行政院國家科學委員會專題研究計畫 期末報告

民主、教育與經濟成長

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中 華 民 國　102 年 10 月 12 日

中 文 摘 要 ： 跨國資料顯示：各國民主化程度與其所得間呈現高度之正相關現象。但是，本研結果發現：一旦考慮不同國家之特性與組內變異時，政治民主化對經濟成長之影響會立即消失。而且此一推論不會因計量方法、樣本與控制變數之不同而有所改變。此外，如果政治制度不能影響經濟成長，到底何種因素能影響成長？本研究結論認為除了文化、族群與國家地理環境外，最重要的因素還是教育。教育不但較政治更能影響成長，在某種程度上還能對政治民主化產生影響。

中文關鍵詞： 民主政治、教育、經濟成長、固定效果、因果關係

英 文 摘 要 ： Cross country data reveal a strong and positive correlation between democracy and income. The results obtained in this project document that this correlation is not robust to including fixed effects and exploiting the within-country variation over time. The lack of association is highly robust to different econometric techniques, to estimation in various different samples, and to the inclusion of different sets of covariates. However, if democracy does not cause growth, then what does? Other than time-invariant country characteristics such as geography, culture, and ethnicity, the empirical evidence suggests a time-varying factor – education. Not only is education a more important variable in predicting economic growth than political institutions, but also the outcome of a democratic or autocratic regime is to some extent determined by education.

英文關鍵詞： democracy, education, economic growth, fixed effects, causality

行政院國家科學委員會補助專題研究計畫 ■期中進度報告
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中 華 民 國 102 年 10 月 12 日

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   跨國資料顯示：各國民主化程度與其所得間呈現高度之正相關現象。但是，本研究結果發現：雖然在簡單的迴歸模型中，民主化程度會影響經濟成長。但是，一旦控制了不同國家的固定效果特性與組內變異時，政治民主化對經濟成長之影響會立即消失。而且此一推論不會因計量方法、樣本與控制變數之不同而有所改變。但是，如果政治制度不能影響經濟成長，到底何種因素能影響成長？本研究計畫結論認為除了文化、族群與國家地理環境外，最重要的因素還是教育。教育不但較政治更能影響成長，在某種程度上還能對政治民主化產生影響。

Democracy, Education and Economic Growth

Abstract

Cross country data reveal a strong and positive correlation between democracy and income. The results obtained in this project document that this correlation is not robust to including fixed effects and exploiting the within-country variation over time. The lack of association is highly robust to different econometric techniques, to estimation in various different samples, and to the inclusion of different sets of covariates. However, if democracy does not cause growth, then what does? Other than time-invariant country characteristics such as geography, culture, and ethnicity, the empirical evidence suggests a time-varying factor – education. Not only is education a more important variable in predicting economic growth than political institutions, but also the outcome of a democratic or autocratic regime is to some extent determined by education.

I. Introduction

As indicated by Glaeser *et al.* (2004), economic research has adopted two broad approaches to identify the relationships among democracy, education, and economic growth. The first approach emphasizes the need to start with democracy and with checks on government power so as to secure property rights. With better property rights institutions in place, investment in human/physical capital, and therefore economic growth, are expected to follow. Thus, democracy and other institutional improvements have a first-order effect on education and long-run economic growth.

The second approach emphasizes the need for education to start the process, since a high level of educational attainment is a prerequisite for both democracy and economic growth. Education enables a culture of democracy and a set of economic and social conditions that can bring about economic development. There seems, however, to be no one-to-one relationship between the strength of democracy and economic performance. If the citizenry were well-educated, even pro-market dictators could secure property rights as a matter of policy choice, and not of political constraints. This can be seen by using an old-fashioned method of comparative institutional analysis to understand whether or not democracy may help or hinder the process of development. For instance, one can easily draw upon the contrasting development experiences in largely authoritarian East Asia and democratic South Asia over the 1960s, 1970s and 1980s. It is evident that over these three decades average economic performance, both in terms of per capita income growth and human capital accumulation, has been substantially better in the former region than in the latter. This distinction is especially obvious in the bilateral comparison of the two largest economies in this region: China (in East Asia) and India (in South Asia). As observed by Bardhan (1999), this bright contrast most likely arises from China's far better performance in the provision of primary education at the local level.[1] Thus, democracy has only a second-order effect on economic performance. The first-order effect comes from education or investment in human capital that shapes both the institutional and productive capacities of a society.

Basically, each approach has its own implications, not only for the role of government, but also for economic growth. In this project, I simply let the data speak for themselves to

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[1] He also notes that similar examples of more effective rural basic education in Cuba compared to some of the more democratic regimes in Latin America are also available.

identify the relationship (or the lack of it) among education, the political regime, and economic development, in a way that may not be apparent from a simple cross-country aggregative statistical correlation.

The rest of this project is organized in the following manner. Section II outlines different hypotheses that could plausibly explain the correlations among education, democracy, and income. Section III describes the sources and appropriateness of the data. Section IV develops a preliminary framework which allows for the incorporation of fixed effects in a straightforward and intuitive way. Section V uses an augmented Solow model to estimate the impact of democracy on income, while controlling for the impacts of other determinants of growth (e.g., human capital and the convergence effect). Finally, Section VI concludes the article.

II. Democracy, Education, and Economic Growth

Studies on the relationships among democracy, education, and economic growth abound with contradictory hypotheses and findings. Democracy, for example, is alleged both to promote and to inhibit economic development – yet some scholars conclude that democracy and growth are unrelated. Education, on the other hand, is sometimes identified as a cause of economic growth, and sometimes as a consequence of it. This section describes these controversies by highlighting recent findings from the theoretical and empirical literature.

A. From Institutions to Growth?   In the literature, the importance of democracy was first proposed by Montesquieu (1748) and Smith (1776). New Institutional Economics has also stressed the importance of political institutions for both economic growth and social stability (North and Thomas 1973; North, 1990). This line of argument maintains that democratic processes as well as the existence and exercise of fundamental civil liberties generate the social conditions most conducive to upholding private property rights which in turn promote economic development.[2] Under this framework, private property rights can guarantee the efficient use of resources, since owners enjoy both the costs and

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[2] Previous studies on the effect of democracy on growth have been systematically surveyed by Sirowy and Inkeles (1990). They distinguish three perspectives on the topic: a compatibility perspective, in which democracy enhances economic growth; a conflict perspective which argues that democracy hinders growth; and a skeptical perspective which doubts that there is any systematic linkage between democracy and growth. Generally speaking, the argument presented in this subsection (*From Institutions to Growth?*) can be categorized as the compatibility perspective.

benefits of their resource use decisions. Only under the circumstances in which people are free to accrue and dispense their resources within the marketplace will the most innovative and competitive technologies emerge. Adam Smith thus stresses that private property is a precondition for the mutually beneficial exchanges that foster specialization, innovation, and economic growth. Furthermore, the literature on economic growth, starting with early contributions by Knack and Keefer (1995) and Mauro (1995), also emphasizes that property rights are better protected under democracy. More recently, Hall and Jones (1999), Easterly and Levine (2003), and Acemoglu *et al*. (2001, 2002) supply empirical support for this view using data on the urbanization of European regions during the last millennium, which exhibit faster growth under more constrained governments.

Based on this line of argument, the basic requirement of economic growth is a set of well-defined and enforced property rights and democracy is the only way that is better-suited in providing this environment. The maximum economic value can be drawn from resources only when private property rights are clearly defined and well protected by democratic regimes. This argument emphasizes that the rise of European civilization in the seventeenth century is principally characterized by the compatibility between democracy and growth. In addition, there is a well-known presumption made in this literature which is that the positive relationship between democracy and growth is neither peculiarly limited to Europe, nor relevant only to the seventeenth century, but rather that democratic institutions are the best possible mechanism for promoting economic growth in the currently less-developed countries.[3]

Intuitively, the correlation between democracy and growth proposed by the previous argument can be explained by Figure 1, which uses the Polity democracy index and focuses on the sample of democracies in every five-year interval between 1950 and 2005.[4] Figure 1 classifies countries into two groups depending on whether or not the Polity democracy score is above or below the average level in the world. In this way, countries are divided into two groups: more democratic countries (exhibiting Polity above World Median) and less democratic countries (exhibiting Polity below World Median). Figure 1 then calculates the fraction of log income per capita for countries in

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[3] As surveyed by Sirowy and Inkeles (1990), this argument proposes that democracy is best suited to promote economic growth in the LDCs, since democratic processes as well as the exercise of fundamental civil liberties and political rights generate the social conditions most conducive to economic development.
[4] Details on the measure of democracy will be provided in Section III.

each group that are higher than the world average. Thus, Figure 1 can reveal which group has relatively higher or lower income. The evidence indicates that the fraction of countries with income above the world average in the more democratic group (0.49) is significantly higher than that in the less democratic group (0.16). Thus, the result is consistent with the compatibility perspective that democratic countries are more likely to attain high income levels. Statistically, this evidence corresponds to the regression of income on the degree of democracy without controlling for fixed effects. However, as indicated by Acemoglu *et al.* (2005, 2008), this kind of study looks only at the cross-sectional correlation between democracy and income rather than at the within-country variation. Hence, it might carry a potential risk by omitting some important factors that influence both income and democracy in the long run.

B. From Education to Growth? Since the early 1970s, the perspective of compatibility between democracy and growth has been questioned by a growing literature. For instance, Huntington (1987) explicitly describes the causal relationship between democracy and growth as being conflictive, even to the point of incompatibility. In general, this skeptical perspective argues that developing countries cannot achieve rapid economic growth through a democratic framework and, in some cases, economic growth is even hindered by the democratic organization of political decision-making (Andreski, 1968; Chirot, 1977; and Rao, 1985). Fundamental to this approach is the proposition that there is no systematic relationship between democracy and economic growth. Having a democratic government alone means little for economic development. This argument is further supported by the literature on "East Asian Exceptionalism" that emphasizes the experiences of China, South Korea, and Taiwan, which grew rapidly under one-party dictatorships with the latter two eventually turning to democracy. Empirically, Doucouliagos and Ulubasoglu (2008) also apply meta-regression analysis to the population of 483 estimates derived from 84 studies on democracy and growth and find no correlation between democracy and economic growth, once factor accumulation, endogeneity, and regional effects are controlled for. Thus, democracy or authoritarianism may be neither necessary nor sufficient for fostering the institutional mechanisms behind various basic economic, geographical, and educational factors.

The skeptical perspective can be further explained by examining Figure 2 that illustrates the relationship between democracy and growth once the omitted

time-invariant variables affecting both income and democracy are controlled.[5] To do this, Figure 2 divides countries into two groups depending on whether or not the Polity score for a particular country improves or declines during the period between 1950 and 2005. This method of classification divides countries into two groups: countries exhibiting democratic improvements and countries exhibiting democratic deterioration. Figure 2 then calculates the fraction of growth rates (the change in log income per capita) for countries in each group that are higher than the world average so as to identify which countries have relatively higher or lower growth rates than the average level of the world. This allows one to investigate the within-country variation by looking at the relationship between the changes in the log income per capita (growth rate) and the changes in democracy. The evidence in Figure 2 shows that the fraction of countries' economic growth rates that are higher than the world average in the democratic improvement group (0.43) is not significantly different from that of the democratic deterioration group (0.54). Thus, in contrast to Figure 1, Figure 2 shows that democracies that are better than usual are not more likely to experience a higher economic growth rate.[6] This evidence therefore provides a preview of how the results presented later in this project are likely to change once the omitted variables affecting both income and democracy are controlled.

However, if democracy does not cause growth, then what does? Here, the approach taken to answer this question is based on the work of Lipset (1960) and Glaeser *et al.* (2004), who argue that people having high education levels have better possibilities of resolving their differences through negotiation and voting than through violent disputes. This, in turn, brings about better protection of property rights and faster economic growth. *Education is needed for courts to operate and to empower citizens to engage with government institutions. Literacy encourages the spread of knowledge about the government's malfeasance. According to this view, countries differ in their stocks of human and social capital – which can be acquired through policies pursued even by dictators – and institutional outcomes depend to a large extent on these endowments* (Glaeser *et al.* 2004, p. 272). The focus therefore should be on how to improve the

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[5] This allows one to focus on the "within-country variation" across two time points.

[6] Figures 1 and 2 are extensions of Acemoglu *et al.* (2009, p.1045). They can be explained by using a contrast between the United States and Afghanistan. The United States is more democratic and richer, so Figure 1 that does not control for fixed country effects would suggest that a more democratic regime leads to higher income. However, on the other hand, Figure 2 focusing on the "within-country variation" can help to identify whether or not Afghanistan is more likely to become richer as it becomes more democratic.

educational system and development strategies, which may vary independently of the democratic character of a political regime. This skepticism with regard to democratic legitimacy implies that different political systems are capable of adopting the same economic or education policy and suggests that the effects of democracy on growth are negligible (Pye, 1966; McKinlay and Cohan, 1975). This skeptical perspective is shaped to some extent by the contrasting experiences between China and India over the period between 1950 and 2000. Over these five decades, average economic performance has been significantly better in the former than in the latter. However, if the degree of democracy is measured by 'constraints on the executive' of Polity IV data, then over the same period India has an average score of 7 which is much higher than that of -8 for China. According to this perspective, the rationalization is that Chinese dictator Deng Xiaoping chose to enhance human resource development by providing more education in China, and hence the country grew rapidly, reaching a per capita income (PPP adjusted) level of US $4,076 in 2000.[7] The Indian democratic government, by contrast, chose to ignore the implications for education, and the country only reached a level of income of US $2,687.[8] Based on this, this strand of the literature goes further and argues that the difference in education is a major causal factor explaining not only differences in income, but also in democracy.

C. *Economic Implications.* Consider two major development challenges around the globe: how to encourage growth and how to promote democracy at the same time. Glaeser *et al*. (2004) indicate that the two previous distinct strands of the literature have identified very different approaches to confronting these challenges. The perspective "*from democracy to growth*" emphasizes the need to start with democracy and other executive constraints as the basis for securing property rights so as to promote growth. It strongly disagrees with the assumption that economic growth needs to be commanded in all respects by a central authority, since the dictatorship takes a heavy toll in terms of citizen rights and fundamental freedoms (Holt and Turner 1966). Conversely, the perspective "*from education to growth*" emphasizes the need for human capital accumulation to start the process. Glaeser *et al.* (2004) argue that economic growth or even improvements in democracy is seen as the consequence of increased education, and

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[7] Barro and Lee (2000) show that, in 2000, 41% of the population aged 25 and above in China had a secondary education compared with 33% in India.
[8] Income per capita is obtained from the Penn World Tables (PWT), version 6.3, series RGDPCH.

not as its cause. In the LDCs, even pro-market dictators can secure property rights as a matter of policy choice, but not of political constraints.

While both perspectives emphasize the need for secure property rights to support investment in human and physical capital, Glaeser *et al.* (2004) indicate that these two hypotheses highlight very different causal mechanisms. The former sees the pro-growth policies largely as a consequence of the established democratic constraints on government, whereas the latter sees these policies as choices of their – typically unconstrained – leaders, and not a consequence of their political constraints. In particular, the East Asian experiences show that democratic government may not be a viable approach to secure property rights and economic growth. It is education that matters the most for growth because it generates a set of political conditions best suited for economic development. Growth in the LDCs may be feasible without an immediate improvement in democracy, and is likely in turn to lead to democratization.

The empirical results of Glaeser *et al.* (2004) are much closer to the second perspective of "*from education to growth*" than to the first one. Growth in the LDCs may be feasible even without the democratic improvement. Nevertheless, their model is along the lines of Lipset (1960), namely education externality is not technological but political. Thus, their study tends to focus on the role of political institutions in the linkage between human capital and economic growth. In differentiating from Glaeser *et al.* (2004), this project emphasizes that the political regime is not the main mediating channel through which education or human capital has an effect on economic growth. Other than the political regime, the effects of education on growth work through many other channels such as labor productivity, social networks, and the philosophy of religion, etc. Thus, the following study will employ an augmented Solow model and incorporate human capital directly as a production factor in the production function.

III. Data

In order to examine the possible effect of political democracy on the level of economic development, a panel sample of 145 countries over the period 1950-2005 is used. This sample represents the largest number of countries for which it is possible to obtain comparable measures of per capita income and assessments of democracy. The preliminary results using these data are then confirmed by adding other country control

variables and by using more complex estimation techniques for a smaller sample of countries. For instance, in order to assess the effects of education on subsequent economic growth, the sample is reduced to 95 countries and a model of comparative growth is estimated for the period from 1950 to 2000. Fortunately, the results of using different sample sizes are very similar, suggesting that the use of smaller numbers of countries, where necessary, does not give rise to major estimation problems.

A. Democracy.   The main measure of democracy in this study is a widely-used measure, the composite Polity index, which is adapted from the Polity IV dataset over the period 1950-2005 (Marshall and Jaggers, 2010). It is the difference between the democracy and autocracy indices. The former index ranges from zero to ten and is used to measure the democratic characteristics of the regime (e.g., the presence of institutions through which citizens can express effective preferences regarding alternative policies and leaders, the existence of institutionalized constraints on the executive, and the guarantee of civil liberties to all citizens). The latter index also ranges from zero to ten, but it is used to measure the autocratic characteristics of the regime (e.g., the competitiveness of political participation, the regulation of participation, and the openness and competitiveness of executive recruitment). Since many governments have both democratic and autocratic characteristics, either the democracy index or autocracy index alone does not provide relevant information about the regime type, and they should both be used to measure the level of democracy (Li and Reuveny, 2003; Acemoglu *et al.*, 2008). I thus measure democracy as the difference between the democracy index and autocracy index, constructing an index (denoted by *Democracy* hereafter) ranging from -10 to 10, with a higher score denoting greater constraints. According to Acemoglu *et al.* (2002, 2005, and 2008) and Li and Reuveny (2003), it is a useful concept since it measures limitations on the arbitrary use of power by the executive, and is presumably correlated with the security of property rights.

B. Education.   The use of secondary schooling to explain economic growth is suggested by a wide variety of endogenous growth theories and human capital theories. Thus, in this project, the second level educational attainment (complete) of the total population aged 25 and over is used as a proxy to evaluate policies regarding human resources. The data are obtained from the Barro and Lee (2000) education dataset which is available in five-year intervals between 1950 and 2000. This variable is denoted by *Education* in the

later analysis.

C. Income.   To permit useful international comparisons, the GDP per capita in purchasing power parity in international dollars is obtained from Version 6.3 of the Penn World Table (PWT). The PWT provides national income accounts converted to international prices for 189 countries/territories for some or all of the years 1950-2009.

D. Relationships among Democracy, Education, and Income.   Using these data, I construct five-year and annual panels. Figure 3 takes the observation every fifth year and shows the relationships among *Democracy*, *Education*, and *Income*. To facilitate visual comparison, the original ranking (from －10 to 10) for *Democracy* is converted here to a scale from zero to one, where zero corresponds to the fewest rights (*Democracy*=－10) and one to the most rights (*Democracy*=10). *Education* and *Income* are also converted in the same way. The solid line in Figure 3 shows the time path of the unweighted averages of *Democracy* across countries for the years 1950, 1955, …, 2000. The dotted and dash lines show *Education* and *Income*, respectively. For *Democracy*, Figure 3 shows that the mean of the index peaked in 1950, fell to a low point in 1980, and then subsequently rose until 2000. Barro (1999) explains that the main reason for the decline in *Democracy* after 1960 is the deterioration in democracy in sub-Saharan Africa. He suggests that this pattern results from the fact that many of the African countries began with ostensibly democratic institutions when they became independent in the early 1960s, but that most had evolved into one-party dictatorships by the 1970s. On the other hand, both *Education* and *Income* exhibit different trends from that of *Democracy*. They have increased more or less steadily, although *INCOME* fell within a narrow range during times of economic downturns. Given that Figure 3 evidently shows a strong correlation between *Education* and *Income,* it seems to portend that education is a more important variable in predicting economic performance than political institutions.

IV. Democracy, Human Capital, and Growth (Fixed Effects Model)

Acemoglu *et al.* (2005, 2008) use fixed effects regression to investigate the relationship between income and democracy but find no causal effect of income on democracy. Nevertheless, Acemoglu *et al.* (2005, 2008) point out that this result does not imply that democracy has no effect on economic growth. They also use the study of Persson and Tabellini (2007) as an example to suggest that the impact of various time-varying effects

of democracy on growth should be important areas for future empirical research. Thus, this project goes in a reverse direction from their track to see whether democracy has an effect on economic performance or not. Based on their experiences, this project first uses fixed effects OLS to investigate the causal effects of democracy and education on income, respectively, and then uses a first-differenced regression based on the Solow model to discuss this issue.[9]

A. Democracy and Growth.   Consider the following pooled cross-sectional model which is exactly the same as the stylized textbook counterparts,

$$Income_{it} = \alpha\ Income_{it-1} + \gamma\ Democracy_{it-1} + \delta_i + \mu_t + \varepsilon_{it}, \qquad (1)$$

where $Income_{it}$ is the level of real GDP per capita for country i in period t. The lagged value of income on the right-hand side ($Income_{it-1}$) is included to capture persistence in income as well as the potentially mean-reverting dynamics. The latter reflects the tendency of the income to return to some equilibrium value for the country. The main variable of interest is $Democracy_{it-1}$, which denotes the Polity IV democratic score of a particular country. The parameter γ thus measures the impact of democracy on income. Equation (1) does not include any additional variables in the regression. There are certainly many other factors that may affect income. To control for these effects, a country-specific dummy denoted by δ_i is included in (1). Besides, a time-specific dummy denoted by μ_t is also included to capture common shocks to the income levels of all countries. Finally, ε_{it} is an error term which captures all other omitted factors, with $E(\varepsilon_{it}) = 0$.

B. Pooled OLS Results.   The extant literature (e.g., Barro 1996a,b and 1999) typically uses pooled OLS to examine the effects of democracy on income. Column (A) of Table 1 reports the results of the pooled OLS using the five-year panels for the period 1950-2005. To perform the five-year panels, the regression takes the observations every fifth year. As indicated by Acemoglu *et al.* (2008), this procedure is more satisfactory than trying to

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average the five-year data, since averaging might create spurious serial correlation, thereby making inference and estimation more difficult.[10] The regressions include one (five-year) lag for democracy, and one lag of log GDP per capita, but exclude country dummies δ_i and time dummies μ_t. As shown in Column (A), the variable of interest $Democracy_{it-1}$ is positive and significant, supporting the positive relationship between income and democracy.

However, as previously indicated, there is a potential risk of omitted variable bias, since some other omitted factors may determine both the nature of the political regime and the potential for economic growth.[11] In the long run, the omission of these variables will lead to spurious positive estimates of γ. For instance, one may argue that the significance of the effect of democracy on income is a consequence of the existence of some omitted factor (such as human capital) that has an impact on both income and democracy. These omitted factors that are correlated with democracy may account for economic growth, rendering our results spurious. In fact, in the real world, it is well known that countries that are able to maintain a higher level of democracy are also blessed with other advantages (e.g., high quality education, good culture, and a favorable geographical situation) to achieve a higher income.

C. Fixed Effects OLS. To measure all such country-specific factors affecting both income and democracy, the tentative strategy developed here is to include country fixed effects, or $\delta_i\text{'s}$. If these omitted country-specific variables are time-invariant, the inclusion of fixed effects will remove them and this source of bias. This means that factors that are constant across the time period of interest (1950-2005) will be eliminated by this research design. This can be explained by using a poignant contrast between the United States and Afghanistan. The United States is more democratic and richer, so a simple cross-country comparison that does not control for fixed country effects would suggest that a more democratic regime leads to higher income. However, on the other hand, using the fixed effects OLS to focus on the "within-country variation" can help to

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[10] The regression results are also checked with ten-year panels using the observations from every tenth year. The estimates in all cases are very similar.

[11] Another potential bias is reverse causality which means that income might influence democracy rather than the other way round. However, compared to omitted variable bias, the issue of endogeneity is easier and more convenient to handle by using instrumental variables estimation to estimate the impact of democracy on income. This issue will be discussed later.

identify whether or not Afghanistan is more likely to become richer as it becomes more democratic.[12] Theoretically, the fixed effects estimator is consistent even in the presence of a correlation between the error term and any of the explanatory variables. *In this sense, it is always safe to use the fixed effects estimator to estimate panel data models* (Hill *et al*., 2007, p. 404). Thus, the results obtained will suffer from omitted variable bias only if the 'changes' in income and the 'changes' in democracy are both driven by some other factors. To reduce this potential risk, the time dummy variable (μ_i) is also included in the regressions.

   Column (B) of Table 1 presents the regression results with fixed effects. It evidently shows that the relationship between income and democracy disappears once the fixed effects δ_i's and μ_i's are included. The estimated coefficient of $Democracy_{it-1}$ (0.33) becomes insignificant, indicating that democracy is not a major determinant of income. Column (C) presents an easier specification from which $Democracy_{it-1}$ is dropped. Again, the fixed effects OLS result shows no significant effects of democracy on income.

D. Arellano and Bond GMM Results. Column (D) considers an alternative estimation strategy to deal with the potential biases, which is to use a generalized method of moments (GMM) estimator proposed by Arellano and Bond (1991). Their approach is to time difference equation (1), to obtain

$$\Delta Income_{it} = \alpha\, \Delta Income_{it-1} + \gamma\, \Delta Democracy_{it-1} + \Delta \mu_t + \Delta \varepsilon_{it}, \qquad (2)$$

in which the fixed country effects are removed by time-differencing. Basically, this approach is an IV estimator based on the first-differenced data using all available instruments for all potential lags. Under the assumption of no serial correlation in the original residual ε_{it}, not only is $Income_{it-2}$ uncorrelated with $\Delta\varepsilon_{it}$, but all further lags of $Income_{it}$ are uncorrelated with $\Delta\varepsilon_{it}$, and can also be used as additional instruments for $\Delta Democracy_{it-1}$.[13] Thus, Column (D) uses the first-differenced GMM panel data estimator to estimate $\Delta Income_{it}$ and uses $\Delta Democracy_{it-1}$ as one of the regressors, in

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[12] See Acemoglu *et al.* (2008, p.810) for more details.
[13] When these conditions are fulfilled, the GMM estimator is then effectively unbiased and more efficient than the fixed effects OLS estimator.

which $\Delta Democracy_{it-1}$ is instrumented by using the second and the third lags of *Income*. (Note that the first lag still has a correlation with the residual.) It indicates that the estimated coefficient of $\Delta Democracy_{it-1}$ even turns out to be negative (-0.44, standard error = 5.27). The Hansen *J* test, reported in the third row from the bottom of Table 1, also indicates that the overidentifying restrictions implied by this GMM procedure are not rejected. Finally, Column (E) estimates equation (1) with the fixed effects OLS using annual observations. This complementary regression is useful since the fixed effects estimator is more consistent as the number of observations becomes large, although it might induce serial correlation. The evidence presented in Column (E) still shows no evidence of a significant positive effect of democracy on income.

E. Inclusion of Education.   The remaining columns of Table 1 investigate the relationship between democracy and income when human capital is included, that is, by estimating a model of the form

$$Income_{it} = \alpha \, Income_{it-1} + \gamma \, Democracy_{it-1} + \beta \, Education_{it-1} + \delta_i + \mu_t + \varepsilon_{it}. \quad (3)$$

Both Columns (F) and (G) show no evidence of a significant effect of democracy on income regardless of whether pooled OLS or fixed effects OLS is used. This implies that the effect of democracy on income is absorbed by education which seems to be more robust and deeper than political institutions as suggested by Lipset (1959, 1960) and Glaeser *et al.* (2004).

   Overall, the inclusion of fixed effects proxying for time-invariant country-specific characteristics or the inclusion of education proxying for a third, time-varying factor seems to entirely remove the effect of democracy on income. Such evidence sheds considerable doubt on the conventional wisdom that democracy has a strong causal effect on income.

F. Human Capital and Growth.   To provide more support for the previous argument, Table 2 presents the same growth regression evidence as in Table 1, except that the variable of interest has been changed from democracy to education.

$$Income_{it} = \alpha \, Income_{it-1} + \gamma \, Education_{it-1} + \delta_i + \mu_t + \varepsilon_{it}.$$

In contrast to the uniform insignificance of $Democracy_{t-1}$ in explaining income in Table 1, $Education_{it-1}$ is a strong predictor of subsequent income both in the case of the pooled OLS and fixed effects format. At a statistical level, the answer is clear: even though I include time-invariant country characteristics (fixed effects) that affect the level of income, there still exists a well-documented positive relationship between education and income over a relatively short horizon of 5 years. One interpretation of this result follows the argument "*From Education to Growth*". That is, human capital leads to higher growth by improving the ability of a country to develop, implement, and adopt new technologies and perhaps by providing more benign politics, less violence, and more political stability.

V. Democracy, Human Capital, and Growth (Solow Model)

The fixed effects result discussed in the previous model provides no evidence that democracy can predict growth, but there is some evidence that human capital is able to. This result regarding the relationship between democracy and income leaves us skeptical about causality between these two variables. However, as shown in Column (A) of Table 1, it is a stylized fact that there is a strong positive association between income and democracy. In order to dig deeper into these issues, this section will use an extended form of the Solow growth model to further investigate the relationships among these measures.

As discussed above, there are two shortcomings of the fixed effects estimation. First, it imposes a unique intercept for each country. Factors that are constant across the time period of interest, such as geography and culture, are eliminated by this estimation design. However, the estimation does nothing to control for factors that may vary over time. In other words, it would not help inference if there are time-varying omitted factors affecting both the dependent variable and explanatory variables. To solve this, I use an augmented Solow model to control for the impact of some time-varying determinants of growth such as physical capital investment, the convergence effect, and the evolution of human capital emphasized in this project. Second, the fixed effects format does not necessarily identify the causal effect of democracy (or education) on income, since the estimation of causal effects requires exogenous sources of variation. To address this issue, I use an instrumental variables (IV) regression to estimate the impact of democracy (or

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education) on growth.

A. Augmented Solow Model. The empirical specification is an augmented version of the Solow growth model in which human capital enters as a factor of production in symmetrical fashion with physical capital and raw labor. This model is developed by Mankiw *et al.* (1992) in whose study aggregate output in country i in year t (Y_{it}) is determined by a Cobb-Douglas production function:

$$Y_{it} = K_{it}^{\alpha} H_{it}^{\beta} (A_t L_{it})^{1-\alpha-\beta}. \tag{4}$$

Here, K_{it} denotes physical capital, H_{it} denotes human capital, L_{it} denotes the stock of labor, and A_t denotes the level of technology. This specification implies constant returns to all factors taken together, and hence diminishing returns to any combination of physical and human capital. Besides, L_{it} and A_t are assumed to grow at constant rates n_i and g, respectively, implying that the number of effective units of labor ($A_t L_{it}$) grows at the rate $n_i + g$. Besides, Mankiw *et al.* (1992) assume that both K_{it} and H_{it} depreciate at the rate δ. Thus, I assume that the technology growth rate $g = 0.02$ and the depreciation rate $\delta = 0.03$. I then impose $(n_i + g + \delta) = n_i + 0.05$ in the regression later on. Finally, if sk_{it} is the fraction of output invested in physical capital, and sh_{it} is the fraction invested in human capital, then the evolution of the steady state output per capita $Income_{it} = Y_{it}/L_{it}$ becomes:[14]

$$\ln(Income_{it}) = \ln A_0 + gt - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n_{it} + g + \delta) + \frac{\alpha}{1-\alpha-\beta}\ln sk_{it} + \frac{\beta}{1-\alpha-\beta}\ln sh_{it}.$$

Under this specification, the evolution of the economy is governed by $dK_{it}/dt = sk_{it}Y_{it} - \delta K_{it}$ as well as $dH_{it}/dt = sh_{it}Y_{it} - \delta H_{it}$. This makes the growth rate of income per capita $GROWTH_{it} = \ln Income_{it} - \ln Income_{it-1}$ as follows:

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[14] See Mankiw *et al.* (1992, pp. 416-417) for the details.

$$GROWTH_{it} = (1 - e^{-\lambda t})\frac{\alpha}{1 - \alpha - \beta}\ln sk_{it} + (1 - e^{-\lambda t})\frac{\beta}{1 - \alpha - \beta}\ln sh_{it}$$

$$- (1 - e^{-\lambda t})\frac{\alpha + \beta}{1 - \alpha - \beta}\ln(n_{it} + g + \delta) - (1 - e^{-\lambda t})\ln Income_{i0}$$

$$= \pi_1 \ln sk_{it} + \pi_2 \ln sh_{it} + \pi_3 \ln(n_{it} + g + \delta) + \pi_4 \ln Income_{i0} + \varepsilon_{it}, \quad (5)$$

in which π_i is the coefficient to be estimated, and ε_{it} is the error term. A negative estimated value for π_4 is evidence of convergence, matching up with the intuition that low per capita output economies grow more quickly than high per capita output ones do.[15]

Following the standard empirical approach, the first strategy is to use *Education*, which is the second level educational attainment (complete) of the total population, as the proxy variable for sh_{it} (Mankiw *et al.*, 1992; Barro, 1996a and 1999). I also use the investment ratio (I/GDP) as the proxy variable for sk_{it} (Mankiw *et al.* 1992). Second, I include other possible determinants of growth ($\mathbf{X}$) in equation (5) in a linear form (Barro 1996a; Levine and Renelt 1992). Third, the time difference of democracy ($\Delta Democracy_{it}$, changes in Polity measures) is included as a variable of interest (Acemoglu *et al.* 2005, 2008). Finally, by letting $GROWTH_{it} = \ln Income_{it} - \ln Income_{it-1}$ in the panel data analysis, the time-invariant country-specific characteristics are removed by time-differencing:

$$GROWTH_{it} = \pi_1 \ln(\frac{I}{GDP})_{it} + \pi_2 \ln Education_{it} + \pi_3 \ln(n_{it} + g + \delta)$$

$$+ \pi_4 \ln Income_{i0} + \pi_5 \Delta Democracy_{it} + \mathbf{X'\Pi} + \delta_i + \mu_t + \upsilon_{it}. \quad (6)$$

Under this specification, my main variables of interest are $\Delta Democracy_{it}$ and $Education_{it}$. The former variable ($\Delta Democracy_{it}$) can help investigate: (1) if both "changes" in income and "changes" in democracy are caused by a third, time-varying

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[15] This is because the former ones could benefit from the technology spillovers from the latter ones while enjoying the advantage of backwardness.

factor (Please refer to Figure 2); and (2) if the correct growth model is the one with fixed growth effects rather than fixed level effects.[16] The latter variable ($Education_{it}$) enters as a level variable under the augmented Solow model.[17]

B. Other Possible Determinants of GROWTH (**X**).   Although the fixed effect format can deal with the problem of invariant controls, it does nothing to control for factors that vary over time. To strengthen the robustness of the results, several time-varying determinants of *GROWTH* are included so as to control these effects. These controls are regularly used in the literature and include: $Inflation_{it}$, understood as the annual percentage change in the GDP deflator (in natural logarithms) (Source: PWT 6.3); $Government\ share_{it}$, understood as the government share of real GDP per capita (Source: PWT 6.3); $Trade\ Openness_{it}$, understood as imports and exports as a share of GDP (Source: PWT 6.3). Besides, two time-invariant variables are also included to control for country characteristics: $Ethnolinguistic_i$, understood as the probability that two randomly selected individuals from a country are from different ethnolinguistic groups (Source: LLSV, 1999); $English_i$, understood as the Common law countries that were part of the British Empire (Source: LLSV, 1999). These variables are introduced seriatim so as to test their individual effects on *GROWTH*.

C. Instrumental Variables Estimation. The literature emphasizes that growth may itself lead to a more democratic regime (or a better education). In order to avoid the potential endogeneity bias,[18] I thus use the IV estimation to extract the exogenous sources of the variations in democracy and education. I select instruments from two sources of variables that determine a country's political institutions.

The first one concerns the geographical characteristics of each country based on the following two reasons.[19] (1) The empirical growth literature argues that geographical conditions lead to long-lasting differences in political institutions and human capital (Barro, 1996a and 1999; Hall and Jones, 1999; Engerman and Sokoloff, 1997; Maddison, 2001; Acemoglu *et al.*, 2001 and 2002). Thus, my IVs should be highly correlated with

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[16] See Acemoglu *et al.* (2008, pp.827-831) for the details.

[17] The causal link between changes in education and changes in income will be discussed later in the robustness analysis.

[18] However, I do not believe that it will pose a serious problem, since it is unlikely that a country's growth rate in time *t* would have any effect whatsoever on its democracy measure at *t-1*.

[19] According to Sachs and Warner (1995a,b, 1997), the environment, such as latitude, shapes economic development directly by influencing the inputs in the production function and the production function itself.

democracy and education. (2) A country's geographical characteristics are not affected by its income, education, political institutions and other factors that influence income. Thus, these IVs are uncorrelated with the error term in equation (6). This means that they are orthogonal to any other omitted characteristics and not correlated with *GROWTH* through any other channel than their effect via democracy and education. In fact, it is difficult to think of reasons why a country's geographical characteristics could have important effects on its income except through their impact on institutional and human capital development.[20] Based on this, there are two promising potential instruments. The first instrument is the absolute value of latitude (distance from the equator, denoted by *Latitude* hereafter). The data are obtained from LLSV (1999). The second geography-based instrumental variable is the "natural trade openness" (denoted by *Natural Openness* hereafter) constructed by Frankel and Romer (1999). They argue that countries' geographical characteristics have important effects on growth and trade, and are plausibly uncorrelated with other determinants of income or institutions. They thus construct a predicted trade share by using a gravity equation to regress bilateral exchanges on countries' sizes, their distances from one another, whether they share a border, and whether they are landlocked, as well as other geographical variables.

The second source of the IVs is a set of earlier values of the variables. Following Barro (1996b, pp. 4-5) I use $Income_{it-1}$ (the five-year earlier value of $Income_{it}$; e.g., for 1960 in the 1965 equation), $Education_{it-1}$ and $Democracy_{it-1}$ as the IVs. Barro indicates that this method of estimation is quite accurate since the residuals from the growth rate equations for the various periods exhibit little correlation.

D. Results. Based on equation (6) and using five-year time intervals between 1950 and 2000, Table 3 performs instrumental variables/fixed effects estimation to investigate the effects of education and democracy on economic growth. The estimation weights countries equally, but allows for different error variances in each period and for correlation among these errors over time. As instruments, the regression estimation uses $Latitude_i$, $Natural\ Openness_i$, $Income_{it-1}$, $Democracy_{it-1}$, $Education_{it-1}$ to instrument for

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[20] For instance, based on Engerman and Sokoloff (1997), both Acemoglu *et al.* (2002) and Easterly and Levine (2003) claim that the geographical characteristics' main impact on economic growth runs through long-lasting institutions. They further indicate that environments in which crops are most effectively produced using large plantations can quickly develop political institutions that protect the few landholders from the many peasants and can even create a slavery system. Based on their findings, I can thus safely claim that these IVs are uncorrelated with the residuals in equation (6).

$\Delta Democracy_{it}$ and $Education_{it}$. Columns (A) and (B) report the results for a simpler specification of equation (6) in which the other possible determinants of growth ($\mathbf{X}$) are dropped. The evidence suggests that human capital is a more important variable predicting economic growth than political institutions. In Column (A), $\Delta Democracy$ is insignificant either with or without controlling for $Education$. Conversely, in Column (B), the estimated coefficient of $Education$, 0.90, is significant in explaining economic growth. For a 10-point increase in $Education$, $GROWTH$ increases by 2.07 percentage points, implying that the effect of an educational improvement on growth is strong and goes beyond that of democratization.

To consider a concrete example of the implications of this evidence, take the case of India, which has mean values of $Education$=33% and $GROWTH$=2.81% over the sample period. If India were to improve its education system, $Education$ would increase from the level at the 80th percentile to the one at the 90th percentile of the distribution ($Education$=41%), which is equivalent to the level for China. The results of Column (B) suggest that the maximum increase in $GROWTH$ that would result is 1.87 percentage points. In other words, an 8 percentage point increase in $Education$ could increase the growth rate from 2.81% to 4.68%, which would explain roughly 60% of the differences in growth rates between these two countries. To further strengthen this finding, Columns (C) - (G) report the regression results when a set of control variables are entered one at a time in the regressions. The results obtained still exhibit the same pattern as those of the baseline specification in Columns (A) and (B). In all cases, except for Column (F) in which $Ethnolinguistic$ is controlled, the effect of democracy on growth is insignificant, suggesting that the form of political institutions has a very limited effect on changing economic performance.

In brief, the IV regressions with fixed effects still show no evidence of a causal effect of democracy on growth. On the other hand, high human capital indeed accelerates economic growth, even though I include other time-varying (e.g., $Inflation_{it}$, $Trade$ $Openness_{it}$, and $Government\ share_{it}$) or time-invariant (e.g., $Ethnolinguistic_i$ and $English_i$) covariates that affect $GROWTH$. This finding indicates that, although income and democracy are positively correlated, there is no evidence of a causal effect from democracy to growth. Thus, in Column (A) of Table 1, the omitted factor (most probably human capital) may have shaped different political and economic development paths

across countries, leading to the positive relationship between income and democracy.

E. Robustness.   The fact that the previous investigation has been based exclusively on the use of the Polity score and the secondary schooling enrollment rate as the proxies for democracy and education may stand in the way of it becoming truly persuasive. Table 4 addresses this concern by investigating the way in which the regression results are affected if alternative proxy variables for the political system and human capital are used.

  Firstly, I use the Freedom House political rights index (denoted by *Democracy Freedom*) as an alternative measure of democracy. It is a subjective ranking made directly by local observers in each country to measure the degree of executive constraints. A country is given the highest score if its political rights come closest to the ideals suggested by a checklist of questions (e.g., whether or not there are free and fair elections, whether or not there are competitive parties or other competitive political groupings, and whether or not the opposition plays an important role). Operationally, the level of political rights is applied on a subjective basis to classify countries annually on a scale from one (the highest degree) to seven (the lowest). Following Barro (1996b), I convert the original ranking from one to seven to a scale from zero to one, where zero corresponds to the fewest political rights and one to the most political rights. Thus, they lie between zero and one, with one corresponding to the most democratic set of institutions. Besides, since the Freedom House data begin in 1972, I assign the 1972 score to 1970 for the purpose of the five-year regressions.

  Secondly, I use the average years of schooling in the total population aged 25 and above (*Education Year*, Source: Barro and Lee, 2000) as the proxy for human capital rather than the secondary schooling. The data are available in five-year intervals between 1950 and 2000.

  Finally, the regression results reported in Table 4 still exhibit the same pattern as those of Table 3. Besides, the estimated coefficients of *Education Year* are still positive and become even more statistically significant than before, implying that human capital is more critical in determining economic growth than political institutions.

F. From Education to Democracy.   Lipset (1959, 1960) indicates that an improvement in education can promote economic growth through strengthening the political institutions of a country. His argument has also received considerable support in the study of Glaeser *et al.* (2004). They emphasize that the positive externality of education is not

only technological but also political. This political externality, in turn, brings about better protection of property rights and more rapid economic growth. Table 5 replicates the study of Glaeser *et al.* (2004) on the causal relationship between democracy and education. The only difference from their specification is that I use a different set of exogenous controls. Basically, this approach looks at timing. If the causality runs from democracy to education, then lagged values of democracy should predict improvements in education. On the other hand, if education comes first, then the lagged values of education should predict an improvement in the outcome of democracy. Based on this, Table 5 reports the regression (using five-year intervals) results of the following models:

$$\Delta Education_{it} = \xi_0 + \xi_1 \, Education_{it-1} + \xi_2 \, Democracy_{it-1} + \ln Income_{it-1} + \mathbf{Z'}\zeta_1 + \delta_{1i} + \mu_{1t} + \tau_{1it} \quad (7)$$

$$\Delta Democracy_{it} = \xi_0 + \xi_1 \, Democracy_{it-1} + \xi_2 \, Education_{it-1} + \ln Income_{it-1} + \mathbf{Z'}\zeta_2 + \delta_{2i} + \mu_{2t} + \tau_{2it} \quad (8),$$

in which $\mathbf{Z'}$ includes all the IVs and exogenous controls used in equation (6).[21] In Table 5, Columns (A) and (B) of Panel (A) report the results of the regression on equation (7). The evidence shows some mean reversion in *Education* (perhaps due to measurement error). However, there is no effect of the initial level of *Democracy* on the growth of human capital regardless of whether $\mathbf{Z}$ is included or not.

Panel (B) looks at the changes in *Democracy* over five-year intervals as depicted by equation (8). The results evidently show that the initial level of *Education* is a strong predictor of improvements in institutional outcomes over the next five years.[22] Democracy is seen as the consequence of increased education, and not as its cause. Such evidence is consistent with the view of Glaeser *et al.* (2004) that high human capital leads to an improvement in democracy.

While it seems to be that education is exogenous, the specification must also satisfy the exclusion restriction: *Education* should affect *GROWTH* only through *Democracy*. However, in differentiating from Glaeser *et al.* (2004), this project emphasizes that the political system is not the main mediating channel through which education or human capital has an effect on economic growth. Other than the political regime, the effects of

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[21] $\mathbf{Z}$ includes *Latitude$_i$*, *Natural Openness$_i$*, *Income$_{it-1}$*, *Inflation$_{it-1}$*, *Government share$_{it-1}$*, *Trade Openness$_{it-1}$*, *Ethnolinguistic$_i$*, and *English$_i$*.
[22] As the result in panel (A), there is a lot of mean reversion in these measures of institutions. This is about the same as the findings of Glaeser *et al.* (2004).

human capital on growth work through many other channels such as labor productivity, social networks, and the philosophy of religion, etc. At this point, poor countries with a high initial endowment of human capital can easily get out of poverty through good policies, even if these polices were initiated by dictators. This finding seems to accord well with the experiences of China, South Korea and Taiwan, which grew rapidly under one-party dictatorships.

To support my hypothesis, Table 6 uses a test of the overidentifying restrictions (OIR) to investigate the following question: Does education explain economic growth through any other channels besides a political democracy? The null hypothesis of the OIR test is that democracy is the main channel through which education can influence growth. In terms of the framework given by the following equation, this would amount to implying that education is orthogonal to any other omitted characteristics and is not correlated with economic growth through any channels other than their effect via the political channel. If this null hypothesis is not rejected, then the effect of education on growth must be mediated through the democracy channel. It is impossible for autocratic countries to improve their economic performances even if they do provide a good educational system.

$$
\begin{aligned}
GROWTH_{it} = {} & \pi_1 \ln(\frac{I}{GDP})_{it} + \pi_2 \ln(n_{it} + g + \delta) \\
& + \pi_3 \ln Income_{i0} + \pi_4 \Delta Democracy_{it} + \mathbf{X'\Pi} + \delta_i + \mu_t + \upsilon_{it}.
\end{aligned}
\tag{9}
$$

Basically, equation (9) is a modified version of equation (6), in which $\Delta Democracy_{it}$ is instrumented by $Education_{it-1}$ and $Democracy_{it-1}$. Thus, education becomes an excluded exogenous variable. Under this specification, if democracy is the main channel through which education can influence growth, then $Education_{it-1}$ should be valid and not correlated with the error term in equation (9). This specification produces a Lagrange multiplier test statistic that under the null hypothesis is distributed as chi-squared (m), where m is the number of OIRs.[23] The rejection of the OIR test is a rejection of the hypothesis that education can only explain economic growth through the political regime.

The results presented in Table 6 are summarized by two main points. First, even

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[23] The number of OIRs equals the number of excluded exogenous variables ($Education_{it-1}$ and $Democracy_{it-1}$) minus the number of endogenous variables ($\Delta Democracy_{it}$).

though education is used as the IV for democracy, there is still no evidence for a causal effect of democracy on income. Second, the third row from the bottom of Table 6 reports the results of the OIR test based on the specifications of (9). With no controls, Column (A) indicates that the OIR test rejects the null hypothesis that the education is valid and consistent at the 5% level. Therefore, education explains growth beyond its ability to explain cross-country differences in democracy. Columns (B) – (F) indicate that adding exogenous controls does not affect the main finding. A politically constrained government is not the only viable strategy to enhance growth. Growth may be achieved by better education without a substantial improvement in political institutions.

VI. Conclusion

Cross country data exhibit a strong and positive correlation between democracy and income. Some of the relevant literature thus argues that a high level of democracy is a prerequisite for economic growth. The results obtained in this project document that this proposition is not robust when I control for fixed effects and look into the within-country variation over time. The conclusion of a lack of a relationship between democracy and income is highly robust to different econometric techniques, to estimation in various different samples, and to the inclusion of different sets of covariates. However, if democracy does not cause growth, then what does? Other than time-invariant country characteristics such as geography, culture, and ethnicity, the empirical evidence suggests a time-varying factor – education. Not only is education a more important variable in predicting economic growth than political institutions, but the outcome of a democratic or autocratic regime is also to some extent determined by education.

Nevertheless, none of the above is intended to lead to the claim that political institutions do not matter. This is because this project has merely exploited the five-yearly variation in the postwar era (1950-2000). Nevertheless, it is likely that changes in political institutions have very long-run effects (e.g., over 50 or 100 years) that do not manifest themselves in the shorter time frame as far as I have examined. I do not wish to push these results too far. This project can only lead me to express some skepticism about the viability of democracy in countries with low levels of human capital.

In my mind, an interesting interpretation should be that along the lines of Lipset (1959,

1960) and Barro (1999), namely, those democracies that arise without proper human capital do not tend to last. The exporting of democratic institutions from the advanced western countries to developing nations is not necessarily good for economic growth in the LDCs. This conclusion sends two messages. The first one is that more democracy is not the key to economic growth if the country is not willing to invest in education. The second message is that democracy survives only if it can get in line with a country's human capital development. Therefore, my result is consistent with Barro's conclusion that the advanced western countries would contribute more to the welfare of poor nations by exporting their education systems rather than their political systems.

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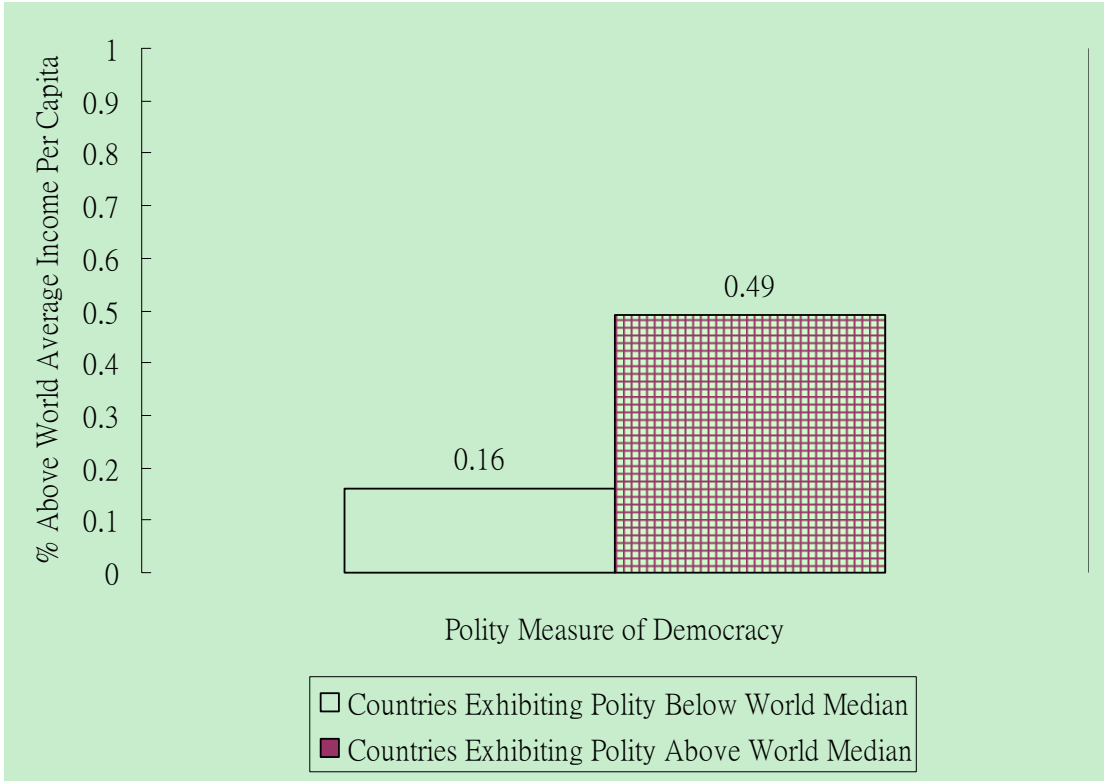
Figure 1:   Democracy and Income (Across-Country Variation)
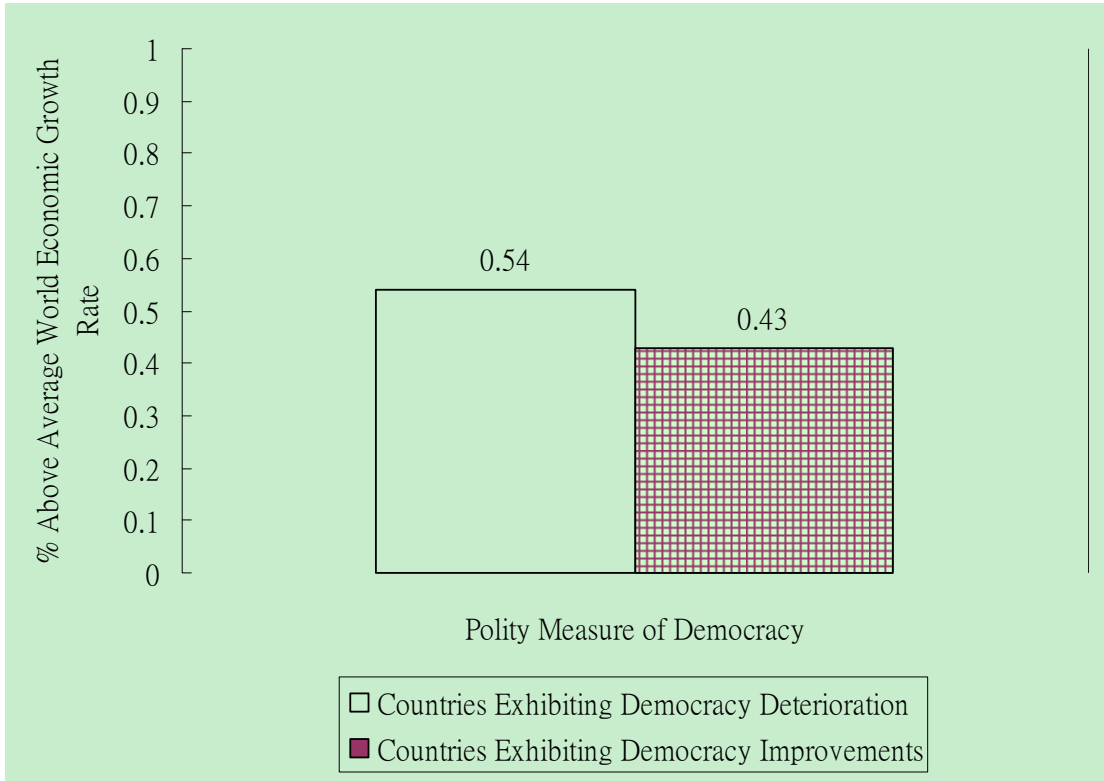
Figure 2:   Democracy and Income (Within-Country Variation)
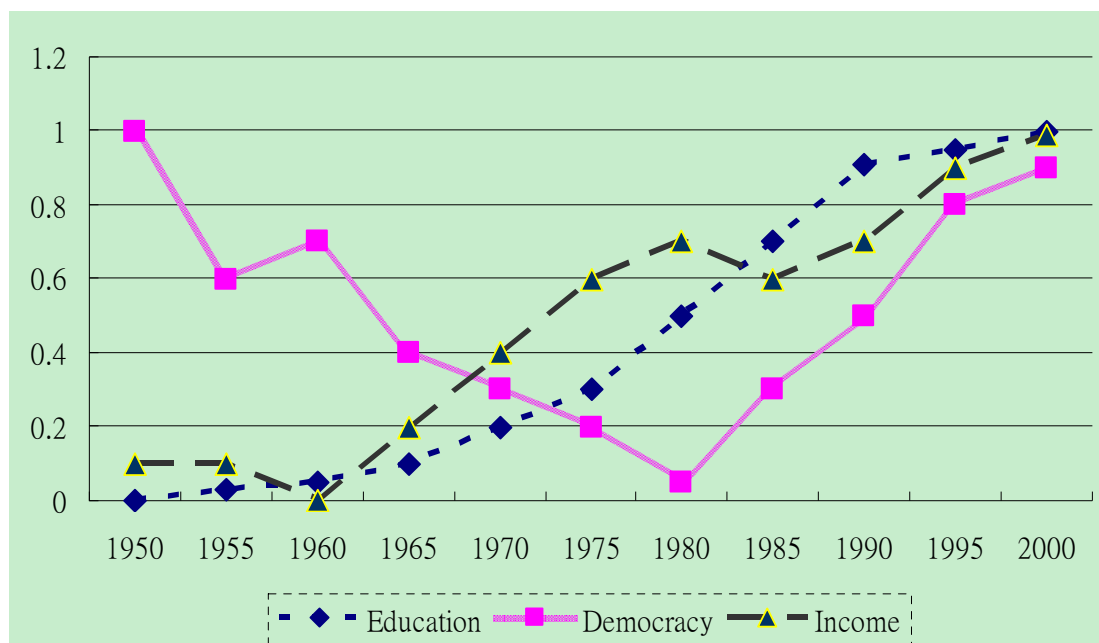
Figure 3:   Democracy, Education and Income

Notes. To facilitate visual comparison, the original ranking (from −10 to 10) of *Democracy* is converted here to a scale from zero to one, where zero corresponds to the fewest rights (−10) and one to the most rights (10). *Education* and *Income* are also converted in the same way. The solid line in Figure 3 shows the time path of the unweighted averages of *Democracy* across countries for the years 1950, 1955, …, 2000. The dotted and dash lines show *Education* and *Income*, respectively.

Table 1: Fixed Effects Results Using *Democracy* as the Variable of Interest

(Dependent Variable: *Income*$_{it}$)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Period	1950-2005					1950-2000	
Time Interval	5-year	5-year	5-year	5-year	Annual	5-year	5-year
Method	Pooled OLS	Fixed Effects OLS		Arellano-Bond GMM	Fixed Effects OLS	Pooled OLS	Fixed Effects OLS
Democracy$_{i\,t-1}$	4.27*** (1.59)	0.33 (1.84)	8.89 (8.30)	−0.44 (5.27)	−0.19 (0.91)	4.97 (8.10)	−1.56 (8.84)
Income$_{i\,t-1}$	1.01*** (0.00)	0.99*** (0.01)		0.76*** (0.08)	0.96*** (0.00)	0.83*** (0.02)	0.84*** (0.02)
Education$_{i\,t-1}$						74.68*** (10.76)	66.65*** (12.46)
Hansen *J* test [P-value]				15.10 [0.24]			
R^2	0.99	0.99	0.91		0.99	0.92	0.93
Observations	1252	1252	1281	1231	6442	775	775

Notes: Columns (B), (C), (E), and (G) are estimated by the fixed effects model with both time- and country-specific effects. Column (D) uses the first-differenced GMM panel data estimator to estimate $\Delta Income_{it}$ and uses $\Delta Democracy_{it-1}$ as one of the regressors, in which $\Delta Democracy_{it-1}$ is instrumented by using the second and the third lags of *Income*. The fixed effects OLS specification includes a constant and fixed effects, but I do not report the estimates in the table. Standard errors are in parentheses. *** indicates that the estimates are significant at the 1% level, ** at the 5% level, and * at the 10% level. The estimation weights countries equally, but allows for different error variances in each period and for correlation among these errors over time.

Table 2: Fixed Effects Results Using *Education* as the Variable of Interest

(Dependent Variable: *Income$_{it}$*)

	(A)	(B)	(C)	(D)
Period	1950-2000			
Time Interval	5-year	5-year	5-year	5-year
Method	Pooled OLS	Fixed Effects OLS		Arellano-Bond GMM
Education$_{i\,t\text{-}1}$	75.24*** (9.62)	73.47*** (10.98)	306.26*** (18.86)	235.81*** (1.56)
Income$_{i\,t\text{-}1}$	0.83*** (0.02)	0.81*** (0.02)		0.41*** (0.02)
Hansen *J* test [P-value]				12.18 [0.99]
R^2	0.92	0.93	0.70	
Observations	884	884	912	720

Notes: Columns (B) and (C) are estimated by the fixed effects model with both time- and country-specific effects. Column (D) uses the first-differenced GMM panel data estimator to estimate $\Delta Income_{it}$ and uses $\Delta Democracy_{it-1}$ as one of the regressors, in which $\Delta Democracy_{it-1}$ is instrumented by using the second and the third lags of *Income*. The fixed effects OLS specification includes a constant and fixed effects, but I do not report the estimates in the table. Standard errors are in parentheses. *** indicates that the estimates are significant at the 1% level, ** at the 5% level, and * at the 10% level. The estimation weights countries equally, but allows for different error variances in each period and for correlation among these errors over time.

Table 3: IV Estimation Results Using Polity Measure of Democracy and Secondary Schooling

(1950-2000; Dependent Variable: *GROWTH*)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
$\ln (n_{it} + g + \delta)$	-14.69^{***} (4.04)	-10.91^{*} (5.69)	-3.67 (6.02)	-10.34^{*} (5.75)	-11.87^{**} (5.75)	0.87 (5.92)	-10.74^{*} (5.74)
$\ln I/GDP$	1.69^{***} (0.45)	1.69^{***} (0.68)	2.20^{***} (0.72)	1.65^{**} (0.68)	1.54^{**} (0.69)	1.60^{**} (0.67)	1.70^{***} (0.68)
$\ln Income_{i0}$	-1.02^{***} (0.33)	-1.66^{***} (0.64)	-1.46^{**} (0.66)	-1.68^{***} (0.64)	-1.65^{***} (0.64)	-2.03^{***} (0.67)	-1.69^{***} (0.66)
$\ln Education_{it}$		0.90^{**} (0.46)	0.83^{*} (0.48)	0.94^{**} (0.46)	0.85^{*} (0.46)	0.94^{**} (0.44)	0.92^{**} (0.45)
$\Delta Democracy_{it}$	0.02 (0.02)	0.04 (0.03)	0.03 (0.03)	0.04 (0.03)	0.04 (0.03)	0.05^{*} (0.03)	0.04 (0.03)
$Inflation_{it}$			-0.85 (0.92)				
$Government\ share_{it}$				-0.03 (0.05)			
$Trade\ Openness_{it}$					0.01 (0.01)		
$Ethnolinguistic_{i}$						-4.08^{***} (1.60)	
$English_{i}$							-0.17 (0.81)
R^2	0.21	0.25	0.23	0.25	0.25	0.26	0.25
Observations	882	631	589	631	631	607	631

Notes. The regressions are estimated by using instrumental/fixed effects estimation to investigate the effects of democracy and education on economic growth. The specifications include a constant and fixed effects, but I do not report the estimates in the table. The figures in parentheses are standard errors. *** indicates that the estimates are significant at the 1% level, ** at the 5% level, and * at the 10% level. The estimation weights countries equally, but allows for different error variances in each period and for correlation among these errors over time. The regression estimation uses *Latitude_i, Natural Openness_i, Income_{it-1}, Democracy_{it-1}*, and *Education_{it-1}* to instrument for *Democracy_{it}* and *Education_{it}*.

Table 4: IV Estimation Results Using Freedom House Measure of Democracy and Average Years of Schooling:

Robustness Checks

(1972-2000; Dependent Variable: *GROWTH*)

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
$\ln(n_{it} + g + \delta)$	-13.05^{***} (4.57)	-5.54 (6.75)	2.00 (6.99)	-4.89 (6.79)	-7.62 (6.86)	5.52 (7.22)	-5.81 (6.81)
$\ln(I/GDP)_{it}$	1.61^{***} (0.54)	0.71 (0.83)	0.69 (0.89)	0.69 (0.83)	0.44 (0.85)	0.76 (0.84)	0.69 (0.84)
$\ln Income_{i0}$	-0.92^{**} (0.39)	-2.65^{***} (0.76)	-2.81^{***} (0.78)	-2.78^{***} (0.77)	-2.69^{***} (0.76)	-2.90^{***} (0.80)	-2.61^{***} (0.77)
$\ln(Education\ Year_{it})$		3.45^{***} (0.79)	3.82^{***} (0.83)	3.56^{***} (0.80)	3.31^{***} (0.79)	2.72^{***} (0.78)	3.43^{***} (0.79)
$Democracy\ Freedom_{it}$	-0.37 (0.89)	-0.88 (1.06)	-0.80 (1.08)	-0.81 (1.07)	-0.96 (1.06)	-0.72 (1.01)	-0.86 (1.07)
$Inflation_{it}$			0.53 (1.05)				
$Government\ share_{it}$				-0.05 (0.06)			
$Trade\ Openness_{it}$					0.02^{*} (0.01)		
$Ethnolinguistic_i$						-4.27^{**} (1.92)	
$English_i$							0.31 (0.97)
R^2	0.22	0.29	0.29	0.29	0.29	0.28	0.29
Observations	634	480	453	480	480	460	480

Notes. The regressions are estimated by using instrumental/fixed effects estimation to investigate the effects of democracy and education on economic growth. The specifications include a constant and fixed effects, but I do not report the estimates in the table. The figures in parentheses are standard errors. *** indicates that the estimates are significant at the 1% level, ** at the 5% level, and * at the 10% level. The estimation weights countries equally, but allows for different error variances in each period and for correlation among these errors over time. The regression estimation uses $Latitude_i$, $Natural\ Openness_i$, $Income_{it-1}$, $Democracy\ Freedom_{it-1}$, and $Education\ Year_{it-1}$ to instrument for $Democracy\ Freedom_{it}$ and $Education\ Year_{it}$.

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Table 5: Causal Relationship between Education and Democracy

(1950-2000)

Panel A: Dependent Variable is the 5-year change in $\Delta Education_{it}$		
	(A)	(B)
$Education_{it\text{-}1}$	-0.12^{***} (0.02)	-0.14^{***} (0.03)
$Democracy_{it\text{-}1}$	0.004 (0.013)	0.01 (0.01)
Log $Income_{it\text{-}1}$	1.42^{***} (0.31)	0.44 (0.44)
Exogenous Controls ($\mathbf{Z}$): F Test [P-value]		2.66^{***} [0.00]
R^2	0.18	0.20
Observations	736	626
Panel B: Dependent Variable is the 5-year change in $\Delta Democracy_{it}$		
	(A)	(B)
$Democracy_{it\text{-}1}$	-0.95^{***} (0.04)	-0.99^{***} (0.04)
$Education_{it\text{-}1}$	0.21^{***} (0.06)	0.12^{*} (0.07)
Log $Income_{it\text{-}1}$	2.14^{***} (0.86)	4.25^{***} (1.27)
Exogenous Controls ($\mathbf{Z}$): F Test [P-value]		1.08 [0.37]
R^2	0.46	0.48
Observations	787	665

Notes. The regressions are estimated by the fixed effects model with both time- and country-specific effects. The specifications include a constant and fixed effects, but I do not report the estimates in the table. The figures in parentheses are standard errors. *** indicates that the estimates are significant at the 1% level, ** at the 5% level, and * at the 10% level. The estimation weights countries equally, but allows for different error variances in each period and for correlation among these errors over time. The Exogenous Controls include $Latitude_i$, $Natural$ $Openness_i$, $Income_{it\text{-}1}$, $Inflation_{it\text{-}1}$, $Government$ $share_{it\text{-}1}$, $Trade$ $Openness_{it\text{-}1}$, $Ethnolinguistic_i$, and $English_i$.

Table 6: IV Estimation Results Using Education and Earlier Values of Polity Measures as Instruments

(1950-2000)

(Dependent Variable: *GROWTH*)

	(A)	(B)	(C)	(D)	(E)	(F)
$\ln(n_{it} + g + \delta)$	-7.50 (5.14)	-0.27 (5.50)	-7.18 (5.17)	-8.15 (5.19)	5.43 (5.45)	-7.51 (5.17)
$\ln I/GDP$	2.10^{***} (0.58)	2.33^{***} (0.62)	2.05^{***} (0.59)	1.95^{***} (0.60)	2.22^{***} (0.61)	2.10^{***} (0.59)
$\ln Income_{i0}$	-1.16^{**} (0.50)	-0.73 (0.53)	-1.16^{**} (0.50)	-1.16^{**} (0.50)	-1.47^{***} (0.52)	-1.15^{**} (0.51)
$\Delta Democracy_{it}$	0.01 (0.03)	0.004 (0.03)	0.01 (0.03)	0.01 (0.03)	0.01 (0.03)	0.01 (0.03)
$Inflation_{it}$		-0.98 (0.89)				
$Government\ share_{it}$			-0.03 (0.05)			
$Trade\ Openness_{it}$				0.01 (0.01)		
$Ethnolinguistic_{it}$					-4.15^{***} (1.46)	
$English_{it}$						0.03 (0.75)
OIR test [P-value]	4.38^{**} [0.04]	4.03^{*} [0.05]	4.53^{**} [0.03]	4.23^{**} [0.04]	4.32^{**} [0.04]	4.36^{**} [0.04]
R^2	0.25	0.22	0.25	0.25	0.27	0.25
Observations	693	641	693	693	662	693

Notes. The regressions are estimated by using instrumental/fixed effects estimation to investigate the effects of democracy on economic growth. $\Delta Democracy_{it}$ is instrumented by $Education_{it\text{-}1}$ and $Democracy_{it\text{-}1}$. The OIR test has one degree of freedom: two excluded exogenous variables ($Education_{it\text{-}1}$ and $Democracy_{it\text{-}1}$,) minus one endogenous regressor ($\Delta Democracy_{it}$). The specifications include a constant and fixed effects but I do not report the estimates in the table. The figures in parentheses are standard errors. *** indicates that the estimates are significant at the 1% level, ** at the 5% level, and * at the 10% level. The estimation weights countries equally, but allows for different error variances in each period and for correlation among these errors over time.

Appendix 1: Variable Definitions

Variable	Definition
	Measures of Institutions
Democracy	The composite Polity index, which is adapted from the Polity IV dataset over the period 1950-2005 (Source: Marshall and Jaggers, 2010). It is the difference between the democracy and autocracy indices. Data posted on http://www.systemicpeace.org/polity/polity4.htm
Democracy Freedom	Freedom House political rights index. It is a subjective ranking made directly by local observers in each country to measure the degree of executive constraints. Source: Freedom House; Data posted on http://www.freedomhouse.org/template.cfm?page=439
	Democracy Freedom
	Measures of Education
Education	The second level educational attainment (complete) of the total population aged over 25. The data are obtained from Barro and Lee (2000).
Education Year	Years of schooling of the total population aged over 25. This variable is constructed as the average from 1950 through 2000. Source: Barro and Lee (2000); Data posted on http://www.cid.harvard.edu/ciddata/ciddata.html
	Solow Variables
Income	Gross domestic product over population. Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
GROWTH	Growth rate of per capita income. Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
$n_{it} + g + \delta$	n_{it} denotes the growth rate of population; g denotes the constant exogenous technological progress rate; δ denotes the depreciation rate for both human and physical capital. Assume that the technology growth rate $g = 0.02$ and the depreciation rate $\delta = 0.03$. Thus, this project imposes $(n_i + g + \delta) = n_i + 0.05$ in all of the regressions. Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
I/GDP	Investment Share of Real GDP per capita. Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
$Income_{i0}$	Initial Income is the GDP per capita in 1950. Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
	Instrumental Variables (Geographical Factors)
Latitude	The absolute value of latitude, which is the distance from the equator. Source: LLSV (1999).
Natural Openness	The "natural trade openness" which is constructed by Frankel and Romer (1999).
	Other Controls
Inflation	Annual percentage change in the GDP deflator (natural logarithm). Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
Government share	government share of real GDP per capita. Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
Trade Openness	Imports and exports as a share of GDP. Source: PWT; Data posted on http://pwt.econ.upenn.edu/php_site/pwt_index.php
Ethnolinguistic	The probability that two randomly selected individuals from a country are from different ethnolinguistic groups. Source: LLSV (1999).
English	The Common law countries that were part of the British Empire. Source: LLSV (1999).

國科會補助計畫衍生研發成果推廣資料表

國科會補助計畫	計畫名稱: 民主、教育與經濟成長	
	計畫主持人: 馬泰成	
	計畫編號: 101-2410-H-034-008-	學門領域: 經濟發展、技術變動與成長

無研發成果推廣資料

101 年度專題研究計畫研究成果彙整表

計畫主持人：馬泰成　　　　計畫編號：101-2410-H-034-008-

計畫名稱：民主、教育與經濟成長

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計畫主持人：馬泰成　　　　計畫編號：101-2410-H-034-008-

計畫名稱：民主、教育與經濟成長

	其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等,請以文字敘述填列。)	跨國資料顯示:各國民主化程度與其所得間呈現高度之正相關現象。但是,本研究結果發現:雖然在簡單的迴歸模型中,民主化程度會影響經濟成長。但是,一旦控制了不同國家的固定效果特性與組內變異時,政治民主化對經濟成長之影響會立即消失。而且此一推論不會因計量方法、樣本與控制變數之不同而有所改變。但是,如果政治制度不能影響經濟成長,到底何種因素能影響成長?本研究計畫結論認為除了文化、族群與國家地理環境外,最重要的因素還是教育。教育不但較政治更能影響成長,在某種程度上還能對政治民主化產生影響。希望此一結果能提供政府擬定教育政策之參考。

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與(閱聽)人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估 ■達成目標 □未達成目標（請說明，以 100 字為限） 　　　□實驗失敗 　　　□因故實驗中斷 　　　□其他原因 　說明：
2. 研究成果在學術期刊發表或申請專利等情形： 論文：□已發表 ■未發表之文稿 □撰寫中 □無 專利：□已獲得 □申請中 ■無 技轉：□已技轉 □洽談中 ■無 其他：（以 100 字為限） 本研究正投稿中。
3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限） 跨國資料顯示：各國民主化程度與其所得間呈現高度之正相關現象。但是，本研究結果發現：雖然在簡單的迴歸模型中，民主化程度會影響經濟成長。但是，一旦控制了不同國家的固定效果特性與組內變異時，政治民主化對經濟成長之影響會立即消失。而且此一推論不會因計量方法、樣本與控制變數之不同而有所改變。但是，如果政治制度不能影響經濟成長，到底何種因素能影響成長？本研究計畫結論認為除了文化、族群與國家地理環境外，最重要的因素還是教育。教育不但較政治更能影響成長，在某種程度上還能對政治民主化產生影響。希望此一結果能提供政府擬定教育政策之參考。