established practice, and begin to build models and theories that will allow us to learn more about the process itself.

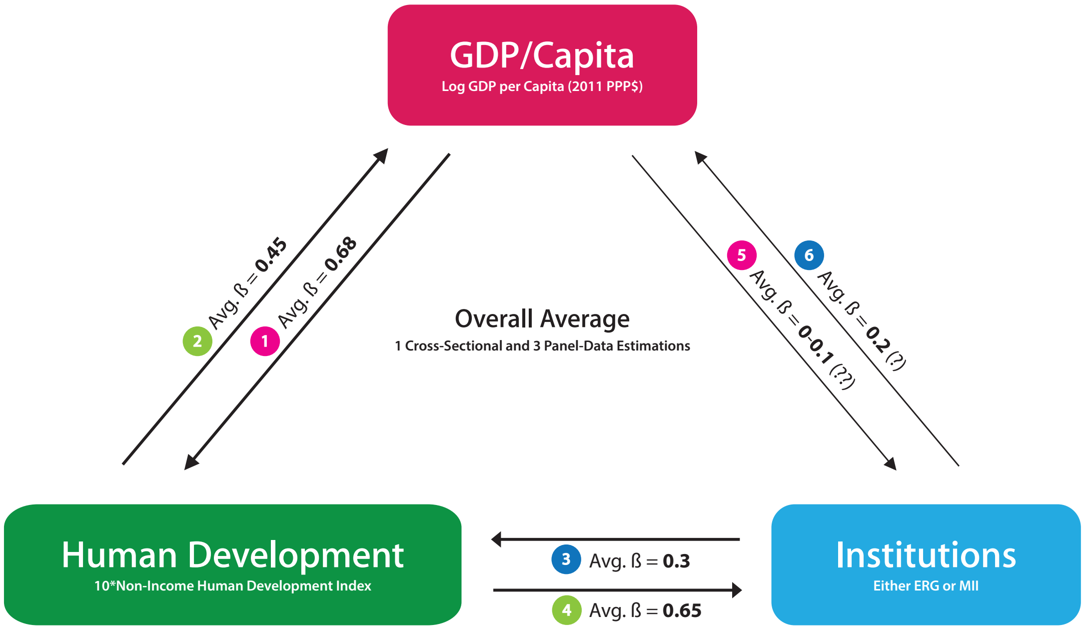
The aim of this paper was to present a simple beginning in that direction. A summary of the findings follows. The main findings of each of the 4 specifications estimated can be taken from the summary graphics (Figures 10, 21, 22 and 23). All 4 specifications picked up a very significant two-way relationship between HD and EG. The coefficients of around 0.45 for the effect of HD on log income and approx. 0.68 for the effect of log income on HD are very persistent across the different specifications. These two-way effects also turn out to be almost equal in magnitude (taking into account the exact interpretation of log-level coefficients $\%\Delta y = 100 * (e^{\beta_x} - 1)$ such that $\%\Delta y = 100 * (e^{0.45} - 1) \approx 57\%$). The sequencing implications drawn from Figures 12, 13 and 14 are broadly in line with the findings of Ranis et al. (2000) and Suri et al. (2011) and suggest that human development generally precedes income growth and is therefore more important in terms of sequencing. All 4 specifications have also picked up a significant two-way relationship between HD and institutions: this relationship has been more difficult to establish empirically, mostly due to the persistence of institutions. The estimates for the impact of institutions on HD vary between 0.45 (as suggested by the cross-section), and 0.1 (as suggested by the 5-year panel). Considering that the cross-section is more capable of dealing with persistence effects in institutions, and acknowledging the lack of external instruments in the 5-year and long-term panel, the result from the time varying instruments panel, 0.3, is adopted as a middle-way result of choice for this effect. Perhaps the most interesting and most contestable finding in this research is the very large impact of HD on institutions picked up by all 4 specifications. The size of this effect varies from 0.9 (cross-section) to 0.6 (decadal panel with time-varying instruments). Since the cross-sectional coefficient emerges as too large, and the the three panel-models have been very closely in line (0.6-0.66), 0.65

is adopted as the result of choice. Open questions remain though, because (presumably due to the between-country persistence of institutions) this effect was not visible in the data (e.g. in Figures 15, 16 or 17) nor in the correlation matrices (e.g. Tables 28 and 31). If this effect comes to be empirically confirmed though it suggests not only the existence of a very dynamic relationship between HD and institutions, but also that institutions do change significantly under HD inputs to the population and need not be treated as static as the institutionalists imply.

The greatest challenge of this research has been to capture the two way relationship between income and institutions. Arguably the empirical efforts conducted thus far have not sufficed to provide sufficient evidence on this relationship. The least evidence has been collected on the effect of EG on institutional quality. Suggestive coefficients are between 0 and 1, with around 0.05 probably being the most realistic size. More evidence could be collected on the chain from institutions to income, where the cross section could establish a fairly unambiguous coefficient between 0.18 and 0.46 in size (0.25 being the result of choice). The panel data models have also provided a few significant coefficients. With sizes between 0.06 and 0.1 however these estimates materialized as much smaller, and in most cases were only marginally significant. Placing grater faith into the cross-section as well as the already strong effect of institutions on income (human capital held fixed) established in Acemoglu et al. (2014) and other papers, a coefficient of 0.2 is taken to represent the strength of this chain. A final resume of the research of this paper containing the results of choice is presented in Figure 24.

The findings of this paper imply that long run development is indeed an equilibrium process. The most crucial node in this process appears to be human development, as it causes both income and institutional quality to improve significantly. A large part of the impact of institutions on income, in fact, seems to run through the human development channel. If this paper were to be taken as a guide to international policy making, it would therefore suggest that efforts to advance human development will have greater returns in the long-run than efforts aimed at improving income or the quality of institutions. This is a reassuring finding, since development is about humans after all. As the author if this paper I do however not believe in such grand policy solutions based on cross-country evidence. Much rather the findings of this paper should be taken as inspiration for researchers and policy-makers to try and estimate similar (and hopefully more complex) structural models of the particular regions or economies they are working in, in order to better understand the specific development-mechanisms at play, and to estimate and simulate the general-equilibrium effects of potential policies aimed at improving particular nodes of the development process.

Figure 24: Final Results of Choice Summary
Note: Coefficients apply to NIHDI scaled by 10



On the theoretical side also more research is still needed, both into macro-development dynamics and into the effects of human development, growth and institutions onto each other. The framework of this paper has treated institutions, human development and income as equals, and estimated the effect of levels ad well as differences of these three on one-another, drawing inspiration from previous empirical treatments such as by Dollar & Kraay (2003). While this framework has allowed for estimation of the two-way interactions between HD and EG, and provided some insight into what drives institutional change, there are some problems with it. For the cross-section, taking levels of institutions, HD and income might have been the appropriate strategy. However the panel-data models, especially the graphics but also the correlation matrices 28 and 31 have revealed that institutions are empirically not on equal footing with HD end EG. Particularly Tables 28 and 31 are extremely interesting since they show that changes in HD and EG are strongly related to levels of institutional quality, and changes in institutional quality might also be related to levels of HD and EG. The tables also show that for the most part HD and EG are on equal footing and move together (e.g. changes in HD are related to levels of income in more or less the same manor than changes in EG are related to levels of HD). Taking these correlations seriously means that more research needs to be done with different specifications. The impact of levels of institutional quality on growth rates of income and human development needs to be be investigated further, and also the impact of levels of income and human development on institutional improvement emerges as a fruitful path for continued investigation. Other necessary avenues for continued investigation are to assess the strength of particular transition channels, as stipulated in the theoretical part and partly also shown in Figure 4. This investigation should be accompanied by an inquiry on what determines the strength of the 6 chains estimated across different countries (e.g. in line with the work of Suri et al. (2011)). The model could also be made more complex by allowing for non-linear relationships and adding additional nodes (for example trade or technology). All these possibilities present themselves as fruitful and necessary lines of investigations in order to better understand regional and macro-development dynamics and take serious the general-equilibrium nature of the long-term development process.

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10 APPENDIX

10.1 Supplementary Materials

The supplementary materials contain the datasets and a code file for the STATA statistical package that will allow the reader to reproduce all empirical tables presented in this paper. It also contains the results (and source code) for the random-forrest model selection exercize not reported in section 5 (conducted in R). Finally, the file contains datasets and code for the plots, which were produced in the R statistical package. Next to the plots shown thus far, the user will able to create some further interesting plots (of decadal growth rates etc.) that were not reported in this paper.

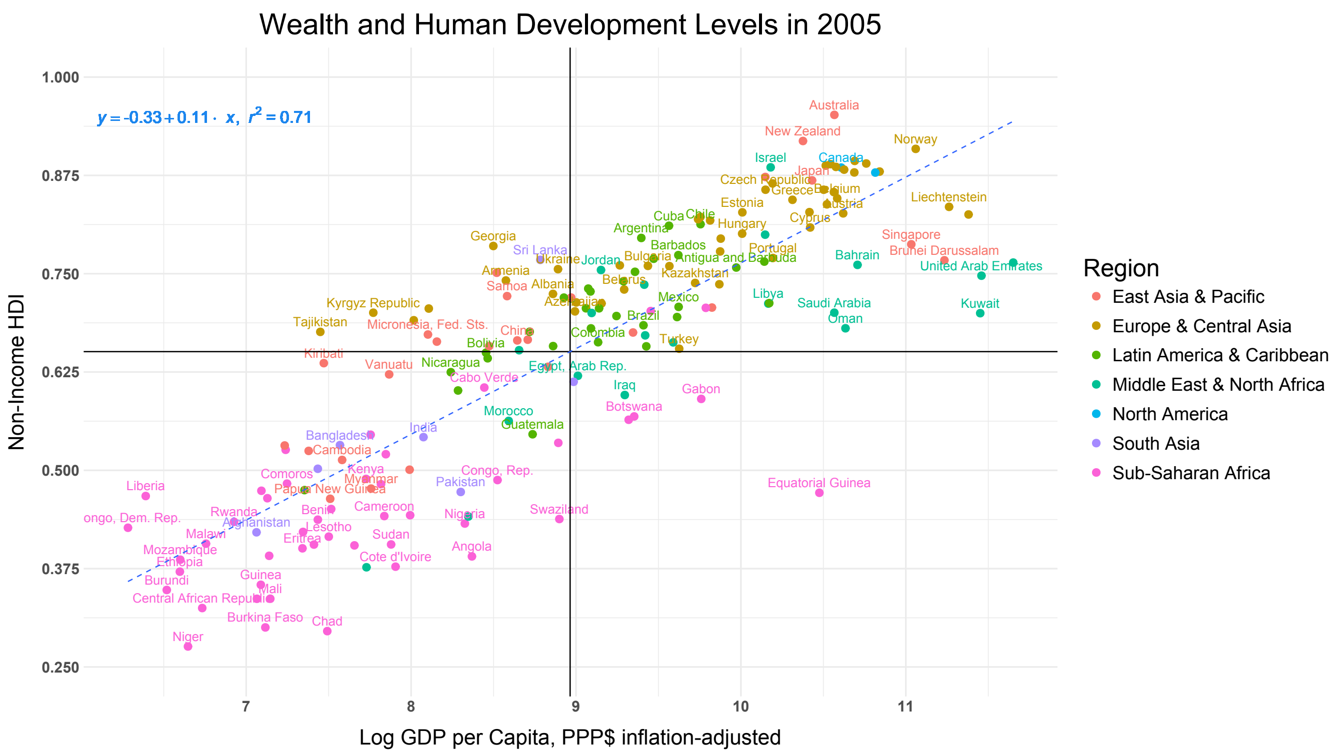
LINK https://www.dropbox.com/s/vssjjml9twnvu2v/Krantz%202017%2C%20The%20Interdependence%20of%20EG%2C%20HD%20and%20Pol.%20Inst.%20-%20SUPPLEMENTARY%20MATERIALS.rar?dl=0

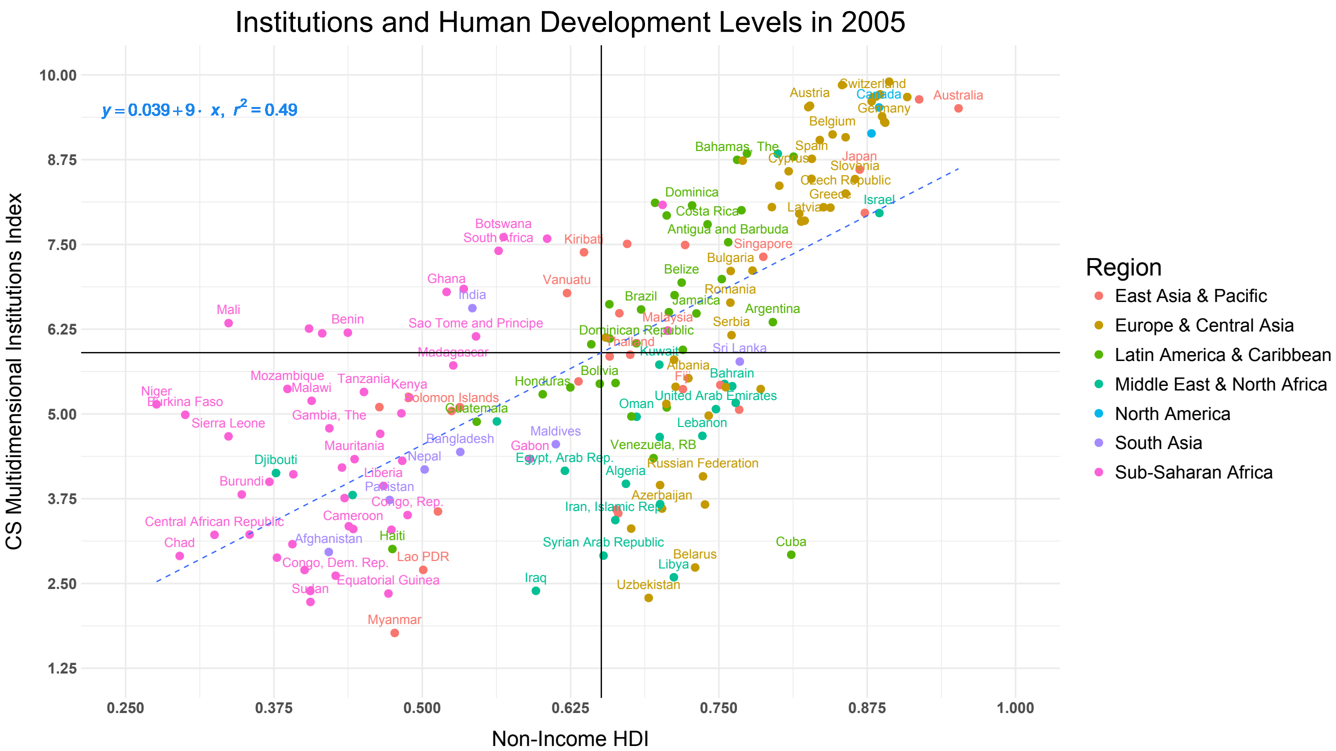
10.2 Additional Plots

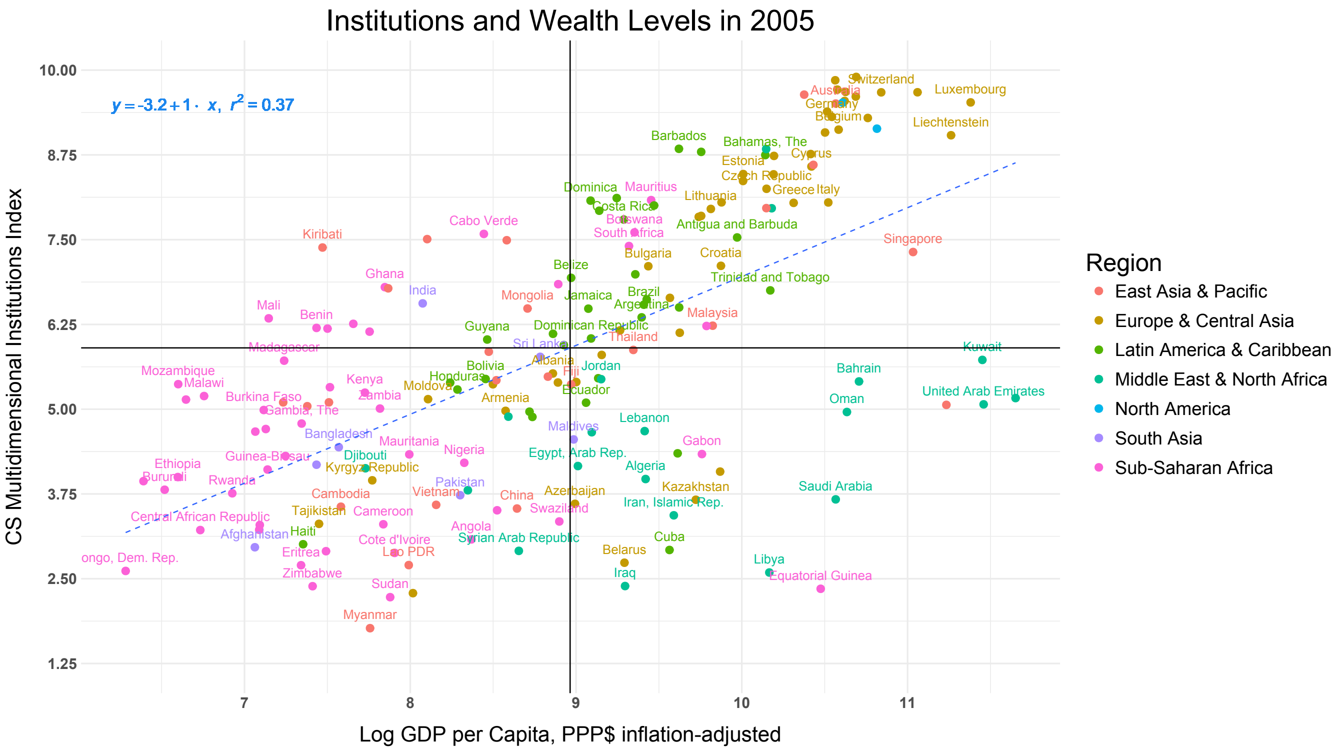
This plot appendix provides 3 series of additional plots. For the cross-section of section 6, some plots on the levels of wealth, human development and institutional quality in 2005 are presented. Afterwards, since this emerged as an interesting avenue for continued research, some plots on the relationship between the level of institutional quality and the growth rates of income and human development are presented. Finally, some disaggregated versions of Figures 11, 12, 15 and 18 are presented. These plots provide a grand overview over the joint evolution of wealth, HD and institutional quality, and are not as susceptible to data aggregation effects as their equivalents shown in the paper.

10.2.1 Levels of Institutional Quality, Wealth, and Human Development in 2005

The following three plots show the levels of HD, Institutions and Income in 2005. The data is taken from the cross-sectional dataset used in section 6. The points are colored using the macro-regional classification of the World Bank.

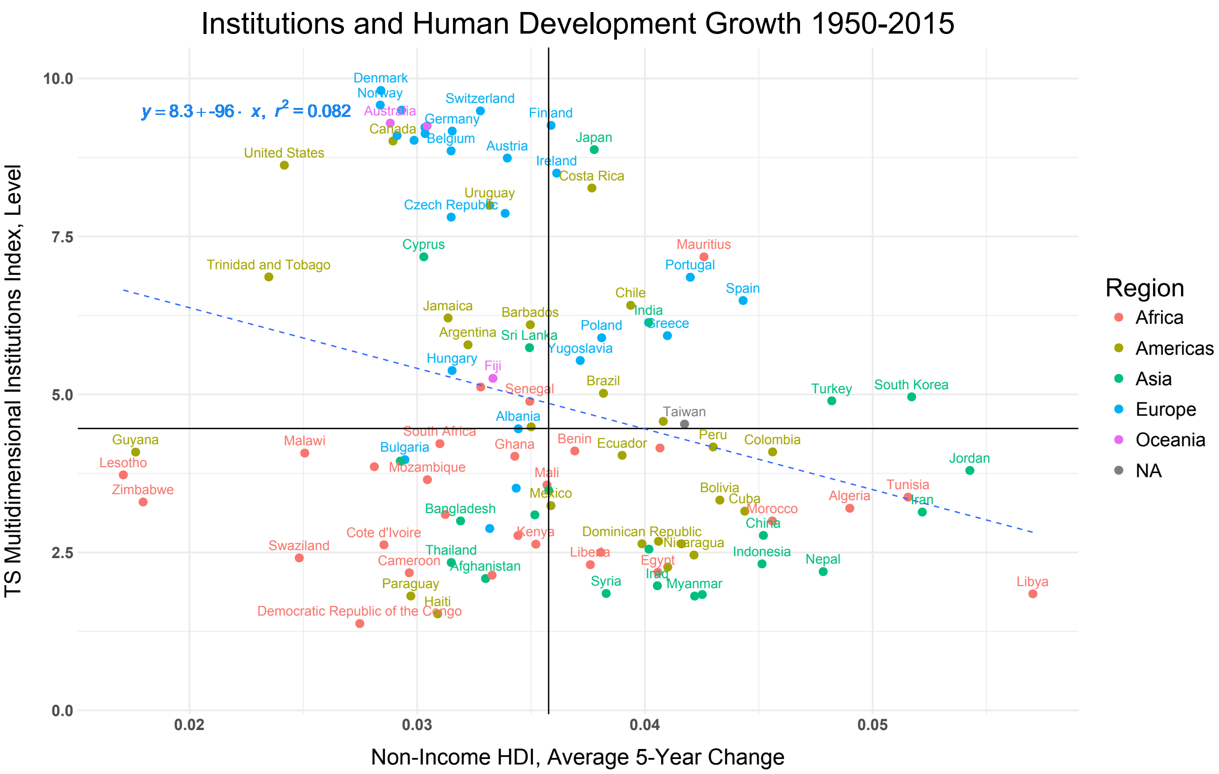


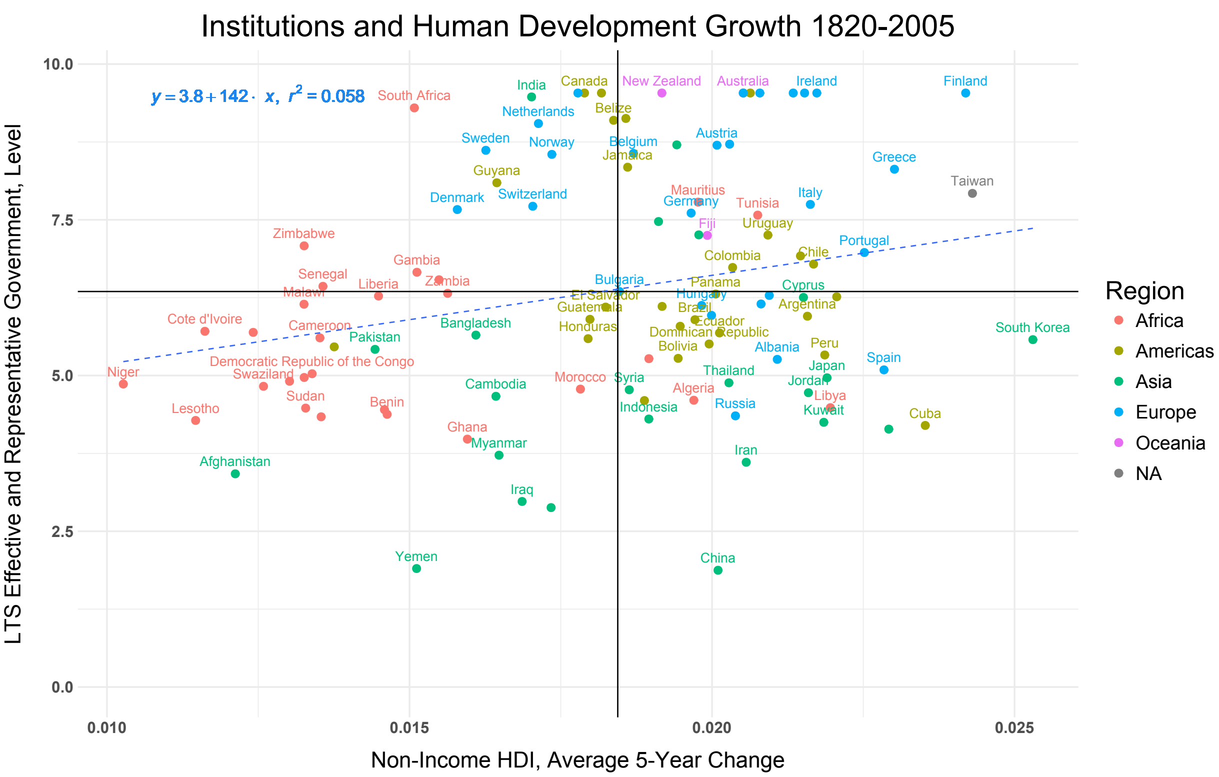

Institutions and Human Development Levels in 2005
$y = 0.039 + 9 \cdot x,\ r^2 = 0.49$
CS Multidimensional Institutions Index
Non-Income HDI
10.00
8.75
7.50
6.25
5.00
3.75
2.50
1.25
0.250
0.375
0.500
0.625
0.750
0.875
1.000
Region
East Asia & Pacific
Europe & Central Asia
Latin America & Caribbean
Middle East & North Africa
North America
South Asia
Sub-Saharan Africa
Austria
Switzerland
Canada
Australia
Germany
Belgium
Bahamas, The
Spain
Cyprus
Japan
Slovenia
Czech Republic
Dominica
Greece
Latvia
Israel
Costa Rica
Antigua and Barbuda
Singapore
Bulgaria
Belize
Romania
Brazil
Jamaica
Argentina
Malaysia
Serbia
Dominican Republic
Thailand
Kuwait
Sri Lanka
Albania
Bahrain
Fiji
United Arab Emirates
Oman
Lebanon
Venezuela, RB
Russian Federation
Algeria
Azerbaijan
Iran, Islamic Rep.
Syrian Arab Republic
Cuba
Belarus
Libya
Uzbekistan
Iraq
Botswana
South Africa
Kiribati
Ghana
India
Vanuatu
Mali
Benin
Sao Tome and Principe
Madagascar
Mozambique
Tanzania
Kenya
Malawi
Niger
Burkina Faso
Solomon Islands
Honduras
Bolivia
Guatemala
Gambia, The
Sierra Leone
Maldives
Mauritania
Bangladesh
Gabon
Egypt, Arab Rep.
Djibouti
Nepal
Liberia
Burundi
Pakistan
Congo, Rep.
Cameroon
Central African Republic
Chad
Afghanistan
Haiti
Congo, Dem. Rep.
Lao PDR
Equatorial Guinea
Sudan
Myanmar

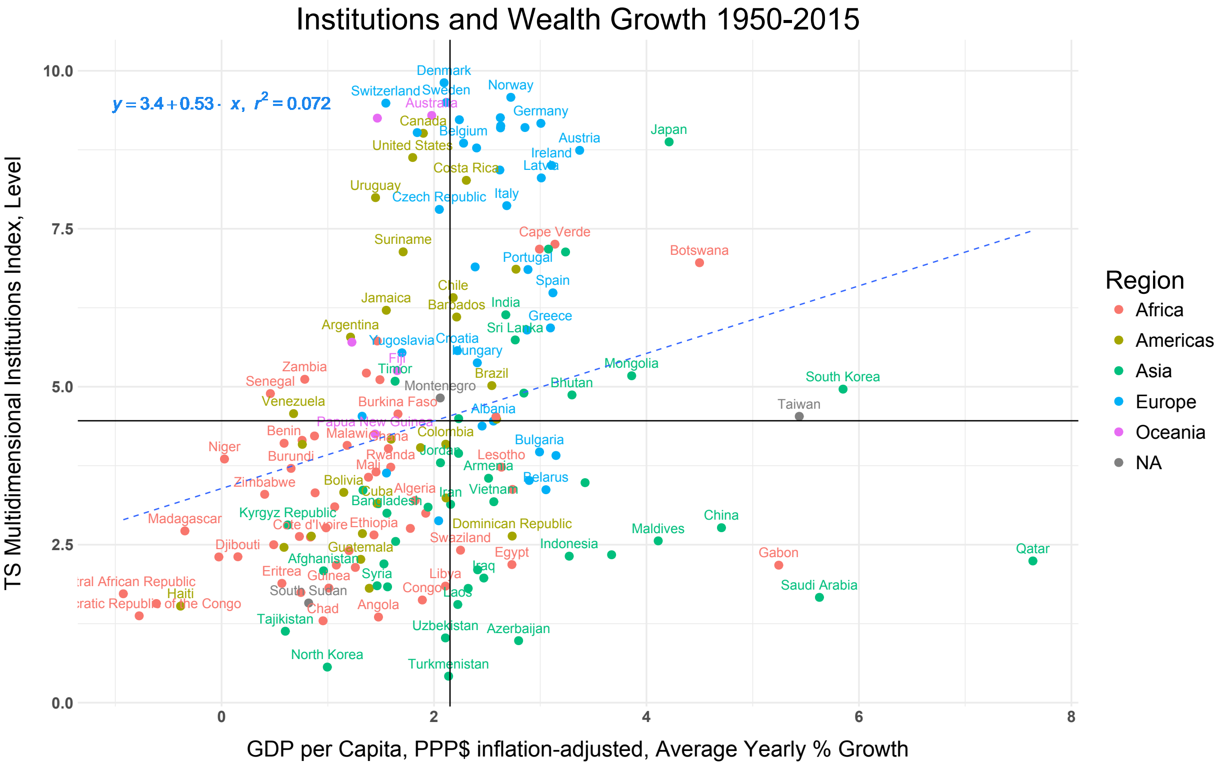

Institutions and Wealth Levels in 2005
$y = -3.2 + 1 \cdot x,\ r^2 = 0.37$
CS Multidimensional Institutions Index
Log GDP per Capita, PPP$ inflation-adjusted
10.00
8.75
7.50
6.25
5.00
3.75
2.50
1.25
7
8
9
10
11
Region
East Asia & Pacific
Europe & Central Asia
Latin America & Caribbean
Middle East & North Africa
North America
South Asia
Sub-Saharan Africa
Switzerland
Luxembourg
Austria
Germany
Belgium
Liechtenstein
Barbados
Bahamas, The
Cyprus
Estonia
Czech Republic
Dominica
Mauritius
Lithuania
Greece
Italy
Costa Rica
Botswana
South Africa
Antigua and Barbuda
Singapore
Cabo Verde
Kiribati
Bulgaria
Croatia
Belize
Trinidad and Tobago
Ghana
India
Mongolia
Jamaica
Brazil
Argentina
Malaysia
Mali
Benin
Guyana
Dominican Republic
Thailand
Kuwait
Madagascar
Sri Lanka
Albania
Bolivia
Jordan
Bahrain
Mozambique
Malawi
Kenya
Honduras
Fiji
Ecuador
Moldova
Zambia
Armenia
Oman
United Arab Emirates
Burkina Faso
Gambia, The
Lebanon
Bangladesh
Maldives
Gabon
Mauritania
Nigeria
Egypt, Arab Rep.
Ethiopia
Guinea-Bissau
Djibouti
Kyrgyz Republic
Algeria
Burundi
Rwanda
Pakistan
Saudi Arabia
Cambodia
Vietnam
China
Azerbaijan
Kazakhstan
Iran, Islamic Rep.
Tajikistan
Cameroon
Swaziland
Central African Republic
Afghanistan
Haiti
Angola
Syrian Arab Republic
Cuba
Cote d'Ivoire
Eritrea
Lao PDR
Belarus
Libya
Congo, Dem. Rep.
Zimbabwe
Iraq
Equatorial Guinea
Sudan
Myanmar

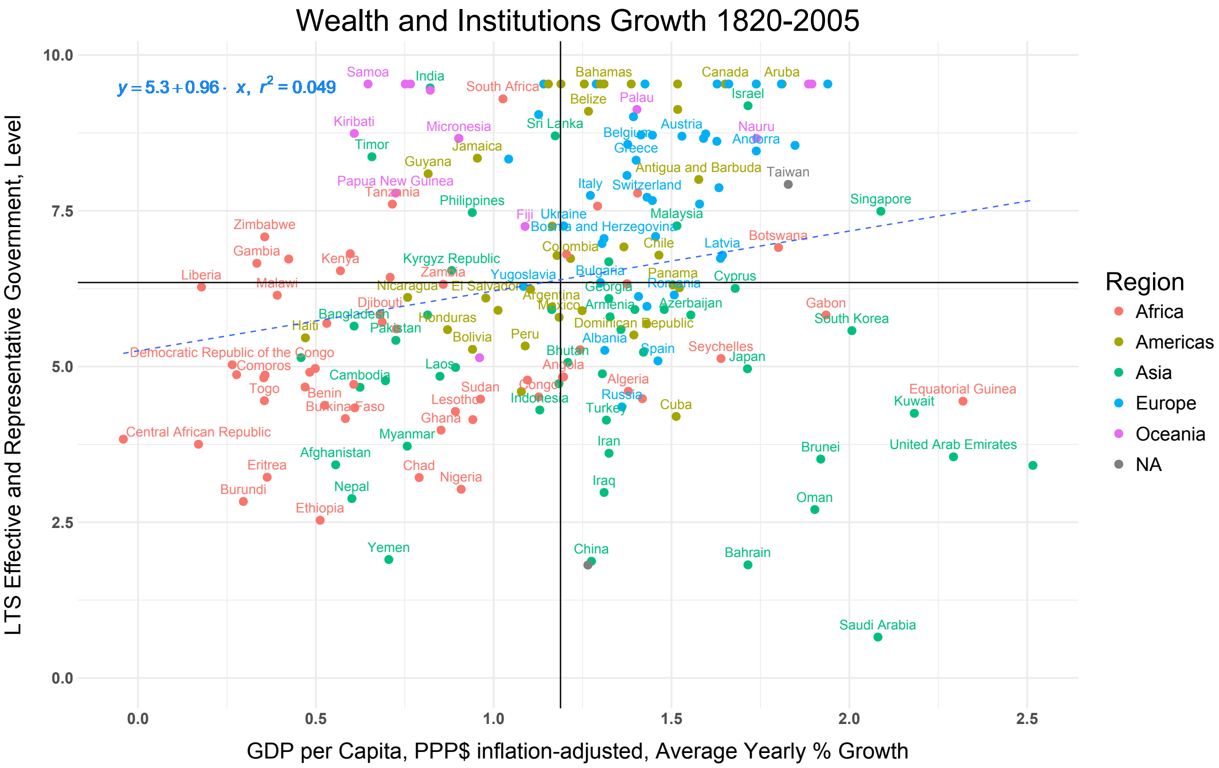
10.2.2 Levels of Institutional Quality and Growth Rates of Income and HD

The conclusion stipulated that looking at the relationship between levels of institutional quality and growth rates of income and human development might be interesting avenues for further research. The following 4 plots document these relationships over the medium and long-term period.



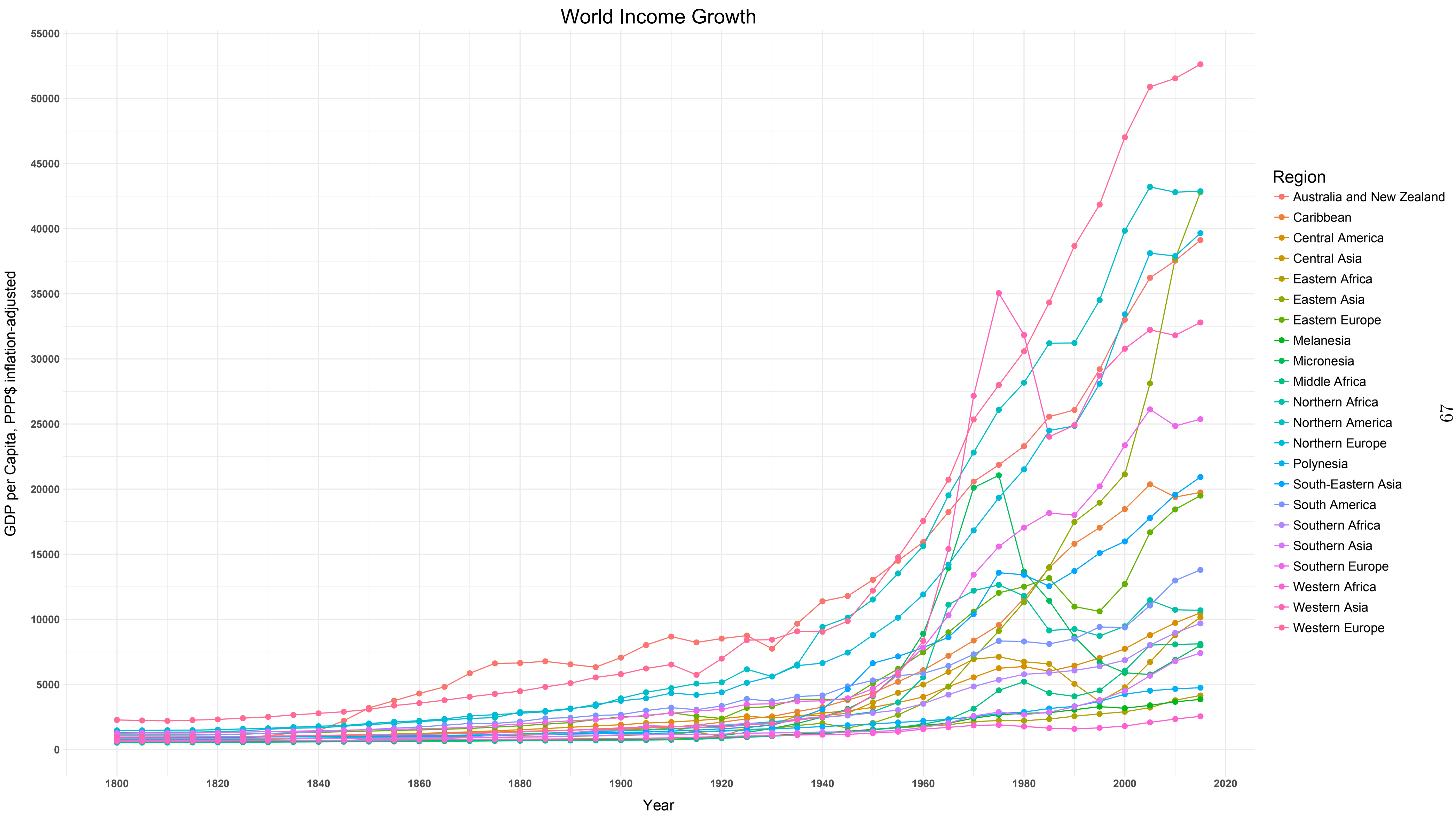


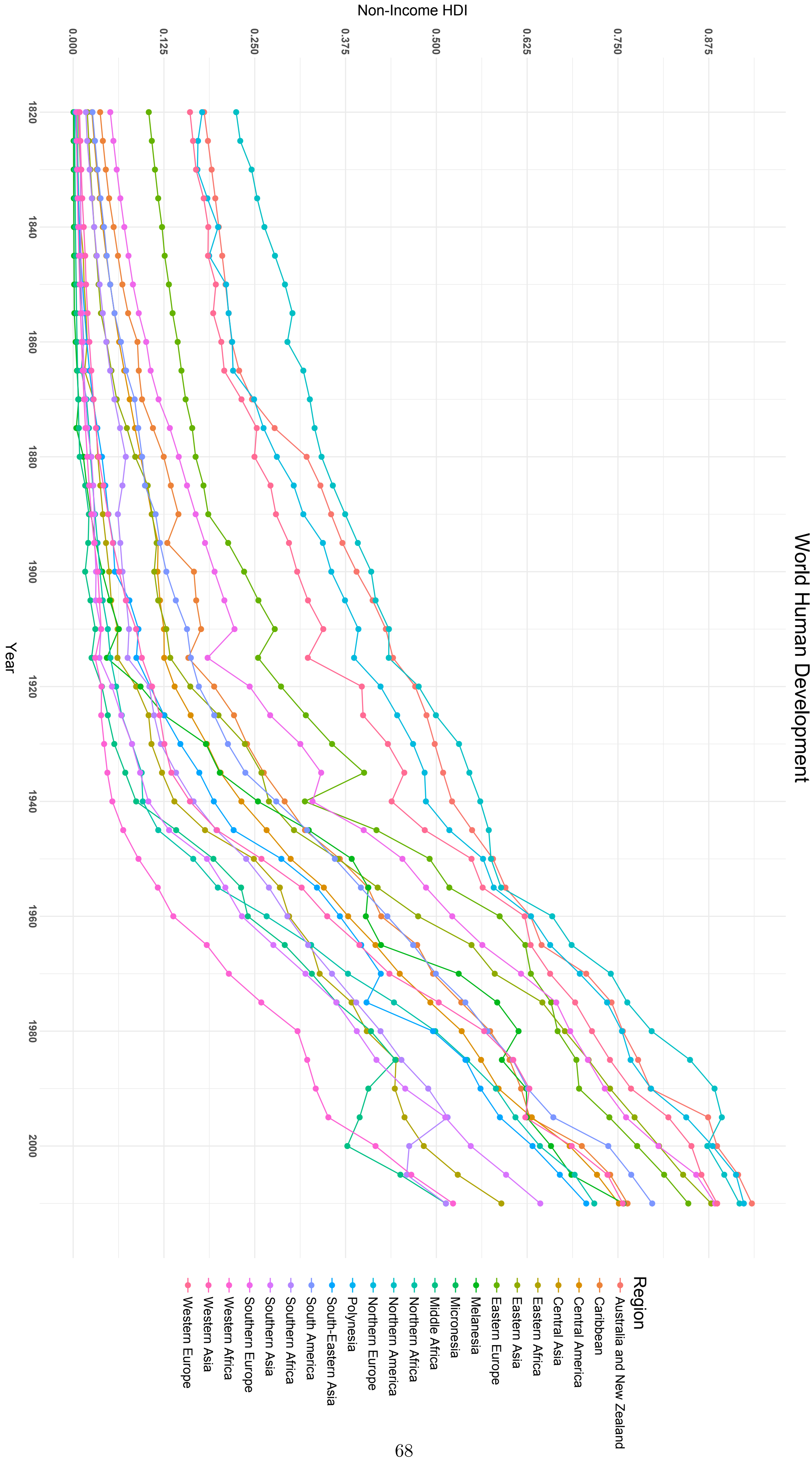

Institutions and Wealth Growth 1950-2015
y = 3.4 + 0.53 · x, r² = 0.072
TS Multidimensional Institutions Index, Level
GDP per Capita, PPP$ inflation-adjusted, Average Yearly % Growth
Region
Africa
Americas
Asia
Europe
Oceania
NA
Denmark
Switzerland
Sweden
Norway
Australia
Germany
Canada
Belgium
United States
Austria
Japan
Ireland
Latvia
Costa Rica
Uruguay
Czech Republic
Italy
Cape Verde
Botswana
Suriname
Portugal
Spain
Chile
Jamaica
Barbados
India
Greece
Sri Lanka
Argentina
Yugoslavia
Croatia
Hungary
Fiji
Zambia
Timor
Brazil
Mongolia
South Korea
Senegal
Montenegro
Bhutan
Taiwan
Venezuela
Burkina Faso
Albania
Papua New Guinea
Benin
Malawi
Ghana
Colombia
Niger
Bulgaria
Burundi
Rwanda
Jordan
Lesotho
Mali
Armenia
Zimbabwe
Bolivia
Belarus
Cuba
Algeria
Iran
Vietnam
Bangladesh
Kyrgyz Republic
Madagascar
Cote d'Ivoire
Ethiopia
Dominican Republic
Maldives
China
Swaziland
Indonesia
Djibouti
Guatemala
Afghanistan
Egypt
Gabon
Qatar
Eritrea
Guinea
Syria
Libya
Iraq
Saudi Arabia
Central African Republic
Congo
Haiti
South Sudan
Laos
Democratic Republic of the Congo
Chad
Angola
Tajikistan
Uzbekistan
Azerbaijan
North Korea
Turkmenistan

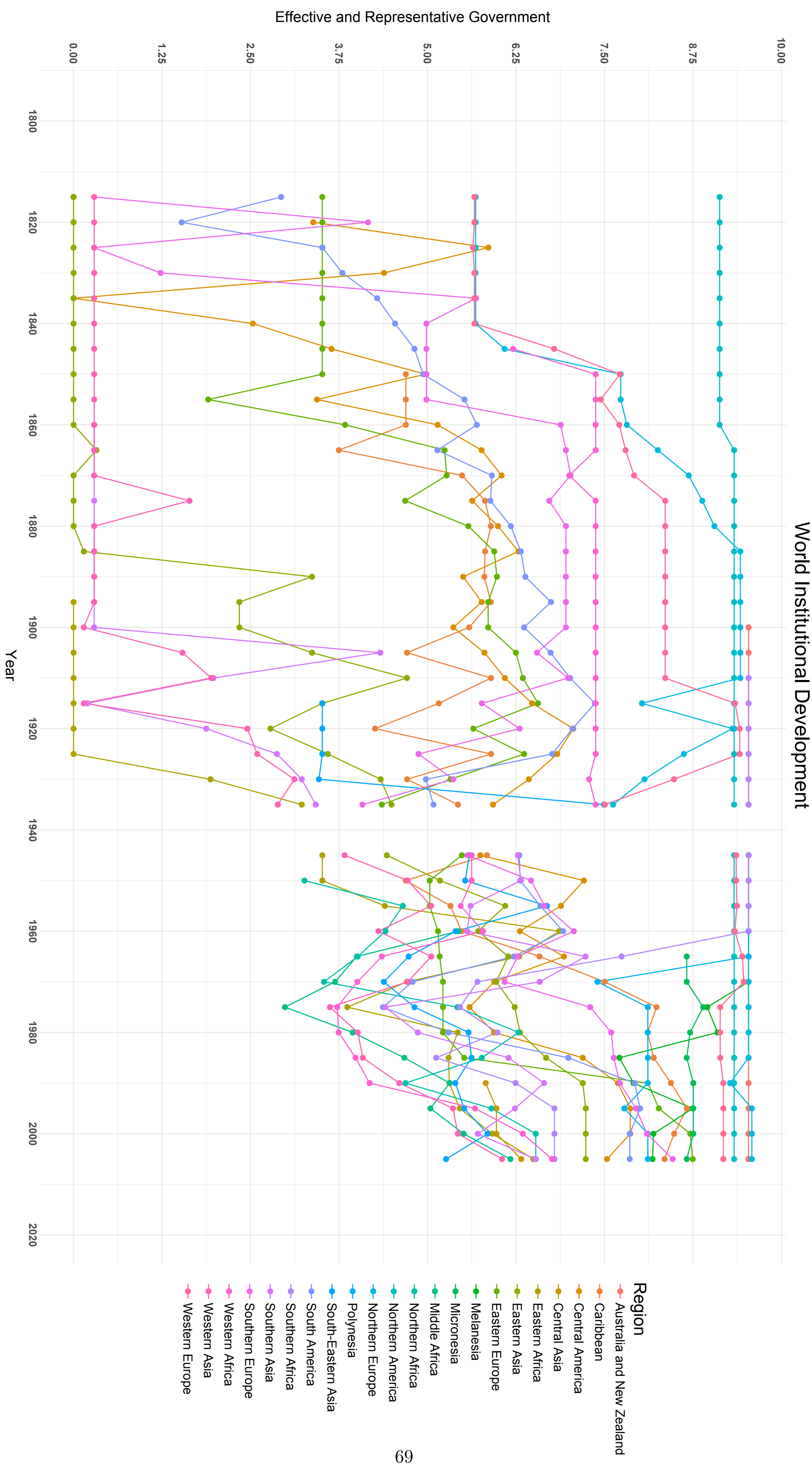

Wealth and Institutions Growth 1820-2005
y = 5.3 + 0.96 · x, r² = 0.049
LTS Effective and Representative Government, Level
GDP per Capita, PPP$ inflation-adjusted, Average Yearly % Growth
Region
Africa
Americas
Asia
Europe
Oceania
NA
Samoa
India
South Africa
Bahamas
Canada
Aruba
Israel
Belize
Palau
Kiribati
Micronesia
Sri Lanka
Belgium
Austria
Nauru
Andorra
Timor
Jamaica
Greece
Guyana
Antigua and Barbuda
Taiwan
Papua New Guinea
Tanzania
Italy
Switzerland
Philippines
Singapore
Zimbabwe
Fiji
Ukraine
Malaysia
Bosnia and Herzegovina
Gambia
Kenya
Kyrgyz Republic
Colombia
Chile
Latvia
Botswana
Liberia
Malawi
Zambia
Nicaragua
El Salvador
Yugoslavia
Bulgaria
Panama
Romania
Cyprus
Georgia
Djibouti
Argentina
Mexico
Armenia
Azerbaijan
Gabon
Bangladesh
Honduras
Haiti
Pakistan
Dominican Republic
South Korea
Bolivia
Peru
Albania
Democratic Republic of the Congo
Bhutan
Spain
Seychelles
Japan
Comoros
Laos
Angola
Cambodia
Algeria
Togo
Benin
Sudan
Congo
Russia
Equatorial Guinea
Burkina Faso
Lesotho
Indonesia
Turkey
Cuba
Kuwait
Ghana
Central African Republic
Myanmar
Iran
Brunei
United Arab Emirates
Afghanistan
Eritrea
Chad
Nigeria
Iraq
Burundi
Nepal
Oman
Ethiopia
Yemen
China
Bahrain
Saudi Arabia

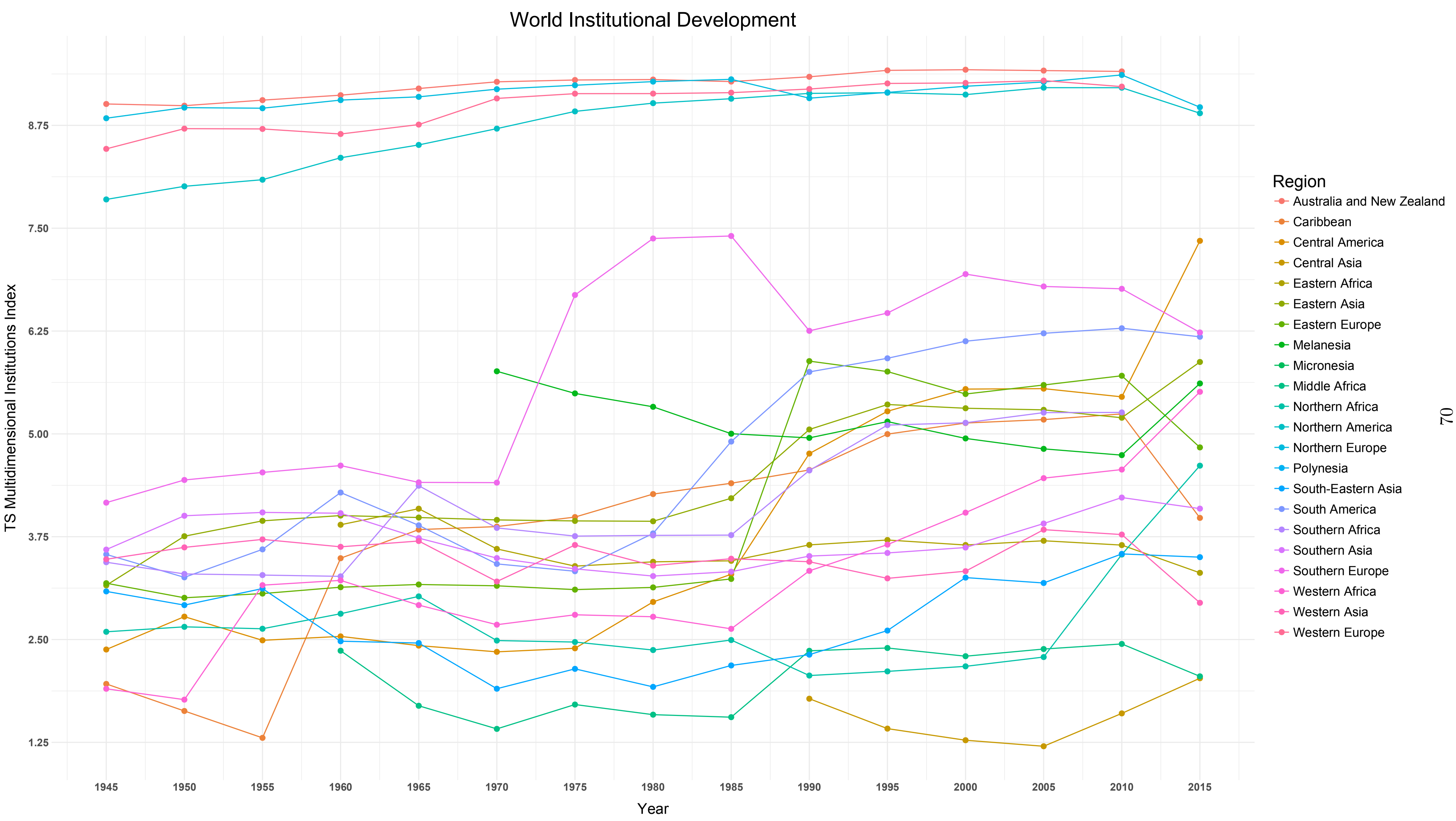
10.2.3 Disaggregated Evolution Plots

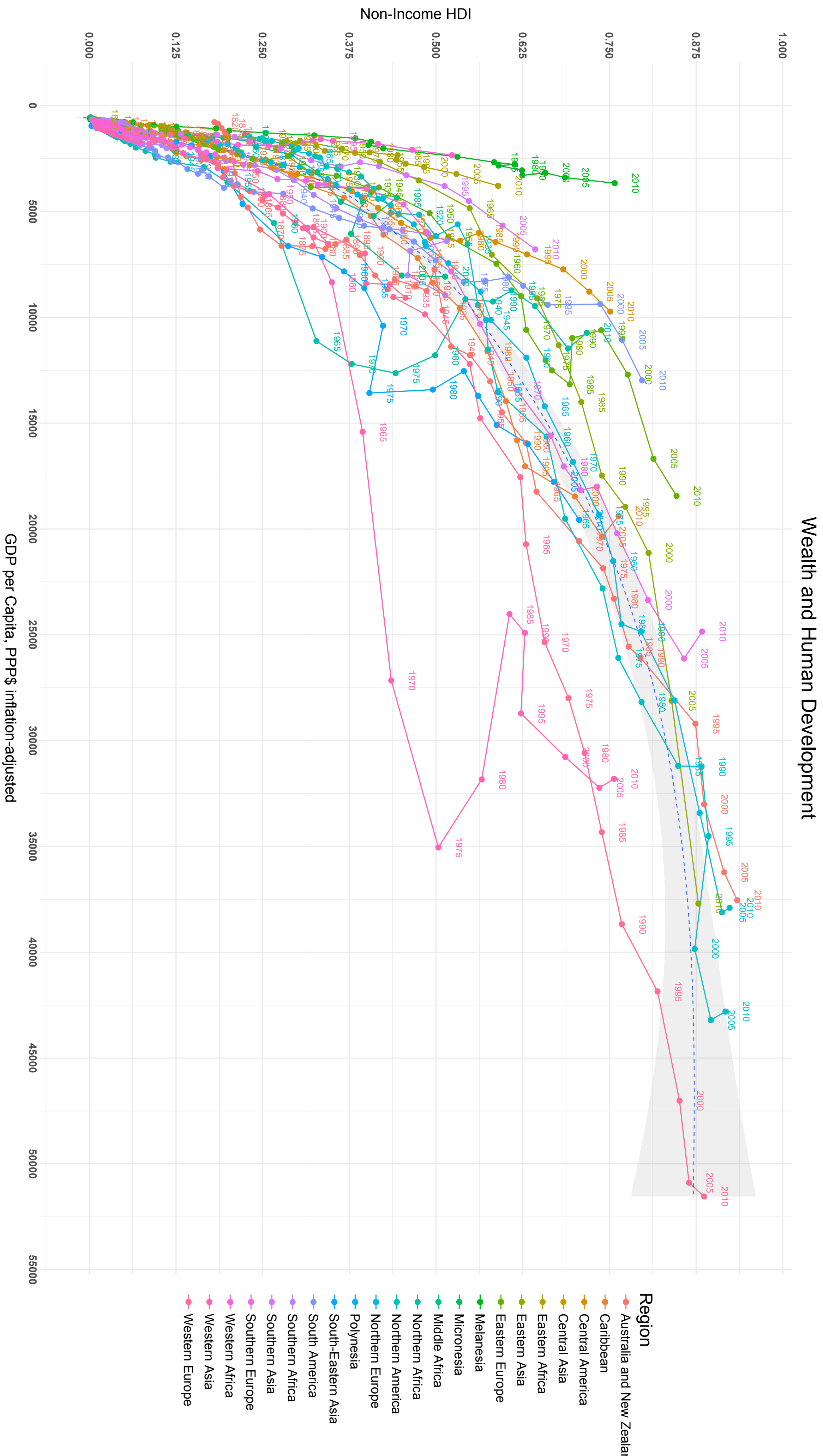
In the light of the deplorable aggregation effects visible in Figures 11, 12, 15 and 18, this part of the appendix presents the same plots but disaggregated to the regional level. These disaggregated plots do a better job at visualizing trends and patterns in the long-term joint evolution of income, human development and the quality of governance.

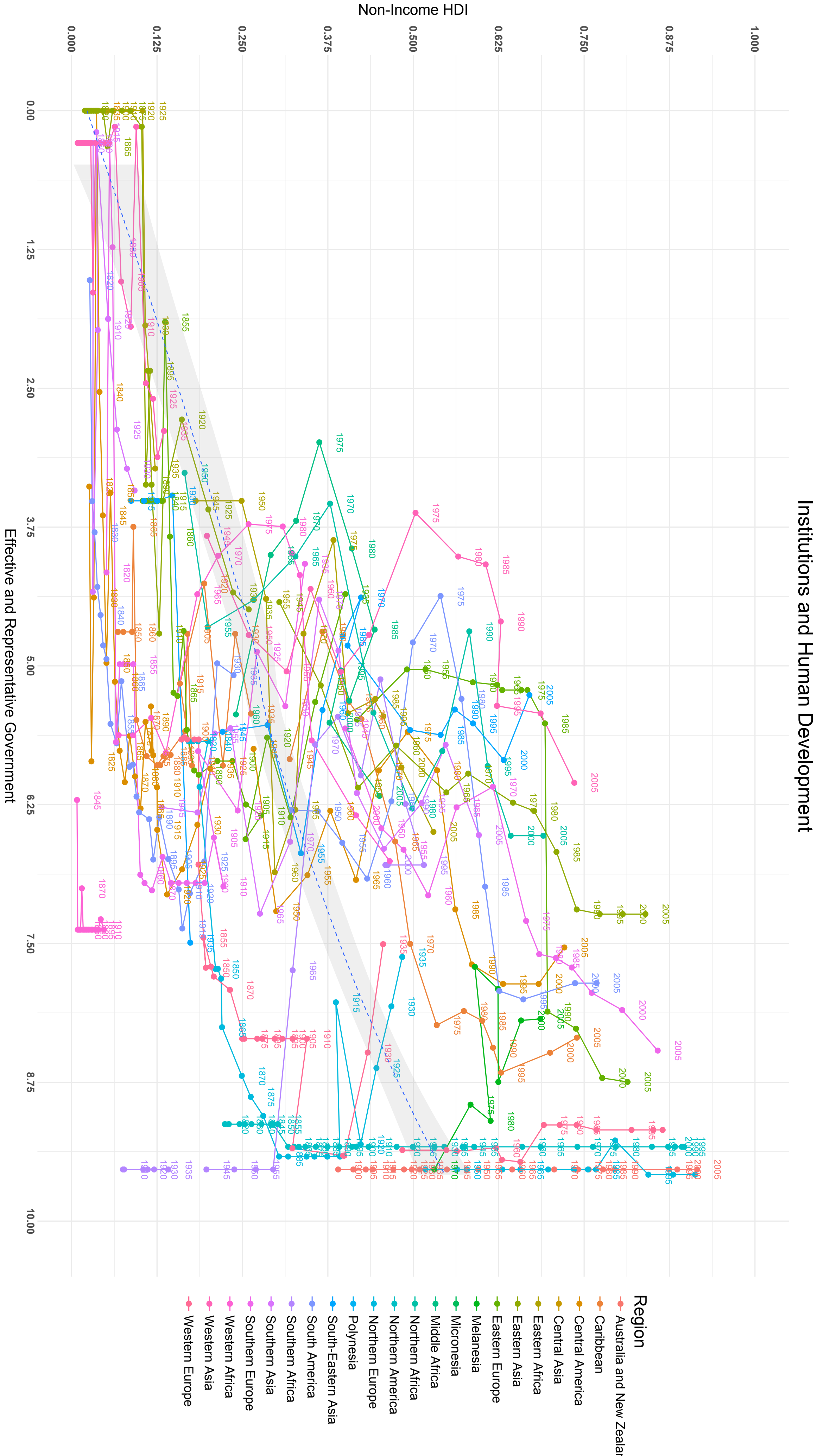

World Income Growth
GDP per Capita, PPP$ inflation-adjusted
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
1800
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020
Year
Region
Australia and New Zealand
Caribbean
Central America
Central Asia
Eastern Africa
Eastern Asia
Eastern Europe
Melanesia
Micronesia
Middle Africa
Northern Africa
Northern America
Northern Europe
Polynesia
South-Eastern Asia
South America
Southern Africa
Southern Asia
Southern Europe
Western Africa
Western Asia
Western Europe


World Human Development
Non-Income HDI
0.000
0.125
0.250
0.375
0.500
0.625
0.750
0.875
Year
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
Region
Australia and New Zealand
Caribbean
Central America
Central Asia
Eastern Africa
Eastern Asia
Eastern Europe
Melanesia
Micronesia
Middle Africa
Northern Africa
Northern America
Northern Europe
Polynesia
South-Eastern Asia
South America
Southern Africa
Southern Asia
Southern Europe
Western Africa
Western Asia
Western Europe

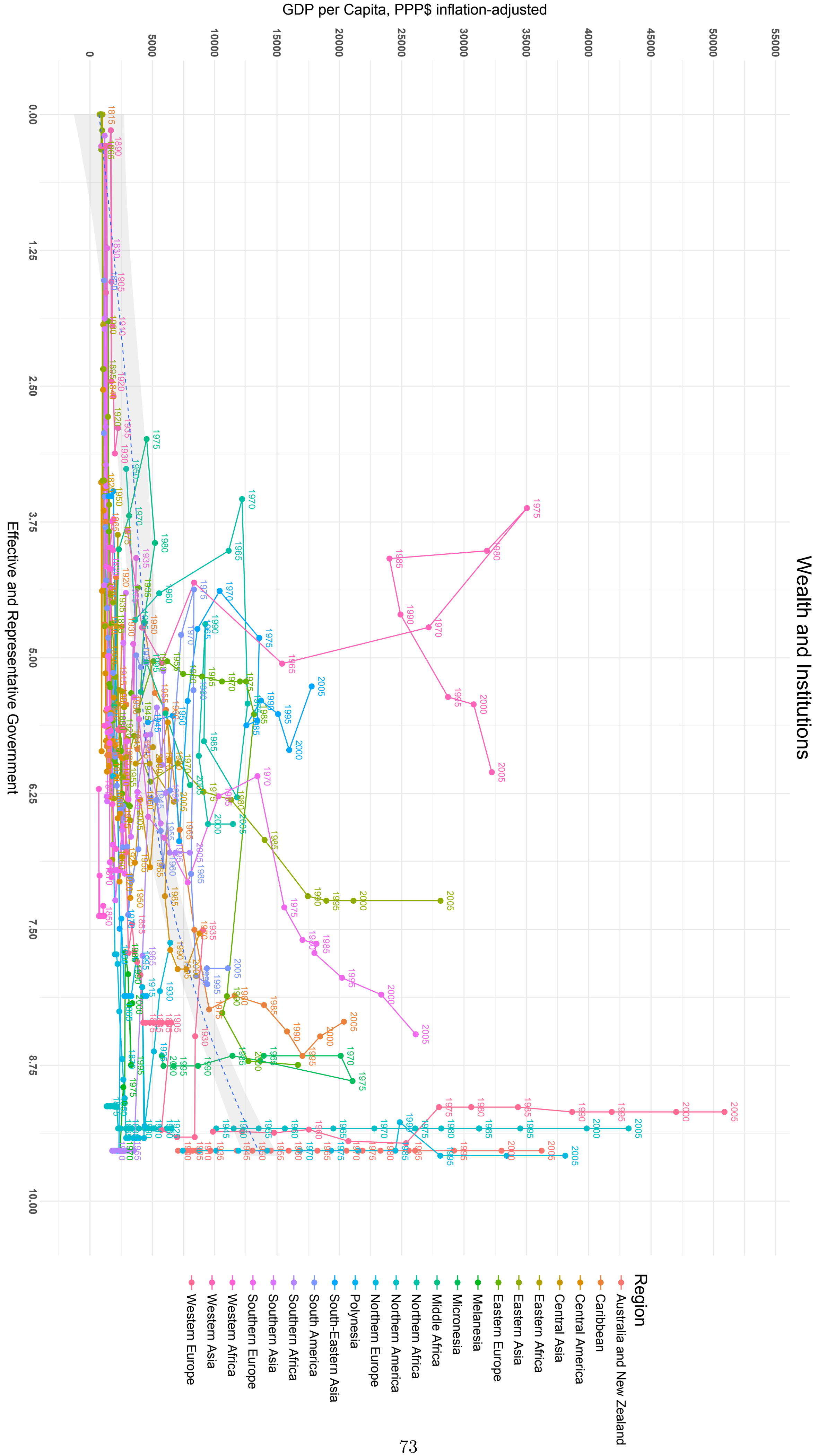

World Institutional Development
Effective and Representative Government
0.00
1.25
2.50
3.75
5.00
6.25
7.50
8.75
10.00
Year
1800
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020
Region
Australia and New Zealand
Caribbean
Central America
Central Asia
Eastern Africa
Eastern Asia
Eastern Europe
Melanesia
Micronesia
Middle Africa
Northern Africa
Northern America
Northern Europe
Polynesia
South-Eastern Asia
South America
Southern Africa
Southern Asia
Southern Europe
Western Africa
Western Asia
Western Europe


World Institutional Development
TS Multidimensional Institutions Index
8.75
7.50
6.25
5.00
3.75
2.50
1.25
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year
Region
Australia and New Zealand
Caribbean
Central America
Central Asia
Eastern Africa
Eastern Asia
Eastern Europe
Melanesia
Micronesia
Middle Africa
Northern Africa
Northern America
Northern Europe
Polynesia
South-Eastern Asia
South America
Southern Africa
Southern Asia
Southern Europe
Western Africa
Western Asia
Western Europe


Wealth and Human Development
Non-Income HDI
0.000
0.125
0.250
0.375
0.500
0.625
0.750
0.875
1.000
GDP per Capita, PPP$ inflation-adjusted
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
Region
Australia and New Zealand
Caribbean
Central America
Central Asia
Eastern Africa
Eastern Asia
Eastern Europe
Melanesia
Micronesia
Middle Africa
Northern Africa
Northern America
Northern Europe
Polynesia
South-Eastern Asia
South America
Southern Africa
Southern Asia
Southern Europe
Western Africa
Western Asia
Western Europe



Institutions and Human Development
Non-Income HDI
Effective and Representative Government
Region
Australia and New Zealand
Caribbean
Central America
Central Asia
Eastern Africa
Eastern Asia
Eastern Europe
Melanesia
Micronesia
Middle Africa
Northern Africa
Northern America
Northern Europe
Polynesia
South-Eastern Asia
South America
Southern Africa
Southern Asia
Southern Europe
Western Africa
Western Asia
Western Europe



Wealth and Institutions
GDP per Capita, PPP$ inflation-adjusted
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
Effective and Representative Government
0.00
1.25
2.50
3.75
5.00
6.25
7.50
8.75
10.00
Region
Australia and New Zealand
Caribbean
Central America
Central Asia
Eastern Africa
Eastern Asia
Eastern Europe
Melanesia
Micronesia
Middle Africa
Northern Africa
Northern America
Northern Europe
Polynesia
South-Eastern Asia
South America
Southern Africa
Southern Asia
Southern Europe
Western Africa
Western Asia
Western Europe