2 What We Know about Policy and Growth from Cross-Country Analysis*

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1 INTRODUCTION

What role have national economic policies played in creating the huge differences in living standards that we see around the globe? 'Once one starts to think about . . . [the consequences for human welfare of government actions that alter long-run per capita growth rates], it is difficult to think about anything else' (Lucas, 1988, p. 5). Thus motivated, Romer (1986, 1990), Lucas (1988), Barro (1990), and Rebelo (1991) initiated the most recent push to improve our theory of economic growth and provide a better framework for understanding the linkages between policies and growth.[1] This paper's purpose is to gain insight into such linkages through empirical analysis. Using primarily cross-country regressions, we examine the empirical regularities – and irregularities – concerning long-run growth and indicators of monetary, fiscal, exchange rate, trade, and financial policies.

1.1 Why Use Cross-Country Regressions?

Although cross-country analyses are no place for the methodological perfectionist, we should humbly face the daunting array of methodological, conceptual, and measurement problems that plague our ability to interpret growth regressions confidently (see Levine and Renelt, 1991). While the title of this paper is 'What We Know about . . .,' the inherent problems associated with cross-country studies imply that, at best, we can only expect to unearth suggestive regularities.

'What We Know about' becomes even more opaque when the objects of analysis are national policies. In models, economists frequently study distortions or taxes. Yet, data sets do not contain simple constructs of distortions and taxes. Thus, most broad cross-country studies do not examine policy instruments. Instead, they use 'indicators', such as the ratio of government expenditures to GDP or the ratio of exports to GDP. These indicators are not directly tied to executable government actions, so cross-country regressions do not directly link policy and growth.

Given the conceptual problems with interpreting cross-country regressions, why run them? Though unlikely to produce 'facts', cross-country growth regressions may yield helpful empirical regularities. Demonstrating that certain features of the interactions between policy and growth hold well across countries will help shape our beliefs about the links between policy and growth. Put differently, beliefs that are not confirmed by cross-country results will suffer from greater scepticism than those results supported by cross-country regressions.

1.2 Back to the 'Facts'

To examine the strength of the empirical relationship between long-run growth and various policy indicators, this paper adopts the approach of Levine and Renelt (1992), henceforth LR. LR examine whether the conclusions from existing growth studies are robust or fragile with respect to small alterations in the conditioning set of information – i.e., do slight alterations in the right-hand-side variables change the results? LR examine the relationship between economic growth and a wide assortment of fiscal expenditure, fiscal revenue, monetary, trade, and exchange rate policy indicators as well as political and economic stability indexes for a broad cross-section of countries over the 1960–89 and 1974–89 periods. They find that almost all cross-country regression results are sensitive to minor alterations in the conditioning set of variables.

The rest of this paper is divided into two parts. In section 2, we modify the LR analysis in four ways. First, based on work by King and Levine (1992a, 1993a, 1993b), we include indicators of the level of domestic financial sector development that were not included in LR. Second, we use an improved measure of the black-market premium. Third, based on Easterly and Rebelo (1992), we use a measure of the total public sector surplus. Fourth, we use a reduced-form specification based on Barro (1991) since these 'Barro-style' regressions have become the standard specification.[2]

We find a few robust regularities, but we primarily confirm the irregularities of LR. First, various indicators of the level of financial sector development are robustly associated with long-run growth (as first noted by King and Levine, 1993a). Second, unlike LR, the black-market exchange rate premium is negatively related to long-run growth in the 'Barro-style' regression framework used in this paper. Third, a host of individual monetary, fiscal, and trade indicators are not robustly related to growth even in the Barro framework.

Section 3 of this paper studies the relationship between inflation and growth. After demonstrating that inflation and growth are not strongly correlated in simple regressions, we attempt to discover whether the relationship between growth and inflation is different in 'very'-high-inflation countries as opposed to countries with more 'moderate' inflation rates. This allows us to illustrate a number of additional difficulties – such as defining 'outliers' and altering the sample of countries – associated with attempting to draw interpretable results from cross-country regressions. We find that although economists would almost unanimously argue that high inflation is bad for growth, this result is difficult to find in a broad cross-section of countries.

2 EXTREME BOUNDS ANALYSIS

2.1 Motivation

Previous cross-country growth analyses identify over fifty different policy and political indicators as significantly correlated with long-run per capita growth rates.[3] Are these results believable? Should they change our views and policies? To answer these questions, we need an empirical definition of 'believable'. Levine and Renelt (1992) (LR) use a narrow definition to show that most existing 'empirical facts' are not believable. Their definition of believable is derived from Edward Leamer's work on extreme bounds analysis (EBA).[4] Basically, LR show that small alterations in the conditioning information set, i.e., small alterations in the right-hand-side variables, change the statistical significance of most existing results. We use the LR approach to further investigate the robustness of partial correlations between growth rates and 'policy' variables over the 1960–89 period for a broad cross-section of about 100 countries.

2.2 Technique

The EBA uses linear, ordinary least squares regressions:

$$GYP = \beta_i I + \beta_m M + \beta_z Z + u \quad (1)$$

where GYP is the growth rate in GDP per capita averaged over the 1960–89 period for a cross-section of up to 100 countries, I is a set of base variables always included in the regression, M is the variable of particular analytical interest, and Z is a set of variables chosen from a pool of variables that we believe represent appropriate conditioning information. The EBA involves varying the Z variables to determine whether the coefficient on the M variable is consistently significant when the conditioning information set varies. If the coefficient on the M variable remains significant we call this result 'robust'. If the coefficient on the M variable becomes insignificant, we call this result 'fragile'.

Our I variables – the base set of variables that we always include in the regressions – are $LSEC$, the log of the initial (1960) secondary school enrolment rate, LYO, the log of initial real GDP per capita, and $REVC$, the number of revolutions and coups.[5] We choose this new set of I variables because they correspond to the 'Barro-style' regressions that have become the standard cross-country growth regression. Thus, choosing these I variables facilitates comparisons with other studies. We began by using the complete set of Barro (1991) control variables but dropped the log of the initial primary school enrolment rate, the number of assassinations, and the 1960 average deviation from unity of the purchasing power parity index for investment goods since the inclusion of these variables did not importantly alter our findings.[6] Thus, equation (1) becomes

$$GYP = C + \beta_1 LYO + \beta_2 LSEC + \beta_3 REVC + \beta_m M + \beta_z Z + u \quad (2)$$

First, for each variable of interest, M, we run a base regression with only the basic set of variables, that is, we do not include any Z variables. This regression determines whether the variable of interest is significantly correlated with long-run growth after controlling for initial conditions and for the degree of political stability.

Second, we run separate regressions including each variable – one at a time – from the pool of potential Z variables in regression equation

(2). Then we run separate regressions including every combination of *two* variables from the pool of potential Z variables; finally, we run separate regressions including every combination of *three* variables from the pool of potential Z variables. Out of all of these regressions we compute the extreme upper and lower bound on the coefficient β_M. The extreme upper bound is equal to the highest calculated value of $\beta_M + 2 *$ the standard error of β_M; the extreme lower bound is the lowest calculated value of $\beta_M - 2 *$ the standard error of β_M. For example, in some cases the addition of only one Z variable may produce the extreme upper bound for β_M, while the addition of three Z variables produces the extreme lower bound.

These extreme bounds can help clarify the degree of confidence that one can place in the partial correlation between growth (*GYP*) and the *M* variable. If β_M remains significant and of the same sign at both the extreme upper and lower bounds, we interpret the result as robust. However, if this coefficient becomes insignificant or changes sign at these bounds, we would find any 'finding' about the partial correlation between this *M* variable and growth less believable, and we interpret such results as fragile. If a result is fragile, the following tables will also indicate how many and which Z variables are causing the 'weakness'. For instance, if a result is classified as fragile: 0, the zero indicates that the *M* variable is insignificant without adding any additional Z variables; i.e., the *M* variable enters insignificantly in the base regression. If a result is classified as fragile: 1, the 'one' indicates that the *M* variable is significantly correlated with growth in the base regression but the inclusion of only one additional right-hand-side variable causes the partial correlation between growth and the *M* variable to turn insignificant.

The pool of variables from which we allow the EBA to choose Z variables includes the average inflation rate (*PI*), the standard deviation of inflation (*STPI*), the government fiscal surplus ratio to GDP (*SURY*), imports plus exports as a share of GDP (*TRD*), the black-market premium (*BMP*), and liquid liabilities as a ratio to GDP (*LLY*), for a total of seven possible Z variables.[7] For each *M* variable, this pool is restricted by excluding any variable which, *a priori*, we think may measure the same phenomenon. For example, when *TRD* is the *M* variable, we exclude the black-market premium from the Z pool as both variables may reflect aspects of international policy. By eliminating such duplication, we give each *M* variable a better chance at achieving the 'robust' status.

2.3 Fiscal Policy Indicators

Table 2.1 presents the sensitivity results for four fiscal policy indicators. Many empirical investigations into the relationship between average per capita growth and fiscal policy use measures of the size of government in the economy and measures of government deficits. The first variable *GOV*, the ratio of government consumption to GDP, attempts to measure the role of the government in economic activity. Barro (1990) shows that if countries are choosing the optimal amount of fiscal expenditures and taxes, then the ratio of government expenditures or revenues to GDP should be unrelated to long-run growth. On the other hand, many policy arguments are based on the assumptions that the size of government expenditures is typically larger than optimal and that government expenditures are spent on the 'wrong' things. An important problem with *GOV* is that it is an aggregate measure of government size and, therefore, does not capture the distribution of expenditures, the efficiency with which the government uses any given level of expenditures, or whether the government size is sub-optimal.

The EBA results for *GOV* show that regardless of the conditioning set of information, the partial correlation between *GOV* and growth is always negative but never significant at the 0.05 level. This may reflect optimal fiscal policy or that *GOV* is poorly measured.

Further examining the link between fiscal policy and growth, Barro (1991, p. 430) argues that 'expenditures on education and defence are more like public investment then public consumption', and therefore he constructs the variable government consumption expenditures minus education and defence expenditures divided by GDP, over the 1970–85 period, and calls this variable *HSGVXDXE*. This variable is also fragile. When *LLY*, *TRD*, and *STPI* are included, the coefficient on *HSGVXDXE* is insignificant.[8]

Many studies examine the role of government fiscal surpluses and deficits. Government deficits are frequently considered bad for growth, or, sometimes, deficits are viewed as indicative of structural problems associated with poor growth. First, we study the ratio of the central government surplus to GDP (*SURY*). The EBA shows that only with particular combinations of explanatory variables does this variable have a significant partial correlation with growth. *SURY* does not enter significantly in the base regression, but the EBA finds that when *PI*, *STPI*, and *LLY* are included, the coefficient on *SURY* becomes significant.

Table 2.1 Sensitivity results for fiscal policy indicators (Dependent variable: growth rate of real per capita GDP 1960-89)

	Beta	*Standard error*	*T-statistic*	*Countries*	R^2	*Other variables*	*Robust/fragile (#)*
Government Consumption Share (*GOV*)							
High	0.026	0.034	0.77	96	0.41	*PI, STPI, BMP*	
Base	0.022	0.034	0.67	99	0.37		Fragile:0
Low	0.004	0.034	0.13	97	0.42	*PI, STPI, TRD*	
Government Consumption Share, less education and defence 1970–85 (*HSGVXDXE*)							
High	−9.429	5.26	1.79	90	0.26	***LLY, TRD, STPI***	
Base	−15.665	4.98	3.15	92	0.20		Fragile:3
Low	−12.994	5.00	2.60	84	0.36	*BMP, PI, STPI*	
Government Fiscal Surplus (*SURY*)							
High	0.118	0.056	2.10	75	0.50	*PI, STPI, LLY*	
Base	0.086	0.052	1.65	79	0.39		Fragile:0
Low	0.063	0.055	1.15	74	0.48	*STPI, TRD, BMP*	
Public Sector Fiscal Surplus (1970–88) (*PSSUR*)							
High	20.083	7.68	2.62	48	0.45	*LLY, TRD, BMP*	
Base	14.418	7.93	1.82	49	0.30		Fragile:0
Low	9.219	9.00	1.02	49	0.36	*TRD, PI, STPI*	

Notes:
The base beta is the estimated coefficient from the regression with the variable of interest (*M*-variable) and the always included variables (*I*-variables). The *I*-variables, are *LYO, LSEC, and REVC*. The high beta is the estimated coefficient from the regression with the extreme high bound (βm + 2-standard deviations); the low beta is the coefficient from the regression with the extreme lower bound.

The 'other variables' are the *Z*-variables included in the base regression that produce the extreme bounds. The variables in bold print are the minimum additional variables that make the coefficient of interest insignificant or change sign.

The Robust/Fragile designation indicates whether the variable of interest is robust or fragile. If fragile, the column indicates how many additional variables need to be added before the variable is insignificant or of the wrong sign. A zero indicates the coefficient is insignificant with only the *I*-variables included. If robust, the text provides information about further robustness tests.

SURY, however, does not accurately measure the size of the entire public sector deficit. For example, in many countries, the government owns public enterprises, and local governments and municipalities play important fiscal roles. Therefore, Easterly and Rebelo (1993) calculate a measure of the total public sector surplus, *PSSUR*. *PSSUR*, however, is also fragile.

Though all four of these fiscal variables enter with the predicted sign, none is robust with respect to slight alterations in the conditioning set of information. The fragile relationship between aggregate fiscal policy indicators and growth, however, does not rule out fiscal policy's importance in affecting long-run growth. There may be no substitute for a detailed examination of the types of fiscal expenditures and taxes, and the efficiency with which government provides services and collects taxes, within the context of individual country circumstances.

2.4 Monetary Policy Indicators

Inflation may be related to growth through many channels. Although we discuss these channels and examine the relationship between inflation and growth in greater detail in the next section, Table 2.2 shows the results for two monetary policy indicators, the average rate (*PI*) and the standard deviation of the inflation rate (*STPI*). Though they reflect not only monetary policy but also shocks and other policies, these have been widely used in empirical investigations of the link between monetary policy and growth (see, for example, Kormendi and Meguire, 1985). The results of the sensitivity analysis show that both variables are fragile; no specification yields a significant partial correlation. Even after removing *BMP* from the *Z* variable pool since *BMP* may reflect an inconsistent combination of exchange rate and monetary policies, *PI* and *STPI* remain fragile.

2.5 International Distortion Indexes

Much theory suggests that openness to international trade will spur economic growth.[9] Unfortunately, there does not exist a good indicator of international trade policy. Pritchett (1991) shows that most cross-country indicators of trade policy are not highly correlated with themselves! Thus, different trade policy indicators tend to produce different rankings of countries in terms of openness. Following tradition, we use the share of total trade in GDP (*TRD*).[10] *TRD* is fragile.

Table 2.2 Sensitivity results for monetary and trade policy indicators (Dependent variable: growth rate of real per capita GDP)

	Beta	*Standard error*	*T-statistic*	*Countries*	R^2	*Other variables*	*Robust/fragile (#)*
Inflation (*PI*)							
High	−0.00003	0.00003	0.93	94	0.45	*TRD, BMP, GOV*	
Base	−0.00002	0.00003	0.57	102	0.36		Fragile:0
Low	−0.00003	0.00003	0.93	94	0.45	*TRD, BMP, GOV*	
Standard Deviation of Inflation (*STPI*)							
High	−0.000006	0.000006	0.97	88	0.56	*BMP, TRD, GOV*	
Base	−0.000002	0.000008	0.23	102	0.36		Fragile:0
Low	−0.000006	0.000006	0.97	88	0.56	*BMP, TRD, GOV*	
Imports plus Exports Share (*TRD*)							
High	0.013	0.005	2.53	97	0.42	*PI, STPI, GOV*	
Base	0.011	0.005	2.36	100	0.38		Fragile:1
Low	0.001	0.005	0.12	91	0.51	*PI, STPI, **LLY***	
Black Market Premium (*BMP*)							
High	−0.0079	0.0035	2.27	96	0.41	*PI, STPI, GOV*	
Base	−0.0084	0.0027	3.07	98	0.41		Robust
Low	−0.0079	0.0035	2.27	96	0.41	*PI, STPI, GOV*	

Notes: As for Table 2.1.

We found three *TRD* 'outliers', i.e., where *TRD* is greater than 1.5 (Hong Kong, Luxembourg, and Malta). When these three countries are removed from the sample, *TRD* is insignificant in the base regression.

The black-market premium, *BMP*, is often used as a general index of international distortions. Intuition suggests that larger black-market premia will be associated with slower growth. However, the black-market premium suffers several drawbacks as an indicator of policy. One problem with *BMP* is that it is a general index of distortions. A country could have a freely floating currency and zero black-market premium but still impose severe trade restrictions. Similarly, the combination of a fixed exchange rate of inflationary monetary policy could produce a large black-market exchange rate premium even with a relatively open trade regime. Thus, it is difficult to link *BMP* with any single policy. As shown in Table 2.2, *BMP* has a robust negative correlation with growth. This suggests a negative association between international distortions and growth.[11]

2.6 Financial Policy Indicators

Recent research suggests an intrinsic link between financial intermediaries and economic growth.[12] This research notes that economies with more developed and more efficient financial systems will be able to more effectively allocate savings to the best investments. This in turn leads to increased productivity, potentially higher savings rates, and faster growth.

To examine the relationship between financial policy and growth, we use three variables constructed by King and Levine (1993a) to reflect the level of financial sector development. To represent the size of the financial system, we use *LLY*, the ratio of liquid liabilities to GDP.[13] As shown in Table 2.3, *LLY* earns the robust classification. The significant, positive partial correlation between growth and *LLY* shows that countries with larger per capita growth rates tend to have larger financial systems.

To examine the relationship between growth and the types of financial intermediaries that are conducting financial intermediation, we examine the variable *BANK*, which equals deposit money bank domestic credit divided by deposit money banks domestic credit plus central bank domestic credit. Again confirming the findings in King and Levine (1992c). *BANK* is positively and robustly correlated with long-run growth.

Table 2.3 Sensitivity results for financial policy indicators
(Dependent variable: growth rate of real per capita GDP 1960-89)

	Beta	*Standard error*	*T-statistic*	*Countries*	R^2	*Other variables*	*Robust/fragile (#)*
Liquid Liabilities Share (*LLY*)							
High	0.029	0.007	4.31	89	0.56	*PI, STPI, GOV*	
Base	0.029	0.007	4.44	92	0.52		Robust
Low	0.025	0.007	3.82	88	0.56	*PI, TRD, GOV*	
Deposit Money Bank Domestic Credit Share (*BANK*)							
High	0.038	0.011	2.76	79	0.54	*PI, STPI, TRD*	
Base	0.038	0.012	3.19	83	0.48		Robust
Low	0.038	0.011	2.76	79	0.54	*PI, STPI, TRD*	
Claims on Private Sector to Total Domestic Credit (*PRIVATE*)							
High	0.031	0.011	2.96	82	0.47	*PI, STPI, TRD*	
Base	0.031	0.010	3.04	82	0.46		Robust
Low	0.025	0.010	2.40	79	0.54	*STPI, TRD, BMP*	

Notes: As for Table 2.1.

Finally, to examine the importance of where the financial system allocates credit, we perform the EBA on the variable *PRIVATE*, which equals the credit to the private sector divided by total domestic credit. Once again, *PRIVATE* enters with a positive and robust coefficient. These findings help support the view that financial intermediary services are important for long-run growth.

3 TRYING TO FIND FACTS: AN EXAMPLE

3.1 Setup

Arguably, the single most studied issue in economics is the relationship between money and economic activity.[14] Theory suggests that inflation may affect growth by influencing capital accumulation, inducing agents to shift out of socially productive endeavours into rent-seeking activities, or causing people to substitute out of money exchange into transactions technologies that require more time and effort. Similarly, inflation may influence investment decisions by increasing uncertainty. In addition to existing models, more could be created that exemplify the linkages between inflation and long-run growth.

Perhaps just as important as the debates surrounding theoretical models of inflation and growth is the generally accepted policy conclusion that inflation is, in most cases, bad for long-run growth. A poll of economists would probably find us recommending that *ceteris paribus* lower inflation is better than higher inflation. If we went to a country with a 100 per cent inflation, we would tend to recommend that the country pursue policies designed to reduce the inflation rate. Moreover, international organizations in the business of giving economic policy advice would, almost unanimously, argue that a policy of lower inflation is better than a policy of higher inflation; one rarely sees the International Monetary Fund or the World Bank recommending that countries increase their inflation rates. Given this uncharacteristically unified view among economists and policy analysts, we should expect a negative relationship between growth and inflation to 'jump out' at us from the data. Yet no empirical evidence strongly supports the contention that countries with higher inflation rates tend to have slower long-run growth rates *ceteris paribus*. A cross-country analysis of the relationship between growth and inflation, therefore, offers a particularly appealing opportunity to illustrate a few of the difficulties inherent in trying to identify the 'facts' concerning policy and growth.

3.2 Initial Findings

In a cross-section of 102 countries, the correlation between the average annual real per capita growth rate (*GYP*) and the average annual inflation rate (*PI*) over the 1960–89 period is −0.17 with a *P*-value of 0.10. Though weak, any model would suggest controlling for other factors when examining the relationship between inflation and growth.

Thus, we run a regression of *GYP* on *PI* including the logarithm of real per capita GDP in 1960 (*LYO*) to control for initial income, the logarithm of the secondary-school enrolment rate in 1960 (*SEC*) to control for initial investment in human capital, and the number of revolutions and coups over the 1960–89 period (*REVC*) to control for political instability.[15] The regression results presented in Table 2.4 indicate that inflation is not significantly related to long-run growth at standard significance levels, as the *t*-statistic for the coefficient on inflation is only 0.58. Thus, a simple negative association between inflation and growth still does not 'jump out' at us.

3.3 Outliers: Inflation Greater Than 80 Per Cent Per Annum

The relationship between inflation and growth may, however, be discontinuous or non-linear. For example, it may take extreme inflation rates before people significantly alter how they allocate their time and resources; or, at sufficiently high inflation rates for sufficiently long periods, people may become inured to inflation, so that marginal alterations in the inflation rate have little effect on the economy.[16] We attempt to characterize the relationship between growth and inflation using fairly simple procedures. We study whether the relationship between growth and inflation is different for very-high-inflation countries as opposed to economies with more moderate inflation rates by using dummy variables to identify and control for countries with very high inflation rates.[17]

Consider the simple scatter plot of the average annual inflation rates for 102 non-oil-producing countries in Figure 2.1. There are clearly outliers in the sample, but where should one draw the line between high and moderate? As can be seen in the scatter plot, the inflation rates of both 80 and 40 per cent suggest relatively clear demarcations. We examine both.

First define high inflation as those countries with inflation rates over 80 per cent. Define the dummy variable *HIPI*80 as having a value of 1 for those countries with average inflation rates greater than 80

Table 2.4 Inflation and growth
(Dependent variable: growth rate of real per capita GDP)

Regression#	1	2	3
Observations	102	102	102
Independent variables			
C	0.047**	0.051**	0.051**
	(0.005)	(0.005)	(0.005)
LYO	−0.007**	−0.007**	−0.007**
	(0.003)	(0.003)	(0.003)
LSEC	0.009**	0.009**	0.009**
	(0.002)	(0.002)	(0.002)
REVC	−0.023**	−0.023**	−0.023**
	(0.008)	(0.008)	(0.008)
*HIPI*40		.	−0.019**
			(0.007)
*PI*HIPI*40		.	0.00042
			(0.00026)
*HIPI*80		−0.009	.
		(0.013)	
*PI*HIPI*80		0.00037**	.
		(0.00015)	
PI	−0.00002	−0.00036**	−0.00038
	(0.00003)	(0.00014)	(0.00026)
F-TEST[1]		0.027	0.979
		(0.870)	(0.325)
R^2	0.36	0.40	0.40
	(standard errors in parentheses)		

* significant at the .10 level.
** significant at the .05 level.
LYO = log real per capita GDP, 1960.
LSEC = log secondary school enrolment rate, 1960.
REVC = number of revolutions and coups per year.
HIPIXX = 1 for countries with *PI*>*XX*, 0 otherwise.
PI = average annual inflation rate.
[1] *F*-test of hypothesis that the coefficients on *PI*HIPIXX* and *PI* sum to zero.

Regression#	2A	3A	4	5	6
Observations	100	100	98	98	96
Independent variables					
C	0.051**	0.051**	0.042**	0.050**	0.041**
	(0.005)	(0.005)	(0.006)	(0.007)	(0.0072)

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Table 2.4 *continued*

Regression#	2A	3A	4	5	6
Observations	100	100	98	98	96
LYO	−0.008**	−0.007**	−0.007**	−0.009**	−0.008**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
LSEC	0.009**	0.009**	0.009**	0.010**	0.010**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
REVC	−0.022**	−0.022**	−0.016**	−0.018**	−0.011**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
*HIPI*40	.	−0.015*	.	.	.
		(0.009)			
*PI*HIPI*40	.	0.00041	.	.	.
		(0.00026)			
*HIPI*80	−0.008	.	−0.001	−0.006	0.001
	(0.014)		(0.013)	(0.013)	(0.013)
*PI*HIPI*80	0.00031*	.	0.00021	0.00033**	0.00021
	(0.00017)		(0.00017)	(0.00016)	(0.00016)
PI	−0.00031*	−0.00038	−0.00022	−0.00033**	−0.00024
	(0.00016)	(0.00026)	(0.00016)	(0.00016)	(0.00016)
TRD	.	.	0.009*	.	0.011**
			(0.005)		(0.005)
GOV	.	.	.	0.023	0.010
				(0.034)	(0.034)
F-TEST[1]	0.017	0.351	0.008	0.190	0.686
	(0.895)	(0.555)	(0.927)	(0.664)	(0.410)
R^2	0.38	0.38	0.39	0.40	0.43

(standard errors in parentheses)

* significant at the .10 level.
** significant at the .05 level.
LYO = log real per capita GDP, 1960.
LSEC = log secondary school enrolment rate, 1960.
REVC = number of revolutions and coups per year.
HIPIXX = 1 for countries with *PI*>*XX*, 0 otherwise.
PI = average annual inflation rate.
GOV = government consumption as share of GDP.
TRD = exports + imports as share of GDP.
Regression 2A (3A) = Regression 2(3) minus Uganda and Nicaragua.
[1] *F*-test of hypothesis that the coefficients on *PI*HIPIXX* and *PI* sum to zero.

per cent over the 1960–89 period and a value of 0 otherwise. We run the regression:

$$GYP = \beta_1 C + \beta_2 LRGDP + \beta_3 LSEC + \beta_4 REVC + \beta_5 HIPI80 + \beta_6 PI*HIPI80 + \beta_7 PI \quad (3)$$

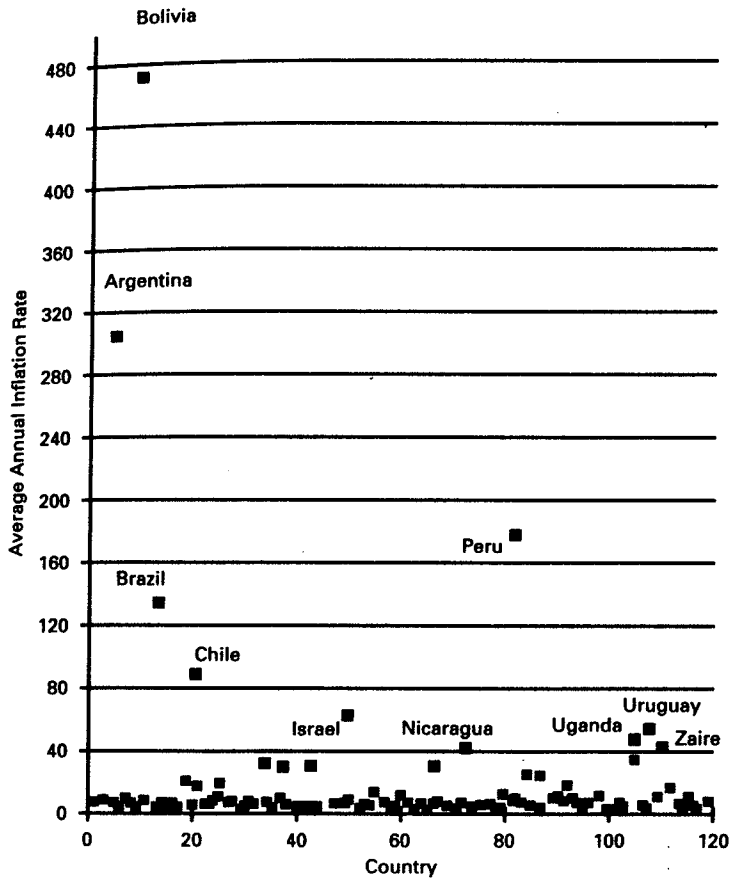

Figure 2.1 Annual Inflation Rate, 1960–89

The coefficient on *HIPI*80, β_5, indicates whether countries with inflation rates over 80 per cent per annum have a different intercept from countries with inflation rates of less than 80 per cent. The regression defined in equation (3) also permits the slope coefficient on inflation to differ between high- and non-high-inflation countries. The regression implies that a marginal increase in inflation is associated with a change in per capita growth defined by

$$\frac{\partial GYP}{\partial \pi} = \beta_6 HIPI80 + \beta_7$$

$$\frac{\partial GYP}{\partial \pi}\Big|_{HIPI80 = 1} = \beta_6 + \beta_7 \qquad (4)$$

$$\frac{\partial GYP}{\partial \pi}\Big|_{HIPI80 = 0} = \beta_7$$

Thus, if β_6 is significantly different from zero, high-inflation countries respond differently from non-high-inflation countries to changes in the inflation rate. If $\beta_6 + \beta_7$ is not significantly different from zero, then a marginal increase in inflation in a high-inflation country is not associated with a change in real per capita GDP.

Regression 2 of Table 2.4 incorporates these new variables and demonstrates a potentially appealing 'finding'. First, after controlling for high-inflation countries, we now find that increasing the inflation rate in a moderate-inflation environment does have a negative impact on growth. If a country such as Italy, with a thirty-year average annual inflation rate of 10 per cent, instead had an average inflation rate of 5 per cent, this regression (taken literally) implies that Italy would have grown an extra 0.2 per cent per year in per capita terms. Cumulating over thirty years, this means that Italy's per capita income in 1990 would be about 1.3 million lira higher.[18] Second, for those countries with high inflation, defined here as greater than 80 per cent, a marginal change in the inflation rate is not associated with a change in economic growth; the summation of the coefficients on *PI*HIPI*80 and *PI* are not significantly different from zero. Finally, the high-inflation economies do not grow slower than the low-inflation countries; β_5 is not significantly different from zero. These results are consistent with the story that countries with high inflation rates over 30 years become 'desensitized' to inflation, but countries with moderate inflation rates exhibit a significant negative relationship between growth and inflation.

3.4 Outliers: Inflation Greater than 40 Per Cent Per Annum

Now, we define high inflation as countries with average annual inflation rates of 40 per cent or greater over the 1960–89 period. Regression 3 in Table 2.4 shows that the results are now different, though still potentially appealing. Regression 3 indicates that a marginal change in inflation is unrelated to growth in both the high- and non-high-inflation countries. But, the over 40 per cent inflation group does grow more slowly; the coefficient on *HIPI*40 is significantly less than zero.[19] Thus, using 40 per cent inflation as the definition of 'high' leads to a different conclusion: high inflation is negatively associated with growth, but a marginal increase in inflation is not importantly related to long-run growth.

3.5 Resolution: The 'Over-Importance' of a Couple of Countries?

The dichotomous interpretations evoked by the two outlier choices warrant some additional digging. One or some of the five countries with inflation between 40 and 80 per cent are causing the coefficients in the regressions to jump around. These countries are Israel, Nicaragua, Uganda, Uruguay and Zaire. When these countries are included as high-inflation countries, we conclude that (i) high inflation is negatively associated with growth, but (ii) increases in inflation in moderate-inflation-countries are not linked to growth. On the other hand, if these five countries are not counted as high-inflation countries, we conclude that (i) high inflation is not negatively associated with growth, but (ii) increases in inflation in moderate-inflation-countries are negatively linked to growth.

Of these five crucial countries, two experienced extreme political disruptions over the sample period: Uganda and Nicaragua. Do we want the experiences in Uganda and Nicaragua to determine our opinion of the relationship between growth and inflation?

To test whether these two countries are responsible for the variations in results, the same regressions are run excluding these countries. For the 40 per cent outlier level, the removal of both countries from the sample causes a reversion to the original result that inflation is unrelated to growth (regression 3A in Table 2.4). Similarly, when 80 per cent per annum inflation is used to define high inflation, the removal of Nicaragua and Uganda substantially weakens the previous result that inflation is negatively related to growth in moderate-inflation economies; the coefficient on inflation is now only significant at the 0.06 significance level (regression 2A in Table 2.4).

3.6 Ceteris Paribus

Finally, we think it is worth pointing out that the relationship between inflation and growth depends importantly on which explanatory variables are included in an attempt to hold other things equal. For example, in the last regression which defines high inflation as

greater than 80 per cent but excludes Nicaragua and Uganda (regression 2A), the addition of international trade as a share of GDP (*TRD*) causes the *t*-statistic on inflation's coefficient to drop from 1.92 to 1.42 as shown in regression 4. In contrast, regression 5 indicates that if instead of including *TRD* we add the ratio of government consumption expenditures to GDP (*GOV*), we find that inflation is now significantly negatively correlated with growth in moderate-inflation countries. But regression 6 shows that when we include both *GOV* and *TRD*, inflation is not significantly related to growth '*ceteris paribus*'. Thus, the choice of the conditioning information set, i.e., the definition of *ceteris paribus*, importantly alters the conclusions one would draw on the relationship between growth and inflation.

This evidence suggests that any link between policies and long-run growth must be scrutinized carefully. The investigating economist can easily 'find' several distinct but appealing 'facts'. Not only must the result be robust with respect to variations in the explanatory variables, but it must also be checked for outliers, changes in the *definition* of an outlier, and for small variations in the sample.[20]

4 CONCLUSION

Using a different econometric specification and some additional policy indicators, this paper confirms the findings of Levine and Renelt (1992): very few policy indicators have strong partial correlations with long-run growth in a broad cross-section of countries over the 1960–89 period. While measures of financial sector development are positively associated with growth and the black market premium is negatively related to growth, popular indicators of policies such as fiscal expenditures, government deficits, inflation, and international trade are not strongly linked with long-run economic growth.

We also attempt to determine whether the relationship between inflation and growth is different for high-inflation countries from that of moderate-inflation countries. We find that small alterations in the definition of 'high' inflation countries and slight alterations in the sample of countries can importantly change the conclusions concerning the association between inflation and growth.

Notes

* The findings, interpretations, and conclusions are the authors' own. They should not be attributed to the World Bank, its Board of Directors, its management, or any of its member countries.

1. Also see, for example, Grossman and Helpman (1990, 1991), Jones and Manuelli (1990), Young (1991), Mankiw, Romer and Weil (1992).
2. Levine and Renelt (1992) use a different specification from Barro (1991). The differences are noted below.
3. See Levine and Renelt (1991).
4. See Leamer (1973, 1983, 1985) and Leamer and Leonard (1983).
5. Note that this basic set of always included variables is different from those used in LR. When *GYP* is the dependent variable, LR's *I* variables are initial income, initial secondary-school enrolment, population growth, and the ratio of investment to GDP. LR also investigate the robustness of the partial correlation between the investment share and each *M* variable.
6. In addition, we do not include the ratio of real government consumption less defence and education expenditures to GDP, which is part of Barro's (1991) set of control variables, because (i) this fiscal variable is a contemporaneous economic policy indicator and not a variable to control for initial conditions or political stability and (ii) it is averaged over the 1970–85 period rather than over the 1960–89 period that we examine. We do, however, examine this fiscal expenditure variable as an *M* variable.
7. For the pool of *Z* variables, LR use *PI*, *STPI*, *GOV*, *TRD*, *REVC*, the growth rate of domestic credit, and the standard deviation of the growth rate of credit.
8. When the average growth rate of domestic credit (*GDC*) is added to the pool of *Z* variables, *HSGVXDXE* changes to the classification fragile: 2. The addition of *LLY* and *GDC* to the base regression causes β_M to become insignificant.
9. See Grossman and Helpman (1990, 1991) and Rivera-Batiz and Romer (1991).
10. As LR show, very similar results emerge with the export to GDP ratio or the import to GDP ratio.
11. If these outliers are excluded and the standard deviation of domestic credit growth, *STGDC*, is added to the *Z* variable pool, *BMP* becomes 'fragile' when *PI* and *STGDC* are both included.

    When the EBA is carried out using the specification in Levine and Renelt (1992), the partial correlation between *BMP* and both growth and the investment share is fragile. Thus, the difference between the findings in this paper and LR is a product of using different *I*-variables, not from using a different measure of the black-market exchange rate.
12. See Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Levine (1991), Roubini and Sala-i-Martin (1991, 1992), King and Levine (1992a, 1993a, 1993b), Saint-Paul (1992), and De Gregorio and Guidotti (1992).
13. Liquid liabilities equals M1 plus interest-bearing liabilities of the banking system, plus demand and interest-bearing liabilities of non-bank financial intermediaries.

14. See the extensive review by Orphanides and Solow (1990) and the papers by Fischer (1979), Stockman (1981), and De Gregorio (1991, 1992).
15. Adding the initial literacy rate, initial primary-school enrolment, the number of assassinations, or the number of wars to this control set of variables does not change this paper's results.
16. We only look at the average annual inflation rate. This rate may be strongly influenced by a few observations and therefore may not adequately represent the inflation rate in any time-period. We get similarly inconclusive results when we use the standard deviation of inflation instead of the average inflation rate.
17. Similarly, as discussed in section 2, there are so many endemic problems with cross-country analyses of growth that we should not push the econometrics beyond the low quality and limited interpretability of available data.
18. Italy's GDP per capita in 1990 was about 22.7 million lira, and its average real per capita growth rate over the thirty years between 1960 and 1990 was about 3.5 per cent per annum.
19. The coefficient indicates that countries in the *HIPI*40 group grow an average 0.02 per cent slower per year. While statistically significant, this is economically minute.
20. Also see the paper by Easterly, Kremer, Pritchett and Summers (1993) that examines order sensitivity analyses.

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3 Income Disparity among Countries and the Effects of Freer Trade*

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1 INTRODUCTION

In recent years, there has been a considerable amount of attention devoted to the question of income convergence among countries. The empirical validity of the neoclassical convergence predictions was questioned in the pathbreaking work of Romer (1983, 1986) and Lucas (1988), leading them in search of alternative theoretical explanations that could produce, among other things, a more accurate account of the behaviour of income differentials over time.

The lack of convergence among 113 market economies is evident in Figure 3.1.[1] Average annual rates of growth of real per capita income for each country, between 1960 and 1985, are measured along the vertical axis. Along the horizontal axis are the real per capita income levels of each country in 1960 relative to the US, which was the wealthiest country at the time.[2]

The crossed lines in the centre of the graph depict the average world level of per capita income in 1960 (which was just under 30 per cent of the US level) and the annual growth rate of average world income over the 25-year span. These lines divide the figure into four quadrants. Convergence requires that all countries be located in either the top left quadrant, or the bottom right one.

The sloped line represents the locus of points which the countries would have to be on to reach the world's average level of income in 1985. The height of the schedule at each point is determined by the following equation:

$$\lambda_i^{60\text{-}85} = 100\left[\left(\frac{Y_{avg}^{85}}{Y_i^{60}}\right)^{\frac{1}{25}} - 1\right]$$