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Macroeconomic Adjustment and Growth

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Cross-Country Studies of Growth and Policy

Methodological, Conceptual, and Statistical Problems

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and
David Renelt

The design, implementation, and interpretation of cross-country investigations should be improved. This review of conceptual, methodological, and statistical weaknesses in cross-country studies suggests that existing findings warrant only limited confidence.

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This paper — a product of the Macroeconomic Adjustment and Growth Division, Country Economics Department — is part of a larger effort in PRE to understand empirically the links between policy and long-run growth. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact CECMG staff, room N11-024, extension 39175 (54 pages).

Levine and Renelt review the conceptual, methodological, and statistical problems associated with drawing inferences from cross-country regressions. They elaborate on the particular problems associated with empirical attempts to link particular policies with long-run growth.

They hope to stimulate improvements in the design, implementation, and interpretability of cross-country investigations and to caution readers about the confidence they place in existing findings.

(See also WPS 609.)

TABLE OF CONTENTS

Helpful comments were received from Bill Easterly and Lant Pritchett.

I. Introduction

The recent boom in theoretical analyses of long run growth has sparked research and interest in cross-country empirical studies of growth. These studies typically regress the average rate of growth for a sample of countries on a group of explanatory variables. The variety of cross-country growth regressions is enormous. A quick glance at Table 1 indicates that authors study different sets of countries, over different years, and use different explanatory variables. The great diversity of studies makes it difficult both to discern consistent relationships and to compare the results of studies. Furthermore, the analytical problems that plague cross-country regressions make it difficult to consider any set of findings reliable.

This paper has two purposes. First, by discussing the methodological, conceptual, and statistical problems associated with large cross-country studies of growth, we hope to stimulate improvements in the design, implementation, and therefore, the interpretability of cross-country investigations. Although we do not make specific recommendations, we outline general ways to (a) enhance the econometric design of large cross-country regression analyses, (b) improve the data construction and the sample selection processes, and (c) enhance the presentation and interpretation of cross-country studies. Also, this paper may serve as a useful - though perhaps overly detailed - warning to readers of the growth literature about the confidence they should place in cross-country findings.

This paper's second purpose is to examine the particular problems associated with cross-section attempts to link macroeconomic policies with growth. Although we would like to construct objective, internationally

comparable measures of "fiscal policy," "trade policy," "financial policy," etc., it is difficult to construct precise empirical measures of these aggregate concepts for a very broad collection of countries. Consequently, researchers frequently resort to using measures of economic performance like the share of exports in GDP. Since these measures of economic performance are not measures of specific economic policies, cross country growth regressions involving these performance measures cannot quantify the links between specific policy changes and growth. Moreover, Levine and Renelt (1990) show that there is not a strong independent relationship between almost every existing economic performance measure and long-run growth.

The next section of the critique, Part II, discusses methodological, conceptual, and statistical problems with cross-country regressions. In particular, we discuss sampling, aggregation, the interpretation of coefficients, causality, the selection of data, the implications of measurement error, and econometric techniques designed to extract particular components of the data. This entire section may be skipped by readers who are uninterested in general analytical problems with cross-country regressions. Part III of this paper provides a review and critique of cross-country empirical attempt to link policy and growth. We review the theoretical ties between a host of macroeconomic policies and growth, the empirical findings regarding each of these policies, and the particular problems associated with interpreting existing empirical studies of growth and policy.

II. General Issues

Many cross-country empirical studies of growth regress the average rate of growth for a collection of countries on a set of explanatory variables. While having a common form, empirical studies of growth are not homogeneous: authors examine different subsets of an enormous number of "right-hand-side" variables, use different countries, measure variables differently, employ different data sets, and aggregate data over different periods. Consequently, it is difficult to discern consistent relationships. Furthermore, methodological, statistical, and conceptual quandaries aggravate the problem of drawing reliable inferences from the extensive growth literature.

This section collects, extends, and discusses the analytical shortcomings of cross-country studies in the hopes of stimulating improvements in the design, implementation, and interpretability of cross-country research.

Although cross-country studies may be no place for the methodological perfectionist [Harberger 1987], authors should be able to answer "yes" to the following four questions if readers are to have confidence in the results:

1. Are countries the appropriate unit of study?
2. Can the coefficients in a cross-country regression be interpreted in an economically meaningful way?
3. Are the data used in the regression measured accurately and do they appropriately represent the concepts for which they proxy?
4. Have extensive sensitivity analyses been conducted to establish the robustness of the results?

This section discusses each of these questions in some detail. It should be pointed out that most of the concerns raised in this section have been discussed by the conductors of cross-country studies themselves. This section's major practical theme (expressed in Section II.E.) is that **insufficient effort has been devoted to examining the fragility of existing empirical conclusions. The econometric work in Levine and Renelt (1990) suggests that almost all cross-country regression results are fragile: they are not robust to slight alterations in the list of explanatory variables.**

A. Aggregation and Sampling

In thinking about studying the determinants of growth, a very basic question comes to mind: What is the appropriate unit of study? In particular, are countries the appropriate unit to study, or should we conduct analysis at a more disaggregated level? Since countries are composed of productive sectors, any country's growth rate depends on world-wide trends in the country's key sectors as well as country-specific factors that influence all sectors within the economy.[1] Decomposing growth into country and sectoral components would quantify the importance of country-specific factors in growth.[2] Furthermore, empirically isolating the country- and sector-specific components of growth is important even if we are only interested in dissecting the country-specific component of growth. For example, cross-country

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[1] Similarly, the performance of any industry within a given country depends on worldwide trends in that industry and country-specific factors that influence all industries within that country.

[2] Stockman (1988) conducts such a decomposition for seven European countries and the United States. He finds that there are both important industry-specific and country-specific components to industrial performance. It would be worthwhile to extend this analysis to more countries.

regressions of aggregate growth rates on macroeconomic policy indicators that do not account for each country's sectoral composition and world-wide sectoral trends may capture spurious relationships or miss signi icant relationships because of the added variability in growth induced by international factors.[3] Those attempting to quantify the explanatory power of macroeconomic indicators associated with fiscal, monetary, trade and financial policy might obtain more accurate and easily interpretable results by first expunging the component of national growth reflecting world-wide trends in the country's major sectors.[4]

A second problem with using a country as the unit of study involves sampling. Regression analysis presupposes that the data are samp.ed from a single "population." It is not clear, however, whether countries are indeed drawn from the same population. Harberger (1987) asks "What do Thailand, the Dominican Republic, Zimbabwe, Greece, and Bolivia have in common that merits their being put in the same regression analysis?" Harberger concludes almost "nothing at all" and warns that "He who puts them in the same regression, should have a very good reason for doing so." (p.256)

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[3] For example, consider some macroeconomic policy regime P, and assume that P positively affects industry 1 and negatively affects industry 2. Also consider two sets of countries all with policy regime P: countries in group A are composed of industry 1, while group B countries are composed of industry 2. In a cross-country regression with a sample dominated by group A, researchers might inappropriately conclude that policy regime P should be maintained by everyone, including group B countries.

[4] Econometrically decomposing national growth rates has its own problems: it may be impossible to obtain sufficiently disaggregated data for many countries; also, if technology differs significantly across nations, the decomposition technique employed by Stockman will not isolate the country-specific component of growth [See: Stockman (1985), p. 404-8]. Nonetheless, given the general lack of success in empirically linking macroeconomic indicators with average growth rates in cross-sectional regressions [see: Levine and Renelt (1990), extracting the nation-specific component of growth and re-running the cross-sectional analyses with this - albeit problematic - measure of the nation-specific growth rate seems like a worthwhile endeavor.

This question of whether countries belong in the same sample is, at least implicitly, recognized by many researchers when they exclude major oil-exporting countries, or isolate "developing" countries, or sort countries by continent. In excluding major oil-exporting countries, Barro (1989) argues that "These countries tend to have high values of real GDP per capita, but ... act more like countries with lower values of income. This behavior can probably be explained by thinking of these countries as receiving large amounts of income from natural resources, but otherwise not being advanced in terms of technology, human capital, and so on." (p.18) Alternatively, one may argue that it is not the large percentage of income received from natural resources that motivates the exclusion of major oil-exporting countries from the sample but the fact that these countries experienced large terms of trade changes.[5] While plausible, these arguments imply that countries receiving a "large" amount of income from natural resources or countries experiencing "large" terms of trade shocks are not part of the sample of countries we have in mind in considering a particular set of hypotheses. Should we then exclude all countries that receive some specified amount of income from exporting natural resources (not just oil producers) and all countries that experienced sufficiently large terms of trade shocks?

Another example of our difficulty in deciding which countries belong in the same regression is the frequent separation of developing from industrialized countries. Table 1 gives a list of cross-country studies of

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[5] An important statistical problem with major oil exporting countries is that many data sets use 1980 prices. Consequently, when initial income is computed in 1950 or 1960 measured initial income for major oil exporting countries is huge and does not appropriately reflect relative income levels in these earlier years.

growth and indicates whether the samples include only developing countries, only industrialized countries, or both. Those researchers that distinguish between developing and industrialized countries are expressing their belief that countries with different per capita incomes are sampled from different populations. It is not clear, however, that we should arbitrarily use per capita income levels to distribute countries into different "population" groups. Furthermore, the delineation between developing and industrialized countries by per capita income yields troubling categorizations. For example, this delineation states that Spain and Japan are drawn from the same population, and Portugal and South Korea are drawn from the same population, but Spain and Portugal (as well as Japan and South Korea) are drawn from different populations.[6] Although there is no simple resolution to the question of what countries to include authors should discuss their reasons for choosing a particular sample and provide information about how the results change when they use different selection criteria.

Before concluding this discussion of sampling, we raise the problem of time aggregation: Should a variable measured over long time periods be aggregated into a single data point? If yes, what should be the frequency of aggregation? Presumably, the answer depends on what we are trying to measure. Since most modern theories of growth are discussed in terms of steady-state solutions, we tend to think about growth as movement along a steady-state path. Consequently, when we turn to the data, we generally seek to measure

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[6] Grier and Tullock (1989) show that countries, grouped by the OECD and then by continent, should not be pooled - given the basic macroeconomic variables for which they control.

"long-run trends" in output as opposed to (a) cyclical variation in production or (b) transitional movements toward a steady-state

Separating the "trend" component of production from the "cyclical" component requires that we have a good idea of the frequency of cycles.[7] In practice, taking averages over twenty year periods does not do gross injustice to our notions of what is a business cycle and what is not. However, when we perform pooled cross-section, time-series investigations using five year averages, it is less clear that we have eliminated cyclical components.[8]

A second time-aggregation problem involves distinguishing steady-state growth from transitions toward the steady state growth path. Unfortunately, empirically distinguishing "long-run" trends from transitions toward these trends is less amenable to reasonable empirical approximations than expunging cyclical variation from GDP. Our "new" growth models predict that structural changes such as tax changes, government expenditure changes, and alterations in the legal system can alter steady-state growth rates. If such changes occur frequently, the economy will be continually adjusting towards a series of ever changing steady-state paths. This would imply that we can never empirically capture the notion of steady-state GDP movements contained in our models - and our minds - because we never observe them. Some suggestive

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[7] This problem is confounded in cross-country studies because countries may not have the same cyclical frequencies. Furthermore, if we define cycles as periodic, self-generating movements in output, the profession has not yet concluded that cycles exist. However, as long as the steady-state path is fixed, aggregation in the absence of cycles will still capture steady-state trends.

On the other hand, cycles may be importantly related to steady-state growth. Thus, "expunging" the "cyclical" component of output may remove important information about the long-run growth process.

[8] This problem is further complicated because business cycle frequencies may be different across countries and across variables within the same country.

empirical evidence regarding our ability to capture long-run steady-state trends is provided in Table 2. Using growth rates over five year periods, Table 2 shows that cross-period correlations are weak and in some cases negative. Thus, the variables in our regressions may not conform with the steady-state notions of our theories.

B. Interpreting Coefficients

A second methodological issue that should be confronted when conducting cross-section regressions is interpreting the coefficients. In many types of econometric work, coefficients represent our estimates of elasticities or behavioral relationships. We can then perform conceptual experiments of the kind: if x changes by one percent our estimates indicate that y will change by about 'beta' percent. This is not the case with cross-section regressions. Cross-country regressions do not represent behavioral equations; they do not "describe a single piece of machinery through time." [Harberger 1987, p.256]

Ram (1986) warns that parameter estimates reflect intercountry averages and do not apply to any single country. In addition, coefficients are not structural parameters: the sign of an estimated coefficient is "the sign of the partial correlation between ... [growth] ... and each regressor, with the other regressors held constant. The corresponding t-statistic ... then can be taken as a test of the strength of the partial correlations." [Kormendi and Meguire, 1985, p.146] Consequently, cross-country regressions may best be viewed as establishing patterns of correlations. Only theory provides us with a means of interpreting these patterns. Of course, different theories may have different explanations for any given set of correlations. By systematically expanding the set of stylized correlations, however, cross-

country empirical studies may be able to favor some existing theories over others and broaden the equirements of future theories.[9]

C. Causality

The problem of establishing causal relationships in economics is familiar: Does money cause output, or does output cause money? Does economic prosperity foster financial market innovations, or do improvements in financial arrangements stimulate economic activity? The list of such questions is almost endless. Given the quantity of variables used on the "right-hand-side" of cross-country growth regressions, the problem of interpreting causal linkages is particularly acute. We agree with Romer's (1989b) belief that cross-country regressions can only be interpreted within the context of a theory and that causality only acquires economic content when we have a theoretical framework for understanding the relationship.[10]

While it seems almost self-evident that we need economic theory to interpret statistical relationships in an economically meaningful way, the growth literature to date has not optimally integrated econometrics with economic theory. We have an impressive array of theoretical papers, each

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[9] Non-parametric techniques can be used to enhance our understanding of patterns in the data without using regressions. A nice example of this is in Dervis and Petri (1987) where they show that " 'high growers' (that is, countries selected by the criterion of rapid growth) invest like the 'high investors' (countries selected by the criterion of high investment ratios.)" [Harberger 1987, p.256]. Illustrative characterizations of the data help establish empirical relationships without implying that the results apply to any individual country or suggesting that the results are structural.

[10] Of course, there are empirical definitions of causality. See, for example, Engle, Hendry, and Richard (1983). But, these definitions also only acquire economic significance when there is a theoretically meaningful way to describe the empirically defined causal relationship.

motivated by a few stylized correlations; and, we have an impressive array of cross-country empirical studies, each advertising a few stylized correlations. What we have not had is a sufficiently intensive study of the fragility of frequently used stylized correlations or a systematic empirical competition among competing theoretical models of growth.

D. Measurement

This subsection discusses statistical and conceptual issues associated with measuring and constructing the data used in cross-country growth studies. The subsection is divided into two parts. The first part examines both the general implications of measurement error and specific biases associated with cross-country regressions. The second part involves a rather lengthy discussion of the statistical and conceptual differences between using data constructed by the International Comparisons Project [see: Summers and Heston (1988) and Kravis and Lipsey (1990)] or own currency price data available from the International Monetary Fund and the World Bank. This section may be skipped by readers not interested in a detailed discussion of the data.

1. Measurement Error, Index Problems, and Data Availability

A troubling problem with cross-country studies of growth is the measurement of the underlying data. Measurement error generally biases coefficient estimates. Although data problems plague much empirical work, measurement problems may be particularly important in cross-country growth studies because the data collection processes in many countries are poor. Furthermore, the accuracy of data collection may be correlated with factors

such as administrative competence, country size, economic structure, economic policies (that promote black market activity), and political instability that may be correlated with economic growth and the level of development.

One example of how measurement error can induce a spurious result involves the estimation of income in an initial year. Neoclassical growth theory predicts that income levels of similar countries should converge so that the coefficient in a cross-country regression of growth on initial income should be negative. Romer (1989a) points out that when initial income is mis-measured that the estimated coefficient on initial income in a regression of average growth on initial income will be biased towards being negative. The usual approach to errors-in-variables is to instrument the mis-measured variable. Romer (1989a) does this and finds the negative partial correlation of initial income with growth disappears when he uses the number of radios and the consumption of newsprint per capita as instruments. However, these may not be adequate proxies for initial income and the measurement error in these variables may be correlated with measurement error in income.

There also exist index number problems in analyzing growth rates as the structure of production and relative prices may be changing as a country undergoes growth and structural transformation. For example, the relative price of capital intensive manufactured goods to labor intensive agricultural goods or services tends to be greater at lower income levels than higher income levels. If the manufacturing sector grows more rapidly than the agricultural or service sectors during economic development, the reported real rate of growth will be overstated if initial period prices are used and understated if later period prices are used. A simple chain index can mitigate this index number problem.

Another problem is that many policy variables are not directly measurable. Kormendi and Meguire (1985, p.157) state, "The main issue requiring more attention is how accurately some of our variables reflect the hypothesized phenomena." Many institutional aspects of a country such as the protection of property rights and functioning of the legal system may be important for growth but cross-country comparative measures of these factors are weak. This also applies to important policy variables such as the degree of financial market and trade liberalization. The policy stance of a country is often inferred from looking at real interest rates, real exchange rates, effective rates of protection, trade shares, etc., but these measures may not appropriately reflect underlying policies."[11] By carefully constructing measures of policy and examining the sensitivity of results to competing measures of the same policy, researchers could improve our ability to document the empirical relationships between growth and policy.

2. International Price Indexes vs Own Currency Price Indexes

It is very difficult to compare national incomes. The most common way to make international comparisons is to convert GDP numbers in own currency terms into a common currency using exchange rates. This may be unsatisfactory, however, because nominal exchanges rates generally do not reflect the real purchasing powers of currencies. For example, if it takes 10 frances to buy in France what $1 will buy in the United States, and the exchange rate is 5 frances per dollar, then the conversion of French income expressed in frances into dollars using the exchange rate will overstate France's real income [from Kravis (1984, p.2]. Furthermore, as Kravis (1984)

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[11]See Pritchett (1990) for a discussion of trade openness measures.

and Kravis and Lipsey (1988) discuss, there are good reasons to believe that own currency prices systematically exaggerate real income differences between rich and poor countries because non-traded goods are less expensive in poorer countries but nominal exchange rates do not reflect these differences.

The purpose of the International Comparison Program is to create internationally comparable figures for real GDP, the components of real GDP, and to produce purchasing power parity exchange rates [see: Summers and Heston (1988) and Kravis and Lipsey (1990)]. Purchasing power parity exchange rates are the rates that would have to be used such that a given basket of goods that cost $X in the United States (the numeraire country) could be purchased in any other country - say Chile - by changing the X dollars into Chilean pesos at the PPP exchange rate and then buying the identical basket of goods in Chile. Thus, the International Comparisons Project (ICP) collects prices for about 150 basic categories of goods for a large number of benchmark countries and then constructs purchasing power parity indexes. These PPP indexes are aggregated to form PPPs for summary groups of goods (e.g., capital goods) and further aggregated up to GDP. These PPP indexes are then used to compare national incomes. Extrapolation is used to provide estimates for countries not covered by benchmark studies, and, since prices are not collected every year, ICP extrapolates PPP indexes intertemporally.

Although these data are subject to data limitations, index number problems, questions associated with the extrapolation techniques, and quandaries associated with distinguishing the quality of the "same" good in different countries, Heston and Summers (1988), Kravis and Lipsey (1990), and Marris (1984) argue that international prices provide a better estimate of

income levels for international comparisons than using exchange rates.[12] For example, Kravis and Lipsey (1990, p.4) argue that "the purchasing power of the currencies of low income countries is much greater than that indicated by exchange rates ... the real income per capita of the Asian countries was twice that suggested by exchange rate conversions and that of the Central and South American countries was half again as much as the exchange rate conversions indicated." Even so, Kravis and Lipsey (1990) suggest that methodological problems could cause estimates to be off by 20-25% for low-income benchmark countries and 30-35% for non-benchmark countries.

Although ICP prices may provide more easily comparable estimates of income levels in a given year than one can obtain using exchange rates, it is much less clear whether ICP prices should be used to compute growth rates or economic ratios like the share of investment or government spending in GDP.

We first discuss growth rates - following closely the presentation in Kravis and Lipsey (1990, p.32). The most common way of computing real growth rates is by deflating each country's nominal GDP figure by its own GDP price deflator and, then, determining the growth rate of this real GDP statistic. Since every country's deflator is defined by a different basket of goods, the growth rate of every country measures the change in a basket of goods that is different from that measured by all other countries. Thus, this own-currency-computed growth rate answers the question "How much change has there been in the quantity of the base year bundle of goods produced in a country?"

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[12] The organizers of the ICP, Robert Summers, Robert Lipsey, Irving Kravis, and Alan Heston, are very careful to document the procedures they use in constructing indexes, and they highlight any problems about which they think users of the data should be aware.

Computing growth rates using international prices answers a different question. For ICP-computed growth rates, the questions is "What is the change in the value of the goods produced in a country where value is computed using the same international price index for all countries?" "Such growth rates have the merit of treating a given increase in a given good as making the same contribution to growth in both countries. They have the drawback that the prices used may be very dissimilar from the prices of one or both of the situations." (Kravis and Lipsey, 1990, p.32)

Thus, we tend to agree with Kravis and Lipsey (1990) that ICP growth rates may better capture notions of international opportunity costs while own currency growth rates better capture welfare considerations because own currency prices more accurately reflect the representative consumption baskets of consumers. Statistically, we found that over the period 1960 to 1985 the two growth rates have a simple correlation coefficient of almost 0.9.

Turning to economic ratios, there exist important conceptual and statistical differences in the use of international vs. own currency prices in computing the shares of various economic variables in GDP. Investment goods tend to be relatively more expensive than consumption or government services in low-income countries, while government services are generally more expensive in high-income countries. This implies that the actual quantity of investment goods purchased will be smaller in a low-income than a high-income country for any given proportion of income spent on investment. Thus, investment measured using international prices may more accurately measure the augmentation of the capital stock. One problem with using ICP data in computing investment shares, however, is that international differences in these prices may also reflect trade and fiscal policies which may

inappropriately affect the pricing of capital goods.[13] De Long and Summers (1990) point out that some of the newly industrializing countries such as Korea and Brazil have relatively low prices of investment durables relative to construction prices. They argue that this is a result of different trade and tax policies in these countries designed to promote industrialization. The effects of policy on investment prices may be particularly important for countries for which benchmark studies of prices have not been done as one may be estimating effects based on extrapolating from other countries policies. Even for benchmark countries this could be important as extrapolations from the benchmark year to other years may not fully account for policy changes.

The issue of choosing ICP or own country data may be even more problematic in the case of government expenditures because there are various interpretations of what the government expenditure to GDP ratio is supposed to measure. Ram (1987) argues that ICP prices are better than own currency prices when one is trying to measure government provision of productive services because own currency prices will not account for the tendency of government services to be relatively inexpensive in low-income countries. Thus, the ratio of government expenditures to GDP computed using own currency prices may under-estimate the provision of public goods in low-income countries. On the other hand, if one is trying to measure the distortionary effects of taxation, one may prefer own country prices because these may more accurately reflect the relative size of the government in the economy.

Statistically, the simple correlations of growth and government consumption share over the period 1960-85 are strongly negatively correlated using the data constructed by Summers-Heston and positively correlated using

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[13]See Bradford (1987), Barro (1989), and De Long and Summers (1990).

World Bank data. Because of the conceptual and empirical differences associated with using either own currency prices (associated with World Bank and IMF data) or ICP prices (associated with the Summers and Heston data set), researchers should make specific arguments for using one set of data rather than the other and may even want to compare results using both sets of data.

E. Sensitivity Analysis & Fragile Results

Doing sensitivity analysis means addressing the question: "Do the conclusions withstand slight alterations in the right-hand-side variables, in functional form, serial correlation assumptions, measurement error processes, distributional assumptions, sample period, and the weighting of observations? We must subject our econometric studies to systematic sensitivity analyses to determine whether the results are fragile or robust; i.e., sensitivity analyses help determine the extent to which we believe econometric studies.

While pioneers in the field of sensitivity analyses such as Edward Leamer may complain about the haphazard way we study the fragility of empirical results, many cross-country empirical studies do not suffer from this criticism because they have failed to analyze the robustness of their results, haphazardly or otherwise. For example, Barro (1989, 1990, 1991), Ram (1986), and Landau (1983, 1986) focus on the relationship between government expenditures and growth, but they never test whether their findings would change if they included proxies for tax policy, trade policy, or financial policy. Similarly, Tyler (1981), Feder (1983), and Moschos (1989) study the growth effects of trade policy, but they do not examine the sensitivity of the results to the inclusion of variables that represent fiscal, monetary, or exchange rate policies. A quick glance at Table 1 indicates that most studies

focus on a limited set of relationships and do not inquire whether the results are sensitive to other explanatory variables.

The lack of sensitivity analyses is particularly troublesome because of the serious methodological, conceptual, and statistical problems with cross-country regressions discussed above. We need to investigate extensively the sensitivity of our findings to slight changes in the list of explanatory variables, small reweighting of observations, minor alterations in assumptions about the distribution of residuals, different measurement error processes, etcetera.[14] Levine and Renelt (1990) present evidence showing that slight alterations in the list of explanatory variables can over turn the results found in many empirical growth studies. This finding surely tempers the confidence we should place in the conclusions of existing studies.

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[14] See Leamer (1983, 1987) for a general discussion of sensitivity analyses and for citations that exemplify different types of sensitivity analyses.

III. Linking Policy and Growth

This section discusses the problems associated with empirically linking policy with growth. Researchers have used measures of fiscal, monetary, trade, financial, and exchange rate policies as well as indicators of the institutional, legal, and political character of countries in cross-country regressions. This section reviews the theoretical ties between each policy and growth. We then critique existing empirical findings and summarize their methodological, conceptual and statistical problems.

Although each subsection focuses on particular problems associated with linking specific policies with growth, some general themes emerge from the discussion. First, it is very difficult to construct objective, continuous, internationally comparable measures of macroeconomic policies such as "fiscal policy" or "trade policy" or to construct sharp empirical measures of concepts such as "the efficiency of the legal system" or "the degree of political stability." Second, since it is difficult to measure policy directly, researchers resort to measures of performance such as the share of exports in GDP or the share of government consumption in GDP. Therefore, we must be careful not to interpret these measures as indicators of specific policies and we must be particularly careful in drawing causal inferences. For example, the common finding that the growth of exports is positively related to the growth of output does not necessarily indicate that export promotion policies stimulate growth because (1) we have not related any particular export promotion policy to growth; and (2) all findings using exports can be replicated using imports or total trade [Levine and Renelt (1990)]. Finally, almost none of the findings in cross-country studies of growth is robust to

slight alterations in the list of explanatory variables. Considerably more cross-section work needs to be done to confidently link policy with growth. Detailed case studies may be able to more accurately capture salient policy differences than broad cross-country studies.

A. Trade Policy

This section summarizes the conceptual and statistical difficulties associated with cross-country studies that attempt to link trade policy and growth. Four important themes run though this review. First, theory typically analyzes the relationship between trade and growth, but empirical work frequently focuses on the relationship between exports and growth. Econometrically, this does not induce important problems because exports and imports are highly correlated, so that all of the results obtained using exports can be obtained using imports or total trade. Using exports instead of trade becomes a problem when authors interpret their results as establishing an exclusive empirical relationship between exports and growth instead of a general relationship between trade and growth. Second, policy makers are concerned about the relationship between trade policy and growth, but many empirical studies do not examine trade policy; they examine the correlation between exports and growth. We must, therefore, be very careful not to interpret these studies as quantifying the effects of trade policy (particularly export promotion policies). Third, it is very difficult to quantify trade policy with objective, continuous, internationally comparable proxies. Consequently, although studies that measure trade policy address an important policy question, the measurement problems are so severe [see: Edwards (1989) and Pritchett (1990)] that a skeptical reader could justifiably

conclude that the links between trade policy and growth are tenuous. Finally, the conclusions of many growth studies can be easily overturned by slightly altering the list of explanatory variables.

1. Theory

Economists' concern with the relationship between international trade and economic growth extends back at least until Adam Smith. Smith focused on the gains in productivity that result from increases in specialization, and noted that openness to international markets could encourage specialization. International trade may enhance productivity by allowing agents to specialize in activities that would be unprofitable in smaller markets and by allowing countries to specialize in fields in which they have comparative advantages. Along these lines, Rivera-Batiz and Romer (1989) and Grossman and Helpman (1989) have recently constructed rigorous models in which technology is produced in profit maximizing firms. They show that openness to international markets can increase the growth rate of technology by increasing the size of the market available to technology producers and allowing those countries with a comparative advantage in technology production to specialize in this key industry. Romer (1986, 1990) also notes that international trade may improve domestic productivity and economic growth by increasing communication with and therefore "knowledge spillovers" from trading partners.

Focussing on the negative effects of trade distortions, Krueger (1974) Grossman and Helpman (1989, NBER 2970), Murphy, Shleifer, and Vishny (1990) show that quotas may divert talented people out of productive activities and into rent-seeking endeavors. This distortion can slow the rate of technological improvement and retard growth. Similarly, Corden (1974) discusses the conditions under which trade restrictions may induce

entrepreneurs in protected sectors to alter their labor-leisure choices and work less. Although in most models trade distortions retard economic growth, Grossman and Helpman (1989) point out circumstances under which certain trade distortions accelerate growth.[15] Thus, there is an important empirical question regarding the relationship between various trade policies and economic growth.

2. Empirical Studies

In a thorough review of the trade-growth literature, Sebastian Edwards (1989) divides the empirical growth literature on trade policy into three categories:[16] papers that attempt to link measures of either export growth or the role of exports in the economy to growth; investigations that use theoretical models to compute continuous, objective measures of trade distortions and then link these measures of trade intervention with growth; and large multicountry case-studies that attempt to link indicators of trade orientation with growth.

In synthesis volumes of multicountry-case studies, Krueger (1978), Bhagwati (1978), Balassa (1982), and The World Bank (1987) carefully document the experiences of many countries that have undergone trade liberalization efforts. Although a wealth of information is contained in these studies, Edwards (1989) argues that methodological and statistical problems dampen the

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[15]For example, in a world where technology is produced and where technology has external effects, a country with a comparative advantage in technology production can increase world growth by protecting the technology sector.

[16] Edwards (1989) also considers studies that try to uncover the determinants of exports.

confidence we should attach to their conclusions regarding the favorable relationship between trade liberalization and growth. Nonetheless, a careful reading of these studies would make it very difficult for even a skeptical reader to conclude that trade liberalization does not hold favorable implications for growth.

The second group of empirical studies identified by Edwards (1989) are those that attempt to link measures of trade policy with growth. Papers by Krueger (1983), Havrylyshyn (1985), and Edwards (1989) compute the discrepancies between observed trade and the predictions of the Heckscher-Ohlin model and use these discrepancies as indicators of trade policy. Although this procedure produces continuous, objective, and internationally comparable indicators of trade policy, these measures depend on the adequacy of the Hechscher-Ohlin model. Furthermore, the resulting estimates of trade intervention display troublesome patterns. For example, the intervention measure used by Edwards (1989) is Leamer's (1987) intervention index. This measure of intervention, however, is significantly positively correlated with Leamer's measure of openness. Using a different approach, Dollar (1990) constructs an index of the distortion between domestic and international prices and shows that this index is correlated with growth in a cross-section of countries. In a thorough study of trade policy indicators, Pritchett (1990) concludes that there do not exist reliable cross-country estimates of trade policy. Similarly, Pack (1988) and Rodrik (1989) conclude that there is no clear cut confirmation that countries open to international trade enjoy more rapid productivity growth.[17]

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[17] Also see Levine and Renelt (1990).

The third and most heavily populated group of empirical studies identified by Edwards (1989) are papers that focus on the relationship between exports and growth. This group can be subdivided into (1) studies that use the share of the export sector in domestic output (or the change in the share of the export sector in output) [Romer (1989, 1990) and Kormendi and McGuire (1985)] and (2) studies that use measures of export growth [Balassa (1978), Tyler (1981), Feder (1983), Kavoussi (1984), Ram (1985), and Moschos (1989)].

Romer (1990) and Kormendi and McGuire (1985) - who use measures of the share of exports in GDP - explicitly state that they are attempting to proxy for the importance of international activity in the country's economic life, i.e., they are trying to measure openness, not exports per se. Thus, we are supposed to interpret the coefficients in these regressions as addressing the question: "Do countries with relatively more economic interactions with the world community grow faster." Or if one is using the growth rate in the share of exports in GDP, the question becomes "Do countries where the proportion of economic activity conducted with the rest of the world increases quickly enjoy faster growth rates than other countries?" We must, however, recognize that (1) differences in the fraction (or differences in the growth rate of the fraction) of exports to GDP may not be tied to policy changes, and (2) the ratio of exports or trade to CDP may not be a good indicator of growth inducing economic interactions with the international community.

Empirically, there is a fairly robust two-step empirical link between the share of exports in GDP and output growth. For a very diverse set of specifications, Romer (1990b) and Levine and Renelt (1990) demonstrate that the share of exports in GDP is significantly positively correlated with the ratio of investment expenditures to GDP and that the investment ratio is

significantly positively correlated with per capita output growth.[18] These findings should be interpreted as establishing a robust two-step partial correlation between the trade share and growth because the results using trade share (or import share) are equal to those obtained using exports. This partial correlation between trade share and growth, of course, does not tell us much about trade policy, and, in particular, these findings do not tell us anything about export promotion policies.

The second category of growth studies that focus on the relationship between exports and growth use measures of export growth in their growth regressions. They typically find a positive coefficient. Theoretical justification for using export growth (or the interaction term export growth times the share of exports in GDP) is provided by Feder (1983). He assumes that there are positive externalities associated with exports. Thus, the production of non-export goods is assumed to depend positively on the production of exports. Many studies show that output growth is positively correlated with export growth. While there may indeed be externalities associated with exports, some readers may be bothered by a regression that includes the growth rate of two variables in the national accounts identity. Since the basic components of the GNP accounts will probably covary positively over long time periods, regressing output growth on export growth may not tell us much about the importance of international economic relationships in economic development. Interestingly, Ram (1986) argues that government provision of public goods provide external benefits to domestic production and

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[18] The export shares is not significantly correlated with per capita growth when the investment share is included in the regression, but the investment share remains significantly correlated with growth when the export share is included.

that government expenditures - like exports - should be included as separate entries in domestic production functions.[19] Levine and Renelt (1990) combine the Feder (1983) study of export growth and output growth with the Ram (1986) study of government spending growth and output growth and show that export growth enters insignificantly once government expenditure growth and the growth in government's share of GDP are included.

Turning from empirical to conceptual issues, causality is particularly problematic in cross-country regressions of output growth on export growth. For example, a shift in government expenditures from defense to education might stimulate long-run domestic production, including the production of exports. Attributing the growth in output to growth in exports would be inappropriate. Indeed, Jung and Marshall (1985) show that increases (or decreases) in the growth rate of exports are very poor predictors of increases (or decreases) in the growth rate of output.

Another weakness with cross-country growth regressions that focus on the relationship between exports and growth is that they generally do not examine specific proxies for trade policy and yet they tend to draw conclusions concerning trade policy in general and export promotion policies in particular.[20] Since (1) these studies do not include proxies for trade policy, (2) the causal relationship between export growth and output growth is ambiguous, (3) all the empirical relationships obtained by these studies using

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[19] Similarly, it is not difficult to envisage the argument that imports are an important source of knowledge spillovers and that imports too belong as separate entries in the production functions of domestically produced goods.

[20] Balassa (1985) uses a measure of import penetration as a policy indicator. Pritchett (1990), however, demonstrates the problem with using import penetration as a measure of trade policy.

export growth can be obtained using import growth or trade growth [Levine and Renelt (1990)], and (4) the empirical results obtained by these cross-country studies of growth and export growth break-down when government spending growth is included [Levine and Renelt (1990)], we should not base our support or opposition to export promotion policies on existing cross-country growth regressions involving exports.

3. Conclusions concerning Trade-Growth Literature

In summing-up this discussion of cross-country empirical studies of growth and trade policy three points standout. First, it is difficult to read the carefully documented multicountry studies by Krueger, Bhagwati, and Balassa and believe that trade policy and growth are unrelated. Yet, the conceptual and statistical problems with these studies discussed by Edwards (1989) makes one reluctant to conclude that "trade liberalization promotes growth." Second, although attempts at constructing objective, continuous, internationally comparable proxies of trade policy have thus far been plagued by crippling measurement problems, the potential benefits of constructing "good" proxies for trade policy is enormous. It is only with "good" proxies for trade policy that we can address the relevant question: what is the relationship between specific trade policies and growth. Finally, studies of the relationship between exports and growth suffer from a number of interpretational problems: (1) one can substitute imports or trade everywhere in these papers without changing the results; (2) these studies have no direct link to trade policy in general or to export promotion policies in particular; (3) the conclusions of these studies are typically not robust to the inclusion

of other policy variables; and (4) the causal ties between exports and output are ambiguous both theoretically and empirically.

B. Fiscal Policy

One of the most important issues in economics is the role of government expenditures and taxation in economic growth. A large number of cross-country studies of growth have attempted to link aggregate measures of fiscal policy with average annual growth rates computed over long time periods [see: Table 1]. Thus far, the literature has been generally unsuccessful in identifying robust empirical relationships between growth and aggregate indicators of government expenditures or taxes. This section briefly reviews the theoretical relationships between fiscal policy and growth, the conceptual complexities associated with using macroeconomic theory to guide cross-country empirical investigations of growth and fiscal policy, and some statistical reasons why we have been unsuccessful in identifying consistent empirical relationships between existing measures of fiscal policy and growth. There are three basic themes in this review. First, the intuition underlying the theoretical linkages between fiscal policy and growth is intuitively appealing and fairly straightforward. Second, it is difficult to measure government provision of services because aggregate measures of expenditures do not delineate among categories of government expenditures that may have very different growth implications, and money spent may not accurately represent the actual delivery of services. Third, a country's "tax system" is difficult to represent using aggregate measures because the structure of taxes, enforcement, and the tax base differ internationally. Evaluating fiscal

policy is complex and not easily amenable to broad, internationally comparable macroeconomic indicators.

The recent endogenous growth literature has created a new class of models in which fiscal policy can have long-run steady-state growth effects. The ideas behind these models, however, h 're been around for a very long time. Governments can accelerate growth by providing essential public goods, and well-designed taxes and subsidies can close the gap between private and social costs. On the other hand, government funds may be spent on activities for which there is not a clear role for the government. Thus, broad measures of government expenditures may not appropriately measure the provision of growth-inducing social services. Furthermore, even if one obtains more disaggregated data on government expenditures, funds may be spent effectively or ineffectively, so that using simple expenditure data without accounting for government efficiency may be very misleading. Similarly, it is very difficult to construct meaningful measures of something as complex as a country's "tax system" while appropriately considering international differences in the structure of taxes and the size of the tax base.

Even putting aside the differential growth effects of different types of government expenditures and the differential growth effects of different types of taxes, there may be complex tradeoffs between the beneficial effects of government services and the deleterious effects of distortionary taxes. In Barro (1990) and Easterly (1990), growth increases with taxation and expenditures at low levels and then decrease as the distortionary effects of taxation exceed the beneficial effects of public goods. Government expenditures and growth are positively correlated when government expenditures are below the optimum amount, negatively related when they are above, and

there is no cross-section correlation when governments are providing the optimal amount of services. Unfortunately, cross-country empirical studies have not exploited this potentially non-linear relationship and instead estimate simple linear equations.

The above discussion indicates that, even though the intuition underlying the models of fiscal policy and growth is simple, it is very difficult to construct informative empirical proxies for social services. Empirically, Ram (1986) finds a positive correlation between the growth rate of government expenditures and output growth. It is not clear, however, if this correlation has much economic content. For example, if the demand for government services increases with income, one could find a positive correlation between government expenditures and growth even if greater government expenditures hamper growth.[21] Furthermore, one might find a positive relationship between the growth rate of government expenditures and output growth even if the role of government in the economy falls as the country develops. These interpretational problems have led many researchers to use more disaggregated measures of government expenditures.

Barro (1989, 1990, 1991) and Diamond (1989) use detailed measures of government expenditures on capital goods, education, defense, and consumption spending less defense and education payments. Barro (1991) finds that the ratio of government consumption expenditures less defense and education expenditures to GDP is negatively correlated with growth. Levine and Renelt (1990), however, show that this negative correlation becomes insignificant for

[21]A number of papers [see Ram(1987)] have considered Wagner's Law (the share of government expenditures increases with income) but this need not hold for a strong positive correlation between output growth and government growth to hold because if the government share remains unchanged there will be proportionality between the two growth rates.

some econometric specifications. Barro (1991) also finds that the coefficient on the ratio of government capital expenditure or education expenditures to growth depend on the specific econometric specification employed. Diamond (1989) tests for separate effects of a number of categories of public expenditure (over a short period-1980-85) with mixed results. He finds generally positive effects for capital expenditure in the social and education sectors (which may augment human capital). The coefficients for other categories of government expenditures are quite fragile to the inclusion of other explanatory variables.[22]

Attempts to capture the effects of taxes on growth have also produced mixed results. Trying to get an aggregate measure of the potentially negative implications of government activity, many researchers use government consumption spending as a proxy for the distortionary taxes that must be raised to support that spending.[23] In this case, total government expenditures and not government consumption expenditures should be used, but these data are not available for many countries over very long time periods.[24] Kormendi and MeGuire (1985) find that the average growth rate of the ratio of government consumption spending to GDP is not closely associated with growth and Levine and Renelt (1990) find that both the ratio of government consumption expenditures and total government expenditures to GDP are not

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[22] This raises further aggregation issues: government transfers, interest payments, expenditures by different levels of government, and public enterprises expenses may have different effects from other consumption expenditures.

[23] See Landau (1983,1986), Romer (1989a,b), and Easterly and Wetzel (1989).

[24] Total government expenditures is a concept that varies across countries depending on whether it includes all levels of government, just the central government, various categories of state enterprises, etc.

strongly related to growth. These results suggest that more detailed information on taxes may be necessary to assess the growth effects of taxes.

There are, of course, considerable conceptual and statistical problems inherent in constructing cross-country measures of taxes. First, it is difficult to define the tax base. Poorer countries tend to have a smaller taxable sector which is taxed at higher rates. When GDP is used in the denominator of tax ratios, it yields a low "average" tax rate for some countries without capturing the distributional aspects of tax policy. Second, it is difficult to proxy for the "tax system". There are tremendous differences in the types of taxes used and the enforcement of the tax code. Also the structure of taxation tends to vary systematically with income. Poorer countries rely more on trade taxes and less on personal income taxes. To the extent that different taxes have different growth effects, using aggregate measures that miss these differences will not capture salient aspects of the tax system.[25] Finally, it is difficult to measure marginal taxes. This problem is compounded when one considers th . .axes differ across sectors, so that computing a country's marginal tax means somehow aggregating sectoral taxes into an average national marginal tax rate.

Given these difficulties, some efforts have been made to test for the impact taxes on growth. For example, Koester and Kormendi (1989) try to examine the differential effects of marginal and average taxes. They use the tax to GDP ratio as a measure of average taxes and interpret the regression coefficient of GDP on taxes as a marginal tax rate. They find that taxes do not have growth effects. In a second example, Skinner (1987) and Manas-Anton

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[25]See Shah and Whalley (1990) for a discussion of tax structure differences in developing countries.

(1987) analyze the differential effects of direct vs. indirect taxation. The null hypothesis is that indirect taxes tend to fall more heavily on consumption and therefore have smaller growth effects. Skinner (1987) finds evidence that individual and corporate taxes have greater negative growth effects than trade or sales taxes in Africa, but Manas-Anton (1987) finds little support for a greater negative impact of direct vs. indirect taxes.[26] It would appear that tax policy is an area in which more detailed studies will be needed to evaluate the growth effects of fiscal policy.

The empirical work on fiscal policy and economic growth has not produced robust empirical relationships. This may be because governments are providing the optimal amount of public goods. However, the inability of researchers to establish empirical links between fiscal policy and growth may stem from inadequate measures of the delivery of public goods or our failure to capture the relevant characteristics of national tax systems. A detailed analysis of the composition of government expenditures and the structure of the tax system may be necessary if we are to link fiscal policy with growth. Unfortunately, the data needed for such analysis is not readily available for a wide cross-section of countries.

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[26] Statistically, the severity of direct taxes may be overstated in some developing countries if they fall heavily on economic rents, such as mineral extraction or monopolies.

C. Financial Policy & Monetary Policy

Financial instruments and financial institutions have been integral parts of economic activity for over two hundred years. The most important financial instruments have probably been nonmetallic money and demand deposits, but bonds, equities, options, and forward contracts also play important economic roles. Similarly, banks have been the most ubiquitous financial institutions, but mutual funds, investment banks, and insurance companies are becoming increasingly important in many countries. To the extent that an economy's financial structure - its composition of financial instruments and institutions - affects economic growth, financial and monetary policy may affect growth by altering the financial structure. Theoretically, however, the profession is only beginning to integrate financial markets into modern growth theories. And, econometrically, it is very difficult to obtain good measures of financial policy - or even financial market performance - for a broad cross-section of countries to include in cross-country growth studies.

The role of money in economic activity is one of the most frequently studied issues in economics [see: the extensive survey by Orphanides and Solow in the Handbook of Monetary Economics]. Early rational expectations models by Lucas (1972, 1973) and Barro (1976, 1980) predicted a neutral relationship between anticipated money growth and output. But, in recent models, high money-growth, high inflation environments can elicit behaviors that reduce growth. For example, talented agents may transfer out of productive enterprises and into rent-seeking activities, agents may substitute out of simple money exchange and into transactions technologies that require more time and effort, or capital accumulation may be discouraged [Stockman (1981)]. Consequently, rapid money-growth could retard growth. On the other hand, the

Tobin-Mundell school argues that inflation will induce a substitution out of money into capital so that growth may increase.

The cross-country empirical evidence on the relationship between money, growth, and inflation is ambiguous. Kormendi and Meguire conclude that average growth rate of inflation is negatively correlated with growth, and M1 growth has little relation to growth. But, Grier and Tullock (1989) find that both the sign and the significance of the inflation-growth correlation depends importantly on the sample chosen. Levine and Renelt (1990) demonstrate that the relationship between growth and inflation and between growth and domestic credit growth depend on the inclusion of other policy variables.

Although theory suggests that monetary policy variability should impede the efficient allocation of resources, the empirical relationship between monetary policy uncertainty and growth is ambiguous. For example, Hayek (1944), Friedman (1977), and Barro (1976, 198C) argue that variable inflation or monetary policy uncertainty can interfere with the ability of agents to extract information from relative prices and may reduce investment and economic performance. Empirically, Kormendi and Meguire (1985) find a negative correlation between the standard deviation of M1 growth and output growth. Grier and Tullock (1989), however, again find that both the sign and significance of this correlation depend on the sample of countries chosen, and Levine and Renelt (1990) demonstrate that small changes in the explanatory variables can change the sign of the coefficient on the standard deviation of inflation or the standard deviation of the growth rate of domestic credit in cross-country growth regressions. A country's monetary policy may be so closely linked to the broad macroeconomic policy configuration of the country

that simple linear growth regressions can not isolate the effects of monetary policy on growth.

Outside of money, the financial system may provide a variety of important services. As discussed in the World Development Report 1989, financial systems can help pool, allocate, and manage risk, mobilize savings for projects that could not be independently financed, monitor the activities of mangers, provide information on the economy, and evaluate enterprises for investors. Although these products of the financial system are well known, it is only recently that economists have begun to study the emergence and implications of financial assets and institutions within the context formal theoretical frameworks. McKinnon (1973) and Shaw (1973) provide insightful descriptions of the role of finance in growth. Bernanke and Gertler (1989, 1990) formally model the role of financial markets in depressions. Jovanovic and Greenwood (1990), Greenwald and Stiglitz (1989), and Levine (1990, 1991) formally model potential linkages between economic growth and financial markets that emerge to mitigate specific problems that exist in the model economy, e.g., allocation of risk under asymmetric information, economies of scale in information gathering, etc.

Econometrically, it is difficult to construct measures of specific financial policies or of the services provided by financial markets that are meaningful and available for a broad cross-section of countries. Gelb (1989), The World Development Report (1989), Goldsmith (1969), and McKinnon (1973) have linked measures of domestic financial activity to growth. For example, Goldsmith (1969) finds that as real income rises the ratio of financial institutions' assets to GNP grows, while The World Development Report 1989 demonstrates that the distribution of financial assets among financial

institutions systematically differs when countries are grouped according the real per capita income. Gelb (1989) presents cross-country regressions results indicating a positive relationship between the ratio of M3 to GDP for a sample of 31 countries, and also shows that real interest rates are positively related to growth - potentially capturing the negative growth implications of repressed nominal interest rates.

Two problems with these empirical studies - as all of the authors note - is disentangling causal directions and isolating specific policies that underlie the performance criteria used in the studies. For example, per capita output growth and technological change may elicit the creation and modification of financial arrangements; thus, a positive relationship between an indicator of financial market activity and growth may not imply that financial markets cause growth. Similarly, finding a positive correlation between the M3-GDP ratio and output growth has little to say about specific financial market policies.

The empirical evidence suggests a positive relationship between financial market activity and growth, but the profession has been unable to determine the direction of causality or link specific financial market policies with economic performance. Given the potential importance of monetary and financial policy in economic growth, considerably more work should be devoted to constructing indicators o' financial policy and attempting to link these indicators to growth. Along these lines, one unexploited and potentially profitable research endeavor would be to incorporate measures of policies toward international capital - instead of simply focussing on domestic financial markets - into our growth models and empirical designs.

D. Economic Stability, Institutions and Property Rights

Economists have become increasingly concerned about the role of property rights, economic stability, and political instability in growth. Although some serious attempts have been made to include measures of these concepts in cross-country regressions, it is clear that internationally comparable, objective measures of notions such as "the efficiency of tne legal system" or "the degree of political uncertainty" may be impossible to obtain. Nonetheless, we should not ignore these concepts if we are to explain cross-country differences in growth rates.

The theoretical links between growth and economic stability, political security, and well-designed, efficiently enforced property rights is well grounded even though not much formal work has been done within the context of growth models. Macroeconomic instability, political volatility, and insecure or poorly enforced property rights create uncertainty as to the ability of individuals to reap the benefits of investments in physical and human capital. Thus, increased uncertainty associated with these phenomena will tend to lower investment and growth. Furthermore, political and legal institutions define the "rules of the game." If these "rules" are uncertain or severely burdensome to economic players, it makes the types of complex exchanges that occur in modern economies very difficult.

Empirically, however, it is very difficult to isolate the effects of "politics" or "the efficiency of the legal system" on economic activity.[27]

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[27] The statistical measurement of instability is also problematic. One year of severe inflation, for example, in an otherwise stable country may lead to a higher measure of instability than a country which has numerous bouts of moderate inflation. Statistically isolating these differences is a hurdle that growth economists must face. Similarly, since data is usually measured over long time

For example, Londregan and Poole (1990) find that the propensity of coups is positively related to the level of poverty and also that past coups contribute to slower growth. Similarly, Barro (1991) finds that social indicators of war, revolution and civil liberties [also see: Scully (1988) and Kormendi and Meguire (1985)] are negatively related to growth. But, there is a significant correlation between these measures of political instability and measure of monetary or exchange rate variability (about 0.4 with each). This highlights the difficulties in drawing causal links. It may be that politically unstable countries produce policy instability or that policy instability leads to political instability or both. The difficulties inherent in disentangling these effects and relating them to growth are as difficult as they are important.[28]

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periods, taking averages of measures like revolutions or coups may not adequately distinguish continual political unrest from a brief period of intense unrest.

[28]Haggard, Kaufmann, Shariff, and Webb (1990) discuss economic and political instability links.

IV. Conclusion

After reviewing the analytical problems associated with drawing inferences from cross-country regressions, this paper discussed the particular problems associated with interpreting empirical attempts to link macroeconomic policy indicators with growth. By collecting and studying the problems with existing empirical studies of growth, we hope to (1) stimulate researchers to advance the study of long-run growth, and (2) caution readers about the confidence they should place in existing findings. Regionally based pooled cross-section, time-series analyses that allow for more country specific information while maintaining the ability to use standard econometric techniques along with detailed longitudinal case studies that rely more on qualitative analyses may - in conjunction with improved cross-sectional work - augment our understanding of the linkages between policy and long-run growth.

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Table 1

Cross-Section Studies of Economic Growth

Study	Period	#C	D.V.	Independent Variables* IS	LG	HK	IY	XG	XS	GC	GK	TX	FL	IN	PI	PF	OV
Balassa (85)	1973-89	43d	GY	+	0		-	+									Y
Barro (89a)	1960-85	72	GYP	+	-	0	-			-	+/0				-	+/0	Y
Barro (89b)	1960-85	94	GYP	+		+	-			-					-		Y
Cardoso & Fishlow (89)	1950-80P	18d	GY	+	+			+									N
De Long (88)	1870-79	22	GYP				-										Y
De Long & Summers (90)	1960-85	42	GYP	+/0	0		-/0										Y
Diamond (89)	1980-85	38d	GY	+	0	+/0		+	0	0	+/0						N
Dollar (90)	1976-85	95d	GYP	+													Y
Easterly & Wetzel (89)	1960-85	70d	GY	+	+/0				+	-			+				Y
Edwards (89)	1960-82	28d	GY	+	+	0											Y
Feder (83)	1964-73	31d	GY	+	+			+									N
Gelb (89)	1965-85	34d	GY										+				Y
Grier & Tullock (89)	1950-81P	24D	GYP		+		-			-				-			Y
	1960-81P	89d	GYP		+		+			-				-		+	Y
Gupta & Islam (83)	1965-73	52d	GY	+	+												Y
Hicks (80)	1960-77	65d	GYP	+		+		+									Y

*+ (-) indicates found significantly positive (negative), 0 indicates insignificant, +/0 indicates significant in some regressions, blank indicates variable not included in study

Period: Time period of cross section analyzed, P indicates panel used
#C: Number of countries, d indicates limited to developing countries, D to developed
D.V.: GY=Growth of GDP, GYP=Growth of per capita GDP
I.V.: IS=Investment share of GDP, LG=Labor growth, HK=Human capital variable, IY=Initial period income, XG=Growth of exports, XS=Export share, GC=Government consumption share, GK=Government capital share, TX=Tax variable, FL=Financial liberalization, IN=Inflation variable, PI=Political instability, PF=Political freedom, OV=Other variables used (Y/N) these are reviewed on the following page. Variable content and definitions may vary across studies.

Table 1: Cross-Section Studies of Economic Growth Continued

Study	Period	#C	D.V.	Independent Variables* IS	LG	ED	IY	XG	XS	GC	GK	TX	FL	IN	PI	PF	OV
Hwa (83)	1970-79	87	GY	+	+			+						-			Y
Khan & Reinhart (90)	1970-79	24d	GY	+	+/0			+			0						N
Koester & Kormendi (89)	1970-79	63	GY	+	+		-					0					Y
Kormendi, Lavy, & Meguire (88)	1968-81	62d	GY	0	0		-		+								Y
Kormendi & Meguire (85)	1950-77	47	GY	+	+		-		+/0	0				-		+	Y
Landau (83)	1961-76	96	GYP			+	-			-							Y
Landau (86)	1960-80P	65d	GYP	+	0	+	-			-	0						Y
Lavy (88)	1968-82	22d	GY	+	+/0			0									Y
Londregan & Poole (90)	1950-82P	121	GY				-								-/0		Y
Manas-Anton(86)	1973-82	39d	GY		+		0		+	0	0	-/0		-			N
Mankiw, Romer & Weil (90)	1960-85	98	GYP	+	0	+	-										N
Marsden (83)	1970-79	20d	GY	+	+							-					N
Martin & Farmanesh (90)	1972-81	76	GY	+	+					+		-					Y
Moschos (89)	1970-80	71d	GY	+	0			+									N
Murphy, Shleifer & Vishny (90)	1970-85	91	GYP	+		+/0	-			-/0					-		Y

*+ (-) indicates found significantly positive (negative), 0 indicates insignificant, +/0 indicates significant in some regressions, blank indicates variable not included in study

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Table 1: Cross-Section Studies of Economic Growth Continued

Study	Period	#C	D.V.	Independent Variables* IS	LG	ED	IY	XG	XS	GC	GK	TX	FL	IN	PI	PF	OV
Otani & Villanueva (90)	1970-85	55d	GYP	+	-/0	+/0		+									Y
Ram (86)	1960-80	115	GY	+	+					+/0							N
Rittenberger(89)	70-82	57d	GY	+	+/0			+									Y
Robinson (71)	1958-66	39d	GY	+	0												Y
Romer (89a)	1960-85	94	GYP	+		+/0	-/0			-							Y
Romer (89b)	1960-85	90	GYP	+			+/0		+	-							Y
Scully (88)	1960-80	115	GYP													+	N
Skinner (87)	1965-82	29d	GY	0	0					-	+	-			-		Y
Tyler (81)	1960-77	41d	GY	+	+			+									N
Weede (83)	1960-79	94	GYP	+		+	0										Y
Wheeler (80)	1960-77	43d	GY	+	+	+											Y

*+ (-) indicates found significantly positive (negative), 0 indicates insignificant, +/0 indicates significant in some regressions, blank indicates variable not included in study

Period: Time period of cross section analyzed, P indicates panel used
#C: Number of countries, d indicates limited to developing countries,D to developed
D.V.: GY=Growth of GDP, GYP=Growth of per capita GDP
I.V.: IS=Investment share of GDP, LG=Labor growth, HK=Human capital variable, IY=Initial period income, XG=Growth of exports, XS=Export share, GC=Government consumption share, GK=Government capital share, TX=Tax variable, FL=Financial liberalization, IN=Inflation variable, PI=Political instability, PF=Political freedom, OV=Other variables used (Y/N) these are reviewed on the following page. Variable content and definitions may vary across studies.

Table 1: Other Variables Included and Results

Balassa (85)	Outward Orientation (+), Manuf. Share Exports (+)
Barro (89a,b)	Socialist economy (-/0), Mixed economy (-/0)
	Invest. Price deviation (-), Africa (-), Latin America (-)
De Long (88)	Protestant religion (+)
De Long & Summers (90)	Investment durables price and share (+)
Dollar (90)	Real exchange rate distortion (-) & variability (-)
Easterly & Wetzel (89)	Inward trade orientation (-), Africa (-), Latin America (-)
Edwards (89)	Trade intervention (-)
Gelb (89)	Distortion index [Agarwala,1983] (-)
Grier & Tullock (89)	Variation in output growth (+)
Gupta & Islam (83)	Foreign Aid(+/0),Foreign Investment(0), Other Foreign Capital (+)
Hicks (80)	Life expectancy (+)
Hwa (83)	Agriculture growth (+)
Koester & Kormendi (89)	Marginal tax (-/0)
Kormendi, Lavy & Meguire (88)	Money growth (0), Variation in output (0), Foreign aid (+/0)
Kormendi & Meguire (85)	Variation in output (+)
Landau (83)	Climate dummies (+/0)
Landau (86)	Population (-),Transfers from abroad (+), Distance to seaport(-)
Lavy (88)	Terms of trade (-/0)
Londregan & Poole (90)	Africa (-), Europe & North America (+)
Martin & Farmanesh (90)	Government deficit (-)
Murphy, Shleifer, & Vishny (90)	Engineering students (+/0),Law students (-/0)
Otani & Villanueva (90)	Interest rate on external debt (0)
Rittenberger (89)	Agriculture Growth (+/0), Manufacturing growth (+/0)
	Services growth (+)
Robinson (71)	Net foreign balances (+), Change in agriculture share (+)
	Change in city share of population (+)
Romer (89a,b)	Africa (-), Latin America (-)
Skinner (87)	Terms of trade (+), Oil (+/0)
Weede (83)	Political democracy (-/0), Military (+)
Wheeler (80)	Change in nutrition (+)

TABLE 2

SUBPERIOD CORRELATIONS OF GROWTH OF REAL PER CAPITA GDP 1960-85

ALL COUNTRIES

	1960-85	1960-65	1965-70	1970-75	1975-80	1980-85
1960-85	1	.47	.57	.65	.66	.64
1960-65		1	.01	.20	.03	.17
1965-70			1	.29	.37	.14
1970-75				1	.23	.21
1975-80					1	.35

NON-OIL COUNTRIES

	1960-85	1960-65	1965-70	1970-75	1975-80	1980-85
1960-85	1	.52	.60	.64	.74	.69
1960-65		1	.10	.10	.23	.25
1965-70			1	.35	.33	.23
1970-75				1	.32	.25
1975-80					1	.46

LATIN AMERICA

	1960-85	1960-65	1965-70	1970-75	1975-80	1980-85
1960-85	1	.15	.68	.63	.57	.75
1960-65		1	.23	-.25	-.36	.34
1965-70			1	.31	.17	.45
1970-75				1	.17	.23
1975-80					1	.28

AFRICA

	1960-85	1960-65	1965-70	1970-75	1975-80	1980-85
1960-85	1	.50	.53	.68	.62	.62
1960-65		1	.00	.14	.05	.16
1965-70			1	.34	.20	.11
1970-75				1	.30	.22
1975-80					1	.35

OTHER NON-OIL COUNTRIES

	1960-85	1960-65	1965-70	1970-75	1975-80	1980-85
1960-85	1	.43	.74	.57	.75	.54
1960-65		1	.17	-.03	.33	-.06
1965-70			1	.40	.35	.24
1970-75				1	.17	.05
1975-80					1	.49

Source: Summers-Heston (1988)

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