

**ECONOMIC STUDIES**  
**DEPARTMENT OF ECONOMICS**  
**SCHOOL OF BUSINESS, ECONOMICS AND LAW**  
**UNIVERSITY OF GOTHENBURG**

**177**

---

**Essays on**  
**Social Distance, Institutions, and Economic Growth**

**Gustav Hansson**

**ISBN 91-85169-36-6**  
**ISBN 978-91-85169-36-8**  
**ISSN 1651-4289 print**  
**ISSN 1651-4297 online**



**UNIVERSITY OF GOTHENBURG**

**To my parents**



# Abstract

## **Paper 1: Country Size and the Rule of Law: Resuscitating Montesquieu**

In this paper, we demonstrate that there is a robust negative relationship between the size of country territory and a measure of the rule of law for a large cross-section of countries. We outline a theoretical framework featuring two main reasons for this regularity; firstly that institutional quality often has the character of a local public good that is imperfectly spread across space from the core of the country to the hinterland, and secondly that a large territory usually is accompanied by valuable rents and a lack of openness that both tend to distort property rights institutions. Our empirical analysis further shows some evidence that whether the capital is centrally or peripherally located within the country matters for the average level of rule of law.

## **Paper 2: Nationalism and Government Effectiveness**

The literature on nation-building and nationalism suggests that nation-building affects economic and political performance, mitigates the problems associated with ethnic heterogeneity, but that nationalism, an indicator of successful nation-building, is linked to dismal performance via protectionism and intolerance. This paper shows that there is a nonlinear association between nationalism and government effectiveness, that nationalism leaves no imprint on the effects of ethnic heterogeneity but may be a positive force in former colonies, and that actual trade flows are independent of the level of nationalism in the population.

## **Paper 3: Same Same but Different? A Comparison of Institutional Models**

In the growing literature on the creation of institutions, the theories emphasizing colonial and legal origin, religious affiliation, Western European influence, and settler mortality, have been especially influential. The influence of these studies rests heavily on empirical modeling, which, since the theories are obviously closely related, might actually capture the same primary mechanism. It is therefore unclear whether the empirical relationships found are the same or if they are different. Therefore, this paper takes the empirical models seriously and

discriminates amongst the existing models by using modeling selection criteria, tests of encompassing, and modeling selection.

#### **Paper 4: Where Did All the Investments Go? New Evidence on Equipment**

##### **Investment and Economic Growth**

Equipment investment is one of the very few variables claimed to be robustly related to economic growth. This paper examines new empirical evidence on the robustness of this relation. Firstly, the main result from DeLong and Summers (1991) is extended and tested. Secondly, the investment growth nexus is examined in a panel data setting. Thirdly, the paper relates the investment-growth relationship to recent findings on investment prices and economic development. The results repeatedly refute that there is a strong robust correlation between investment and income growth.

**Keywords:** institutions, rule of law, government effectiveness, development, colonial origin, country size, Montesquieu, nationalism, nation-building, ethnic diversity, protectionism, non-nested tests, modeling selection, economic growth, productivity, equipment investment, investment prices.

**JEL Classification:** E31, F52, F54, N40, N50, O11, O16, O40, P33, P48.

**Contact information:** [gustav.hansson@economics.gu.se](mailto:gustav.hansson@economics.gu.se), Department of Economics, University of Gothenburg, P.O. Box 640, SE-405 40 Gothenburg, Sweden.

# Preface

During the work with this thesis, I received valuable advice, suggestions, encouragement, and support from a large number of people.

First and foremost I would like to thank my supervisor Ola Olsson. I have been truly fortunate to have a supervisor with the same devotion to the same research questions that I am interested in. I am thankful for that you are constantly aiming high, and constantly demand more of me. Your guidance has learnt me a lot.

I am also very grateful to Arne Bigsten: your door has always been open to me, and I greatly appreciate all the comments, suggestions, and support you have given me over the years.

At the department I am especially grateful to Fredrik Carlsson, Dick Durevall, Lennart Flood, Olof Johansson Stenman, Måns Söderbom, and Ali Tasiran, for valuable comments and suggestions. From my licentiate seminar, I am grateful for all the comments and suggestions from Carl-Johan Dalgaard. Amongst the administrative staff, I would especially like to thank Eva-Lena Neth Johansson, Eva Jonason, and Jeanette Saldjoughi.

One of the most important factors for me during these years is the support and encouragement from my fellow classmates: Anders Boman, Mulu Gebreyesus, Anders Johansson, Peter Ljunggren, Carl Mellström, and Matilda Orth. Our journey through both the ups and downs and the support we give each other is something I have cherished greatly.

My life at the department would also not have been the same without: Pelle Ahlerup, Wisdom Akpalu, Per-Åke Andersson, Daniela Andrén, Constantin Belu, Anna Brink, Heather Congdon Fors, Olof Drakenberg, Anders Ekbom, Marcus Eliason, Thomas Ericson, Elizabeth Földi, Marcela Ibanez, Anne-Sofie Isaksson, Niklas Jakobsson, Karin Jonson, Innocent Kabenga, Elina Lampi, Annika Lindskog, Åsa Löfgren, Anne-Lee Löf, Florin Maican, Andreea Mitrut, Katarina Nordblom, Alexis Palma, Miguel Quiroga, Yoshihiro Sato, Daniel Slunge, Björn Sund, Sven Tengstam, Elias Tsakas, Jiegen Wei, Rick Wicks, Anna Widerberg, and Miyase Yesim Köksal. Thank you for all the discussions, laughter and joy.

I am also thankful to Henry Ohlsson and Dora Kos-Dienes in assisting me in my application to University of California, Berkeley. I am also very thankful to the Erik and

Göran Ennerfelt foundation for international studies, which made my stay in Berkeley financially possible. My year at UC Berkeley, in classes and in interaction with professors and students, was highly stimulating and has given a direct inspiration to some of the papers in this thesis.

Financial support from the Swedish Research Council (2006-2224), Sida/Sarec (2006-281), the Wallander, Hedelius, Browaldhs foundation (P2007-0218:1), the Wallander, Hedelius foundation (J013-16), the Adlerbertska foundation, the Paul and Marie Berghaus foundation, the Knut and Alice Wallenberg foundation, the Emily Egberta Nonnen foundation, and the Uno and Margaretha Thorburn foundation, are greatly acknowledged.

Saving the best for last, a great thanks to my family, thank you Mamma Eva, Mike, Johan, Ida, Kurrie and Sven for all the encouragement and support. Inge, Ingrid and Inez, I know you would have liked to witness the completion of my thesis, and perhaps you are from above.

Gustav Hansson  
Östersund, August 1, 2008

# Contents

<b>Abstract</b>	v
<b>Preface</b>	vii
<b>Introduction</b>	
Introduction	1
A Short Primer on Institutions	2
Paper One: On Country Size and Rule of Law	3
Paper Two: On Nationalism and Government Effectiveness	4
Paper Three: A Comparison of Institutional Models	6
Paper Four: On Equipment Investment and Economic Growth	7
References	9
<b>Paper 1:</b>	
<b>Country Size and the Rule of Law: Resuscitating Montesquieu</b>	
(Ola Olsson and Gustav Hansson)	
1. Introduction	1
2. The institutional impact of country size	4
2.1. The broadcasting effect	4
2.2. The rent seeking/openness effect	9
3. Empirical analysis	10
3.1. Data and model specification	10
3.2. Correlates of country size	12
3.3. Location of the core area	14
3.4. Robustness tests	15
4. Conclusions	18
References	18
Data Appendix	35
<b>Paper 2:</b>	
<b>Nationalism and Government Effectiveness</b>	
(Pelle Ahlerup and Gustav Hansson)	
1. Introduction	2
2. Nationalism, Nation-building, and Ethnic Diversity	4
2.1. Nationalism: Definition and determinants	4
2.2. The Role of Nationalism for Nation-building	6
2.3. Ethnic Diversity	9
2.4. Theoretical Framework	10
3. A cross-country study	13
3.1. Regression framework	13



3.2. Data on Government Effectiveness	14
3.3. Data on Nationalism	15
4. Results	16
4.1. The relation between Pride and Government Effectiveness	17
4.2. Robustness	20
5. Conclusions	23
References	24
Appendix A: Sample and Variable Description	32
Appendix B: Constructing the Constructed Trade Share	36

### **Paper 3:**

#### **Same Same but Different? A Comparison of Institutional Models**

(Gustav Hansson)

1. Introduction	1
2. Theoretical Background	4
2.1. Colonial Origin, Legal Origin, and Religion	4
2.2. Western European Influence and Settler Mortality	6
3. Data and Regression Specifications	7
3.1. Data	7
3.2. Regression Specifications	8
3.3. Results I	9
4. Comparing Models	10
4.1. Tests of Encompassing	10
4.2. Results II: Tests of Encompassing	12
5. Modeling Selection	14
5.1. Can Modeling Selection Help?	14
5.2. Results III: Modeling Selection	15
5.3. Additional Results	17
6. Conclusions	18
References	19
Data Appendix	30

### **Paper 4:**

#### **Where Did All the Investments Go? New Evidence on Equipment Investment and Economic Growth**

(Gustav Hansson)

1. Introduction	2
2. Equipment Investment and Economic Development	5
2.1. Why Should Investment Cause Growth?	5
2.2. Extending DeLong and Summers (1991)	5
2.3. Data and Sample	6
2.4. Results	9
2.5. Problems and Weaknesses	12
3. An Alternative Approach	14

3.1. Real Investments and Growth	14
3.2. Panel Data Results	15
4. The Behavior of Equipment Prices	16
4.1. Equipment Prices and Income	16
4.2. Implications for the Investment Share	19
4.3. Further Implications	20
4.3.1. Real or Nominal?	20
4.3.2. Equipment Prices and Investment Shares	22
5. Conclusions	23
References	24
Data Appendix:	37



# Introduction

“In 1988, output per worker in the United States was more than 35 times higher than output per worker in Niger. In just over ten days, the average worker in the United States produced as much as an average worker in Niger produced in an entire year. Explaining such vast differences in economic performance is one of the fundamental challenges of economics.” (Hall and Jones, 1999:83)

I could not agree more with Robert Hall and Charles Jones in that answering the question of why some countries are rich while others are poor is one of the fundamental challenges of economics, and once one starts to think about it, it is hard to think of anything else. This question was the primary reason for why I once began to study economics, and is also the primary research question that this thesis is built around.

In recent years, the importance of institutions for economic development and growth is becoming a well-established finding (see, e.g., North, 1990; Knack and Keefer, 1995; Hall and Jones, 1999; Acemoglu et al., 2001; and Rodrik et al., 2003). Closely related to both institutions and economic development is the role of social distance between people. Most notably, Easterly and Levine (1997) argue that ethnic diversity distorts public policies, which in turn adversely affect economic growth, while Mauro (1995) argues that diversity promotes corruption and therefore hurts economic growth. Others, e.g., Alesina et al. (1999), La Porta et al. (1999), and Miguel (2004) find that ethnic diversity distorts the provision of public goods.

This thesis consists of four self-contained papers on: social distance, institutions, and economic growth. The first three papers deal explicitly with social distance and the determinants of institutional quality, whereas the fourth paper examines the relationships between investments and economic growth.

Since the thesis to a large extent concerns the importance of institutions, the following section gives a brief explanation of the notion of institutions, followed by a brief introduction to each of the four papers.

## A Short Primer on Institutions

Following North (1990), it is the interaction between institutions and organizations that shapes the development of an economy. While institutions make up the rules, the organizations are the players. The organizations consist of: political bodies (political parties, councils, etc.), economic bodies (firms, trade unions etc), social bodies (churches, clubs, etc.), and educational bodies (schools and universities). Hence, institutions are the key determinant of what kinds of organizations a society develops, since organizations reflect the opportunities provided by the institutional framework; if the institutional framework promotes corruption, the organizations will be corrupt. Institutions consist of formal and informal constraints, or as North (1996:344) writes:

“Institutions are the humanly devised constraints that structure human interaction. They are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self imposed codes of conduct), and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies.”

Importantly, the informal constraints (the norms) give legitimacy to the formal constraints (the rules), and from this follows that in order for the rules to have the desired effect, the underlying norm has to be in accordance with the rules. The understanding of institutions can thus be described as:

Norms  $\Rightarrow$  Rules  $\Rightarrow$  Organizations  $\Rightarrow$  Economic Performance,

where norms give legitimacy to rules, which together shape the incentive structure of organizations, which in turn determine economic performance. Since it is the norms that give legitimacy to the rules, a society that adopts the rules of another country will not necessarily experience the same economic performance, due to differences in norms. The most important enforcement of the rules is through the self-enforcing codes of behavior, norms and values. In order for the rules to have the desired effect, the underlying norms and values have to change in accordance with the rules. However, this change can be a very lengthy process.

In order to measure the strength of institutions, the empirical literature has since Knack and Keefer (1995) mainly directed its attention towards measures of property rights, rule of law, and the quality of the bureaucracy, issues that in line with North (1990) are argued to be favorable for economic development.

In this thesis, the main indicators of institutional quality are measures of the rule of law and government effectiveness, both from Kaufmann et al. (2005). Rule of law reflects the idea that no individual is above the law, and the indicator therefore measures to what extent the legal system acts as a safeguard against arbitrary governance and expropriation. Government effectiveness captures the competence of the bureaucracy and the quality of public service delivery. The institutional measures from Kaufmann et al. (2005) are constructed by combining a large number of different measures from a wide range of sources. The argument for using a large number of measures is that while the actual level of institutional quality cannot be observed directly, each individual measure contributes an indication of the true level of institutional strength. Therefore, the argument for using the Kaufmann et al. measures is that the resulting aggregate indicators are more informative about the unobserved governance than any individual data source. The measures constructed by Kaufmann et al. (2005) have gained increasing attention and are today widely recognized.

## **Paper One: On Country Size and Rule of Law**

In the first paper (Country Size and the Rule of Law: Resuscitating Montesquieu), we demonstrate that for a large cross-section of countries there is a robust negative relationship between the size of a country and the strength of its rule of law.

The importance of country size has been a topic among political philosophers for centuries. Montesquieu (1750) argued that in countries with large territories, there are “large fortunes” that can be exploited, and the common good runs the risk of being “sacrificed to a thousand of considerations.” Conversely, in a country with a small territory, the public good is closer to each citizen and therefore more strongly felt. In a similar vein, Plato and Aristotle argued that small countries were naturally superior to larger ones, and that a country’s entire territory should not be larger than what could be surveyed from a hill.

In line with Montesquieu we argue that country size has two principal effects: Firstly, a large territory translates into higher expected rents from lands and mines, which makes

revenue-maximizing autocratic rulers less dependent on international trade and less interested in maintaining strong private property rights and protection against expropriation. Secondly, we conjecture that the strong concentration of power in the capital cities implies that public goods like rule of law weaken with distance, i.e., it is weaker in the hinterlands than in the capital cities. The problem of broadcasting power over space should therefore be further intensified in countries where the capital is non-centrally located.

Using data on the size of country territory and institutional measures such as rule of law, political stability, and corruption, we show that country size is robustly negatively related to institutional quality. Due to the fact that the borders in many countries were constructed endogenously, we focus specifically on former colonies whose borders were exogenously determined by the colonial powers and have since remained the same. In our base sample of 127 former colonies, we show that the negative relationship between country size and rule of law is robust when controlling for a large range of variables such as distance to the equator, settler mortality, ethnic fractionalization, legal origin, and continental dummies.

Unlike any other study that we are aware of, we also construct two indicators of how centrally located the seat of government is. It turns out that, as hypothesized, when country size and other controls are held constant, the strength of rule of law is lower in countries where the seat of government is located far from the country center. Our interpretation of these results is that the exogenously determined country territories have been a major impediment of the creation of strong institutions.

## **Paper Two: On Nationalism and Government Effectiveness**

In the second paper (Nationalism and Government Effectiveness), we empirically examine the effects of perceived levels of nationalism on government effectiveness. Nationalism is related to the notion of nation-building, which generally refers to the process of unifying the population in a country by constructing a national unity where people feel bounded together by a sense of community and where people talk to, understand, and trust one another.

Nation-building has long been a policy tool on the country level, and we find many interesting cases of how nation-building is brought into practice. Perhaps most evident is the importance of nation-building in post colonial Africa, which is characterized by having

highly ethnically heterogeneous societies. Prime examples include Tanzania and Kenya, who despite similar initial conditions concerning geography and ethnic composition chose vastly different strategies of nation-building, which in both cases have, as argued by Miguel (2004), had substantial effects on government effectiveness and the provision of local public goods. Nation-building is not only confined to Africa, but relates to almost all countries in the world.

At the core of nation-building is the creation of a sense of nationalism and nationalistic sentiments. Based on previous literature, a high degree of nationalistic sentiments is suggested to have a positive effect on government effectiveness since it promotes the acceptance of the state and thus the state's execution of power. As in the example with Tanzania and Kenya, a high degree of nationalistic sentiments is also suggested to mitigate the problems associated with ethnic fractionalization.

On the other hand, nationalistic sentiments are postulated to affect government effectiveness negatively, and are suggested to promote inwardness and idolization of the nation, which could induce protectionism and a deviation from the best policy.

Despite an increasing theoretical literature on the effects of nationalism, empirical evidence that the degree of nationalistic sentiment is related to institutional performance is still largely absent. The aim of this paper is therefore to empirically try to identify the effects of nationalistic sentiments on government effectiveness. The main contribution of this paper is that it is, to our knowledge, the first attempt to go beyond the theoretical discussion and to empirically estimate the effects of nationalism on a macro scale.

Using data from the World Values Survey on national pride in 79 countries, we find that pride seems to have a hump-shaped relationship with government effectiveness. At low levels of pride, an increase in pride is associated with higher government effectiveness, whereas at moderate and high levels of pride the effect is the opposite. Furthermore, we find that pride does not seem to mitigate the problem associated with ethnic fractionalization. We also find that pride does not seem to affect actual trade flows.



## **Paper Three: A Comparison of Institutional Models**

In paper one, we identified country size as an impediment in creating strong and healthy institutions, due to the finding that size induces a social distance between the center of the country and the hinterland. In paper two, we investigated the possibilities of nationalism as a remedy against social distance associated with ethnic fractionalization. In paper three (*Same Same but Different? A Comparison of Institutional Models*), the focus is still on institutional models, and the attention is directed to the previous literature and the most influential theories.

Arguably the most influential theories on the determinants of institutions emphasize the importance of legal origin and religious affiliation (La Porta et al., 1999), ethnic diversity and colonial origin (Mauro, 1995), Western European influence (Hall and Jones, 1999), and settler mortality (Acemoglu et al., 2001). One of the most prominent factors responsible for the large impact of these studies is that they to a large extent are motivated by empirical modeling. However, since the theories are obviously related, the empirical findings from one study might actually capture the same primary mechanism found in another study. It is therefore unclear whether the empirical relationships found are basically the same or if they are different. There is for example a large literature documenting that the identity of the colonial ruler has played an important part the development of many countries. For example, the colonial rulers transplanted their legal systems and religions. The empirical findings in La Porta et al. (1999) concerning legal origin and religious affiliation might therefore indirectly capture the importance of colonial origin.

The proposed mechanisms for colonial and legal origin, religion, latitude, and settler mortality, are obviously related and hard to disentangle. The validity and influence of these theories rest heavily on empirical findings, which might in fact capture the mechanism proposed by a competing theory. Therefore, this paper takes the empirical models of La Porta et al. (1999), Mauro (1995), Hall and Jones (1999), and Acemoglu et al. (2001) seriously, in order to discriminate between existing models and to identify the variables that best explain the variation in institutional quality. The aim of this paper is thus to provide answers to the following questions: (i) Do these models capture the same information? (ii) Is there one model which explains more of the variation in institutional quality than the other models? And (iii), if we let the information pertained in the data decide, which combination of variables would be selected?

Focusing mainly on a sample of 77 former colonies, the methods used are modeling selection criteria, tests of encompassing, and modeling selection following Hendry and Krolzig (2001). The econometric framework in this paper is similar to Bleaney and Nishiyama (2002), who used non-nested tests and modeling selection to discriminate between income growth models in a cross-country setting. Bleaney and Nishiyama (2002) only used the simple backwards selection method. The method chosen in paper three is therefore closer to Hoover and Perez (2004), which greatly improves the accuracy of the well-known methods implemented by Levine and Renelt (1992) and Sala-i-Martin (1997) in their search for robust determinants of economic growth. The paper is also related to Islam and Montenegro (2002), Straub (2000), and Barro (1999), who empirically examine the determinants of institutional quality, although the focus, variables, and empirical methods are vastly different.

#### **Paper Four: On Equipment Investment and Economic Growth**

In the fourth and final paper (Where Did All the Investments Go? New Evidence on Equipment Investment and Economic Growth), the focus shifts from institutions to economic growth and one of its most promising determinants: equipment investments.

Equipment investment is one of the very few variables claimed to be robustly related to economic growth (DeLong and Summers, 1991; Levine and Renelt, 1992; Sala-i-Martin, 1997; and Hoover and Perez, 2004). The importance of equipment investment has therefore almost come to be accepted as a stylized fact (Abel, 1992) and is an often advocated remedy for poor growth (Easterly, 2001).

However, the strength of the investment-growth nexus is heavily questioned by, e.g., Auerbach et al. (1994) and Easterly (2001). Interestingly, the data constructed in DeLong and Summers (1991, 1993) has survived to this day and is the same data used in Sala-i-Martin (1997) and Hoover and Perez (2004). The fact that both arguments and data from DeLong and Summers (1991, 1993) still play an influential role in the debate motivates the following research question: If we reconstruct and extend the analysis using more recent data, do the main results from DeLong and Summers (1991) still hold?

The analysis is implemented in three steps. Firstly, by using updates of detailed Purchasing Power Parity (PPP) adjusted data from the U.N. International Comparison

Programme, we are able to reconstruct and extend the analysis from DeLong and Summers (1991) to the period 1960-2000 for 78 countries. As it turns out, the estimated effects of equipment investments on economic growth are with the new data most often statistically different from the effects found in DeLong and Summers (1991), and in the most recent sample the effect is even insignificant. Updating and extending the data, the relationship between equipment investment and income growth is therefore no longer a strong and robust finding in a DeLong and Summers regression set-up.

Secondly, the detailed data on equipment investment and growth is transformed into a panel data setting, which arguably is better at addressing problems of endogeneity and measurement error. Using measures of the equipment share, the producer durables share, and the total investment share, the results show that investments, however defined, do not correlate strongly and robustly to income growth.

Thirdly, the paper relates to a recent debate in Hsieh and Klenow (2006) about the use of nominal versus real investment shares. However, neither when the nominal investment share is used does investment seem to promote income growth.

This paper thus presents new evidence on the relationship between investments and economic growth. The findings suggest that although investments are important, their benefits are probably not as robust and large as they are often portrayed to be. Policy that aims at promoting income growth should therefore not overemphasize the importance of capital formation.

## References

- Abel, Andrew B. (1992) "Comments and Discussion." *Brookings Papers on Economic Activity* 1992 (2):200-211.
- Acemoglu, Daron. Johnson, Simon. and James A. Robinson. (2001) "The Colonial Origins of Comparative Development: An Empirical Investigation" *American Economic Review*, 91(5): 1369-1401.
- Alesina, Alberto. Baqir, Reza. and William Easterly (1999) "Public Goods and Ethnic Divisions" *Quarterly Journal of Economics*, 114(4):1243-84.
- Auerbach, Alan J. Hasset, Kevin A.. and Stephen D. Oliner. (1994) "Reassessing the Social Returns to Equipment Investment" *Quarterly Journal of Economics*, 109(3): 789-802.
- Barro, Robert J. (1999) "Determinants of Democracy" *Journal of Political Economy*, 107(6): S518-S183.
- Bleaney, Michael. and Akira Nishiyama. (2002) "Explaining growth: a contest between models" *Journal of Economic Growth*, 7: 43-56.
- Dahl, Robert A. and Edward R. Tuft. (1973) *Size and Democracy*, Stanford University Press.
- DeLong, J. Bradford. and Lawrence H. Summers. (1991) "Equipment Investment and Economic Growth" *Quarterly Journal of Economics*, 106(2): 445-502.
- DeLong, J. Bradford. and Lawrence H. Summers. (1993) "How strongly do developing economies benefit from equipment investment?" *Journal of Monetary Economics*, 32: 395-415.
- Easterly, William. and Ross Levine (1997) "Africa's growth tragedy: policies and ethnic divisions" *Quarterly Journal of Economics*, 112(4): 1203-50.
- Easterly, William. (2001) *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics*, Cambridge, Mass: The MIT Press.
- Hall, Robert E. and Charles I. Jones. (1999) "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" *Quarterly Journal of Economics*, 114 (1): 83-116.
- Hendry, David F. and Hans-Martin Krolzig. (2001) *Automatic Econometric Model Selection*. London: Timberlake Consultants Press.
- Hoover, Kevin D. and Stephen J. Perez. (2004) "Truth and Robustness in Cross-country Growth Regression" *Oxford Bulletin of Economics and Statistics*, 66(5): 765-798.
- Hsieh, Chang-Tai. and Peter J. Klenow. (2006) "Relative Prices and Relative Prosperity." Forthcoming *American Economic Review*  
<<http://www.econ.berkeley.edu/users/chsieh/RPandRP.pdf>>

- Islam, Roumeen. and Claudio E. Monenegro. (2002) "What Determines the Quality of Institutions" World Bank Policy Research Working Paper No. 2764.
- Knack, Stephen. and Philip Keefer. (1995) "Institutions and Economic Performance: Cross-Country Tests using Alternative Institutional Measures" *Economics and Politics*, 7: 207-27.
- La Porta, Rafael. Lopez-de-Silandes, Florencio. Shleifer, Andrei. and Robert Vishny. (1999) "The Quality of Government" *Journal of Law, Economics, & Organizations*, 15: 222-79.
- Levine, Ross. and David Renelt. (1992) "A Sensitivity Analysis of Cross-Country Growth Regressions" *American Economic Review*, 82(4): 942-963.
- Mauro, Paolo. (1995) "Corruption and Growth" *Quarterly Journal of Economics*, 110(3):681-712.
- Miguel, Edward. (2004) "Tribe or Nation? Nation-building and Public Goods in Kenya versus Tanzania" *World Politics*, 56: 327-62.
- Montesquieu, C.L. (1750) *The Spirit of Laws*. (Quoted in Dahl, R.A. and E.R. Tufte (1973), p. 7).
- North, Douglass C. (1990) *Institutions, Institutional Change and Economic Performance*. Cambridge, Mass: Cambridge University Press.
- North, Douglass C. (1996) "Epilogue: economic performance through time" in Alston, L. J. Eggertsson, T. and North, D. C. *Empirical Studies in Institutional Change*. Cambridge: Cambridge University Press.
- Rodrik, Dani. Subramanian, Arvind. and Francesco Trebbi. (2004) "Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development" *Journal of Economic Growth*, 9(2): 131-65.
- Sala-i-Martin, Xavier X. (1997) "I just ran four million regressions" NBER Working Paper No. 6252.
- Straub, Stéphane. (2000) "Empirical Determinants of Good Institutions: Do We Know Anything?" Inter-American Development Bank Research department Working Paper No. 423.

**Paper I**



# Country Size and the Rule of Law: Resuscitating Montesquieu

Ola Olsson\* and Gustav Hansson

Göteborg University

October 4, 2007

## Abstract

In this paper, we demonstrate that there is a robust negative relationship between the size of country territory and a measure of the rule of law for a large cross-section of countries. We outline a framework featuring two main reasons for this regularity; firstly that institutional quality often has the character of a local public good that is imperfectly spread across space from the core of the country to the hinterland, and secondly that a large territory usually is accompanied by valuable rents and a lack of openness that both tend to distort property rights institutions. Our empirical analysis further shows some evidence that whether the capital is centrally or peripherally located within the country matters for the average level of rule of law.

**Keywords:** country size, rule of law, institutions, development, Montesquieu.

**JEL Codes:** N40, N50, P33.

”It is in the nature of a republic that it should have a small territory; without that, it could scarcely exist. In a large republic, there are large fortunes, and consequently little moderation of spirit...

In a large republic, the common good is sacrificed to a thousand considerations; it is subordinated to various exceptions; it depends on accidents. In a small republic, the public good is more strongly felt, better known, and closer to each citizen...”

(From *The Spirit of Laws*, C.L. Montesquieu, 1750, Book VIII)

## 1 Introduction

We demonstrate that there is a robust negative relationship between the size of country territory and the strength of rule of law for a large cross-section of

---

\*Corresponding author: Ola Olsson, Department of Economics, Göteborg University, Box 640, 405 30 Göteborg, Sweden. Email: ola.olsson@economics.gu.se. We are grateful for comments from Carl-Johan Dalgaard, Assar Lindbeck, Joel Mokyr, Finn Tarp, Ragnar Torvik, David Weil, Alan Winters, and seminar participants at University of Copenhagen, Göteborg University, NTNU in Trondheim, RIIIE in Stockholm, the DEGIT XI Conference in Jerusalem, the EEA Conference in Vienna, and the Säröhus workshop on globalization.



countries. We also show that the internal location of the capital matters for the geographical spreading of institutions. In the spirit of Montesquieu, we argue that there are two basic reasons for these results; firstly that large countries tend to have a low dependency on foreign trade and be endowed with sizeable potential rents that distort the incentives of the regime, and secondly that the rule of law has the character of a local public good that is imperfectly broadcast from the country capital to the hinterland.

The importance of country size for social development has been a topic among political philosophers for centuries. Both Plato and Aristotle preceded Montesquieu arguing that small nations like the Greek city states were naturally superior to larger entities and that a country's entire territory should not be larger than that it could be surveyed from a hill. Likewise, Rousseau later claimed that small states prosper "...simply because they are small, because all their citizens know each other and keep an eye on each other, and because their rulers can see for themselves the harm that is being done and the good that is theirs to do..." (Rousseau, quoted in Rose, 2005).

The opposite argument, that the diversity of preferences and the effects of fractionalization are more easily handled within large countries, was proposed by both David Hume and James Madison.<sup>1</sup> Later influential works like Dahl and Tufte (1973) and Alesina and Spolaore (2003) have tended to think of the problem as encompassing a trade-off where small countries have advantages in terms of democratic participation and preference homogeneity, whereas smallness on the other hand implies higher per capita costs of non-rival public goods, a small internal market, and that small countries easily might be partitioned or swallowed by larger countries with a greater military capacity. The latter argument appears to have been particularly relevant for the European continent (Tilly, 1990).

Within the economics discipline, the relationship between country size and economic performance has not rendered a lot of attention. Early endogenous growth models like Romer (1990) and Aghion and Howitt (1992) included a prediction that larger countries should grow faster because they had a larger pool of potential innovators. On the whole, these early models did not receive strong empirical support.<sup>2</sup> Alesina et al (1998) show that large countries tend to have large governments and that they are less open to trade than smaller countries. Using the level of the population as the measure of country size, Rose (2005)

---

<sup>1</sup>See Dahl and Tufte (1973), Alesina and Spolaore (2003), and Rose (2005) for reviews of the older literature.

<sup>2</sup>Kremer's (1993) extreme long-run analysis of population growth on different continents is sometimes viewed as giving some support to the 'scale-effect' prediction, but it was effectively refuted by the evidence in Jones (1995) and led to the development of growth models without scale effects.

fails to find any systematic effect of size on a range of institutional and economic performance variables. Similarly, Knack and Azfar (2003) argue that empirical studies that have shown a negative relationship between corruption and population size have suffered from sample selection bias and that the relationship disappears when a broader sample is used. Dahl and Tufte (1973) is probably the most comprehensive study of the importance of country size and is one of few studies that actually considers country area as a potential determinant of economic outcomes.

In this article, we show that the size of country territory is strongly negatively associated with rule of law. Figure 1 shows the unconditional correlation for all 208 countries in the world with available data. The relationship is significant ( $t$ -value is 6.83) and size alone explains nearly 15 percent of the whole variation in the rule of law which is remarkable for a cross-country regression. We recognize however that boundaries are potentially endogenous to institutional quality and therefore restrict our analysis to former colonies whose borders were determined by the colonial powers.

We argue that country size has two primary effects: Firstly, that a large territory means a lower dependency on foreign trade and a larger absolute value of expected rents from lands and mines. Our argument is that both the lower openness and the easy flow of rents give autocratic rulers weak incentives for upholding a strong rule of law. Secondly, we propose (in the spirit of the emerging literature on 'new economic geography') that the strong concentration of power in the capitals and core areas of former colonies implies that public goods like the rule of law diffuse according to a spatial decay-function so that the levels felt in the hinterland are much weaker than in the capitals. This problem should be further exacerbated in countries where the capital is non-centrally located.

As the base sample for testing our hypotheses, we use data from 127 former colonies which - unlike most of the previous literature on colonialism - arguably contains all large and small countries that were ever colonized. We show that the size of country territory has a very robust negative impact on our measure of the rule of law, even after controlling for distance from the equator, openness to trade, settler mortality, ethnic fractionalization, colonial history, continental dummies, and a number of other variables. We also show that country territory appears to have a stronger association with rule of law than the level of the population. This fact, together with the general endogeneity of population size to institutions, suggest to us that country territory is a more appropriate indicator of country size than population.

Unlike any other study that we are aware of, we further construct two indicators of the peripherality of the capital. As hypothesized, it turns out that when we hold country territory and some other controls constant, the strength

of rule of law decreases with our size-neutral measure of the peripherality of the capital. Our interpretation of these results is that exogenously determined country territory has been a major impediment to the creation of strong institutions in large countries like Indonesia, Sudan, and Algeria, whereas it has been highly beneficial to small countries like Bahrain, Martinique, and Singapore.

Since the strength of rule of law is a kind of institutional variable, our approach is obviously highly related to the growing empirical literature on the determinants of institutional strength (Hall and Jones, 1999; Acemoglu et al, 2001, 2002; Rodrik et al, 2004). In the spirit of Glaeser et al (2004), we think of property rights institutions and the rule of law as variables that governments actually can influence in the medium run. This assumption distinguishes our approach somewhat from works in the tradition of Douglass North (1990) such as Acemoglu et al (2001, 2002) where institutional persistence from colonial times is a central element.

The article is organized as follows: In section two, we develop a general theoretical framework for understanding the linkages between size and institutions. In section three, we provide the main empirical investigation using the reduced sample of former colonies. Section four concludes.

## 2 The institutional impact of country size

In this section, we discuss the potential channels through which country size affects institutional quality within countries. We argue that there are two primary effects of country territory: A direct *broadcasting effect* and an indirect *openness/rent seeking effect*.

### 2.1 The broadcasting effect

Power within states almost always originate from one core area of the country, usually from the area around the capital.<sup>3</sup> The broadcasting of power to the other parts of the country, or even beyond existing borders, is essentially a story of state consolidation, well known from accounts on European history. The basic notion that our argument in this section rests upon is that the political influence from the core will typically diminish with geographical distance. We argue that this has been a stylized fact throughout history as well as in more recent times. For example, during antiquity, the Roman influence on the Campanian region in the Italian south was naturally greater than its influence in the British isles. To use a more current example, the government of Singapore has a far greater

---

<sup>3</sup>This core area or city might of course change over longer time horizons. Even the Roman empire eventually shifted its epicenter from Rome to Constantinople and Ravenna.

potential to effectively broadcast power to all parts of their geographically tiny country than the government of vast, nearby Indonesia.<sup>4</sup>

The spatial broadcasting of state power includes several important components, for instance taxation and a shared monetary system. Another key factor in the exercise of state power is the maintenance of *rule of law*, i.e. basic law and order, a respected police force, and courts that rule impartially in accordance with codified and generally recognized law. An efficient rule of law is characterized by that the state has the power to protect its citizens from predation by other citizens but also guarantees that the government itself (or any other public authorities) will not predate on its people.

Although the rule of law is typically partly organized on a local basis (through for instance local police, local courts, or district attorneys), the laws that it all rests upon essentially emanate from the capital or the core region where legislation is made. We argue that both the supply and the demand for the rule of law will depend on geographical distance from the core. On the supply side, although the law will typically be the same throughout the country, it is likely that the 'legislative signal' is felt stronger near the capital than in the periphery, where people possibly are subject to the influence of a competing neighbouring country's government's jurisdiction.<sup>5</sup> On the demand side, it is likely that people's political preferences in the periphery are different from those in the core where most major decisions are made.<sup>6</sup> Both supply and demand considerations thus lead us to believe that a country's rule of law in general is strongest in the core from where it ultimately emanates.

We argue that this assumption is well in line with a large literature in economic geography showing that there are in general significant costs associated with the diffusion of public goods over space. For instance, Keller (2002) shows that the benefits from technology externalities are halved every 1,200 kilometers from the center of origin. Arzaghi and Henderson (2005) have recently suggested that similar costs of distance apply also for other public goods. A

---

<sup>4</sup>When East Timor formally seceded from Indonesia in 2002, it was one of the most geographically distant areas from capital Jakarta that was lost.

<sup>5</sup>The situation in the Democratic Republic of the Congo is a good current example of how the supply of rule of law depends on geography. It is generally recognized that whereas the new government has a certain degree of control over the Western provinces near the capital Kinshasa, it has still very little control over the eastern parts which are characterized by widespread lawlessness. Even before the fall of Mobutu in 1997, Eastern Congo was something of power vacuum, a circumstance which contributed to the mass plunder that about a dozen neighbouring African armies engaged in at the turn of the millennium (Olsson and Congdon Fors, 2004). The influence of the well organized militaries of Uganda and Rwanda continue to loom over Eastern Congo, despite the presence of UN peacekeepers.

<sup>6</sup>This is indeed a key argument in Alesina and Spolaore (1997). Even here, DR Congo might serve as an example. The Banyamulenge ethnic group in Eastern Congo are historically close to the Tutsi of Rwanda. When Mobutu harassed the Banyamulenge in the summer of 1996, they asked the Tutsi government in Rwanda for help. This triggered the war that eventually ousted Mobutu from power.

recurring theme in the development literature is how the broadcasting of power over space in former colonies is associated with significant challenges, particularly in Africa (Herbst, 2000). Public goods like the legislation and enforcement of property rights are most strongly felt in and around the capital among the elite groups that control the state and its functions. These geographical limitations in the broadcasting of public goods and power are further the fundamental reason why the world comprises some 200 odd states rather than, say, just one.

There is further a common assertion in the literature that in particular among former colonies, both executive and legislative power tend to originate almost exclusively from the capitals (Bates, 1981; Herbst, 2000). Following the old colonial logic, whoever controls the capital is usually also internationally recognized as the legitimate regime. Given the lack of democracy and the rarity of strong regional identities or federal states, the maintenance of rule of law has remained highly centralized.<sup>7</sup>

If this is a correct assertion, then the location of the capital or core area in relation to the rest of the country, should also matter for the success of broadcasting power to the whole country. Obviously, a capital located in the geographical center of the country should make it easier for public goods to reach the whole country, whereas capitals located on the border should be less effective in this regard.

In order to illustrate these ideas somewhat more rigorously, let us imagine that the strength of rule of law in the core area of country  $i$  is given by a variable  $z_i$ . We will henceforth approximate the location of the core area with the location of the capital. Let us also imagine, as in Alesina and Spolaore (1997), that the size and location of countries in the world can be described as non-overlapping intervals on the real line where  $s_i > 0$  is the size of country  $i$  and where  $[l_i, l_i + s_i] \subset \mathbb{R}_+$  defines the unique country location with  $l_i > 0$  as the 'coordinate' for the left-hand side border.<sup>8</sup> The capital of the country, in turn, is located at a point  $c_i \in [l_i, l_i + s_i]$ . Obviously, if the capital is located exactly in the middle of the country, it will be found at  $c_i = l_i + s_i/2$ . The geographical distance from the capital to some location  $l_{i,j} \in [l_i, l_i + s_i]$  within country  $i$  is described by the term  $d_{i,j} = |l_{i,j} - c_i| \in [0, s_i]$  (see Figure 2 for a graphical illustration). We further make the implicit assumption for now that within countries, the population is uniformly distributed.

As discussed above, we might postulate that the strength of rule of law diminishes with distance from the capital according to a spatial decay-function

---

<sup>7</sup>There are of course exceptions to this generalization. India is a well-known example of a democratic country with strong regional autonomy.

<sup>8</sup>The one-dimensional nature of country size is used for simplicity. As shown by Alesina and Spolaore (1997), modelling size as two-dimensional significantly increases the complexity of calculations without any intuitive gains.

$$z_{i,j} = z_i (1 - a_i d_{i,j}) \quad (1)$$

where  $z_{i,j}$  is the level of rule of law at location  $l_{i,j}$  and where  $a_i > 0$  is a parameter describing the marginal decline in institutional quality over space. The level of  $a_i$  is assumed to be such that  $a_i s_i < 1$ .<sup>9</sup>

If we define the average distance to the capital within a country as  $\bar{d}_i$ , we can calculate this measure as a weighted average

$$\bar{d}_i = \frac{(c_i - l_i)^2 + (l_i + s_i - c_i)^2}{2s_i}. \quad (2)$$

This distance function can assume two extreme values. The first is given by the situation when the capital is located exactly in the middle of the country so that  $c_i = l_i + s_i/2$ . In this case, simple algebra shows that  $\bar{d}_i = \frac{s_i}{4}$ . In the other extreme case with the capital located at either of the two borders, we will have that  $\bar{d}_i = \frac{s_i}{2}$ . We can thus describe average distance more generally as

$$\bar{d}_i = \frac{(1 + q_i) s_i}{4} \quad (3)$$

where  $q_i \in [0, 1]$  is a size-neutral index of the 'peripherality' or 'uncentrality' of the capital where a high  $q_i$  indicates a location near (or at) a border and where a low  $q_i$  means a location near (or at) the center of the country.

The strength of rule of law for the average person in this country should thus be:

$$\bar{z}_i = z_i \left( 1 - \frac{a_i (1 + q_i) s_i}{4} \right) \quad (4)$$

A straightforward insight from this kind of spatial decay-function is that with a given strength of rule of law in the core area  $z_i$ , average rule of law  $\bar{z}_i$  should decrease with country size  $s_i$ . Average rule of law should also decrease with spatial frictions  $a_i$  and with the peripherality of the capital  $q_i$ . Among countries with an ocean coast, it seems however likely that capitals by the sea might have a beneficial effect due to a greater openness to the outside world. In the empirical section, we will investigate both the country size argument and our hypotheses regarding the internal location of the capital.

It is important to recognize however that the results above do not necessarily imply that the average person in a large country experiences a weaker rule of law than an average person in a small country. In general,  $\bar{z}_i$  will depend to a great

---

<sup>9</sup>This condition is imposed to ensure that  $z_{i,j} > 0$  at all  $l_{i,j}$ . The same type of spatial decay-function for public goods is used by Arzaghi and Henderson (2005). 'Iceberg' functions in spatial economics and in the 'new economic geography' is discussed for instance by Krugman (1998).

extent on the level in the core area  $z_i$ , which might happen to be greater in a large country and thus might neutralize the negative impact of a great  $s_i$ . One might further plausibly argue that large countries are large because they are endowed with a strong and efficient government that is capable of extending its power over great distances, i.e. a very high level of  $z_i$ . Analogously, small countries might be small because their government is weak. In terms of the expression above, this reasoning would suggest that  $s_i$  could be a function of  $z_i$ . This potential endogeneity of borders over the long run is indeed the central theme of the 'endogenous borders'-literature (Friedman, 1977; Alesina and Spolaore, 1997, 2003; and Wittman, 2000).

We argue that among former colonies, it is highly implausible that  $s_i$  could be a function of  $z_i$ . Although the type of process envisaged by Alesina and Spolaore probably well describes developments in Europe and parts of Asia where country formation has been going on for centuries or even millennia, it is less apparently relevant for the former colonies in America and Africa that received independence much more recently. Herbst (2000) argues that for Africa in particular, the size and number of countries was organized in a more or less random manner during the infamous Berlin conference of 1885.<sup>10</sup>

For one thing, there was relatively little a priori information for boundary creators due to a lack of traditional boundaries as well as natural geographic boundaries. Ultimately, the Berlin conference made it possible to claim sovereignty over an area regardless of the ability to administer the area. Therefore, there was no discrimination enabling only the more powerful colonizers to claim large areas. The logic of the partition was primarily to serve European strategic interests and the colonial powers more or less ignored existing state structures and ethnic boundaries (Pakenham, 1991).<sup>11</sup> Indeed, the wider effects of the random nature of African borders has been a major topic in social science (Davidson, 1992; Englebert et al, 2002; Alesina et al, 2006). The endogeneity of borders with respect to levels of social and economic development can also be questioned for the other former colonies, although there are some examples of country break-ups after independence.<sup>12</sup> In sum, we will treat  $s_i$  as exogenous

<sup>10</sup>In Herbst's (2000, p 141) own words: "...the inertia of the national experience and the incentives posed by international structures and norms that have developed over time combine to make the demarcation of the state a non-issue in most countries most of the time. Here, I differ greatly from writings by economists who seek to find the optimal number of states by assuming that states cooperate to design themselves in a way that will maximize 'their joint potential net revenue' [Friedman] or who believe that the size and shape of states is determined on the basis of majority votes motivated by precise calculations of economic interests [Alesina and Spolaore]"

<sup>11</sup>In Jackson and Rosberg's (1985, p 46) words: "The boundaries of many countries, particularly but by no means exclusively in French-speaking Africa, were arbitrarily drawn by the colonial powers and were not encouraging frameworks of unified, legitimate, and capable states."

<sup>12</sup>Well-known incidences of break-ups of colonies include the formation of India, Pakistan,

to levels of institutional development in the analysis ahead.

## 2.2 The rent seeking/openness effect

It is a well-known fact in the empirical trade literature that trade intensity is inversely related to measures of country size. Both Frankel and Romer (1999) and Alcalá and Ciccone (2004) show that both the sizes of country area and population have a negative association with the sum of imports and exports as a share of GDP. Larger countries are more likely to host most of the production of goods and services that their citizens demand within their borders. In this sense, it is not surprising that, for instance, the United States is less dependent on foreign trade than the Netherlands.

What is then the link from trade to institutions like the rule of law? Our main argument is that trade and openness to the outside world has a disciplining effect on government's willingness to commit themselves not to predate on foreign or domestic firms. For a small country dependent on several internationally traded goods, it might be devastating to have a government that expropriates production and reneges on contracts. As emphasized in the literature on 'the liberal peace', free trade among countries appears to foster a sense of liberal attitudes emphasizing private property rights, the honoring of contracts, and a general distaste for violence as a means of solving disputes (Mousseau, 2003). Large countries, on the other hand, can more easily find internal substitutes for internationally traded goods and also typically have a stronger power to solve international disputes to their own short term advantage. Trade is therefore usually not an effective behavioral constraint for governments in large countries.

There is potentially yet another channel through which country size affects institutions. Not only are large countries less dependent on the tradeables sector, they are also generally more endowed with valuable natural resources. A growing literature on 'the curse of natural resources' have shown that a large inflow of natural resource rents can be devastating for institutional quality (Leite and Weidemann, 1999; Sala-i-Martin and Subramanian, 2003; Dalgaard and Olsson, 2007). The reason is mainly that easily appropriable rents from minerals like diamonds and oil tend to become objects of predatory struggles involving government elites, guerillas, warlords, and criminal gangs. Congdon Fors and Olsson (2007) develop a model of endogenous institutional choice among newly independent former colonies. A key result is that in countries without natural resources and where a manufacturing sector is relatively important, it is even

---

and Bangladesh in 1949 and of Colombia, Venezuela, and Ecuador in 1830. However, all the countries mentioned had their break-up in conjunction with or very soon after independence and post-colonial developments have therefore had at most a very small impact on border formation.



in the private interests of the ruling elite in the core to restrain themselves from predatory activities since such a policy will generate legitimate private rents that exceed predatory rents. In natural resource-dominated economies, on the other hand, rent seeking elites are more likely to favor weak institutions so that they can more easily appropriate resource rents from the highly immobile mining enterprises.<sup>13</sup> In terms of equation (4) above, we might thus expect a negative indirect rent seeking/openness effect of  $s_i$  on  $z_i$  which is distinct from the broadcasting effect.

Figure 3 summarizes the joint framework that will form the basis for the subsequent empirical analysis. Our main efforts will be devoted to analyzing the causal relationships indicated by the double arrows 1-3, controlling for geography, colonial history and additional variables suggested by the literature.

### 3 Empirical analysis

#### 3.1 Data and model specification

The dependent variable throughout is *Rule of law* in 2004 from Kaufmann et al (2005). *Rule of law* measures the quality of contract enforcement, the quality of the police and the courts, as well as the likelihood of crime and violence. As our main measure of country size, we use *LogArea*, which shows the logged value of the total area of a country (including lakes and rivers) in square kilometers. Due to the potential endogeneity of country size, we use a restricted sample of 127 former colonies that we have identified among the 208 countries listed in Kaufmann et al (2005). These countries were colonized between 1462 and 1922 following the expansion of Western Europe. Borders in former colonies have rarely been changed since colonial days and might thus reasonably be regarded as being exogenous to current levels of economic and institutional development. Some of the countries in our sample are very small both in terms of population and territory (for instance Nauru with a population of roughly 12,000 individuals on 21 square kilometers) and some are still dependencies to their old colonial powers. Many cross-country studies exclude such tiny countries, but given the issue at hand, they are relevant observations in our study.<sup>14</sup> We further believe that this inclusion neutralizes the concerns of Knack and Azfar (2003) about a commonly observed sample selection bias towards including only those relatively developed small countries where international investors have economic interests. Our sample is further by far the largest sample of former colonies in the literature

---

<sup>13</sup>In a working paper version, we included some basic equations describing the most important features of this model (Hansson and Olsson, 2006).

<sup>14</sup>In section 4.4, we show that our main results are robust when we control for dependencies and exclude the smallest countries as well as those with the most uncertain data.

and arguably includes all countries that were ever colonized.

The basic equation that we test in this section is given in (5)

$$Z_i = \alpha_0 + \alpha_1 S_i + \alpha_2 C_i + \epsilon_i \quad (5)$$

where  $Z_i$  is the measure of *Rule of law* in country  $i$ ,  $S_i$  is our country size variable (mainly *LogArea*), and  $C_i$  is a vector of control variables that are non-correlated with  $S_i$ ,  $\epsilon_i$  is the normally distributed error term, and  $\alpha_k$  are the coefficients.

The main variable of interest here is of course  $S_i$ . As argued in the theoretical section above, the issue of identification should be resolved since it seems highly implausible that  $Z_i$  could have caused  $S_i$  in the sample at hand. Our main hypothesis is obviously that  $\alpha_1 < 0$ . The vector of controls in  $C_i$  will always include the purely exogenous variable *Latitude*, measuring the absolute distance from the equator in latitude degrees, and the regional dummies *Sub-Saharan Africa* and *Neo-Europe*. The motivation for including *Latitude* is partially that it can be regarded as a proxy for the marginal 'spatial cost' of broadcasting institutions,  $a_i$  and possibly also as a correlate of colonial institutions.<sup>15</sup> A *Neo-Europe*-dummy for Australia, Canada, New Zealand, and the United States is included since these four countries are extreme outliers and do not fit well into our basic framework, as explained above. Including a Sub-Saharan Africa dummy in our baseline regression further ensures that our results are not driven by some special characteristic of the African countries.

However, if we use the regression equation in (5), we are not able to distinguish between a broadcasting effect and a rent seeking/openness effect. The parameter  $\alpha_1$  will simply pick up both types of effects. If we add a vector of intermediate variables  $X_i$  that are structurally related to size, we can estimate the following equation:

$$Z_i = \beta_0 + \beta_1 S_i + \beta_2 C_i + \beta_3 X_i + \eta_i \quad (6)$$

The main variables that we will include in  $X_i$  are proxies for openness and rent seeking, in accordance with our hypothesis above. Obviously, we would expect that  $\beta_3$  is significant if the rent seeking/openness hypothesis applies (arrow 3 in Figure 3).<sup>16</sup> Similarly, if  $\beta_1 < 0$  and significant, we might interpret this as a support of the broadcasting hypothesis (arrow 1 in Figure 3).

Suppose further that we can model the indirect effect of country size (arrow

---

<sup>15</sup>See Diamond (1997), Herbst (2000), and Olsson and Hibbs (2005) for general treatments and Sachs (2001) for a more detailed discussion of the economic and institutional difficulties that are faced by governments near the equator. Hall and Jones (1999) develop further the argument for how *Latitude* might be seen as a proxy for Western influence.

<sup>16</sup>The sign will depend on what variable we include.

2 in Figure 3) as

$$X_i = \gamma_0 + \gamma_1 S_i + v_i. \quad (7)$$

In this case, there is clearly a 'built-in' colinearity between  $S_i$  and  $X_i$  that makes inference about the coefficients in (6) problematic. If we substitute the equation in (7) for  $X_i$  into (6), the reduced-form expression for *Rule of law* can be rewritten as

$$Z_i = \beta_0 + \beta_3 \gamma_0 + \beta_2 C_i + (\beta_1 + \beta_3 \gamma_1) S_i + \beta_3 v_i + \eta_i. \quad (8)$$

Note that this equation is the equivalent of (5) with  $\alpha_0 = \beta_0 + \beta_3 \gamma_0$ ,  $\alpha_1 = \beta_1 + \beta_3 \gamma_1$ ,  $\alpha_2 = \beta_2$ , and  $\epsilon_i = \beta_3 v_i + \eta_i$ . The central feature of this expression is that it shows how the reduced form-estimate for  $S_i$  picks up both the direct effect  $\beta_1$  and the indirect effect  $\beta_3 \gamma_1$  of country size.<sup>17</sup>

### 3.2 Correlates of country size

Column 1 in Table 1 shows the baseline regression of our study, which is the equivalent of equation (5). *LogArea* is here strongly and negatively related to *Rule of law*, and together with the three controls (*Latitude*, *Neo-Europe*, and *Sub-Saharan Africa*) it explains 57 percent of the variation in *Rule of law*. That there indeed is a clear relationship between *LogArea* and *Rule of law* is probably best described by a partial scatter plot as in Figure 4. If we were to interpret this result, a 100 percent increase in total area for any country implies a reduction in the *Rule of Law*-index by 0.152, which translates into about 3.6 percent of the whole dispersion between the highest and the lowest possible score (4.23). This relatively small effect is explained by that countries differ drastically in size.<sup>18</sup> If we instead compare a country with a total area of 1,000 square kilometers (about the size of Hong Kong) with a country with an area of 1,000,000 square kilometers (like Mauretania or Bolivia), the model predicts that all else equal the larger country should have a score on *Rule of law* that is 1.05 points lower, which is clearly a large effect.

Country area is however not the only variable that captures important elements of country size. In the tradition of Alesina and Spolaore (1997, 2003) most studies have used the level of the population as the indicator of country size. In a recent paper, Rose (2005) investigates whether the level of the pop-

<sup>17</sup>A potential alternative strategy would be to try to find instruments for  $X_i$ , the rent seeking and openness variables. Frankel and Romer (1999) use country size as an instrument for trade openness, but given the hypothesis in this paper of a direct effect of size on institutions, this is not a viable strategy. The approach above is instead in the spirit of for instance Easterly and Levine (1997) who empirically described a direct and indirect effect of ethnic fractionalization on income growth.

<sup>18</sup>India, one of the largest countries in our sample, is about 130'000 times larger than Macau, which is one of the smallest countries in our sample.

ulation has an impact on a battery of economic and institutional variables and finds that it has no or, at best, a very weak effect. We argue that unlike country area, the level of the population is in general endogenous to economic and institutional environments, sometimes even in the short run.<sup>19</sup> Nonetheless, we include the level of the population as a regressor in Table 1 to check whether country area or population size can best explain variations in *Rule of law*.

Column 2 shows that when *LogArea* is replaced by *LogPop* (the natural logarithm of the level of the population), the effect from *LogPop* is also negative and significant.<sup>20</sup> When included together with *LogArea* in column 6, the effect from *LogPop* is insignificant and changes sign whereas *LogArea* is still significant. Given the high correlation between *LogArea* and *LogPop*, one should of course not take the specific estimate too seriously, but column 6 appears to indicate that even when holding population constant, *Rule of law* diminishes with country territory and retains its significance.

Table 1 also includes two variables that are intended to be proxies for our intermediate rent seeking/openness effect. The first one is an indicator of natural resource rents, *Log Natural Resources*, measuring the absolute energy rents (oil, gas and coal) in 2001. In our theoretical reasoning above we assumed that the abundance of natural resources is a positive function of country area. Hence, we believe that *LogArea* and *Log Natural Resources* should be collinear. This presumably also explains why *Log Natural Resources* is negatively and significantly related to *Rule of law* in column 3 but insignificant when run together with *LogArea* in column 6.

The second variable that is highly related to country size is *LogOpen*, measured in the conventional way as the log of imports plus exports as a share of GDP. In accordance with our theory, Table 1 suggests that a high degree of openness appears to act as a disciplining device for countries to uphold strong property rights and judicial constraints against opportunistic behavior by governments and individuals. The estimate in column 4 is positive and highly significant and the coefficient is still significant when *LogArea* is included in column 7. Finally in column 8, *LogArea*, *Log Natural Resources*, and *LogOpen* are included alongside each other.

In Table 2, we proceed with some simple tests of arrow 2 in Figure 3 concerning the effect of size on rent seeking/openness. We indeed find that *LogArea*

---

<sup>19</sup>There are several recent examples of episodes when the population has changed drastically as a result of institutional failures. In 1994, 800,000 Tutsi were slaughtered in Rwanda as a result of a collapse of the rule of law. The older experiences of Nazi Germany and Stalin's Soviet Union are well-known examples of how bad institutions have a very large impact on the level of the population.

<sup>20</sup>This result stands in sharp contrast to the main tendency in Rose (2005) who finds no robust association between population size and a number of institutional and economic variables.

positively affects *Log Natural Resources* and negatively affects *LogOpen*. The final specification in column 8, Table 1 is therefore clearly affected by endogeneity, and we will henceforth drop *Log Natural Resources* and *LogOpen* from the analysis. It should be kept in mind, however, that by excluding these variables the estimate for *LogArea* will be greater in absolute terms than it would be otherwise since it captures both direct and indirect effects of size, as shown in equation (8).

### 3.3 Location of the core area

Apart from the size of country territory, the degree of peripherality of the capital  $q_i$  was an important ingredient of the theoretical reasoning above. The model predicts that rule of law should decrease with  $q_i$ , holding country size  $s_i$  constant. Using data from CEPII (2006) and CIA (2005), we have constructed a measure of the distance in kilometers from the approximate center of the country to the city hosting the seat of the government (which is usually also the capital).<sup>21</sup> The measure is available for 120 countries in our ex-colony sample. The countries with the greatest distances are not surprisingly the United States and Canada.

The natural logarithm of this score makes up *LogDistance*, which is featured in Table 3. When run together with *LogArea*, *LogDistance* is negative and significant in column 4, and strongly significant in column 1 when featured alone. The distance measure is however clearly correlated with country area (larger countries like Brazil and Indonesia will, ceteris paribus, have a greater absolute distance from center to capital), and the coefficient in column 1 where *LogArea* is excluded presumably picks up some of the effect of country size. Furthermore, *LogDistance* is an imperfect proxy for  $q_i$  in the theory section since  $q_i$  is a size-neutral index of the peripherality of the capital.

We have therefore created a measure that, we believe, more clearly reflects the degree of peripherality. We have done so by dividing our calculated distance from center to capital by an approximate measure of the distance from the center of the country to the border, where we approximate the shape of all countries to be congruent to a circle as is standard in the trade literature (Head and Meyer, 2002). Countries which are divided, like for example island groups, can clearly not be said to have a country area approximate to a circle, and are therefore dropped from the sample (see Data Appendix for details).

Table 4 shows the countries with the five lowest and the five highest scores on *Periphery*. This size-adjusted measure shows countries like Namibia and Costa Rica as being among the very lowest scorers whereas the countries with the most

---

<sup>21</sup>The measure was produced by translating data on locations in latitude and longitude degrees to distances in kilometers by employing the Great Circle Formula. See the Data Appendix for the exact details.

peripheral capitals include Mozambique and Benin. Interestingly, Namibia, one of the least peripheral countries, has a larger country size than any of the five countries with the highest score on *Periphery*. In fact, the correlation between *Periphery* and country area is only 0.1, which indicates that we seem to have created a size neutral measure of periphery.

Our theoretical reasoning predicts that the strength of *Rule of law* should decrease with *Periphery*. Including *Periphery* instead of *LogArea* in the regression, as in column 2, Table 3, the effect from *Periphery* is indeed negative but insignificant.

Often when the capital is uncentrally located, it is instead positioned at the coast to enable trade and contact with the rest of the world. A capital which is uncentrally located could then presumably offset the negative effect from *Periphery* by being located by the coast. Therefore in column 3 we include a dummy for *Core Area by Coast*. The effect from *Periphery* is now both negative and significant whereas *Core Area by Coast* has a positive impact, as predicted. Our theoretical reasoning further predicts that *Periphery* would have a negative effect while holding country size constant, and therefore column 5 includes *LogArea*. As before, *LogArea* remains negative and significant whereas *Periphery* is negative but loses its significance.<sup>22</sup>

To conclude, we believe that Table 3 provides some supporting evidence of the notion that the geographical peripherality of the capital negatively affects the average intensity of *Rule of law* although the results are not very robust. It is further quite likely that our measure of *Periphery* is measured with error. More work on the impact of core area location should be able to shed further light on the true relationship. It should also be noted that the coefficient for *LogArea* remains negative and highly significant throughout all specifications.

### 3.4 Robustness tests

In Table 5, we extend our set of control variables in  $C_i$  from just *Latitude*, *Neo-Europe*, and *Sub-Saharan Africa* to include several other variables that have been suggested in the literature. Ethnic, cultural, and or religious fractionalization is an often argued cause for differences in institutional quality and civil conflict (see for example Alesina et al (2003), Easterly and Levine (1997), and Hibbs (1973)). Recently, partly due to the revived interest in the effects of fractionalization, Alesina et al (2003) and Fearon (2003) have created new measures for different aspects of fractionalization. The measures Ethnic fractionalization from Fearon (2003) (*Ethnicity1*, used above) and Ethnic and Religious fractionalization (hereafter called *Ethnicity2* and *Religion*) both from Alesina et al

---

<sup>22</sup>The  $p$ -value is 0.134.

(2003) are used as control variables. As can be seen from Table 5, the coefficient for *LogArea* is still negative and statistically significant, while controlling for the fractionalization measures. Before we leave the fractionalization measures, it is interesting to note that the correlations between *LogArea* and the three fractionalization measures are surprisingly low.<sup>23</sup> A large country, therefore, does not automatically imply a more fractionalized country.

Intuition suggests that large countries are more likely to be federal states with bicameral legislatures, i.e. with more regionally decentralized power. If public goods like the rule of law are primarily provided by regional governments, the negative impact of country size should be smaller. In order to control for this, we include a measure of *Unitarism*, a proxy for the degree of power separation between national and regional polities developed by Gerring et al (2005). A country with a high score on *Unitarism* is characterized by a high power concentration with the national government (non-federalism) and a single 'house' of parliament (non-bicameralism), whereas the lowest score implies a federal, bicameral state. In column 4, *Unitarism* has a negative but insignificant effect on *Rule of law*. The effect from *LogArea* remains negative and significant, indicating that a large country size is bad for institutional quality regardless of whether countries have centralized or decentralized modes of governance.

Since we have a sample of former colonies, variables related to colonial heritage are obviously highly relevant. An often used variable is Acemoglu et al's (2001, 2002) famous proxy for settler mortality, constructed by using data on the mortality of soldiers and bishops in tropical diseases during colonial days. The hypothesis proposed by Acemoglu et al (2001) was that a high settler mortality and a subsequent low intensity of European settlement should have contributed to extractive, harmful colonial institutions that have persisted to this day, and vice versa.<sup>24</sup> When controlling for *Log Settler Mortality* in column 5 the coefficient for *LogArea* is still negative and significant.

The other colonial variables are *Duration of colonial rule* (suggested by Grier, 1999, and Price, 2003), *Years of independence from colonial rule*, and *Legal Origin* (as suggested by La Porta et al, 1999). Controlling for these measures of colonial heritage does not alter the main results; the coefficient for *LogArea* is still negative and significant in all regressions.

Some additional variables related to geography and urbanization are included in Table 6. In column 1, we include an adjusted measure of country area, taking into account that large portions of countries might be more or less uninhabitable. Consider for instance the population distribution of Algeria in Figure 5.

<sup>23</sup>The Pearson correlation coefficients between *LogArea* and *Ethnicity1*, *Ethnicity2*, and *Religion*, are respectively; 0.1735, 0.4441, and -0.0920.

<sup>24</sup>See Rodrik et al (2004) and Glaeser et al (2004) for further discussions of this work.

Although the country has the eighth largest territory area in our sample, the politically relevant area where people live in the north is much smaller.<sup>25</sup> In order to test whether hinterland countries like Algeria in any way drive our results, we subtract areas with four or less inhabitants per square kilometers from country size to form *LogArea2* (see Data Appendix for details). The sample is reduced to 117 countries but the effect from country size is still negative and significant. A previous version of this paper also adjusted area by subtracting polar and desert areas, and the effect from *LogArea* was still significant.

Controlling for *Island* status or whether the country is *Landlocked* or a *Dependency* (a country that is not sovereign) does not alter the significance of the coefficient for *LogArea*. The results remain unchanged when including a *Latin America* dummy in column 5.

In columns 6 and 7 we include further controls for the distribution of the population: *Urbanization* (urban population as percentage of total population) and *Variation in Pop.Density* (the standard deviation of population density among regional units within countries). We do this since our theoretical framework actually assumes a uniform distribution of the population, a fact which we have so far not controlled for. When holding these measures of population distribution constant, the effect from *LogArea* is still significant. More urbanized countries further appear to have a stronger *Rule of Law*.

As the presence of mountains naturally impedes the ability to broadcast power, we have in the last column in Table 6 included a measure for the *Variation in Elevation* (standard deviation of elevation among regional units within countries). As expected, more variation in elevation reduces the quality of *Rule of law*, although the effect from *LogArea* is almost unchanged.

Lastly, in Table 7, we have attempted to control for sample selection bias and measurement error. In row 1, we exclude the smallest countries in the sample, and in row 2 we exclude countries with the largest potential measurement error. In the latter case, we exclude observations with a standard error in the measurement of the dependent variable that is larger than 0.2, which reduces the sample to 90 countries.<sup>26</sup> This does not alter the significance of the effect from *LogArea*. In rows 3-4, we use two related measures from Kaufmann et al

---

<sup>25</sup>We do not argue, however, that deserts or uninhabited land is irrelevant for a country's level of institutional quality. In line with Herbst (2000) and others we argue that hinterlands like the Sahara constitutes an enormous challenge to governments since such areas easily become the home of rebel groups and other destabilizing forces.

<sup>26</sup>Our *Rule of Law* measure from Kaufmann et al (2005) is a composite index based on several different independent sources. Therefore, attached to each country's score is also the estimate's standard error and how many sources that has been used for that particular estimate. For the *Rule of Law* 2004 estimate, the great majority of countries have a standard error of between 0.1 and 0.2. The cut-off point that we employ is therefore to exclude countries with a standard error larger than 0.2. This turns out to be almost the same as excluding those countries with less than six independent sources.



(2005) as dependent variables instead of *Rule of law: Government Effectiveness* and *Regulatory Quality*. The level of the estimate changes somewhat but the relationship is still robustly negative. Finally, in row 5, we use a quantile regression, or median regression, which estimates the median of the dependent variable and therefore is more robust to outliers. The coefficient for *LogArea* remains negative and significant.<sup>27</sup>

## 4 Conclusions

In the spirit of Montesquieu, this paper demonstrates that there is a clear, robust and significant negative relationship between the size of nations and the strength of rule of law for a large cross-section of countries. For former colonies, up to 60 percent of the variation in rule of law is explained by the variables *LogArea*, *Latitude*, and *Sub-Saharan Africa*, and *NeoEurope*. This strong negative relationship is robust to the inclusion of a variety of control variables such as trade openness, ethnic and religious fractionalization, settler mortality, colonial heritage, and legal origin. The negative relation between *LogArea* and *Rule of Law* is even robust to including the level of the population, suggesting that country area is a stronger predictor of institutional quality than population levels. We believe that these results suggest that large countries are seriously disadvantaged in the formation and maintenance of institutions for economic development.

In our model, we further propose that the centrality of the capital should play an important role in the broadcasting of high quality institutions. We therefore construct a measure for the peripherality of the capital by relating the distance in kilometers from the capital to the center of the country, to the approximate distance from the center of the country to the border. As predicted by our model, the peripherality of the capital appears to be negatively associated with *Rule of Law*, although the result is not very robust. We believe that the relationship between the location of the capital and the country-wide provision of public goods is a potential area for future research.

## References

- [1] Acemoglu, D., S. Johnson and J.A. Robinson (2000) "The Colonial Origins of Comparative Development: An Empirical Investigation" *NBER Working Paper* 7771, <<http://www.nber.org/papers/w7771>>

---

<sup>27</sup>A similar result is achieved is using a robust regression (rreg in STATA).

- [2] Acemoglu, D., S. Johnson and J.A. Robinson (2001) "The Colonial Origins of Comparative Development: An Empirical Investigation" *American Economic Review* 91(5): 1369-1401.
- [3] Acemoglu, D., S. Johnson and J.A. Robinson (2002) "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution", *Quarterly Journal of Economics* 117(4): 1231-1294.
- [4] Aghion, P. and P. Howitt (1992) "A Model of Growth Through Creative Destruction", *Econometrica* 60(2), 323-351
- [5] Alcalá, and Ciccone (2004) "Trade and Productivity" *Quarterly Journal of Economics*, 613-646.
- [6] Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., and R. Wacziarg. (2003). "Fractionalization", *Journal of Economic Growth*. 8(2), 155-194.
- [7] Alesina, A., W. Easterly, and J. Matuszeski (2006) "Artificial States", Harvard University, *mimeo*.
- [8] Alesina, A. and G. Spolaore (1997) "On the Number and Size of Nations" *Quarterly Journal of Economics* 112: 1027-1056.
- [9] Alesina, A. and G. Spolaore (2003) *The Size of Nations* Cambridge, Mass: MIT Press.
- [10] Alesina, A, G. Spolaore, and R. Wacziarg (1998) "Openness, Country Size, and Government" *Journal of Public Economics* 69: 305-321.
- [11] Arzaghi, M. and V. Henderson (2005) "Why Countries Are Fiscally Decentralizing" *Journal of Public Economics* 89: 1157-1189.
- [12] Bates, R.H. (1981) *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies*, Berkeley: University of California Press.
- [13] CEPII (2006) "Distances" <<http://www.cepii.fr/anglaisgraph/bdd/distances.htm>>.
- [14] CIA (2005) *The World Factbook 2005*. <<http://www.cia.gov/cia/publications/factbook/index.html>>, accessed nov-dec.
- [15] CIESIN (2006) "Gridded Population of the World Project" <<http://sedac.ciesin.columbia.edu/gpw/country.jsp?iso=DZA>>, accessed September 2006.
- [16] Congdon Fors, H. and O. Olsson (2007) "Endogenous Institutional Change After Independence" *European Economic Review*, forthcoming.
- [17] Dahl, R.A. and E.R. Tufte (1973) *Size and Democracy*. Stanford University Press.
- [18] Dalgaard, C.J. and O. Olsson (2007) "Windfall Gains, Political Economy, and Economic Development", *Journal of African Economies*, forthcoming.

- [19] Davidson, B. (1992) *The Black Man's Burden: Africa and the Curse of the Nation-State*, New York: Times Books.
- [20] Diamond, J. (1997) *Guns, Germs, and Steel: The Fates of Human Societies*. London: W W Norton & Company.
- [21] Englebert, P., S. Tarango, and M. Carter (2002) "Dismemberment and Suffocation: A Contribution to the Debate on African Boundaries" *Comparative Political Studies* 35(10), 1093-1118.
- [22] Easterly, W., and R. Levine. (1997) "Africa's Growth Tragedy: Policies and Ethnic Divisions" *Quarterly Journal of Economics*, Vol. 112, No. 4: 1203-1250.
- [23] Fearon, J. (2003) "Ethnic and Cultural Diversity by Country" *Journal of Economic Growth* 8(2): 195-222.
- [24] Frankel, J. and D. Romer (1999) "Does Trade Cause Growth?" *American Economic Review* 89(3): 379-399.
- [25] Friedman, D. (1977) "A Theory of the Size and Shape of Nations" *Journal of Political Economy* 85(1): 59-77.
- [26] Gerring, J., S.C. Thacker, and C. Moreno (2005) "Centripetal Democratic Governance: A Theory and Global Inquiry" *American Political Science Review* 99(4): 567-581.
- [27] Glaeser, E., R. la Porta, F. Lopez-de-Silanes, and A. Shleifer (2004) "Do Institutions Cause Growth?" *Journal of Economic Growth* 9: 271-303.
- [28] Grier, R. M., (1999), "Colonial legacies and economic growth", *Public Choice* Vol. 98:317-335.
- [29] Hall, R. and C.I. Jones (1999) "Why Do Some Countries Produce So Much More Output Than Others?" *Quarterly Journal of Economics* 114(1): 83-116.
- [30] Hansson, G. and O. Olsson (2006) "Country Size and the Rule of Law: Resuscitating Montesquieu" *Working Papers in Economics* no 200, Department of Economics, Göteborg University.
- [31] Head, K. and T. Meyer (2002) "Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade" *CEPII Working paper*, 2002-01, <<http://www.cepii.fr/anglaisgraph/workpap/summaries/2002/wp02-01.htm>>.
- [32] Herbst, J. (2000) *States and Power in Africa*. Princeton University Press.
- [33] Hibbs, D.A. (1973), *Mass Political Violence*, New York, Wiley
- [34] Jackson, R.H. and C.G. Rosberg (1985) "The Marginality of African States", in Carter, G. and P. O'Meara, *African Independence: The First Twenty Five Years*. Bloomington: Indiana University Press.

- [35] Jones, C. (1995) "R&D-Based Models of Economic Growth", *Journal of Political Economy* 103(4), 759-784.
- [36] Kaufmann, D., A. Kraay, and M. Mastruzzi (2005) "Governance Matters IV: Governance Indicators for 1996-2004" *World Bank Policy Research Working Paper 3630*.
- [37] Keller, W. (2002) "Geographic Localization of International Technology Diffusion" *American Economic Review* 92(1): 120-142.
- [38] Knack, S. and O. Azfar (2003) "Trade Intensity, Country Size, and Corruption" *Economics of Governance* 4: 1-18.
- [39] Kremer, M. (1993) "Population Growth and Technological Change: One Million B.C. to 1990" *Quarterly Journal of Economics* 108(3): 681-716.
- [40] Krugman, P. (1998) "Space: The Final Frontier" *Journal of Economic Perspectives* 12(2): 161-174.
- [41] La Porta, R., Lopez-de-Silanes, F., Shleifer, A., and R. Vishny., (1999), "The Quality of Government", *Journal of Law, Economics, & Organization*, V15, N1.
- [42] Leite, C. and J. Weidmann (1999) "Does Mother Nature Corrupt? Natural Resources, Corruption and Economic Growth" *IMF Working Papers* 99/85.
- [43] Montesquieu, C.L. (1750) *The Spirit of Laws*. (Quoted in Dahl, R.A. and E.R. Tufte (1973), p 7).
- [44] Mousseau, M. (2003) "The Nexus of Market Society, Liberal Preferences, and Democratic Peace: Interdisciplinary Theory and Evidence" *International Studies Quarterly* 47: 483-510.
- [45] North, D. (1999) *Institutions, Institutional Change and Economic Performanc.* Cambridge University Press
- [46] Olsson, O. and D.A Hibbs (2005) "Biogeography and Long-Run Economic Development" *European Economic Review* 49(4): 909-938.
- [47] Pakenham, T. (1991) *The Scramble for Africa*. London: Abacus.
- [48] Price, G. N., (2003), "Economic Growth in a Cross-section of Nonindustrial Countries: Does Colonial Heritage Matter for Africa?", *Review of Development Economics*, Vol. 7(3): 478-795.
- [49] Rodrik, D., A. Subramanian and F. Trebbi (2004) "Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development" *Journal of Economic Growth* 9(2): 131-165.
- [50] Romer, P. (1990) "Endogenous Technological Change", *Journal of Political Economy* 98(5), 71-102.

- [51] Rose, A.K. (2005) "Size Really Doesn't Matter: In Search of a National Scale Effect" *CEPR Working Paper* No 5350.
- [52] Sachs, J. (2001) "Tropical Underdevelopment" *NBER Working Paper* 8119, NBER.
- [53] Sala-i-Martin, X. and A. Subramanian (2003) "Addressing the Natural Resource Curse: An Illustration from Nigeria" *NBER Working Paper* No. 9804, NBER.
- [54] Tilly, C. (1990) *Coercion, Capital, and European States, AD 990-1992*. Cambridge, Mass: Blackwell.
- [55] Wittman, D. (2000) "The Wealth and Size of Nations" *Journal of Conflict Resolution* 44(6): 868-884.

**Table 1: OLS regressions for Rule of Law**

	Dependent Variable: Rule of Law							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LogArea	-0.152 <sup>***</sup> (0.016)				-0.132 <sup>***</sup> (0.043)	-0.190 <sup>***</sup> (0.041)	-0.106 <sup>***</sup> (0.025)	-0.107 <sup>**</sup> (0.047)
LogPop		-0.173 <sup>***</sup> (0.021)			-0.030 (0.055)			
Log Natural Resources			-0.015 <sup>*</sup> (0.009)			0.005 (0.008)		0.004 (0.008)
LogOpen				0.569 <sup>***</sup> (0.116)			0.273 <sup>*</sup> (0.140)	0.324 <sup>**</sup> (0.155)
Latitude	0.023 <sup>***</sup> (0.006)	0.022 <sup>***</sup> (0.007)	0.018 <sup>*</sup> (0.009)	0.022 <sup>***</sup> (0.007)	0.023 <sup>***</sup> (0.007)	0.022 <sup>***</sup> (0.008)	0.025 <sup>***</sup> (0.007)	0.026 <sup>***</sup> (0.007)
Neo -Europe	1.953 <sup>***</sup> (0.256)	1.643 <sup>***</sup> (0.238)	1.773 <sup>***</sup> (0.284)	1.864 <sup>***</sup> (0.202)	1.924 <sup>***</sup> (0.268)	2.071 <sup>***</sup> (0.312)	2.012 <sup>***</sup> (0.250)	2.041 <sup>***</sup> (0.272)
Sub-Saharan Africa	-0.374 <sup>***</sup> (0.122)	-0.498 <sup>***</sup> (0.128)	-0.455 <sup>**</sup> (0.198)	-0.409 <sup>***</sup> (0.131)	-0.383 <sup>***</sup> (0.120)	-0.188 (0.161)	-0.325 <sup>**</sup> (0.125)	-0.205 (0.164)
Constant	1.176 <sup>***</sup> (0.203)	2.180 <sup>***</sup> (0.294)	-0.397 (0.281)	-0.351 <sup>**</sup> (0.144)	1.411 <sup>***</sup> (0.397)	1.545 <sup>***</sup> (0.547)	0.685 <sup>**</sup> (0.277)	0.628 (0.522)
<i>n</i>	127	127	88	97	127	88	97	80
<i>R</i> <sup>2</sup>	0.571	0.520	0.402	0.510	0.573	0.532	0.596	0.565

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses.

**Table 2:** Bivariate regressions estimating the impact of LogArea on correlated variables.

Independent variable: LogArea				
Dependent variables	Constant	LogArea coefficient	<i>n</i>	<i>R</i> <sup>2</sup>
(1) Log Natural Resources	-18.431 <sup>***</sup> (6.558)	2.369 <sup>***</sup> (0.512)	88	0.212
(2) LogOpen	0.911 <sup>***</sup> (0.150)	-0.108 <sup>***</sup> (0.012)	97	0.317

Notes: The superscript <sup>\*\*\*</sup> denotes significant at the 1% level, <sup>\*\*</sup> denotes significant at the 5% level, and <sup>\*</sup> denotes significant at the 10% level. In parenthesis are robust standard errors.

**Table 3: Uncentrality of Core Area**

Independent Variables	Dependent Variable: Rule of Law				
	(1)	(2)	(3)	(4)	(5)
LogArea				-0.100 <sup>***</sup> (0.028)	-0.163 <sup>***</sup> (0.032)
LogDistance	-0.267 <sup>***</sup> (0.040)			-0.123 <sup>**</sup> (0.056)	
Periphery		-0.145 (0.158)	-0.376 <sup>**</sup> (0.169)		-0.222 (0.147)
Core Area by Coast (dummy)			0.498 <sup>***</sup> (0.158)		0.184 (0.150)
Controlling for Latitude, Neo-Europe, and Sub-Saharan Africa	Yes	Yes	Yes	Yes	Yes
<i>n</i>	120	94	94	120	94
<i>R</i> <sup>2</sup>	0.520	0.353	0.422	0.557	0.554

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Intercept included but not reported.



**Table 4:** Lowest and Highest Five Scores on Periphery Measure

<b>Country</b>	<b>Isocode</b>	<b>Periphery</b>	<b>Distance (km)</b>	<b>Area (sq km)</b>
Lowest Five Scores				
Costa Rica	CRI	0.059	7.542	51100
Belize	BLZ	0.076	6.483	22966
Rwanda	RWA	0.115	10.493	26338
Namibia	NAM	0.125	63.923	825418
Gambia, The	GMB	0.150	9.022	11300
Highest Five Scores				
Bahrain	BHR	1.634	23.774	665
Cuba	CUB	1.635	307.151	110860
Vietnam	VNM	1.725	558.680	329560
Mozambique	MOZ	1.771	894.444	801590
Benin	BEN	1.829	346.374	112620

**Table 5: Controlling for Fractionalization, Unitarism, and Colonial Heritage**

	Dependent Variable: Rule of Law							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LogArea	-0.158 <sup>***</sup> (0.042)	-0.168 <sup>***</sup> (0.020)	-0.145 <sup>***</sup> (0.016)	-0.140 <sup>***</sup> (0.019)	-0.183 <sup>***</sup> (0.035)	-0.149 <sup>***</sup> (0.016)	-0.137 <sup>***</sup> (0.021)	-0.135 <sup>***</sup> (0.018)
Ethnicity1	0.762 <sup>**</sup> (0.304)							
Ethnicity2		0.427 (0.263)						
Religion			0.546 <sup>**</sup> (0.212)					
Unitarism				-0.016 (0.123)				
Log Settler Mortality					-0.237 <sup>**</sup> (0.096)			
Duran of Colonial Rule						0.001* (0.000)		
Years of Independence from Colonial Rule							-0.002 (0.001)	
Legal Origin France (dummy)								0.822 <sup>***</sup> (0.195)
Legal Origin UK (dummy)								0.978 <sup>***</sup> (0.207)
Controlling for Latitude, Neo-Europe, and Sub-Saharan Africa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>n</i>	92	117	125	88	69	127	127	125
<i>R</i> <sup>2</sup>	0.527	0.568	0.592	0.568	0.652	0.579	0.578	0.623

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Intercept included but not reported. a: Omitted group is Socialist Legal origin (coefficient for constant=0.1402, se=0.3047).

**Table 6:** Controlling for Geography and Urbanization

	Dependent Variable: Rule of Law							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LogArea		-0.145 <sup>***</sup> (0.023)	-0.150 <sup>***</sup> (0.016)	-0.137 <sup>***</sup> (0.017)	-0.152 <sup>***</sup> (0.016)	-0.145 <sup>***</sup> (0.017)	-0.121 <sup>***</sup> (0.035)	-0.140 <sup>***</sup> (0.023)
LogArea2 <sup>a</sup>	-0.177 <sup>***</sup> (0.022)							
Island (dummy)		0.067 (0.169)						
Landlocked (dummy)			-0.120 (0.166)					
Dependency (dummy)				0.584 <sup>***</sup> (0.151)				
Latin America (dummy)					0.172 (0.144)			
Urbanization						0.009 <sup>***</sup> (0.002)		
Variation in Pop. Density							-0.026 (0.029)	
Variation in Elevation								-0.093 <sup>***</sup> (0.031)
Controlling for Latitude, Neo-Europe, and Sub-Saharan Africa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>n</i>	117	127	127	127	127	123	112	109
<i>R</i> <sup>2</sup>	0.576	0.572	0.573	0.591	0.577	0.624	0.521	0.581

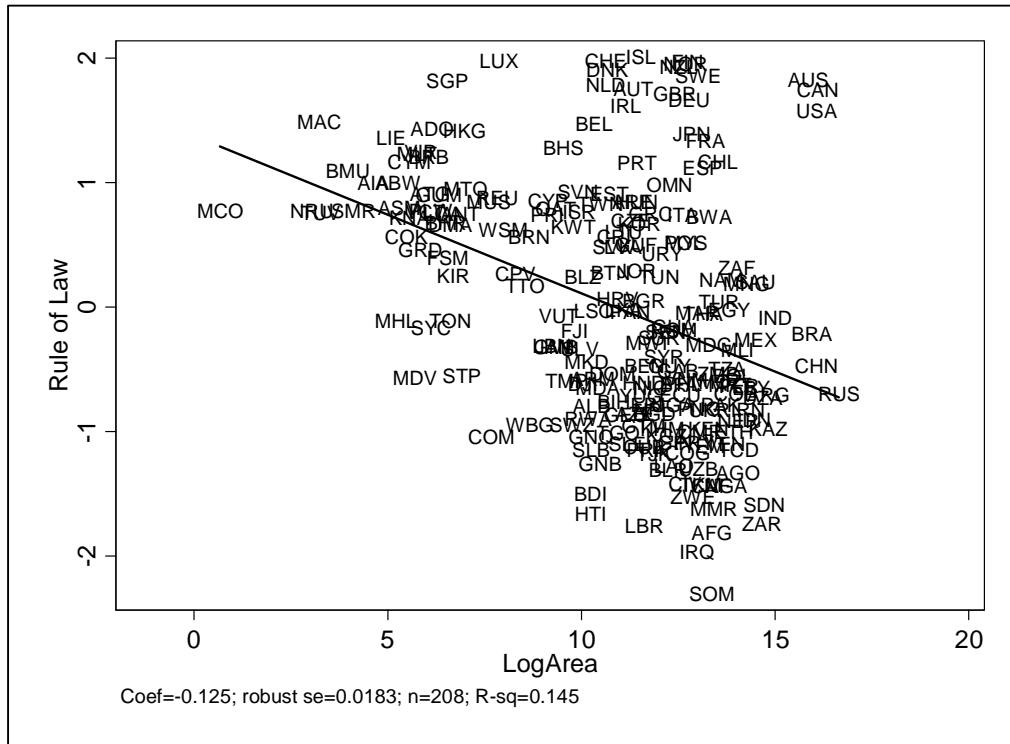
Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Intercept included but not reported. a: Only country area with more than 4 persons per square kilometer.

**Table 7:** Controlling for sample selection bias and measurement error.

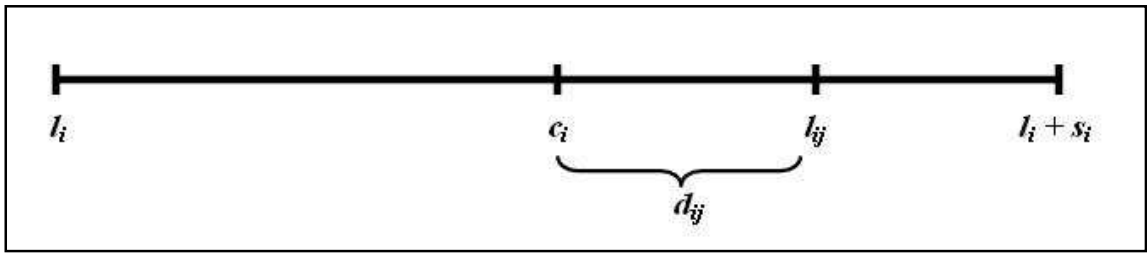
Dependent variable: Rule of Law				
	LogArea coefficient	Controls for Latitude, Neo-Europe, and Sub- Saharan Africa	<i>n</i>	<i>R</i> <sup>2</sup>
(1) Excluding countries w/ population<1,000,000	-0.162*** (0.045)	Yes	90	0.506
(2) Excluding countries w/ imprecise estimates (standard error of Rule of Law>0.2)	-0.161*** (0.039)	Yes	90	0.521
(3) Using Government Effectiveness as dependent variable	-0.081*** (0.022)	Yes	127	0.420
(4) Using Regulatory Quality as dependent variable	-0.115*** (0.021)	Yes	126	0.390
(5) Quantile Regression	-0.158*** (0.026)	Yes	127	0.377 <sup>a</sup>

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Robust standard errors in parentheses. Intercept included but not reported. OLS estimator in rows (1)-(4), and quantile regression (*qreg* in *Stata*) in row (5). a: Pseudo *R*<sup>2</sup>.

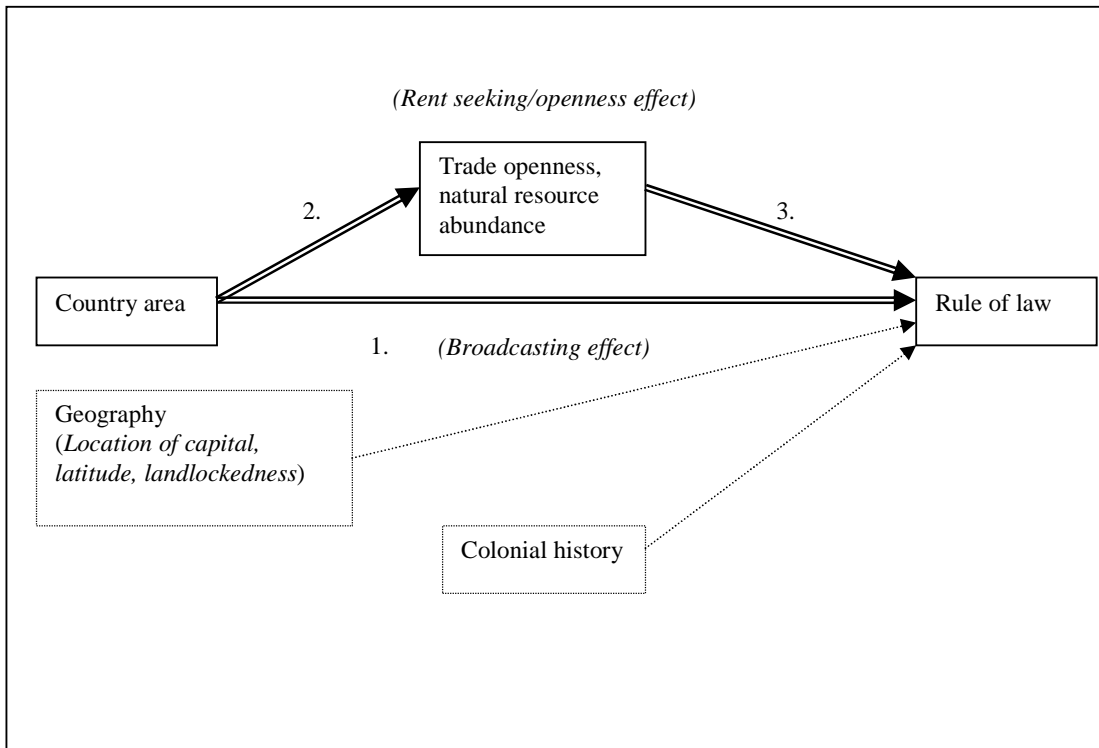
**Figure 1:** Simple Correlation between Rule of Law and LogArea for 208 countries.



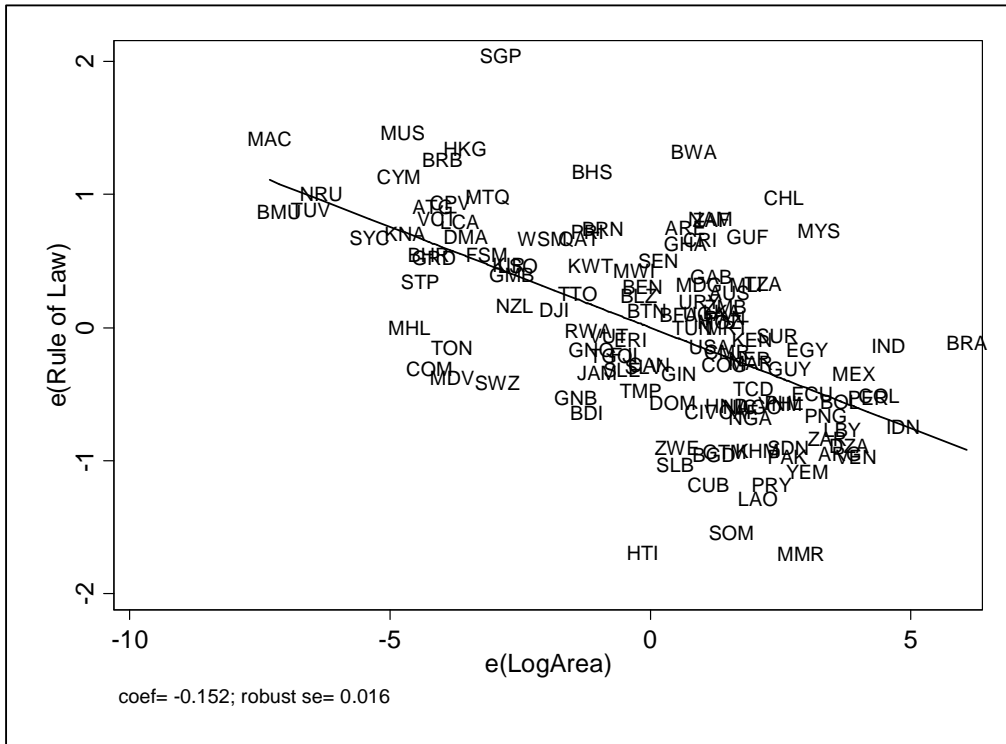
**Figure 2:** Illustration of Distance to Capital



**Figure 3:** Hypothesized Causal Linkages



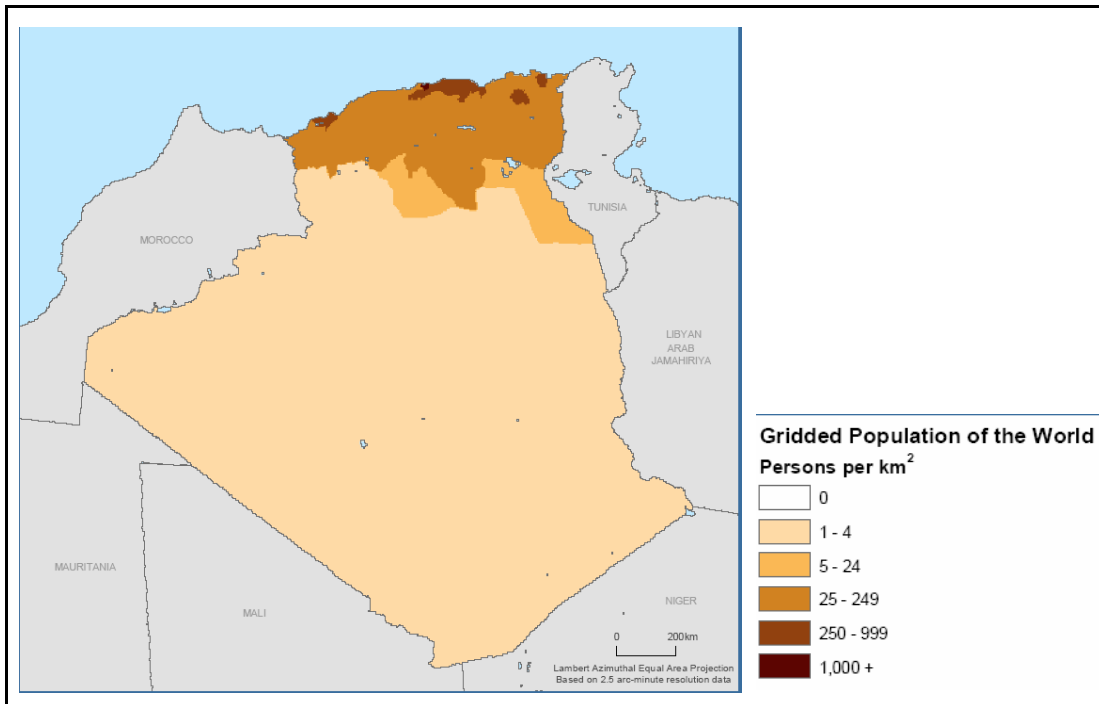
**Figure 4:** Partial Scatter Plot, Rule of Law vs. LogArea (former colonies)



Notes: Partial scatter from regression 1 in Table 1.



**Figure 5: Population Distribution of Algeria.**



Source: CIESIN (2006).

# Data Appendix

## Variable Description

Core Area by Coast	Dummy =1 if capital is located at ocean coast. Own assessment based on maps.google.com.
Dependency	Dummy variable. =1 if country is not independent according to CIA World Factbook 2005
Duration of Colonial Rule	Duration of colonial rule. Year of independence (max 2004) minus year of colonialization. Own assessment.
Ethnicity1	Ethnic Fractionalization. From Fearon (2003)
Ethnicity2	Ethnic Fractionalization. Covers the period 1979-2001. From Alesina et al (2003)
Island	Dummy variable. =1 if Island. An Island is defined as a country with no land boundary. Based on “land boundary” from CIA World Factbook 2005.
Landlocked	Dummy variable. =1 if country is landlocked. From CIA World Factbook 2005
Latin America	Dummy variable. =1 if country is part of Latin America
Latitude	Absolute latitude degree. Source CIA World Factbook 2005,
Legal Origin France	Legal Origin French From La Porta et al (1999)
Legal Origin UK	Legal Origin British, From La Porta et al (1999)
Log Natural Resources	Natural logarithm of total energy rents +1. Rents from energy depletion 2001 in current USD. Energy consists of crude oil, natural gas, and coal, and the rents=volume*(market price-production cost). From World Bank data on Adjusted Net Savings. <a href="http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/NVIRONMENT/EXTEEI/0,,contentMDK:20502388~menuPK:1187778~pagePK:148956~piPK:216618~theSitePK:408050,00.html">http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/NVIRONMENT/EXTEEI/0,,contentMDK:20502388~menuPK:1187778~pagePK:148956~piPK:216618~theSitePK:408050,00.html</a>
Log Settler Mortality	Natural logarithm of Settler Mortality, from Acemoglu et al (2000)
LogArea	Natural logarithm of total area (including lakes and rivers) in sq km. Source CIA World Factbook 2005
LogArea2	Natural logarithm of country area with more than 4 persons per square kilometer. Calculated by using data on population and area from the G-econ dataset. (G-Econ Project, Yale University, New Haven, CT, USA, William D. Nordhaus, Project Director)
LogDistance	<p>Natural logarithm of the distance in kilometers from the Seat of the Government (data from CEPII, 2006) to the approximate center of the country (CIA, 2005). Calculated by Great Circle Distance Formula (see <a href="http://mathworld.wolfram.com/GreatCircle.html">http://mathworld.wolfram.com/GreatCircle.html</a>, and; <a href="http://www.meridianworlddata.com/Distance-Calculation-asp">http://www.meridianworlddata.com/Distance-Calculation-asp</a>)</p> <p>Step 1: Retrieve the coordinates for the two locations, expressed in decimal degrees.  Step 2: Convert all latitude and longitude degrees into radians by taking the decimal degree/(180/ <math>\Pi</math>) where <math>\Pi=3.14159</math>. Define the first coordinate as “lat1” and “lon1” and the second coordinate as “lat2” and “lon2”.  Step 3: calculate according to Great Circle Formula:</p> $Distance=r*\arccos*[\sin(lat1)*\sin(lat2)+\cos(lat1)*\cos(lat2)*\cos(lon2-lon1)]$ <p>where <math>r=6378.7</math> is the radius of the earth in kilometers.</p> <p>A number of countries had clearly erroneous values for either seat of government or approximate center. For 25 of these countries the distance value was therefore manually adjusted. Although these changes are small, the correlation between adjusted and unadjusted distance data is 0.97. For six countries adjustment was not possible (Kiribati, Micronesia, Nauru, Saint Vincent and the Grenadines, Seychelles, and Tuvalu).</p>
LogOpen	Natural logarithm of Open, where Open=(exports + imports)/GDP, all from 2002 in current prices local currency units. Source World Development Indicators 2004
LogPop	Log of total population (2002). Source UNSTATS
Neo-Europe	Dummy variable, =1 if Australia, Canada, New Zealand, or the USA

Periphery	<p>Measure of uncentrality of core area (seat of government).  <math>Periphery = Distance / (Area/\pi)^{1/2}</math>, For <i>Distance</i> see description of LogDistance.</p> <p>The shape of all countries is here assumed to be congruent to a circle where <math>(Area/\pi)^{1/2}</math> is the radius of that circle, hence the approximate distance from the center to the border.</p> <p>Countries which we defined as “island group” have been excluded. Island groups are the countries which shape least can be approximated as a circle. Countries classified as an Island group are: Antigua and Barbuda, The Bahamas, Bermuda, Comoros, Cape Verde, Cayman Islands, Fiji, Grenada, Saint Kitts and Nevis, Maldives, Marshall Islands, New Zealand, Philippines, Solomon Islands, Sao Tome and Principe, Tonga, Trinidad and Tobago, Vanuatu, and Samoa. Also excluded are countries which cover water or in other ways are divided: Brunei, Equatorial Guinea, Hong Kong, Haiti, Indonesia, Macau, Malaysia, and Papua New Guinea.</p>
Religion	Religious Fractionalization, for 2001. From Alesina et al (2003)
Rule of Law	Rule of Law, source Kaufmann et al (2005)
Rule of Law n	Standard Error of Rule of Law measure, source Kaufmann et al (2005)
Rule of Law se	Number of sources per estimate, source Kaufmann et al (2005)
Sub-Saharan Africa	Dummy variable. =1 if country is part of Sub-Saharan Africa
Unitarism	Unitarism year 2000. Average of Nonfederalism and Nonbicameralism. Nonfederalism is coded as 0 = federal (elective regional legislatures plus conditional recognition of subnational authority), 1= semifederal (where there are elective legislatures at the regional level but in which constitutional sovereignty is reserved to the national government), or 2=nonfederal. Nonbicameralism is coded as 0=strong bicameral (upper house has some effective veto power; the two houses are incongruent), 1 = weak bicameral (upper house has some effective veto power, though not necessarily a formal veto; the two houses are countuent), or 2 = unicameral (no upper house or weak upper house). Source: Teorell, Jan, Sören Holmberg & Bo Rothstein. 2006. The Quality of Government Dataset, version 1Jul06. Göteborg University: The Quality of Government Institute, <a href="http://www.qog.pol.gu.se">http://www.qog.pol.gu.se</a> .
Urbanization	Urban population as percentage of total in 2004. Source: World Development Indicators
Variation in Elevation	Natural logarithm of the average standard deviation in elevation (in km). Source: G-econ data.
Variation in Pop.Density	Natural logarithm of the standard deviation of population density in country. Weighted to account for the different area size of the grid cells. Calculated using data on population and area from the G-econ data..
Years of Independence	Years of independence since colonialization. 2004 minus year of independence. Own assessment.

## Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Colonized after 1850	127	0.5197	0.5016	0.0000	1.0000
Core Area by Coast	95	0.4632	0.5013	0.0000	1.0000
Dependency	127	0.0551	0.2291	0.0000	1.0000
Duration of Colonial Rule	127	173.1890	126.5852	38.0000	513.0000
Ethnicity1	92	0.5522	0.2536	0.0395	1.0000
Ethnicity2	117	0.4932	0.2601	0.0000	0.9302
Island	127	0.2992	0.4597	0.0000	1.0000
Landlocked	127	0.1417	0.3502	0.0000	1.0000
Latin America	127	0.2756	0.4486	0.0000	1.0000
Latitude	127	15.2793	10.0048	0.0000	60.0000
Legal Origin France	125	0.4960	0.5020	0.0000	1.0000
Legal Origin UK	125	0.4640	0.5007	0.0000	1.0000
Log Natural Resources	88	10.9669	10.4610	0.0000	25.4591
Log Settler Mortality	69	4.6852	1.2171	2.1459	7.9862
LogArea	127	10.9877	3.0812	3.0445	16.1166
Area	127	680882.0000	1634000.0000	21.0000	9984670.0000
LogArea2	117	10.9671	2.5215	3.2347	15.4256
LogDistance	120	4.9109	1.4181	0.9285	7.6325
LogOpen	97	-0.3360	0.5369	-1.4426	1.0761
LogPop	127	15.0881	2.3000	9.2398	20.7762
Neo-Europe	127	0.0315	0.1753	0.0000	1.0000
Periphery	94	0.7801	0.4123	0.0591	1.8294
Religion	125	0.4621	0.2427	0.0023	0.8603
Rule of Law	127	-0.2194	0.8876	-2.3068	1.9258
Rule of Law n	127	9.2047	4.4496	1.0000	17.0000
Rule of Law se	127	0.1786	0.0749	0.1135	0.7105
Sub-Saharan Africa	127	0.3622	0.4825	0.0000	1.0000
Unitarism	88	1.5455	0.6371	0.0000	2.0000
Urbanization	123	50.0997	25.5773	9.7200	100.0000
Variation in Elevation	109	-4.1316	1.8674	-13.4497	-0.3716
Variation in Pop.Density	112	8.9828	2.5665	-0.5556	13.2038
Years of Independence	127	62.7638	57.3785	0.0000	228.0000



**Paper II**



# Nationalism and Government Effectiveness

Pelle Ahlerup and Gustav Hansson \*

Department of Economics, University of Gothenburg  
July 2008

## Abstract

The literature on nation-building and nationalism suggests that nation-building affects economic and political performance, mitigates the problems associated with ethnic heterogeneity, but that nationalism, an indicator of successful nation-building, is linked to dismal performance via protectionism and intolerance. This paper shows that there is a nonlinear association between nationalism and government effectiveness, that nationalism leaves no imprint on the effects of ethnic heterogeneity but may be a positive force in former colonies, and that actual trade flows are independent of the level of nationalism in the population.

Keywords: Nationalism, Nation-building, Ethnic Diversity, Government Effectiveness, Protectionism.

JEL Codes: F52, N40.

---

\* Contact information: Department of Economics, University of Gothenburg, P.O. Box 640, SE-405 30 Gothenburg. (email: [pelle.ahlerup@economics.gu.se](mailto:pelle.ahlerup@economics.gu.se); [gustav.hansson@economics.gu.se](mailto:gustav.hansson@economics.gu.se).) We are grateful to Daniella Andrén, Arne Bigsten, Lars Bohlin, Lars Hultkranz, Olof Johansson Stenman, Ola Olsson, Måns Söderbom, and seminar participants at the University of Gothenburg, the SSGPE Workshop 2007, and NCDE 2008 for helpful comments and suggestions. All errors are our own. Hansson gratefully acknowledges financial support from Sida/Sarec (2006-281), the Swedish Research Council (2006-2224), and the Wallander, Hedelius, Browaldh Foundation (P2007-0218:1).



# 1. Introduction

Nation-building generally refers to a process of unifying the population in a country by constructing a *national unity* where people feel bounded together by a sense of community and cohesion, and where people talk to, understand, and trust one another. Nation-building also refers to the creation of a common national identity, as opposed to a tribal or regional identity, and has been proposed as a possible remedy against problems associated with ethnic fractionalization (Miguel, 2004). Empirical evidence that the creation of a national unity is a worthwhile policy is, however, still largely absent. The purpose of this paper is to, for a wide cross-section of countries, empirically assess the effects of nationalistic sentiments on the ability of governments to effectively formulate and implement good policies.

Nation-building has a long history as a policy tool on the country level, and there are several interesting cases of how nation-building is brought into practice in post-colonial Africa. African countries are largely characterized by arbitrarily drawn borders and, partly as a result of these, of having highly ethnically heterogeneous societies. Attempts at nation-building during and after the decolonization process took different forms in different countries, and the results show similar disparities. Prime examples include the East African neighbors Tanzania and Kenya, who despite having similar initial conditions and ethnic composition, chose very different strategies of nation-building. This has had substantial effects on government effectiveness and the provision of public goods in the two countries, as argued by Miguel (2004).

African leaders pursuing nation-building could find historical precedence in policies conducted in already developed countries. The idea of nation-building has long been present in the form of the intentional creation of national symbols, such as statues of heroes from historic times, intended to spur feelings of national community and pride in one's country (Hylland Eriksen, 1993). The notion of nation-building is also central for an organization such as the European Union, which invests great effort in creating a European rather than a national sense of community. In fact, while the creation of the Economic and Monetary Union (EMU) as a common currency region surely has a wider political and economic rationale, it should partly be understood as an integral part of the efforts to build a European sense of community.<sup>1</sup>

---

<sup>1</sup> Kaelberer (2004:173) writes: "The introduction of the euro is merely another part of this construction of a common European identity. It makes European identity more tangible and provides a concrete European symbol that engraves another element of 'Europeanness' into the daily lives of individuals."

In the modern literature, nation-building is often discussed as a remedy for potential problems associated with social distance in general, and with ethnically fragmented societies in particular. Ethnic diversity, or rather the potential problems associated with high levels of ethnic diversity, has often been proposed as a partial explanation for the poor economic and political performance of some countries. Most notably, Easterly and Levine (1997) argue that ethnic diversity distorts public policies, which in turn adversely affect economic growth, and Mauro (1995) claims that diversity enables corruption and therefore hurts economic growth. Others, such as Alesina et al. (1999), La Porta et al. (1999), and Miguel (2004), find that ethnic diversity leads to a distorted provision of public goods. Should nation-building moderate these negative effects, it would indeed be a recommendable policy.

More intense nationalistic sentiments signal successful nation-building in the sense that the population is united and that citizens take pride in the nation. However, there is a caveat: Promoting nationalism, with the intention to improve cooperation among citizens, may entail less understanding and less acceptance of *other* nations or cultures. Simply put, there may be good and bad forms of nationalism (Brown, 1999). Furthermore, people with stronger nationalistic sentiments tend to have stronger aversions to imported goods, and therefore have a more protectionistic attitude (Mayda and Rodrik, 2005). In sum, it is not clear from the literature whether nation-building, in the sense of creating nationalistic sentiments towards one's country, should be regarded as part of the cure or as part of the disease for troubled countries.

Despite this apparent lack of clarity in the literature, there is hardly any empirical evidence of a link between nationalistic sentiments and the ability of governments to formulate and implement good policies. The aim of this paper is therefore to provide answers to the following questions: Are more intense nationalistic sentiments associated with better government effectiveness, with a reduction in the supposedly negative effects of ethnic fractionalization, and with less openness to international trade?

In order to try to understand the importance of nation-building, our approach is to first identify a suitable measure of national unity and then relate it to an indicator of government effectiveness. A successful nation-building process can be analytically separated into several aspects: that the citizens of a country feel bounded together by a sense of community; that they talk to, understand and trust one another; and that they identify with and take pride in the nation. In this paper we focus on one of these aspects – the intensity of nationalistic sentiments. In the absence of direct measures of nation-

building we use a measure of the level of national pride in the population. This measure, previously used by Shulman (2003), is obtained for a broad cross-section of countries from the World Values Survey (WVS).

The main contribution of this paper is that it is, to our knowledge, the first attempt to go beyond the theoretical discussion and to empirically estimate the effects of nationalism on a macro scale. Our findings include that of a hump-shaped relationship between nationalism and government effectiveness, that nationalism does not affect the negative association between ethnic fractionalization and poor government effectiveness, and, in contrast to Mayda and Rodrik's (2005) finding that nationalism is translated into a protectionist *attitude*, we document that there does not seem to be any relation between nationalism and *actual* trade.

The paper is organized as follows. Section 2 reviews the literature on nationalism, nation-building, and ethnic diversity. The econometric framework and data are described in Section 3. Section 4 presents the results, and Section 5 concludes the paper.

## **2. Nationalism, Nation-building, and Ethnic Diversity**

### **2.1. Nationalism: Definition and determinants**

Nationalism is an ideology where the members of a nation, or nation-state, are held to have a duty to be loyal to the nation and where the primacy of the welfare of the nation is emphasized. Nationalism also refers to both the *attitude* that members of a nation have when they think of themselves in terms of members of the nation, and the *actions* they take when they seek to ensure self-determination of the nation (Stanford Encyclopedia of Philosophy, 2008).

The literature often distinguishes between civic nationalism, where the nation is defined in mainly political or territorial terms and is thought of as united by a common destiny, and ethnic or cultural nationalism, where the nation is defined in terms of ancestry and historical roots, and hence is thought of as united by a common past. This distinction is routinely criticized for its normative implications as civic nationalism is depicted as rational and forward-looking and associated with liberal and developed Western societies, while ethnic nationalism is regarded as irrational and backward-looking and associated with authoritarian and less developed Eastern countries (see for instance Barrington, 2006, and Shulman, 2002). The distinction is also criticized on empirical

grounds. Investigating a number of potential indicators for ethnic and civic nationalism, Shulman (2002) finds that they rarely follow the theorized rule of ethnic nationalism in the East and civic nationalism in the West, and when they do the relationship is weak.

While there is a general consensus that nationalism is a historically modern phenomenon, there is more disagreement on the historic origins of nations and the roots of contemporary national identities. The different theories can be ordered on a time scale where constructivists or modernists (Gellner, 1983; Andersson, 1983) hold that nations and national identity are recent and moldable concepts emerging during the last two centuries, whereas primordialists or perennialists (Smith, 1986) hold that nations have ancient origins and deep cultural roots, and thus change very slowly, if at all. Discussing the origins of the European centralized nation-states, Tilly (1992) describes what could be seen as the origin of different national identities and finds that "in the process [of creating powerful states with war making capacity] states generally worked to homogenize their populations and break down their segmentation by imposing common languages, religions, currencies, and legal systems"(1992:100). A result was that "life homogenized within states and heterogenized among states. National symbols crystallized, national languages standardized, national labor markets organized." (1992:116). Gellner (1983), in contrast, sees the rising nation-states as answering to the need of the industrial societies of the nineteenth century. Though constructivists differ in their perspectives on the timing of the rise of the nation-states and national identity, they would generally agree that national identity changes slowly.

Due to the only quite recent interest in empirical studies on values and attitudes, long time series with data on nationalistic sentiments are not available, and so far the scholarly interest has focused on the determinants, rather than on the effects, of national identity. Shulman (2003) investigates whether wealth and economic equality influence national pride and identity. Using data from the WVS and the International Social Survey Programme (ISSP), he finds that within countries, poor people on average have higher scores on measures of national identity. In a comparison of 59 countries, Shulman also finds that relatively poor countries on average have higher scores on national identity and national pride.<sup>2</sup> Therefore, Shulman concludes that a nation's wealth does not generally play a substantial role in increasing the strength of national identity.

---

<sup>2</sup> Shulman uses, among other measures, the question "How proud are you to be [Nationality]?" from WVS, which is also used in this paper. While Shulman uses data from 1990-93 and 1995-97 for a total of 59 countries, we use data from 1981-2004 for a total of 79 countries.

The measures used in Shulman (2003) relate to general nationalistic sentiments. Evans and Kelley (2002) instead study pride related to more specific national achievements in for example sports, arts, literature, science, and the economy, and find clear differences among individuals from different countries in terms of what achievements they are more proud of. Even more important is that these differences are better explained by culture than by more objective measures of the actual success or failure of the respective nations in a given area. That the intensity of nationalistic sentiments may have cultural roots is supported by the findings in Smith and Kim (2006), who find that neighboring countries, with supposedly relatively similar cultures, show similarities in levels of national pride beyond what could be expected based on income patterns. Apparently, there is no consensus on the origins of nationalism.

## **2.2. The Role of Nationalism for Nation-building<sup>3</sup>**

In his often cited definition of a nation, Anderson (1983) describes it as an *imagined community*. It is an *imagined* community “(...) because the members of even the smallest nation will never know most of their fellow-members, meet them, or even hear of them, yet in the minds of each lives the image of their communion” (1983:6). The reason why people are able to be bound together in a community is, according to Hylland Eriksen (1993), that nationalism promotes solidarity between rich and poor, between low caste and high caste, and between left and right on the political scale. In a sense, nationalism endorses a particular kind of equality in that all members of a nation are *equal* in their membership in that nation.

Especially in poor regions, nationalism may be an instrument in the building of a more efficient state apparatus. Discussing the problem of state power in sub-Saharan African countries, Herbst (2000:126) argues that “Nationalism can be thought of as another way for the state to consolidate its power over distance not, as with taxes, through the agencies of coercion, but through the norm of legitimacy.” Herbst (2000:126) also notes that nationalism can be the poor man’s weapon as “(...) it may represent a way of broadcasting state authority that does not require the financial resources that poor countries lack.” The answer to the question of whether the promotion of a civic nationalism is a real policy option fundamentally rests on the

---

<sup>3</sup> Though the difference is not always clear, nation-building is separate from the concept of state building. Which one precedes the other has shifted over time and space. One view holds that while European countries generally underwent nation-building first and then state building, the order has been the opposite in many post-colonial states (Stephenson, 2005).

acceptance of the constructivist perspective of national identity and of nationalistic sentiments as moldable.

According to Pye (1971), a conflict based on ethnic diversity is a sort of “identity crisis” since the state cannot function properly as a national unit because large parts of the population identifies with, and therefore holds higher allegiances to, subnational groups.<sup>4</sup> Fundamental for understanding this form of identity crisis is therefore the concept of nationalistic sentiment, or the extent to which people feel that they are bound together by a common association. Verba (1971:312) concurs by noting that in order to mitigate the problems associated with allocating resources between competitors, the existence of an overarching set of a common identity, a “we-feeling,” may be most useful.

In a comparison of Tanzania and Kenya, Miguel (2004) finds that the existence of a national unity based on deliberate nation-building is associated with superior financing of local public goods such as schooling and water wells. Tanzania and Kenya are interesting to compare because they are similar in terms of their geography and historical and colonial institutional legacies, yet quite different when it comes to their ambition to build a national unity. The government in Tanzania has devoted significant efforts into building a national unity, to a great extent due to former president Julius Nyerere who downplayed ethnic affiliations and emphasized a unified Tanzanian national identity. In Kenya, on the other hand, it is well-known that the leaders have repeatedly played out ethnic groups against each other in national politics. Comparing the funding of local public goods in rural areas in Tanzania and Kenya, Miguel finds that the rural areas in Tanzania were quite successful in fund-raising for local public goods, whereas the rural areas in Kenya usually failed. Therefore, Miguel (2004:328) argues that “the Kenya-Tanzania comparison provides suggestive microeconomic evidence that serious nation-building reforms can successfully bridge social divisions and affect important economic outcomes, like public goods provision.”

However, there is an obvious problem with the idea that people’s sense of national unity can be enhanced by encouraging nationalism – national identity is created in relation to other national identities and for there to be an “us” there has to be a “them.” Promoting nationalism to improve cooperation among a country’s inhabitants may thus come at the price of less understanding or acceptance of other nations or cultures. Indeed, this effect may even be the primary objective in some cases of efforts to promote

---

<sup>4</sup> Other forms of identity crisis are based on income/class, geographic location, and old/new society.

a sense of national unity. Individuals identifying more with a nation than with an ethnic group, or even individuals with purely individualistic identities, will be less resistant to war-mongering national leaders appealing to real or imagined injustices committed against a part of the community.

Using data from the WVS and the ISSP, Mayda and Rodrik (2005) find that countries with stronger nationalistic sentiments also on average have stronger feelings against imported goods, and therefore are less pro-trade. That individuals with strong national pride are more opposed to multilateralism and internationalism is shown also by Smith and Kim (2006), who add that a strong national pride is associated with a more negative view of immigrants and a more “demanding sense of what is important for someone to be considered a true member of a country” (2006:133). McFarland and Mathews (2005) argue that nationalism and ethnocentrism are associated with lower support for human rights in general and a willingness to restrict the rights of unpopular groups in particular. Schatz and Levine (2007) refer to work showing that a sentimental attachment to the nation and a concern for national symbolism is associated with an uncritical support for government policies as well as a rejection of national criticism and a “stalwart national allegiance.” They also find that individuals with more concern for national symbols are more nationalistic (as opposed to universalistic) and have a stronger national identity, but are no more likely to take actions associated with better monitoring of officials or improved functioning of the state. These findings are all in line with the quite common notion that nationalism is positively associated with discrimination as well as with civil conflict and violence since it can be associated with antipathy, tensions, hostility, and violence among members of different groups in society.

That more intense nationalistic sentiments have to be associated with more protectionism is not evident on the theoretical level. Nakano (2004) notes that while “economic nationalism,” an ideology seeking to empower and enrich the nation-state, has traditionally been coupled with more protectionism and active state policies, the opposite may be true under certain circumstances. One example is small countries that tend to follow more pro-trade policies to benefit the country as a whole, since they stand to lose relatively more from pursuing protectionist policies. Though some groups still may benefit from protectionist policies, an economic nationalist agenda can encourage the implementation of policies regarded as economically rational. The fact that nationalists under certain conditions are in favor of international openness and competition is discussed also in Shulman (2000). In addition, Shulman points out the

faulty logic that credits nationalism for the policy of mercantilism, when the latter predates the former by several hundred years. Nakano further argues that modernization and industrialism need a strong state to guarantee the civil rights and liberties of the citizens and that this requires the support of the population. To the extent that nationalistic sentiments work as a unifying force to promote an at least superficial solidarity among citizens, nationalism can be positively associated with stronger support for, and hence capacity of, the state.

Nationalism can thus have positive effects via cooperation and understanding and negative effects via protectionistic policies and less understanding of other cultures and ethnicities. The mechanisms with which nationalism and nation-building are assumed to affect economic and political outcomes closely resemble those proposed for ethnic fractionalization. It is to the latter we turn in the next section.

### **2.3. Ethnic Diversity**

The economic literature contains a rich documentation on relationships between ethnic diversity and public goods provision, corruption, and in the end, economic development (Alesina and La Ferrara, 2005). In the seminal contribution by Easterly and Levine (1997), ethnic diversity is shown to distort public goods provision and therefore depress economic growth. Easterly and Levine ascribe a large part of the poor performance of the countries in sub-Saharan Africa to their high levels of ethnic fractionalization. The negative relationship between ethnic diversity and public goods provisions such as roads, sewers, schooling, water wells, and general infrastructure has been documented in a still increasing number of studies (Miguel and Gugerty, 2005; Miguel, 2004; Alesina et al., 2003; Alesina et al., 1999; La Porta et al., 1999). Others, starting with Mauro (1995), argue that ethnic diversity affects economic growth not by distorting public goods provision but by promoting corruption. In fact, ethnic diversity often plays a central role in studies directly examining the determinants of corruption (Pellegrini and Gerlagh, 2007; Treisman, 2000; and La Porta et al., 1999).

Different mechanisms for how ethnic diversity can affect public goods provision have been suggested. Following Miguel (2004) we can distinguish between two sets of theories. The first builds on the notion that individuals in different groups can differ systematically in their preferences and tastes. Not only do different groups prefer different kinds of public goods, they also dislike sharing goods with other groups. The effect of this is that individuals tend to prefer to fund public goods that benefit only their



own ethnic group. A study favoring this explanation is Alesina et al. (1999). The second set of theories takes as a starting point that the problems of sustaining collective actions above the group-level stem from the fact that individuals from different groups sometimes have too little interaction and communication. What these communities are lacking is public policies for better social sanctioning; policies that promote interaction, information sharing, and coordination across groups (Miguel, 2004).

A policy that has been suggested as a remedy to the problems of conflicts along ethnic lines is that of institutionalized power-sharing among groups, but since this may solidify already existing divisions and prevent new non-ethnic identities from emerging, it does not constitute the panacea of ethnic conflicts. Another policy is to promote dialogue and interaction among leaders to strengthen their ability to extend their within-group social sanctions to apply also to violations of norms of between-group behavior (Miguel, 2004). The obvious question is then how to successfully promote dialogue and interaction in environments where these virtues are problematic, or even missing.

Pye (1971) argues that an “identity crisis” caused by ethnic diversity can be solved by either *assimilation* or *accommodation*. Assimilation is when the population is homogenized, as for instance when all ethnic groups are assimilated into a dominant ethnic group. Tilly (1992), Fearon (2003), and Ahlerup and Olsson (2007) discuss how the states in Europe have deliberately and actively homogenized their populations in order to obtain populations with a common national identity and culture. Accommodation, on the other hand, is when different ethnic groups conform or adjust to each other.<sup>5</sup> The idea of nation-building lies closer to the accommodation strategy in that it entails the creation of a national unity where people have the “imagined” feeling that they are bound together by a common association.

## 2.4. Theoretical Framework

The informal theoretical discussion above reflects the multidisciplinary research on nationalism and points to the need for a stricter theoretical framework. Building on our prior discussion, we propose that the ability of a government to formulate and implement good policies, i.e. the level of government effectiveness, is a function of the demand for good policies, the individuals’ acceptance of the authority of the government, and the level of the country’s openness to international trade and influence.

---

<sup>5</sup> Accommodation is the strategy used by the EU. The importance of getting along within the EU was recently emphasized in an article in Time magazine (Farouky, 2007).

### **Best Practice Demand**

We denote the level of government effectiveness  $Q$ . Let us then define the *Best Practice Demand* ( $BPD$ ) as the level of the individuals' demand for economically rational policies. The higher the demand for rational policies, the more effective the government has to be to meet the demand from its subjects, so that  $Q_{BPD} > 0$ , where  $Q_{BPD} = \partial Q / \partial BPD$ .

A more nationalistic population has a lower *demand* for economically rational and technologically best-practice policies, since nationalistic individuals tend to value ideas and methods originating within the nation very highly. This preferential treatment of internal ideas constitutes a restriction on what new ideas and techniques are considered to be both acceptable and improvements on prior policies, and therefore on what policies people believe should be adopted. The lower demand for best-practice policies also stems from a general status quo bias originating in the idealization, and even idolization, of the nation's history and traditions. Higher levels of nationalism are therefore associated with a lower demand for policies designed to enhance societal efficiency and a higher demand for policies that clearly support national glory and that are in accordance with national traditions and culture.

It is well established that societies with more heterogeneous populations tend to be less capable of agreeing on common policies (Miguel, 2004). The implication is that deviations from a demand for a common set of rational policies depend positively on the social distance between groups and are larger in ethnically fragmented societies. In sum, letting  $N$  denote Nationalism and  $E$  denote Ethnic Fragmentation we have that  $BPD = BPD(N, E)$ , with  $BPD_N < 0$  and  $BPD_E < 0$ .

### **Acceptance**

Following Herbst (2000) we conjecture that the ability of the state and its bureaucracy to implement the desired policies depends on its legitimacy, i.e. the extent to which the population accepts its authority. Defining Acceptance ( $A$ ) as the individuals' acceptance of the state's authority, we have  $Q_A > 0$ . A more nationalistic population is more likely to accept the authority of the state, while a more fragmented population is less likely. This gives us that  $A = A(N, E)$ , with  $A_N > 0$  and  $A_E < 0$ .

## Openness

Openness to international trade is a disciplining device that, by determining the competitive pressure on the effectiveness of a government, can force countries to adopt sound policies.<sup>6</sup> Denoting openness  $O$ , we have  $Q_O > 0$ . The standard assumption is that nationalism entails attitudes against international openness, but as discussed in Section 2.2, a nationalistic individual may in principle favor openness if he/she believes it benefits the nation. Following the standard assumption we have  $O = O(N)$  with  $O_N < 0$ . Bringing these concepts together gives us

$$Q = Q(BPD, A, O) \text{ and } Q = Q[BPD(N, E), A(N, E), O(N)]. \quad (1)$$

Taking the total derivative of this with respect to nationalism gives us

$$dQ/dN = Q_{BPD} BPD_N + Q_A A_N + Q_O O_N. \quad (2)$$

The effect of nationalism on government effectiveness has three components: The first,  $Q_{BPD} BPD_N < 0$  reflects the negative effect of a larger deviation from best practice demand and of a stronger status quo bias when there is more nationalism. The second,  $Q_A A_N > 0$ , reflects the positive effect that a more nationalistic population is more accepting of state authority, which enables a more effective broadcasting of power.

The third component,  $Q_O O_N$ , reflects that nationalism affects openness which in turn affects government effectiveness. The positive effect of openness is translated into a negative effect on government effectiveness only if  $O_N < 0$ , i.e. if more nationalistic populations are in favor of less actual openness. As discussed above, this is not completely evident a priori, and the positive and negative effects may well cancel each other out in the end. If it turns out that nationalism does not affect actual openness,  $O_N = 0$ , then nationalism will not affect government effectiveness through this channel.

If there is no acceptance of the government, then the government simply cannot function and it is not important whether the population demands irrational policies. Hence, we expect that a marginal change in nationalism at low levels of nationalism will have a positive effect on government effectiveness. Once people have a fundamental

---

<sup>6</sup> The mechanism may be that the government can afford to be less efficient if it is not troubled by foreign pressure, and/or that the citizens are less aware of the weaknesses of the state if there is less openness; see for example Olsson and Hansson (2006).

acceptance of the authority of the government, the diversionary costs from the demand for irrational policies will probably become increasingly problematic. Eventually, the costs will dominate the benefits. Therefore, we hypothesize that we can expect positive effects at low levels of nationalism and negative effects at higher levels.

$BPD$  and  $A$  both depend negatively on ethnic fractionalization,  $E$ , and so will therefore also  $Q$ . If the negative effects of ethnic fractionalization ( $BPD_E < 0$  and  $A_E < 0$ ) are mitigated by nationalism, we expect to find that  $\frac{\partial^2 BPD}{\partial E \partial N} > 0$  and  $\frac{\partial^2 A}{\partial E \partial N} > 0$ , which would give us  $\frac{\partial^2 Q}{\partial E \partial N} = \frac{\partial^2 BPD}{\partial E \partial N} + \frac{\partial^2 A}{\partial E \partial N} > 0$ .

We take this brief sketch of the plausible channels through which nationalism could affect both government effectiveness and the associations between government effectiveness and openness or ethnic fractionalization, as a starting point when we in the next section move on to the empirical analysis.

### 3. A cross-country study

#### 3.1. Regression framework

The discussion so far indicates that the overall effect of nationalism on government effectiveness is nonlinear. As stated in the introduction, our aim is to provide answers to the following questions: Are more intense nationalistic sentiments associated with better government effectiveness, with a reduction in the negative effects of ethnic fractionalization, and with less openness to international trade? Building on equation (2) developed in the previous section, we form the following system of simultaneous equations:

$$Q_i = \beta_0 + \beta_1(nationalism_i) + \beta_2(nationalism_i^2) + \beta_3(ethnic_i) + \beta_4(O_i) + \mathbf{X}_i' \boldsymbol{\gamma} + \varepsilon_i \quad (3)$$

$$O_i = \alpha_0 + \alpha_1(Const.Trade_i) + \alpha_2(nationalism_i) + \alpha_3(nationalism_i^2) + \alpha_4(ethnic_i) + \mathbf{X}_i' \boldsymbol{\chi} + \eta_i, \quad (4)$$

where  $Q_i$  is a measure of government efficiency in country  $i$ ,  $nationalism_i$  is a measure of the level of nationalism in the population,  $ethnic_i$  is a measure of ethnic fractionalization,

$O_i$  is (log) trade openness,  $\mathbf{X}_i$  is a vector with controls, and  $\varepsilon_i$  is the error term (all variables to be explained in greater detail below). Trade is here instrumented by  $Const.Trade_i$ , the constructed trade share based on the Frankel and Romer (1999) gravity equation (see Appendix B for details). It is therefore possible to see whether nationalism affects *actual* trade openness when the exogenously determined trade share is controlled for, instead of *attitudes* about trade openness as in Mayda and Rodrik (2005). More importantly, from (4) it is possible to see whether there is a direct effect of nationalism on government effectiveness when also controlling for trade.

For our second question, whether the degree of nationalism can mitigate the negative effect of ethnic diversity, we modify the above systems of equations to include ethnic diversity and the interaction of ethnic diversity and nationalism,  $\beta_5(ethnic_i * nationalism_i)$  and  $\alpha_5(ethnic_i * nationalism_i)$  in (3) and (4), respectively. If more nationalism reduces the negative effects of ethnic diversity, then the parameter estimate for the interaction term ( $\beta_5$ ) should be positive and significant. To identify these relationships, we require reliable measures for government effectiveness, ethnicity, and intensity of nationalism.

### 3.2. Data on Government Effectiveness

As dependent variable we use *Government Effectiveness*, which is one of the World Bank's Governance Indicators (Kaufmann et al., 2005). *Government Effectiveness* is constructed to indicate the ability of the government to "produce and implement good policies and deliver public goods" (Kaufmann et al., 2003). This variable therefore captures the most important aspects of the quality of government, as examined by La Porta et al. (1999), while at the same time being in line with Miguel (2004) by capturing the quality of public service delivery. *Government Effectiveness* is highly correlated to other institutional measures such as corruption and political stability.<sup>7</sup>

The measures of quality of governance constructed by Kaufmann et al. (2005) have gained increasing attention and are today widely used. The governance measures are constructed by combining a large number of different measures from a wide range of sources. The argument for using a large number of measures is that while the actual level of government effectiveness cannot be directly observed, each individual measure

---

<sup>7</sup> The correlation between Government Effectiveness and Corruption is 0.96, and between Government Effectiveness and Political Stability it is 0.80 (for the year 2004, all measures from Kaufmann et al., 2005).

contributes a signal about the true level of governance. Kaufmann et al. (2005) isolate each signal and combine the many data sources by using an unobserved components model. Therefore, the Kaufmann et al. measures for government effectiveness is more informative about the unobserved governance than any of the individual indexes.

### **3.3. Data on Nationalism**

Nationalism affects the level of duty people feel to act in ways that favor the nation. What we need to capture is therefore both that individuals identify themselves as tied to the nation and the intensity of this tie. The latter is essential since it determines an individual's choice in a situation when he/she faces a trade-off between an action that gives a high private return and an action that gives a lower private return but a higher return to the nation. Asking people whether they are nationalistic, and if so about the intensity of their nationalism, is however unlikely to provide a reliable measurement of the sentiments we want to capture, since the term nationalist is often considered to be pejorative. In the absence of a direct measure of nationalism, the standard measure in the literature has been the level of national pride in the population, as has been discussed in previous sections. This turns out to be an ideal measure for our purpose for the following reasons which are linked to the discussion in Section 2.4. An individual who does not consider herself as tied to a nation will obviously not report that she feels proud to be a member of that nation. Higher pride will signal a closer emotional connection to the nation. The stronger the emotional tie to a nation an individual feels, the more skewed will his/her assessment of the quality of ideas and goods originating in that nation be. Hence, the prouder an individual is of his/her nation, the lower demand for rational and best practice policies and the stronger skepticism toward imports and international exchange, all in line with the reasoning in Section 2.4. Similarly, an individual who does not feel tied to (and hence is not proud to be a member of) a nation will either feel tied to another nation or not pledge allegiance to any nation. In neither of the latter cases will the individual accept the authority of the leaders or government of the nation. The closer the ties to the nation and hence the higher the pride of being a member of it, the more important the welfare of the nation in the eyes of the individual, and the more he/she will accept the authority of the government given that it is seen to rule in the interest of the nation. As discussed in Section 2.2, it is indeed the case that individuals with more national pride are more uncompromising in their support of the government.

The World Values Survey (WVS) has since 1981 conducted detailed public opinion surveys of human beliefs and values in a multitude of areas and for a broad cross section of countries.<sup>8</sup> We make use of the following question from the WVS: “How proud are you to be [*Nationality*]?” The respondents had four options; they could answer “very proud,” “quite proud,” “not very proud,” or “not at all proud.” We assign the value 1 for “not at all proud” and 2 for “not very proud” etc., and then calculate the average for each country, giving us a maximum range of 1 to 4. If a country is included in the surveys more than once, we use the figure from the most recent survey. This gives us a range from the year 1995 (Australia) to 2003 (Kyrgyz Republic and Saudi Arabia), with the most observations from 1999, for our base sample of 79 countries. In the forthcoming analysis we refer to this variable as *Pride*. Calculating the mean over all survey periods gives a similar result.<sup>9</sup>

## 4. Results

Table 1 presents the descriptive statistics for the countries in our main sample.<sup>10</sup> The variable *Pride* has a mean of 3.41 and a standard deviation of 0.33, and since quite proud = 3 and very proud = 4, people on average seem to be more than quite proud of their country. The lowest scores (from 2.7 to 2.8) are found in Germany, Taiwan, Japan, The Netherlands, and Russia (ordered from low to high). We find the highest scores (3.8-3.9) in Egypt, Venezuela, Morocco, Iran, and Puerto Rico (low-high). The U.S. is not far behind with a score of 3.7.

Since we will later relate the measure of national *Pride* to *Government Effectiveness*, a natural question is whether *Pride* can be considered to be exogenous. In Section 2.1, which discusses the creation of nationalism, we learned that there is no simple answer to what determines nationalism. The correlations between *Pride* and other variables tell us a similar story (see Table 2). First of all, *Ethnic Fractionalization* from Alesina et al. (2003), which measures the probability that two randomly drawn individuals from the same country belong to different ethnic groups, is uncorrelated with *Pride*. Although a priori one could imagine that ethnically homogenous societies are prone to stronger nationalism, it does not seem to be the case.

---

<sup>8</sup> See [www.worldvaluessurvey.org](http://www.worldvaluessurvey.org) for more information.

<sup>9</sup> The correlation between *pride*(latest) and *pride*(mean) is 0.97.

<sup>10</sup> The main sample consists of the countries for which we have data for specification (4) in Table 3.

Since the average distance to other people is smaller in smaller countries, one may think that people in these countries feel closer to each other and therefore feel a stronger sense of community and national pride. Table 2 therefore includes two measures of country size: *Log Population* and *Log Area*. The correlations between *Pride* and these two measures are nevertheless only marginally positive and not significantly different from zero at the 5 percent level. The correlation between *Pride* and *State Antiquity* (from Bockstette et al., 2002) indicates that countries with less historical experience of an independent and sovereign state apparatus, often indicating younger countries, are more likely to have more proud populations. Negative correlations are also found between *Pride* and *Democracy* (measured as Polity2 from Polity IV project) and between *Pride* and *GDP/capita 1990*. Interestingly, *Pride*, which is measured for the years 1995-2003, is not correlated with *Government Effectiveness in 1996* (where 1996 is the earliest year for which data is available). In the regressions that will follow, we use values of *Pride* for the years 1995-2003 to explain *Government Effectiveness* in 2004. Moreover, in Section 4.2 we will investigate alternative hypotheses – the *low income* hypothesis, the *satisfaction* hypothesis, and the *manipulation* hypothesis – that, if true, would imply that *Pride* may be an endogenous variable in our regressions.

#### 4.1. The relation between Pride and Government Effectiveness

Table 3 presents the main results, and starting in Column (1) the results indicate that on average, more *Pride* is associated with less *Government Effectiveness*. The linearity of this specification does not correspond to the theoretical discussion above, however, and in Column (2) there is a clear nonlinear association between the two variables. The nonlinear effect indicates that at lower levels of *Pride* there is a positive effect on *Government Effectiveness* while this effect changes sign at higher values of *Pride*.

In Column (3) we include *Ethnic Fractionalization* along with our baseline control variables. We include dummies for *Legal Origin* following La Porta et al. (1999) and a dummy for *NeoEuropes*. The inclusion of the *NeoEurope* dummy, taking the value one for Australia, Canada, New Zealand, and USA and zero for all other countries, is motivated not by their unusual values in terms of *Pride* or *Government Effectiveness* but by their unusual character as rich democratic settler colonies and their unusual combination of high *Pride* and high *Government Effectiveness*. The inclusion of a dummy for neo-Europe is not uncommon in cross-country regressions.



The inclusion of our baseline control variables in Column 3 has only a marginal effect on the parameter estimates for *Pride* and *Pride-Square*. The coefficient for *Ethnic Fractionalization* has the expected negative sign. Countries with *Socialist* legal origin have significantly worse and countries with *Scandinavian* legal origin have significantly better government effectiveness than countries with *British* legal origin, which is the excluded category.

Column (4) includes *Log Trade*, resulting in only a slight change in the coefficients for *Pride* and *Pride-Square*. The positive coefficient indicates that trade may work as a disciplining device, in the sense that more open countries are subject to higher competitive pressure and therefore implement more effective policies. *Log Trade* could here clearly be endogenous due to the plausible simultaneity between *Log Trade* and *Government Effectiveness*. Therefore, we instrument *Log Trade* using *Log Const. Trade* which is estimated using a gravity equation similar to Frankel and Romer (1999), details of which are presented in Appendix B. By instrumenting we also indirectly test whether *Pride* has a direct effect on *Log Trade*.

In Column (5) we estimate *Log Trade* in a two-stage procedure using *Log Constructed Trade* as the excluded instrument. Importantly, *Log Const. Trade* has a positive and significant effect on *Log Trade* ( $F\text{-value} = 39.42$ ) in the first stage, and the effect of *Pride* is insignificant. That is, although Mayda and Rodrik (2005) find that countries with more nationalistic sentiments have less pro-trade *attitudes*, we find that nationalistic sentiments do not seem to affect *actual* trade flows. Turning to the second stage, the parameter estimate for *Log Trade* is now larger than with OLS. This is similar to Frankel and Romer (1999) who find that OLS understates the relationships between trade and income per capita.

A multitude of studies have shown that there is a strong geographical component of trade; i.e., smaller countries and countries closer to each other trade more. This component should not be affected by nationalism or a preference for protectionism. Though the coefficient for trade is larger in Column (5), the coefficients for *Pride* and *Pride-square* are quite stable despite the use of predicted rather than actual trade share. This is further evidence that the link does not seem to go from nationalism to government effectiveness via openness, since removing the endogenous part of trade from the regression has only a moderate effect on the estimates of the pride variables.

To illustrate the nonlinear relationship between *National Pride* and *Government Effectiveness* in Column 5 of Table 3, Figure 1 depicts the component-plus-residual plot,

which is used to illustrate functional form.<sup>11</sup> The figure makes it evident that the effect of *Pride* is first positive and then negative. The result indicates that the effect of *Pride* is positive up to a value of about 3 (corresponding to “quite proud”), but that more than quite proud is associated with worse scores on *Government Effectiveness*. From the figure it is interesting to note that the sub-Saharan African countries in our sample – Nigeria (NGA), Tanzania (TZA), Uganda (UGA), and Zimbabwe (ZWE) – are located at the bottom right of Figure 1 with high *Pride* but low *Government Effectiveness* (see Appendix A for a listing of countries included in the sample).

Though the graph illustrates a distinct hump-shaped relationship, most countries lie in the region where more nationalism is associated with worse government effectiveness. For the countries that lie in the region where more nationalism is associated with better government effectiveness, the potential gain seems to be moderate. Thus, while promotion of nationalism may be a marginally good idea in some cases, it can be really bad in others.

Proceeding to the second question of this article – whether nationalism can reduce the negative effects of ethnic heterogeneity – Table 4 includes the interaction between *Ethnic Fractionalization* and *Pride*. If the hypothesis that national pride could mitigate the effects of ethnic diversity is true, then the estimated parameter should be significantly positive. This is not the case in any of our specifications. We have here employed a host of indicators for heterogeneity in the population – ethnic fractionalization, linguistic fractionalization, religious fractionalization, size of majority group, the number of ethnic groups, and ethnic polarization. Of these, all but religious fractionalization and ethnic polarization enter significantly and with the expected sign when included on their own, but none interacts significantly with *Pride*. We have also elaborated certain combinations of shares of the largest and the second largest groups, but the results are the same – there is no indication that national pride would either mitigate or worsen the problems associated with a more heterogeneous population (results not shown but available upon request).

Table 4 also includes a dummy for former colonies (CEPII 2007). The negative parameter estimate for the colony dummy in Column 5 indicates that former colonies on average have worse *Government Effectiveness* than countries that were never colonized.

---

<sup>11</sup> To adequately illustrate a partial relationship from a regression specification with this number of explanatory variables is of course not possible. One can approximately graph the relationship using an “added variables plot” to assess the presence of outliers, or a “component-plus-residuals plot” to assess the functional form. See for example the Stata manual.

Although *Pride* does not seem to mitigate the negative effects of *Ethnic Fractionalization*, it seems to mitigate the negative effect of being a former colony, as indicated by the positive effect of the interaction term in Column 6.

## 4.2. Robustness

In Tables 5 and 6 we include more controls, restrict the sample, and use other dependent variables. Columns 1 and 2 of Table 5 include the size measures *Log Population* and *Log Area*, and the effect of *Log Trade* is insignificant. The correlation between (predicted) *Log Trade* and *Log Area* is -0.92, and they are jointly significant. Now the constructed trade share is not even significant, making it a weak instrument. Since population size is a component of the constructed trade share, this effect is to be expected. Appendix B shows that for a larger sample, *Log Const. Trade* is a valid instrument while also controlling for *Log Area* and *Log Population* (see Table B2). The fact that the constructed trade share is not always a strong instrument in Tables 5 and 6 is due to the smaller sample and to more factors being controlled for. The rest of Table 5 includes controls for *State Antiquity*, *Federalism*, member to the European Union (*EU*), and absolute *Latitude*, and the effect from *Pride* is still significant and nonlinear.

A natural concern is that the results presented so far may not represent causal relationships. Alternative explanations include reversed causality and that *Pride* acts as a proxy for some other more fundamental, but omitted, variable such as income or democracy. The ideal solution would be to use good instruments for national *Pride*, but we have failed to find any such instruments. Reversed causality (that causality flows from *Government Effectiveness* to *Pride*) would for instance be the case if people in countries with more effective governments expressed a higher level of *Pride* just for that reason. We investigated this by regressing nationalism on government effectiveness in 1996 (the earliest year available) and found no effect in that direction. We allowed for nonlinearities and added control variables such as ethnic fractionalization, size of population, openness, growth, and income, yet in none of the regressions was past government effectiveness a significant determinant of *Pride*. (Results not shown but available upon request.)

It is a priori fully possible that the statistically significant coefficient for *Pride* and *Pride-square* could be due to the omission of “true” correlates of government effectiveness, such as income, economic growth, and level of democracy. The first of these potential concerns draws from Shulman (2003), who when observing a negative relationship between income and nationalism concluded that a strong national identity

can serve as an equalizer between rich and poor countries. Similar to the logic of nationalism in a country making the poor feel equal to the rich (which was discussed in Section 2.1), a strong national identity can make poor low-status countries feel equal to rich countries. Therefore, Shulman (2003:46) concludes: “(...) due to their need for self-esteem and a positive self-image, people in poorer, low-status countries may have a greater psychological investment in a strong and positive national identity than those in rich countries.” Since government effectiveness is highly related to income, the result that high *National Pride* and low *Government Effectiveness* go hand in hand could also be explained by this psychological phenomenon – a *low income* hypothesis. At the same time, richer countries can afford to pay for better and larger governments, hence income should ideally be included in the regression. The econometric problem lies in the fact that income is very likely to be endogenous to government effectiveness. In Column (1) of Table 6 we nonetheless include income in the model and still find a nonlinear association between *Pride* and *Government Effectiveness*. This shows that our result concerning the effects of *Pride* is not easily explained by populations in poorer countries being inclined to display high national pride just because they are poor. We admit that we are unable to provide a definite answer.

A second potential concern is that the level of *Pride* may reflect the level of satisfaction with recent economic performance – a *satisfaction* hypothesis.<sup>12</sup> With the caveat that growth is also very likely to be endogenous to government effectiveness, we include it in Column (2). The hump-shaped effect of *Pride* is intact. In Column (3) we find that the association between higher income and better government effectiveness is weakened by more *Pride*. Overall, the inclusion of income and growth leaves the main results fairly stable and significant.

A third potential concern is that the effect of *Pride* can reflect the possibility that less democratic nations are more likely to have leadership that manipulates nationalism as a means to improve its own power and position, without an intention to improve efficiency. Controlling for the potential effect of having a manipulative leadership – a *manipulation* hypothesis – is less than straightforward, but it is safe to assume that manipulations are less likely to be effective in more developed and solid democracies. Column (4) of Table 6 includes a measure of the quality of *Democracy*, Polity2 from the Polity IV project, and the results concerning *Pride* remain. In Columns (5) and (6) we split the sample into *Democracies* and *Autocracies*. As in Persson and Tabellini (2003),

---

<sup>12</sup> Needless to say, this mechanism could in principle also result in a positive association between income and *Pride*, but the negative correlation between these suggests otherwise.

democracies are countries with Polity2 values larger than zero. The sample of autocracies is small which may contribute to the seemingly dramatic effects in this sample, but the fact that the effect is clear and strong in the sample with only democratic countries contradicts the manipulation hypothesis. Thus, while we are unable to provide strict statistical proof that the findings represent causal effects, we can conjecture that the most likely alternative hypotheses are false.<sup>13</sup>

The last columns of Table 6 show that our results are not sensitive to our particular choice of dependent variable. The results from using the indicators *Control of Corruption* and *Rule of Law* from Kaufmann et al. (2005) show that the nonlinear association with national pride can be generalized to other indicators of institutions and government effectiveness.

Finally, to allow for unobserved country heterogeneity and estimate the effects of changes in, as opposed to levels of, *Pride* and *Government Effectiveness*, we estimated the model on a panel data set (results not shown). Setting up the data in panel format is possible since the WVS is conducted at several points in time. The number of times a country is included differs and some countries are only included once. As mentioned earlier, the WVS data stretches from 1981 to 2006. This means that we cannot use the Kaufmann et al. (2005) data on *Government Effectiveness* since it does not have the same coverage. An alternative dependent variable, the *Quality of Government*, constructed by the PRS Group (see Appendix A for details), is used instead. The *Quality of Government* index is the average score of three indexes: Corruption, Law and Order, and Bureaucratic Quality. The index Bureaucratic Quality is also included as one of the components in *Government Effectiveness* by Kaufmann et al. (2005) used earlier, and *Government Effectiveness* and *Quality of Government* are highly correlated (0.92).<sup>14</sup>

Using a within-groups estimator we fail to obtain significant estimates, quite possibly due to the very modest variation over time in *Pride* and *Quality of Government*. An alternative approach similar to Krueger and Lindahl (2001) is to extract the maximum amount of variation in the data by taking the latest observation minus the earliest. Yet, changes in *Pride* do not seem to significantly explain changes in *Quality of Government* with this approach either.

---

<sup>13</sup> When we combine specification (3) and (4) by including GDP/capita, the interaction between GDP/capita and Pride, Growth, and Democracy in one regression, the coefficients are all significantly estimated with coefficients in roughly the same region as in (3) and (4), and the coefficients for Pride and Pride-square are significant and take values between those in (3) and (4). When we add the Colony-dummy, Latitude, and State Antiquity, none of which enters significantly, the two pride-coefficients are fairly stable but Pride-Square becomes marginally non-significant with a p-value of 0.106.

<sup>14</sup> For the year 2002, due to data availability.

## 5. Conclusions

We find that the level of nationalism, measured by the level of national pride, has a robust inverted U-shaped relationship with government effectiveness. Though data limitations restrict an adequate examination over time, the cross-country evidence is clear – more pride is associated with better government effectiveness at low levels of national pride, while the effect is the opposite at high levels of national pride.

We find no support for the idea that nation-building, in the sense of a higher level of national pride, can resolve potential problems that come with high levels of ethnic fractionalization. However, there are indications that the general problem of low government effectiveness in former colonies may be mitigated by more national pride.

Finally, we find that higher levels of national pride do not seem to come at the expense of lower trade flows. Previous research on survey data has shown that national pride is negatively associated with pro-trade *attitudes* on the micro level, but this does not seem to translate into a negative relationship between attitudes and *actual* trade flows on the macro level.

## References

- Ahlerup, P. and O. Olsson (2007) "The Roots of Ethnic Diversity" *Working Papers in Economics* no. 281. Department of Economics, Göteborg University.
- Alesina, A., R. Baqir, and W. Easterly (1999) "Public Goods and Ethnic Divisions" *Quarterly Journal of Economics*, 114(4):1243-84.
- Alesina, A. and E. La Ferrara (2005) "Ethnic Diversity and Economic Performance" *Journal of Economic Literature*, 43(3): 762-800.
- Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg (2003) "Fractionalization" *Journal of Economic Growth*, 8:155-94.
- Anderson, B. (1983) *Imagined Communities: Reflections on the origin and spread of nationalism*. Repr., London, UK: Verso, 1992.
- Barrington, L. W. (2006) *Nationalism & Independence: In After Independence: Making and Protecting the Nation in Postcolonial and Postcommunist States* (ed: Barrington, L.W.). Ann Arbor: The University of Michigan Press.
- Bockstette, V., Chanda, A. and L. Putterman. (2002) "States and Markets: The Advantage of an Early Start" *Journal of Economic Growth*, 7: 347-69.
- Brown, D. (1999) "Are there good and bad nationalisms?" *Nations and Nationalism*, 5(2): 281-302.
- CEPII (2007), Centre d'Etude Prospective et d'Informations Internationales (online) < <http://www.cepii.fr/> >
- Easterly, W. and R. Levine (1997) "Africa's growth tragedy: policies and ethnic divisions" *Quarterly Journal of Economics*, 112(4):1203-50.
- Evans, M.D.R and J. Kelley (2002) "National Pride in the Developed World", *International Journal of Public Opinion Research*, 14(3).
- Hylland Eriksen, T. (1993) *Ethnicity and Nationalism: Anthropological Perspectives*, Repr., London, UK: Pluto Press. 2002.
- Farouky, J.. (2007) "The Many Faces of Europe," *TIME*. February 26:16-23.
- Fearon, J. D. (2003) "Ethnic and Cultural Diversity by Country" *Journal of Economic Growth*, 8:195-222.
- Frankel, J. A. and D. Romer. (1999) "Does Trade Cause Growth?" *American Economic Review*, 89(3): 379-399.
- Frankel, J. A. and A. K. Rose. (2002) "An estimate of the effect of common currencies on trade and income" *Quarterly Journal of Economics*, 117(2): 437-66.
- Gellner, E. (1983) *Nations and Nationalism*, Oxford: Blackwell.
- Herbst, J. (2000) *States and Power in Africa*. Princeton: Princeton University Press.
- Kaelberer, M. (2004) "The euro and European identity: symbols, power and the politics of European monetary union" *Review of International Studies*, 30:161-78.
- Kaufmann, D., A. Kraay, and M. Mastruzzi. (2003) "Governance Matters III: Governance Indicators for 1996-2002" *World Bank Policy Research Working Paper 3106*.
- Kaufmann, D., A. Kraay, and M. Mastruzzi. (2005) "Governance Matters IV: Governance Indicators for 1996-2004" *World Bank Policy Research Working Paper 3630*.
- Krueger, A. B. and M. Lindahl. (2001) "Education for Growth: Why and For Whom?" *Journal of Economic Literature*, 39: 1101-36.
- La Porta, R., F. Lopez-de-Silandes, A. Shleifer, and R. Vishny (1999) "The Quality of Government" *Journal of Law, Economics, & Organizations*, 15: 222-79.
- Mauro, P. (1995) "Corruption and Growth" *Quarterly Journal of Economics*, 110(3):681-712.
- Mayda, A. N. and D. Rodrik. "Why are some people (and countries) more protectionist than others?" *European Economic Review* 49:1393-1430.
- McFarland, S. and M. Mathews (2005) "Who Cares About Human Rights?" *Political Psychology*, 26(3):365-85.

- Miguel, E. (2004) "Tribe or Nation? Nation-building and Public Goods in Kenya versus Tanzania" *World Politics*, 56:327-62.
- Miguel, E. and M. K. Gugerty (2005) "Ethnic diversity, social sanctions, and public goods in Kenya" *Journal of Public Economics*, 89:2325-68.
- Nakano, T. (2004) "Theorising economic nationalism" *Nations and Nationalism* 10(3), 2004, 211--229.
- Olsson, O. and G. Hansson. (2006) "Country Size and the Rule of Law: Resuscitating Montesquieu" *Working Papers in Economics* no. 200. Department of Economics, Göteborg University.
- Pellegrini, L. and R. Gerlagh (2007) "Causes of corruption: a survey of cross-country analyses and extended results" *Economics of Governance*, (online)  
<<http://www.springerlink.com/content/6014743x057h1338/fulltext.pdf> >
- Persson, T. and G. Tabellini. (2003) *The Economic Effects of Constitutions*, Cambridge: The MIT Press.
- Pye, L. W. (1971) "Identity and the Political Culture" in *Crises and Sequences in Political Development*, ed. Binder, L. et al. Princeton: Princeton University Press.
- Schatz, R.T. and H. Levine (2007) "Waving the Flag: National Symbols, Social Identity, and Political Engagement" *Political Psychology*, 28(3):329-55.
- Shulman, S. (2000) "Nationalist Sources of International Economic Integration" *International Studies Quarterly*, 44, 365-390.
- Shulman, S. (2002) "Challenging the Civic/Ethnic and West/East Dichotomies in the Study of Nationalism" *Comparative Political Studies*, 35:554-85.
- Shulman, S. (2003) "Exploring the Economic Basis of Nationhood" *Nationalism and Ethnic Policies*, 9(2):23-49.
- Smith, Anthony D. (1986) *The Ethnic Origin of Nations*, Oxford: Basil Blackwell.
- Smith, T. W. and S. Kim (2006) "National Pride in a Comparative Perspective: 1995/96 and 2003/04" *International Journal of Public Opinion Research*, 18(1)
- Stanford Encyclopedia of Philosophy, online  
<<http://plato.stanford.edu/entries/nationalism>>
- Stephenson, Carolyn . "Nation-building." *Beyond Intractability*. Eds. Guy Burgess and Heidi Burgess. Conflict Research Consortium, University of Colorado, Boulder. Posted: January 2005 <[http://www.beyondintractability.org/essay/nation\\_building/](http://www.beyondintractability.org/essay/nation_building/)>.
- Tilly, C. (1992) *Coercion, Capital, and European States, AD 990-1992*, Oxford: Blackwell.
- Treisman, D. (2000) "The causes of corruption: a cross national study" *Journal of Public Economics*, 76:399-457.
- Verba, S.(1971) "Sequences and Development" in *Crises and Sequences in Political Development*, L. Binder et al. (ed), Princeton: Princeton University Press.



**Table 1: Summary Statistics**

Variable	Obs.	Mean	Std. Dev.	Min	Max
Control of Corruption	79	0.394	1.138	-1.110	2.530
Democracy	75	5.800	5.782	-10	10
Dummy for Former Colony	79	0.734	0.445	0	1
Ethnic Fractionalization	79	0.350	0.228	0.002	0.930
EU member	79	0.304	0.463	0	1
Federalism	67	1.433	0.733	0	2
Log GDP/capita 1990	77	8.197	1.430	5.155	10.413
Government Effectiveness	79	0.464	1.005	-1.200	2.250
Growth 1990-2004	77	0.016	0.020	-0.047	0.087
Latitude	79	37.579	15.535	0.333	64.150
Log Area	79	12.320	2.021	5.756	16.655
Log Population	79	9.722	1.650	5.677	14.078
Log. Constr. Trade	79	-1.946	0.765	-3.585	-0.032
LogTrade	79	-0.250	0.512	-1.395	1.467
Pride	79	3.409	0.332	2.691	3.908
Rule of Law	79	0.320	1.061	-1.530	2.010
State Antiquity	75	0.523	0.222	0.069	0.938

**Table 2: Pair-wise Correlations Between Pride and Other Variables.**

	Ethnic Fractionalization	State Antiquity	Federalism	Democracy	Government Effectiveness in 1996	Government Effectiveness in 2004
Pride	0.0875	-0.2453	-0.0915	-0.2297	-0.0994	-0.1815
(p-value)	(0.4430)	(0.0339)	(0.4615)	(0.0474)	(0.3833)	(0.1094)
Obs.	79	75	67	75	79	79
	Log Population	Log Area	Former Colony	NeoEurope	Log GDP/capita 1990	Growth 1990-2004
Pride	0.1267	0.2203	0.2808	0.1659	-0.2420	0.1826
(p-value)	(0.2657)	(0.0511)	(0.0122)	(0.1440)	(0.0340)	(0.1119)
Obs.	79	79	79	79	77	77

**Table 3: Relationship Between Pride and Government Effectiveness.**

Panel A					
Dependent Variable: Government Effectiveness in 2004.					
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	2SLS
Pride	-0.550*	17.461***	13.256**	12.517***	12.065***
	(0.323)	(6.166)	(5.075)	(4.376)	(4.217)
Pride-square		-2.717***	-2.179***	-2.033***	-1.944***
		(0.918)	(0.758)	(0.649)	(0.629)
Ethnic Fractionalization			-1.130***	-1.072***	-1.037***
			(0.387)	(0.339)	(0.323)
French Legal Origin			0.038	0.048	0.054
			(0.291)	(0.250)	(0.245)
Socialist Legal Origin			-0.856***	-0.998***	-1.084***
			(0.313)	(0.271)	(0.258)
Scandinavian Legal Origin			1.053***	1.069***	1.078***
			(0.358)	(0.303)	(0.288)
German Legal Origin			0.362	0.558	0.679*
			(0.495)	(0.428)	(0.407)
Dummy for NeoEuropes			1.747***	2.013***	2.176***
			(0.266)	(0.254)	(0.299)
LogTrade				0.634***	1.021***
				(0.119)	(0.173)
Constant	2.340**	-27.186***	-18.690**	-17.727**	-17.139**
	(1.113)	(10.259)	(8.496)	(7.389)	(7.077)
Observations	79	79	79	79	79
R-squared	0.033	0.107	0.626	0.71	0.68

Panel B: First Stage Results for Log Trade Share.	
Log. Constr. Trade	0.435***
	(0.069)
Pride	-2.428 <sup>a</sup>
	(3.096)
Pride-square	0.330 <sup>a</sup>
	(0.466)
Ethnic Fractionalization	-0.039
	(0.211)
French Legal Origin	-0.050
	(0.133)
Socialist Legal Origin	-0.050
	(0.159)
Scandinavian Legal Origin	-0.260
	(0.225)
German Legal Origin	-0.364
	(0.246)
Dummy for NeoEuropes	-0.095
	(0.226)
Constant	5.095
	(5.161)
F(trade)	39.42

Notes: Panel A reports robust standard errors in parentheses, Panel B reports ordinary standard errors. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. 2SLS performed with Stata's ivreg2 command. a: not jointly significant at the 10% level.

**Table 4: Pride, Ethnic Fractionalization, and Colonial Past.**

Panel A							
Dependent Variable: Government Effectiveness in 2004.							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Pride	15.501*** (5.310)	13.612** (5.207)	12.590*** (4.441)	11.835*** (4.169)	10.541** (4.289)	10.129** (4.437)	10.023** (4.456)
Pride-square	-2.440*** (0.811)	-2.145*** (0.783)	-2.030*** (0.661)	-1.945*** (0.617)	-1.686*** (0.639)	-1.706** (0.670)	-1.709** (0.665)
Ethnic Fractionalization	-3.678 (4.708)	4.575 (4.169)	-0.112 (4.079)	-3.577 (3.850)	-0.857*** (0.317)	-0.823*** (0.315)	-2.266 (3.483)
Pride*Ethn.Frac	0.612 (1.347)	-1.640 (1.191)	-0.276 (1.167)	0.732 (1.098)			0.415 (1.001)
LogTrade			0.623*** (0.135)	1.083*** (0.187)	1.084*** (0.182)	1.170*** (0.189)	1.202*** (0.212)
Dummy for Former Colony					-0.349** (0.169)	-3.020** (1.469)	-2.958** (1.506)
Pride*Colony						0.794* (0.437)	0.776* (0.445)
Legal Origin & NeoEuropes	no	yes	yes	yes	yes	yes	yes
Constant	-23.203*** (8.659)	-20.305** (8.717)	-18.017** (7.530)	-16.325** (7.110)	-14.775** (7.216)	-13.176* (7.370)	-12.773* (7.538)
Observations	79	79	79	79	79	79	79
R-squared	0.232	0.636	0.71	0.67	0.68	0.68	0.67

Panel B							
First Stage Results for Log Trade Share.							
Log. Constr. Trade				0.409*** (0.074)	0.424*** (0.070)	0.425*** (0.072)	0.405*** (0.077)
Pride				-2.072 <sup>a</sup> (3.123)	-1.806 <sup>a</sup> (3.147)	-1.813 <sup>a</sup> (3.180)	-1.571 <sup>a</sup> (3.203)
Pride-square				0.312 <sup>a</sup> (0.466)	0.226 <sup>a</sup> (0.475)	0.226 <sup>a</sup> (0.479)	0.219 <sup>a</sup> (0.480)
All exogenous variables as IVs	-	-	-	yes	yes	yes	yes
F(trade)				30.21	36.98	34.64	27.86

Notes: Panel A reports robust standard errors in parentheses, Panel B reports ordinary standard errors. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. 2SLS performed with Stata's ivreg2 command. a: not jointly significant at the 10% level.

**Table 5: Pride and more control variables.**

Panel A						
Dependent Variable: Government Effectiveness in 2004.						
	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Pride	12.909** (5.531)	14.976* (8.126)	10.789*** (4.158)	12.009*** (4.476)	9.889*** (2.911)	11.837*** (3.858)
Pride-square	-2.039** (0.809)	-2.337** (1.158)	-1.740*** (0.618)	-1.921*** (0.675)	-1.580*** (0.437)	-1.864*** (0.572)
Ethnic Fractionalization	-0.992** (0.393)	-1.243** (0.596)	-1.039*** (0.349)	-1.568*** (0.367)	-0.573** (0.287)	-0.657** (0.289)
LogTrade	1.601 (1.121)	2.320 (2.512)	1.085*** (0.239)	1.204*** (0.211)	0.584*** (0.192)	0.692*** (0.171)
Log Population	0.122 (0.221)					
Log Area		0.243 (0.440)				
State Antiquity			0.636 (0.446)			
Federalism				-0.202* (0.122)		
EU member					0.727*** (0.140)	
Latitude						0.021*** (0.006)
Legal Origin & NeoEuropes	yes	yes	Yes	Yes	yes	yes
Constant	-20.051* (10.495)	-24.989 (17.662)	-15.450** (7.021)	-16.608** (7.368)	-14.512*** (4.837)	-18.154*** (6.521)
Observations	79	79	75	67	79	79
R-squared	0.55	0.32	0.67	0.71	0.79	0.75

Panel B						
First Stage Results for Log Trade Share.						
Log. Constr.	0.220 (0.139)	0.112 (0.106)	0.381*** (0.078)	0.513*** (0.081)	0.436*** (0.077)	0.498*** (0.075)
Trade	-1.949 <sup>a</sup> (3.061)	-2.290 <sup>a</sup> (2.832)	-2.349 <sup>a</sup> (3.184)	-3.098 <sup>a</sup> (3.071)	-2.418 <sup>a</sup> (3.124)	-2.681 <sup>b</sup> (3.037)
Pride	0.248 <sup>a</sup> (0.461)	0.310 <sup>a</sup> (0.426)	0.316 <sup>a</sup> (0.480)	0.424 <sup>a</sup> (0.464)	0.328 <sup>a</sup> (0.470)	0.343 <sup>b</sup> (0.456)
Pride-square						
All exogenous variables as IVs	yes	yes	Yes	Yes	yes	yes
F(trade)	2.52	1.12	23.96	40.54	32.38	43.85

Notes: Panel A reports robust standard errors in parentheses, Panel B reports ordinary standard errors. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. 2SLS performed with Stata's ivreg2 command. In the first stage of column 6, Pride and Pride-sq are jointly significant with a p-value equal to 0.09. a: not jointly significant at the 10% level. b: Jointly significant at the 10% level.

**Table 6: Income, Growth, and Democracy.**

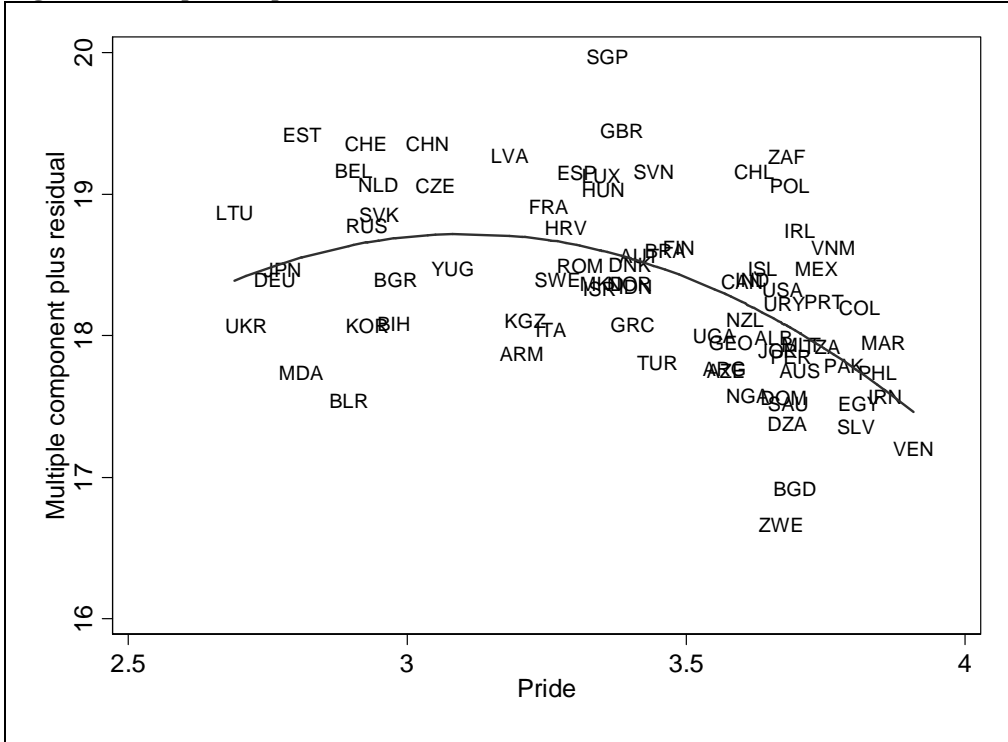
Panel A									
Dep.Variable	Government Effectiveness					CoC		RoL	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
						Demo	Auto		
Pride	6.789*	10.121**	6.877**	9.366**	10.917***	12.860***	31.048*	11.840**	10.300**
	(3.482)	(3.986)	(3.152)	(4.016)	(3.832)	(4.560)	(17.612)	(4.684)	(4.755)
Pride-square	-1.078**	-1.655***	-0.752*	-1.506**	-1.704***	-2.055***	-4.777*	-1.895***	-1.661**
	(0.533)	(0.600)	(0.409)	(0.608)	(0.572)	(0.687)	(2.691)	(0.710)	(0.715)
Ethnic Fractionalization	-0.333	-0.761**	0.056	-0.914***	-0.935***	-1.222***	-1.409**	-1.124***	-1.355***
	(0.240)	(0.357)	(0.225)	(0.326)	(0.320)	(0.414)	(0.665)	(0.373)	(0.351)
LogTrade	0.416**	1.148***	0.519***	0.892***	0.785***	1.162***	-0.264	1.340***	1.278***
	(0.196)	(0.188)	(0.135)	(0.250)	(0.225)	(0.258)	(0.271)	(0.216)	(0.204)
Log GDP/capita 1990	0.397***		1.383***						
	(0.069)		(0.389)						
Growth 1990-2004		8.785**	13.193***						
		(3.871)	(2.103)						
Pride * Log GDP/capita			-0.278**						
			(0.114)						
Democracy				0.051***	0.215				
				(0.014)	(0.135)				
Pride * Democracy					-0.047				
					(0.038)				
Legal Origin & NeoEuropes	yes	yes	Yes	Yes	yes	yes	yes <sup>c</sup>	yes	yes
Constant	-12.871**	-14.135**	-17.730***	-13.335**	-16.380**	-18.216**	-49.057*	-16.899**	-14.419*
	(5.485)	(6.568)	(6.221)	(6.607)	(6.439)	(7.536)	(28.063)	(7.698)	(7.905)
Observations	77	77	77	75	75	61	14	79	79
R-squared	0.82	0.67	0.88	0.74	0.75	0.69	0.14	0.67	0.63

Panel B									
First Stage Results for Log Trade Share.									
Log. Constr. Trade	0.422***	0.471***	0.457***	0.408***	0.441***	0.443***	0.595	0.435***	0.435***
	(0.080)	(0.069)	(0.079)	(0.078)	(0.082)	(0.074)	(0.314)	(0.069)	(0.069)
Pride	-2.447 <sup>a</sup>	-3.489 <sup>a</sup>	-5.314 <sup>a</sup>	-1.947 <sup>a</sup>	-3.287 <sup>b</sup>	-4.324 <sup>b</sup>	14.118 <sup>a</sup>	-2.428 <sup>a</sup>	-2.428 <sup>a</sup>
	(3.177)	(3.087)	(3.504)	(3.140)	(3.295)	(2.675)	(17.254)	(3.096)	(3.096)
Pride-square	0.337 <sup>a</sup>	0.483 <sup>a</sup>	0.614 <sup>a</sup>	0.245 <sup>a</sup>	0.415 <sup>b</sup>	0.618 <sup>b</sup>	-2.188 <sup>a</sup>	0.330 <sup>a</sup>	0.330 <sup>a</sup>
	(0.480)	(0.464)	(0.482)	(0.474)	(0.490)	(0.405)	(2.547)	(0.466)	(0.466)
Ethnic Fractionalization	0.052	0.165	0.242	-0.072	-0.062	0.259	-1.532*	-0.039	-0.039
	(0.237)	(0.222)	(0.244)	(0.218)	(0.217)	(0.198)	(0.792)	(0.211)	(0.211)
All exogenous variables as IVs	yes	yes	Yes	Yes	yes	yes	yes	yes	yes
F(trade)	28.07	46.18	33.55	27.44	29.13	35.55	3.59	39.42	39.42

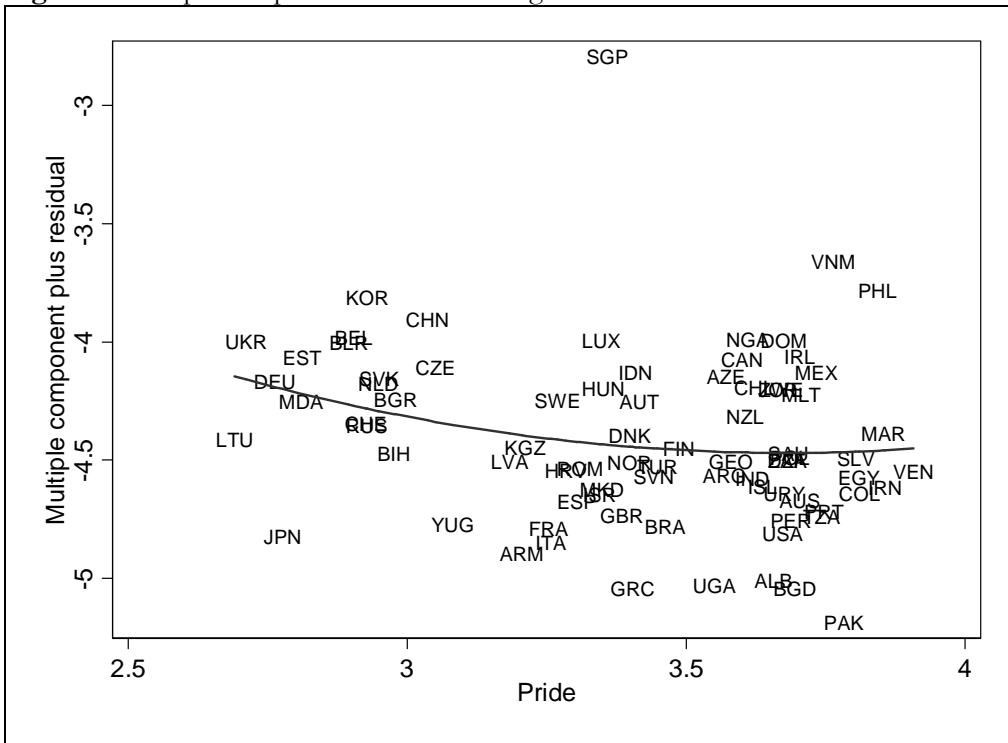
Notes: Panel A reports robust standard errors in parentheses, Panel B reports ordinary standard errors. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. 2SLS performed with Stata's ivreg2 command. Demo = sample with democratic countries, Auto = sample with autocratic countries. Column 8 uses "Control of Corruption" and Column 9 uses "Rule of Law" as dependent variable. Constant included in all regressions. In the first stage of Column 5 (6), Pride and Pride-sq are jointly significant with a p-value equal to 0.089 (0.098). a: not jointly significant at the 10% level. b: Jointly significant at the 10% level. c: Scandinavian and German Legal Origin and NeoEurope dummy dropped due to collinearity.

**Figure 1:** Component plus Residual Plot: Gov't Effectiveness & Pride.



Note: Component-plus-residual plot of Pride for regression 5 in Table 3.

**Figure 2:** Component plus Residual Plot: Log Trade & Pride



Note: Component-plus-residual plot for first stage of 5 in Table 3.

## Appendix A: Sample and Variable Description

**Table A1:** Countries included in Pride Sample (81 countries).

Country	Code	Region	Income group
Australia	AUS	East Asia & Pacific	High income
Japan	JPN	East Asia & Pacific	High income
Korea, Rep.	KOR	East Asia & Pacific	High income
New Zealand	NZL	East Asia & Pacific	High income
Singapore	SGP	East Asia & Pacific	High income
Austria	AUT	Europe & Central Asia	High income
Belgium	BEL	Europe & Central Asia	High income
Czech Republic	CZE	Europe & Central Asia	High income
Denmark	DNK	Europe & Central Asia	High income
Estonia	EST	Europe & Central Asia	High income
Finland	FIN	Europe & Central Asia	High income
France	FRA	Europe & Central Asia	High income
Germany	DEU	Europe & Central Asia	High income
Greece	GRC	Europe & Central Asia	High income
Iceland	ISL	Europe & Central Asia	High income
Ireland	IRL	Europe & Central Asia	High income
Italy	ITA	Europe & Central Asia	High income
Luxembourg	LUX	Europe & Central Asia	High income
Malta	MLT	Europe & Central Asia	High income
Netherlands	NLD	Europe & Central Asia	High income
Norway	NOR	Europe & Central Asia	High income
Portugal	PRT	Europe & Central Asia	High income
Slovenia	SVN	Europe & Central Asia	High income
Spain	ESP	Europe & Central Asia	High income
Sweden	SWE	Europe & Central Asia	High income
Switzerland	CHE	Europe & Central Asia	High income
United Kingdom	GBR	Europe & Central Asia	High income
Israel	ISR	Middle East & North Africa	High income
Saudi Arabia	SAU	Middle East & North Africa	High income
Canada	CAN	North America	High income
United States	USA	North America	High income
Bulgaria	BGR	Europe & Central Asia	Upper middle income
Croatia	HRV	Europe & Central Asia	Upper middle income
Hungary	HUN	Europe & Central Asia	Upper middle income
Latvia	LVA	Europe & Central Asia	Upper middle income
Lithuania	LTU	Europe & Central Asia	Upper middle income
Poland	POL	Europe & Central Asia	Upper middle income
Romania	ROM	Europe & Central Asia	Upper middle income
Russian Federation	RUS	Europe & Central Asia	Upper middle income
Serbia and Montenegro	YUG	Europe & Central Asia	Upper middle income
Slovak Republic	SVK	Europe & Central Asia	Upper middle income
Turkey	TUR	Europe & Central Asia	Upper middle income
Argentina	ARG	Latin America & Caribbean	Upper middle income
Brazil	BRA	Latin America & Caribbean	Upper middle income
Chile	CHL	Latin America & Caribbean	Upper middle income
Mexico	MEX	Latin America & Caribbean	Upper middle income
Uruguay	URY	Latin America & Caribbean	Upper middle income

Venezuela, RB	VEN	Latin America & Caribbean	Upper middle income
South Africa	ZAF	Sub-Saharan Africa	Upper middle income
China	CHN	East Asia & Pacific	Lower middle income
Indonesia	IDN	East Asia & Pacific	Lower middle income
Philippines	PHL	East Asia & Pacific	Lower middle income
Albania	ALB	Europe & Central Asia	Lower middle income
Armenia	ARM	Europe & Central Asia	Lower middle income
Azerbaijan	AZE	Europe & Central Asia	Lower middle income
Belarus	BLR	Europe & Central Asia	Lower middle income
Bosnia and Herzegovina	BIH	Europe & Central Asia	Lower middle income
Georgia	GEO	Europe & Central Asia	Lower middle income
Macedonia, FYR	MKD	Europe & Central Asia	Lower middle income
Moldova	MDA	Europe & Central Asia	Lower middle income
Ukraine	UKR	Europe & Central Asia	Lower middle income
Colombia	COL	Latin America & Caribbean	Lower middle income
Dominican Republic	DOM	Latin America & Caribbean	Lower middle income
El Salvador	SLV	Latin America & Caribbean	Lower middle income
Peru	PER	Latin America & Caribbean	Lower middle income
Algeria	DZA	Middle East & North Africa	Lower middle income
Egypt, Arab Rep.	EGY	Middle East & North Africa	Lower middle income
Iran, Islamic Rep.	IRN	Middle East & North Africa	Lower middle income
Jordan	JOR	Middle East & North Africa	Lower middle income
Morocco	MAR	Middle East & North Africa	Lower middle income
Vietnam	VNM	East Asia & Pacific	Low income
Kyrgyz Republic	KGZ	Europe & Central Asia	Low income
Bangladesh	BGD	South Asia	Low income
India	IND	South Asia	Low income
Pakistan	PAK	South Asia	Low income
Nigeria	NGA	Sub-Saharan Africa	Low income
Tanzania	TZA	Sub-Saharan Africa	Low income
Uganda	UGA	Sub-Saharan Africa	Low income
Zimbabwe	ZWE	Sub-Saharan Africa	Low income

Note: This included the countries in the *Pride* sample classified according to the World Bank into income and geographic location groups. The economies are divided among income groups according to 2006 gross national income (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low income, \$905 or less; lower middle income, \$906–3,595; upper middle income, \$3,596–11,115; and high income, \$11,116 or more.

The World Bank sometimes refers to low-income and middle-income economies as developing economies. By this definition, 30 out of 79 countries in this sample are developing countries.

East Asia & Pacific: 9 countries  
 Europe and Central Asia: 43 countries  
 Latin America & Caribbean: 10 countries  
 Middle East & North Africa: 7 countries  
 North America: 2 countries  
 South Asia: 3 countries  
 Sub-Saharan Africa: 5 countries.

High income: 31 countries  
 Upper middle income: 18 countries.  
 Lower middle income: 21 countries.  
 Low income: 9 countries



## Variable Description

**Auto:** Autocratic countries. Equals one for countries where *Democracy* is smaller than or equal to zero. See *Democracy*.

**Control of Corruption:** Source Kaufmann et al. (2005).

**Democracy:** Polity2 from Polity IV project (<http://www.cidcm.umd.edu/polity/data/showFiles.asp>).

Polity2 is a combined polity score which is computed by subtracting the variable AUTOOC from the variable DEMOC, the resulting polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic). The Democracy score used represents December 31, 2003.

**Demo:** Democratic countries. Equals one if *Democracy* is larger than zero. See *Democracy*.

**EU:** Dummy for member countries of the European Union.

**Ethnic Fractionalization:** Ethnic Fractionalization. Based on the Herfindahl index and is the probability that two randomly drawn individuals from the same country belong to different groups. Source: Alesina et al. (2003).

**Federalism:** Federalism or unitarism year 2000. Average of Nonfederalism and Nonbicameralism. Nonfederalism is coded as 0 = federal (elective regional legislatures plus conditional recognition of subnational authority), 1 = semifederal (where there are elective legislatures at the regional level but in which constitutional sovereignty is reserved to the national government), or 2 = nonfederal. Nonbicameralism is coded as 0 = strong bicameral (upper house has some effective veto power; the two houses are incongruent), 1 = weak bicameral (upper house has some effective veto power, though not necessarily a formal veto; the two houses are congruent), or 2 = unicameral (no upper house or weak upper house). Source: Teorell, Jan, Sören Holmberg & Bo Rothstein. 2006. The Quality of Government Dataset, version 1Jul06. Göteborg University: The Quality of Government Institute, <http://www.qog.pol.gu.se>.

**Former Colony:** Dummy for having been subject to Colonization. Source: CEPII (2007).

**Government Effectiveness:** Government Effectiveness. Measuring the competence of the bureaucracy and the quality of public service delivery. Source: Kaufmann et al. (2005).

**Growth 1990-2004:** Annual growth rate in real GDP per capita from 1990 until 2004. GDP per capita data from World Development Indicators.

**Latitude:** Distance from the equator. Absolute latitude in degrees. Source: CEPII.

**Legal Origin:** Identifies the legal origin of the Company Law or Commercial Code for each country. There are five possible origins: English Common Law, French Commercial Code, Socialist/Communist laws, Scandinavian Commercial Code, and German Commercial Code. Divided into five dummy variables, for English legal origin = 1 if English legal origin, otherwise 0. Source: La Porta et al. (1999).

**Log Area:** Natural logarithm of total area (including lakes and rivers) in sq km. Source CIA World Factbook 2005

**Log GDP/capita in 1990:** Log GDP per capita (constant 2000 US\$) Source: World Development Indicators (2006)

**Log Population:** Natural logarithm of total population (2004). World Development Indicators 2007

**Log Trade:** Natural logarithm of (exports + imports)/GDP divided by 100, all from 2004 in current local currency units. World Development Indicators 2007.

**Low Income:** Dummy variable equal to 1 if Low Income country as classified by the World Bank (see Table A1).

**NeoEurope:** Dummy for Australia, Canada, New Zealand, USA.

**Pride:** Pride of nationality. Question G006 from World Values Survey: “How proud are you to be [Nationality]?” 1 = Not at all proud, 2 = not very proud, 3 = quite proud, 4 = very proud. (Note that we have reversed the scoring in relation to WVS in order to have a high score reflecting a high degree of pride.) The latest possible data is used where for the main sample of 79 countries this includes observations from 1995 to 2003. The mean value of pride for each country is then calculated, with respect to the weights (S017). The weights are used to better represent the country as a whole.

**Quality of Government:** Average of Corruption, Law and Order, and Bureaucratic Quality. From the International Country Risk Guide, The PRS Group. Retrieved from: Teorell, Jan, Sören Holmberg & Bo Rothstein. 2007. The Quality of Government Dataset, version 1July07. Göteborg University: The Quality of Government Institute, <http://www.qog.pol.gu.se>.

**Rule of Law:** Source: Kaufmann et al. (2005).

**State Antiquity:** State Antiquity from year 0 until 1950, Source Bockstette et al. (2002).

## Appendix B: Constructing the Constructed Trade Share

The constructed trade share is constructed in two steps: in step 1 we estimate the parameters of the bilateral gravity equation, which in step 2 are used to predict the constructed trade share.

To estimate the gravity equation we use the dataset from Frankel and Rose (2002), which consists of bilateral trade data for the year 1990 alongside data on distance, population, common border, landlocked etc. Using this data we then specify the gravity equation similar to Frankel and Romer (1999), except the use of Log Area for the two countries as well as their interaction with the common border dummy. Since area and population capture the same mechanism, and because the constructed trade share using both population and area resulted in a constructed trade share highly related to Log Area (correlation equal to -0.87), the specification with population only, seemed the most reasonable. The regression results for the gravity equation using bilateral trade data is presented in Table B1.

**Table B1:** Estimating the Bilateral Trade Gravity Equation

Dependent Variable: $\text{Log}(\text{Trade}_{ij}/\text{GDP}_i)$		
	Variable	Interaction
Constant	-2.333*** (0.503)	-
Log Distance <sub>ij</sub>	-1.035*** (0.051)	-0.137 (0.339)
Log Population <sub>i</sub>	-0.266*** (0.022)	-0.187 (0.177)
Log Population <sub>j</sub>	0.605*** (0.022)	0.089 (0.145)
Landlocked <sub>ij</sub>	-0.606*** (0.083)	0.774*** (0.297)
Border <sub>ij</sub>	2.080 (2.103)	-
Obs.		4052
R-squared		0.238

Robust standard errors in (.). \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. The first column reports the coefficients on the variable listed, and the second column reports the coefficient on the variable's interaction with the common border dummy.

Since some of the countries for which we have data on national *Pride* are not included in the dataset from Frankel and Rose (2002), we generate the constructed trade share using a complementary dataset. Constructing this complementary dataset we start by including all 184 countries for which the World Development Indicators (WDI) have data on international trade for the year 2004. We then match each country with each of the other 183 countries, resulting in 33,672 country pairs.

Following the variable specification in Frankel and Rose we then merge in data on distance, population, common border, and landlockedness. The distance between countries is calculated using the Great Circle Formula and data on location from the CIA World Factbook. Distance between countries is expressed in miles to be in line with Frankel and Rose. The variables “common border” and “landlocked” are also constructed using data from the CIA World Factbook. Population is total population in

2004 (expressed in thousands) from WDI. The careful reader might point out that Frankel and Romer (1999) used data on labor force, although based on Table B1 and the data from Frankel and Rose (2002) we have to use data on population.

Finally, having constructed the complementary dataset of 184 countries, we use the parameter estimates from Table B1 and predict the log (bilateral) trade share. We then take the exponential of this to get the predicted (bilateral) trade share and sum over each country, which results in the predicted (total) trade share for each country.

The suitability of the constructed trade share is illustrated in Table B2, where *Log Constructed Trade* is related to *Log Trade*. Importantly, the effect from the *Log Const. Trade* is still significant while also controlling for *Log Area* and *Log Population*.

**Table B2:** Relation between Actual and Constructed Overall Trade Share

	Dependent Variable: Log Trade	
	(1)	(3)
Log Const. Trade	0.419*** (0.045)	0.258*** (0.077)
Log Area		-0.047 (0.030)
Log Pop		-0.014 (0.034)
Constant	0.581*** (0.085)	0.960*** (0.158)
Obs.	165	165
R-squared	0.312	0.350
F(trade)	85.67	11.14

Robust standard errors in (.). \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Since the instrument depends on the parameters of the bilateral trade equation, the standard errors in the tables including the constructed trade share should be adjusted. The variance-covariance matrix is estimated as the usual IV formula plus  $(\partial \hat{\mathbf{b}} / \partial \hat{\mathbf{a}}) \hat{\mathbf{\Omega}} (\partial \hat{\mathbf{b}} / \partial \hat{\mathbf{a}})'$ , where  $\hat{\mathbf{b}}$  is the vector of estimated coefficients from the cross country institutions regression,  $\hat{\mathbf{a}}$  is the vector of estimated coefficients from the bilateral trade equation, and  $\hat{\mathbf{\Omega}}$  is the estimated variance-covariance matrix of  $\hat{\mathbf{a}}$  (see Frankel and Romer, 1999: 387n). Solving numerically, this translates into a very small change.



**Paper III**



# Same Same but Different? A Comparison of Institutional Models

Gustav Hansson\*  
University of Gothenburg

June 8, 2008

## Abstract

In the growing literature on the creation of institutions, the theories emphasizing colonial and legal origin, religious affiliation, Western European influence, and settler mortality, have been especially influential. The influence of these studies rests heavily on empirical modeling, which, since the theories are obviously closely related, might actually capture the same primary mechanism. It is therefore unclear whether the empirical relationships found are the same or if they are different. Therefore, this paper takes the empirical models seriously and discriminates amongst the existing models by using modeling selection criteria, tests of encompassing, and modeling selection.

**Keywords:** institutions, colonial origin, non-nested tests, modeling selection.

**JEL Codes:** N40, F54.

## 1. Introduction

Institutions have come to play an increasingly important role in economics, both as indicators and determinants of the wealth of nations. The importance of good institutions is by now a well-established finding (North, 1990; Knack and Keefer, 1995; Hall and Jones, 1999; Acemoglu et al., 2001; Lindner and Strulik, 2004). Consequently, the search to understand the creation of institutions is of great importance. The arguably most influential theories in this context emphasize the importance of legal origin and religion (La Porta et al., 1999), ethnic diversity and colonial origin (Mauro, 1995), Western European influence (Hall and Jones, 1999), and settler mortality (Acemoglu et al., 2001). One of the most prominent factors responsible for the large impact of these studies is that they to a large extent are motivated by empirical modeling. However, since

---

\*[gustav.hansson@economics.gu.se](mailto:gustav.hansson@economics.gu.se), Department of Economics, University of Gothenburg, Box 640, SE-40530 Göteborg, Sweden. I would like to thank Arne Bigsten, Dick Durevall, Anders Fredriksson, Annika Lindskog, Ola Olsson, Sven Tengstam, and seminar participants at the Nordic Conference in Development Economics 07 and at the University of Gothenburg for helpful comments. All errors are my own.



these theories are obviously related, the question is whether the empirical finding in one study is not actually capturing the mechanism portrayed in one of the other studies?

There is for example a large literature documenting that the identity of the colonial ruler has played an important part in the institutional and economic development of many countries (Grier, 1999; Bertocchi and Canova, 2002; Price; 2003, and Bernhard et al., 2004). Among other things, the colonial rulers transplanted their legal systems, religions, and languages. The empirical findings in La Porta et al. (1999) concerning legal origin and religious affiliation might therefore in fact indirectly capture the importance of colonial origin.

Hall and Jones (1999) emphasize the importance of Western European influence, measured by absolute latitude and the fraction speaking a European language. Acemoglu et al. (2001) argue instead that it is not the *extent* of Western European influence that matters, but rather the *type* of colonization strategy, proxied by settler mortality, that is. The mechanism proposed by Hall and Jones (1999) and Acemoglu et al. (2001) are both clearly related to a colonial origins effect, whereas their empirical findings might also to a large extent capture the same mechanism.

The proposed mechanisms of latitude, settler mortality, and colonial origin are obviously related and hard to disentangle. The validity and influence of these theories rest heavily on empirical findings, and might in fact capture the mechanism proposed by a competing theory. According to De Haan (2007) the reason why the literature is full of papers with conflicting results, is because of empirical modeling without a solid sensitivity analysis. Therefore, this paper takes the empirical models of La Porta et al. (1999), Mauro (1995), Hall and Jones (1999), and Acemoglu et al. (2001) seriously, in order to discriminate among existing models and to identify the model and variables that best explain the variation in institutional quality. The aim of this paper is thus to provide answers to the following questions: (i) Is there one model which explains more of the variation in institutional quality than the other models? (ii) Do these models capture the same information? And (iii), if we let the information pertained in the data decide, which combination of variables would be selected?

In order to discriminate among the empirical models, this paper conducts encompassing tests following Mizon and Richards (1986). The test of encompassing, sometimes referred to as a test of non-nested models, enables us to test whether a model A encompasses the information of a rival model B. The test also provides interesting information about the interrelationships between models, such as if the data is

compatible with both models, or simply if the models both contain a partial truth, indicating that we might benefit from searching for a new model. For example: legal origin and colonial origin do not seem to empirically capture the same information, neither in a sample of the world nor in a sample of former colonies. Religious affiliation on the other hand, is not significantly related to institutional performance if we control for either of legal origin, colonial origin, Western European influence, or settler mortality. The tests also show that the Hall and Jones model, with absolute latitude and language spoken, dominates all other models when using a strict selection rule and controlling for outliers. Interestingly, the Hall and Jones model is also preferred based on modeling selection criteria such as the adjusted R-square and the Akaike information criteria.

Since no single model strongly dominates all other models, it is interesting to try to construct an encompassing model that does. With the help of modeling selection methods such as backwards selection and the automated modeling selection algorithm PcGets associated with Hendry and Krolzig (1999, 2001), a new model specification is suggested. Interestingly, the selected specification contains a little of all models, with for example settler mortality and latitude alongside each other.

The econometric framework in this paper is similar to Bleaney and Nishiyama (2002), who use non-nested tests and modeling selection to discriminate among income growth models in a cross country setting. The method used in this paper is from Hendry and Krolzig (2001) which greatly improves the accuracy of the well-known methods implemented by Levine and Renelt (1992) and Sala-i-Martin (1997) in their search for robust determinants of economic growth. The paper is also related to Serra (2006), Islam and Montenegro (2002), Straub (2000), and Barro (1999) who empirically examine the determinants of different aspects of institutional quality, although the focus, variables, and empirical methods are vastly different.

The main contribution of this paper is that it is the only study, to my knowledge, that explicitly compares these institutional models using tests of encompassing, and modeling selection in order to answer the question whether these models capture the same mechanism or not. This exercise is done on samples representing the whole world, as well as former colonies. Out of the 20 pair-wise comparisons, only seven have been made before, yet, these seven comparisons are now based on different samples. For example, although the comparison between legal origin and religious affiliation has previously been investigated in La Porta et al. (1999), the number of countries is now larger, and interestingly, the result is different. The present study therefore gives new

information about the interrelationships among colonial and legal origin, religious affiliation, Western European influence, and settler mortality.

The paper is organized as follows: Section 2 shortly describes the theoretical background of the institutional models. Section 3 discusses data issues as well as presents regression results. Section 4 compares the empirical models by using tests of encompassing, and Section 5 forms an encompassing model based on modeling selection. Section 6 concludes the paper.

## **2. Theoretical Background**

### **2.1. Colonial Origin, Legal Origin, and Religion**

La Porta et al. (1999) propose two possible channels to explain the variation in institutional quality and governance across countries: the importance of legal origin and religious affiliation. Legal traditions are intended to capture the power of the State in relation to private property owners, and thus to indicate the degree of private property protection. According to La Porta et al. (1999) the Socialist legal tradition is created by the State in order to maintain ultimate control of the economy. The English legal tradition, on the other hand, partly developed as a defense against the attempts by the sovereign to regulate and expropriate property owners. English legal tradition is therefore predicted to be the least interventionist and the most efficient in protecting private property. The Socialist legal tradition is predicted to be the most interventionist and the least efficient. The French system also developed as a means for the sovereign to control economic life, although it is ranked slightly higher than the Socialist. Lastly, the German and Scandinavian systems are ranked higher than the French, but not as high as the English system.

Religious affiliation, or more specifically the proportion of the population adhering to a specific religion, is intended to proxy for cultural influences such as norms, values, and customs. Cultural influences are in line with Landes (1998) argued to be especially important in shaping institutions. La Porta et al. (1999) focus on the three most widespread religions: Catholicism, Protestantism, and Islam. Catholicism and Islam partly grew to support the State and are therefore seen as more interventionist. La Porta et al. (1999) therefore predict that Catholic and Muslim countries will exhibit inferior government performance compared to Protestant countries.

The different legal traditions developed in England, France, Germany, Scandinavia, and the Soviet Union and then spread across the world through conquest, colonization, or voluntary adoption. Legal origin is therefore not equivalent to colonial origin. Countries with a French legal origin consist for example of countries colonized by France, Spain, or Portugal, as well as countries that voluntarily adopted their legal tradition. The same reasoning goes for religions, which also spread across the world through conquest, colonization, or voluntary adoption. However, it is difficult to ignore the close connections among colonial origin, legal origin, and religion. In fact, legal origin and religion could be proxies for the institutions left behind by the colonial rulers.

There is a large literature documenting that the identities of the colonial rulers have played a large part in the institutional and economic development of countries (Mauro, 1995; Grier, 1999; Bertocchi and Canova, 2002; Price, 2003; Bernhard et al., 2004). Colonial rulers had vastly different strategies of how their colonies should be managed. The British colonies were for example generally much more decentralized than the French and Spanish colonies. According to Grier (1999), the decentralized rule in the British colonies not only allowed local governments to develop; it also resulted in an educational system constructed to be integrated with the native culture. This is in stark contrast to the French who implemented a very strict centralized form of rule which also alienated the indigenous population, not only from their own native culture but also from their fellow Frenchmen. Other major differences involved trade restrictions. The British colonies experienced mostly free trade, while the French and the Spanish were very restrictive. The Spanish colonies were for example only allowed to trade with Spain (Grier, 1999). There are therefore strong historical indications that colonial heritage matters for the development of current day institutions.

La Porta et al. (1999) acknowledge that colonization might have integrated both religion and legal systems, but argue that by including religion and law as explanatory variables, the effect on institutions is measured directly instead of indirectly. Surprisingly, La Porta et al. (1999) did not check their results by controlling for colonial origin, both since a country does not have to be colonized to have a certain legal tradition and since colonial status is hard to measure. The use of data on colonial origin is, however, widespread (see, e.g., Mauro, 1995; Sala-i-Martin, 1997; Grier, 1999; Bertocchi and Canova, 2002; and Price, 2003). The results in La Porta et al. (1999) might therefore be driven by colonial origin and actually have very little to do with a specific legal system or religion.

## 2.2. Western European Influence and Settler Mortality

Instead of focusing on the identity of the colonizers, the specific religion, or legal system, Hall and Jones (1999) argue that it is simply the degree of Western European influence that matters. The degree of Western European influence is measured by the distance to the equator using absolute latitude degrees, and by the fraction of the population using English or a European language (English, French, German, Portuguese, or Spanish) as a first language today.<sup>1</sup> The reasoning behind using latitude is that Europeans were more likely to migrate to areas that were broadly similar in climate to Western Europe, and hence distant from the equator. Since Europe early developed well functioning institutions (e.g., property rights), countries subject to Western European influence were more likely to have a positive development of institutions.

Acemoglu et al. (2001) later added refinements to this reasoning with their measure of settler mortality. The main idea is that high settler mortality, measured as the mortality of bishops and soldiers during colonial days, should result in low European settlement intensity and therefore result in harmful extractive colonial institutions which have persisted to this day. Low settler mortality should, on the contrary, result in high European settlement and consequently beneficial institutions. The settler mortality measurement can therefore be interpreted as an actual estimate of Western European settlement and influence in colonial days.<sup>2</sup>

Acemoglu (2005) points out that the theories behind using latitude and settler mortality are different. Firstly, settler mortality is designed solely for former European colonies, while latitude is used for the entire world. Secondly, while Hall and Jones argue that the extent of European influence on institutional quality was generally positive, Acemoglu et al. (2001) argue that the European influence had vastly different effects depending on what the most attractive colonization strategy was. Acemoglu (2005) therefore argues that there is no reason for using latitude instead of settler mortality. Others, including Persson and Tabellini (2003) and Easterly and Levine (2003), argue that latitude and settler mortality operate by the same channel: where the mortality risk was

---

<sup>1</sup> The constructed trade share from Frankel and Romer (1999) was also included. This variable was most probably included since the measure for institutional quality, social infrastructure, was partly constructed by a measure for trade openness. The core variables to proxy for Western European influence were latitude, English, and European language spoken.

<sup>2</sup> It is important to note that both Western European influence and settler mortality are by Hall and Jones and Acemoglu et al. used as instruments for institutional quality in an income regression. As pointed out by Rodrik (2004), “An instrument does not a theory make.” Although this is true, both Western European influence and settler mortality are presented and interpreted as theories in the literature and are therefore treated as such in this paper as well.

low, as measured either directly by settler mortality or indirectly by latitude, Europeans settled and were therefore more likely to incorporate the institutional framework they were accustomed to from home. Clearly, both settler mortality and latitude measure some sort of geographical features. An important difference is instead that while settler mortality measures the extent of Western European influence in colonial days, latitude alongside language spoken today measures the extent of Western European influence in colonial and post-colonial days.

To sum up, we have described five highly influential theories of how institutions are created. Three of them argue that institutions are created dependent on the identity of the colonizer and what type of legal system and religion they incorporated, while the other two theories focus on the extent of Western European influence and settler mortality. Now which of these theories tell us the right story? The next section tries to answer this question by taking the empirical models seriously and compare the information contained in the data.

### **3. Data and Regression Specifications**

#### **3.1. Data**

The models by La Porta et al. (1999), Hall and Jones (1999) and Acemoglu et al. (2001) are all related to measures of property rights and expropriation risk. The dependent variable in Hall and Jones (1999) is “Social Infrastructure” and consists of measures of law and order, bureaucratic quality, corruption, risk of expropriation, government repudiation of contracts, and trade openness. Acemoglu et al. (2001) make use of one of these variables as their dependent variable: risk of expropriation.<sup>3</sup> La Porta et al. (1999) use a wide variety of measures for institutional quality where one of the most important is an index of property rights that captures the extent to which the government protects and enforces private property laws. The three measures (Property Rights, Social Infrastructure, and Expropriation Risk) are all highly related and have a specific focus on property rights and the protection from arbitrary expropriation.

For our analysis it is important to find a measure that captures all the attributes of the measures mentioned above, and at the same time being neutral in the sense that it does not a priori favor any of the models examined. The main dependent variable used in

---

<sup>3</sup> For more information on Social Infrastructure, Expropriation Risk and other institutional measures, see Hansson (2006).

this paper is a measure of Rule of Law from Kaufmann et al. (2005). Rule of Law is the concept that no individual is above the law, and is therefore a safeguard against arbitrary governance and expropriation. Rule of Law does therefore not only capture protection of property rights, but also measures the quality and efficiency of the police and court system, and whether everyone is equal before the law. By definition, Rule of Law is therefore not exactly the same as Expropriation Risk or Property Rights. However, Rule of Law by definition encompasses all the attributes of property rights and expropriation risk, and is therefore a highly suitable measure for our purposes. Not surprisingly, the correlations among Rule of Law, Property Rights, Social Infrastructure, and Expropriation Risk are very high, as can be seen in Table 1.

Concerning the explanatory variables, the original data from La Porta et al. (1999), Hall and Jones (1999), and Acemoglu et al. (2001) are used as far as possible. A detailed description of all the variables as well as descriptive statistics are presented in the appendix. The only variable that may deserve some further explanation here is the colonial origins data. Most of the previous literature starting with Barro (1999) and Sala-i-Martin (1997) uses the last official colonial power to proxy for colonial influence (with a dummy for former British colony, etc.). This paper therefore measures colonial origin by using the identity of the last ruler, with data from Sala-i-Martin (1997). Due to data limitations a few adjustments have been made, details of which are described in the appendix.

### 3.2. Regression Specifications

The baseline regression model, from which all regression specifications in this paper are based on, is directly inspired by a specification in La Porta et al. (1999) of the following form:

$$inst_i = \alpha + \beta(ethnic_i) + \mathbf{X}_i' \boldsymbol{\gamma} + \varepsilon_i, \quad (1)$$

where  $inst_i$  is our institutional measure Rule of Law,  $ethnic_i$  is the common control variable (ethnolinguistic fractionalization),  $\mathbf{X}_i$  is the vector with the variables under focus (legal origin or religious affiliation),  $\varepsilon_i$  is a random error, and  $i$  refers to country. For obvious reasons, the La Porta et al. (1999) models with legal origin (referred to as *LP1*) and religious affiliation (referred to as *LP2*) are going to be modeled this way also in this paper. For ease of comparability, the remaining models are specified in the same way. For example, the model with colonial origin includes *ethnic* as the common control

variable and the core model with dummies for *British*, *French*, *Spanish*, and *Other colonial origin*. To follow the La Porta et al. model set-up is especially suitable for our purposes, since it provides us with a minimum of control variables, where we instead of capturing differences in controls capture differences in the core models, which enables us to compare the models at an equal footing.

The colonial origins model with ethnic fractionalization directly resembles a model originally used by Mauro (1995), and will therefore be referred to as the *M*-model. Similarly, the Hall and Jones (1999) model will be referred to as the *HJ*-model, and the Acemoglu et al. (2001) model the *AJR*-model.

### 3.3. Results I

Tables 2 and 3 present the regression results. In Table 2, the models are estimated with all possible data available, resulting in four slightly different samples representing the whole world, and a fifth that only consists of former colonies (*AJR*).

All coefficients have the expected sign and magnitude. For ease of interpretation, the dependent variable Rule of Law is scaled to take a value between 0 and 100, where a high number indicates a high degree of Rule of Law. For example, having a *Socialist legal origin* is associated with a 17.70 percentage point lower Rule of Law compared to a country with *English legal origin*. Examining the adjusted R-squares, the *HJ*-model explains most of the variation in Rule of Law.

Because the samples in Table 2 are slightly different from each other, it would be interesting to compare the models when the sample of countries is the same. Table 3 restricts the regressions to the same sample, which also translates into a sample consisting only of former colonies. Since the five models are all related to a colonial origin story, the examination of this sample is perhaps the most interesting.<sup>4</sup>

In the colony sample, the *LP1*-model now only consists of *English*, *Socialist*, and *French legal origin*. The coefficients for *Socialist* and *French legal origin* have doubled, although their confidence intervals overlap with their respective confidence intervals in Table 2.<sup>5</sup> The coefficients for *Muslim* and *Other religions* are not individually significant, but jointly significant at the 10% level ( $p$ -value=0.07). Probably the most interesting result in Table 3 is that the adjusted R-square and the Akaike Information Criterion (AIC) single out the *HJ*-model as explaining most of the variation in Rule of Law.

---

<sup>4</sup> This sample is presented in Table A2 in the appendix.

<sup>5</sup> For Socialist legal origin in Table 2, the 95% confidence interval is [-7.04; -28.36], and in Table 3 [-25.59; -44.45].



To summarize: the results in Tables 2 and 3 indicate that all five models, except the *LP2*-model, explain a large fraction of the variation in Rule of Law. The *HJ*-model explains most of the variation in Rule of Law both for the whole world and for former colonies. These results, however, tell us nothing about whether the models capture the same information. Comparing the five models based on the information they possess is therefore the topic of the next section.

## 4. Comparing Models

### 4.1. Tests of Encompassing

This section compares the five models with the help of tests of encompassing associated with Mizon and Richard (1986), sometimes also referred to as tests of non-nested models. Simply put, a model A is said to encompass model B (denoted  $M_A \varepsilon M_B$ )<sup>6</sup> if model A contains the information of model B, or as Hendry (1995:501) explains: “Encompassing seeks to resolve the proliferation of rival models by requiring any given model to account for, or to explain, the results obtained by other models.”

To test whether model A encompasses model B, one simply forms the non-redundant joint model of A and B, and performs the *F*-test for A being a valid reduction of the joint model. For example, if we were to form the non-redundant joint model of *LP1* (with legal origin) and *LP2* (with religion), we would get:

$$inst_i = \alpha + \beta(ethnic_i) + \mathbf{X}_i'\boldsymbol{\gamma} + \mathbf{Y}_i'\boldsymbol{\eta} + \varepsilon_i, \quad (2)$$

where  $\mathbf{X}_i$  is the vector with the legal origin variables and  $\mathbf{Y}_i$  is the vector with the religious affiliation variables. Then, if  $\boldsymbol{\eta}$  is found not to be significantly different from zero by the usual *F*-test, *LP1* is said to encompass *LP2*. Recall that the *F*-statistic can be written as a function of the R-square of the unrestricted model (equation 2) and the restricted model (equation 1). The test can therefore be interpreted as whether or not *LP2* contributes to *LP1*.

---

<sup>6</sup> Then notation for encompassing ( $\varepsilon$ ) should not be confused with the notation for subset ( $\subseteq$ ). If  $M_A \subseteq M_B$ , then naturally  $M_B \varepsilon M_A$ , but it could also be the case that  $M_A \varepsilon M_B$  so-called “parsimonious encompassing.” In modeling selection it is the notion of parsimonious encompassing that enables us to go from a general model to a specific model. See Hendry (1995:511).

Obviously, the testing procedure can result in four possible outcomes: Case 1 when model A encompasses model B, but model B does not encompass model A (denoted  $M_A \varepsilon M_B$  and  $M_B \not\varepsilon M_A$ ). We will interpret this as model A “dominates” model B, (denoted  $M_A d M_B$ ). Similarly, Case 2 is when model B “dominates” model A.

Case 3 is when model A encompasses model B, and model B encompasses model A ( $M_A \varepsilon M_B$  and  $M_B \varepsilon M_A$ ). It is here not possible to discriminate between the two models. Model A contains the information of model B, and B contains the information of model A. This can be interpreted as if models A and B are “approximately equivalent” (and will be denoted  $M_A \approx M_B$ ).

The fourth case is when model A does not encompass model B, and B does not encompass A ( $M_A \not\varepsilon M_B$  and  $M_B \not\varepsilon M_A$ ). It is not possible here either to discriminate between the two models. This is interpreted as that the two models A and B are “different” (denoted here as  $M_A \neq M_B$ ), and therefore, both explain a partial truth and are complimentary to each other.

It is important to remember that for the inference to be valid, the joint model in (2) must fulfill the assumptions of the classical linear regression model as well as normality of the errors.<sup>7</sup> To test for model adequacy, White’s test for heteroscedasticity and the Shapiro-Wilks test for normality of the residuals are used ( $\alpha=0.05$ ). If the White test rejects the null of homoscedasticity, then the robust Wald test is used instead. The White test does not rely on the normality assumption, and the  $F$ -test as well as the Wald test are asymptotically valid regardless of the normality assumption.<sup>8</sup> However, if any of the model assumptions are not fulfilled we will try to assess why and adjust for it accordingly.

An alternative test of non-nested models is the  $J$ -test associated with Davidson and Mackinnon (1981). It comes with the problem of only being valid asymptotically. In small samples, it tends to reject the null hypothesis more frequently than it should, and conclude that the models are different when they really are not (Baltagi, 1998:209). The  $F$ -test is still valid, and therefore preferable for our analysis. It is also intuitively appealing and resembles what researchers actually do when they check the robustness of their main results while controlling for other factors. The encompassing  $F$ -test is also the preferred test used in sophisticated modeling selection algorithms such as Hoover and Perez (2004) and PcGets associated with Hendry and Krolzig (1999, 2001).

---

<sup>7</sup> This is the notion of congruence, see Hendry (1995:511) or Hendry and Krolzig (2001:135). A formal definition of congruence can be found in Hendry (1995:465).

<sup>8</sup> See for example Gujarati (2004:413, 280) and Amemiya (1985:144).

## 4.2. Results II: Tests of Encompassing

Table 4 presents the first set of results of the encompassing tests. For all model comparisons, the sample of countries is a representation of the whole world, except those that involve the *AJR*-model, which is confined only to former colonies. In several of the comparisons, the homoscedasticity and/or normality requirements are not met. The notation (N) indicates when the normality assumption is not met, and (R) indicates that the homoscedasticity assumption is not met and the robust Wald-test is used instead. In trying to assess why the model requirements are not met, country dummies are included for countries where the absolute studentized residual is larger than or equal to 2.5.<sup>9</sup> This correction usually takes care of the problem, and the conclusion reached in Table 4 remains the same. Most of the time, the countries that are singled out are Singapore, Hong Kong, and Malaysia. These countries are often singled out as outliers in cross-country studies.

For almost all model comparisons, the tests rule that models they are “different” ( $\neq$ ), where both models each explain a partial truth. Interesting to note is that *LP1* and *LP2* are here termed as different. This is in contrast to La Porta et al. (1999) who find the legal origin variables to be significantly related to property rights, while the effect from the religious variables is insignificant. A difference that could possibly help explain this is that the regression in La Porta et al. has a sample size of 124 countries, while the sample size in Table 4 is 150.<sup>10</sup>

The comparisons between *AJR* and *LP1* and between *AJR* and *M*, are partially already covered in Acemoglu et al. (2001) as part of their robustness check. The results in Acemoglu et al. and the results in this paper is the same, although their base sample is slightly different compared to ours. Acemoglu et al. also control for religion, but although we are informed that log settler mortality is significant, we are not told what happens to religion. Table 4, shows that religious affiliation has no explanatory power when log settler mortality is included.

Regarding the *HJ*-model, Acemoglu et al. do include latitude as a control variable. However, it is important to note that they do not include the full *HJ*-model with *English* and *European Language*, and they therefore do not compare the significance of *Log Settler Mortality* to the full *HJ*-model. Including both these models together as in Table 4 gives

---

<sup>9</sup> The studentized residual for an observation can be interpreted as the *t*-statistic of including a dummy for that observation in the regression (Belsley, Kuh, and Welsch, 1980). The studentized residual is therefore useful in identifying outliers that do not appear to be consistent with the rest of the data.

<sup>10</sup> See La Porta et al. (1999) Table 6 with property rights as the dependent variable.

us a regression where neither the homoscedasticity nor the normality requirements are fulfilled. The robust Wald-test finds these two models to be “different.” Controlling for Singapore and Hong Kong, as indicated by the studentized residuals, the requirements are fulfilled and the models are still different. Controlling for Malaysia, as indicated by the partial scatter plot in Figure 1, *HJ* is found to dominate *AJR*. Using *Expropriation Risk* as the dependent variable, the *HJ* model is again found to dominate *AJR* when controlling for Singapore, Hong Kong, and Malaysia.<sup>11</sup>

In Table 5, all model comparisons are done with the former colonies sample. The model comparisons involving *AJR* are thus very much the same as in Table 4. *LP1* and *M* are still “different.” Legal origin does therefore not simply capture a colonial origin, even in a sample of former colonies. Regarding *LP2*, this model is “dominated” by either of *LP1*, *M*, or *AJR*. Concerning the difference between *HJ* and *LP2*, the joint model fails to satisfy the normality assumption, and the *F*-test indicates that the models are “different.” Controlling for the countries with large absolute studentized residuals (Singapore and Hong Kong) takes away the problem; now *HJ* “dominates” *LP2*. For a sample of former colonies, the *LP2*-model with religious affiliation therefore seems to be dominated by all other models.

In the comparisons involving the *HJ*-model, the homoscedasticity and normality requirements are usually not fulfilled. Comparing *HJ* with *LP1*, the robust Wald-test determines that they are “different.” Controlling for Singapore and Hong Kong satisfies the model requirements, and the *F*-test determines that *HJ* “dominates” *LP1* at the 5% level but that they are “different” at the 10% level. The same goes for *HJ* and *M*: control for Singapore and Hong Kong and the requirements are fulfilled, where *HJ* and *M* are different at the 10% level but where *HJ* dominates *M* at the 5% level.

To conclude, if we choose to have a strict selection rule at the 5% significance level and controlling for outliers, there is some evidence that the *HJ*-model dominates all other models in a sample of former colonies. If instead a more lenient approach is chosen with a 10% significance level, then no single model dominates all other models. This last approach is probably the most reasonable, especially since the model requirements are not met in six out of the ten comparisons in Table 4. That the regression models in Tables 4 and 5, as well as in Tables 2 and 3, often fail to meet the homoscedasticity and/or normality assumptions indicates that there might be something wrong with the model specification. Therefore, the fact that the model comparisons are not able to

---

<sup>11</sup> This is also true by using the same base sample as in Acemoglu et al. (2001) (excluding Vietnam due to data limitation).

clearly decide on a dominating model, and that the model requirements are violated so frequently, indicate that we might benefit from forming an encompassing model that captures the information of all models. The selection of such a model is the topic of the next section.

## 5. Modeling Selection

### 5.1. Can Modeling Selection Help?

Modeling selection is an interesting complement to deductive learning and guides us towards thinking in new directions. Trying to form a model that encompasses the information of all five models, modeling selection provides us with an interesting alternative based on the information contained in the data. The modeling selection literature can basically be divided into two main branches: Bayesian Modeling Averaging (BMA) and classical modeling selection such as general-to-specific. According to Hendry and Reade (2005), modeling averaging performs poorly when dummy variables are present in the model. The focus in this paper is therefore on classical modeling selection methods.

Probably the best known modeling selection method is backwards selection. It starts with a *general* model where the variable associated with the lowest  $t$ -value is excluded. The regression is then estimated again, and the next variable associated with the lowest  $t$ -value is excluded. This is repeated in a stepwise manner until a *specific* model is reached where all the remaining variables have statistically significant coefficients. Due to its familiarity and simplicity, backwards selection is one of two methods used in this paper.

Two other methods that have received a lot of attention in the literature are those proposed by Levine and Renelt (1992) and Sala-i-Martin (1997), who search for robust correlates to income growth in a cross country setting. While the method in Levine and Renelt (1992) is criticized for being too strict (De Haan, 2007), the method in Sala-i-Martin (1997) is argued to be too slack (Hoover and Perez, 2004). Hendry and Krolzig (2001) therefore suggest a general-to-specific modeling selection method called PcGets that is somewhere in-between, not too strict and not too loose. The algorithm rests heavily on the theory of reduction and encompassing (see e.g., Hendry, 1995). In brief the algorithm reduces the “general” model from “top to bottom” (similar to backwards

selection) as well as from the “bottom and up” eliminating variables individually as well as in blocks. Using multiple paths, the algorithm can suggest several specifications that are selected amongst using test of encompassing. The final selected model encompasses the information of all models as well as the general model. The performance of PcGets is well documented (see, e.g., Hendry and Krolzig, 1999, 2001, 2005, and Owen, 2002), and is probably the most respected automated modeling selection method on the market today. PcGets is the second modeling selection method used in this paper.

## 5.2. Results III: Modeling Selection

The results from backwards selection and PcGets are presented in Table 6. The analysis is here restricted to the former colonies sample and all models (*LP1*, *LP2*, *M*, *HJ*, *AJR*) are included in the “general model” from which the selection begins.

Column 1 presents the specific equation from the backwards selection method. This regression consists of one especially obvious outlier: Singapore.<sup>12</sup> If we single out the countries where the absolute value of the studentized residual is greater than or equal to 2.5 in the general model, we are left with only Singapore. Column 2 therefore presents the specific equation from backwards selection while also controlling for Singapore, and reassuringly, this is the same equation as in Column 1. Finally, Column 3 presents the selected equation from PcGets. PcGets is here set to the default settings for a cross section, which automatically controls for outliers.<sup>13</sup> Reassuringly, PcGets selects the same set of variables as backwards selection as well as controlling for Singapore.

As a first observation, it is interesting to note that the selected equation consists of a little of all models: *Socialist legal origin* (from *LP1*), *Other religions* (from *LP2*), *Former Spanish colony*, and *Other colonial origin* (from *M*), *Latitude* and *European language* (from *HJ*), and *Log Settler Mortality* (from *AJR*).

The *Socialist legal origin* dummy exerts a significant negative effect, and is actually a dummy for Laos and Myanmar. There are at least three ways to interpret this: Either we still have a legal origins effect, but it is only *Socialist legal origin* that is important, or, this as a pure Socialism effect which has very little to do with different legal codes. Alternatively, since the dummy is only equal to one for Laos and Myanmar, we are capturing mainly noise.

---

<sup>12</sup> This specification is also heteroscedastic; thus robust standard errors are used. In all the previous stages, all specifications were homoscedastic.

<sup>13</sup> PcGets version 1.0. Default settings for a cross section with the outlier correction set to 2.56. The “Liberal strategy” with outlier correction gives the same result.

The *Former Spanish colony* dummy exerts a negative effect on Rule of Law. This variable translates into almost the same as a dummy for Latin America. A Latin America dummy is often included in cross country growth regressions, which makes one wonder if the significant effect from *Former Spanish colony* is actually a Latin America effect, or vice versa. Another possibility is that it is a time effect since the Latin American countries were colonized early.

That both *Other colonial origin* and *Other religions* are selected is interesting. Usually, the contents of these “other” groups are not viewed as very important, which is the reason why they are bundled together. The fact that they are selected here begs to differ. *Other colonial origins* include former Portuguese, Belgian, and Dutch colonies. Among these, the Democratic Republic of the Congo (former Belgian colony) and Guinea-Bissau (former Portuguese colony) are both countries with relatively low values of Rule of Law.<sup>14</sup> *Other religions* consists of the share of the population who adhere to Hinduism, Buddhism, Chinese folk religions, different local tribe religions, and minor religions.

If we replace *Other colonial origin* and *Other religions* with their disaggregated groupings in column 2 in Table 6 and run the regression again, the coefficients for *Former Portuguese colony* and *Chinese folk religion* are statistically significant (see Table A3 in the appendix). The effects from *Other religions* thus seem to be driven mainly by Asian countries where a large part of the population are adherent to Chinese folk religions. This finding also helps explain why in Table 5 the LP2-model with religion was dominated by all other models *only* when also controlling for outliers, which were all Asian countries. Besides, starting from the general model where all models are included, the conditional information set is both richer and different; therefore the results are also slightly different.

Probably the most interesting result in Table 6 is that *Log Settler Mortality* is selected alongside *Latitude* and *European language*. The modeling selection did therefore not decide in favor of the AJR- or HJ-model, but instead simply that these two models are complementary to each other. The significant effect from *Log Settler Mortality* is here not sensitive to Singapore, Hong Kong and Malaysia, as it was in Table 5.

There are at least two ways to interpret why both the HJ- and AJR-model are selected: A skeptic interpretation would be that *Latitude* and *Settler Mortality* capture the same mechanism. While *Latitude* is an objective measure, *Settler Mortality* is subjectively constructed, and the accuracy of the construction is heavily questioned by Albouy (2006).

---

<sup>14</sup> The other former colonies of this group are Angola and Brazil (former Portuguese colonies), Burundi, and Rwanda (former Belgian colonies), Indonesia, and Suriname (former Dutch colonies).

Preferably, *Settler Mortality* should therefore be dropped from the regression. A more constructive interpretation would instead accept both measures and realize that the two models are complementary. While *Settler Mortality* captures the extent of Western European influence in colonial days, *Latitude* and *European language* capture the degree of Western European influence in colonial *and* post-colonial days. With this interpretation, it seems natural that the *AJR*- and *HJ*-model are entered alongside each other.

All in all, the selected specification makes intuitive sense and points mainly towards a Western European influence story, as well as captures the heterogeneous nature that exists across countries.

### 5.3. Additional Results

It is important to point out that the models examined are designed to explain the variation in Rule of Law and property rights. The results concerning other types of institutional quality could therefore be different. Moreover, there could be other variables than those considered here that are important to institutional quality.

Table 7 presents some additional results using PcGets with three different aspects of institutional quality. In column 1 the dependent variable is Legal Systems & Property Rights from the Fraser Institute's index for economic freedom. This variable is similar to Rule of Law and the results can therefore be viewed as a robustness check of the previous results. Reassuringly, the specification is the same as with Rule of Law in Table 6, except the inclusion of Singapore as an outlier.

In Table 7, column 2, the dependent variable is Political Rights<sup>15</sup> from the Freedom House organization, and in column 3 the dependent variable is the Corruption Perception Index from Transparency International. The selected specifications for these dependent variables are somewhat different to the specification with Rule of Law or Property Rights. Firstly, *Latitude* and *European language fraction* are present both in columns 2 and 3, whereas *Log Settler Mortality* is only present in column 3. The Western European influence effect thus still seems to play an important role. The same goes for *Socialist Legal Origin* which is included in all models. The difference instead lay in that the models with Corruption and Political Rights both include *Catholic* and *Muslim*. This can be interpreted as while the measure for Rule of Law is heavily influenced by formal rules, the measures of Corruption and Political Rights are perhaps more influenced by informal rules such norms and values. The measures for *Catholic* and *Muslim* could thus proxy for

---

<sup>15</sup> The original score is reversed (8-score) in order for a high value to mean higher level of political rights, in accordance with the other dependent variables.



informal rules, and could therefore be the reason for why these variables are selected for Corruption and Political Rights.

## 6. Conclusions

In the growing empirical literature on the creation of institutions, the importance of legal origin and religious affiliation (La Porta et al., 1999), ethnic diversity and colonial origin (Mauro, 1995), Western European influence (Hall and Jones, 1999), and settler mortality (Acemoglu et al., 2001) have been especially influential. The validity and influence of these theories rest heavily on empirical findings, which, due to the similarity across theories, might in fact capture the mechanism proposed by a competing theory. Therefore, this paper takes the empirical models seriously in order to discriminate among the existing models and to identify the model and variables that best explain the variation in institutional quality. There are four main conclusions:

(1) Modeling selection criteria such as the adjusted R-square and the Akaike information criteria singles out the Hall and Jones (1999) model with latitude, English language, and European language explaining most of the variation in Rule of Law.

(2) In samples representing the whole world, tests of encompassing indicate that no single model dominates and thereby solely captures the information of all other models.

(3) Although no single model clearly dominates all other models, the encompassing tests point to interesting interrelationships. For example, legal origin and colonial origin do not seem to capture the same information, even in a sample of former colonies.

(4) Using the modeling selection methods backwards selection and PcGets gives a regression specification that contains a little of all models. The results, however, mainly points towards a Western European influence story with Latitude and Settler Mortality entered alongside each other. This can be interpreted as while Settler Mortality captures the extent of Western European influence in colonial days, Latitude and European language capture the degree of Western Europe influence in colonial *and* post-colonial days.

## References

- Acemoglu, Daron. (2005) "Constitutions, Politics, and Economics: A Review Essay on Persson and Tabellini's The Economic Effects of Constitutions" *Journal of Economic Literature*, Vol. 43(4): 1025-1048.
- Acemoglu, Daron, Simon Johnson and James A. Robinson. (2001) "The Colonial Origins of Comparative Development: An Empirical Investigation" *American Economic Review*, Vol. 91(5): 1369-1401.
- Albouy, David. (2006) "The Colonial Origins of Comparative Development: An Investigation of the Settler Mortality Data" Center for International and Development Economic Research, University of California, Berkeley. Paper C04-138.  
< <http://repositories.cdlib.org/iber/cider/C04-138>>
- Amemiya, Takeshi. (1985) *Advanced Econometrics*. Cambridge, Mass: Harvard University Press.
- Baltagi, Badi H. (1998) *Econometrics*. New York: Springer.
- Barrett, David B., ed. (1982) *World Christian Encyclopedia: A Comparative Study of Churches and Religions in the Modern World, AD 1900-2000*. New York: Oxford University Press.
- Barro, Robert J. (1999) "Determinants of Democracy" *Journal of Political Economy* Vol. 107(6): S518-S183.
- Belsley, David A., Kuh, Edwin, and Roy E. Welsch. (1980) *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*. New York: John Wiley & Sons.
- Bernhard, Michael., Christopher Reenock, and Timothy Nordstrom. (2004) "The Legacy of Western Overseas Colonialism on Democratic Survival" *International Studies Quarterly*, Vol. 48: 225-250.
- Bertocchi, Grazilla, and Fabio Canova. (2002) "Did colonization matter for growth? An empirical exploration into the historical causes of Africa's underdevelopment" *European Economic Review*, Vol. 46: 1851-1871.
- Bleaney, Michael, and Akira Nishiyama. (2002) "Explaining growth: a contest between models" *Journal of Economic Growth*, Vol. 7: 43-56.
- Davidson, Russell, and James G. MacKinnon. (1981) "Several tests for model specification in the presence of alternative hypotheses" *Econometrica*, Vol. 49(3): 781-793.
- De Haan, Jakob. (2007) "Political institutions and economic growth reconsidered – Presidential address for the European Public Choice Society conference, Turku, April 2006" *Public Choice*. Vol. 131: 281-292.
- Easterly, William, and Ross Levine. (1997) "Africa's Growth Tragedy: Policies and Ethnic Divisions" *Quarterly Journal of Economics*, Vol. 112(4): 1203-1250.

Easterly, William, and Ross Levine. (2003) "Tropics, germs, and crops: how endowments influence economic development" *Journal of Monetary Economics*, Vol. 50(1): 3-39.

Frankel, Jeffrey A, and David Romer. (1999) "Does Trade Cause Growth?" *American Economic Review*, Vol. 89(3):379-399.

Glaeser, Edward L., Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer. (2004) "Do Institutions Cause Growth?" *Journal of Economic Growth*, Vol. 9(3): 271-303.

Grier, Robin. (1999) "Colonial legacies and economic growth" *Public Choice*, Vol. 98: 317-335.

Gujarati, Damodar N. (2003) *Basic Econometrics 4<sup>th</sup> International Edition*. New York: McGraw-Hill.

Hall, Robert E. and Charles I. Jones. (1999) "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" *Quarterly Journal of Economics*, Vol. 114 (1):83-116.

Hansson, Gustav. (2006) "Institutions and their Measures: A Black Box of Goodies" Göteborg University, Working Papers in Economics No. 206.  
<http://swopec.hhs.se/gunwpe/abs/gunwpe0206.htm>

Hendry, David F. (1995) *Dynamic Econometrics*. Oxford: Oxford University Press.

Hendry, David F, and Hans-Martin Krolzig. (1999) "Improving on 'Data mining reconsidered' by K.D. Hoover and S.J. Perez" *Econometrics Journal*, Vol. 2: 202–219.

Hendry, David F, and Hans-Martin Krolzig. (2001) *Automatic Econometric Model Selection*. London: Timberlake Consultants Press.  
<http://www.pcgive.com/pcgets/index.html>

Hendry, David F. and Hans-Martin Krolzig. (2005) "The properties of automatic gets modelling" *Economic Journal*, Vol. 115: C32–C61

Hendry, David F, and J. James Reade. (2005) "Problems in Model Averaging with Dummy Variables" Paper presented at Model Evaluation in Macroeconomics Workshop, University of Oslo, 6-7<sup>th</sup> of May 2006  
[http://folk.uio.no/rnymoen/Evalwork\\_ModAver.pdp](http://folk.uio.no/rnymoen/Evalwork_ModAver.pdp) retrieved February 9, 2006.

Hoover, Kevin D., and Stephen J. Perez. (2004) "Truth and Robustness in Cross-country Growth Regression" *Oxford Bulletin of Economics and Statistics*, Vol. 66(5):765-798.

Islam, Roumeen and Claudio E. Monenegro. (2002) "What Determines the Quality of Institutions" World Bank Policy Research Working Paper No. 2764.

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi. (2005) "Governance Matters IV: Governance Indicators for 1996-2004" World Bank Policy Research Working Paper 3630.

- Knack, Stephen and Philip Keefer. (1995) "Institutions and Economic Performance: Cross-Country Tests using Alternative Institutional Measures" *Economics and Politics*, Vol. 7: 207-227.
- Landes, David. (1998) *The Wealth and Poverty of Nations*. New York: W.W. Norton.
- La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer and Robert Vishny. (1999) "The Quality of Government" *Journal of Law, Economics, & Organization*, Vol. 15 (1): 222-279.
- Levine, Ross and David Renelt. (1992) "A Sensitivity Analysis of Cross-Country Growth Regressions" *American Economic Review*, Vol. 82(4): 942-963.
- Lindner, Ines and Holger Strulik. (2004) "Why not Africa? – Growth and welfare effects of secure property rights" *Public Choice*, Vol. 120: 143-67.
- Mauro, Paolo. (1995) "Corruption and Growth" *Quarterly Journal of Economics*, Vol. 110(3): 681-712.
- Mizon, Grayham H. and Jean-Francois Richard. (1986) "The Encompassing Principle and its Application to Testing Non-Nested Hypotheses" *Econometrica*, Vol. 54(3): 657-678.
- North, Douglass C. (1990) *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
- Owen, P. Dorian. (2002) "General-to-Specific Modelling Using PcGets" University of Otago Economic Discussion Papers No. 0213.
- Persson, Torsten and Guido Tabellini. (2003) *The economic effects of constitutions*. Cambridge: The MIT Press.
- Price, Gregory N. (2003) "Economic Growth in a Cross-section of Nonindustrial Countries: Does Colonial Heritage Matter for Africa?" *Review of Development Economics*, Vol. 7(3): 478-495.
- Rodrik, Dani. (2004) "Getting Institutions Right" CESifo DICE Report. <<http://www.ifo-institut.de/pls/guestci/download/CESifo%20DICE%20Report%202004/CESifo%20DICE%20Report%202/2004/dicereport204-forum2.pdf>>
- Sala-i-Martin, Xavier X. (1997) "I just ran four million regressions" NBER Working Paper No. 6252.
- Serra, Danila. (2006) "Empirical determinants of corruption: A sensitivity analysis" *Public Choice*. Vol. 126: 225-56.
- Straub, Stéphane. (2000) "Empirical Determinants of Good Institutions: Do We Know Anything?" Inter-American Development Bank Research department Working Paper No. 423.

Teorell, Jan, Sören Holmberg & Bo Rothstein. 2006. The Quality of Government Dataset, version 15Nov06. Göteborg University: The Quality of Government Institute, <http://www.qog.pol.gu.se>

**Table 1: Correlation of Institutional Measures**

	Property Rights Index (La Porta et al.)	Social Infrastructure (Hall and Jones)	Expropriation Risk (Acemoglu et al.)
Rule of Law	0.8244	0.8320	0.8084
Obs.	149	125	129
p-value	0.0000	0.0000	0.0000

Notes: Pearson correlation coefficients. Rule of Law for the year 1998 (Kaufmann et al., 2005). Property Rights 1997 (La Porta et al., 1999), Social Infrastructure 1986-1995 (Hall and Jones, 1999), and Expropriation Risk 1982-1997 (Acemoglu et al., 2001). See Data Appendix for more information.

**Table 2: Institutional Models (Different Samples)**  
 Dependent variable: Rule of Law

	(1) LP1	(2) LP2	(3) M	(4) HJ	(5) AJR
Constant	58.57*** [4.27]	Constant 76.39*** [8.66]	Constant 76.43*** [3.66]	Constant 18.10*** (4.30)	Constant 89.20*** [9.98]
Ethnic	-25.79*** [5.33]	Ethnic -27.77*** [5.22]	Ethnic -24.40*** [6.08]	Ethnic 3.73 (5.54)	Ethnic -9.35* [5.60]
Socialist legal origin	-17.70*** [5.40]	Catholic -23.47** [9.60]	Former British colony -17.91*** [5.58]	Latitude 95.99*** (8.93)	Log Settler Mortality -9.56*** [2.06]
French legal origin	-9.05** [3.71]	Muslim -32.49*** [8.80]	Former Spanish colony -30.66*** [5.11]	English Language frac. 10.04* (5.91)	
German legal origin	28.48*** [6.82]	Other religions -19.27* [10.28]	Former French colony -31.99*** [5.50]	European language frac. 11.91*** (4.31)	
Scandinavian legal origin	35.52*** [4.14]		Other colonial origin -36.38*** [6.94]		
Obs.	150	150	129	138	78
Adj. R <sup>2</sup>	0.351	0.214	0.429	0.565	0.376

Notes: Standard errors in ( ), robust standard errors in [ ]. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Dependent variable Rule of Law 1998 is between 0 and 100, where a high number means a high degree of Rule of Law. For *LP1* the omitted group is English legal origin, for *LP2* the omitted group is Protestant.

**Table 3: Institutional Models (Colony Sample)**  
 Dependent variable: Rule of Law

	(1) LP1	(2) LP2	(3) M	(4) HJ	(5) ΔJR
Constant	64.33*** [5.85]	Constant 71.32*** [16.81]	Constant 62.37*** [5.79]	Constant 23.34*** (6.24)	Constant 89.23*** [9.94]
Ethnic	-26.54*** [6.26]	Ethnic -29.11*** [7.50]	Ethnic -24.08*** [6.42]	Ethnic 1.95 (7.88)	Ethnic -10.09* [5.65]
Socialist legal origin	-35.02*** [4.73]	Catholic -29.39* [16.82]	Former Spanish colony -16.67*** [5.73]	Latitude 62.18*** (16.79)	Log Settler Mortality -9.46*** [2.06]
French legal origin	-18.78*** [4.66]	Muslim -23.07 [15.40]	Former French colony -17.46*** [4.61]	English Language frac. 22.95*** (7.74)	
		Other religions -6.61 [21.21]	Other colonial origin -29.15*** [5.32]	European language frac. 9.74 (6.49)	
Obs.	77	77	77	77	77
Adj. R <sup>2</sup>	0.320	0.189	0.332	0.406	0.379
AIC	658.44	672.97	658.06	649.03	650.57

Notes: Standard errors in ( ), robust standard errors in [ ]. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. AIC=Akaike Information Criterion. Dependent variable Rule of Law 1998 is between 0 and 100, where a high number means a high degree of Rule of Law. For *LP1* the omitted group is English legal origin, for *LP2* the omitted group is Protestant. For *M*, which now consists of only former colonies, the omitted group is former British colonies. In Column (2), Muslim and Other religions are jointly significant at the 10% level.



**Table 4: Encompassing Tests (different samples)**

	LP1	LP2	M	HJ
LP2	LP1 $\neq$ LP2 n=150 (N)	-		
M	M $\neq$ LP1 n=129 (R)	M $\neq$ LP2 n=129	-	
HJ	HJ $\neq$ LP1 n=138 (N)	HJ $\neq$ LP2 n=138 (N)	HJ $\neq$ M n=127 (N)	-
AJR	AJR $\neq$ LP1 n=78	AJR $d$ LP2 n=78	AJR $\neq$ M n=78 (R)	AJR $\neq$ HJ n=77 (R, N)

Notes: Test of encompassing (F-test,  $\alpha=0.05$ ).

$M_A \varepsilon M_B$  and  $M_B \varepsilon M_A$  are denoted  $M_A d M_B$  ( $M_A$  dominates  $M_B$ ).

$M_A \varepsilon M_B$  and  $M_B \varepsilon M_A$  are denoted  $M_A \approx M_B$  ( $M_A$  is approx. equivalent to  $M_B$ ).

$M_A \varepsilon M_B$  and  $M_B \varepsilon M_A$  are denoted  $M_A \neq M_B$  ( $M_A$  is different from  $M_B$ ).

(R) indicates that White's test rejects the null of homoscedasticity ( $\alpha=0.05$ ), and the robust Wald-test is used instead. (N) indicates that the Shapiro Wilks test rejects the null of normality ( $\alpha=0.05$ ). See text for further information.

**Table 5: Encompassing Tests (Colony sample, n=77)**

	LP1	LP2	M	HJ
LP2	LP1 $d$ LP2	-		
M	M $\neq$ LP1 (R)	M $d$ LP2	-	
HJ	HJ $\neq$ LP1 (R, N)	HJ $\neq$ LP2 (N)	HJ $\neq$ M (N)	-
AJR	AJR $\neq$ LP1	AJR $d$ LP2	AJR $\neq$ M (R)	AJR $\neq$ HJ (R, N)

Notes: Test of encompassing (F-test,  $\alpha=0.05$ ).

$M_A \varepsilon M_B$  and  $M_B \varepsilon M_A$  are denoted  $M_A d M_B$  ( $M_A$  dominates  $M_B$ ).

$M_A \varepsilon M_B$  and  $M_B \varepsilon M_A$  are denoted  $M_A \approx M_B$  ( $M_A$  is approx. equivalent to  $M_B$ ).

$M_A \varepsilon M_B$  and  $M_B \varepsilon M_A$  are denoted  $M_A \neq M_B$  ( $M_A$  is different from  $M_B$ ).

(R) indicates that White's test rejects the null of homoscedasticity ( $\alpha=0.05$ ), and the robust Wald-test is used instead. (N) indicates that the Shapiro Wilks test rejects the null of normality ( $\alpha=0.05$ ). See text for further information.

**Table 6: Modeling Selection**  
Dependent variable: Rule of Law

Independent Variables	(1) BWS	(2) BWS (w/ outlier)	(3) PcGets	(4) Model
Socialist legal origin	-38.08*** [6.64]	-33.71*** (9.27)	-33.71*** (9.27)	LP1
Other religions	24.45*** [7.57]	20.34*** (6.86)	20.34*** (6.86)	LP2
Former Spanish colony	-9.06** [3.86]	-9.54** (4.33)	-9.54** (4.33)	M
Other colonial origin	-14.08*** [3.81]	-12.63*** (4.50)	-12.63*** (4.50)	M
Latitude	38.79** [17.93]	50.57*** (13.58)	50.57*** (13.58)	HJ
European language fraction	18.28*** [4.35]	19.68*** (4.11)	19.68*** (4.11)	HJ
Log Settler Mortality	-5.84*** [1.98]	-4.45*** (1.38)	-4.45*** (1.38)	AJR
Singapore (dummy)		47.67*** (12.26)	47.67*** (12.26)	outlier
Constant	53.12*** [12.54]	44.53*** (9.20)	44.53*** (9.20)	-
Observations	77	77	77	
Adj. R <sup>2</sup>	0.639	0.700	0.700	

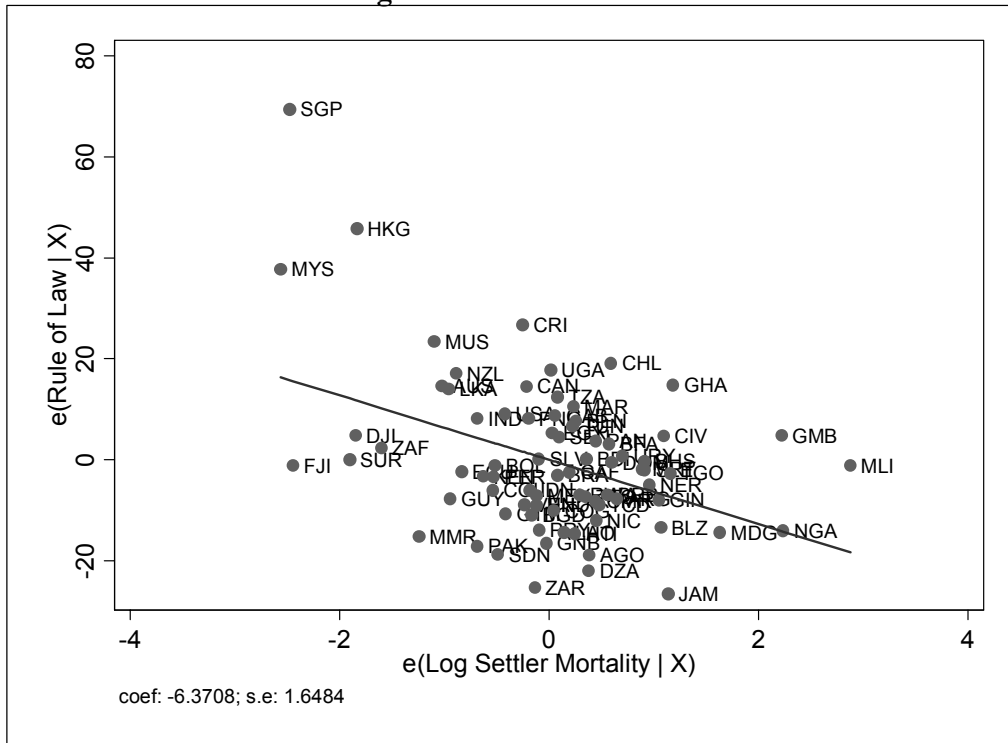
Notes: Standard errors in ( ), robust standard errors in [ ]. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Column (1): BWS = Backwards selection (alfa=0.05). Column (2): BWS = Backwards selection with outlier correction (alfa=0.05). A dummy is included if the absolute value of the studentized residual from the GUM is greater or equal to 2.5. Column (3): PcGets using liberal strategy with outlier correction. The general model includes (all variables from Table 3): Ethnic, Socialist legal origin, French legal origin, Catholic, Muslim, Other religions, Former French colony, Former Spanish colony, Other colonial origin, Latitude, English language frac., European language frac., and Log Settler Mortality.

**Table 7: Additional results using PcGets**

Independent Variables	(1) Legal System & Property Rights	(2) Political Rights	(3) Corruption Perception Index	(4) Model
Socialist legal origin	-3.14*** (1.09)	-3.70*** (1.04)	-3.11*** (0.84)	LP1
Catholic		-1.82*** (0.63)	-2.41*** (0.53)	LP2
Muslim		-2.52*** (0.68)	-2.24*** (0.56)	LP2
Other religions	1.41** (0.66)			LP2
Former Spanish colony	-1.40*** (0.40)			M
Other colonial origin	-1.35*** (0.45)			M
Latitude	3.47*** (1.24)	3.22** (1.53)	5.35*** (1.40)	HJ
European language fraction	1.49*** (0.38)	2.86*** (0.55)	1.29*** (0.46)	HJ
Log Settler Mortality	-0.45*** (0.14)		-0.39*** (0.14)	AJR
Singapore (dummy)			5.26*** (1.19)	outlier
Constant	6.00*** (0.92)	4.16*** (0.42)	5.47*** (0.83)	-
Observations	68	76	75	
Adj. R <sup>2</sup>	0.641	0.579	0.666	

Notes: Standard errors in ( ), robust standard errors in [ ]. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Method is PcGets with defaults cross section with outlier detection set to 2.56. The general model includes (all variables from Table 3): Ethnic, Socialist legal origin, French legal origin, Catholic, Muslim, Other religions, Former French colony, Former Spanish colony, Other colonial origin, Latitude, English language frac., European language frac., and Log Settler Mortality.

Figure 1: Partial Scatter Plot



Note: Partial scatter plot for Log Settler Mortality for the regression  $inst_i = a + \beta(Ethnic_i) + \gamma_1(Log\ Settler\ Mortality_i) + \eta_1(Latitude_i) + \eta_2(English_i) + \eta_3(European_i) + \varepsilon_i$

## Data Appendix

### Variable Description and sources

**Corruption Perception Index:** Index for corruption year 2007 (due to data availability. The index for 1998 contains only 40 countries in our colony sample. The correlation between the 2007 and 1998 measures are 0.95). From Transparency International <[http://www.icgg.org/corruption.cpi\\_2007.html](http://www.icgg.org/corruption.cpi_2007.html)>

**English Language frac:** Fraction of population speaking English. Source Hall and Jones (1999)

**Ethnic:** Ethnolinguistic fractionalization. Average value of five different indices of ethnolinguistic fractionalization. Its value ranges from 0 to 1. The five component indices are: (1) index of ethnolinguistic fractionalization in 1960, which measures the probability that two randomly selected people from a given country will not belong to the same ethnolinguistic group; (2) probability of two randomly selected individuals speaking different languages; (3) probability of two randomly selected individuals not speaking the same language; (4) percent of the population not speaking the official language; and (5) percent of the population not speaking the most widely used language. Source: La Porta et al. (1999) whose main source is Easterly and Levine (1997).

**European language frac:** Fraction of population speaking a Western European language (English, French, German, Portuguese, and Spanish) as a first language. Source: Hall and Jones (1999).

**Expropriation Risk:** Risk of “outright confiscation and forced nationalization” of property. Calculated as the 1982-1997 average on a scale from 0 to 10 where higher values equal a lower probability of expropriation. Source: Glaeser et al. (2004) (originally from International Country Risk Guide, i.e., the same source as Expropriation Risk 1985-1995 used in Acemoglu et al., 2001).

**Former Colony:** Dummy variables indicating the identity of a former colony (most recent ruler). Divided into former British, Spanish, and French colonies as well as a group called “Other colonial origin.” The data is from Hoover and Perez (2004), originally from Sala-i-Martin (1997) and Barro (1996). The data has been adjusted as follows: (1) Use the data from Hoover and Perez (2004) on former British, Spanish, and French colonies. (2) For countries that are former colonies according to the Log Settler Mortality data, but miss information on the identity of the former ruler, the data has been imputed. There are four cases: Belize (British), Djibouti, Laos, and Vietnam (all French). Listing was based on CIA World Factbook. (3) For countries that are former colonies according to Log Settler Mortality but were not listed as a British, Spanish, or French former colony, a dummy called “Other colonial origin” was created (Angola, Brazil, Burundi, DR Congo, Guinea-Bissau, Indonesia, Rwanda, and Suriname). Papua New Guinea was here listed as a former British colony, as suggested by Price (2003). (4) For countries that are in the Sala-i-Martin (1997) sample (a sample of the world), and are listed as former colonies according to the Quality of Government dataset (Teorell et al., 2006) but not as British, Spanish, or French, further adjustments were made (five cases): Cape Verde, Mozambique, Philippines (all listed as Other colonial origin), Yemen (listed as British, as suggested by Price, 2003), and Oman (dropped from the sample since it is arguably not a former colony, as suggest by Price, 2003). The latter correction (4) is only

in effect for the world sample in Table 2, Column 3, and in the encompassing tests in Table 4.

**Latitude:** Distance from the equator, calculated as the absolute value of latitude degrees divided by 90. Source: Hall and Jones (1999).

**Legal origin:** Identifies the legal origin of the Company Law or Commercial Code for each country. Divided into five dummy variables: English Common Law, French Commercial Code, Socialist/Communist laws, Scandinavian Commercial Code, and German Commercial Code. For example: English legal origin equals zero if English legal origin, otherwise zero. Source: La Porta et al. (1999).

**Legal System & Property Rights:** Index for Legal System & Property Rights year 2000. From the Economic Freedom of the World Data 2007, Fraser Institute, <[http://www.freetheworld.com/datasets\\_efw.html](http://www.freetheworld.com/datasets_efw.html)>

**Log Settler Mortality.** Ln of Settler Mortality, originally used in Acemoglu et al. (2001). Data retrieved from Glaeser et al. (2004) (<http://www.andrei-shleifer.com/data.html>). Afghanistan and Ethiopia were dropped since they are clearly not former colonies.

**Political Rights:** index for political rights year 1998. Reversed so that a high number means high level of political rights (8 – score). From Freedom House <<http://www.freedomhouse.org>>

**Property rights index:** A rating of property rights in each country in 1997 (on a 1-5 scale). The more protection private property receives, the higher the score. The score is based, broadly, on the degree of legal protection of private property, the extent to which the government protects and enforces laws that protect private property, the probability that the government will expropriate private property, and the country's legal protection of private property. Source: La Porta et al. (1999).

**Religion:** Identifies the fraction of the population of each country that belonged to one of the three most widely spread religions in the world in 1980. The numbers are in decimals. The three religions identified here are: Roman Catholicism, Protestantism, Islam, and with the residual called “Other religions” (=1-Catholic-Protestant-Muslim). Source: La Porta et al. (1999). When disaggregating “Other religions” Barrett (1982) is used, which is also the source used by La Porta et al. (1999). “Non-religious” in Table A3 consists of both non-religious and atheists.

**Rule of Law:** Rule of Law in 1998. Scaled to be a number between 0 and 100 (by taking  $100 * (\text{score} - \text{min}) / (\text{max} - \text{min})$ ). The higher the score, the higher the level of Rule of Law. Source: Kaufmann et al. (2005).

**Social Infrastructure:** Social Infrastructure 1986-1995 (on a 0-1 scale). The higher the score, the more Social Infrastructure. Source: Hall and Jones (1999).

**Table A1: Descriptive statistics (former colony sample)**

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Rule of Law	77	40.3947	20.5820	0.0000	97.2286
Ethnic	77	0.4359	0.3133	0.0000	0.8902
English legal origin	77	0.3636	0.4842	0.0000	1.0000
French legal origin	77	0.6104	0.4909	0.0000	1.0000
Socialist legal origin	77	0.0260	0.1601	0.0000	1.0000
Protestant	77	0.1142	0.1511	0.0000	0.5840
Catholic	77	0.3749	0.3579	0.0010	0.9660
Muslim	77	0.2336	0.3366	0.0000	0.9940
Other religions	77	0.2772	0.2540	0.0030	0.9800
Former British colony	77	0.4026	0.4936	0.0000	1.0000
Former French colony	77	0.2857	0.4547	0.0000	1.0000
Former Spanish colony	77	0.2078	0.4084	0.0000	1.0000
Other colonial origin	77	0.1039	0.3071	0.0000	1.0000
Latitude	77	0.1690	0.1207	0.0025	0.4859
English language frac.	77	0.1156	0.2907	0.0000	1.0000
European language frac.	77	0.3124	0.4155	0.0000	1.0000
Log Settler Mortality	77	4.6969	1.2114	2.1459	7.9862
Legal System & Property Rights	68	4.9430	1.6935	1.9826	9.4947
Political Rights	76	4.2237	2.0951	1.0000	7.0000
Corruption Perception Index	75	3.4573	1.8964	1.4000	9.4000

**Table A2: The former colony sample**

Country	Code	Country	Code
<b>Africa (35 countries)</b>			
ALGERIA	DZA	KENYA	KEN
ANGOLA	AGP	MADAGASCAR	MDG
BENIN	BEN	MALI	MLI
BURKINA FASO	BFA	MAURITANIA	MRT
BURUNDI	BDI	MAURITIUS	MUS
CAMEROON	CMR	MOROCCO	MAR
CENTRAL AFRICAN REPUBLIC	CAF	NIGER	NER
CHAD	TCD	NIGERIA	NGA
CONGO, REP.	COG	RWANDA	RWA
CONGO, DEM. REP.	ZAR	SENEGAL	SEN
DJIBOUTI	DJI	SIERRA LEONE	SLE
EGYPT	EGY	SOUTH AFRICA	ZAF
GABON	GAB	SUDAN	SDN
GAMBIA	GMB	TANZANIA	TZA
GHANA	GHA	TOGO	TGO
GUINEA	GIN	TUNISIA	TUN
GUINEA-BISSAU	GNB	UGANDA	UGA
IVORY COAST	CIV		
<b>Latin America and the Caribbean (26 countries)</b>			
ARGENTINA	ARG	NICARAGUA	NIC
BELIZE	BLZ	PANAMA	PAN
BOLIVIA	BOL	PARAGUAY	PRY
BRAZIL	BRA	PERU	PER
CHILE	CHL	SURINAME	SUR
COLOMBIA	COL	URUGUAY	URY
COSTA RICA	CRI	VENEZUELA	VEN
ECUADOR	ECU	BAHAMAS	BHS
EL SALVADOR	SLV	BARBADOS	BRB
GUATEMALA	GTM	DOMINICAN REPUBLIC	DOM
GUYANA	GUY	HAITI	HTI
HONDURAS	HND	JAMAICA	JAM
MEXICO	MEX	TRINIDAD AND TOBAGO	TTO
<b>Asia (10 countries)</b>			
BANGLADESH	BGD	MALAYSIA	MYS
HONG KONG	HKG	MYANMAR	MMR
INDIA	IND	PAKISTAN	PAK
INDONESIA	IDN	SINGAPORE	SGP
LAOS	LAO	SRI LANKA	LKA
<b>Oceania (4 countries)</b>			
AUSTRALIA	AUS	NEW ZEALAND	NZL
FIJI	FJI	PAPUA NEW GUINEA	PNG
<b>North America (2 countries)</b>			
CANADA	CAN	UNITED STATES	USA

Note: Compared to the base sample in Acemoglu et al. (2001), the colony sample above includes: Benin, Burundi, Central African Republic, Chad, Djibouti, Guinea-Bissau, Mauritania, Mauritius, Rwanda, Belize, Suriname, Barbados, Laos, Myanmar, Fiji, and Papua New Guinea (16 countries). The colony sample excludes Ethiopia and Malta, since they are not former colonies, and excludes Vietnam due to lack of data.



**Table A3: Selected regression with disaggregated values**  
 Dependent variable: Rule of Law

Independent Variables		Independent Variables cont.	
Socialist legal origin	-29.71** (13.88)	Former Portuguese colony	-17.10** (6.51)
Hindus	7.53 (11.50)	Former Belgian colony	-10.38 (6.83)
Buddhists	16.39 (16.35)	Former Dutch colony	-7.50 (8.27)
Jewish	168.91 (316.53)	Latitude	50.72*** (15.48)
Chinese folk religions	85.44*** (24.36)	European language fraction	22.15*** (4.46)
Non-religious	26.29 (34.52)	Log Settler Mortality	-3.14** (1.56)
Other religions2	14.45 (9.12)	Singapore (dummy)	12.53 (16.79)
Former Spanish colony	-11.56** (4.38)	Constant	38.40*** (9.96)
Observations			77
Adj. R <sup>2</sup>			0.724

Notes: This is one regression. Standard errors in ( ), \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Other religions2 = Other religions – (Hindus+Buddhists+Jewish+Chinese folk religions+non-religious). The data for religion is from Barrett (1982).

**Paper IV**



# Where Did All the Investments Go? New Evidence on Equipment Investment and Economic Growth

Gustav Hansson\*  
University of Gothenburg

February 7, 2007

## Abstract

Equipment investment is one of the very few variables claimed to be robustly related to economic growth. This paper examines new empirical evidence on the robustness of this relation. Firstly, the main result from DeLong and Summers (1991) is extended and tested. Secondly, the investment growth nexus is examined in a panel data setting. Thirdly, the paper relates the investment-growth relationship to recent findings on investment prices and economic development. The results repeatedly refute that there is a strong robust correlation between investment and income growth.

**Keywords:** Economic Growth; Productivity; Equipment Investment; Prices.  
**JEL classification:** E31; O11; O16; O40.

---

\* Department of Economics, Göteborg University, P.O. Box 640, SE-405 30 Gothenburg, Sweden, (email: [gustav.hansson@economics.gu.se](mailto:gustav.hansson@economics.gu.se)). I would like to thank Ola Olsson, Arne Bigsten, Ali Tasiran, Jo Thori Lind, Sven Tengstam, Annika Lindskog, Ann-Sofi Isaksson, Ida Hanson, and seminar participants at the Nordic Conference on Development Economics 06 and at University of Gothenburg for helpful comments on an earlier draft. All errors are my own.

## 1. Introduction

Understanding the process of economic growth is one of the most important objectives in economics. However, to empirically determine the robust correlates to income growth has proven surprisingly hard. In a series of papers, DeLong and Summers (1991, 1992, 1993) described a strong and robust relationship between equipment investment and income growth. Equipment investment was also one of the very few variables found to be robustly related to growth by Levine and Renelt (1992), Sala-i-Martin (1997a, b), and Hoover and Perez (2004). The importance of equipment investment has therefore almost come to be accepted as a stylized fact (Abel, 1992) and is an often advocated remedy for poor growth (World Bank, 2005; Easterly, 2001).

The strength of the investment growth nexus is questioned by Auerbach et al. (1994), Blomström et al. (1996), Easterly and Levine (2001) and Easterly (2001) among others. The critique is of both theoretical and empirical nature. Theoretically, the discussion ranges from the Solow (1956) growth model, where investment is not the key to long run growth due to diminishing returns to capital, to the *AK* model where “learning by doing” due to capital accumulation leads to sustained income growth. Empirically, the relation between equipment investment and growth described in DeLong and Summers (1991) is challenged foremost by Auerbach et al. (1994), who show that the results are sensitive to small sample modifications and are based on poor data. Because of these data limitations, DeLong and Summers (1994, p.807) reply that they “hope and expect to see others either confirm or disconfirm our results by using different procedures to estimate the components of investment, by analyzing different samples and time periods...”

Despite the uncertainty about the relationship, the belief that investment is important for growth remains strong and is largely influenced by DeLong and Summers (1991) and Sala-i-Martin (1997a, b). Interestingly, the data constructed in DeLong and Summers (1991, 1993) has survived to this day and is the same data used in Sala-i-Martin (1997a,b) and Hoover and Perez (2004). The fact that both arguments and data from DeLong and Summers (1991, 1993) still play an influential role in the debate today motivates the following question: If we reconstruct and extend the

analysis using more recent data, do the main results from DeLong and Summers (1991) still hold? The analysis is implemented in three steps.

Firstly, the main regressions from DeLong and Summers (1991) are reconstructed and extended. Most importantly, the average equipment investment share is reconstructed and extended using updates of detailed Purchasing Power Parity (PPP) adjusted data from the U.N. International Comparison Programme. As it turns out, the estimated effects from equipment investment are much lower and most often statistically different from the effects found in DeLong and Summers (1991). Moreover, in the largest sample, the effect from equipment investment is statistically insignificant. The relationship between equipment investment and income growth is therefore no longer a strong and robust finding in a DeLong and Summers regression set-up.

Secondly, although the relationship between equipment investment and growth is proven to be weak using more recent data, one might still not be satisfied with the data construction and regression specification suggested by DeLong and Summers (1991). Most importantly, this concerns the measurement of the average equipment share and the possibility of reverse causality, as pointed out by Sala-i-Martin (1997a,b), Hoover and Perez (2004), and Blomström et al. (1996) among others. This paper therefore suggests an alternative yet straightforward approach which includes all the variables proposed by DeLong and Summers, but at the same time uses better and more direct measures of the investment shares as well as initial investment shares in a panel data setting in order to reduce the problems of reverse causality. Using measures of the equipment share, the producer durables share, and the total investment share, the results show that investments, however defined, do not correlate strongly and robustly to income growth.

As a last exposition, this paper relates DeLong and Summers (1991) to recent findings on the relationship between investment prices and economic development. Closely connected to the claim that investment is important for income growth is the claim that countries that invest too little have a high price on investment goods. Rich countries are here associated with high quantities of investment and low prices of investment. It is therefore often suggested that policy should aim at reducing trade restrictions and taxes on capital goods.<sup>1</sup> As clarified by Hsieh and Klenow (2006), the

---

<sup>1</sup> See the reference cited in Hsieh and Klenow (2006).

price level of investment goods is not systematically higher in poor countries compared to rich. The relative price level is negatively related to income, simply due to consumption goods in general being much cheaper in poor countries. Furthermore, this relates to the derivation of the PPP adjusted prices used to transform expenditures valued at domestic prices (called nominal expenditures) to expenditures valued at common international prices (called real expenditures). As it turns out, the real investment share is positively related to income, while the nominal investment share is not. These findings create interesting questions relating to our analysis of investment and growth. Firstly, since the findings above highlight the importance of the nominal equipment share, is there any justification for using the nominal equipment share in a growth regression, and what would the results then be? This paper argues that the use of nominal shares could be justifiable, but the nominal investment shares still do not seem to be robustly related to income growth. Secondly, how does the above relation between prices and income relate to the DeLong and Summers argument that low prices of investment are associated with high quantities of investment, which in turn are associated with high income growth rates? As it turns out, although there is no systematic relation between the investment price and income, countries with lower investment prices tend to invest more, however, higher investment quantities do not seem to promote growth.

The three main contributions of this paper are that it reconstructs and extends the influential analysis of DeLong and Summers (1991), it examines the relation between initial investment shares to subsequent growth in a panel data setting (while the use of initial investment shares is not new, the use of the detailed ICP data in a DeLong and Summers regression set-up to my knowledge is), and that it relates recent findings about investment prices and income levels to the analysis of investment prices and income growth. Additionally, the use of nominal investment shares in a cross country growth regression is, as far as I know, a novelty in the literature.

The paper is organized as follows: Section 2 reconstructs, extends, and discusses the main regression in DeLong and Summers (1991). Section 3 transforms the cross section regressions into a panel data set using initial investment shares. Section 4 discusses the nature of investment prices and its implications for the investment share, and Section 5 concludes the paper.

## **2. Equipment Investment and Economic Development**

### **2.1 Why Should Investment Cause Growth?**

The difference between capital fundamentalists and their critics can be explained as the difference between the *AK* model and the Solow (1956) growth model. In the Solow model, the investment share (equal to the saving rate) is important since it determines the income level, even though investment is not the key to long run growth due to diminishing returns to capital. As capital accumulation takes place, each additional unit of capital will produce less and less additional output up to the point where a steady state is reached where growth is only determined by technological progress. In the *AK* model, the diminishing returns to capital effect is absent, often modeled to be due to the notion of “learning by doing” introduced by Arrow (1962). The intuition is that the capital accumulation in itself teaches us something about the production process, and this learning by doing contributes to productivity.<sup>2</sup>

The assumption made in DeLong and Summers (1991, 1992, 1993) is that the strong correlation between equipment investment and income growth is due to these additional benefits of capital accumulation, or more specifically as DeLong and Summers (1992, p.193) write: “...the large coefficient on equipment investment arises because equipment investment is a trigger of learning-by-doing and thus of substantial total factor productivity growth.”

The idea that there is a “learning by doing” effect is neither farfetched nor implausible. The question should maybe instead be concerned with the size of this effect. Either the “learning by doing” effect is large and we should see a strong positive relationship between investment and growth, or it is very small or non-existent and investment has a very small or no effect on long run growth.

### **2.2 Extending DeLong and Summers (1991)**

Investment, or more formally Gross Capital Formation, is divided into: Construction (residential, nonresidential, and land improvements), Producer Durables (transport equipment, electrical and non-electrical machinery and equipment); and Increases in Stocks (inventories and valuables). In DeLong and Summers (1991)

---

<sup>2</sup> See for example Barro and Sala-i-Martin (1995).



(henceforth DS), investment is divided into equipment investment and non-equipment investment in order to demonstrate the importance of equipment investment specifically, as the important driver of income growth. The main regression specification used in DS to test and describe the impact of equipment investment and growth is formulated as

$$growth_i = \beta_0 + \beta_1(equip. share_i) + \beta_2(struct. share_i) + \beta_3(n_i) + \beta_4(gap_i) + \varepsilon_i, \quad (1)$$

where “*growth*” is the annual growth rate of GDP per worker from 1960 to 1985. The “*equipment share*” is the average equipment investment share of GDP from 1960 to 1985, and the “*structures share*” is the average share of GDP devoted to non-equipment investment for the same period. “*n*” is the growth rate of the labor force also for the same period, and “*gap*” is the proportionate initial gap in real GDP per worker relative to the US in 1960.<sup>3</sup> The control variables “*gap*” and labor force growth “*n*” are included to capture other factors that could influence the growth rate of GDP per worker. More specifically, the “*gap*” variable is included to control for any “systematic causal relationship running from the level of GDP per worker to the level of equipment investment” (DeLong and Summers, 1991, p.453).

As a first exercise, this paper will try to extend and reconstruct equation 1 by using more recent data. That is, using more recent data, does the main result from DeLong and Summers (1991) still hold? To do this, let us first get a clear understanding of the data and how the investment share is constructed.

## 2.3 Data and Sample

Cross country comparisons of national accounts are usually made by using data valued at common international prices. Detailed headings such as the equipment investment share are not readily available at international prices. DS therefore constructed their average equipment investment share based on data from the United Nations International Comparison Programme (ICP) and the Penn World Tables (Summers and Heston, 1990).

The ICP collects prices of hundreds of identically specified goods and services around the world in order to construct PPP estimates. The data collection is made

---

<sup>3</sup> Gap =  $1 - (Y/L)_i / (Y/L)_{us}$ , where  $Y$  is GDP,  $L$  is labor force, and the subscripts  $i$  and  $us$  stand for country  $i$  and the US, respectively.

about every fifth year for a limited number of countries, and forms a so-called “benchmark.” The PPPs for the countries and years not part of the ICP benchmark are then estimated based on the benchmark data. The PPPs that finally emerge are used to convert expenditures in *domestic* prices into expenditures at *common* prices called “real expenditures,” enabling international comparisons. Well-known datasets such as the Penn World Tables and the World Development Indicators base their PPP adjusted data on these benchmark studies from the ICP.<sup>4</sup>

DS wanted to calculate the average real equipment share for the 1960-1985 period, but the ICP data was only available for the years 1970, 1975, and 1980. DS therefore combined the ratio of equipment investment to total investment and multiplied it by the total investment share of GDP from the Penn World Tables in the following manner: If the equipment-to-total-investment-ratio was available for 1970, 1975, and 1980 (which were the benchmarks available at the time), then the average equipment share was constructed by multiplying the 1970 ratio by the average total investment share of GDP from 1960-72, multiplying the 1975 ratio by the average total investment share of GDP from 1973-1977, and the 1980 ratio by the average equipment shares from 1978-1985. These three values were then averaged. If only the 1975 and 1980 ratios were available, then they were first multiplied by the average investment share of GDP from 1960-1977 and 1978-1985, respectively, and then averaged. Finally, if only the 1980 equipment share of investment was available, then it was simply multiplied by the average investment share of GDP from 1960-1985.

Since the DS study, more ICP benchmark data has become available, and data for the benchmark years 1970, 1975, 1980, 1985, and 1996 is freely available from the Penn World Tables website.<sup>5</sup> It is therefore possible to reconstruct and extend the average equipment share as formulated in DS, and this paper presents three ways in which this is done.

Firstly, the data is reconstructed for the 1960-1985 period, which is the same period as in DS, using the same method as DS but with more up-to-date data (Penn

---

<sup>4</sup> For more information on the ICP procedure and PWT methodology, see for example: Handbook of the International Comparison Programme (1992), Summers and Heston (1991), Data Appendix for Space-Time System of National Accounts: Penn World Table 6.1 (PWT 6.1), and PWT6 Technical Documentation.

<sup>5</sup> <http://pwt.econ.upenn.edu/Downloads/benchmark/benchmark.html> The years and number of countries for the different ICP benchmark studies are: 1970 (16 countries), 1975 (34 countries), 1980 (61 countries), 1985 (64 countries), 1990 (24 countries), and 1996 (115 countries). The 1990 benchmark is not available at the Penn World Tables website.

World Tables 5.6). The reconstructed equipment share has a correlation of 0.9 to the original DS equipment share, and is therefore an almost perfect image of the original data.

Secondly, by using the ICP benchmark data for 1985 and Penn World Tables 5.6, the average equipment share is extended to cover the 1960-1990 period. The matching between the equipment-to-total-investment-ratio and the total investment share is done in the same spirit as in DS, details of which are presented in the Data Appendix.

Thirdly, the ICP benchmark 1996 is added and the period covered is now 1960-2000, using Penn World Tables 6.1. The 1996 benchmark is special since the investment data is now only disaggregated into producer durables (equipment investment and transport equipment), construction, and change in stocks. This should be of little concern. DS focused primarily on equipment investment and not producer durables since they found that transportation provided “little information” (DS p.449). In DeLong and Summers (1992, 1993), the focus is instead on producer durables. The difference between producer durables and equipment investment should therefore play a minor role. The matching between the producers-durables-to-total-investment-ratio and the total investment share is done in the same DS spirit, details of which are described in the Data Appendix.

The use of ICP benchmark data restricts the sample to only include benchmark countries. DS divided this sample into a “large” sample containing all countries available ( $n=61$ ), and a “high productivity” sample ( $n=25$ ) (both after excluding major oil exporting countries). A high productivity sample is created since DS are skeptical of what can be learnt by combining very poor countries, which have very low productivity levels, with very rich countries, which have high productivity levels. The high productivity sample is constructed to consist of industrialized countries most like the US, by including countries with GDP per worker levels greater than 25 percent of the US level in 1960 ( $(Y/L)_i / (Y/L)_{us} > 0.25$ ).

In a critical comment by Auerbach et al. (1994), an OECD sample is preferred to represent the countries most like the US. They demonstrate that for the OECD sample, the relationship between equipment investment and growth falls apart. DeLong and Summers (1994) reply that the OECD is foremost a political and not an economic grouping. Since the goal of DS was to create a high productivity sample

with industrialized countries most like the US, it is argued that the high productivity sample should be based on economic rather than political grounds. In DeLong and Summers (1993), the importance of a high productivity sample is weakened, and it is shown using a new dataset that the equipment and growth nexus is the strongest amongst developing countries. Since this paper primarily follows in the footsteps of DS, both a large and a high productivity sample will be used. Regardless of the sample, the empirical examination will put special attention into finding influential outliers. As it turns out, the choice of sample plays a crucial role, and we will return to this issue repeatedly throughout the paper.

## 2.4 Results

Table 1 presents the regression results using the reconstructed and extended data. Columns 1-6 present the regression results for the 1960-1985 period. Columns 1 and 2 contain the regression results for the high productivity sample (labeled hp) and for all countries (labeled large), using the original DS data as it appears in the journal article.<sup>6</sup> Not surprisingly, the parameter estimates for the real equipment shares are positive and statistically significant in both the hp and the large sample. If the parameter estimate for the equipment share in the hp sample were to be interpreted, then a three percentage point increase (one standard deviation) in the equipment share would lead to a 1.02 percentage point increase in the annual GDP per worker growth, which is a large effect.

Columns 3 and 4 present the regression results for the same sample of countries using the same benchmark years as in the previous columns, but using the reconstructed data based on Penn World Tables 5.6. As mentioned earlier, the reconstructed equipment share has a correlation of 0.9 to the original DS data, and the coefficients are therefore also very similar to the original DS results.

The regression results in Columns 5 and 6 are based on the same data sources as in Columns 3 and 4. However, the high productivity sample is here selected by the more recent data source (Penn World Table 5.6), and the large sample also includes Syria, Romania, and Yugoslavia.<sup>7</sup> The regression results concerning the equipment

---

<sup>6</sup> I am aware that DeLong and Summers have made a slight modification in this dataset due to an error. Nonetheless, the error is supposed to play only a minor role, and the replications in Columns (1) and (2) still serve their purpose.

<sup>7</sup> These countries are in the 1970, 1975, or 1980 ICP benchmarks, but were for some reason not included in DS.

share in Columns 5 and 6 are still in line with the original DS results. Reconstructing the data for the 1960-1985 period does therefore not present any surprises concerning the relationship between the equipment share and income growth.

In the next two columns, 7 and 8, the benchmark year 1985 has been added and the period studied is 1960-1990. The coefficients for the equipment share are still positive and significant, although the coefficient for the equipment share in Column 7 is statistically different from the DS result in Column 1.<sup>8</sup> The coefficient in Column 7 can be interpreted as if the equipment share increases by three percentage points, then the annual growth rate increases by 0.64 percent. This is almost half of the effect compared to the DS high productivity sample.

Finally, in the last two columns of Table 1 (Columns 9 and 10), the ICP benchmark year 1996 is added and the period studied is 1960-2000. As described above, the equipment investment share now includes transportation equipment. The 1960-2000 sample makes use of most ICP benchmark studies and a more recent version of the Penn World Tables (Mark 6.1). The investment shares that emerge are not necessarily of any higher quality than before, but the sample of countries is the largest and therefore perhaps the most important of the samples in Table 1. As it turns out, the coefficient for the equipment share in Columns 9 and 10 are both statistically insignificant and statistically different from the coefficients in Columns 1 and 2. If the effect from the hp sample was to be interpreted despite its insignificance, then a three percent increase in the equipment share would increase the annual growth rate by 0.3 percentage points. This effect is rather poor, and is less than a third of the effect that DS found.

Figure 1 illustrates the partial scatter plot between the equipment share and income growth for the 1960-2000 hp sample (Column 9 in Table 1). More precisely, the figure illustrates the component of the equipment share that is orthogonal to the GDP per worker gap, labor force growth, and the non-equipment share, against the component of income growth that is orthogonal to the same three variables. The plot does not portray a convincing picture of a robust relation between investment and income growth.

The insignificance of the equipment share in the high productivity sample is robust both to an exclusion of large fuel exporting countries, and to an extension of

---

<sup>8</sup> The parameter estimate for equipment investment in Column 7 is not included in the 95% confidence interval for the corresponding parameter estimate in Column 1.

the sample to include countries missing up to 10 years of GDP per worker or labor force observations. If the 1960-2000 sample is reduced to only include those countries of the *large* DS sample (as in Column 2 and 4 with the exception of Tunisia, West Germany, and Botswana due to data limitations), then the coefficient for the equipment investment is still insignificant. If instead the 1960-2000 sample is reduced to the DS *hp* sample (as in Column 1 and 3 except West Germany), then the coefficient for the equipment share is instead positive and significant. The insignificant effect from equipment investments in Column 9 is therefore not due to strange data, but instead to what sample is being used.<sup>9</sup>

Turning the attention to the non-equipment share, it is important to note that its coefficient in Column 1 is statistically insignificant. DS argued that this suggests that equipment investments drive growth and not the other way around. If it were the case that income growth causes investments, then the coefficients for both the equipment *and* non-equipment investments would logically be significant. For the reconstructed and extended data in Table 1, the coefficient for the non-equipment share is significant for the *hp* sample for the 1960-1985 period (Column 5) and the 1960-1990 period (Column 7) and in all large samples (Columns 2, 4, 6, 8, and 10). By using the DS argumentation, this indicates that growth might actually cause investment and not the other way around.

To summarize, there are three main conclusions to be made from Table 1. Firstly, the coefficients for the equipment share are positive in all specifications, but statistically insignificant for the 1960-2000 samples. The relationship between investment and growth is therefore no longer a robust finding in a DeLong and Summers regression set-up. Secondly, the effects from equipment investment are with the extended and reconstructed data much lower and most often statistically different from the effects using the original DS data. Thirdly, the effects from equipment investment and non-equipment investment both being statistically significant indicate that income growth might cause investment and not the other way around.

---

<sup>9</sup> The difference between the DS high productivity sample and the 1960-2000 high productivity sample is the exclusion of West Germany and Hong Kong, and the inclusion of Australia, Barbados, Colombia, El Salvador, Greece, Iceland, Jordan, New Zealand, Portugal, Sweden, Switzerland, and Trinidad and Tobago.

## 2.5 Problems and Weaknesses

Although the causal relationship between equipment and growth seems less strong when the DS analysis is updated, one might still be dissatisfied with how the analysis is implemented. As with most research, the DS analysis has its weaknesses. The weaknesses discussed in this paper are: The measurement of the investment share, the likely possibility of reverse causality, sample selection, and data availability forcing us to put the most emphasis on regressions with only 23 to 35 observations.

As described above, the average equipment share is constructed by multiplying the equipment-to-total-investment-share-ratio for a specific year by the average total investment share. As DeLong and Summers (1992, 1993) themselves explain, this construction relies heavily on the ratio of equipment investment to total investment in the benchmark years as being a good proxy for the average ratio of equipment to total investment. In order to sharpen these estimates, DeLong and Summers (1992) impute values based on equipment imports from the OECD, and DeLong and Summers (1993) impute values based on the relationship between the equipment share in their 1991 paper and reported equipment imports from the OECD, the relative price of capital, the total investment share, and the average ratio of the national product per worker to the US one. Still, these equipment shares can only be rough approximations of the true equipment shares, and in light of what will be clarified in Section 4 about the relation between the relative price of equipment and income, the above procedure raises doubts.

A more important question is if the use of an *average* equipment share is desirable at all. Using the DeLong and Summers (1993) data on equipment shares, Sala-i-Martin (1997a,b) and Hoover and Perez (2004) found equipment investment to be one of the very few variables to be robustly related to income growth.<sup>10</sup> The average equipment share for 1960-1985 was related to the income growth rate for 1960-1992. Sala-i-Martin (1997a, p.8) therefore makes clear that the inclusion of “such a variable may be ‘more endogenous’ than exogenous,” and that a variable measured at the beginning of a period would be preferable. Hoover and Perez (2004, p.788n) also remark that it is “ambiguous” to interpret the coefficient for equipment investment in their final specification due to endogeneity concerns. That is, although

---

<sup>10</sup> Hoover and Perez (2004) use the dataset from Sala-i-Martin (1997a, b). The reference for equipment investment cited in Sala-i-Martin (1997a,b) is DeLong and Summers (1991), while the data is in fact from DeLong and Summers (1993).

both Sala-i-Martin (1997a, b) and Hoover and Perez (2004) found equipment investment to be one of the very few variables robustly related to growth, they also clearly acknowledge that their results could be due to reverse causality. The significant non-equipment effects in Table 1 also indicate that we might have reverse causality.

Time series studies on investments and growth put more light on this issue. Blomström et al. (1996) found that growth rates cause investments, but investment shares do not cause growth rates. Carroll and Weil (1994) found a similar result between savings and growth. Podrecca and Carmeci (2001) found that causality probably runs in both directions: investment shares Granger-cause growth rates, and growth rates Granger-cause investment shares. Additionally, the causality from investment shares to growth rates is in Podrecca and Carmeci (2001) found to be negative. A negative correlation between growth and lagged investment, controlling for lagged growth, is perfectly consistent with the Solow (1956) growth model, but inconsistent with endogenous growth theory such as for example the *AK* model.<sup>11</sup>

In DS the endogeneity concern is addressed to some degree by having the lagged investment shares for the 1960-1975 period determine the income growth rate for the 1975-1985 period (Table VII in DS). Using the original DS data as well as reconstructing the data using Penn World Tables 5.6, the “lagged” investment regressions are presented in Table 2. In the large sample, neither the DS data nor the replicated data can show a statistically significant coefficient for the lagged equipment share or the lagged non-equipment share. In the high productivity sample, the coefficient for the lagged equipment share is positive and significant while using the DS data, but insignificant using the replicated data. The replicated hp sample is based on Penn World Tables 5.6, where Hong Kong and Japan no longer meet the requirements for being part of the hp sample and are therefore not included. In fact, this small change makes a difference. If Hong Kong and Japan instead are included, then the parameter estimate for the lagged equipment share is positive and significant also when using the replicated data. This small exercise therefore demonstrates that the results are sensitive to small sample modifications, a problem that is exaggerated by the small sample size.

---

<sup>11</sup> See Vanhoudt (1998) for a formal demonstration.



However, the lagged equipment shares as constructed by DS and used in Table 2 are not really lagged equipment shares. The lagged equipment shares were constructed by taking the average of the equipment-to-total-investment-ratios for the benchmark years 1970, 1975, and 1980, and then multiplying them to the average total investment share of GDP for 1960-1975. As much as 10 out of the 25 countries in the hp sample are only part of the 1980 benchmark. Hong Kong and Israel are two countries that are only part of the 1980 benchmark and both have large lagged equipment shares and high income growth rates. If the equipment investment ratios were achieved through high income growth, then the “lagged” investment shares become biased. Consequently, the “lagged” investment share is not really a lagged investment share.

### **3. An Alternative Approach**

#### **3.1 Real Investments and Growth**

The problems mentioned above call for an alternative approach to examine the relationship between equipment investment and income growth. This alternative approach should include the variables proposed by DS, but at the same time improve upon gaining better measurements of the investment share and be less likely to suffer from reverse causality.

As mentioned above, real PPP adjusted data for such a detailed heading as equipment share is hard to come by. The best possible data of real equipment shares is from the ICP benchmark data. Therefore, in order to use the best possible data available and at the same time try to reduce the risk of reverse causality, the equipment share from the 1970 ICP benchmark will be used to explain the income growth rate from 1970 to 1975. The other benchmark years will work the same way. This is a very straightforward approach, and as suggested by Sala-i-Martin (1997a), having the equipment share measured at the beginning of the period is preferable to using averages over the growth period. The identification strategy is therefore to have the average annual growth rate of GDP per worker for the period 1970-1975 regressed on the equipment share 1970, the non-equipment share 1970, the labor force growth rate 1970-1975, and the GDP per worker gap 1970. The ICP benchmarks used are 1970, 1975, 1980, 1985, and 1996, which are related to the growth rates for the time period 1970-75, 1975-80, 1980-85, 1985-90, and 1996-2000, respectively. The fact

that we are now studying the growth rates over five year periods instead of over a 25 year period is an important difference. Analyses of shorter time periods might be more important in a political perspective.

To make things more interesting, the ICP benchmark data is used to derive both the equipment investment share (as in DeLong and Summers, 1991) and the producer durables share (as in DeLong and Summers, 1992, 1993). The use of the ICP benchmark data allows for the study of the detailed headings equipment and producer durables, but also restricts the sample to former benchmark countries. To widen the sample, the total investment share (gross capital formation) is also studied. Since the total investment share consists of both producer durables and non-equipment investment, it is no longer a study of the difference between these two types of investment. On the positive side, there is no longer a restriction of only benchmark countries and years, and the sample stretches from 1970 to 2000 using investment data for 1970, 1975, 1980, 1985, 1990, and 1995.

The different time series are formed into a panel that lets us control for both time and country fixed effects. The idea that each country has a fixed effect (like culture and moral) that is correlated with investment effort seems most plausible, and the Hausman test agrees.

To summarize, the variables and the division into a large and high productivity are the same as in the DS regression set-up. The differences are that now we are using a more direct measurement of the investment shares, another matching of years which gives less opportunity for reverse causality, and a panel data set that gives us the opportunity to control for both time and country fixed effects.

### **3.2 Panel Data Results**

The main results from this exercise are presented in Table 3. As can be seen, neither the equipment shares nor the producer durables shares are significant in any sample. The total investment share is significant only in the large sample. The effect can be interpreted as if the total investment share increases by three percentage points (one standard deviation), then the annual growth rate in GDP per worker increases by 0.3 percentage points. As depicted by the partial scatter plot in Figure 2, this effect is sensitive to the inclusion of Romania (ROM) and Guinea Bissau (GNB). If these two countries are dropped, the effect from total investment is insignificant.

It is important to note that although the samples overlap, they are also different. The significance of the total investment share does not prove it is “better” than the equipment share or the producer durables share. In the case of the total investment share, the number of observations, countries, and time periods are superior to the other samples. If the sample is reduced as close as possible to the sample with the equipment share or the producer durables share, then the coefficient for the total investment share is insignificant.

## 4. The Behavior of Equipment Prices

### 4.1 Equipment Prices and Income

Closely connected to the claim that investment is important for income growth is the claim that countries that invest too little have a high price on equipment investment. In DS, low prices of investment are associated with high quantities of investment, which in turn are associated with high income growth rates. Similarly, rich countries are often associated with high quantities of investment and low prices of investment. As portrayed in Figure 3, the relative price of equipment investment is higher in relatively poor countries compared to rich ones. A common argument is therefore that poor countries have low investment shares simply because they tax capital or have other barriers to capital imports. Hence, policy should be aimed at reducing trade restrictions and taxes on equipment goods.<sup>12</sup> As is clarified by Hsieh and Klenow (2006), although this is not untrue, it does not tell the whole story. In order to make things clear, let us take a look at the relative price:

$$R_{ij} = \frac{p_{ij}^{dom} q_{ij}}{\sum_{i=1}^m p_{ij}^{dom} q_{ij}} \bigg/ \frac{p_i^{ppp} q_{ij}}{\sum_{i=1}^m p_i^{ppp} q_{ij}}. \quad (2)$$

The relative price ( $R_{ij}$ ) is the amount of expenditure spent on good  $i$  in country  $j$  (price times quantity;  $p_{ij}^{dom} q_{ij}$ ) in relation to total spending (the sum of expenditures for all  $m$  goods;  $\sum_{i=1}^m p_{ij}^{dom} q_{ij}$ ), both at domestic prices, relative to the amount spent on good  $i$  in

---

<sup>12</sup> See the references cited in Hsieh and Klenow (2006).

relation to total spending at international prices ( $p_i^{ppp} q_{ij} / \sum_{i=1}^m p_i^{ppp} q_{ij}$ ) (note that prices at international PPP prices are constant across countries). Equation 2 therefore tells us the relation of the price *structure* of good  $i$  in country  $j$ , compared to some world average price *structure* of good  $i$ . To use the language of Kravis, Heston, and Summers (1982), equation 2 is maybe better referred to as the relative “price structures” instead of the “relative price.” Alternatively, the price level as denoted in for example Penn World Tables 6.1 is:

$$P_{ij} = \frac{PPP_{ij}}{xrate_j} = \frac{P_{ij}^{usd}}{P_i^{ppp}},$$

where  $P_{ij}$ , the price level for good  $i$  in country  $j$ , is equal to the PPP of good  $i$  for country  $j$ , divided by the exchange rate of country  $j$  in relation to US dollars. The price level for good  $i$  in country  $j$  is therefore the price for good  $i$  in country  $j$  converted to US dollars, compared to the international (PPP) price of the same good (where the international price is expressed in US dollars). The price level ( $P_{ij}$ ) compares the price of a specific good to some “average” price for the same good. The relative price structure ( $R_{ij}$ ), on the other hand, compares the price *structure* at domestic currency (that is the expenditure on a specific good compared to all other goods) to the price *structure* at international prices.

Figure 4 illustrates the relationship between the log equipment price levels and log real GDP per worker. It is evident that investment prices are not systematically higher in relatively poor countries. On the contrary, equipment prices seem somewhat higher in relatively rich countries. The reason why the relative price is negatively related to income, while the price level is not, is easily explained. Let us consider equation 2 again, and simplify so that there are only two goods: investment goods and consumption goods. The relative price structure for investment goods can then be denoted as:

$$R_{ij} = \frac{P_{ij}^{dom} q_{ij}}{P_{ij}^{dom} q_{ij} + P_{Cj}^{dom} q_{Cj}} \bigg/ \frac{P_i^{ppp} q_{ij}}{P_i^{ppp} q_{ij} + P_C^{ppp} q_{Cj}}.$$

The subscript  $I$  stands for investment goods and  $C$  stands for consumption goods. Let us rewrite this as:

$$R_{ij} = \frac{q_{Ij}}{q_{Ij} + \left(\frac{p_{Cj}^{dom}}{p_{Ij}^{dom}}\right)q_{Cj}} \bigg/ \frac{q_{Ij}}{q_{Ij} + \left(\frac{p_C^{ppp}}{p_I^{ppp}}\right)q_{Cj}}. \quad (3)$$

Assume now that we have only two types of countries: rich and poor ( $j=rich, poor$ ). As is shown in Figure 4 and Table 4, the price level for investment goods is roughly the same for poor and rich countries, whereas consumption prices (or as in Table 4 “the aggregate price level for all other goods than equipment goods”<sup>13</sup>) are lower in poor countries. The results in Table 4 are perfectly reasonable. To give an intuitive explanation, let us simplify by thinking of investment goods as highly internationally traded goods (for example computers), while consumption goods can be said to consist mainly of non-internationally traded goods (for example haircuts). Computers cost roughly the same in poor and rich countries, while the price of a haircut probably varies greatly. The fact that consumption goods in general are cheaper in relatively poor countries is a well-known fact and is referred to as the “Penn Effect” or “Balassa-Samuelson Effect.”<sup>14</sup>

To continue with the relationship between the relative price and the price level, it is useful to know that the Gheary-Khamis aggregation method, used in for example Penn World Tables to generate PPP prices, uses weights according to aggregate quantities. This means that there will be more weight put on rich country prices relative to poor country prices. The derived international price will therefore tend to be closer to the prices in rich countries than in poor countries.<sup>15</sup> With this knowledge we can make the following simplifications:  $p_I^{ppp} = p_{I,poor}^{dom} = p_{I,rich}^{dom}$  and  $p_C^{ppp} = p_{C,rich}^{dom} > p_{C,poor}^{dom}$ . The price ratio of consumption goods to investment goods for

<sup>13</sup> These are mostly consumption goods or modestly internationally traded goods. Hsieh and Klenow (2006) focus on subsections of consumption goods valued at both official exchange rates and black market exchange rates.

<sup>14</sup> The Penn effect is the empirical finding that consumer price levels are systematically higher in rich countries compared to poor ones. The Balassa-Samuelson hypothesis, from Balassa (1964) and Samuelson (1964), is one of the theories that try to explain the Penn effect, hence it is also known as the Balassa-Samuelson effect. For another explanation of the Penn effect see, Bhagvati (1984).

<sup>15</sup> See for example the Handbook of the International Comparison Programme (1992, page 75), or Hsieh and Klenow (2006, p.10).

a poor country therefore seems smaller in domestic currency than in international currency:

$$\left( \frac{p_{C,Poor}^{dom}}{p_{I,Poor}^{dom}} \right) < \left( \frac{p_{C,Poor}^{PPP}}{p_{I,Poor}^{PPP}} \right). \quad (4)$$

From (3) and (4) we can then see that the relative price structure is smaller in a relatively poor country compared to a rich one ( $R_{I,poor} < R_{I,rich}$ ). This is not due to differences in investment prices across countries; on the contrary, it is due to the fact that consumption prices differ.

To summarize, the equipment price is roughly the same for poor and rich countries, but the relative price is not. To use our example of computers and haircuts, a computer costs roughly the same in Tanzania as in the US, whereas the price of a computer compared to a haircut is probably higher in Tanzania than in the US.<sup>16</sup>

## 4.2 Implications for the Investment Share

Interestingly, the relation between consumption and investment prices helps explain the relation between the investment share of GDP and GDP per worker. As demonstrated in Table 5 and by Hsieh and Klenow (2006), Eaton and Kortum (2001), and Restuccia and Urrutia (2001): real investment shares measured at international prices are higher in relatively rich countries compared to poor ones, while the investment share measured at domestic prices is roughly the same for poor and rich countries. To understand why, let us again simplify GDP to consist of only two goods (investment and consumption) and two countries (rich and poor). The investment share at domestic prices for country  $j$  can then be denoted as:

$$i_j^{dom} = \frac{q_{Ij}}{q_{Ij} + \left( \frac{p_{Cj}^{dom}}{p_{Ij}^{dom}} \right) q_{Cj}}.$$

With the same reasoning as above, if  $p_I^{PPP} = p_{I,poor}^{dom} = p_{I,rich}^{dom}$  and  $p_C^{PPP} = p_{C,rich}^{dom} > p_{C,poor}^{dom}$  are approximately true, then the relation between relative prices in (4) are still

---

<sup>16</sup> For further discussion, see Hsieh and Klenow (2006).

valid. This implies that for a poor country the investment share is smaller at international prices than at nominal prices ( $i_{poor}^{ppp} < i_{poor}^{dom}$ ). This difference is not due to differences in quantities or investment prices, but simply to differences in consumption prices.

### 4.3 Further Implications

In the description above we have learnt that the price of equipment investment is not systematically related to income, and that nominal equipment shares are not systematically lower in poor countries. Now, what are the implications of these findings for the results in DS and our examination of the relation between the investment share and income growth? Let us pose two questions: Firstly, since the analysis above highlights the importance of the *nominal* equipment share, is there any justification for using the nominal equipment share in a growth regression, and what would the results then be? Secondly, how does the above relation between prices and *income levels* relate to our examination of investment shares and *income growth rates*? These questions are addressed below.

#### 4.3.1 Real or Nominal?

DeLong and Summers (1991, 1992, 1993), and to my knowledge most other studies, use the *real* equipment share of GDP, measured at common international PPP adjusted prices. The reason is straightforward, as we saw above in Table 4: prices across countries vary, especially for non-traded consumption goods. Therefore, when comparing the GDPs of two countries, the comparison is made more transparent if the expenditures are valued at common international prices. A comparison between the two countries would then not be influenced by the relative price levels in the two countries, but rather be a comparison of quantity.

As described above, the real equipment share is higher in relatively rich countries compared to poor ones, while the nominal equipment shares are not. That is, looking at domestic prices, poor countries do not spend less on investment goods as a share of their income compared to rich countries. Does this mean that their investment effort is the same? Which of these equipment shares should we use: the real (at international prices) or the nominal (at domestic prices)? The answer depends on what we mean by “investment effort.” A simplified interpretation to the real equipment share is that it is more a matter of looking at quantity. When comparing the equipment

share for two countries valued at the same *real* prices, it is more a question of comparing how many investment goods compared to all other goods one country has in comparison to the other. The *nominal* equipment share is instead a pure expenditure measure. That is, based on a country's actual income valued at domestic prices, how much is spent on investment goods? Remember then that this investment share is determined at the prevailing actual domestic prices, which is what investors actually face and base their decision on.

If there is indeed a “learning by investing” effect, as is the implicit assumption for why investment should cause growth, then do we learn by having many machines (looking at real shares), or could it be the case that if the machine is relatively more expensive (nominal shares), more care will be put into the machine and therefore more will be learnt? This paper examines both alternatives. The use of nominal investment share in a cross country growth regression is, to my knowledge, a novelty in the literature.

Table 6 presents the regression results for the nominal investment shares. It displays the regression results for three types of investment shares in a panel data setting with time and country fixed effects, for both the high productivity and the large sample. Table 6 is therefore constructed similar to Table 3, with the single difference that the real investment shares are replaced by nominal shares. The results are also similar. The effects from equipment investment and producer durables investment are low and statistically insignificant. The effect from the total investment share is insignificant in the high productivity sample, but significant in the large sample. The data for the total investment share is retrieved from the World Development Indicators, which therefore deals with a slightly different sample than the real total investment share in Table 3 does. For the large sample, the effect can be interpreted as if the nominal total investment share increases by 3 percentage points, then the income growth rate increases by 0.1 percentage points.

Figure 5 depicts the partial scatter plot of this effect, and makes one wonder about robustness. If we exclude Papua New Guinea (PNG) and Guinea Bissau (GNB) (with or without Lesotho, LSO), then the effect from total investment is insignificant. The effect is also insignificant if we only include countries with Penn World Tables



data quality rank A and B (the two highest ranks out of four), or if countries are weighted according to their data quality rank.<sup>17</sup>

### 4.3.2 Equipment Prices and Investment Shares

Above, we saw that equipment prices and nominal investment shares are not systematically related to *income levels*. Now how does this relate to our discussion about investment shares and *income growth rates*? DS argued that low prices of investment should be associated with high quantities of investment, which in turn should be associated with high income growth rates. This, a maybe more important issue, is not empirically examined by Hsieh and Klenow (2006). Therefore, by taking the Hsieh and Klenow (2006) findings one step further and relating it to DS, this paper uses an instrumental variables approach to test whether low investment prices are associated with high investment quantities, and whether these are associated with high growth rates. The identification strategy is to regress income growth on labor force growth, the GDP per worker gap, the non-equipment share, and the equipment share, where the latter is instrumented by the equipment price level ( $P_{ij}$ ). This is similar to DS, who instrument equipment investment by the relative price of equipment ( $R_{ij}$ ).

In order to use the most accurate data available, the ICP benchmark data on equipment, non-equipment, and prices is used. The data is from 1975, 1980, 1985 and 1996, the years with broad cross sections of countries. The equipment share for e.g. 1975 is then used to explain the income growth rate from 1975 to 1980.

Table 7 reports the results from this short exercise. Interestingly, in the first stage regressions, the coefficients for the equipment price are negative and, most of the time, statistically significant. This means that although there are little differences between equipment prices in poor and rich countries, those countries with lower equipment prices indeed seem to have higher equipment shares. However, focusing on the second stage regressions, equipment shares do not seem to be related to income growth. The coefficients for the equipment share are statistically insignificant in all columns except for when the 1980 benchmark is used. Similar results are achieved if using producer durables investment in a cross section or in a panel data setting with time and country fixed effects.

---

<sup>17</sup> From the PWT 6.1 Data Appendix. The weights used were A=1, B=0.75, C=0.50, and D=0.25.

## 5. Conclusions

This paper presents new evidence on the relationship between investment and economic growth. Motivated by the influential analysis of DeLong and Summers (1991), it reconstructs and extends their analysis as closely as possible using more recent data, and relates to recent findings about the relation between investment prices and economic development.

Reconstructing and extending the analysis, there are three main conclusions: Firstly, the effects of equipment investment are much lower and most often statistically different from the effects in DeLong and Summers (1991). Secondly, the effects of equipment investment and non-equipment investment both being statistically significant indicate that growth might cause investment and not the other way around. Thirdly, for the largest sample, which covers the 1960-2000 period, the effect from equipment investment is statistically insignificant. The relationship between equipment investment and income growth is therefore no longer a strong and robust finding in a DeLong and Summers regression set-up.

The construction of an average investment share in DeLong and Summers (1991, 1992, 1993) is subject to critique, both because it is ill measured and because the regression is likely to suffer from reverse causality. This paper therefore suggests an alternative approach that includes all the variables proposed by DeLong and Summers, but at the same time uses better and more direct measures of the initial investment share in a panel data setting. Using measures of the equipment share, the producer durables share, and the total investment share, the results show that the investment share, however defined, is not strongly and robustly correlated with income growth.

As a last exposition, this paper relates to recent findings showing that the price of investment is not systematically higher in rich countries compared to poor ones. It shows that although the investment price is not systematically related to income, countries with investment prices tend to invest more, but these higher investments do not seem to promote growth.

This paper therefore repeatedly refutes the much acclaimed impression that there is a strong and robust correlation between investment and income growth, which is in line with the Solow (1956) growth model and is not controversial. The findings suggest that although investments are important, the benefits from investments are

probably not as large as they often are portrayed to be. Policy that aims at promoting income growth should not overemphasize the importance of capital formation.

## References

- Abel, Andrew B. (1992) "Comments and Discussion." *Brookings Papers on Economic Activity* 1992 (2):200-211.
- Arrow, Kenneth J. (1962) "The Economic Implications of Learning by Doing." *The Review of Economic Studies* 29(3):155-173.
- Auerbach, Alan J., Hasset, Kevin A., and Stephen D. Oliner. (1994) "Reassessing the Social Returns to Equipment Investment." *Quarterly Journal of Economics* 109(3): 789-802.
- Barro, Robert J., and Xavier X. Sala-i-Martin. (1995) *Economic Growth*, The MIT Press, Cambridge, Massachusetts.
- Blomström, Magnus., Robert E. Lipsey and Mario Zejan. (1996) "Is Fixed Investment the Key to Economic Growth?" *Quarterly Journal of Economics* 111(1): 269-276.
- Carrol, Christopher D. and David N. Weil. (1994) "Savings and growth: a reinterpretation." *Carnegie-Rochester Conference Series on Public Policy* 40: 133-192.
- Data Appendix for Space-Time System of National Accounts: Penn World Table 6.1 (PWT 6.1) <<http://pwt.econ.upenn.edu/Documentation/append61.pdf>>
- DeLong, J. Bradford., and Lawrence H. Summers. (1990) "Equipment Investment and Economic Growth." *NBER Working Papers Series* No. 3515.
- DeLong, J. Bradford., and Lawrence H. Summers. (1991) "Equipment Investment and Economic Growth." *Quarterly Journal of Economics* 106 (2, May): 445-502.
- DeLong, J. Bradford., and Lawrence H. Summers. (1992) "Equipment Investment and Economic Growth: How Strong is the Nexus?" *Brookings Papers on Economic Activity* 1992 (2): 157-211.
- DeLong, J. Bradford., and Lawrence H. Summers. (1993) "How strongly do developing economies benefit from equipment investment?" *Journal of Monetary Economics* 32: 395-415.
- DeLong, J. Bradford., and Lawrence H. Summers. (1994) "Equipment Investment and Economic Growth: Reply." *Quarterly Journal of Economics* 109 (2): 803-807.
- Eaton, Jonathan., and Samuel Kortum. (2001) "Trade in capital goods." *European Economic Review* 45: 1195-1235.

Easterly, William. (2001) *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics*, The MIT Press, Cambridge, Massachusetts.

Easterly, William., and Ross Levine. (2001) "It's Not Factor Accumulation: Stylized Facts and Growth Models." *The World Bank Economic Review* 15(2): 177-219.

*Handbook of the International Comparison Programme*. United Nations, New York, 1992

Heston, Alan., Robert Summers and Bettina Aten, Penn World Table Version 6.1, Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002.

Hoover, Kevin D., and Stephen J. Perez. (2004) "Truth and Robustness in Cross-Country Growth Regressions." *Oxford Bulletin of Economics and Statistics* 66, 5(2004), 0305-9049.

Hsieh, Chang-Tai., and Peter J. Klenow. (2006) "Relative Prices and Relative Prosperity." Forthcoming *American Economic Review*  
<<http://www.econ.berkeley.edu/users/chsieh/RPandRP.pdf>>

Levine, Ross and David Renelt. (1992) "A Sensitivity Analysis of Cross-Country Growth Regressions." *American Economic Review* 82(4): 942-963.

Podrecca, Elena and Gaetano Carmecchi. (2001) "Fixed investment and economic growth: new results on causality." *Applied Economics* 33: 177-182.

PWT6 Technical Documentation.  
<<http://pwt.econ.upenn.edu/Documentation/Doc-tech.pdf>>

Sala-i-Martin, Xavier X. (1997a) "I Just Ran Four Million Regressions." NBER Working Paper No. 6252.

Sala-i-Martin, Xavier X. (1997b) "I Just Ran Two Million Regressions." *American Economic Review* 87(2): Papers and Proceedings of the Hundred and Fourth Annual Meeting of the American Economic Association, p. 178-183.

Solow, Robert M. (1956) "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics* 70(1): 65-94.

Summers, Robert, and Alan Heston. (1990) "The Penn World Table V." University of Pennsylvania Xerox

Summers, Robert and Alan Heston. (1991) "The Penn World Tables (Mark 5): An Expanded Set of International Comparisons, 1950-1988." *Quarterly Journal of Economics* 106(2): 327-368.

Vanhoudt, Patrick. (1998) "A fallacy in causality research on growth and capital accumulation" *Economic Letters* 60: 77-81.

World Bank (2005) *Meeting the Challenge of Africa's Development: A World Bank Group Action Plan*. Africa Region, The World Bank.  
<[http://siteresources.worldbank.org/INTAFRICA/Resources/aap\\_final.pdf](http://siteresources.worldbank.org/INTAFRICA/Resources/aap_final.pdf) >

**Table 1**  
**Replication and Extension of the Main Results in DeLong and Summers (1991)**  
 Dependent Variable: Real GDP per worker growth

	1960-1985 sample, using the 1970-75-80 benchmarks						1960-1990 sample, 1970-75-80-85 benchmarks		1960-2000 sample, 1970-75-80-85-96 benchmarks	
	Original DeLong and Summers (1991) data		Replicated data, same sample		Replicated data, new sample <sup>a</sup>		hp	large	hp	large
	hp	large	hp	large	hp	large	hp	large	hp	large
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Equipment share <sup>b</sup>	0.3373 <sup>***</sup> (0.0538)	0.2653 <sup>***</sup> (0.0654)	0.3261 <sup>***</sup> (0.0755)	0.2474 <sup>***</sup> (0.0786)	0.2663 <sup>***</sup> (0.0666)	0.2379 <sup>***</sup> (0.0785)	0.2135 <sup>***</sup> [0.0624]	0.1439* (0.0745)	0.0905 (0.0594)	0.0442 (0.0502)
Non-equipment share <sup>c</sup>	-0.0147 (0.0328)	0.0623* (0.0349)	0.0516 (0.0547)	0.1067 <sup>***</sup> (0.0374)	0.0772* (0.0431)	0.1137 <sup>***</sup> (0.0336)	0.0793* [0.0403]	0.1236 <sup>***</sup> (0.0324)	0.0623 (0.0413)	0.1533 <sup>***</sup> (0.0282)
Labor Force growth	-0.0004 (0.1463)	-0.0296 (0.1986)	-0.0427 (0.1741)	-0.0681 (0.1894)	-0.1839 (0.1408)	-0.0736 (0.1726)	-0.3120 <sup>**</sup> [0.1391]	-0.2768 (0.1758)	-0.5857 <sup>***</sup> (0.1350)	-0.6122 <sup>***</sup> (0.1467)
GDP/wkr gap 1960	0.0305 <sup>***</sup> (0.0088)	0.0202 <sup>**</sup> (0.0092)	0.0373 <sup>***</sup> (0.0086)	0.0389 <sup>***</sup> (0.0084)	0.0252 <sup>***</sup> (0.0080)	0.0404 <sup>***</sup> (0.0079)	0.0236 <sup>***</sup> [0.0067]	0.0315 <sup>***</sup> (0.0069)	0.0239 <sup>***</sup> (0.0062)	0.0210 <sup>***</sup> (0.0051)
<i>n</i>	25	61	25	61	23	64	27	71	35	78
<i>R</i> <sup>2</sup>	0.718	0.338	0.701	0.405	0.720	0.439	0.717	0.421	0.672	0.522

Notes: The superscript <sup>\*\*\*</sup> denotes significant at the 1% level, <sup>\*\*</sup> significant at the 5% level, <sup>\*</sup> significant at the 10% level. Standard errors in ( ), robust standard errors in [ ], robust standard errors if heteroscedasticity according to Whites test. Each regression includes a constant, which is not reported. hp denotes a high productivity sample where the ratio between the GDP/wkr in country *i* and the GDP/wkr 1960 in the US is larger than 0.25. For further information see text and Data Appendix. Rows (1) until (6) have the income growth rate for the 1960-1985 period, labor force growth rate, and average investment shares for the same period. The other samples are constructed in a similar manner with the difference of considering the 1960-1985 period and the 1960-2000 period.

a: The differences from the previous samples are that the hp sample is based on PWT 5.6, and that Romania, Syria, and Yugoslavia are added to the large sample.

b: Electrical and non-electrical machinery. For the 1960-2000 sample, producer durables (equipment + transport equipment) has been used due to data limitations.

c: Structures, transport equipment and change in stocks. For the 1960-2000 sample, only structures and change in stocks.

**Table 2**  
**Lagged Investment**  
Dependent Variable: Real GDP per worker growth rate 1975-1985

Independent Var.	Original Delong and Summer (1991) data		Replicated data, new samples	
	hp sample	larger sample	hp sample	larger sample
Equipment share 1960-75	0.3903*** (0.0965)	0.1304 (0.1016)	0.1535 (0.1080)	-0.0170 (0.1347)
Non-equipment share 1960-75	0.0272 (0.0515)	-0.0455 (0.0368)	0.0861 (0.0532)	-0.0127 (0.0618)
Labor force growth 1975-85	-0.0558 (0.2637)	-0.4297 (0.3403)	-0.5083** (0.2205)	-0.5171* (0.2998)
GDP/wkr gap 1975	0.0176 (0.0154)	0.0088 (0.0129)	0.0018 (0.0140)	0.0118 (0.0127)
<i>n</i>	25	61	23	66
<i>R</i> <sup>2</sup>	0.541	0.074	0.615	0.054

Notes: Standard errors in ( ). \*\*\* significant at the 1% level, \*\* 5% level, \* at the 10% level. Intercept included but not reported. Hp sample in replicated data excludes Hong Kong and Japan. The lagged equipment share was constructed by taking the average of the ratio from equipment investment to total investment for the benchmark years 1970, 1975, and 1980, and then multiplying it by the total investment share of GDP for 1960-1975. The correlation between the original DS lagged equipment share and the reconstructed is 0.91 for the large sample and 0.97 for the hp sample. The difference between the large reconstructed sample and the large sample in Table 1, Column 6 is the inclusion of Hungary and Poland.

**Table 3**  
**Real Investment and Growth**  
Dependent Variable: Real GDP per worker growth

	hp (1)	hp (2)	hp (3)	large (4)	large (5)	large (6)
Equipment share	0.003 (0.137)			0.002 (0.150)		
Non-equipment share	-0.145** (0.065)			-0.111* (0.060)		
Producer durables share		-0.066 (0.081)			0.034 (0.079)	
Non-producer durables share		-0.146*** (0.052)			-0.116*** (0.042)	
Total investment share			-0.019 (0.032)			0.100*** (0.022)
GDP/wkr gap	0.120* (0.069)	0.035 (0.021)	0.076*** (0.018)	0.147** (0.070)	0.047* (0.027)	0.134*** (0.021)
Labor force growth	-1.450*** (0.494)	-0.225 (0.391)	-0.639*** (0.122)	-1.410*** (0.168)	-1.147*** (0.169)	-0.783*** (0.097)
Time and country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
<i>Number of observations</i>	85	140	308	147	244	635
<i>Number of countries</i>	35	54	56	68	103	115
<i>R<sup>2</sup> (within)</i>	0.570	0.452	0.255	0.563	0.359	0.213

Standard errors in ( ). \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.



**Table 4**  
**Relative Equipment Prices vs. Equipment Prices**  
Independent variable: log PPP GDP per worker

Dependent var.	1975	1980	1985	1996 <sup>a</sup>
Log Relative equipment price	-0.3933 <sup>***</sup> (0.0539) R <sup>2</sup> =0.6244	-0.2152 <sup>***</sup> (0.0503) R <sup>2</sup> =0.2367	-0.3806 <sup>***</sup> (0.0425) R <sup>2</sup> =0.5645	-0.4055 <sup>***</sup> [0.0420] R <sup>2</sup> =0.5288
Log Equipment price	-0.0319 (0.0344) R <sup>2</sup> =0.0262	0.0125 (0.0379) R <sup>2</sup> =0.0018	-0.0505 [0.0337] R <sup>2</sup> =0.0213	0.0517 [0.0335] R <sup>2</sup> =0.0209
Log Aggregate price level of all goods other than equipment	0.3858 <sup>***</sup> [0.0606] R <sup>2</sup> =0.5587	0.2381 <sup>***</sup> [0.0435] R <sup>2</sup> =0.3101	0.3449 <sup>***</sup> [0.0486] R <sup>2</sup> =0.4787	0.4924 <sup>***</sup> [0.0581] R <sup>2</sup> =0.5164
<i>n</i>	34	61	64	114

Notes: Standard errors in ( ), robust standard errors in [ ]. \*\*\* significant at the 1% level, \*\* 5% level, \* at the 10% level. See text for further information.

a: Price for producer durables. Aggregate price is then the aggregate price level of all goods other than producer durables.

**Table 5**  
**Real vs. Nominal Investment shares**  
Independent variable: log PPP GDP per worker

<b>Real Shares</b>				
Dependent Var.	1975	1980	1985	1996
Real equipment share	0.0150 <sup>***</sup> (0.0051) R <sup>2</sup> =0.2158	0.0129 <sup>***</sup> (0.0038) R <sup>2</sup> =0.1603	0.0191 <sup>***</sup> (0.0024) R <sup>2</sup> =0.5082	N.A.
Real producer durables share	0.0194 <sup>***</sup> [0.0047] R <sup>2</sup> =0.2230	0.0173 <sup>***</sup> [0.0045] R <sup>2</sup> =0.1979	0.0273 <sup>***</sup> (0.0029) R <sup>2</sup> =0.5946	0.0253 <sup>***</sup> (0.0044) R <sup>2</sup> =0.2265
<b>Nominal Shares</b>				
	1975	1980	1985	1996
Nominal equipment share	-0.0077 <sup>*</sup> [0.0045] R <sup>2</sup> =0.0780	0.0030 (0.0028) R <sup>2</sup> =0.0192	0.0051 <sup>*</sup> (0.0030) R <sup>2</sup> =0.0431	N.A.
Nominal producer durables share	-0.0139 <sup>*</sup> [0.0073] R <sup>2</sup> =0.1322	0.0022 [0.0037] R <sup>2</sup> =0.0068	0.0058 (0.0037) R <sup>2</sup> =0.0375	-0.0041 (0.0060) R <sup>2</sup> =0.0041
<i>n</i>	34	61	64	114

Notes: Standard errors in ( ), robust standard errors in [ ]. \*\*\* significant at the 1% level, \*\* 5% level, \* at the 10 % level. Producer durables are equipment plus transport equipment.

**Table 6**  
**Nominal Investment and Growth**  
Dependent Variable: Real GDP per worker growth

	(1)	(2)	(3)	(4)	(5)	(6)
	hp	hp	hp	large	large	large
Nominal equipment share	0.051 (0.179)			0.167 (0.158)		
Nominal non-equipment share	-0.192 (0.124)			-0.150* (0.080)		
Nominal producer durables share		-0.051 (0.089)			0.001 (0.071)	
Nominal non-producer durables share		-0.161** (0.066)			-0.122** (0.054)	
Nominal total investment share			0.002 (0.029)			0.047** (0.021)
GDP/wkr gap	0.129* (0.069)	0.048** (0.021)	0.082*** (0.017)	0.171** (0.068)	0.057* (0.026)	0.120*** (0.020)
Labor force growth	-1.287** (0.507)	-0.265 (0.407)	-0.557*** (0.115)	-1.267*** (0.180)	-1.047*** (0.174)	-0.774*** (0.092)
Time and country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
<i>Number of observations</i>	85	140	287	147	244	587
<i>Number of countries</i>	35	54	55	68	103	114
<i>R<sup>2</sup> (within)</i>	0.5467	0.4167	0.2799	0.5622	0.3454	0.2283

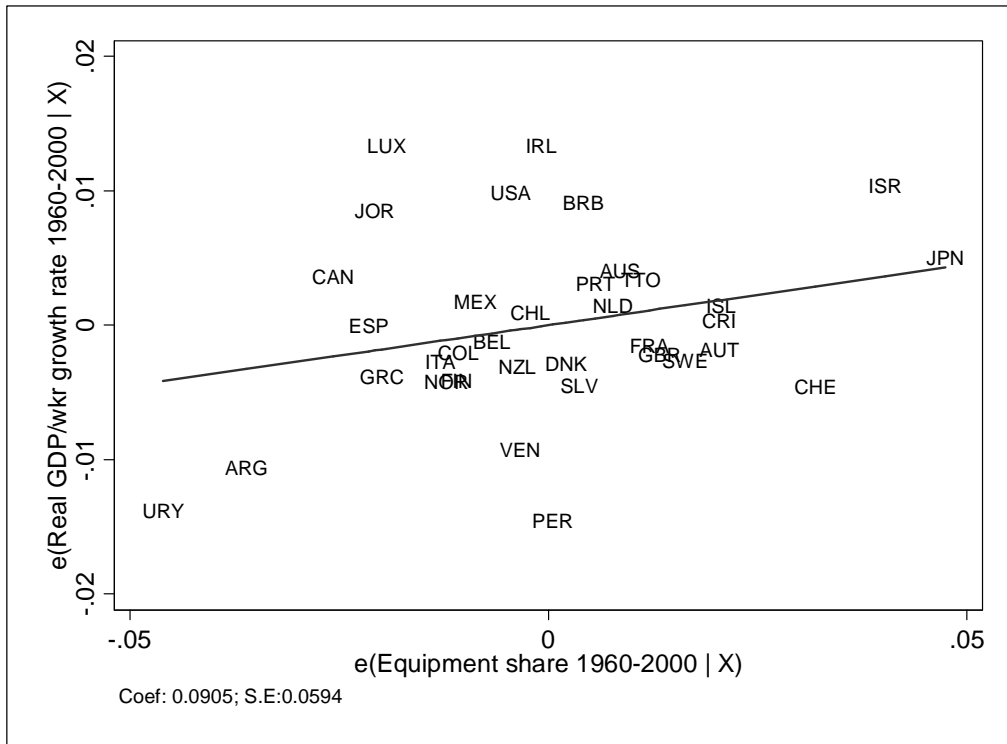
Standard errors in ( ). \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 7**  
**IV-Regressions**  
Dependent Variable: Real GDP per worker growth

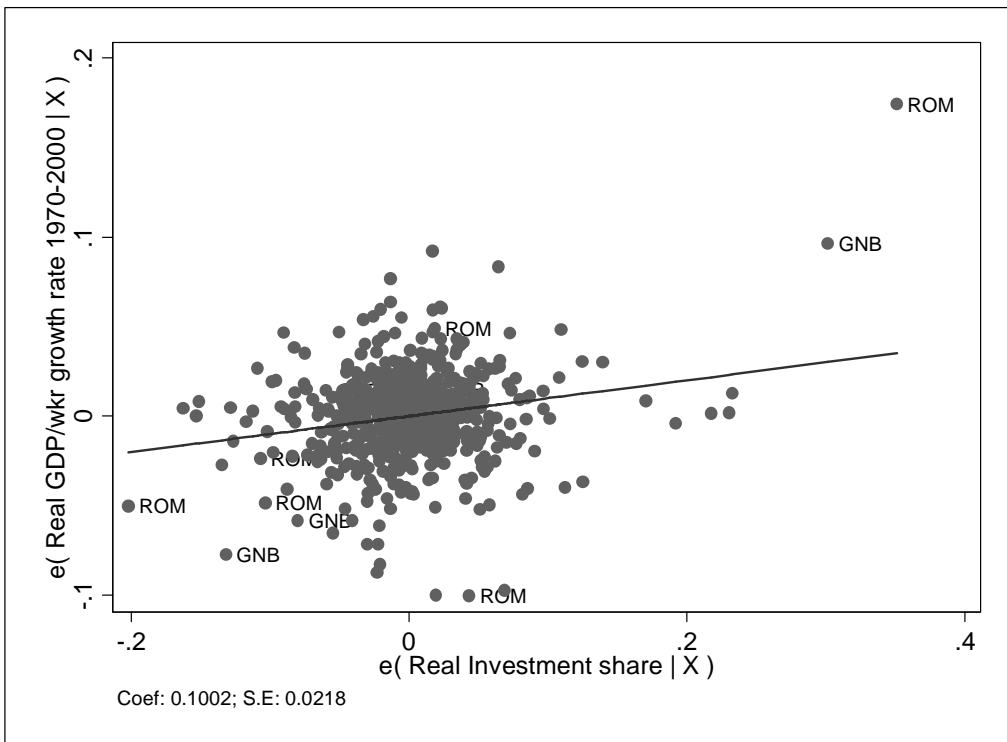
benchmarks	High Productivity Sample				Large Sample			
	1975	1980	1985	1996	1975	1980	1985	1996
	Second Stage				Second Stage			
Predicted equipment share	0.2194 (0.3471)	0.6406 <sup>***</sup> (0.2279)	-1.1928 (1.6785)	0.0965 (0.1343)	0.8464 (0.6672)	0.3918* (0.2157)	0.5219 (0.6255)	1.0283 (1.6730)
Non-equipment share	-0.3492 <sup>**</sup> (0.1580)	0.0014 (0.0716)	0.0411 (0.2248)	-0.0511 (0.0588)	-0.4433* (0.2169)	-0.0278 (0.0657)	-0.0504 (0.1258)	0.0033 (0.0768)
Labor force growth	-0.9836* (0.5252)	-0.0110 (0.4802)	-2.7679 (1.6154)	-0.5801* (0.3170)	-0.5507 (0.6517)	-0.8253 <sup>**</sup> (0.3706)	-1.2228 <sup>***</sup> (0.2171)	-2.0387 (1.9226)
GDP/wkr gap	0.0581* (0.0287)	-0.0065 (0.0178)	-0.0024 (0.0479)	-0.0026 (0.0140)	0.0641* (0.0338)	0.0220 (0.0154)	0.0433 (0.0308)	0.1089 (0.1789)
	First Stage				First Stage			
Log equipment price.	-0.1079 <sup>***</sup> (0.0278)	-0.0528 <sup>***</sup> (0.0122)	-0.0343 (0.0228)	-0.1282 <sup>***</sup> (0.0449)	-0.0484 <sup>**</sup> (0.0205)	-0.0434 <sup>***</sup> (0.0090)	-0.0152 <sup>***</sup> (0.0056)	-0.0084 (0.0125)
$R^2$	0.596	0.492	0.312	0.356	0.545	0.471	0.726	0.344
$n$	22	38	28	44	34	61	55	104

Notes: The superscript <sup>\*\*\*</sup> denotes significant at the 1% level, <sup>\*\*</sup> significant at the 5% level, <sup>\*</sup> significant at the 10% level. Standard errors in ( ). Estimated regression is:  $I_{eq}/Y = \alpha_0 + \alpha_1(\log equip.price) + \alpha_2(n) + \alpha_3(gap) + \alpha_4(I_{st}/Y) + e$ ,  $growth = \beta_0 + \beta_1(pred.I_{eq}/Y) + \beta_2(I_{st}/Y) + \beta_3(n) + \beta_4(gap) + v$ . For 1975, growth is the income growth rate 1975-1980,  $n$  is the labor force growth for the same period,  $gap$  is the GDP per worker gap 1975,  $I_{eq}/Y$  and  $I_{st}/Y$  is the equipment share 1975, and  $\log equip. price$  is the log equipment price 1975. The other benchmark years have a similar set-up. Due to data limitations in real GDP per worker and labor force, some countries are excluded. For 1985 these are: The Bahamas, Barbados, Botswana, Ethiopia, Nepal, St. Lucia, Suriname, Swaziland, and Tanzania. For 1996: Antigua and Barbuda, The Bahamas, Bermuda, Dominica, Grenada, Israel, Qatar, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines.

**Figure 1: Partial Scatter Plot (Table 1, Column 9)**

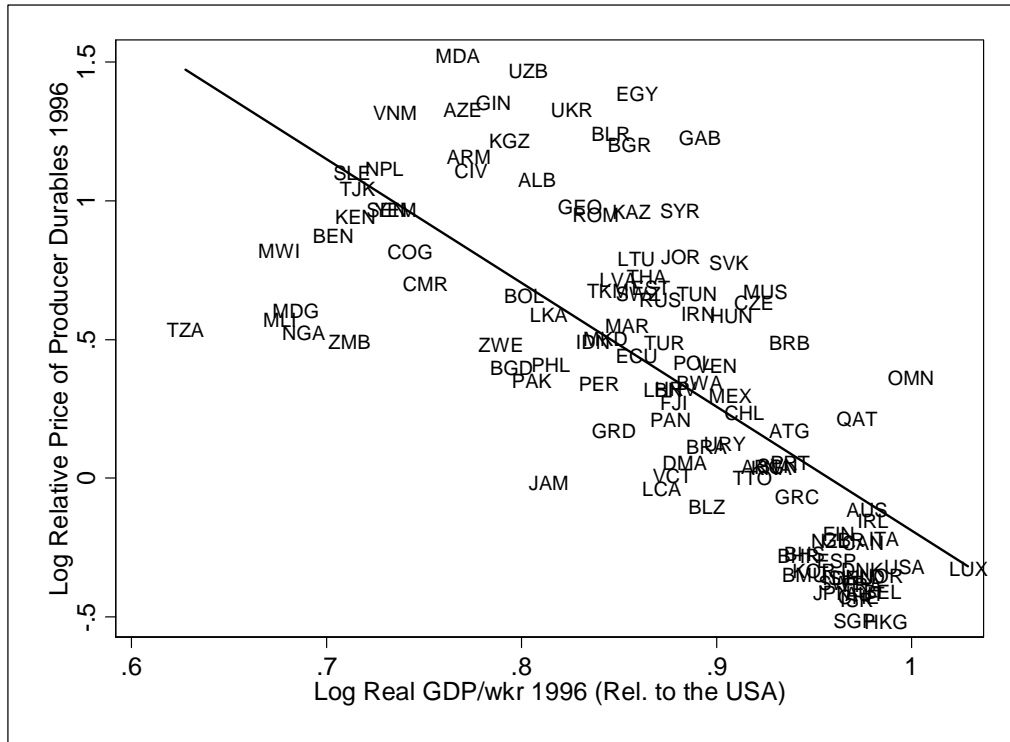


**Figure 2: Partial Scatter Plot (Table 3, Column 6)**

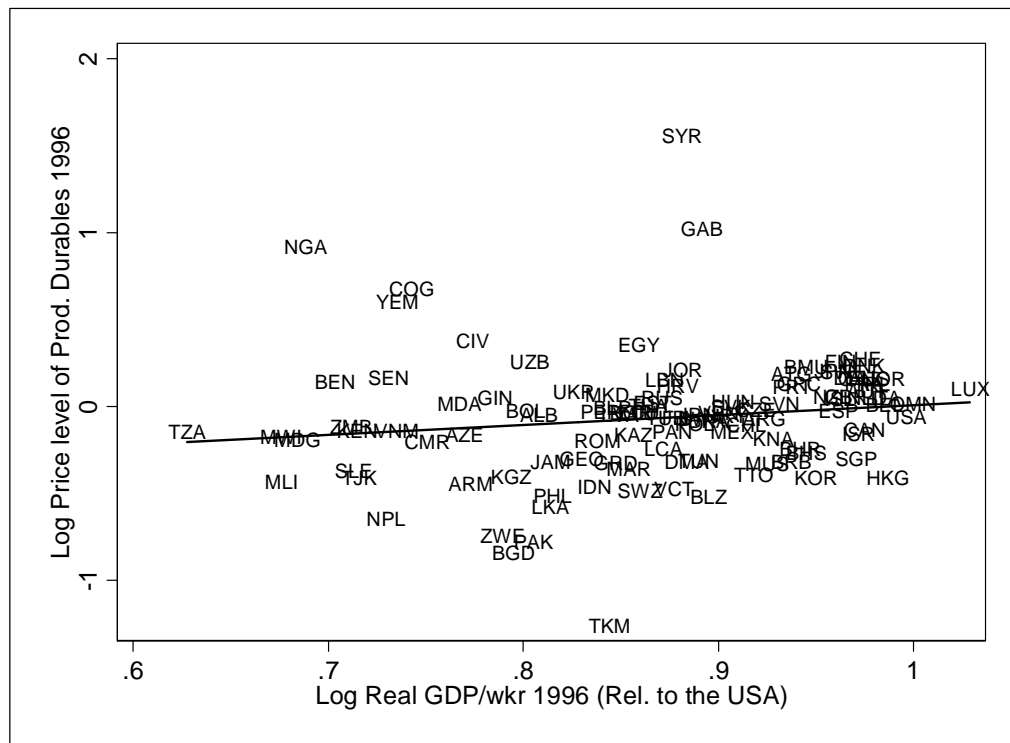


Note: Only a selection of country codes are included

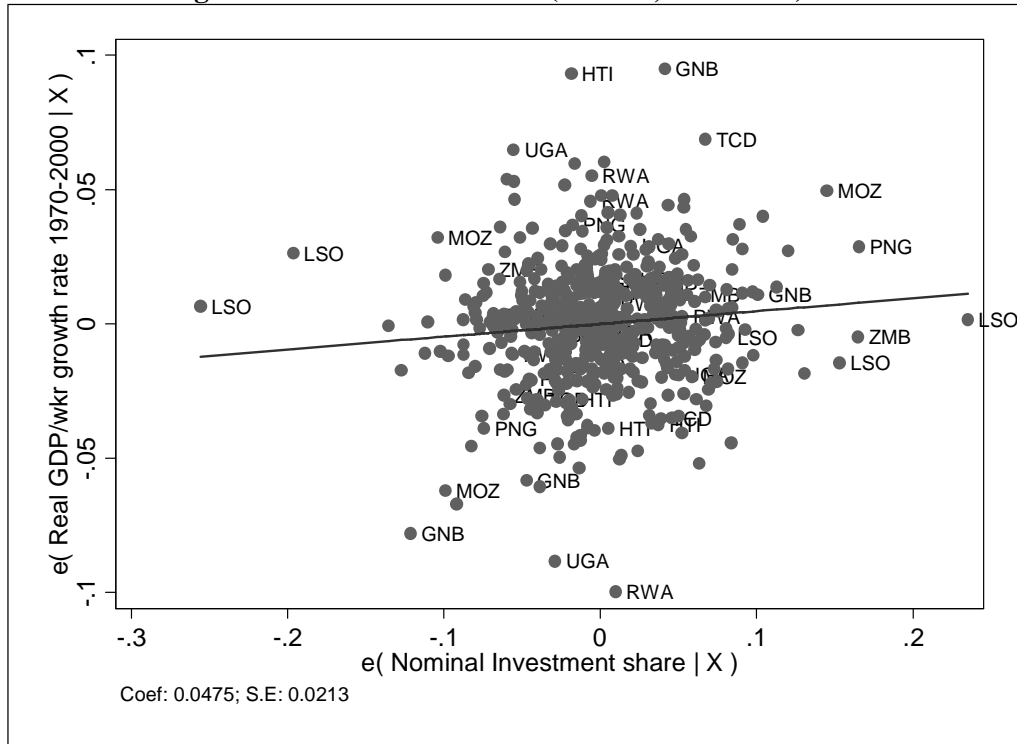
**Figure 3: Relative Price of Equipment vs. Income 1996**



**Figure 4: Price of Equipment vs. Income 1996**



**Figure 5: Partial Scatter Plot (Table 6, Column 6)**



Note: Only a selection of country codes are included

## Data Appendix:

### A1. Reconstructing DeLong and Summers

For the replicated data in Table 1, the average equipment shares of GDP were created by taking the ratio between equipment investment and total investment for a benchmark year and multiplying it by the average total investment share of GDP for a specific period. The equipment-total-investment ratio is calculated based on ICP benchmarks from the Penn World Tables.<sup>18</sup> The total investment share is the real investment share in constant prices retrieved from PWT 5.6 or PWT6.1, depending on coverage.

#### A1.1 The 1960-1985 sample (benchmarks 1970, 75, 80)

Benchmark			Total Investment Share		
70	75	80	70	75	80
70	75	80	1960-72	1973-77	1978-85
	75	80		1960-77	1978-85
		80			1960-85
+	70	75	1960-72	1973-85	
+		75		1960-85	

For Thailand (part of the 1975 benchmark), Malaysia (1970, 1975) and Jamaica (1975), there is no information in DS on how to calculate. The table above indicates how these countries have been calculated. Other countries that are in at least one of the ICP benchmarks studies from 1970 to 1980 but not in the sample are: Poland (1975, 1980), Hungary (1970, 1975, 1980), and Iran (1970, 1975). Iran is excluded because it is a major oil exporter. Hungary and Poland are excluded because there is no data in PWT5.6 on GDP from 1960 to 1969. Including Hungary and Poland while calculating the income growth rate for 1970-1985 does not change the results.

#### Summary statistics 1960-1985 sample, reconstructed data (Table 1, Columns 3-4)

Variable	Obs.	Mean	Std. Dev.	Min	Max
Real GDP /wkr growth 1960-85	64	0.0247	0.0160	-0.0126	0.0685
Equipment share (reconstructed)	64	0.0499	0.0281	0.0038	0.1221
Non-equipment share (reconstructed)	64	0.1372	0.0547	0.0095	0.2499
Labor force growth 1960-85	64	0.0198	0.0094	0.0017	0.0376
GDP/wkr gap 1960	64	0.7289	0.2316	0.0000	0.9780

Note: Data from PWT 5.6.

#### Correlations

Corr(Equip. share (reconstructed); Equip. share (DS original))	0.9151
Corr(Non-equip. share (reconstructed); Non-equip. share (DS original))	0.8592
Corr(Equip. share (reconstructed); Non-equip. share (reconstructed))	0.6094

<sup>18</sup> <http://pwt.econ.upenn.edu/Downloads/benchmark/benchmark.html>



## A1.2 The 1960-1990 Sample (benchmarks 1970, 75, 80, 85)

Equipment investment and total investment ratios (from ICP benchmarks) have been matched to the average total investment share (from PWT 5.6) as follows.

Benchmark				Total Investment Share			
70	75	80	85	70	75	80	85
70	75	80	85	1960-72	1973-77	1978-82	1983-90
70	75	80		1960-72	1973-77	1978-90	
	75	80	85		1960-77	1978-82	1983-90
70	75		85	1960-72	1973-79		1980-90
	75		85		1960-79		1980-90
70	75			1960-72	1973-90		
	75	80			1960-77	1978-90	
		80	85			1960-82	1983-90
		80				1960-90	
			85				1960-90
	75				1960-90		

### Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Real GDP /wkr growth 1960-90	71	0.0201	0.0144	-0.0135	0.0593
Equipment share	71	0.0477	0.0270	0.0081	0.1200
Non-equipment share	71	0.1284	0.0558	-0.0257	0.2354
Labor force growth 1960-90	71	0.0208	0.0093	0.0027	0.0391
GDP/wkr gap 1960	71	0.7027	0.2475	0.0000	0.9687

The difference in sample from DS is the addition of Australia, Benin, Bangladesh, Republic of Congo, Egypt, Iran, Mauritius, New Zealand, Rwanda, Sweden, Syria, Trinidad & Tobago, Turkey, and Yugoslavia, and the exclusion (due to data limitations) of Botswana, Ethiopia, and Tanzania. Extending the sample to include countries that miss up to ten years of data on GDP or investment adds another nine countries (including Botswana and Tanzania), but does not change the main results. Another difference from DS is that Hong Kong and Japan are not part of the high productivity sample.

### A1.3 The 1960-2000 sample (benchmarks 1970, 75, 80, 85, 96)

#### Matching of equipment-to-total-investment-ratio to total-investment-to-GDP.

Benchmark					Total Investment Share				
70	75	80	85	96	70	75	80	85	96
70	75	80	85	96	1960-1972	1973-1977	1978-1982	1983-1990	1991-2000
70	75	80	85		1960-1972	1973-1977	1978-1982	1983-2000	
	75	80	85	96		1960-1977	1978-1982	1983-1990	1991-2000
70	75	80			1960-1972	1973-1977	1978-2000		
	75	80		96		1960-1977	1978-1986		1987-2000
	75		85	96		1960-1979		1980-1990	1991-2000
		80	85	96			1960-1982	1983-1990	1991-2000
70	75				1960-1972	1973-2000			
	75			96		1960-1984			1985-2000
		80	85				1960-1982	1983-2000	
		80		96			1960-1986		1987-2000
			85	96				1960-1990	1991-2000
			85					1960-2000	
				96					1960-2000
		80					1960-2000		

#### Summary statistics 1960-2000 sample

Variable	Obs.	Mean	Std. Dev.	Min	Max
Real GDP /wkr growth 1960-2000	78	0.0186	0.0140	-0.0121	0.0552
Equipment share	78	0.0654	0.0335	0.0084	0.1509
Non-equipment share	78	0.1016	0.0477	-0.0331	0.2217
Labor force growth 1960-2000	78	0.0205	0.0093	0.0021	0.0421
GDP/wkr gap 1960	78	0.6659	0.2833	-0.0584	0.9771

In the PWT benchmark downloads, from which the data has been retrieved, there is no data available for the 1990 benchmark. In the 1996 benchmark the data is only subdivided into producer durables (equipment and transport). The data above is therefore for the producer durables share of GDP, which is still in line with DeLong and Summers (1992, 1993).

The difference between the DS high productivity sample in Column (1) and the 1960-2000 hp sample in Column (9) is that West Germany and Hong Kong have been excluded, and the following countries have been added: Australia (AUS), Barbados (BRB), Colombia (COL), El Salvador (SLV), Greece (GRC), Iceland (ISL), Jordan (JOR), New Zealand (NZL), Portugal (PRT), Sweden (SWE), Switzerland (CHE), and Trinidad & Tobago (TTO) (the country codes in parentheses can be seen in Figure 1). West Germany is excluded because of data limitations. Hong Kong is excluded since it does not meet the requirements of the high productivity sample.

The differences between the DS large sample and the large sample (Column 10) are, in addition to the changes already mentioned above, the inclusion of: Benin, Bangladesh, Republic of Congo, Egypt, Gabon, Guinea, Mauritius, Nepal, Romania, Rwanda, Syria, and Turkey. Botswana and Tunisia are excluded based on data limitations.

There are 127 countries covered by at least one of the ICP benchmark studies 1970, 1975, 1980, 1985, or 1996. Due to data limitations in especially GDP per worker for 1960 and 2000, the sample is reduced to 78 countries. A great majority of

the excluded countries are so called transition countries, which were not their own entities until 1990.

Iran is excluded since it is an oil country. The country was excluded by DS as well. The rationale for excluding major oil countries is that their income is based on natural resources and not industrial development. Except for Iran there is little guidance in DS on how to select and exclude high income oil exporters. The DS sample includes for example Ecuador, Indonesia, Nigeria, and Venezuela, all members of OPEC during the studied period, and with exports consisting to a large extent of oil.

## **A2. Description of variables and sample restrictions**

### **Regressions with equipment investments**

*Equipment share of GDP:* Electrical and non-electrical equipment and machinery investment as a share of GDP. Constructed based on ICP benchmarks from the PWT website.<sup>19</sup> Real shares in panel data are deflated by multiplying the equipment share by the ratio of the investment share at constant prices to the investment share at current prices (investment shares retrieved from PWT 5.6), nominal equipment shares are in current prices.

*Non-equipment share of GDP:* Consists of the non-equipment part of investments (structures, transport investment, and change in inventory). Source: ICP benchmarks. Real shares in panel data are deflated, nominal shares are in current prices.

### **Regressions with producer durables**

*Producer durables share of GDP:* Equipment and transport investments as a share of GDP. Original source: ICP benchmarks from PWT website. Real shares in panel data are deflated by multiplying the producer durables share by the ratio of the investment share at constant prices by the investment share at current prices (investment shares retrieved from PWT 6.1), nominal shares are in current prices.

*Non-producer durables share of GDP:* Consists of the non producer durables part of investments (structures investment and change in inventory). Source: ICP benchmarks. Real shares in panel data are deflated, nominal shares are in current prices.

### **Regressions with total investments**

*Real total investment share* (ki) from PWT 6.1.

*Nominal investment share* = Gross capital formation/GDP in current local currency units from World Development Indicators.

### **Common variables**

*GDP per worker growth rate:* annual growth rate of real GDP per worker. For the 1960-1990 period, GDP per worker (rgdpw) is from PWT 5.6. For the 1960-2000 period, GDP per worker (rgdpwok) is from PWT6.1 (due to data limitations).

---

<sup>19</sup> <http://pwt.econ.upenn.edu/Downloads/benchmark/benchmark.html>

*Labor force growth (n)*: annual growth rate of the labor force. For the 1960-1990 period, labor force is derived from GDP per capita (rgdpch), GDP per worker (rgdpw), and population (pop), all from PWT 5.6, as suggested by Summers and Heston (1991). For the 1960-2000 period labor force is derived from GDP per capita (rgdpch), GDP per worker (rgdpwok), and population (pop) from PWT 6.1.

*GDP per worker gap (gap)*:  $Gap = 1 - (GDP/wkr_i)/(GDP/wkr_{USA})$ .

GDP per worker is for the first year (i.e. for the 1970-1975 period, the gap is for 1970). For the 1960-1990 period, the source is PWT 5.6. For the 1960-2000 period, the source is PWT 6.1.

### High productivity sample (hp)

If the GDP per worker gap ( $GDP/wkr_i/GDP/wkr_{USA}$ ) is greater than 0.25, then part of the high productivity sample otherwise not. For cross sections in Table 1, the GDP per worker gap is based on 1960. For the panel data, it is the average GDP per worker gap during the studied period (due to data limitations). For the 1960-1990 period, GDP per worker is from PWT5.6. For 1960-2000, GDP per worker is from PWT6.1.

### Major fuel exporter

In Tables 3 and 6, a country is labeled “major fuel exporter” and excluded from the sample if the average fuel exports of merchandise exports is greater than or equal to 50 percent over the period studied, and where the fuels consists of oil, gas, coal, and electric current (SITC Section 3, mineral fuels, source World Development Indicators).

## A3. Summary statistics

### Summary statistics for reconstructed lagged data in Table 2

Variable	Obs.	Mean	Std. Dev.	Min	Max
Real GDP /wkr growth 1975-85	66	0.0121	0.0216	-0.0416	0.0683
Equipment share 1960-75	66	0.0522	0.0316	0.0039	0.1209
Non-equipment share 1960-75	66	0.1270	0.0588	0.0090	0.2698
Labor force growth 1975-85	66	0.0202	0.0103	-0.0032	0.0389
GDP/wkr gap 1975	66	0.6448	0.2726	0.0000	0.9780

### Summary statistics for Tables 3 and 6

Variable	Obs.	Mean	Std. Dev.	Min	Max
<b>Equipment investments</b>					
GDP/wkr growth	147	0.0109	0.0311	-0.0882	0.0872
Real equipment share	147	0.0556	0.0295	0.0042	0.1480
Real structures share	147	0.1498	0.0631	-0.0110	0.3231
Nominal equipment share	147	0.0681	0.0201	0.0147	0.1313
Nominal structures share	147	0.1673	0.0483	0.0364	0.3429
Labor force growth	147	0.0191	0.0162	-0.0054	0.1108
GDP/wkr gap	147	0.5973	0.2959	0.0000	0.9699
<b>Producer durables</b>					
GDP/wkr growth	244	0.0153	0.0275	-0.1097	0.0951
Real producer durables share	244	0.0708	0.0393	0.0052	0.2075
Real non-producer durables share	244	0.1141	0.0591	-0.0116	0.4359
Nominal producer durables share	244	0.0950	0.0339	0.0181	0.2373
Nominal non-producer durables share	244	0.1325	0.0490	0.0031	0.3280
Labor force growth	244	0.0172	0.0149	-0.0164	0.1108

GDP/wkr gap	244	0.6007	0.3083	-0.4290	0.9826
<b>Total investments</b>					
GDP/wkr growth	635	0.0135	0.0331	-0.1180	0.1995
Real investment share	635	0.1638	0.0958	0.0076	0.6835
Labor force growth	635	0.0202	0.0150	-0.0433	0.1161
GDP/wkr gap	635	0.6804	0.2869	-0.4274	0.9835
Nominal investment share	587	0.2239	0.0791	0.0340	0.6065

#### Summary statistics for Tables 4 & 5

Variable	Obs.	Mean	Std. Dev.	Min	Max
Log Relative price of equip. 1975	34	0.2637	0.4511	-0.5250	1.1407
Log Relative price of equip. 1980	61	0.2888	0.4230	-0.3595	1.7850
Log Relative price of equip. 1985	64	0.4363	0.5306	-0.2878	1.4561
Log Relative price of prod. dur. 1996	114	0.3902	0.5492	-0.5164	1.5225
Log price of equipment 1975	34	0.0691	0.1788	-0.3779	0.4817
Log price of equipment 1980	61	0.1465	0.2782	-0.4657	0.8156
Log price of equipment 1985	64	0.0183	0.3625	-0.8672	0.8157
Log price of prod. Durables 1996	114	-0.0670	0.3525	-1.2611	1.5590
Log price "all other" 1975	34	-0.2081	0.4678	-1.0878	0.5190
Log price "all other" 1980	61	-0.1545	0.4088	-1.4378	0.5396
Log price "all other" 1985	64	-0.4350	0.5220	-1.7166	0.3347
Log price "all other" 1996	114	-0.4862	0.6748	-1.9925	0.7537
Log GPP/wkr 1975	34	9.1564	0.9062	6.9930	10.3134
Log GPP/wkr 1980	61	9.0635	0.9561	6.5596	10.3640
Log GPP/wkr 1985	64	8.9911	1.0473	6.5582	10.4277
Log GPP/wkr 1996	114	9.5659	0.9849	6.9017	11.3123

Notes: For 1975, 1980, and 1985 the price level for "all other" goods are the price level for all goods other than equipment investment. For 1996, it is the price level of all goods other than producer durables (due to data limitations). See text for further information. Log=natural logarithm (ln)

*Previous doctoral theses in the Department of Economics, Göteborg.  
Avhandlingar publicerade innan serien Ekonomiska Studier startades:*

**Östman, Hugo** (1911), Norrlands ekonomiska utveckling  
**Moritz, Marcus** (1911), Den svenska tobaksindustrien  
**Sundbom, I.** (1933), Prusbildning och ändamålsenlighet  
**Gerhard, I.** (1948), Problem rörande Sveriges utrikeshandel 1936/38  
**Hegeland, Hugo** (1951), The Quantity Theory of Money  
**Mattsson, Bengt** (1970), Cost-Benefit analys  
**Rosengren, Björn** (1975), Valutareglering och nationell ekonomisk politik  
**Hjalmarsson, Lennart** (1975), Studies in a Dynamic Theory of Production and its Applications  
**Örtendahl, Per-Anders** (1975), Substitutionsaspekter på produktionsprocessen vid massaframställning  
**Anderson, Arne M.** (1976), Produktion, kapacitet och kostnader vid ett helautomatiskt emballageglasbruk  
**Ohlsson, Olle** (1976), Substitution och odelbarheter i produktionsprocessen vid massaframställning  
**Gunnarsson, Jan** (1976), Produktionssystem och tätortshierarki – om sambandet mellan rumslig och ekonomisk struktur  
**Köstner, Evert** (1976), Optimal allokering av tid mellan utbildning och arbete  
**Wigren, Rune** (1976), Analys av regionala effektivitetsskillnader inom industribranscher  
**Wästlund, Jan** (1976), Skattning och analys av regionala effektivitetsskillnader inom industribranscher  
**Flöjstad, Gunnar** (1976), Studies in Distortions, Trade and Allocation Problems  
**Sandelin, Bo** (1977), Prisutveckling och kapitalvinster på bostadsfastigheter  
**Dahlberg, Lars** (1977), Empirical Studies in Public Planning  
**Lönnroth, Johan** (1977), Marxism som matematisk ekonomi  
**Johansson, Börje** (1978), Contributions to Sequential Analysis of Oligopolistic Competition

Ekonomiska Studier, utgivna av Nationalekonomiska institutionen vid Göteborgs Universitet. Nr 1 och 4 var inte doktorsavhandlingar. (The contributions to the department series 'Ekonomiska Studier' where no. 1 and 4 were no doctoral theses):

2. **Ambjörn, Erik** (1959), Svenskt importberoende 1926-1956: en ekonomisk-statistisk kartläggning med kommentarer
3. **Landgren, K-G.** (1960), Den "Nya ekonomien" i Sverige: J.M. Keynes, E. Wigfors och utvecklingen 1927-39
5. **Bigsten, Arne** (1979), Regional Inequality and Development: A Case Study of Kenya
6. **Andersson, Lars** (1979), Statens styrning av de kommunala budgetarnas struktur (Central Government Influence on the Structure of the Municipal Budget)
7. **Gustafsson, Björn** (1979), Inkomst- och uppväxtförhållanden (Income and Family Background)
8. **Granholt, Arne** (1981), Interregional Planning Models for the Allocation of Private and Public Investments

9. **Lundborg, Per** (1982), Trade Policy and Development: Income Distributional Effects in the Less Developed Countries of the US and EEC Policies for Agricultural Commodities
10. **Juås, Birgitta** (1982), Värdering av risken för personskador. En jämförande studie av implicita och explicita värden. (Valuation of Personal Injuries. A comparison of Explicit and Implicit Values)
11. **Bergendahl, Per-Anders** (1982), Energi och ekonomi - tillämpningar av input-output analys (Energy and the Economy - Applications of Input-Output Analysis)
12. **Blomström, Magnus** (1983), Foreign Investment, Technical Efficiency and Structural Change - Evidence from the Mexican Manufacturing Industry
13. **Larsson, Lars-Göran** (1983), Comparative Statics on the Basis of Optimization Methods
14. **Persson, Håkan** (1983), Theory and Applications of Multisectoral Growth Models
15. **Sterner, Thomas** (1986), Energy Use in Mexican Industry.
16. **Flood, Lennart** (1986), On the Application of Time Use and Expenditure Allocation Models.
17. **Schuller, Bernd-Joachim** (1986), Ekonomi och kriminalitet - en empirisk undersökning av brottsligheten i Sverige (Economics of crime - an empirical analysis of crime in Sweden)
18. **Walfridson, Bo** (1987), Dynamic Models of Factor Demand. An Application to Swedish Industry.
19. **Stålhammar, Nils-Olov** (1987), Strukturomvandling, företagsbeteende och förväntningsbildning inom den svenska tillverkningsindustrin (Structural Change, Firm Behaviour and Expectation Formation in Swedish Manufactory)
20. **Anxo, Dominique** (1988), Sysselsättningseffekter av en allmän arbetstidsförkortning (Employment effects of a general shortage of the working time)
21. **Mbelle, Ammon** (1988), Foreign Exchange and Industrial Development: A Study of Tanzania.
22. **Ongaro, Wilfred** (1988), Adoption of New Farming Technology: A Case Study of Maize Production in Western Kenya.
23. **Zejan, Mario** (1988), Studies in the Behavior of Swedish Multinationals.
24. **Görling, Anders** (1988), Ekonomisk tillväxt och miljö. Föreningens-struktur och ekonomiska effekter av olika miljövårdsprogram. (Economic Growth and Environment. Pollution Structure and Economic Effects of Some Environmental Programs).
25. **Aguilar, Renato** (1988), Efficiency in Production: Theory and an Application on Kenyan Smallholders.
26. **Kayizzi-Mugerwa, Steve** (1988), External Shocks and Adjustment in Zambia.

27. **Bornmalm-Jardelöw, Gunilla** (1988), Högre utbildning och arbetsmarknad (Higher Education and the Labour Market)
28. **Tansini, Ruben** (1989), Technology Transfer: Dairy Industries in Sweden and Uruguay.
29. **Andersson, Irene** (1989), Familjebeskattning, konsumtion och arbetsutbud - En ekonometrisk analys av löne- och inkomstelasticiteter samt policysimuleringar för svenska hushåll (Family Taxation, Consumption and Labour Supply - An Econometric Analysis of Wage and Income Elasticities and Policy Simulations for Swedish Households)
30. **Henrekson, Magnus** (1990), An Economic Analysis of Swedish Government Expenditure
31. **Sjöö, Boo** (1990), Monetary Policy in a Continuous Time Dynamic Model for Sweden
32. **Rosén, Åsa** (1991), Contributions to the Theory of Labour Contracts.
33. **Loureiro, Joao M. de Matos** (1992), Foreign Exchange Intervention, Sterilization and Credibility in the EMS: An Empirical Study
34. **Irاندoust, Manuchehr** (1993), Essays on the Behavior and Performance of the Car Industry
35. **Tasiran, Ali Cevat** (1993), Wage and Income Effects on the Timing and Spacing of Births in Sweden and the United States
36. **Milopoulos, Christos** (1993), Investment Behaviour under Uncertainty: An Econometric Analysis of Swedish Panel Data
37. **Andersson, Per-Åke** (1993), Labour Market Structure in a Controlled Economy: The Case of Zambia
38. **Storrie, Donald W.** (1993), The Anatomy of a Large Swedish Plant Closure
39. **Semboja, Haji Hatibu Haji** (1993), Energy and Development in Kenya
40. **Makonnen, Negatu** (1993), Labor Supply and the Distribution of Economic Well-Being: A Case Study of Lesotho
41. **Julin, Eva** (1993), Structural Change in Rural Kenya
42. **Durevall, Dick** (1993), Essays on Chronic Inflation: The Brazilian Experience
43. **Veiderpass, Ann** (1993), Swedish Retail Electricity Distribution: A Non-Parametric Approach to Efficiency and Productivity Change
44. **Odeck, James** (1993), Measuring Productivity Growth and Efficiency with Data Envelopment Analysis: An Application on the Norwegian Road Sector
45. **Mwenda, Abraham** (1993), Credit Rationing and Investment Behaviour under Market Imperfections: Evidence from Commercial Agriculture in Zambia
46. **Mlambo, Kupukile** (1993), Total Factor Productivity Growth: An Empirical Analysis of Zimbabwe's Manufacturing Sector Based on Factor Demand Modelling
47. **Ndung'u, Njuguna** (1993), Dynamics of the Inflationary Process in Kenya
48. **Modén, Karl-Markus** (1993), Tax Incentives of Corporate Mergers and Foreign Direct Investments
49. **Franzén, Mikael** (1994), Gasoline Demand - A Comparison of Models
50. **Heshmati, Almas** (1994), Estimating Technical Efficiency, Productivity Growth And Selectivity Bias Using Rotating Panel Data: An Application to Swedish Agriculture



51. **Salas, Osvaldo** (1994), Efficiency and Productivity Change: A Micro Data Case Study of the Colombian Cement Industry
52. **Bjurek, Hans** (1994), Essays on Efficiency and Productivity Change with Applications to Public Service Production
53. **Cabezas Vega, Luis** (1994), Factor Substitution, Capacity Utilization and Total Factor Productivity Growth in the Peruvian Manufacturing Industry
54. **Katz, Katarina** (1994), Gender Differentiation and Discrimination. A Study of Soviet Wages
55. **Asal, Maher** (1995), Real Exchange Rate Determination and the Adjustment Process: An Empirical Study in the Cases of Sweden and Egypt
56. **Kjulin, Urban** (1995), Economic Perspectives on Child Care
57. **Andersson, Göran** (1995), Volatility Forecasting and Efficiency of the Swedish Call Options Market
58. **Forteza, Alvaro** (1996), Credibility, Inflation and Incentive Distortions in the Welfare State
59. **Locking, Håkan** (1996), Essays on Swedish Wage Formation
60. **Välilä, Timo** (1996), Essays on the Credibility of Central Bank Independence
61. **Yilma, Mulugeta** (1996), Measuring Smallholder Efficiency: Ugandan Coffee and Food-Crop Production
62. **Mabugu, Ramos E.** (1996), Tax Policy Analysis in Zimbabwe Applying General Equilibrium Models
63. **Johansson, Olof** (1996), Welfare, Externalities, and Taxation; Theory and Some Road Transport Applications.
64. **Chitiga, Margaret** (1996), Computable General Equilibrium Analysis of Income Distribution Policies in Zimbabwe
65. **Leander, Per** (1996), Foreign Exchange Market Behavior Expectations and Chaos
66. **Hansen, Jörgen** (1997), Essays on Earnings and Labor Supply
67. **Cotfas, Mihai** (1997), Essays on Productivity and Efficiency in the Romanian Cement Industry
68. **Horgby, Per-Johan** (1997), Essays on Sharing, Management and Evaluation of Health Risks
69. **Nafar, Nosratollah** (1997), Efficiency and Productivity in Iranian Manufacturing Industries
70. **Zheng, Jinghai** (1997), Essays on Industrial Structure, Technical Change, Employment Adjustment, and Technical Efficiency
71. **Isaksson, Anders** (1997), Essays on Financial Liberalisation in Developing Countries: Capital mobility, price stability, and savings
72. **Gerdin, Anders** (1997), On Productivity and Growth in Kenya, 1964-94
73. **Sharifi, Alimorad** (1998), The Electricity Supply Industry in Iran: Organization, performance and future development
74. **Zamanian, Max** (1997), Methods for Mutual Fund Portfolio Evaluation: An application to the Swedish market
75. **Manda, Damiano Kulundu** (1997), Labour Supply, Returns to Education, and the Effect of Firm Size on Wages: The case of Kenya
76. **Holmén, Martin** (1998), Essays on Corporate Acquisitions and Stock Market Introductions

77. **Pan, Kelvin** (1998), Essays on Enforcement in Money and Banking
78. **Rogat, Jorge** (1998), The Value of Improved Air Quality in Santiago de Chile
79. **Peterson, Stefan** (1998), Essays on Large Shareholders and Corporate Control
80. **Belhaj, Mohammed** (1998), Energy, Transportation and Urban Environment in Africa: The Case of Rabat-Salé, Morocco
81. **Mekonnen, Alemu** (1998), Rural Energy and Afforestation: Case Studies from Ethiopia
82. **Johansson, Anders** (1998), Empirical Essays on Financial and Real Investment Behavior
83. **Köhlén, Gunnar** (1998), The Value of Social Forestry in Orissa, India
84. **Levin, Jörgen** (1998), Structural Adjustment and Poverty: The Case of Kenya
85. **Ncube, Mkhululi** (1998), Analysis of Employment Behaviour in Zimbabwe
86. **Mwansa, Ladslous** (1998), Determinants of Inflation in Zambia
87. **Agnarsson, Sveinn** (1998), Of Men and Machines: Essays in Applied Labour and Production Economics
88. **Kadenge, Phineas** (1998), Essays on Macroeconomic Adjustment in Zimbabwe: Inflation, Money Demand, and the Real Exchange Rate
89. **Nyman, Håkan** (1998), An Economic Analysis of Lone Motherhood in Sweden
90. **Carlsson, Fredrik** (1999), Essays on Externalities and Transport
91. **Johansson, Mats** (1999), Empirical Studies of Income Distribution
92. **Alemu, Tekie** (1999), Land Tenure and Soil Conservation: Evidence from Ethiopia
93. **Lundvall, Karl** (1999), Essays on Manufacturing Production in a Developing Economy: Kenya 1992-94
94. **Zhang, Jianhua** (1999), Essays on Emerging Market Finance
95. **Mlima, Aziz Ponary** (1999), Four Essays on Efficiency and Productivity in Swedish Banking
96. **Dauidsen, Björn-Ivar** (2000), Bidrag til den økonomisk-metodologiske tenkningen (Contributions to the Economic Methodological Thinking)
97. **Ericson, Peter** (2000), Essays on Labor Supply
98. **Söderbom, Måns** (2000), Investment in African Manufacturing: A Microeconomic Analysis
99. **Höglund, Lena** (2000), Essays on Environmental Regulation with Applications to Sweden
100. **Olsson, Ola** (2000), Perspectives on Knowledge and Growth
101. **Meuller, Lars** (2000), Essays on Money and Credit
102. **Österberg, Torun** (2000), Economic Perspectives on Immigrants and Intergenerational Transmissions
103. **Kalinda Mkenda, Beatrice** (2001), Essays on Purchasing Power Parity, Real Exchange Rate, and Optimum Currency Areas
104. **Nerhagen, Lena** (2001), Travel Demand and Value of Time - Towards an Understanding of Individuals Choice Behavior

105. **Mkenda, Adolf** (2001), Fishery Resources and Welfare in Rural Zanzibar
106. **Eggert, Håkan** (2001), Essays on Fisheries Economics
107. **Andrén, Daniela** (2001), Work, Sickness, Earnings, and Early Exits from the Labor Market. An Empirical Analysis Using Swedish Longitudinal Data
108. **Nivorozhkin, Eugene** (2001), Essays on Capital Structure
109. **Hammar, Henrik** (2001), Essays on Policy Instruments: Applications to Smoking and the Environment
110. **Nannyonjo, Justine** (2002), Financial Sector Reforms in Uganda (1990-2000): Interest Rate Spreads, Market Structure, Bank Performance and Monetary Policy
111. **Wu, Hong** (2002), Essays on Insurance Economics
112. **Linde-Rahr, Martin** (2002), Household Economics of Agriculture and Forestry in Rural Vietnam
113. **Maneschiöld, Per-Ola** (2002), Essays on Exchange Rates and Central Bank Credibility
114. **Andrén, Thomas** (2002), Essays on Training, Welfare and Labor Supply
115. **Granér, Mats** (2002), Essays on Trade and Productivity: Case Studies of Manufacturing in Chile and Kenya
116. **Jaldell, Henrik** (2002), Essays on the Performance of Fire and Rescue Services
117. **Alpizar, Francisco, R.** (2002), Essays on Environmental Policy-Making in Developing Countries: Applications to Costa Rica
118. **Wahlberg, Roger** (2002), Essays on Discrimination, Welfare and Labor Supply
119. **Piculescu, Violeta** (2002), Studies on the Post-Communist Transition
120. **Pylkkänen, Elina** (2003), Studies on Household Labor Supply and Home Production
121. **Löfgren, Åsa** (2003), Environmental Taxation – Empirical and Theoretical Applications
122. **Ivaschenko, Oleksiy** (2003), Essays on Poverty, Income Inequality and Health in Transition Economies
123. **Lundström, Susanna** (2003), On Institutions, Economic Growth and the Environment
124. **Wambugu, Anthony** (2003), Essays on Earnings and Human Capital in Kenya
125. **Adler, Johan** (2003), Aspects of Macroeconomic Saving
126. **Erlandsson, Mattias** (2003), On Monetary Integration and Macroeconomic Policy
127. **Brink, Anna** (2003), On the Political Economy of Municipality Break-Ups
128. **Ljungwall, Christer** (2003), Essays on China's Economic Performance During the Reform Period
129. **Chifamba, Ronald** (2003), Analysis of Mining Investments in Zimbabwe
130. **Muchapondwa, Edwin** (2003), The Economics of Community-Based Wildlife Conservation in Zimbabwe
131. **Hammes, Klaus** (2003), Essays on Capital Structure and Trade Financing
132. **Abou-Ali, Hala** (2003), Water and Health in Egypt: An Empirical Analysis
133. **Simatele, Munacinga** (2004), Financial Sector Reforms and Monetary Policy in Zambia
134. **Tezic, Kerem** (2004), Essays on Immigrants' Economic Integration
135. INSTÄLLD

136. **Gjirja, Matilda** (2004), Efficiency and Productivity in Swedish Banking
137. **Andersson, Jessica** (2004), Welfare Environment and Tourism in Developing Countries
138. **Chen, Yinghong** (2004), Essays on Voting Power, Corporate Governance and Capital Structure
139. **Yesuf, Mahmud** (2004), Risk, Time and Land Management under Market Imperfections: Applications to Ethiopia
140. **Kateregga, Eseza** (2005), Essays on the Infestation of Lake Victoria by the Water Hyacinth
141. **Edvardsen, Dag Fjeld** (2004), Four Essays on the Measurement of Productive Efficiency
142. **Lidén, Erik** (2005), Essays on Information and Conflicts of Interest in Stock Recommendations
143. **Dieden, Sten** (2005), Income Generation in the African and Coloured Population – Three Essays on the Origins of Household Incomes in South Africa
144. **Eliasson, Marcus** (2005), Individual and Family Consequences of Involuntary Job Loss
145. **Mahmud, Minhaj** (2005), Measuring Trust and the Value of Statistical Lives: Evidence from Bangladesh
146. **Lokina, Razack Bakari** (2005), Efficiency, Risk and Regulation Compliance: Applications to Lake Victoria Fisheries in Tanzania
147. **Jussila Hammes, Johanna** (2005), Essays on the Political Economy of Land Use Change
148. **Nyangena, Wilfred** (2006), Essays on Soil Conservation, Social Capital and Technology Adoption
149. **Nivorozhkin, Anton** (2006), Essays on Unemployment Duration and Programme Evaluation
150. **Sandén, Klas** (2006), Essays on the Skill Premium
151. **Deng, Daniel** (2006), Three Essays on Electricity Spot and Financial Derivative Prices at the Nordic Power Exchange
152. **Gebreeyesus, Mulu** (2006), Essays on Firm Turnover, Growth, and Investment Behavior in Ethiopian Manufacturing
153. **Islam, Nizamul Md.** (2006), Essays on Labor Supply and Poverty: A Microeconomic Application
154. **Kjaer, Mats** (2006), Pricing of Some Path-Dependent Options on Equities and Commodities
155. **Shimeles, Abebe** (2006), Essays on Poverty, Risk and Consumption Dynamics in Ethiopia
156. **Larsson, Jan** (2006), Four Essays on Technology, Productivity and Environment
157. **Congdon Fors, Heather** (2006), Essays in Institutional and Development Economics
158. **Akpalu, Wisdom** (2006), Essays on Economics of Natural Resource Management and Experiments
159. **Daruvala, Dinky** (2006), Experimental Studies on Risk, Inequality and Relative Standing
160. **García, Jorge** (2007), Essays on Asymmetric Information and Environmental Regulation through Disclosure

161. **Bezabih, Mintewab** (2007), Essays on Land Lease Markets, Productivity, Biodiversity, and Environmental Variability
162. **Visser, Martine** (2007), Fairness, Reciprocity and Inequality: Experimental Evidence from South Africa
163. **Holm, Louise** (2007), A Non-Stationary Perspective on the European and Swedish Business Cycle
164. **Herbertsson, Alexander** (2007), Pricing Portfolio Credit Derivatives
165. **Johansson, Anders C.** (2007), Essays in Empirical Finance: Volatility, Interdependencies, and Risk in Emerging Markets
166. **Ibáñez Díaz, Marcela** (2007), Social Dilemmas: The Role of Incentives, Norms and Institutions
167. **Ekbom, Anders** (2007), Economic Analysis of Soil Capital, Land Use and Agricultural Production in Kenya
168. **Sjöberg, Pål** (2007), Essays on Performance and Growth in Swedish Banking
169. **Palma Aguirre, Grisha Alexis** (2008), Explaining Earnings and Income Inequality in Chile
170. **Akay, Alpaslan** (2008), Essays on Microeconometrics and Immigrant Assimilation
171. **Carlsson, Evert** (2008), After Work – Investing for Retirement
172. **Munshi, Farzana** (2008), Essays on Globalization and Occupational Wages
173. **Tsakas, Elias** (2008), Essays on Epistemology and Evolutionary Game Theory
174. **Erlandzon, Karl** (2008), Retirement Planning: Portfolio Choice for Long-Term Investors
175. **Lampi, Elina** (2008), Individual Preferences, Choices, and Risk Perceptions – Survey Based Evidence
176. **Mitrut, Andreea** (2008), Four Essays on Interhousehold Transfers and Institutions in Post-Communist Romania
177. **Hansson, Gustav** (2008), Essays on Social Distance, Institutions, and Economic Growth