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NÚMERO 145

Robin Grier

POLITICS & THE ACCUMULATION OF HUMAN & PHYSICAL CAPITAL IN LATIN AMERICA

Abstract

Investment and education are frequently considered exogenous factors in the augmented Solow model, which seems to imply that less developed countries have chosen to be poor. In this paper, I test and find that both investment and education are endogenous in an augmented Solow model for Latin America and thus are not direct choice variables. I estimate a simultaneous model of investment and education and find that political stability, openness to trade, and educational attainment raise investment. Likewise, investment, cultural homogeneity, less unequal income distributions, and democracy raise primary education attainment levels.

Resumen

Inversión y educación son frecuentemente considerados factores exógenos en el modelo aumentado de Solow, el cual parece implicar que los países de menor desarrollo han elegido ser pobres. En este documento, pruebo y encuentro que ambos inversión y educación son endógenos en un modelo aumentado de Solow para Latinoamérica y entonces no son variables directamente elegidas. Estimo un modelo simultáneo de inversión y educación y encuentro que la estabilidad política abiertamente para negociar y el talento educacional edifica la inversión. Igualmente la inversión, la homogeneidad cultural, con menos desigual en las distribuciones de los ingresos e incremento en la educación primaria de la democracia.

I. Introduction

We are still hoping to find the answer to the question that Adam Smith posed in 1776: Why are some countries richer than others? The neo-classical growth model claims that variations in wealth are determined by population growth and differences in human and physical capital, which are considered to be reproducible factors. The fact that most empirical applications of the Solow model treat investment and education as exogenous regressors seems to indicate that countries choose to be poor.[1]

In contrast, I show that investment and education are endogenous regressors in the augmented Solow model using data from 18 Latin American countries. I then estimate a simultaneous model of the joint determination of investment and primary education, using lagged socio-political variables to over-identify the model.[2] This approach offers two advantages. First, it allows me to study the contemporaneous relationship between investment and education and test whether two are complements or substitutes. Second, by explicitly modelling the effect of previous socio-political events on current levels of education and investment, I can shed some light on why socio-political variables often influence growth in reduced form regressions.

I find that past political instability helps to explain differences in current investment ratios, and that military rule is associated with lower primary education rates on average in the region. While several studies find a correlation between income inequality and investment, I find that the relationship is an indirect one. Specifically, my results show that high levels of inequality are associated with lower education attainment, which in turn lowers average investment. My results also indicate a positive correlation between education and investment. Specifically, I find that more primary schooling is associated with higher average levels of investment.[3]

Section II briefly reviews the literature on politics and development and explains how this paper improves upon existing empirical studies of economic performance and socio-political factors. Section III performs a Hausman (1978) specification test and finds that investment and education are endogenous variables in an augmented Solow regression for Latin America. Section IV describes my simultaneous model, explaining the variables used and the over-identifying restrictions of the model. Section V presents and discusses the results of the regressions and Section VI concludes with a brief summary and a discussion of

[1] In the debate whether East Asian growth rates have been driven by increased productivity or merely factor accumulation, Rodrik (1997) makes the important point that the high levels of investment in the region is just as remarkable a phenomena as high productivity rates. The rest of the developing world has not been able to reproduce the East Asian miracle, indicating that investment might be an endogenous factor dependent on other variables.

[2] I use primary education rates because, although primary schooling may be compulsory in most countries, it is nowhere near universal in Latin America. Appendix 2 shows the wide range of primary education attainment in the region.

[3] Investment ratio is the ratio of investment spending to GDP.

potential future work on this topic.

II. Socio-political factors and economic development: the literature

Although the empirical relationship between socio-political factors and economic development has been widely studied, the results of the literature are not conclusive. For example, studies investigating the effects of political instability on economic performance find vastly different results. Barro (1991), Alesina et.al. (1996), and Mauro (1993) show that political instability has a negative and significant effect on investment rates and Venieris & Gupta (1986) find a negative relationship between savings and instability. Londregan & Poole (1990,1991) and Gupta (1990) find no evidence of such a relationship. The results of Perotti (1996) do not conclusively support either side of the debate.

The debate on whether government consumption negatively effects economic performance is similarly inconclusive. Barro (1989) shows a negative relationship between the level of government consumption expenditures and economic growth. Andrés et.al. (1996) find only a weak correlation between the two for OECD countries and De Gregorio (1992) presents evidence showing that the level of government consumption is a significant regressor only when literacy rates are included in the regression. Levine & Renelt (1992) argue that the relationship between government consumption and economic growth is not robust, while Grier & Tullock (1989) and Grier (1997) argue that we should use the growth rate, and not the level, of government consumption in reduced form growth regressions.

Empirical evidence of a relationship between trade policy and economic growth is also widely debated. Andrés et.al. (1996) find that export growth is the only significant regressor in growth equations for the OECD. Kormendi & Meguire (1985) and Levine & Renelt (1992) both present evidence that exports is positively, but not robustly, related to growth. De Gregorio (1992) finds no evidence of a relationship between trade policy and economic growth in a sample of 12 countries, and Harrison (1996) finds that only 3 of 6 commonly used trade policy variables are robust to alternative specifications.

I argue that there are three possible reasons why the empirical literature has not resolved the issue of whether socio-political variables are important to growth. First, the majority of the studies use large cross-sectional regressions that inappropriately combine observations from large groups of disparate countries. As a few examples, Barro (1991) uses a sample of 78 countries, Alesina & Perotti (1996) use 71, Lian & Oneal (1998) use 98, and Gupta (1990) uses 104. Grier & Tullock (1989) show that countries from the OECD, Africa, Asia and the Americas do not share common coefficients in reduced form regressions. Grier (1998) shows that the East Asian tiger countries do not share a common set of coefficients with either OECD or Latin American countries in a reduced form growth equation.

Second, many of the papers in this literature do not take into account the possibility of reverse causality. Alesina et. al. (1996) point out that, while Barro (1996), Benhabib & Spiegel (1994), and Easterly & Rebelo (1993) find evidence of

a negative relationship between instability and growth or investment, none of these studies account for the possibility that political instability is an endogenous variable. Londregan & Poole (1990) show that it is income level which determine the number of coups a country experiences, and not the other way around. If the causality between income (or investment) and instability is bi-directional, then any contemporaneous regressors of instability are endogenous and OLS results will be both biased and inconsistent.

Papers that do estimate simultaneous systems often have other weaknesses. Many of them estimate a two equation system with one equation for economic growth and another for political instability. In the case of Alesina & Perotti (1996), this strategy forces them to collapse all of the political variables into one index, which makes it difficult to determine which of the political variables is actually important to growth.[4] Londregan & Poole (1990,1991) use the same strategy and only look at the effect of coups on growth, ignoring other possible relevant instability variables.

A third potential problem is the fact that, while many of the papers mentioned above include proxies for human capital in their models, none investigate whether education is simultaneously determined with investment ratios. Past studies investigating the relationship between education and investment have argued that the two factors are complementary, insofar as countries with higher education rates can more effectively absorb new technologies.[5] In a similar vein, Romer (1993) argues that developing countries suffer from both object gaps (lack of capital) and idea gaps (lack of knowledge to put to work new technologies), and that countries with higher levels of education are able to integrate new technologies and growth faster on average.[6]

Other contemporary studies of investment and education (McMahon (1998), Machin et.al. (1996), Schultz (1993), Benhabib & Spiegel (1992)) find that investment and education are complementary goods, where more education is associated with higher average levels of investment.[7] Barro (1991), in a cross section of 98 countries in the period 1960-1985, shows that the countries with higher human capital rates also have higher ratios of physical investment to GDP.

This paper is unique in several ways. First, I use panel data for a small, and relatively homogeneous set of countries. Second, I test and find that investment and education are endogenous factors in the explanation of per-capita income levels, and

[4] Hibbs (1973) and Gupta (1990) also collapse various measures of instability into a single, summary variable.

[5] See Veblen (1915), Schumpeter (1961), Gershenkron (1962), and Nelson & Phelps (1966) for more on the subject of social absorption.

[6] Specifically, he finds a significant relationship between secondary education enrollment and equipment imports as a percentage of GDP.

[7] Some studies have emphasized the possible negative relationship between investment and education. Murat & Paba (1997), Goldberg et.al. (1998), and Zeng (1997) present models where new technologies make existing human capital worthless (e.g. Schumpeter=s creative destruction). Upadhyah (1994) creates a model where investment and education are substitute goods and any increased public funding for education reduces investment in physical capital.

go on to estimate a simultaneous system for the joint determination of income and education. Third, I use lagged values of the potentially endogenous socio-political regressors to reduce the problem of reverse causality and over-identify the system.

III. The endogeneity of investment and education

In this section, I test whether investment and education are endogenous factors in an augmented Solow regression using data from 18 Latin American countries (see Appendix 1 for a list of the countries in the sample). As a first step, I must determine if the two variables are correlated with the residuals of the regression. If investment and human capital are exogenous factors, then we would expect to see no relationship between them and the residuals and OLS would be an unbiased and consistent estimator. If they are endogenous, then the coefficients from a 2SLS regression should be significantly different than the coefficients from the OLS regression (see Hausman (1978)).

I estimate the following equation with OLS and 2SLS respectively,

$$\log \text{real per-capita } Y = a_1 + b_1(\log(inv)) + b_2(\log(educ)) + b_3(\log(\text{pop growth})) + e \quad (1)$$

The exogenous variables used to estimate 2SLS are discussed in more detail below, but include lagged values of average executive turnover, military interventions and military rule, coups, government spending, inflation, population growth, income levels, average gini coefficients, trade openness, and ethno linguistic fractionalization.

I perform a Hausman specification test to determine if OLS is a consistent estimator for these data. The statistic is distributed Chi-square (2) and the critical value at the .01 level is 9.21. I calculate a statistic of 12.3, meaning that I can reject the null hypothesis that investment and education are uncorrelated with the error term of equation (1).[8] Thus, investment and human capital are not exogenous factors in the income regression and OLS is not an appropriate technique in this case.

IV. The model

Given that education and investment are endogenous factors in the augmented Solow model in Latin America, and that the contemporaneous errors of investment and education are likely to be correlated, I estimate a simultaneous model of investment and education using 3SLS, which applies generalized least-squares

[8] I also perform Hausman specification tests to determine if investment is still endogenous when education is taken to be an exogenous regressor, and vice versa. The statistic is distributed Chi-square (1) and the critical value at the .05 level is 3.84. I calculate a statistic of 5.50 and 6.06 respectively, meaning that I can reject the null hypotheses that investment and education are individually exogenous regressors.

estimation to the system and takes into account cross-equation variances and covariances.[9]

The endogenous variables are *Inv*, the log of the share of investment in GDP, and *Edu*, the log of primary education attainment. Both are measured in 1965,1970, 1975, 1980,1985, and 1990. To reduce the problem of reverse causation, most of the independent variables are five year lagged averages, resulting in 6 observations for each country, and a sample size of 108 data points.[10] Using panel data, instead of averaging over the entire sample, allows me to capture influences from both the differences between countries and intra-country changes over time.[11]

The sources of all variables are listed in Appendix 4 and the exogenous variables used in the system are described below.

A. Demographics

I include the variables *agini* and *elf* in the system to investigate whether demographic factors are important in the explanation of investment and educational differences across countries. *Agini* is the average Gini coefficient over the sample, while *elf* is the probability that two people from the same country will not be from the same ethno-linguistic group.

Most studies of income distribution and economic performance investigate the relationship between inequality and investment or income. Edwards (1996) explains that heterogeneous agent models predict a positive correlation between income and saving and that taken at a macro level, countries with unequal distributions of income should also have higher savings rates on average.[12] Alesina & Rodrik (1994) and Bertola (1993), on the other hand, argue that there is more demand for wealth redistribution by the taxation of capital when the income distribution is unequal, therefore dampening investment rates.[13] I include *agini* in the investment regression to see if income distribution has a direct effect on investment ratios.

[9] See Madansky (1964) and Pindyck & Rubinfeld (1991) for a good description of 3SLS.

[10] The only exceptions are income distribution and ethno-linguistic fractionalization. I use the average Gini coefficient over the 30 year period and single observation of diversity for each country because of data availability. Fortunately, in the case of income inequality, Deininger & Squire (1996) argue that Achanges in inequality tend to be relatively modest≅ and using a 30 year average should be a decent reflection of the income distribution in each country. Ethnic and linguistic diversity levels are also not likely to have changed dramatically in the last 30 years.

[11] See Grier & Tullock (1989) for a justification of using a 5 year intervals instead of averaging over the entire sample.

[12] Frankel (1985), Feldstein & Bacchetta (1991) and Montiel (1994) find a positive and significative relationship between savings and investment, meaning that higher Gini coefficients (representing a more unequal distribution of income) would also be positively related to investment.

[13] Alesina & Perotti (1996) argue that the relationship between inequality and investment is theoretically ambiguous and must be determined empirically. The empirical evidence is equally inconclusive though. Alesina & Perotti find that unequal income distributions tend to create political instability and uncertainty, both of which have a significant and negative effect on investment rates. Edwards (1996), on the other hand, shows that income distribution is significantly related to savings rates in only one of many regressions.

It is also possible that the relationship between investment and income inequality found in the literature is an indirect one, in that inequality affects education, which in turn affects investment. Chiu (1998) constructs a theoretical model where poor families can only send their children to a university if he or she shows remarkable talent. If the government redistributes income from the rich to the poor, the less talented poor children will have increased opportunities to attend college. While Chiu=s model emphasizes university education, it is possible that a similar phenomena exists with respect to lower levels of education.

Loury (1981) and Galor & Zeira (1993) also construct theoretical models where higher levels of initial inequality are associated with lower accumulation levels of human capital. Flug et.al. (1998) test and find a negative relationship between income inequality and secondary education in cross-country and panel regressions. Based on the theoretical and empirical evidence discussed, I expect *agini* to be negatively and significantly related to the primary education attainment.

The variable *elf* is included in the education regression to investigate whether ethnic diversity has a significant effect on elementary school education. I argue that countries with high levels of fractionalization may not have widespread educational coverage, insofar as sizeable portions of the population do not speak the dominant language. Given that higher values of *elf* represent more fractionalization, I expect to find a negative correlation between *elf* and primary education. I find no reason why *elf* should significantly affect investment and thus use this variable to help over-identify the system.

B. Government policy

To investigate whether government policy has a significant effect on investment and education in the regions, I include *popen* and *inf* in the investment equation and *lgov* in both equations. *Popen* is the percent of time in the last five years a country had open trade, *inf* is the average inflation rate in the last five years, and *lgov* is the log of government consumption expenditures as a percentage of GDP in the last five years.[14]

Sachs & Warner (1995) show a strong correlation between trade openness and investment levels, where openness is associated with an average increase in the investment ratio of 5.4 percentage points. Likewise, Levine & Renelt (1992) find that the positive relationship between the investment ratio and trade shares (the ratio of exports and imports to GDP) is one of the only robust relationships in their study of growth. Harrison (1996) also shows a positive and significant relationship between trade shares and the investment ratio, but finds no robust relationship between investment and any of the other commonly used openness measures. There is no obvious relationship between trade openness and primary school education and thus I use *popen* as another over-identifying variable in the system.

[14] This variable is used with data from Sachs & Warner (1995), who consider a country open if: (i) nontariff barriers which cover less than 40% of the country's trade, (ii) an average tariff rate of less than 40%, (iii) a black market premium less than 20% during the 1970s and 80s, (iv) is not classified by Kornai (1992) to be socialist, and (v) the government does not have a monopoly on major exports.

Inflation is also much more likely to affect investment than initial levels of schooling and is therefore used as an additional over-identifying variable in the system. Most of the literature on inflation and economic performance find a negative relationship between inflation rates and growth (see Fischer (1991), Kormendi & Meguire (1985), Grimes (1991), Andrés et. al. (1996), and Barro (1995)). Edwards (1996), on the other hand, finds no significant relationship between inflation and private saving rates in a cross section of 36 countries. Based on the empirical evidence to date, I expect inflation to be either negatively or insignificantly related to investment ratios.

I expect government consumption spending to significantly affect both education and investment. Barro (1995) finds a negative and significant relationship between the ratio of government consumption to GDP and the investment ratio. The relationship between primary schooling and government consumption may be negative or positive. If government consumption is significantly and positively correlated with education expenditures, then I would expect the coefficient on government consumption to be positive and significant. If the two are substitute goods, where more spending in a non-educational area means less education spending, government consumption will be negative and significant in the education equation.

C. Political factors

There is a wide literature studying the effect of uncertainty on investment, arguing that because investments are irreversible and can potentially be delayed, any increase in uncertainty may have a strong, negative effect on investment rates (See McDonald & Siegel (1986), Majd and Pindyck (1987), Bernanke (1983) and Cukierman (1980)). While Pindyck & Solimano (1993) show that inflation, and not political stability, is the type of uncertainty that is especially damaging to investment, many empirical studies find a negative relationship between political instability and investment ratios.

Edwards (1996) finds that political instability has a negative and significant impact on government savings. Stewart & Venieris (1985) and Venieris & Gupta (1986) also show a negative relationship between savings and instability, arguing that political instability creates uncertainty over property rights and thus dampens the incentive to save and invest. Gyimah-Brempong & Traynor (1996) and Alesina & Perotti (1996) find a negative and significant relationship between investment and political instability.

I include average executive turnover, coups, and military intervention variables in the investment equation to investigate if the uncertainty created by political turmoil has a significant effect on investment ratios in the model.[15] Based

[15] To investigate the relationship between investment and political instability, I enter individually the following variables in the investment equation: *Plength*, average executive turnover; *Pcoups* and *Pinter*, the number of coups and military interventions the country has experienced since independence divided by the total years of independent rule; *Lagcoups* and *laginter*, which measure the number of coups and military interventions in the previous 10 years; and *ccoups* and *cinter*, which is the number of coups and interventions that have occurred in the last 5 years.

on the findings discussed above, I expect the instability variables to have a negative and significant effect on average investment ratios.

Political uncertainty is more likely to affect investment ratios than primary education levels. Given the mixed empirical evidence (see Fedderke & Klitgaard (1998)), and the fact that theory does not provide a relationship between education and political instability, I exclude the political instability variables from the education equation and use them to help over-identify the system.

I argue that the type of government is much more likely to affect education than political uncertainty. Saint-Paul & Verdier (1993) construct a theoretical model where democratization leads to more redistribution, which in turn produces more spending on public education. [16] Empirically, Fedderke & Klitgaard (1998) find a positive rank correlation between the level of education and democracy that ranges from .22 to .80, depending on the proxy of democracy used. To investigate the relationship between primary education and democracy in Latin America, I include the variable *pmil*, which is the number of years of military rule divided by total years of independence, in the education equation.[17] Given the theoretical and empirical studies on this topic, I expect to find a negative relationship between primary education and the amount of time a country has spent under non-democratic, military rule.

Equations 2 and 3 show the structural model of investment and education with the variables discussed above.[18] Lagged values of the log of real per capita income are included in both equation, as it is very likely that past income significantly affects current investment and education levels.

$$Inv_{it} = a_1 + a_2(Agini_1) + a_3(Edu_{it}) + a_4(Lpcy_{it-1}) + a_5(Pol.\ Instab._{it-1}) + a_6(Popen_{it-1}) + a_7(Inf_{it-1}) + a_8(Lgov_{it-1}) + e \quad (2)$$

$$Edu_{it} = b_1 + b_2(Elf_{it}) + b_3(Agini_i) + b_4(Inv_{it}) + b_5(Lpcy_{it-1}) + b_6(Gov.\ Type_{it-1}) + b_7(Lgov_{it-1}) + e \quad (3)$$

V. Results

Table 1 shows the results of using iterative 3SLS to estimate investment and education equations for my sample of 18 Latin American countries. Tables 2 and 3 report the effect of including different measures of political instability in the investment equation.

[16] Although there might not be a one-to-one relationship between education expenditures and attainment levels, it is reasonable to assume that some type of relationship exists between spending and results.

[17] Londregan & Poole (1990) show that low levels of income are associated with more coups. I use lagged values of all of the political variables to help prevent such problems of reverse causality. Alesina et.al. (1996) also use lagged political variables to determine if past levels of instability affect present levels of investment.

[18] Time dummies are included but not reported here for reasons of space.

A. The model

Table 1 presents the results of estimating two systems of equations. System 1 estimates equations 2 and 3 above, while System 2, which is discussed in more detail below, shows the two equations when the insignificant variables are eliminated from the model.

The over-identifying restrictions of System 1 are the exclusion of *elf* and *type of government* from the investment equation and the exclusion of *popen*, *inf*, and *political instability* from the education equation. I find that trade openness and average term length are significantly related to investment ratios at the .01 level. The trade variable is significantly and positively correlated with investment, while average executive term length has a non-linear effect on investment. Average term lengths between 2 and 3.5 years have a negative effect on the log of investment ratios. After 3.5 years, increases in average term length has an increasingly positive effect on investment.

The log of primary education in the investment equation is positive, but only significant at the .20 level. Government consumption, lagged per capita income, inflation, and average gini coefficients are all insignificantly related to investment.

In the education equation, I find that all of the independent variables are related to primary education at the .01 level, except for the log of investment, which is only related primary education at the .20 level. Average gini coefficients are negatively and significantly related to primary education, which indicates that societies with more income inequality tend to have lower average primary education levels. The fact that *agini* is found to be significantly correlated with education and not with investment ratios implies that the relationship between investment and income distribution may be indirect, and that studies concentrating on the relationship between inequality and investment may be in error.

Government consumption spending is positively and significantly related to primary education, indicating that government spending on consumption and education is complementary. Specifically, governments which spend a lot on consumption also tend to spend more on average on education.

Another interesting result that emerges is the negative and significant correlation between military rule and primary education. This finding indicates that the countries with histories of military rule also tend to have lower average primary education attainment rates, which supports the arguments and evidence found by Saint-Paul & Verdier (1993) and Fedderke & Klitgaard (1998).[19]

Ethno-linguistic fractionalization has a non-linear, inverse u-shaped, effect on education rates. Ethnic diversity has a positive, but small, effect on education rates until *elf* reaches .33, at which point increases in diversity have an increasingly negative effect education.

System 2 re-estimates the model after eliminating the insignificant variables,

[19] To investigate whether this result is driven by an outlier, I eliminate Costa Rica from the sample and find that *pmil* is still negatively correlated with education levels at the .01 level.

namely *agini*, *lgov*, *inf*, and *lpcy*.[20] In the new system of equations, average executive term length still has a significant non-linear effect on investment and trade policy is still correlated with investment at the .01 level. The major difference between System 1 and 2 is the coefficient of primary education in the investment equation. The elimination of the insignificant variables in the investment equation raises the significance of education on investment to the .01 level. This result lends support to the idea discussed earlier that countries with higher levels of education are better able to absorb new technologies and increase investment. The log of investment ratios is positively correlated with education levels, but only at the .2 level. The finding indicates that investment and education are complements in that more education is associated with more investment and vice versa, although the statistical significance of the first relationship (more education causing higher average investment) is considerably stronger than the second.

Elf still has a significant non-linear effect on education. As was the case with average executive term length, the coefficients on *elf* and elf^2 in System 2 are almost identical to those in System 1. Average gini coefficients and military rule are still negatively and significantly related to education rates at the .005 level. Lagged per capita income remains an important determinant of primary education rates, as the coefficient on lagged income is significant at the .01 level.

B. Other measures of political instability

Table 2 adds additional measures of political instability to the investment equation. Specifically, I investigate whether the uncertainty generated by military takeovers has a negative and significant effect on investment ratios. The results show that the intervention variable most correlated with investment is *laginter*, which is a measure of the number of interventions in the previous ten years. *Laginter* is negatively associated with investment ratios at the .01 level, indicating that countries with a history of military takeover in the previous 10 years have lower average investment rates. *Pinter*, the number of interventions since independence (divided by total years of independent rule), is not significantly related to investment ratios. *Cinter* is negatively and significantly related to investment at the .05 level, indicating that countries which have experienced military interventions in the past five years have lower levels of investment on average.

Table 3 adds alternative measures of political instability to the investment equation. I investigate the effect of coups on investment ratios in Latin America and find that the relationship between coups and investment mirrors the correlation between interventions and investment. The number of coups in the last ten years (*lagcoups*) is negatively related to investment at the .01 level, while coups which have occurred in the last five years (*ccoups*) is negative and significant at the .05 level. The number of coups since independence is insignificantly related to

[20] I also tested whether the standard deviation of inflation is significantly related to investment, to see if this measure of macroeconomic instability is important in the explanation of investment ratios. The variable was insignificant in every estimated regression. As Grier & Perry (1998) and Grier & Grier (1998) point out though, the standard deviation of inflation is a poor measure of inflation uncertainty.

investment ratios.[21]

VI. Conclusion

Investment and education are frequently considered exogenous factors in the augmented Solow model, which seems to imply that less developed countries have chosen to be poor. In contrast, I find that both investment and education are endogenous in an augmented Solow model for Latin America and thus are not direct choice variables. I estimate a simultaneous model of investment and education and find that the two are complementary goods, where more primary education is positively correlated with more investment on average.

While investment is positively related to income, I find that investment itself is dependent on many other factors. Lagged values of coups, military interventions, executive turnover, trade openness, and education all help to explain differences in investment levels.

Trade openness is also positively and correlated with investment ratios, indicating that the countries with the most open trade policies also had the highest levels of investment. Lagged values of coups and military interventions are both negatively associated with average investment, meaning that the Latin American countries with histories of political instability also have lower average investment ratios. Executive term length and investment are negatively correlated when the average term is between 2 and 3.5 years and positively correlated after an average term of 3.5 years.

Another interesting result that emerges is the fact that many of the variables, such as inflation, government consumption spending, income inequality, and inflation, are not significantly correlated with investment. Many of these variables may affect investment indirectly through education levels. The results show that military rule is negatively and significantly correlated with primary education levels, meaning that the Latin American countries with the longest histories of military rule also have the lowest levels of primary education on average. Government consumption spending is positively and significantly correlated with primary education, indicating that government spending on consumption and education are not substitute activities. Income inequality, which is often thought to primarily influence growth through its effect on investment, is not significantly related to investment ratios but is negatively and significantly related to primary education. Countries with the highest levels of inequality also have the lowest average primary school attainment levels. Ethno linguistic diversity is non-linearly and significantly correlated with education.

Further work on socio-political factors and economic performance should recognize the possibility that investment and education are endogenous regressors

[21] While Londregan & Poole (1990) find that past coups do not significantly affect present income levels in a study of 121 countries, my results indicate that coups, especially those in the last ten years, negatively and significantly affect investment ratios in Latin America.

in augmented Solow models and that the use of OLS may not be appropriate. More empirical work on individual countries, or panel data from groups of relatively homogeneous countries, may help to illuminate and resolve the many significant relationships between economic performance and socio-political variables.

Table 1: Investment and education in Latin America with lagged regressors since independence

System 1:

linv = 2.2 + .34 ledu + .12 lpcyl$_{-1}$ - .93 plength + .13 plength^2 - .0009 inf
(1.9) (1.2) (.88) (2.8) (2.7) (.18)

+ .01 agini - .01 lgov + .003 popen
(.94) (.05) (3.2)

ledu = - 1.0 + 1.5 clf - 2.3 clf^2 - .03 agini + .23 lgov + .15 inv - .37 pmil + .37 lpcyl$_{-1}$
(2.0) (4.2) (4.6) (7.3) (4.4) (1.5) (3.5) (6.4)

R^2 (linv equation) = .399; R^2 (ledu equation) = .746; System R^2 = .839; N=108

System 2:

linv = 3.8 + .45 ledu - 1.1 plength + .16 plength^2 + .002 popen
(6.6) (3.5) (3.5) (3.6) (3.0)

ledu = - 1.2 + 1.5 clf - 2.3 clf^2 - .03 agini + .23 lgov + .16 linv - .36 pmil + .33 lpcyl$_{-1}$
(2.4) (4.2) (4.6) (7.2) (4.5) (1.6) (3.4) (6.7)

R^2 (linv equation) = .384; R^2 (ledu equation) = .745; System R^2 = .839; N=108

The numbers in parentheses are t-statistics. Time dummies were estimated but are not reported for reasons of space.

Table 2: Military interventions, investment, and education in Latin America

System 3:

linv = 4.3 + .37 ledu - 1.27 plength + .17 plength^2 + .002 popen - .74 pinter

(5.9) (2.6) (3.7) (3.9) (2.5) (1.3)

ledu = - 1.1 + 1.6 elf - 2.3 elf^2 - .03 agini + .24 lgov + .11 linv - .37 pmil + .34 lpcyl$_{-1}$
(2.7) (4.3) (4.6) (7.1) (4.6) (1.1) (3.5) (7.0)

R^2 (linv equation) = .391; R^2 (ledu equation) = .744; System R^2 = .831; N=108

System 4:

linv = 3.7 + .41 ledu - 1.1 plength + .16 plength^2 + .003 popen - .10 cinter
(6.6) (3.3) (3.5) (3.7) (3.7) (2.5)

ledu = - 1.2 + 1.52 elf - 2.9 elf^2 - .03 agini + .24 lgov + .15 linv - .36 pmil + .33 lpcyl$_{-1}$
(2.4) (4.2) (4.6) (7.2) (4.5) (1.5) (3.4) (6.8)

R^2 (linv equation) = .416; R^2 (ledu equation) = .746; System R^2 = .845; N=108

System 5:

linv = 3.7 + .36 ledus- 1.02 plength + .15 plength^2 + .003 popen - .08 laginter

(6.8) (2.9) (3.4) (3.6) (4.0) (3.6)

ledu = - 1.2 + 1.5 elf - 2.3 elf^2 - .03 agini + .24 lgov + .17 linv - .35 pmil + .33 lpcyl$_{-1}$
(2.5) (4.2) (4.5) (7.2) (4.6) (1.8) (3.4) (6.9)

R^2 (linv equation) = .444; R^2 (ledu equation) = .745; System R^2 = .854; N=108

The numbers in parentheses are t-statistics. Time dummies were estimated but are not reported for reasons of space.

Table 3: Coups, investment and education in Latin America

System 6:

linv = 4.8 + .32 ledu - 1.41 plength + .18 plength^2 + .003 popen - 2.1 pcoups

(6.0) (2.2) (4.0) (4.0) (3.3) (1.9)

ledu = - 1.1 + 1.5 elf - 2.3 elf^2 - .03 agini + .23 lgov + .17 linv - .36 pmil + .33 lpcyl$_{-1}$
(2.3) (4.3) (4.6) (7.3) (4.5) (1.6) (3.4) (6.6)

R^2 (linv equation) = .389; R^2 (ledu equation) = .745; System R^2 = .839; N=108

System 7:

linv = 3.7 + .41 ledu - 1.0 plength + .15 plength^2 + .003 popen - .06 ccoups

(6.5) (3.3) (3.3) (3.5) (3.5) (1.9)

ledu = - 1.1 + 1.52 elf - 2.3 elf^2 - .03 agini + .24 lgov + .15 linv - .36 pmil + .33 lpcyl$_{-1}$
(2.4) (4.2) (4.6) (7.2) (4.6) (1.5) (3.4) (6.7)

R^2 (linv equation) = .403; R^2 (ledu equation) = .745; System R^2 = .842; N=108

System 8:

linv = 3.7 + .36 ledu - 1.01 plength + .15 plength^2 + .003 popen - .07 lagcoups

(6.7) (2.9) (3.3) (3.4) (4.0) (3.2)

ledu = - 1.2 + 1.5 elf - 2.3 elf^2 - .03 agini + .24 lgov + .16 linv - .35 pmil + .33 lpcyl$_{-1}$
(2.4) (4.3) (4.6) (7.2) (4.6) (1.6) (3.3) (6.8)

R^2 (Linv equation) = .431; R^2 (Ledu equation) = .746; System R^2 = .849; N=108

The numbers in parentheses are t-statistics. Time dummies were estimated but are not reported for reasons of space.

Appendix 1:

The 18 countries in the sample

Costa Rica	Bolivia
Dominican Republic	Brazil
El Salvador	Chile
Guatemala	Colombia
Honduras	Ecuador
Mexico	Paraguay
Nicaragua	Peru
Panama	Uruguay
Argentina	Venezuela

Appendix 2:

Primary Education in Latin America

Countries	Avg.	Std. Dev.	Min.	Max.
Costa Rica	3.43	.221	3.07	3.67
Dominican Rep.	2.29	.165	1.99	2.44
El Salvador	1.99	.504	1.46	2.60
Guatemala	1.49	.320	1.24	1.91
Honduras	1.84	.502	1.49	2.78
Mexico	2.64	.439	2.10	3.15
Nicaragua	1.97	.275	1.59	2.30
Panama	3.61	.354	3.20	4.09
Argentina	4.85	.423	4.29	5.33
Bolivia	2.59	.147	2.47	2.87
Brazil	2.11	.069	2.04	2.22
Chile	3.93	.209	3.59	4.13
Colombia	2.44	.336	2.06	2.79
Ecuador	3.07	.621	2.52	3.97
Paraguay	3.25	.315	2.92	3.62
Peru	3.01	.565	2.40	3.74
Uruguay	4.07	.266	3.80	4.42
Venezuela	2.68	.654	2.08	3.52
Full sample	2.85	.936	1.24	5.33

Appendix 3:

Summary statistics of independent variables

Variable	Mean	Std.dev
$Lpcyl_{t-1}$	2992.4	1564
Edu	2.85	0.94
Inv	15.8	5.52
Gov. C spending (%)	15.3	5.80
Popen	23.7	39.9
Agini	48.9	4.66
Plength	3.20	0.65
Pmil	0.42	0.18
Elf	0.26	0.21
Inflation	-0.40	6.07
Pinter	0.14	0.07
Cinter	0.56	0.83
Laginter	1.20	1.42
Pcoups	0.11	0.05
Ccoups	0.53	0.95
Lagcoups	1.11	1.45

Appendix 4:

Data and sources

Variable	Source
Inv	Penn World Tables
Edu	Barro & Lee (1993)
Agini	Deininger & Squire (1996)
Lpcyl	Penn World Tables
Lgov	Penn World Tables
Inf	Penn World Tables
Pol. Variables	Bienen & van de Walle (1991)
Popen	Sachs & Warner (1995)
Elf	Easterly & Levine (1997)

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