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Markus Ahlborn, Rainer Schweickert

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A MACRO CLUSTER APPROACH

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ABSTRACT

The literature on economic systems and corresponding empirical studies have largely focused on a classification for developed countries, while other world regions have only partly been included and/or not compared to established OECD prototypes on an income-adjusted basis. In our macro clustering approach, we apply Ward as well as Fuzzy C-Means clustering methods and, in contrast with other approaches, correct for the income bias in clustering variables. We are therefore able to include a worldwide sample of 115 developed and developing countries, the latter including transition countries. The major result from using income adjusted variables is that developing countries phase into the OECD divide. On the one hand, most African and Latin American countries join the liberal OECD prototype economies in the *world of inequality.* On the other hand, a large part of Asian developing countries as well all transition countries join the coordinated and liberal European market economies in the *world of equality*. As a robust result, European Nordic and transition countries form a cluster combining high levels of innovation and equality if income differences are phased out. At the same time, as argued by La Porta et al. (2008) and Lange et al. (2006), the distribution of non-transition developing countries between and within these worlds of equality and inequality reveals a clear distinction between British vs. other colonial heritages as one driver of economic systems today.

Keywords: Economic Systems, Varieties of Capitalism, Worlds of Welfare States, Cluster Analysis, Principal Components Analysis, OECD, Developing Countries
JEL classification: H10, P10, P51

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1. Background and Motivation

The literature on traditional OECD countries has revealed the importance of production systems in Varieties of Capitalism (VoC) approaches (see, e.g., Hall and Soskice 2001) and/or welfare systems in Worlds of Welfare States (WWS) approaches (see, e.g., Esping-Andersen 1990). As summarized in Schröder (2013) an integration of these two strands of the literature on institutional diversity is possible. Corresponding empirical analyses, e.g., the cluster analysis of Ahlborn et al. (2016), show that there are OECD prototypes of (combined) production *and* welfare systems, divided into a Liberal variety (basically Anglo-Saxon countries) on one end of the spectrum and a number of Coordinated varieties (Continental, Nordic, and Mediterranean European countries) on the other end.

It is surprising that the literature on developing countries still focuses almost exclusively on the role of institutional *quality* in economic development and largely neglects the role of the *type* of institutions, as analyzed in the literature on economic systems. There are, indeed, arguments put forward in the development literature supporting the hypothesis that the divide revealed for traditional OECD countries should also play a role for developing countries.[1] One seminal paper on the role of institutional quality by Acemoglu et al. (2001) established the role of settler mortality as an exogenous instrument for institutional quality. Hence, colonial heritage should play a role in the design of institutions as we observe them today. There is an almost perfect overlap between settler colonialization in British colonies and the cluster of countries with a Liberal economic system we observe today. In addition, the singularity of the Liberal variety is the most robust result in cluster analyses of economic systems.

More specifically, the literature on colonial heritage and the transplant of institutions contains explicit references to differences between British colonialization and colonialization by others. Lange et al. (2006) summarize empirical evidence on the transplant of British liberal institutions and Spanish mercantilist institutions. Hence, the mature divide in economic systems we observe in traditional OECD countries was already present during the era of colonialization (at least in relative terms). While Lange et al. (2006) implicitly talk about the transplant of different varieties of economic systems, La Porta et al. (2008) explicitly argue that "…legal origins are central to understanding the varieties of capitalism...". Indeed, their categorization of legal origins into English, French (covering all other mature colonializing powers), German, Scandinavian and Socialist reveals an almost perfect overlap with the varieties of economic systems identified for traditional OECD countries today.

Hence, we hypothesize that we should observe group patterns among developing countries that mirror the categorization among OECD countries moderated by geography and colonial heritage. Knowledge about the economic systems in developing countries could provide valuable guidance for future reforms in these countries because the literature on OECD countries has shown that the same government activity does not fit in all systems but rather produces distinct growth effects (Beckmann et al. 2016).

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[1] *Because our focus includes all countries, we use the term developing countries for the whole group of non-traditional OECD countries (as of 1990). This includes emerging market economies and former socialist countries (current and former transition countries).*

In this paper, we attempt to close the abovementioned gap in the literature by implementing a comprehensive macro cluster approach for a broad sample of 115 developed and developing countries Looking at this worldwide sample based on income-adjusted variables constitutes a novel approach among empirical comparative capitalism studies because they have so far only included partly and/or have not been compared to OECD countries on an income-adjusted basis. The paper proceeds as follows. Section 2 provides a brief overview of the empirical evidence on economic systems in OECD and developing countries with a focus on cluster analyses. Section 3 explains our empirical model based on the macro cluster approach, which combines macroeconomic policy and performance variables. We adjust for income level, which drives most variables to a varying extent and is shown to bias cluster results. We implement Ward and Fuzzy C-Means clustering methods as well as principal component analysis to check the robustness of our results. Section 4 presents the results, and Section 5 concludes.

2. Evidence on Varieties of Economic Systems in OECD and Developing Countries

The literature on comparative capitalism identifies prototypes among traditional OECD countries. These prototypes allow for superior economic performance if they feature a consistent economic system where the institutions within all microeconomic spheres are complementary, i.e., they produce matching incentive structures. The framework of these analyses is provided by the VoC approach, which was initiated by Hall and Soskice (2001) and examines production systems, and by Esping Andersen's (1990) WWS approach, which examines welfare systems. These prototype economic systems will be accompanied by distinct performance patterns along the lines of a possible trilemma of social policy objectives. Countries must decide on potential tradeoffs between the three macroeconomic targets of innovative capacity, macroeconomic stability, and income equality (Hall and Gingerich 2009, Iversen and Wren 1998, Kitschelt 2006).

An integration of these two theoretical frameworks by Schröder (2013) and the empirical analysis including the economic performance trilemma allows for the identification of four prototype economic systems among traditional OECD countries (Ahlborn et al. 2016):[2]

1. *Liberal:* Liberal Market Economy, 'Liberal' welfare state, restraint of government interference, focus on macroeconomic stability and innovative capacity
2. *Continental European:* Coordinated Market Economies, 'Conservative' welfare state, active government, focus on income equality and macroeconomic stability
3. *Nordic:* Coordinated Market Economies, 'Social Democratic' welfare state, active government, focus on income equality and innovative capacity
4. *Mediterranean*: Mixed Market Economy, closest to Continental model, few institutional complementarities with resulting performance problems

Several empirical studies have employed cluster analysis to verify the country groups among traditional OECD countries that are attributed to these prototypes (e.g., Amable 2003, Bambra 2007, Danforth 2014, Gough 2001, Hassel 2014, Kangas 1994, Kautto 2002, Obinger and Wagschal 2001, Powell and Barrientos 2004, Pryor 2005, Saint-Arnaud and Bernard 2003, Schröder 2013). Some cluster analyses in comparative capitalism research go beyond the country sample of the traditional OECD countries used in the previously mentioned studies. For

example, Ahlborn et al. (2016), Castles and Obinger (2008), Farkas (2011), Fenger (2007), McMenanim (2004) and Schneider and Paunescu (2012) add the Central and Eastern European Countries (CEECs) to their cluster analyses.

Ahlborn et al. (2016) used a 'comprehensive macroeconomic cluster approach' to identify groups of economic systems, as opposed to the common use of microeconomic variables in previous empirical studies on comparative capitalism. They considered macroeconomic policy variables to account for production and welfare aspects (following, e.g., Amable 2003 and Schröder 2013) and macroeconomic performance variables to account for the (possible) trinity of achieving income, equal distribution, and stability targets underlying the design of economic systems (following, e.g., Kitschelt 2006 and Hall and Gingerich 2009). This approach offers several advantages for our analysis: (1) it constitutes an established approach to identify economic systems in country groups that have not been primarily covered by previous studies; (2) it allows for a comprehensive view on both economic systems and corresponding performance patterns; and (3) it allows us to analyze a worldwide sample due to data availability. However, a major shortcoming is that even in a sample of OECD countries, differences in the level of economic development between, for example, Nordic countries compared to Mediterranean and CEEC countries should bias the results because richer countries should spend and transfer more, regulate less, have higher innovation capacities and be more equal.

Concerning developing countries,[3] there is some incidence of regional differences. Ahrens et al. (2012) analyzed the effect of economic systems on government spending as a macroeconomic performance indicator. As expected, Coordinated Market Economies (CMEs) spend more than Liberal Market Economies (LMEs). Asian and African countries as a group seem to lean rather towards the CME model, while Latin American countries rather lean towards the LME model. However, the dummy variable approach applied by Ahrens et al. (2012) does not allow for cross-regional differences according to colonial origins of economic systems except for Latin America. There, the significance of the cross-term suggests a divide according to income inequality, which may be in line with the differentiation in Spanish colonies according to the extent of resource exploitation in Lange et al. (2006).

Without claiming completeness, examples for the classification of further regions are Amable (2003), who established an Asian cluster; Schneider and Soskice (2009), who analyzed a Latin American cluster that they labeled Hierarchical Market Economies (HMEs); and Ahlborn et al. (2016), who confirmed (still) own varieties of economic systems in CEECs, which, however, lean towards either the liberal or the coordinated OECD prototypes. In total, these samples of 'traditional' OECD countries still provide the main part of the country sample or a specific OECD variety, which provides the benchmark for evaluation.

In contrast, Pryor's (2006) cluster analysis includes a range of developing countries, thereby defining new prototypes. Pryor (2006) distinguishes four models of capitalism among them (*Business*, *Labor*, *Statist* and *Traditional*). While the *Business* cluster is dominated by Asian countries, Latin American countries are spread over all four clusters. For example, Chile joined Asian countries in the *Business* cluster, Argentina is allocated to

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[2] *There is no unified nomenclature concerning the labels of clusters. Hence, different versions are used in different strands in the literature, although they refer to highly similar groups of countries.*

[3] *Throughout the text, we address both emerging market economies and developing (low-income) countries by using the term 'developing countries'.*

the *Labor* cluster, Brazil to the *Statist* cluster and Honduras to the *Traditional* cluster. However, Pryor does not link his analysis to varieties observed in traditional OECD countries and did not consider explicit hypotheses on differences to be expected on the basis of colonial heritage and region-specific circumstances. In addition, the fact that a large number of variables have been reduced using factor analysis implies that initial variables could not be used for the interpretation of the cluster results.

Most importantly, however, the correlation between variables used and the level of development should bias cluster results. This is suggested by the existence of a *Traditional* cluster in the analysis of Pryor but also by a recent cluster analysis based on sectoral clusters for 140 developed and developing countries by Rougier and Combarnous 2017, who arrive at a sample split into developing transition/emerging, and developing countries. As these authors point out, "…the first order of differentiation … refers to institutional formalization…" (p. 303) and, hence, to the level of income as institutional quality and income are highly correlated. Therefore, the interesting question remains whether developing countries reveal similar cluster solutions after variables have been corrected for the income bias.

While empirical evidence from cluster analysis is limited so far, other evidence is available to support both hypotheses: colonial heritage and regional similarities. Lange et al. (2006) are most explicit about the economic systems implemented in colonizing countries at the time of colonization: a liberal economic system in Britain and a mercantilist system in Spain. While this is similar to the major divide today between liberal and coordinated economic systems, the authors argue that the process of transplanting economic systems has varied depending on initial conditions (development, population density, central structures) in place at the time of colonization. The Spanish mercantilist system was most strictly implemented for exploitation in regions with an already centralized system. At the same time, the British liberal systems targeted the accumulation in underdeveloped regions (settler colonization). Hence, there should be an overlap between colonial heritage and regional conditions when economic systems in developing countries are observed. At the same time, Lange et al. (2006) assume that the liberal system is better for development, which led to a reversal of fortune when implemented in previously underdeveloped regions such as the settler colonies, i.e., today's Liberals.

In the same vein, colonial heritage – British vs. other – figures prominently in the literature on economic performance of African countries (see, e.g., La Porta et al. 1998, Bertocchi and Canova 2002, Bertocchi and Guerzoni 2011). While the literature is generally inconclusive on growth in Africa, the contributions assume a role of the type of institutions transferred by colonialization and that there is some (although possibly fading) evidence on the superiority of liberal institutions based on the British legacy. Beyond Africa, there is also empirical evidence that the British legacy matters for other aspects of development such as political governance (Lange 2004) and social security systems (Schmitt 2015).

Hence, the transplant of British institutions, with the extreme case of settler colonization for the countries today (including the UK and Ireland) forming the Liberal cluster, provides a kind of benchmark for developing countries. Compared to other European colonization, British colonization was driven by a very different set of institutions. British influence in today's Commonwealth should then be expected to lead to a divide in economic systems in all developing regions, and the Liberals provide the most robust and distinct cluster when focusing on traditional OECD countries.

A comprehensive cluster analysis that combines the two fields (identification of economic systems among industrialized countries as identified by VoC/WWS literature and types of institutions in developing countries) and systematically analyses corresponding group patterns is still lacking to our knowledge. Consequently, it remains unclear whether the traditional OECD prototypes identified are valid for developing countries as well or whether these countries establish own developmental prototypes of economic systems as suggested by Pryor. Both types of samples - only industrial or only developing countries - run the risk of neglecting important information about economic systems. This is especially true because the literature on colonial heritage allows us to derive hypotheses about potentially close links between both country groups leading to a divide of developing regions according to OECD prototypes. Hence, we test the general validity of prototypes, which are established based on separate samples, by implementing a joint worldwide sample.

3. Empirical Model, Data Description, and Methodology

Benchmark strategy

We start by leaning on the approach developed by Ahlborn et al. (2016), who employ a small set of aggregate macroeconomic variables on government activity and economic performance. The variables used are described in detail in Appendix Table A1.[4] We consider three variables measuring government activity (overall *size of government* incl. transfers, government enterprises, tax system, etc.; *transfer spending* as a proxy for welfare-related involvement; and government *regulation* aggregated on the basis of sectoral regulation in trade, labor and capital markets) and three variables for the three dimensions of macroeconomic targets (*income equality* as measured by the (reversed) GINI index, *innovation capacity* as a proxy for income perspective and measured by the World Bank, and *fiscal stability* measured by using the fiscal debt ratio).

Because this macro approach has been shown to reproduce the core insights from cluster analyses on traditional OECD countries, it offers several advantages for our research:

(1) It allows for the inclusion of a broad worldwide sample because of high data availability. Therefore, it is possible to identify economic systems in country samples that have not been extensively studied yet *and* relate them to the prototypes of traditional OECD countries at the same time.

(2) It allows for a comprehensive view on economic systems by looking at policy variables *and* corresponding performance patterns. Therefore, it is possible to draw conclusions for development strategies with different degrees of government activity.

(3) It allows for the use of Principal Component Analysis (PCA) as an additional, complementary analysis because no weighting of variables is necessary beforehand. Therefore, it is possible to detect groups of economic systems as well as the main driving forces of forming these clusters.

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[4] *We use averages for the period 2010 − 2013 for most of our variables. In the case of the Gini coefficient, we have to rely on data available for some years in this period or refer to the most recent data later than 2005. In addition, we want our analysis to be comparable to the analysis in Ahlborn et al. (2016) and use innovation capacity data provided by the KAM dataset established by the World Bank, which is also available until 2009 only. Because our variables are stable over a longer time horizon, as are economic systems, we assume that all data are still representative for the period 2010–2013.*

We improve the approach adopted by Ahlborn et al. (2016) in two important ways. First, in addition to the Ward hierarchical cluster analysis, which allows for analyzing sub-clusters, we apply Fuzzy C-Means (FCM) Clustering, which allows us to analyze the likelihood of countries belonging to a given number of clusters. Second and even more importantly, we also account for differences in the level of development. Consequently, we implement two versions of our cluster variables: standardized original variables (the world as it is) and standardized residuals from regressing these variables on initial income (the world as it might be). The latter should give us an idea of which variant of liberal or coordinated varieties of economic systems are implemented successfully for guiding development. In the following, we briefly discuss these two points.

Cluster methodology

We employ hierarchical clustering by applying the Ward algorithm to our data because this method allows us to analyze sub-clusters and the related hierarchy. Because a hierarchical structure of economic systems is suggested by theory, Ward clustering is applied by most cluster studies and, hence, could be theoretically checked prior and new results compared to previous results in the literature. This would not be possible using partitioning cluster methods, such as K-means.

However, the Ward algorithm, as any other 'hard' clustering method, assigns objects irrevocably to clusters. This can be disadvantageous since outliers –if already assigned to a cluster- can influence cluster centers to a large degree even though they are not clear members of their cluster. To overcome this disadvantage of hard clustering methods, fuzzy cluster algorithms have been devised, the most prominent of which is the Fuzzy C-Means (FCM) approach by Bezdek (1981). This partitioning algorithm separates objects into c clusters by iteratively reallocating cluster centers (centroids) until an optimal partition has been achieved. Its advantage over the k-means method, which operates similarly, lies in the fact that cluster membership is now 'fuzzy'. Objects are not assigned irrevocably to a cluster but only to a certain degree, expressed by the membership coefficients u_{ij}. This constitutes an advantage over 'hard' clustering methods, since a more detailed analysis of the underlying data structure becomes possible.

In our analysis, this has important implications. First, centroids are less influenced by outliers and can be used to characterize prototypes of economic systems. Second, outliers due to single clustering variables are better integrated and do not tend to form a separate (outlier) cluster. Third, hybrid forms and relations between clusters become clearer because all countries cluster into all clusters with different probabilities. As in any partitioning method, however, the number of clusters must be set in advance. Hence, we are unable to analyze sub-clusters or cluster hierarchy. Therefore, we use both methods, Ward and FCM, and compare the results to make use of both approaches' advantages.

In addition to the cluster analyses, PC analysis offers the possibility of identifying the main drivers of clustering. These PCs are correlated with the original variables and thereby can be expected to "explain" a certain (quantifiable) amount of the variation among the data. We use the first two PCs given by the PC-analysis to generate scatterplots that place our clusters into the PC1/PC2 world.

Coping with income differences

In the context of our analysis, the methodology employed by Ahlborn et al. (2016) has a major disadvantage since the variables used to characterize economic systems are jointly determined by income to a significant extent and some differences found in cluster analyses are driven by these income differences. For example, rich countries spend more than poor countries because the demand for public goods increases with income and the supply increases with the tax base. Hence, poor countries are expected to be different but, correcting for income differences, could lean towards prototype systems found in the developed OECD world.

Therefore, we must consider differences in income by at least determining all cluster variables to a considerable extent, and we need an empirical strategy to address this problem. To do so, we run OLS regressions of each cluster variable separately, in which we regress them on initial GDP per capita (PPP) for the period average 1995–1998, which is when most transition crises should have faded out. Using initial income, we assume that we accounted for endogeneity problems at least to the extent possible in this analysis.[5] We tested three regression models - a linear, a log-linear, and linear model augmented by a quadratic term – and chose the variant with the higher adjusted R-square. In all regressions, the coefficients of initial income are highly significant. We then used the residuals as an income-adjusted measure for our cluster analysis.[6] In this sense, the variance not determined by income differences reveals deviations from the normal pattern, i.e., deviations from the values to be expected given the level of development. In our analysis, we use both the standardized initial variables and the standardized residuals from income regressions to compare results for *the world as it is* with *the world as it might be*.

The difference between the two resulting datasets is revealed by the regional averages shown in Figure 1. Since regions are sorted by their average income from left to right, Figure 1 shows a trend of innovation and equality to increase with income. In case of equality, however, this trend is broken by highly unequal Latin America and Caribbean (LAC) countries and highly equal (other) European and Central Asian (ECA) countries. In addition, the level of debt increases with the possibility of being indebted, i.e., with income. On the policy side, there is a clear trend toward increasing government size and transfer and toward decreasing regulation during development. In particular, large governments driven by large transfers are to some extent the domain of OECD countries. The comparison of original variables and income residuals reveals that Africa and traditional OECD countries (OECD90) provide the extreme cases, but the comparison across regions provides a more diversified and complex picture with no clear trend with respect to the level of economic development. Hence, employing income residuals to detect clusters of economic systems in *the world as it might be* appears plausible.

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[5] *We also tested instrumentation with lagged endogenous variables but did not achieve meaningful results. Estimating fully determined specific instrumentation for all variables was beyond the scope of this analysis.*

[6] *Country samples for regressions differ from the sample used for cluster analysis. Because we want to establish the normal pattern for the world, we included all countries for which data on the single cluster variables are available. The cluster sample was then used to focus on the countries for which all six cluster variables are available.*

Figure 1 – Variables sorted by regions

Standardized Original Variables

Income Residuals
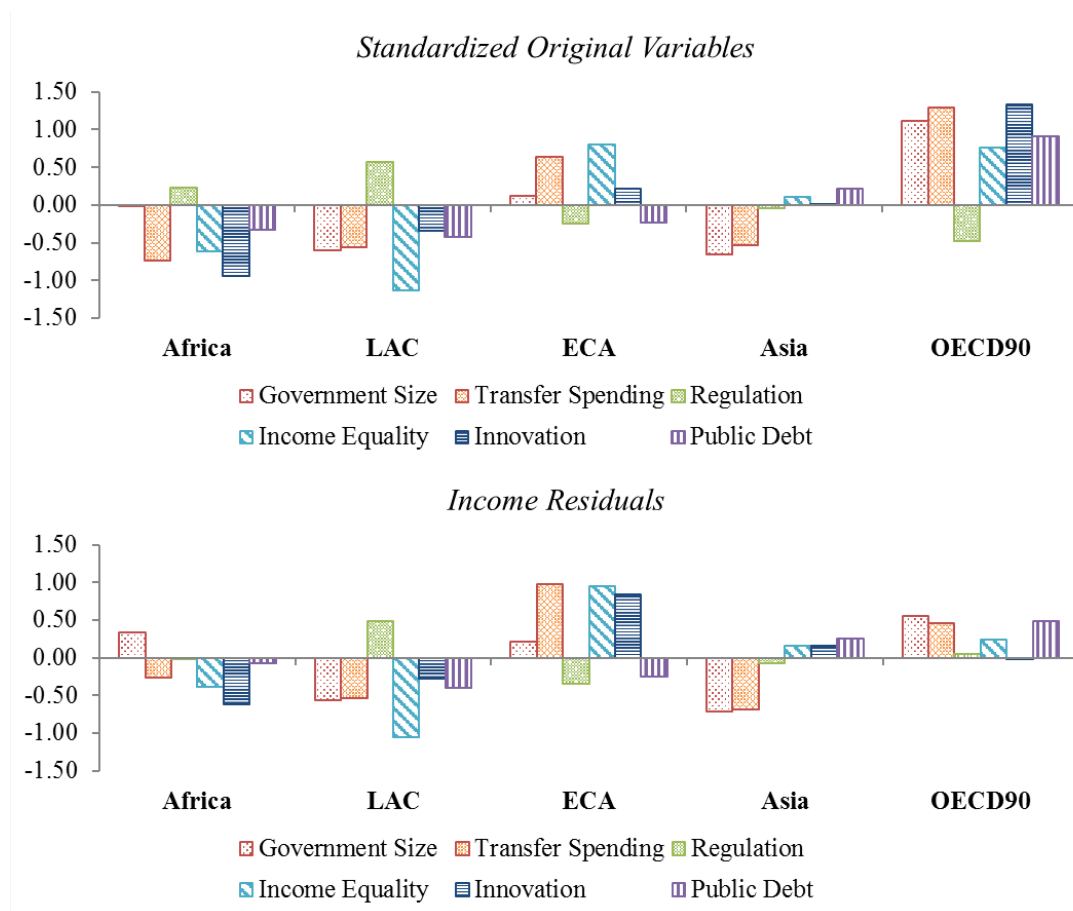
4. Empirical Results

Standardized Initial Variables – Ward Clustering

The results for an eight-cluster-solution[7] based on standardized initial variables are shown in Figure 2, which in the upper part contains a graph showing the unweighted averages for the six cluster variables for all clusters. In the lower part, Figure 2 shows the countries sorted into the eight clusters as well as the aggregations into 4- and 2-cluster solutions (for the cluster dendrogram, see Figure A1 in the appendix).

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[7] *We decided for an 8-cluster solution determined by defining the critical value for homogeneity (hierarchical cut off). This is based on the priors from the literature detecting four prototypes for OECD countries and four prototypes for developing countries by Pryor (2006).*

Figure 2: Groups and their averages: Hierarchical Clusterization (original variables)

Chart (vertical axis from -2,00 to 3,00):
Dev_Low | Dev_Inequ | Dev_Inno | CME_Cont

Legend:
- Government Size
- Transfer Spending
- Regulation
- Income Equality
- Innovation
- Public Debt
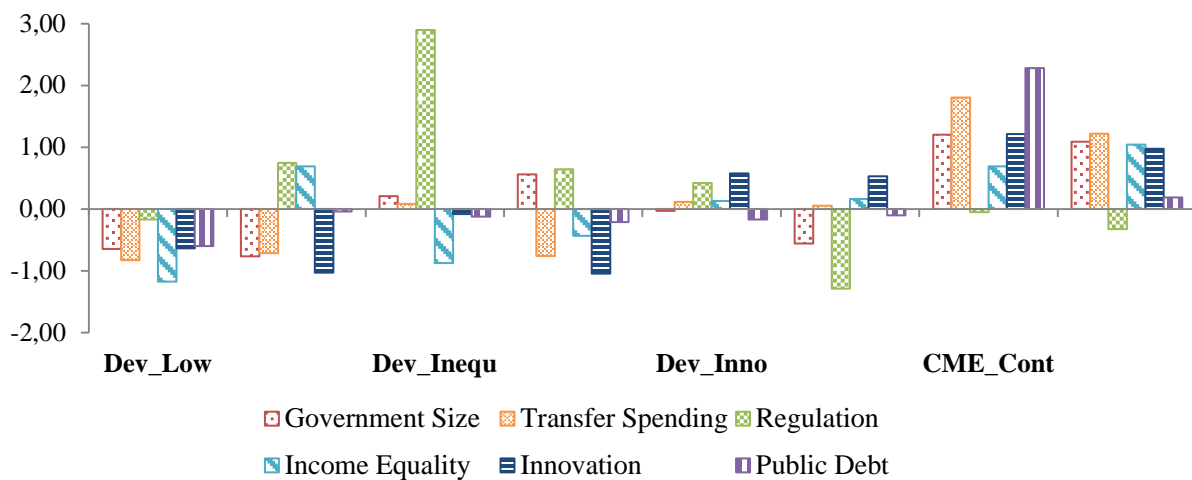
2 Clusters	Developing World				Industrial World			
4 Clusters	Dev__Low	Development			Liberal		Coordinated	
8 Clusters	Dev_Low	Dev_Equ	Dev_Inequ	Dev_High	Dev_Inno	Lib_OECD	CME_Cont	CME_Nordic
	Africa: Lesotho Rwanda Swaziland South Africa Botswana Namibia Zambia Cameroon Madagascar Tanzania Uganda Kenya **LAC:** Colombia Mexico Panama Chile Costa Rica Guatemala Dominican Rep. Paraguay Haiti Honduras Nicaragua El Salvador Peru **Asia:** Thailand Philippines	**Africa:** Egypt Mali Ethiopia Sierra Leone **Asia:** India; Sri Lanka Pakistan Bangladesh Indonesia Cambodia Nepal Yemen **ECA:** Albania Kyrgyz Republic Tajikistan	**LAC:** Brazil Venezuela **Africa:** Zimbabwe **Asia:** Iran	**ECA:** Azerbaijan **Africa:** Burkina Faso Cape Verde Côte d'Ivoire Benin Ghana Angola Morocco Senegal Mozambique **LAC:** Ecuador Bolivia	**Asia:** South Korea Taiwan Israel China Turkey **ECA:** Cyprus Moldova Russia **LAC:** Argentina Uruguay **Africa:** Tunisia	**Asia:** Singapore Hong Kong Jordan Fiji Malaysia **OECD90:** Canada USA Switzerland Australia **ECA:** Estonia Romania Bulgaria Lithuania Armenia Kazakhstan Georgia Macedonia **Africa:** Mauritius	**Asia:** Japan **OECD90:** Belgium France Austria Germany Greece Ireland Italy Portugal	**OECD90:** Luxembourg Denmark Sweden Finland Netherlands Spain Iceland United Kingdom Norway **ECA:** Croatia Malta Hungary Bosnia and Herzegovina Latvia Poland Serbia Ukraine Czech Rep. Slovak Rep. Slovenia

Among the OECD countries, the division established in the previous literature is confirmed as we find country groups, resembling the prototype Liberal (Lib_OECD) and Coordinated (CME_Cont and CME_Nordic) economic systems. As in Ahlborn et al. (2016), CEECs are divided in two groups, integrated either in Lib_OECD (Estonia and others) or in CME_Nordic (Slovenia and others). The major differences from earlier results is the fact that the Mediterranean countries – on a worldwide scale – do not differ significantly from Continental European countries.

Figure 2 also reveals that some more advanced developing countries form a Dev-Inno cluster characterized by a relatively high level of innovation and including countries such as Taiwan, South Korea and China. These countries cluster with the Lib-OECD cluster in a 4-cluster solution. Together, these countries constitute a worldwide liberal cluster, while European countries merge their sub-clusters to a broad European CME cluster. This cluster also includes the UK and Ireland, which typically cluster with Liberals in an OECD sample.

Looking at the developed world, there is some similarity with the results of Pryor (2006) because the developing world spans between low-income countries (comparable to *Traditional*) and an innovative, liberal group (comparable to *Business*). The world in between is, however, slightly more diversified, and we can show how these clusters phase into the broader picture with some convergence towards OECD prototypes. At the same time, we can support the finding in Ahrens et al. (2014) about regional similarities.

Standardized Residual Variables – Ward Clustering

However, the results shown in Figure 2 on the basis of original variables appear to be distorted by the high correlation of our variables with per capita income, which is why we now turn to an analysis of income residuals. This allows us to look at the *world as it might be* if there were no income differences to distort the picture, which should allow a clearer view on economic systems and the differences between developing and industrial countries (apart from those determined by income levels).

As Figure 3 shows, there is a significant difference if the income bias is corrected for:

- The 2-cluster solution distinguishes between an almost exclusively European cluster (Equ_Inno) and the rest of the world.
- The 4-cluster solution reveals that the rest of the world is split into three clusters we refer to as 'Equality', 'Inequ_Lib and 'Inequ_Dev', which all comprise countries from different income groups.

Figure 3: Groups and their averages: Hierarchical Clusterization (income residuals)

3,00
2,00
1,00
0,00
-1,00
-2,00

Equ_Inno   Equ_Debt   Equ_Small   Lib_OECD   Lib_Dev   Africa_Size   LAC_Reg   Asia_Inno

□ Government Size   ▨ Transfer Spending   ▨ Regulation
▨ Income Equality   ▤ Innovation   ■ Public Debt
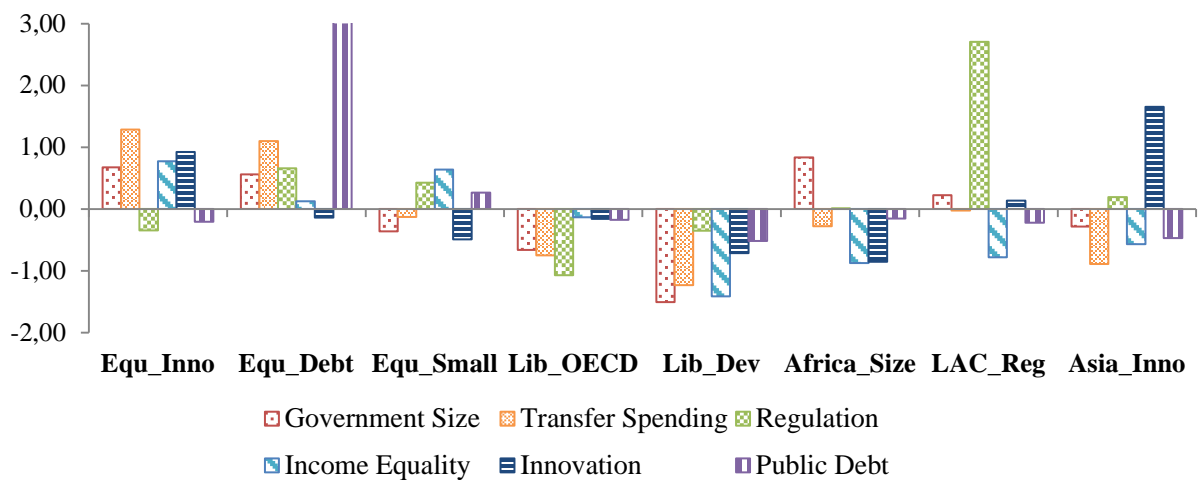
2 clusters	Europe	Rest of the World						
4 clusters	Equ_Inno	Equality		Inequ_Lib		Inequ_Dev		
8 clusters	Equ_Inno	Equ_Debt	Equ_Small	Lib_OECD	Lib_Dev	Africa_Size	LAC_Reg	Asia_Inno
	OECD90: Denmark Sweden France Austria Germany Belgium Netherlands Finland **ECA:** Azerbaijan Bosnia and Herzegovina Croatia Hungary Latvia Poland Czech Rep. Moldova Slovak Rep Slovenia Ukraine Armenia Romania Macedonia Russia Estonia Bulgaria Georgia **Africa:** Tunisia	**Asia:** Japan **OECD90:** Greece Italy Portugal	**Africa:** Morocco Sierra Leone Mali Ethiopia Egypt Madagascar Cameroon **OECD90:** Spain Ireland United Kingdom Iceland Norway **Asia:** Turkey India Yemen Pakistan Sri Lanka Indonesia Bangladesh Cambodia Nepal **LAC:** Uruguay El Salvador **ECA:** Kyrgyz Republic Malta Tajikistan Albania Cyprus	**Asia:** Philippines Fiji Jordan Malaysia **OECD90:** Switzerland Australia Canada USA **LAC:** Peru **ECA:** Kazakhstan **Africa:** Nigeria Tanzania Mauritius Uganda Swaziland Kenya	**LAC:** Mexico Dominican Rep. Guatemala Paraguay Nicaragua Haiti Honduras **Asia:** Hong Kong Singapore	**Africa:** Lesotho Rwanda Botswana Namibia Zambia Cape Verde Cote d'Ivoire Angola Burkina Faso Benin Ghana Senegal Mozambique **LAC:** Colombia Panama Ecuador Bolivia **OECD90:** Luxembourg	**LAC:** Brazil Venezuela Argentina **Africa:** Zimbabwe **Asia:** Iran	**Asia:** South Korea Taiwan Thailand Israel China **LAC:** Chile Costa Rica **Africa:** South Africa

Hence, we can be fairly certain that the results shown in Figure 3 are not driven by income differences. Starting our analysis with the highest level of aggregation, the 2-cluster solution reveals that one branch of the cluster tree is now completely determined by the Equ_Inno cluster, which combines the two Coordinated country groups from the previous analysis of the original variables (CME_Cont and CME_Nordic) and comprises mostly European and ECA countries. Its performance is characterized by above average equality *and* innovation. This is a clear stand-alone characteristic, since all other clusters in the other branches of the cluster tree are either equal or innovative or fail on both accounts ('Equality' or 'Inequality' clusters). As we can see in Figure 3, there are two *Equality* clusters that share an above level equality with the Equ_Inno cluster but fail on the innovation account. The rest of the world splits into the unequal liberal countries and the unequal developing countries. Hence, there is some indication for the major split according to income distribution after correcting for income differences.

We now turn to an analysis of the eight-cluster-solution, which allows more inference on the defining characteristics of these countries' economic systems, apart from income distribution. Concerning the two liberal clusters, Lib_OECD again does not include the UK and Ireland and Lib_Dev consists of the super-liberal countries Hong Kong and Singapore clustered together with a broad group of LAC countries.[8] As seen, these are the countries with the lowest levels of government activity combined with extreme inequality, low innovation capacity but also low debt. This confirms the results from cross-country regressions showing that LAC countries lean towards the liberal model and in addition, do not show a positive correlation between spending and equality (see Ahrens et al. 2014). The similarity between policy and performance indicators of the two liberal clusters compared to the rest of the world is evident although even more pronounced in the Lib_Dev cluster.

High debt countries now constitute a separate cluster (Equ_Debt). This cluster includes Japan (normally an outlier in OECD samples) as well as the Mediterranean countries, possibly reflecting the impact of the financial crisis in these countries. This cluster merges with a mixed European and African cluster including UK, Ireland and Norway. It is interesting to note that these two clusters do not cluster with the broad European cluster in the first place. The outstanding feature of Equ_Inno is that it combines a policy mix of large transfers but (on a worldwide scale) low regulation with both equality and innovation. Equ_Debt with high regulation and debt only achieves average performance with respect to equality and innovation, and Equ_Small runs small governments and fails on the innovation performance.

The last group is composed of regional sub-clusters. Here, we find the Asian countries from the Dev_Inno cluster joined by Israel, Chile, Costa Rica, and South Africa (Asia_Inno). This is consistent with what we know about good policy and performance in this group of countries. The performance in terms of innovation capacity is even more evident after we controlled for the fact that innovation is strongly driven by income. The other clusters show variants of performance problems. Income adjustment reveals that African countries (Africa_Size) spend well beyond what their income level would suggest, although this is not driven by transfers. Correspondingly, inequality is matched by low innovation capacity. LAC countries (LAC_Reg) are characterized by an extreme level of regulation, which are likely to suppress innovation activity. As seen, the common denominator of these regional clusters is that they are most similar with the liberal clusters with which they cluster first. Most likely, this is because of the tendency for low government interference either due to

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[8] *Note that we used the same labels of clusters if plausible in order to show similarities and to keep the use of labels as simple as possible. This does not imply that the underlying country samples are the same.*

policy choice or due to low development levels (although this should have been considered by calculating residuals, at least to some extent).

All in all, the cluster results based on income residuals reveal a major divide into a world of equality and a world of inequality with a standalone characteristic of an innovative and equal European cluster, a confirmed robust liberal group of countries, and a significance for regional groupings among developing countries.
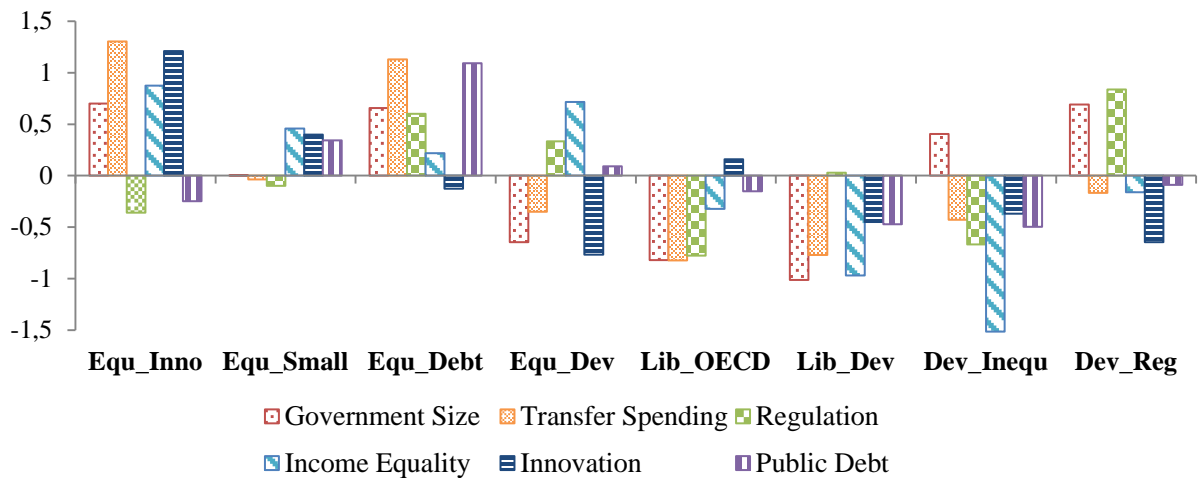
Standardized Residuals – FCM clustering

As argued above, a disadvantage of hierarchical Ward clustering is that is forces countries into one cluster even though they may actually be located between homogenous groups. To check for potential bias in hierarchical clustering, we apply FCM clustering based on an eight-cluster solution. For comparison with the Ward results in Figure 3, Figure 4 shows the resulting clusters, with each country still allocated to *one* cluster based on the maximum probability compared across clusters. The probability matrix linking all countries, grouped according to maximum probabilities, to *all* clusters is shown in Table A2 (discussed below).

In Figure 4 we kept labels of clusters discussed above constant as much as plausible looking at the average performance of clusters. Because hierarchical ordering is not possible here we also kept the organization of clusters from left to right constant as much as possible. The comparison reveals similarities and differences when compared to hierarchical clustering:

- The existence of three clusters with above-average equality organized around OECD90 countries is confirmed. However, the allocation to these clusters changed significantly. Equ_Inno combines Nordic countries with ECA countries, including the CEECs, while Continental European countries are allocated into one cluster with the high debt countries. This result corresponds with the result presented in Ahlborn et al. (2016) for OECD countries that the Nordic cluster provides a kind of best practice in the world of redistribution. Contrary to these results, however, the adjustment for income differences now reveals that CEECs, i.e., the new EU members, are rather similar to the Nordic instead of the Continental European variety of economic systems. Interestingly, China also belongs to this cluster although with a rather low probability (as is the case for some ECA countries).
- The existence of two liberal clusters consisting of mainly developed countries (Lib_OECD) and mainly developing countries (Lib_Dev) is confirmed.

Figure 4: Cluster Centroids and groups: Fuzzy C-Means Clustering (income residuals)

Government Size ☐ Transfer Spending ☒ Regulation ☐
Income Equality ☑ Innovation ☐ Public Debt ☐

Equ_Inno	*Equ_Small*	*Equ_Debt*	*Equ_Dev*	*Lib_OECD*	*Lib_Dev*	*Size_Inequ*	*Size_Reg*
OECD90:	**OECD90:**	**OECD90:**	**Asia:**	**OECD90:**	**LAC:**	**Africa:**	**Africa:**
Finland (0.98)	UK (0.92)	Portugal (0.93)	Cambodia (0.98)	Canada (0.61)	Guatemala (0.97)	Namibia (0.92)	Mozambique (0.95)
Sweden (0.56)	Ireland (0.48)	France (0.91)	Nepal (0.98)	Switzerland (0.61)	Mexico (0.95)	Botswana (0.81)	Senegal (0.89)
Netherlands (0.42)		Austria (0.89)	Indonesia (0.81)	Australia (0.51)	Dom. Rep. (0.95)	Swaziland (0.71)	Ghana (0.69)
Denmark (0.34)	**Asia:**	Germany (0.84)	Pakistan (0.77)	USA (0.41)	Paraguay (0.90)	Rwanda (0.69)	Angola (0.57)
	India (0.68)	Italy (0.73)	Bangladesh (0.71)		Honduras (0.85)	Zambia (0.63)	Ethiopia (0.45)
ECA:	Jordan (0.29)	Belgium (0.65)	Sri Lanka (0.52)	**Asia:**	Haiti (0.53)	Lesotho (0.56)	Benin (0.41)
Poland (0.98)	Turkey (0.29)	Spain (0.56)		Philippines (0.82)	Nicaragua (0.47)	South Africa (0.39)	Cote dIvoire (0.37)
Latvia (0.97)	South Korea (0.28)	Greece (0.52)	**ECA:**	Malaysia (0.50)	El Salvador (0.41)	Nigeria (0.27)	Cape Verde (0.27)
Moldova (0.97)		Japan (0.28)	Cyprus (0.89)	Fiji (0.48)	Chile (0.39)		Zimbabwe (0.27)
Slovakia (0.92)	**ECA:**		Albania (0.51)	Thailand (0.44)	Costa Rica (0.32)	**LAC:**	Burkina Faso (0.25)
Czech Rep (0.91)	Malta (0.88)	**Africa:**	Tajikistan (0.47)	Taiwan (0.35)		Colombia (0.97)	
Croatia (0.85)	Kyrgyz Rep (0.51)	Morocco (0.67)	Kazakhstan (0.35)	Singapore (0.29)	**Africa:**	Panama (0.48)	**LAC:**
Bosnia (0.80)	Armenia (0.36)	Egypt (0.45)		Israel (0.28)	Cameroon (0.60)		Bolivia (0.93)
Hungary (0.79)			**Africa:**				Ecuador (0.55)
Bulgaria (0.69)	**LAC:**		Sierra Leone (0.77)	**Africa:**	**Asia:**		Venezuela (0.38)
Ukraine (0.67)	Uruguay (0.36)		Mali (0.65)	Kenya (0.89)	Hong Kong (0.28)		Argentina (0.33)
Slovenia (0.65)			Madagascar (0.61)	Uganda (0.67)			Brazil (0.21)
Estonia (0.58)			Yemen (0.52)	Mauritius (0.54)			
Georgia (0.56)			Tanzania (0.45)				**OECD90:**
Russia (0.40)				**LAC:**			Norway (0.64)
Romania (0.39)			**OECD90:**	Peru (0.71)			Luxembourg (0.45)
Azerbaijan (0.37)			Iceland (0.28)				
Macedonia (0.37)							**Asia:**
							Iran (0.40)
Africa:							
Tunisia (0.58)							
Asia:							
China (0.37)							

- The existence of a European liberal variety including the UK and Ireland is also confirmed. However, these countries now share the feature of above average innovation and equality with the Equ_Inno cluster.
- In contrast with the hierarchical clustering results, regional clustering is less evident. Instead of the former cluster dominated by African and LAC countries respectively, both groups of countries are now allocated to two clusters characterized by above average government size and inequality (Size_Inequ) and extreme levels of size and regulation (Size_Reg). In addition, the Asia_Inno cluster is dissolved and countries allocated to a number of clusters. As will be further discussed below, a common feature of these countries is that this implies a rather flat distribution of probabilities. Hence, these countries actually share features from a number of clusters to a varying extent.

The case of resource rich, high income Norway may also exemplify the impact of adjustments made in this paper. Using initial variables as in Figure 2, Norway is allocated to the neighboring Nordic countries. Income adjustment shifts Norway to the cluster including the UK, which is characterized by rather low government size (Figure 3). Allowing for multiple cluster solutions and income adjustment revealed that, according to maximum probability, Norway is similar to the group of resource rich LAC countries. We argue that this rather strengthens our point that results not allowing for income adjustment and not looking at probabilities would lead to biased conclusions with respect to the basic institutional design of countries.

It is therefore important to look at the probability matrix presented in Table A2 in the appendix. Here, we organized countries according to their allocation to clusters as in Figure 4. In addition, we looked at the probabilities with respect to the four clusters with above average equality (the world of equality: Clusters 1 to 4) and below average equality (the world of inequality: Clusters 5 to 8). As a first result, the aggregated probabilities of countries in both worlds are approximately 80 percent within the clusters for which they revealed the maximum probability. Hence, multiple clustering may reveal low maximum probabilities for some countries but, overall, the main distribution is within the own world of either equality or inequality.

In addition, probabilities of above 10 percent for single clusters in the other world (marked light gray in Table A2) are rather few in number, although these add up in some cases to aggregate probabilities in the other world of more than 25 percent (marked dark gray in Table A2). That European countries clustered in Equ_Inno and Equ_Debt (all clustered in Equ_Inno based on hierarchical clustering) are relatively isolated from other clusters is also confirmed here. There are few cases of countries belonging to the world of inequality sorting into one of these clusters with a probability above 10 percent. These exceptions are concentrated in the Size_Reg cluster.

The latter result points to a colonial legacy as a possible driver of clustering for developing countries. If we approximate the Anglo-Saxon world by looking at today's Commonwealth of Nations (plus the US; country names marked gray in Table A2), we see that the Commonwealth African countries cluster along this line revealing colonial heritage. These countries primarily cluster with high levels of government size and inequality but low levels of regulation (Size_Inequ).

Other countries of Commonwealth Africa even cluster with the Lib_OECD countries, while non-Commonwealth African countries plus LAC countries share with European role models some features of equality but on the basis

of high levels of regulation (Size_Reg). Interestingly, this cluster also reveals the highest level of heterogeneity across the two worlds distinguished in Table 2. This is consistent with the hypothesis of a Continental European heritage both in African and LAC countries.

Finally, Asian Commonwealth countries are to be found in the world of equality with India joining the Equ_Small cluster with the UK. Only two cases of Commonwealth African countries are to be found in the Equ_Dev cluster, which share some characteristics with the inequality clusters. Hence, a British legacy in determining economic systems today is confirmed at least to some extent. Former British colonies, especially in Africa, seem to have implemented economic systems characterized by high levels of inequality and are, hence, rather similar to the former settler colonies, which form todays Liberals. As suggested by the literature, this heritage is moderated by regional background leading to homogenous groups within each region – especially Africa.[9]

In addition, the major results for OECD countries are confirmed including a kind of single outstanding variety of economic systems to be found in Continental European countries, while most developing countries are rather similar to the Liberal role model even if income levels are adjusted for and multiple clustering is allowed for.

PC Analysis – Main Determinants of Cluster Results

To gain a deeper insight into the driving forces determining the clusters, we have a look at PC analysis results based on income-adjusted variables (Table 2). In contrast with the PC analysis for the more homogenous OECD sample reported in Ahlborn et al. (2016), the first two PCs explain approximately 54 percent of total variance (instead of 63 percent). However, this is still a rather high amount considering the heterogeneity of a worldwide sample and, even more importantly, it is striking that the correlation of these PCs is similar to the correlations observed in the OECD analysis:

- PC1-*Fiscal Restraint & Inequality* shows negative correlations with size, transfer and equality and divides the world according to the extent of redistributive policies and outcomes into a world of equality and a world of inequality.
- PC2-*Regulation, Debt & Low Innovation correlates* strongly with Debt and Regulation, while showing a high negative correlation with Innovation. Hence, PC2 aligns countries according to their regulation/innovation mix within the two worlds revealed by PC1.

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[9] *Unfortunately, most LAC countries belonging to the Commonwealth are not represented in our sample due to the lack of appropriate data. Hence, the plausible divide within the LAC group is not as evident as is the case within the African group.*

Table 2: Principal Components of Standardized Residuals of Initial Income Regressions

Variables and Principal components	PC1	PC2	PC3	PC4	PC5	PC6
			Loadings			
Size	-0.486	0.066	-0.510	0.445	0.232	0.497
transfers	-0.612	-0.099	-0.072	0.084	0.084	-0.772
regulation	-0.220	0.589	-0.361	-0.586	-0.361	0.030
Gini	-0.444	-0.124	0.475	-0.510	0.449	0.317
innovation	-0.265	-0.642	-0.023	-0.102	-0.680	0.210
debt	-0.271	0.459	0.615	0.425	-0.381	0.103
Proportion of Variance	0.337	0.206	0.153	0.127	0.117	0.060
Cumulative Proportion	0.337	0.543	0.696	0.823	0.940	1.000

Figure 5: Centers of Groups and Respective Ellipses (95 % prob.), PC1 vs PC2, 8 Groups Defined by Hierarchical Cluster Tree Cutoff (income residuals)
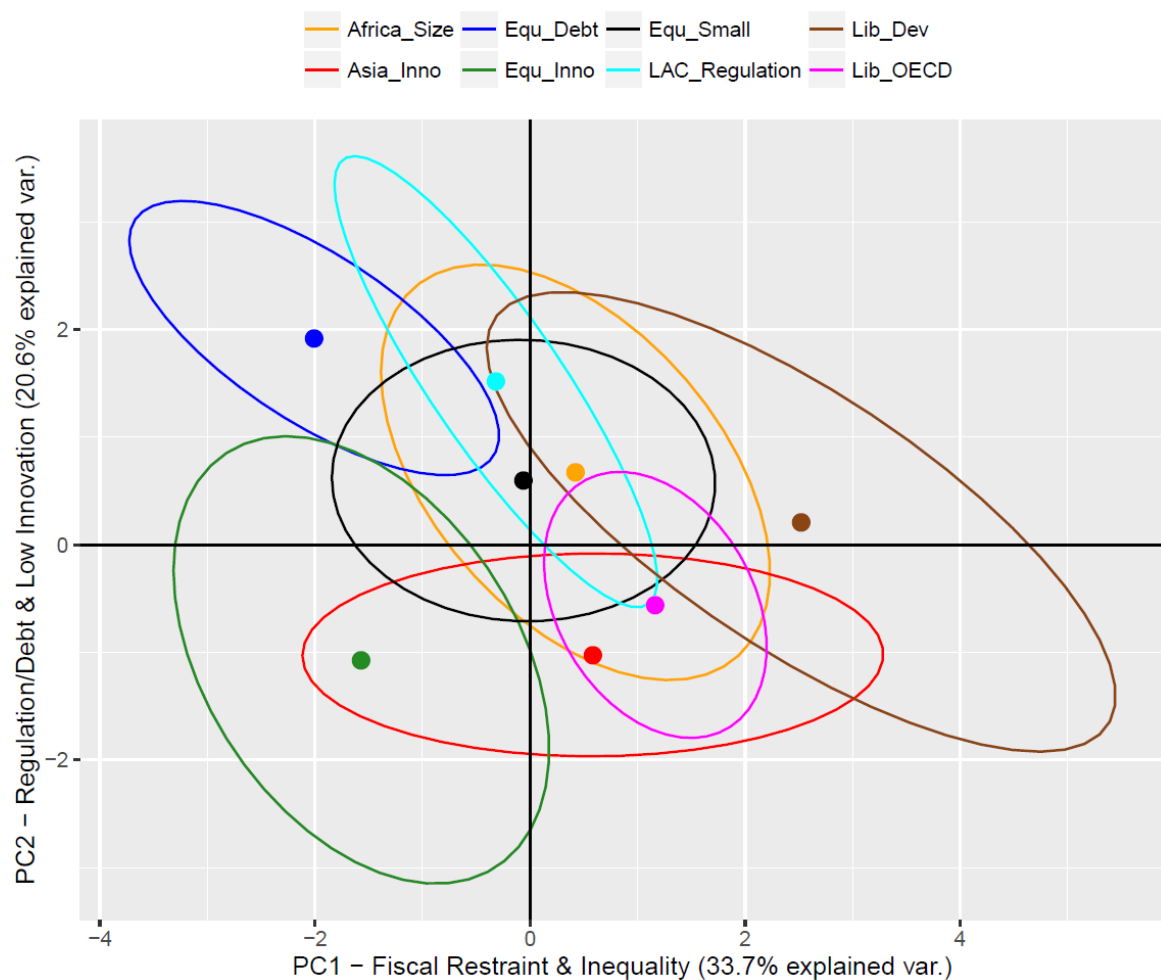
Figure 5 maps the cluster averages based on income adjusted Ward clustering into a PC1 and PC2 space showing the centroids and the distribution. As seen, we only have the broad European cluster in the lower left quadrant showing a combination of redistribution combined with innovation. Also to the left in the world of redistribution we have the clusters with other European (debt and non-debt) countries as well as the LAC countries. As was the case in the OECD sample, the Lib_OECD cluster reveals a performance comparable to the European cluster only distinguished by the extent of redistribution. Asia_Inno is close to the Lib_OECD cluster and Lib_Dev, combining LAC countries with super-liberals Hong Kong and Singapore provides an extreme case. If one thinks of a straight line connecting Lib_Dev and Equ_Inno, this might suggest that a development from a situation of government restraint towards improving equality and innovation capacity may involve more government activity guided by the liberal model of modest government involvement. Other clusters with a tendency towards the upper left quadrant indicate that other models imply some kind of trade-off where more equality comes at the cost of innovation capacity.

**Figure 6: Centers of Groups and Respective Ellipses (95 % prob.), PC1 vs PC2,
8 Groups Defined by FCM algorithm (income residuals)**
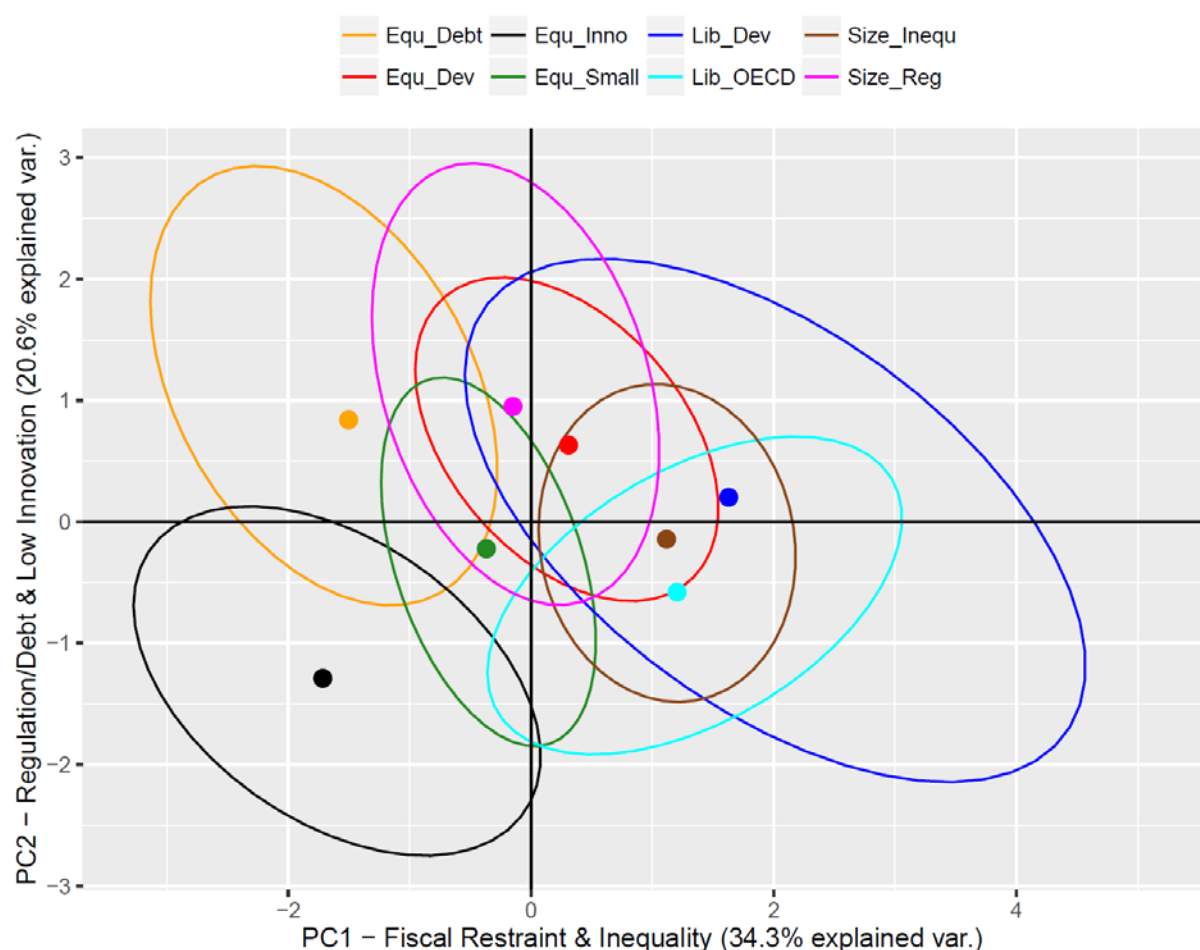
Hence, our preliminary conclusion from PC analysis is that the mapping of countries into the PC1 and PC2 space with similar determinants tells a main story independent of the country sample. Different worlds of redistribution and non-redistribution are hardly comparable because preferences for equality differ between groups of

countries. However, within these sub-groups the most important policy and performance mix is determined by regulation and innovation capacity, which are negatively correlated. Trying to move towards the Equ_Inno model with the European countries as a role model would require that this be taken into consideration.

Again, we can detect important similarities and differences when comparing these results with the results based on income adjusted FCM clustering (Figure 6). Most centroids of clusters have the same position in the PC1/PC2 world, with Lib_Dev, Equ_Inno and Equ_Debt providing the extreme cases. However, the role model of Asia_Inno is not confirmed with Equ_Small and Size_Inequ (Africa_Size in Figure 6) shifted by reallocation of countries towards a policy mix with higher innovation and lower regulation, while Equ_Dev joins Lib_Dev in the upper right quadrant characterizing the worst solutions of inequality and low innovation. In addition, it must be recognized that the Continental European countries do not belong to the Equ_Inno role model. Hence, as in Ahlborn et al. (2016), it is rather the Liberals and the Nordic countries providing a kind of best practice role model in the worlds of equality and inequality, respectively.

5. Summary

Traditionally, economic systems have been analyzed within country samples of OECD countries only. Some papers have included transition countries, Asian countries, and Latin American countries or, in one case, looked at a broad sample of developing countries. We try to avoid a potential sample selection bias that may come from an exclusive focus on one country group and gain insights into comparability of developed and developing countries' approaches towards implementing economic systems. Based on Ahlborn et al. (2016), we provide a comprehensive picture by applying a macro cluster approach for a broad, worldwide sample of 115 developed and developing countries, by accounting for production and welfare aspects (following, e.g., Amable 2003 and Schröder 2013), and by considering performance variables (following, e.g., Kitschelt 2006 and Hall/Gingerich 2009).

An additional innovation in this paper is that we consider both standardized variables as well as standardized residuals from income regressions, the latter correcting for a potential income bias. Indeed, based on standardized, uncorrected variables, the distinction between clusters mainly follows the income divide with low income developing countries and the one end of the distribution and highly developed European OECD countries on the other end of the distribution.

However, once income adjusted residual variables are implemented in hierarchical Ward clustering, developing countries to a larger degree mix up with developed countries:

- Liberal clusters: a cluster of developing liberal market economies, Central Latin American countries plus Hong Kong and Singapore, clusters together with countries grouped around the OECD liberals such as US and Canada.

- Equality clusters: a cluster of European debt countries and a cluster of developing countries grouped around the European liberals UK and Ireland clustering together based on above average equality but failing on innovation.

- Regional clusters: cluster of high spending African countries, high regulating Latin American countries and highly innovative Asian countries (plus Israel, Chile, Costa Rica and South Africa) going together.

- A Continental European cluster: while all these groups cluster are along one part of the cluster tree, there is one outstanding cluster that consists of European (including Nordic countries and transition countries) that produces a unique combination of equality *and* innovation.

Allowing for multiple clustering in a Fuzzy C-Means (FCM) application only partly confirms the regional pattern for developing countries. These regional patterns are moderated by colonial, i.e., British vs. other, legacies as suggested by La Porta et al. (2008) and Lange et al. (2006). Fuzzy clustering as well as PC analysis suggest that the major divide is not along developed and developing countries but rather between the world of equality and the world of inequality. FCM results also reveal that rather Nordic than Continental European countries provide a role model within the world of equality, while Liberal (OECD) countries provide a role model in the world of inequality. The role of innovative Asian countries revealed in the Ward analysis is not confirmed by FCM results.

Principal Component (PC) analysis suggests that the European equality plus innovation solution, which, income adjusted and in worldwide comparison, combines high transfers with low regulation levels is clearly superior as a long-term role model. While the Ward clustering results suggested that other solutions such as the OECD liberals and the innovative Asian countries provide a kind of alternative orientation within in the world of inequality, this is not confirmed by FCM results. In this world, however, OECD liberals still provide the role model in terms of innovation.

While this shows that the European solution (especially the Nordic variety) for designing economic systems may not be very bad after all, economic systems in developing countries are clearly determined by regional factors as well as legacies. Because the results do not show superiority in terms of performance (as is mostly analyzed in the literature), consistency of economic policy within this context is the most important as argued in the Varieties of Capitalism literature.

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Appendix

Table A1 – Variables, Sources, and Definitions

Variables	Source	Description
3 Variables on Macroeconomic Policy		
Size of Government	EFW: "Size of Government"	Indicator 1 'Size of Government', aggregate of sub-indicators on government size, adjusted: 0 (small) to 10 (large)
Transfer Spending	EFW: "Transfers and Subsidies"	Gives a "rating" for 'Transfers and Subsidies as a percentage of GDP': From 0 (many) to 10 (few) Transformation: Variable "turned": Higher value = higher share of Transfers and Subsidies
Government Regulation	EFW: "Regulation"	Indicator for the EFW Report's Fifth Section: 'Regulation', gives a rating from 0 (many) to 10 (few regulations) Transformation: Variable "turned": Higher value = more regulation
3 Variables on Macroeconomic Performance		
Income Equality	WDI: GINI Index	GINI index, adjusted: higher values reflect more equal income distribution
Innovation	KAM	Aggregate measure for efficient innovation system of firms, research centers, universities, consultants and other organizations with respect to acquiring and implementing new technology
Public Debt	WEO	General government gross debt as a percentage of GDP

Note: All variables were standardized, using the z-transformation.

The following sources were used: EFW: Economic Freedom of the World Report by the Fraser Institute; WDI: World Development Indicators by the World Bank; KAM: Knowledge Assessment Methodology by the World Bank; WEO: World Economic Outlook by the International Monetary Fund

Table A2: Probability Matrix: Fuzzy C-Means Clustering (income residuals) part 1

Cluster Membership in…		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 1-4	Cluster 5-8
		Equality				**Inequality**					
		Equ_ Inno	Equ_ Debt	Equ_ Small	Equ_ Dev	Lib_ OECD	Lib_ Dev	Size_ Inequ	Size_ Reg	Equality	In- equality
*Commonwealth country											
Equ_Inno											
OECD90	Finland	**0.98**	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.01
	Sweden	**0.56**	0.06	0.14	0.04	0.04	0.02	0.05	0.09	0.80	0.20
	Netherlands	**0.42**	0.26	0.11	0.03	0.02	0.01	0.03	0.11	0.83	0.17
	Denmark	**0.34**	0.09	0.20	0.06	0.05	0.03	0.09	0.15	0.68	0.32
ECA	Poland	**0.98**	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.00	0.00
	Latvia	**0.97**	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.01
	Moldova	**0.97**	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.01
	Slovak Rep	**0.92**	0.02	0.03	0.01	0.01	0.00	0.00	0.01	0.98	0.02
	Czech Rep.	**0.91**	0.03	0.03	0.01	0.01	0.00	0.01	0.01	0.97	0.03
	Croatia	**0.85**	0.06	0.05	0.01	0.01	0.00	0.01	0.01	0.97	0.03
	Bosnia and Herzegovina	**0.80**	0.08	0.05	0.02	0.01	0.01	0.01	0.02	0.95	0.05
	Hungary	**0.79**	0.07	0.09	0.01	0.01	0.01	0.01	0.01	0.95	0.05
	Bulgaria	**0.69**	0.03	0.10	0.03	0.06	0.03	0.03	0.03	0.86	0.14
	Ukraine	**0.67**	0.11	0.09	0.04	0.02	0.02	0.02	0.04	0.91	0.09
	Slovenia	**0.65**	0.13	0.09	0.03	0.02	0.01	0.01	0.05	0.90	0.10
	Estonia	**0.58**	0.03	0.14	0.04	0.08	0.04	0.05	0.04	0.80	0.20
	Georgia	**0.56**	0.05	0.15	0.03	0.09	0.03	0.05	0.03	0.80	0.20
	Russia	**0.40**	0.08	0.17	0.06	0.08	0.07	0.06	0.09	0.70	0.30
	Romania	**0.39**	0.04	0.30	0.09	0.09	0.03	0.02	0.03	0.82	0.18
	Azerbaijan	**0.37**	0.08	0.18	0.06	0.05	0.03	0.06	0.17	0.69	0.31
	Macedonia	**0.37**	0.11	0.14	0.05	0.09	0.05	0.13	0.06	0.66	0.34
Africa	Tunisia	**0.58**	0.08	0.27	0.02	0.01	0.01	0.01	0.03	0.95	0.05
Asia	China	**0.37**	0.13	0.18	0.05	0.06	0.04	0.07	0.11	0.72	0.28
Equ_Debt											
OECD90	Portugal	0.01	**0.93**	0.02	0.01	0.00	0.00	0.00	0.02	0.97	0.03
	France	0.02	**0.91**	0.02	0.01	0.00	0.00	0.01	0.02	0.96	0.04
	Austria	0.04	**0.89**	0.03	0.01	0.00	0.00	0.00	0.02	0.96	0.04
	Germany	0.05	**0.84**	0.05	0.02	0.01	0.01	0.01	0.03	0.96	0.04
	Italy	0.02	**0.73**	0.07	0.06	0.02	0.02	0.02	0.07	0.87	0.13
	Belgium	0.15	**0.65**	0.08	0.03	0.02	0.01	0.02	0.05	0.91	0.09
	Spain	0.02	**0.56**	0.20	0.04	0.01	0.01	0.01	0.15	0.82	0.18
	Greece	0.07	**0.52**	0.11	0.08	0.04	0.04	0.04	0.10	0.78	0.22
	Japan	0.10	**0.28**	0.16	0.11	0.09	0.07	0.07	0.11	0.66	0.34
Africa	Morocco	0.01	**0.67**	0.07	0.02	0.01	0.01	0.01	0.20	0.78	0.22
	Egypt	0.05	**0.45**	0.12	0.16	0.03	0.03	0.02	0.15	0.78	0.22

Table A2: Probability Matrix: Fuzzy C-Means Clustering (income residuals) part 2

Cluster Membership in…		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 1-4	Cluster 5-8
		Equality				Inequality					
		Equ_ Inno	Equ_ Debt	Equ_ Small	Equ_ Dev	Lib_ OECD	Lib_ Dev	Size_ Inequ	Size_ Reg	Equality	In-equality
*Commonwealth country											
Equ_Small											
OECD90	United Kingdom*	0.01	0.01	**0.92**	0.01	0.02	0.01	0.01	0.01	0.95	0.05
	Ireland*	0.04	0.30	**0.48**	0.05	0.04	0.02	0.02	0.05	0.87	0.13
Asia	India*	0.06	0.06	**0.68**	0.07	0.06	0.02	0.01	0.03	0.87	0.13
	Jordan	0.05	0.07	**0.29**	0.24	0.21	0.06	0.04	0.05	0.64	0.36
	Turkey	0.05	0.08	**0.29**	0.18	0.07	0.10	0.04	0.20	0.60	0.40
	Korea, South	0.12	0.04	**0.28**	0.11	0.22	0.10	0.05	0.07	0.56	0.44
ECA	Malta*	0.01	0.01	**0.88**	0.06	0.02	0.00	0.00	0.02	0.96	0.04
	Kyrgyz Republic	0.05	0.06	**0.51**	0.28	0.03	0.01	0.01	0.04	0.91	0.09
	Armenia	0.18	0.04	**0.36**	0.13	0.18	0.05	0.03	0.03	0.71	0.29
LAC	Uruguay	0.03	0.12	**0.36**	0.12	0.10	0.11	0.05	0.11	0.63	0.37
Equ_Dev											
Asia	Cambodia	0.00	0.00	0.01	**0.98**	0.00	0.00	0.00	0.00	0.99	0.01
	Nepal	0.00	0.00	0.01	**0.98**	0.01	0.00	0.00	0.00	0.99	0.01
	Indonesia	0.00	0.01	0.03	**0.81**	0.03	0.06	0.01	0.05	0.85	0.15
	Pakistan*	0.01	0.02	0.08	**0.77**	0.04	0.03	0.01	0.03	0.89	0.11
	Bangla-desh*	0.01	0.02	0.06	**0.71**	0.08	0.07	0.02	0.03	0.80	0.20
	Sri Lanka*	0.01	0.06	0.16	**0.52**	0.09	0.07	0.02	0.07	0.75	0.25
ECA	Cyprus*	0.00	0.01	0.04	**0.89**	0.02	0.03	0.00	0.02	0.93	0.07
	Albania	0.04	0.13	0.19	**0.51**	0.03	0.03	0.01	0.06	0.87	0.13
	Tajikistan	0.03	0.06	0.19	**0.47**	0.03	0.02	0.01	0.19	0.75	0.25
	Kazakhstan	0.04	0.03	0.13	**0.35**	0.23	0.11	0.05	0.06	0.55	0.45
Africa	Sierra Leone*	0.01	0.02	0.04	**0.77**	0.02	0.02	0.01	0.11	0.84	0.16
	Mali	0.01	0.02	0.07	**0.65**	0.03	0.03	0.01	0.18	0.75	0.25
	Madagas-car	0.01	0.01	0.05	**0.61**	0.08	0.20	0.01	0.04	0.68	0.32
	Yemen, Rep.	0.01	0.06	0.05	**0.52**	0.02	0.03	0.02	0.29	0.64	0.36
	Tanzania*	0.01	0.02	0.12	**0.45**	0.14	0.08	0.06	0.11	0.61	0.39
OECD90	Iceland	0.03	0.07	0.24	**0.28**	0.08	0.05	0.04	0.21	0.63	0.37

Table A2: Probability Matrix: Fuzzy C-Means Clustering (income residuals) part 3

Cluster Membership in…		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 1-4	Cluster 5-8
		Equality				Inequality					
		Equ_ Inno	Equ_ Debt	Equ_ Small	Equ_ Dev	Lib_ OECD	Lib_ Dev	Size_ Inequ	Size_ Reg	Equality	In-equality
*Commonwealth country											
Lib_OECD											
OECD90	Canada*	0.01	0.02	0.18	0.06	**0.61**	0.05	0.04	0.02	0.27	0.73
	Switzerland	0.01	0.01	0.04	0.07	**0.61**	0.24	0.02	0.01	0.12	0.88
	Australia*	0.01	0.01	0.05	0.07	**0.51**	0.28	0.06	0.03	0.13	0.87
	United States*	0.01	0.03	0.11	0.08	**0.41**	0.22	0.09	0.04	0.23	0.77
Asia	Philippines	0.00	0.00	0.02	0.03	**0.82**	0.11	0.01	0.01	0.05	0.95
	Malaysia*	0.02	0.01	0.08	0.03	**0.50**	0.08	0.26	0.03	0.13	0.87
	Fiji*	0.05	0.03	0.14	0.06	**0.48**	0.09	0.12	0.03	0.28	0.72
	Thailand	0.02	0.01	0.23	0.09	**0.44**	0.13	0.03	0.04	0.36	0.64
	Taiwan	0.05	0.03	0.17	0.11	**0.35**	0.17	0.07	0.07	0.36	0.64
	Singapore*	0.02	0.04	0.08	0.10	**0.29**	0.28	0.13	0.06	0.24	0.76
	Israel	0.04	0.04	0.26	0.06	**0.28**	0.14	0.09	0.08	0.41	0.59
Africa	Kenya*	0.00	0.00	0.02	0.01	**0.89**	0.05	0.02	0.00	0.03	0.97
	Uganda*	0.01	0.01	0.07	0.05	**0.67**	0.08	0.09	0.02	0.14	0.86
	Mauritius*	0.01	0.02	0.10	0.17	**0.54**	0.10	0.04	0.02	0.30	0.70
LAC	Peru	0.00	0.00	0.01	0.01	**0.71**	0.22	0.04	0.01	0.03	0.97
Lib_Dev											
LAC	Guatemala	0.00	0.00	0.00	0.00	0.01	**0.97**	0.01	0.00	0.01	0.99
	Mexico	0.00	0.00	0.00	0.00	0.02	**0.95**	0.02	0.01	0.01	0.99
	Dominican Rep.*	0.00	0.00	0.00	0.01	0.02	**0.95**	0.01	0.01	0.02	0.98
	Paraguay	0.00	0.00	0.01	0.01	0.03	**0.90**	0.02	0.01	0.03	0.97
	Honduras	0.00	0.00	0.01	0.02	0.06	**0.85**	0.04	0.01	0.04	0.96
	Haiti	0.01	0.01	0.03	0.04	0.12	**0.53**	0.23	0.04	0.09	0.91
	Nicaragua	0.01	0.01	0.04	0.16	0.19	**0.47**	0.08	0.04	0.22	0.78
	El Salvador	0.01	0.01	0.05	0.31	0.16	**0.41**	0.03	0.03	0.37	0.63
	Chile	0.02	0.01	0.06	0.04	0.31	**0.39**	0.13	0.03	0.14	0.86
	Costa Rica	0.03	0.02	0.12	0.06	0.30	**0.32**	0.09	0.06	0.23	0.77
Africa	Cameroon*	0.00	0.01	0.03	0.15	0.15	**0.60**	0.03	0.03	0.19	0.81
Asia	Hong Kong*	0.04	0.03	0.07	0.08	0.27	**0.28**	0.17	0.06	0.23	0.77

Table A2: Probability Matrix: Fuzzy C-Means Clustering (income residuals) part 4

Cluster Membership in…		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 1-4	Cluster 5-8
		Equality				**Inequality**					
		Equ_Inno	Equ_Debt	Equ_Small	Equ_Dev	Lib_OECD	Lib_Dev	Size_Inequ	Size_Reg	Equality	In-equality
*Commonwealth country											
Size_Inequ											
Africa	Namibia*	0.00	0.00	0.01	0.01	0.02	0.03	**0.92**	0.01	0.02	0.98
	Botswana*	0.01	0.01	0.02	0.01	0.04	0.07	**0.81**	0.03	0.05	0.95
	Swaziland*	0.01	0.01	0.02	0.01	0.14	0.08	**0.71**	0.02	0.05	0.95
	Rwanda*	0.02	0.02	0.04	0.03	0.09	0.06	**0.69**	0.05	0.11	0.89
	Zambia*	0.00	0.01	0.01	0.02	0.04	0.23	**0.63**	0.05	0.05	0.95
	Lesotho*	0.03	0.06	0.06	0.04	0.06	0.06	**0.56**	0.14	0.20	0.80
	South Africa*	0.07	0.06	0.10	0.04	0.13	0.12	**0.39**	0.09	0.26	0.74
	Nigeria*	0.01	0.01	0.08	0.11	0.20	0.19	**0.27**	0.12	0.22	0.78
LAC	Colombia	0.00	0.00	0.00	0.00	0.00	0.01	**0.97**	0.01	0.01	0.99
	Panama	0.01	0.02	0.06	0.02	0.13	0.21	**0.48**	0.07	0.11	0.89
Size_Reg											
Africa	Mozambique*	0.00	0.02	0.01	0.01	0.00	0.00	0.01	**0.95**	0.04	0.96
	Senegal	0.00	0.02	0.04	0.03	0.01	0.01	0.01	**0.89**	0.09	0.91
	Ghana*	0.01	0.05	0.07	0.06	0.03	0.03	0.07	**0.69**	0.19	0.81
	Angola	0.03	0.12	0.05	0.09	0.03	0.04	0.06	**0.57**	0.30	0.70
	Ethiopia	0.03	0.07	0.12	0.26	0.02	0.02	0.02	**0.45**	0.48	0.52
	Benin	0.02	0.03	0.23	0.06	0.07	0.04	0.14	**0.41**	0.34	0.66
	Côte d'Ivoire	0.01	0.07	0.07	0.26	0.06	0.09	0.07	**0.37**	0.41	0.59
	Cape Verde	0.02	0.17	0.11	0.14	0.07	0.09	0.12	**0.27**	0.44	0.56
	Zimbabwe	0.06	0.25	0.12	0.09	0.05	0.09	0.06	**0.27**	0.53	0.47
	Burkina Faso	0.06	0.07	0.17	0.09	0.09	0.05	0.21	**0.25**	0.39	0.61
LAC	Bolivia	0.00	0.01	0.01	0.01	0.01	0.01	0.01	**0.93**	0.03	0.97
	Ecuador	0.01	0.02	0.05	0.05	0.04	0.09	0.20	**0.55**	0.13	0.87
	Venezuela	0.06	0.17	0.08	0.10	0.05	0.08	0.08	**0.38**	0.41	0.59
	Argentina	0.03	0.05	0.15	0.10	0.09	0.17	0.08	**0.33**	0.33	0.67
	Brazil	0.05	0.15	0.13	0.11	0.09	0.18	0.09	**0.21**	0.43	0.57
OECD90	Norway	0.01	0.03	0.05	0.17	0.02	0.04	0.03	**0.64**	0.27	0.73
	Luxembourg	0.08	0.14	0.08	0.06	0.03	0.05	0.11	**0.45**	0.35	0.65
Asia	Iran	0.05	0.08	0.10	0.17	0.05	0.10	0.05	**0.40**	0.39	0.61

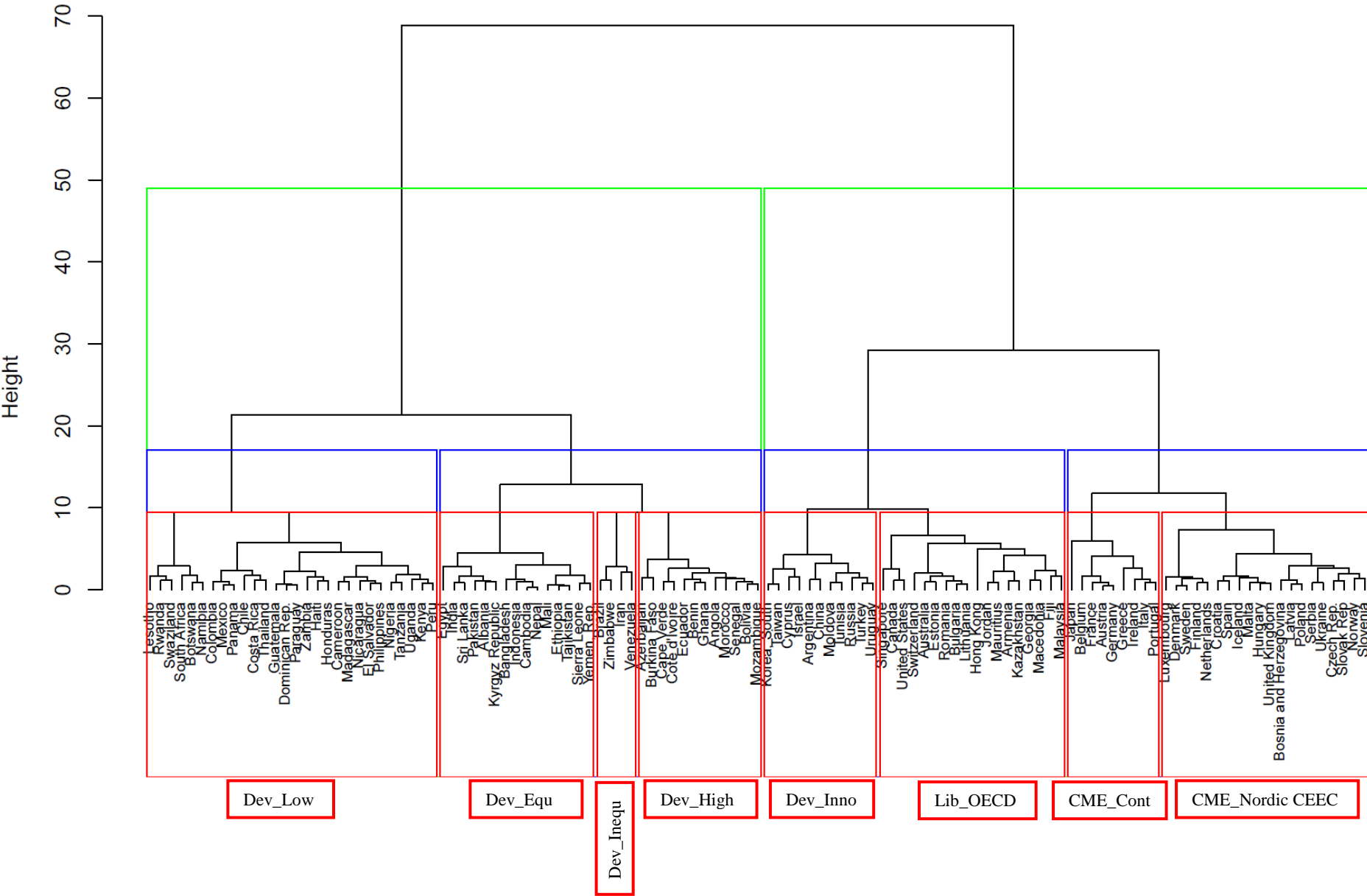**Figure A1: Dendrogram of Standardized Original 6 Variables**

Figure A2: Dendrogram of Standardized Residuals of Initial Income Regressions