The Reversal of Fortune Thesis Revisited

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The Latest Version：April 18th, 2021

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Abstract: Focusing on the *Reversal of Fortune* thesis proposed by AJR (2002), we support the institution hypothesis which emphasizes the role of institutions of private property in the determination of long-term economic divergence. However, the authors' quantitative methodology was biasedly implemented and the contribution of *European* settlement is overestimated. To better examine the conclusion of "the *British* settlement determines the institutional settings of property protection", we select and discuss three obvious problems appeared in AJR (2002), including the avoidance of the African data, measurement bias of the variable "*urbanization in 1500*" and conceptional inaccuracy of the variable "*population density in 1500 data*". We also replace their original IV variable "Log mortality" with an alternative IV variable entitled "European settlement in 1900" to double-check the explanation power of their institutional conclusion. After rounds of robustness check, we find that it is only in British colonies that settlement had a positive effect and that the existence of Reverse of Fortune phenomenon is largely because of the contribution of four countries: The United States, Canada, Australia and New Zealand.

Keywords: long-term economic divergence, institutions of private property, the geography hypothesis and European settlement in 1900

Introduction

What determines the long-term economic divergence and why do some parts of the world which were economically abundant in 1500 tend to be relatively poor now? The topic of "Reversal of Fortune" is systematically proposed by AJR (2002)[1]. The authors propose that the reason why the places where enjoyed economic prosperity five hundred years ago are currently poor is because of the lack of full institutional protections[2].

We agree with this proposition of "institution matters". However, three major problems exist in the original AJR (2002). Firstly, the authors' measure of *urbanization in 1500* contains no data from Africa and thus only consists of 41 observations. Without the relevant data obtained from the African continent, the authors' *institution matters* arguments, to some extent, lose its theoretical generosity. Indeed, some countries which are located at the western coast of Africa were relatively wealthy at 1500. However, after experiencing the European colonization (especially British colonization rule) for many centuries, these new-born African countries also adopt the institutional setting inherited from their colonizer. But why do the relatively same institutional settings generate sharply divergent economic outcomes since these African countries are *currently* considered as typical undeveloped states?

Secondly, despite the authors' claims to the contrary, their measurement of *population density in 1500* does not *accurately* take the total amount of arable lands into consideration. AJR (2002) implements data on arable land from Mcevedy and Jones (1978)[3]. However, a quick glimpse of this arable land dataset generates curiosity. For example, as Bandyopadhyay and Green (2012)

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[1] Acemoglu, D., Johnson, S., & Robinson, J. A. (2002). Reversal of fortune: Geography and institutions in the making of the modern world income distribution. *The Quarterly journal of economics*, *117*(4), 1231-1294.

[2] In AJR (2002), such an institutional protection is named as *institutions of private property*.

[3] McEvedy, C., & Jones, R. (1978). *Atlas of world population history*. Penguin Books Ltd, Harmondsworth, Middlesex, England.

points out, "Mcevedy and Jones (1978) sometimes present data on arable lands inaccurately. In 86 out of 91 observations used by AJR (2002), they list no data on arable land, leading the authors of AJR (2002) to see all land as arable for these observations"[4]. Follow their instructions, we analyze the conceptualization of variable *population density in 1500* and find that AJR (2002) labels the percentage measurements of exemplified countries like Canada and Australia as 100, which is highly problematic given the fact that there exists massive coverage of deserts in Australia and frozen lands in Canada respectively.

Thirdly, AJR (2002) overestimates the role of European institutions. We believe that what leads to the authors' proposal that institutions of private property determine the long-term economic divergence is the factual economic prosperity exclusively among the Neo-Europe. Although European settlement does, to some extent, work as a positive force for better property protection, there is no evidence of a significantly general relation between European colonization, institutions of property rights and long-term economic development. Instead, we propose that it is *British* settlement that helps to explain the core reason why a long-term economic divergence happens. We find out that nine out of ten highest-score countries which value the protection of property rights are derived from British colonization and four of the top five states are from North America and Australasia[5]. Therefore, AJR (2002) overreaches the importance of institutional protections by generalizing the wisdom which applies in Five-Eye Alliance to the whole world.

Lastly, we believe that for the IV 2SLS estimation adopted in the original paper, another IV variable could be implemented as a double check. This variable is one IV variable that AJR (2001) once implements, *European settlement in 1900*. Following the logic induction of AJR (2002),

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[4] Bandyopadhyay, S., & Green, E. (2012). The reversal of fortune thesis reconsidered. *Journal of Development Studies*, *48*(7), 817-831.

[5] Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American economic review*, *91*(5), 1369-1401.; Fails, M. D., & Krieckhaus, J. (2010). Colonialism, property rights and the modern world income distribution. *British Journal of Political Science*, 487-508.

variable "Log mortality" which presents log-formation of estimated settler mortality is *positively* related with the variables that measure pre-modern economic prosperity. The logic is that the first-round settlers (mainly the Spanish and Portuguese) were inclined to embark on places where were economically abundant in 1500, leaving them higher probability to meet local deathful diseases exemplified by malaria which these settlers were not immunized from. This led to one fact that very few first-round settlers occupied the wealthiest lands and therefore when the time came to 1900, the descents of these first-wave European settlers did not cover a significant populational percentage. AJR (2001) clearly points out that countries with Spanish colonization history do not develop matured institutions of property rights compared to the institutional settings of countries which used to be colonized by the British.

However, the case for following-wave settlers which were mostly French and British is quite different. Because the new lands with most abundant resources had already been occupied by the Spanish or Portuguese colonizers, the British and French settlers were forced to settle on places where were relatively poor. Because of the economic backwardness, these British-found places were not in a dense population, which indicated that more settlers could survive because of the lack of deathful tropical diseases. Since local human resources were not abundant at 1500 and that more settlers successfully embarked on these new lands at the Neo-Europe, the percentage of the 1900 population who were the direct descents of the *British* colonizers was significantly higher. Data obtained from AJR (2000) helps us to see that 4 out of top 5 British colonies have populations among which at least 88% are British decedents[6]. Therefore, it is clear to say that since the very few Spanish or Portuguese first-wave settlers "inherited" lands with massive economic resources and humane capitals, they were also prone to "inherit" the pre-existing expropriation institutions

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[6] Albouy, D. Y. (2008). *The colonial origins of comparative development: an investigation of the settler mortality data* (No. w14130). National Bureau of Economic Research.

and their decedents were limited even four centuries later. On the contrary, since the second-wave British settlers embarked on new-found lands where were economically barren and lacked human populations, they were incentive to "reproduce" British institutional legacies exemplified by institutions of private property and there was no wonder why the British decedents occupied the vast majority of these counties' 1900 populations. In all, we propose that variable institution is also *positively* correlated with our proposed IV variable *European settlement in 1900.*

We find out that after including the relevant African data and the new measurement of the controlled variable *population density in 1500*, the statistical significance of the institution hypothesis decreases dramatically. It is also clear that by implementing a new IV 2SLS estimation, settlements only in British colonies have positive effects and that such significant effects of property-protection institutions are largely restricted to four countries: The United States, Canada, Australia and New Zealand.

This paper is organized as follows. Section two is a combined part of simple literature review and a concentrated presentation of diverse theories that explain the topic of "long-term economic divergence". In section three, we will present the major problems of the original AJR (2002), followed by our presented solutions and the detailed measurements of newly-included variables. Section four will be focused on the presentations of replication results and our new results. We will present a simple comparison analysis as well as the final conclusion in Section five.

Literature Review and Theory Presentation

There mainly exist four major schools of thoughts that help to explain why such a long-term economic divergence happens after the *Great Geographical Discovery*.

A. The Geography Hypothesis

The geography hypothesis claims that differences in economic performance reflect differences in geographic, climate and ecological characteristics across countries. Like what presents in Diamond (1999) and Sachs (2001, 2003)[7], we agree that geographical factors play a significantly important role in the economic development of a pre-modern agricultural society. That is why standing on the time spot of 1500, the relatively wealthy countries were concentrated in places where enjoyed the benefit of good geographical factors such as latitudes, access to seas, abundant rainfall level and vast arable lands. Given the fact that the economic prosperity of an agricultural society is determined by natural factors, the better heat and rainfall condition one state receives, the more arable land where one state has, the denser population that one country nurtures, the more economically prosperous one agricultural state may be. We hold no objection with this proposal.

However, after the discovery of the New World, consecutive rounds of Industrial Revolution have been witnessed globally. The dominant economic engine of one *modern* country has gradually transitioned from the First Industry to the Second Industry, especially the Heavy Industry. Under this circumstance, natural factors such as arable lands and latitude level are not as important as before. Therefore, it is intuitive that the economic divergence which mainly happened during the intersection of the First Industrial Revolution and the Second Industrial Revolution was not mainly related with the difference of inter-state graphical factors. It must be related with something else.

B. The Institution Hypothesis

According to the institution hypothesis, societies with a social organization that provides encouragement for investment will enjoy long-time economic prosperity. Smith (1937), Hayek

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[7] Diamond, J. (1997). Guns. *Germs and Steel: The Fates of Human Societies, Vintage*.; McArthur, J. W., & Sachs, J. D. (2001). *Institutions and geography: comment on Acemoglu, Johnson and Robinson (2000)* (No. w8114). National bureau of economic research.; Sachs, J. D. (2003). *Institutions don't rule: direct effects of geography on per capita income* (No. w9490). National Bureau of Economic Research.

(1960) and Locke (1967), together with many other distinguished economic-history papers exemplified by the Douglas North (1991), all extremely value the importance of property rights for the success of the nations[8]. Exclusively among the American continent, what could be immediately discovered is the institutional difference between countries with Spanish colonization history and the northern Neo-Europe states that inherit British institutions of property protection. Let us be crystal clear, the Spanish institutional settings of property preservation were not based upon a whole system of expropriation. Its main problem, as illustrated by North and Weingast (1989)[9], is that unlike the British tradition of developing institutional property protections that covered *each individual* citizen's economic interests, its Spanish counterpart only protected the economic benefit of *the privileged few*, leaving the general mass's incentive of investments not *fully* occupied. This difference in terms of institutional setting, to some extent, explains why most Latin American countries, although periodically becoming leading states of economic growth, were gradually lagged behind in terms of economic abundance when comparing with the wealth condition of Canada and the United States. From this simple and limited comparison studies, there is no wonder why we generally agree with the idea proposed by AJR (2002) that different institutions of property right determined long-term economic divergence.

However, AJR (2002) overestimates the role of European institutions. Although European settlement does, to some extent, work as a positive force for better property protection, there is no evidence of a significantly general relation between European colonization, institutions of property rights and long-term economic development. Instead, we repeatedly argue that it is only the *British* settlement that better illustrates the core reason of causing a long-term economic divergence. We

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[8] Locke, J. (1967). *Locke: Two treatises of government*. Cambridge University Press.; Smith, A. (1937). The wealth of nations. modern library. *New York*, *423*.; Von Hayek, H. (1960). *The human lung*. Hafner Publishing Company.; North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge university press.

[9] North, D. C., & Weingast, B. R. (1989). Constitutions and commitment: the evolution of institutions governing public choice in seventeenth-century England. *Journal of economic history*, 803-832.

will intensively mention the detailed information about this "European settlement V.S. British settlement" comparison in the following parts.

C. The Integration Hypothesis

The Integration hypothesis emphasizes the role of leading positions on the determination of long-term economic difference. As illustrated in Rodrik, Subramanian and Trebbi (2004)[10], the geographical hypothesis and the institution hypothesis both assume that it is *domestic* factors that help to explain the difference of economic prosperity. But is that so? Since the Great Discovery, the whole world had been closely united and in order to seek for the economic dominance (especially the decision-making power of international trade), a bunch of western countries came and went. Coincidentally, these current or used-to-be economic dominators happened to take the majority of the existing wealthy countries. Although it is logically clear that institutions did matter, we also propose that the external secret of being economically wealthy for one typical state lay upon the fact that this referred state was within the group of global trade rule-makers. The countries which controlled the direction of global trade integration were prone to use their dominant positions to carry out international expropriation and diversify their international investment portfolios. Following this logic, it is the position or the integration that fundamentally determine the core question why some countries who used to be relatively wealthy in 1500 are currently lagged behind in terms of economic prosperity. The answer is simple: *these countries are not politically dominant on the stage of global rule-settings[11]*.

Due to the limitation of time and corresponding data, although we firmly agree that what Rodrik,

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[10] Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of economic growth*, *9*(2), 131-165.

[11] Austin, G. (2008). The 'reversal of fortune' thesis and the compression of history: perspectives from African and comparative economic history. *Journal of International Development: The Journal of the Development Studies Association*, *20*(8), 996-1027.

Subramanian and Trebbi (2004) offers is powerful and well-qualified, currently we are not capable of testing the validity of this integration hypothesis and the consistency between position theory and data confirmation. Since many famous articles, as exemplified by Austin (2008), Enterline, Stull and Magagnoli (2013) and Hopkins (2009)[12], clearly illustrate that "once institutions are controlled for, integration has *no* direct effect on incomes, while graphical factors has at best weak direct effects"[13], we are partially confident that by relying on authoritative sources, the quality of institutions trumps other two factors. Therefore, the prioritized focus of this paper is to improve the validity and decrease the appliance coverage of the institution hypothesis.

D. The Initial Inequality Hypothesis

The initial inequity hypothesis is functioned as a theoretical proposition from the institution hypothesis that AJR (2002) establishes. The core of this theory is that history reproduces itself and that "societies which began with more extreme inequality were most likely to develop institutions allowing much of the population only limited access to economic opportunities"[14]. Exemplified by Hoff (2004)[15], professor Hoff believes that exclusively focusing on the process of Spanish settlement in the early 1500s, AJR (2002)'s "institution matters" proposal which forms on the high mortality rate of the first-wave settlers is not *enough*. Although generally agreeing with AJR (2002)'s main arguments, professor Hoff makes herself very clear that even counting together all the first-wave Spanish colonizers including persons who successfully arrived at the New World

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[12] Austin, G. (2008). The 'reversal of fortune' thesis and the compression of history: perspectives from African and comparative economic history. *Journal of International Development: The Journal of the Development Studies Association*, *20*(8), 996-1027.; Enterline, A. J., Stull, E., & Magagnoli, J. (2013). Reversal of fortune? Strategy change and counterinsurgency success by foreign powers in the twentieth century. *International Studies Perspectives*, *14*(2), 176-198.; Hopkins, A. G. (2009). The new economic history of Africa. *Journal of African history*, 155-177.

[13] Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of economic growth*, *9*(2), 131-165.

[14] Hoff, K. (2003). Paths of institutional development: a view from economic history. *The World Bank Research Observer*, *18*(2), 205-226.

[15] Hoff, K. R., & Pandey, P. (2004). *Belief systems and durable inequalities: An experimental investigation of Indian caste* (Vol. 3351). World Bank Publications.

but later died because of the local tropical diseases, the total number of this "delegation" was limited. Given the fact that the lands they conquered were formed upon successful and wealthy agricultural societies which had established matured institutions of taxation expropriation[16], what the Spanish conquerors did is to rely on the pre-existing extreme inequality, to kill the original emperors and to form new ruling coalitions centered around them through intermarrying with the existing local elites. Looking through authoritative historical records, we agree with professor Hoff's inequality manipulation proposal[17].

On the contrary, the following-wave British and French settlers were forced to set on the lands where were characterized as "*labor scarcity* in the economic organizations of the early colonies"[18]. So, what they could rely on was only themselves united in a collective formation and they could only "reproduce" the British institutions of private property to maximize each individual settler's determination of survival. That is to say, the initial economic equality was repaid among the British settlement and equality "reproduced" institutions that allow the majority of the population to have *full* access to economic-interest protection and economic opportunities.

We generally agree with the initial inequity hypothesis proposed by Hoff (2003, 2004). However, due to the limitation of data, which is *quantitatively impossible* given the fact that historical records do not hold economic and social inequality in 1500 accountable, this argument should be treated as theoretical propositions than a series of matured theories. In this paper, we are prioritized to

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[16] In other words, Spanish America was highly matured caste societies where *the aristocratical few ruled the general mass*. See the related information at Sokoloff, K. L., & Engerman, S. L. (2000). Institutions, factor endowments, and paths of development in the new world. *Journal of Economic perspectives*, *14*(3), 217-232 and Engerman, S. L., & Sokoloff, K. L. (2002). *Factor endowments, inequality, and paths of development among new world economics* (No. w9259). National Bureau of Economic Research.

[17] De La Escosura, L. P. (2004). When Did Latin America Fall Behind? Evidence from Long-run International Inequality. In *Universidad Carlos III, Madrid. presented at the Inter-American Seminar on Economics* (pp. 2-4).; Fukuyama, F. (Ed.). (2008). *Falling behind: explaining the development gap between Latin America and the United States*. Oxford University Press.; Fagerberg, J., Srholec, M., & Knell, M. (2007). The competitiveness of nations: Why some countries prosper while others fall behind. *World development*, *35*(10), 1595-1620.

[18] Galenson, D. W. (1996). The settlement and growth of the colonies: population, labor and economic development. *The Cambridge economic history of the United States*, *1*, 135-207.

correct the measurement errors adopted by the original AJR (2002), followed by further testing the validity of "institution matters" argument via a new IV variable, *European settlement in 1900*.

In the next section, four major problem generated at AJR (2002) will be systematically questioned and for each problem, we will present our suggest solution which covers variable conceptualization and variable measurement. We will also present the validity of a new IV 2SLS estimation, which will be followed by a subsample test to prove that compared to the over-generalization of the role of European institutions, it is in British colonies that settlements have positive effects and that such significantly positive effects of property-protection institutions are largely constraint to four countries: *The United States, Canada, Australia and New Zealand.*

Regression Methodology and Major Problems for AJR (2002)

A. Regression Equation

Our paper will adopt the same setting of regression equations just like AJR (2002). The whole regression estimation will be based upon a combination between OLS and IV 2SLS analysis. Again, the puzzle of this paper is to re-estimate the institution hypothesis which claims that the institution of property right determines the long-term economic divergence between 1500 and current days.

Among the regular OLS estimation, our regression equation will be presented as follow:

$$y_{it} = \mu_t + \delta_i + \pi * X_{it} + Z_{it} + \epsilon_{it}$$

Here y_{it} is the outcome variable of current economic prosperity in country *i* at date *t*. δ_i and μ_t represents the country fixed effect and the time effect, respectively. X_{it} is our focused target, represented by *institution* measurements, which is defined as the measurement of institutions of country *i* at date *t*. Z_{it} stand for the controlled variables, which represents combined variables like *urbanization in 1500* and *log population density in 1500.*

Among the IV 2SLS estimation, our combined set of regression equations is presented as follow:

$$First-stage \; regression: X_{it} = \; \gamma * \mathrm{IV}_{it} + \; Z_{it} + v_{it}$$

$$Second-stage \; regression: y_{it} = \; \mu_t + \; \delta_i + \; \tilde{\pi} * \hat{X}_{it} + Z_{it} + U_{it}$$

Here IV_{it} represents the presented IV variable in country i at date t. Our main focus is the direction and the statistical significance of coefficient $\tilde{\pi}$.

   B. AJR (2002)*'s major problems and our suggested solution for each problem*

We propose four major areas that are needed for better improvement in AJR (2002). Following the presentation of each problem, we will also present our solutions of dealing with these problems.

Firstly, the authors' measure of *urbanization in 1500* contains no data from Africa and thus only consists of limited observations. Without the relevant data obtained from the African continent, the authors' *institution matters* arguments, to some extent, lose its theoretical generosity. AJR (2002) typically implements data from Bairoch (1988)[19] and Eggimann (2000)[20], where the authors successfully transform Eggimann (2000)'s 1500 urbanization dataset which is formed upon cities with population of more than 20000 people to a *5000-person minimum* which is consistent with the population measurement of Bairoch (1988). Historians generally agree with one conclusion that "data on small-to-middle ancient cities could be inaccurate for the reasons that abandoned cities can disappear over time and that migration routes can make it difficult to measure cities' permanent populations"[21]. Therefore, it is wiser to largely increase the measurement benchmark of the urbanization in 1500 and to exclusively focus on the population of large cities.

To correct this measurement bias problem, we implement Chandler (1987)'s data on cities with

[19] Bairoch, P. (1988). *Cities and economic development: from the dawn of history to the present*. University of Chicago Press.
[20] Eggimann, G. (2000). *Population des villes des tiers mondes de 1500 à 1950*.
[21] Bandyopadhyay, S., & Green, E. (2012). The reversal of fortune thesis reconsidered. *Journal of Development Studies*, *48*(7), pp. 818.

a population of more than 2000 among the continent of Africa and America as an alternative variable measurement[22]. The implementation of this new dataset has two advantages. Firstly, all of this new dataset comes from a single source, which drastically decreases the potential error generated by the merge transformation. Secondly and more importantly, this new dataset allows us to include much detailed information with regard to African pre-modern population, 43 cities in Africa for 1500 according to the cited information in Chandler (1987), despite AJR (2002)'s claims that they need to exclude African data because such a population measurement is not "detailed" enough.

Secondly, despite the authors' claims to the contrary, their measurement of *population density in 1500* does not *accurately* take the total amount of arable lands into consideration. AJR (2002) implements data on arable land from Mcevedy and Jones (1978)[23]. However, it is easy to find out that the arable land dataset exists measurement biasness. For example, as Bandyopadhyay and Green (2012) points out, "Mcevedy and Jones (1978) sometimes present data on arable lands inaccurately. In 86 out of 91 observations used by AJR (2002), they list no data on arable land, leading the authors of AJR (2002) to see all land as arable for these observations"[24]. Follow their instructions, we analyze the conceptualization of variable "*population density in 1500*" and find that AJR (2002) labels the percentage measurements of exemplified countries like Canada and Australia as 100, which is highly problematic given the fact that there exists massive coverage of deserts in Australia and frozen lands in Canada respectively.

To correct this measurement inaccuracy, we implement data from FAO (2000)[25]. Austin

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[22] Chandler, T. (1987). *Four thousand years of urban growth: An historical census*. Mellen.

[23] McEvedy, C., & Jones, R. (1978). *Atlas of world population history*. Penguin Books Ltd, Harmondsworth, Middlesex, England.

[24] Bandyopadhyay, S., & Green, E. (2012). The reversal of fortune thesis reconsidered. *Journal of Development Studies*, *48*(7), 817-831.

[25] Bot, A., Nachtergaele, F., & Young, A. (2000). *Land resource potential and constraints at regional and country levels* (No. 90). Food & Agriculture Org.

(2008)[26] suggests that "FAO (2000) is the first-time estimated global dataset for land that is potentially arable for growing any one of the 21 major crops under rain-fed conditions", which makes it possible for us to get access to the pre-modern agricultural societies where modern agriculture technology has not been adopted yet. On advantage for FAO (2000)'s implementation is that this data source allows us to *exclude* the amount of non-arable land, exemplified by the land of deserts, mountains, frozen areas and so on, that was mistakenly calculated in the measurement of arable land in AJR (2002). After the re-measurement of substituting Mcevedy and Jones (1978)'s measurement with the corresponding figures of FAO (2000), we are confident that the measurement accuracy of variable *population density* in 1500 improves significantly.

Thirdly, we believe that for the IV 2SLS estimation adopted in the original paper, another IV variable could be implemented as a double check. This variable is one IV variable that AJR (2001) once implements, *European settlement in 1900*. Following the logic induction of AJR (2002), variable "Log mortality" which presents log-formation of estimated settler mortality is *positively* related with the variables that measure pre-modern economic prosperity. The logic is that the first-round settlers (mainly the Spanish and Portuguese) were inclined to embark on places where were economically abundant in 1500, leaving them higher probability to meet local deathful diseases exemplified by malaria which these settlers were not immunized from. This led to one fact that very few first-round settlers occupied the wealthiest lands and therefore when the time came to 1900, the descents of these first-wave European settlers did not cover a significant populational percentage. AJR (2001) clearly points out that countries with Spanish colonization history do not develop matured institutions of property rights compared to the institutional settings of countries which used to be colonized by the British.

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[26] Austin, G. (2008). The 'reversal of fortune' thesis and the compression of history: perspectives from African and comparative economic history. *Journal of International Development: The Journal of the Development Studies Association*, *20*(8), 996-1027.

However, the case for following-wave settlers which were mostly French and British is quite different. Because the new lands with most abundant resources had already been occupied by the Spanish or Portuguese colonizers, the British and French settlers were forced to settle on places where were relatively poor. Because of the economic backwardness, these British-found places were not in a dense population, which indicated that more settlers could survive because of the lack of deathful tropical diseases. Since local human resources were not abundant at 1500 and that more settlers successfully embarked on these new lands at the Neo-Europe, the percentage of the 1900 population who were the direct descents of the *British* colonizers was significantly higher. Data obtained from AJR (2000) helps us to see that 4 out of top 5 British colonies have populations among which at least 88% are British decedents[27]. Therefore, it is clear to say that since the very few Spanish or Portuguese first-wave settlers "inherited" lands with massive economic resources and humane capitals, they were also prone to "inherit" the pre-existing expropriation institutions and their decedents were limited even four centuries later. On the contrary, since the second-wave British settlers embarked on new-found lands where were economically barren and lacked human populations, they were incentive to "reproduce" British institutional legacies exemplified by institutions of private property and there was no wonder why the British decedents occupied the vast majority of these counties' 1900 populations. In all, we propose that variable institution is also _positively_ correlated with our proposed IV variable *European settlement in 1900.*

Lastly, AJR (2002) overestimates the role of European institutions. We believe that what leads to the authors' proposal that institutions of private property determine the long-term economic divergence is the factual economic prosperity among the Neo-Europe. Although European settlement does, to some extent, work as a positive force for better property protection, there is no

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[27] Albouy, D. Y. (2008). *The colonial origins of comparative development: an investigation of the settler mortality data* (No. w14130). National Bureau of Economic Research.

evidence of a significantly general relation between European colonization, institutions of property rights and long-term economic development. Instead, we agree with the idea that it is *British* settlement that helps explains the core reason why a long-term economic divergence happens. We find that 9 out of 10 highest-score countries which value the protection of property rights are derived from British colonization and four of the top five states are from North America and Australasia. Therefore, we believe that AJR (2002) overreaches the importance of institutional protections by generalizing the wisdom which applies in Five-Eye Alliance to the whole world.

See related information at Table 1.

Table 1, Top 10 countries/areas that protect private property in AJR (2001, 2002)

	Average Protection against Expropriation Risk, 1985 – 1995	The origin of colonization
The United States	10	Britain
Canada	9.73	Britain
New Zealand	9.73	Britain
Australia	9.32	Britain
Singapore	9.32	Britain
India	8.27	Britain
The Gambia	8.27	Britain
Hong Kong, China	8.14	Britain
Malaysia	7.95	Britain
Brazil	7.91	Portugal

Source: AJR (2000, 2001, 2002)

In order to deal with this underestimated exaggeration, we create a dummy variable *Britain* to represent whether one targeted state receives British colonization in the past history or not. If the answer is Yes, then variable *Britain* is coded as 1, otherwise it is 0. In this case, we will reorganize the base OLS regression equation as follow:

$$y_{it} = \mu_t + \delta_i + \beta * Britain_{it} * X_{it} + Z_{it} + \epsilon_{it}$$

where $Britain_{it}$ represents whether one state i receives British colonization or not at year t.

Our focus is the *direction* of coefficient β.

Then we will delete all the data collected from the *Neo-Europe* countries on the measurement of institutional settings for property protection and redo the original AJR (2002)'s base-line testing. These combined two robustness check is design to illustrate one fact that it is only in British colonies that settlement had a positive effect and that the existence of Reverse of Fortune phenomenon was largely because of the contribution of four representative countries: The United States, Canada, Australia and New Zealand.

Here we present the baseline descriptive statistics. The dependent variable of this extension research is the log-form GDP Per Capita in 1995 (logpgp95) adopted from the original AJR (2002) dataset. After including the missing African data and remeasuring the variable *population density in 1500* with a more accurate estimation of *total arable land*, I implement major two control variables as *Improvedsjb1500* which means improved urbanization measurement in 1500 and I*mprovedlpd1500s* which represents log-form population density in 1500.

For simplicity and without losing representativeness, I adopt the *Avexpr* measurement as one proxy of the institution setting of private property. Standing for *average protection against expropriation risk from 1985 to 1995*, this variable measures risks of expropriation of foreign investment by government, from 0 to 10, where a higher score generally means less risks.

We also include the statistical summary of one targeted IV variable *Euro1900* which represents the meaning of *European settlement in 1900*. This IV variable measures the percentage of each including state's population that is European or decedents of Europeans settlers.

See the detailed information at Table 2.

Table 2: Selective Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Logpgp95	41	8.458	.881	6.877	10.216
Improvedsjb1500	41	6.385	4.953	0	17.79
Improvedlpd1500s	41	.233	1.921	-3.831	4.61
Avexpr	39	6.883	1.451	3.727	10
Cons90	38	4.868	2.056	1	7
Cons1	39	3.333	2.517	1	7
Euro1900	41	23.229	28.671	0	99

Result

After including the relevant African dataset and redefining one control variable *lpd1500s* with a more accurate denominator measurement, we present our improved baseline regression tables, with *Improvedsjb1500* and I*mprovedlpd1500s* each presenting the economic prosperity of the including states in 1500.

See the detailed information at Table 3 and Table 4.

Table 3: *Improved* Urbanization in 1500 and GDP per Capita in 1995

	(1)	(2)	(3)	(4)
	Base Model_ Urbanization 1500	Model2_Urbanization 1500_Continent	Model3_Urbanization 1500_Latitude	Model4_Urbanization 1500_Resources
Improvedsjb1500	-0.0783**	-0.00844	-0.0340	-0.0301
	(0.0256)	(0.0112)	(0.0185)	(0.0167)
Avexpr		0.452***	0.428***	0.419***
		(0.0377)	(0.0645)	(0.0586)
America		-0.955		
		(0.574)		
Africa		-0.525		
		(0.773)		
Asia		-1.326*		
		(0.607)		
Lat_abst			1.420	
			(0.917)	
Coal				0.112
				(0.278)
Landlock				-0.541
				(0.478)
Island				0.271
				(0.331)
Gold				0.127
				(0.106)
Iron				0.0429
				(0.0921)
Silver				0.119
				(0.0723)
Zinc				-0.105
				(0.125)
Oil				0.000000126
				(0.000000273)
Constant	8.958***	9.951***	8.614***	8.625***
	(0.206)	(0.542)	(0.300)	(0.310)
N	41	41	41	41

Standard errors in parentheses

$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Table 4: *Improved* Population Density in 1500 and GDP Per Capita in 1995

	(1)	(2)	(3)	(4)
	Base Model_Density 1500	Model2_Density 1500_Continent	Model3_Density 1500_Latitude	Model4_Density 1500_Resources
Improvedlpd1500s	-0.336***	-0.0697	-0.234***	-0.158**
	(0.0499)	(0.0381)	(0.0547)	(0.0500)
Avexpr		0.547***	0.390***	0.360***
		(0.0410)	(0.0618)	(0.0545)
America		-0.519		
		(0.435)		
Africa		0.367		
		(0.581)		
Asia		-0.432		
		(0.483)		
Lat_abst			1.030	
			(0.699)	
Coal				0.171
				(0.215)
Landlock				-0.668
				(0.370)
Island				0.275
				(0.244)
Gold				0.0798
				(0.0815)
Iron				-0.0109
				(0.0721)
Silver				0.0496
				(0.0548)
zinc				-0.0409
				(0.0968)
Oil				0.000000158
				(0.000000208)
Constant	8.536***	8.932***	8.312***	8.377***
	(0.0955)	(0.426)	(0.179)	(0.159)
N	41	41	41	41

Standard errors in parentheses $^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

The column (1) of both Table 3 and Table 4 reaffirm the existence of Reverse of Fortune phenomenon. After introducing control variables that measure economic abundance of targeted states at 1500 into Table 3 (*Improvedsjb1500*) and Table 4 (*Improvedlpd1500s*), the results become significantly diverse. From the remaining columns of Table 3, it is clear that after the inclusion of institution of private property right, the statistical significance of variable *Improvedsjb1500* lose immediately, which implies that the establishment of legal and legitimate protection of private property rights could largely explain the reasons why long-term economic divergence happens between the Great Discovery and now.

After including the variable *Avexpr* since column (2), the coefficients of *Improvedlpd1500s*, under most cases, still remain statistically significant. This echoes the acknowledged fact from the original authors that compared to the explanation power of variable *urbanization rate in 1500*, the corresponding compatibility of variable *population density in 1500* is lagged behind. However, at column (2), we could still find out that after controlling the continent dummies, the coefficient of measurements of population density is negative and statistically insignificant, whereas its institutional counterpart remains positive and significant even at 0.1% statistic level. Even under the cases of significance maintenance of *Improvedlpd1500s*, it is clear that the coefficients of property protection are all positive and highly significant, which indicates that higher level of institutional preservation are associated with more prosperous economic performance in 1995.

Apart from baseline regressions, we also introduce the Britain dummy to differentiate the diverse origins of European colonization. This dummy variable is coded as one if one targeted state used to be colonized by the Great Britain and as zero if not. We deliberately introduce the intersection term between Britain dummy variable and the variable *Avexpr* so that the contribution of Britain settlement on the preservation of private property right could be clearly captured.

We also create a Neo-Europe dummy variable which represents a country combination of the United States, Canada. Australia and New Zealand. By generating this dummy variable, we could temporarily delete the existence of four countries and see its correlated impact on the maintenance of the "Reverse of Fortune" phenomenon.

See the detailed information at Table 5 and Table 6.

Table 5: *Improved* Urbanization in 1500 and GDP Per Capita in 1995 (Two Exclusions of Neo-Europe and Two Inclusions of Britain Dummy)

	(1)	(2)	(3)	(4)
	Base Model_Urban 1500_NoNeoEurope	ModelAll_Urban 1500_NoNeoEurope	Model3_Urban 1500_British Rule	ModelAll_Urban 1500_British Rule
Improvedsjb1500	-0.0415	-0.0428	-0.0559*	-0.0541*
	(0.0266)	(0.0308)	(0.0245)	(0.0260)
Avexpr			0.125	0.133
			(0.1052)	(0.1242)
Lat_abst		-0.656		-0.311
		(1.281)		(1.283)
Gold		0.102		0.0833
		(0.452)		(0.114)
Iron		-0.0962		0.0490
		(0.699)		(0.0938)
Silver		0.0801		0.151
		(0.208)		(0.0757)
Zinc		-0.0568		-0.109
		(0.487)		(0.131)
Oil		0.000000266		4.78e-08
		(0.000000548)		(0.000000277)
Britain_Avexpr			0.101**	0.0984*
			(0.0321)	(0.0400)
Constant	8.570***	8.657***	9.037***	8.932***
	(0.228)	(0.332)	(0.223)	(0.414)
N	85	85	37	37

Standard errors in parentheses $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 6: Improved Population Density in 1500 and GDP Per Capita in 1995 (Two Exclusions of Neo-Europe States and Two Inclusions of Britain Dummy)

	(1)	(2)	(3)	(4)
	Base Model_Density 1500_NoNeoEurope	ModelAll_Density 1500_NoNeoEurope	Model3_Density 1500_British Rule	ModelAll_Density 1500_British Rule
Improvedpd1500s	-0.312***	-0.226***	-0.157***	-0.173***
	(0.0638)	(0.0587)	(0.0433)	(0.0504)
Avexpr			0.351***	0.263***
			(0.0571)	(0.0679)
Lat_abst		1.189		0.238
		(0.803)		(0.859)
America		0.190		
		(0.245)		
Africa		-0.759**		
		(0.228)		
Gold		0.0230		0.0546
		(0.0188)		(0.0862)
Iron		-0.0120		0.00110
		(0.131)		(0.0731)
Silver		0.0357		0.0535
		(0.0442)		(0.0574)
Britain_Avexpr			0.0885***	0.162***
			(0.0242)	(0.0424)
Zinc				-0.0427
				(0.103)
Oil				0.000000162
				(0.000000207)
Constant	8.007***	8.061***	8.503***	8.403***
	(0.0956)	(0.250)	(0.0858)	(0.179)
N	86	85	47	47

Standard errors in parentheses

$^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

From the column (1) and (2) of Table 5, we discover that after excluding four New-Europe states, this significance of the improved measurement of *urbanization in 1500* disappears, which reaffirms our original hypothesis that the existence of Reverse of Fortune phenomenon is largely supported by four representative countries: The United States, Canada, Australia and New Zealand.

What's more, after the inclusion of variable *Britain_Avexpr*, we find out that the statistical significance of institutional protection also disappears and that the coefficient of the intersection term between Britain colonization and average protection against expropriation risk becomes numerically positive and statistically significant, which indicates that the explanation of variable *Avexpr* is substantially contributed by the only British legacy of property preservation. Again, this judgement is consistent with our original hypothesis that it is only in British colonies that settlements develop positive effects.

As a comparison, after the temporary exclusion of the existence of four Neo-Europe states, targeted variable *Improvedpd1500s* still maintains its negative numerical numbers and statistical significance even at the 0.1% level. In the column (3) and (4) of Table 6, we could also find that the coefficients of property protection remain highly positive and statistically significant together with a positive and significant intersection term named *Britain_Avexpr*. This situation implies that apart from the contribution of British legal arrangement of private property preservation, there exists other, maybe potentially missing, factors which help to explain why better protection of private property would lead to better long-term economic developments.

Lastly, we also redo the original IV 2SLS estimation by implementing a new IV variable. This time, we borrow one ideal variable entitled *Euro1900* from AJR (2001), which represents the percentage of each including state's population that is European or decedents of Europeans settlers at 1900. Just because of the unexplained influence of variable *Improvedpd1500s*, we worry that many other factors which could substantially explain the positive contribution of institutional settings may have been missed. In other word, our OLS regression may embrace missing variable problem, which is very likely to cause biasness in the presentation of coefficient and significance. Focusing on the target variable *Avexpr*, we believe that it is a practical need to redo the IV 2SLS

estimation as a sound robustness check.

The statistical correlation between variable *average protection against expropriation risk* and instrument variable *European settlers in 1900* as well as the oral reasons why variable *Euro1900* could not directly explain long-term economic development shall be presented firstly.

Following the logic induction of AJR (2002), variable *Log mortality* which presents log-formation of estimated settler mortality is *positively* related with the variables that measure pre-modern economic prosperity. The logic is that the first-round settlers (mainly the Spanish and Portuguese) were inclined to embark on places where were economically abundant in 1500, leaving them higher probability to meet local deathful diseases exemplified by malaria which these settlers were not immunized from. This led to one fact that very few first-round settlers occupied the wealthiest lands and therefore when the time came to 1900, the decedents of first-wave European settlers did not cover a significant populational percentage. AJR (2001) clearly points out that countries with Spanish colonization history do not develop matured institutions of property rights compared to the institutional settings of countries which used to be colonized by the British.

However, the case for following-wave settlers which were mostly French and British is quite different. Because the new lands with most abundant resources had already been occupied by the Spanish or Portuguese colonizers, the British and French settlers were forced to settle on places where were relatively poor. Because of the economic backwardness, these British-found places were not in a dense population, which indicated that more settlers could survive because of the lack of deathful tropical diseases. Since local human resources were not abundant at 1500 and that more settlers successfully embarked on these new lands at the Neo-Europe, the percentage of the 1900 population who were the direct descents of the *British* colonizers was significantly higher. Data obtained from AJR (2000) helps us to see that 4 out of top 5 British colonies have populations

among which at least 88% are British decedents[28]. Therefore, it is clear to say that since the very few Spanish or Portuguese first-wave settlers "inherited" lands with massive economic resources and humane capitals, they were also prone to "inherit" the pre-existing expropriation institutions and their decedents were limited even four centuries later. On the contrary, since the second-wave British settlers embarked on new-found lands where were economically barren and lacked human populations, they were incentive to "reproduce" British institutional legacies exemplified by institutions of private property and there was no wonder why the British decedents occupied the vast majority of these counties' 1900 populations. In all, we propose that variable institution is also *positively* correlated with our proposed IV variable *European settlement in 1900*. The first-stage results of *Euro1900*-driven IV estimations confirms the legitimacy of our theoretical inductions.

It is even intuitive to understand why the measurement of the percentage of population that is European or of European decedents in 1900 could not explain the result of economic prosperity in 1995. Matured scholars could not imagine what the explanation power would be when a theoretical argument like "*previous* composition of population could explain *current* economic prosperity" is presented. Frankly speaking, we do not buy such an ill-literate idea and tend to believe that there is no casual linkage between IV variable *Euro1900* and major dependent variable *Logpgp95*

See the detailed information at Table 7.1 and Table 8.1.

Table 7.1 First-Step IV-2SLS Estimation of Institution_Urbanization in 1500 and GDP Per Capita in 1995

Instrumented Variable	Instrument Variable	Coefficient and Significance	Constant	Control Variables	R^2
Avexpr	Euro1900	1.149*** (0.311)	11.159*** (1.692)	*Yes*	0.554

| Standard errors in parentheses | | | | * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ | |

[28] Albouy, D. Y. (2008). *The colonial origins of comparative development: an investigation of the settler mortality data* (No. w14130). National Bureau of Economic Research.

Table 8.1 First-Step IV-2SLS Estimation of Institution_Population Density in 1500 and GDP Per Capita in 1995

Instrumented Variable	Instrument Variable	Coefficient and Significance	Constant	Control Variables	R^2
Avexpr	Euro1900	0.341*	7.351***	*Yes*	0.408
		(0.160)	(1.105)		

Standard errors in parentheses $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

We present the second-stage results of two IV 2SLS estimations by the implementations of variable *European settlement in 1900*.

See the detailed information at Table 7.2 and Table 8.2.

Table 7.2: IV-2SLS Estimation of Institution_Urbanization in 1500 and GDP Per Capita in 1995

	(1)	(2)	(3)	(4)
	IV2SLS_Urban 1500_Base	IV2SLS_Urban 1500_Indepedence	IV2SLS_Urban 1500_Continent	IV2SLS_Urban 1500_All
Avexpr	0.519***	0.511***	0.622***	0.581***
	(0.102)	(0.0930)	(0.143)	(0.141)
Improvedsjb1500	-0.0238	-0.0192	-0.0195	-0.0190
	(0.0212)	(0.0191)	(0.0213)	(0.0204)
Indtime		0.00359*		0.00246
		(0.00137)		(0.00194)
America			-0.0964	-0.0506
			(0.0491)	(0.0596)
Asia			0.0363	0.0123
			(0.0565)	(0.0571)
Constant	5.062***	4.637***	4.429***	4.379***
	(0.792)	(0.752)	(0.904)	(0.866)
N	38	37	36	36

Standard errors in parentheses $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 8.2: IV-2SLS Estimation of Institution_Population Density in 1500 and GDP Per Capita in 1995

	(1)	(2)	(3)	(4)
	IV2SLS_Density 1500_Base	IV2SLS_Density 1500_Indepedence	IV2SLS_Density 1500_Continent	IV2SLS_Density 1500_All
Avexpr	0.883***	0.669***	1.000*	0.832*
	(0.213)	(0.154)	(0.394)	(0.316)
Improvedlpd1500s	-0.0794	-0.0741	-0.0658	-0.0685
	(0.102)	(0.0771)	(0.118)	(0.0965)
Indtime		0.00393*		0.00406
		(0.00148)		(0.00233)
America			-0.0961	-0.0264
			(0.0639)	(0.0625)
Asia			-0.0793	-0.0944
			(0.126)	(0.105)
Constant	2.357	3.375**	2.200	2.757
	(1.420)	(1.010)	(2.103)	(1.681)
N	64	60	59	59

Standard errors in parentheses $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

The results of all columns in Table 7.2 and Table 8.2 echo our worry that the missing variable problem does exist in the original AJR (2002). Under the IV 2SLS estimation, the coefficients of variable *Improvedsjb1500* in Table 7.2 and variable *Improvedlpd1500s* in the Table 8.2 lose statistical significance immediately, although preserving numerical features of being negative. As a comparison, the measurement of institutional protection, among exactly the same columns, all remains numerically positive and statistically significant. The second-stage results tell us that the maintenance of long-term economic divergence is substantially supported by diverse institutional settings of private property protection, which is consistent with the original authors' conclusion.

Conclusion

This research serves as an extended replication of AJR (2002). Focusing on the *Reversal of Fortune* thesis, we generally agree with the institution hypothesis which emphasizes the role of institutions of private property in the determination of long-term economic divergence. However, three major problems exist in the original research. Firstly, the authors' measure of *urbanization in 1500* contains no data from Africa and thus only consists of limited observations. Secondly, despite the authors' claims to the contrary, their measurement of *population density in 1500* does not *accurately* count the total amount of arable lands. Lastly, AJR (2002) overestimates the role of European institutions.

Among this research, we discover that after including the relevant African data and the new measurement of the controlled variable *population density in 1500*, the statistical significance of the institution hypothesis is still well-preserved. Furthermore, by excluding four Neo-Europe countries and including one intersection term between the Britain dummy and the institutional protection of private property rights, we are also assured that it is in British colonies that settlement had a positive effect and that the existence of *Reverse of Fortune* phenomenon is largely because of the contribution of four countries: The United States, Canada, Australia and New Zealand. Two following-up IV-2SLS estimations implemented by a new IV variable *Euro1900* also reaffirm the explanation power of the original Institution Hypothesis.

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